Compliments of Frank T. Shutt

Canada. Agriculture, Department of.

APPENDIX TO THE REPORT OF THE MINISTER OF AGRICULTURE.

Experimental Farms

EXPERIMENTAL FARMS.

REPORTS

OF THE

DIRECTOR - - -	PROFESSOR SAUNDERS
ENTOMOLOGIST AND BOTANIST -	MR. FLETCHER
CHEMIST - - - -	MR. SHUTT
HORTICULTURIST - -	MR. HILBORN

FOR

1887. – [1890]

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APPENDIX

TO THE

REPORT OF THE MINISTER OF AGRICULTURE

ON

EXPERIMENTAL FARMS.

OTTAWA, 31st December, 1887.

SIR,—I have the honour to submit for your approval the following report of the progress made in regard to the establishment of Experimental Farms inaugurated by you last year, with an outline of the work accomplished on the Central Experimental Farm during the current year. Appended you will also find reports from the Chemist, Mr. Frank T. Shutt, from the Entomologist and Botanist, Mr. James Fletcher, and from the Horticulturist, Mr. W. W. Hilborn. In all of these I trust you will find much information useful to the public and specially useful to the farmers and fruit-growers of the Dominion of Canada.

I have the honour to be,
Your obedient servant,

WM. SAUNDERS.

To the Honourable
Minister of Agriculture.

CENTRAL EXPERIMENTAL FARM.

The land purchased for this important central station comprises in all 466 acres. It is very conveniently situated near the boundary line between the Provinces of Ontario and Quebec, in the Township of Nepean, Carleton County, less than three miles from the Parliament Buildings, at Ottawa, and can be reached by good roads in several directions, also by water and by rail. The land lies high, being from forty to eighty feet above the adjacent rivers, and is so placed that part of it drains to the Rideau River and a part to the Ottawa River. The north front of the farm occupies a commanding position, overlooking the city of Ottawa, the highest point of land being thirty-two feet higher than the main entrance to the Government buildings. The land has that desirable variety of soil which will make it very suitable for the purposes of an experimental farm, including within its area every grade from heavy clay to light sandy loam, much of the larger part, however, is either a dark sandy loam of good quality, or a friable clay loam.

On taking possession of this farm, which comprises a number of small holdings, the dividing fences were found to be well paqked with surface stone collected from the fields; there were also many heaps at different points and large boulders scattered over the surface. While this farm is much less stoney than most of the land in the immediate neighbourhood of Ottawa, nevertheless much labour and expense was entailed in clearing the fields of surface stone. These stones have been got together in piles, a part of them has already been used in improving the roads on the farm, and the remainder will all be useful for a like purpose. In every field there were also many stumps, chiefly pine, either single or in groups, while at the rear end of the farm there were about 140 acres on which the pine stumps were very numerous and the greater part of this area was also covered with a second growth of poplar and birch. With the aid of dynamite which has been freely used, all these stumps—some four or five thousand in number—have been entirely removed, the second growth trees rooted up and burnt, and the whole of this heretofore waste land brought under the plough and it is now ready for crop.

Virgin Soil for Experimental Purposes.

As a result of this clearing the Central Experimental Farm will have the great advantage of a large quantity of virgin soil, on which experiments can be conducted to test the relative value of fertilizers on different sorts of crops, which will permit of important conclusions being reached, comparatively free from the errors which are necessarily associated, to a greater or less extent, with all lands on which fertilizers have previously been used, or with soils more or less exhausted. This feature will add very much to the value and usefulness of this most important section of the work in experimental farming, for no knowledge is more eagerly sought or more highly appreciated by intelligent farmers than accurate information regarding the effect of different fertilizers on crops. This vantage ground will be at once taken up, and a series of experiments are being planned to be begun next spring, including tests with barnyard manure in different stages of decomposition, mineral phosphates, both raw and manufactured, animal phosphates, wood ashes, nitrate of soda and various mixtures of fertilizing salts. These will be associated with similar plots on which the same crops will be grown without manure for the purposes of comparison. By continuing these experiments with the same crops on the same land for a number of years, the possibilities of error in the conclusions which may be reached regarding the usefulness of certain fertilizers as special food for particular crops will be reduced to a minimum.

Within this newly cleared tract there are a number of acres of peaty soil, representative of a very large area in both Quebec and Ontario, on which experiments with some varieties of grasses for meadow and permanent pasture can be carried on with great advantage.

Draining.

To bring the land referred to, as well as some other parts of the farm, into good condition, a thorough system of drainage was early devised, and before the close of the season 6 miles and 46 yards of tile drains had been laid, also 489 yards of box and open drains, including all the larger main drains, which will be required to complete the entire system of drainage. Some unlooked for expense has attended this work, from the fact that in many places ledges of rock were met with from two to four feet below the surface, which necessitated much blasting. The work, however, has been carefully and thoroughly done, and the land thus put in order will give increased returns, and will also aid in demonstrating the value of under drainage.

Grading and Fencing.

A substantial new fence has been erected, enclosing the entire farm. Owing to the irregularities of the ground this has necessarily involved much grading, in order to avoid unsightliness and give a reasonably neat appearance to this part of the work. The roads along each side of the farm approaching the higher ground were hemmed in on either side by high banks, and when the snow drifted badly in winter, these cuttings became filled to such a depth as to make the highway at times impassable. These banks have been cut down, the roads widened, and the material thus obtained used in filling the hollow places along the fence line. These improvements have added much to the appearance of the property, increased its value, and at the same time removed the obstacles to winter travel.

Plans.

A complete topographical plan was prepared at the outset, giving the relative heights all over the farm, which has been of much service in determining the best course for the main drains, and has been found very useful in other respects. A careful plan of the prospective farm, including locations for buildings, roads, shelter and forest belts, &c., has also been prepared by an eminent landscape gardener. This approved plan is being followed as a guide in all work, so that any part once completed will need no further modifying, a condition of things which can scarcely exist without some well devised plan as a guide.

Horses, Waggons, Implements, &c.

The necessary supply of horses required for permanent work, with implements, waggons, &c., were purchased in season for spring work, and from the second of May, when operations began, until frost put an end to farm labour, both horses and men, supplemented by such additional temporary help as was needed, have been kept actively employed.

Buildings.

A temporary office and a seed testing house were provided early in the year, and, as soon as practicable, work was begun on the permanent buildings. Dwellings for the several officers composing the working staff are being erected, and substantial barns and stables are now approaching completion, which will provide the accommodation necessary for the farm horses and room for a sufficient number of animals to permit of the conducting of such experiments as may, from time to time, be found desirable in the interest of stock-raising in this country. From this source it is also expected that surplus stock can in time be had, both of pure bred and grade cattle to test in the different climates of the several Provinces in which the other experimental farms will be located. A temporary laboratory has been fitted up for the use of the chemist in the city which will serve a useful purpose until the permanent laboratory can be erected, which it is hoped will be done during the coming year.

The temporary office is quite inadequate to the requirements of the work, but better facilities for transacting business with the public will no doubt before long be provided. The proposed agricultural museum which is to occupy the upper storey of the new office building is also much needed, so that space may be had in which to store samples of the grain and other products of the Experimental Farms, where visiting farmers will have the opportunity of comparing the different varieties, and of gaining much useful information regarding their respective merits, and of the success attending the growing of different crops under the varying climatic and other conditions which obtain in different parts of the Dominion of Canada. The structure erected for the time being for seed testing and propagating and in which valuable work has been done, is now altogether too small to meet the public demand for this class of work, and much useful experimental and preparatory work, which might be carried on, did space permit during the winter, has necessarily been deferred until better accommodation can be provided.

Water Supply.

Recognising the importance and value of an abundant supply of water for all the purposes required in connection with this farm as well as for fire protection, satisfactory arrangements have been made with the city authorities of Ottawa for obtaining a supply from the Ottawa waterworks. A water main, five inches in diameter, has been laid from the city to the highest point on the farm; hydrants have been located near the barns and stables and similar protection will be afforded to the other buildings as the work progresses. From the main, suitable pipes can be laid, to all buildings where water is required.

Arboretum and Botanic Garden.

Sixty-five acres of very suitable land are to be devoted to the important purposes of an Arboretum and Botanic garden where all the useful trees, shrubs and plants of the Dominion, as far as climatic conditions will permit, will be brought together, their growth carefully noted and a knowledge of many other facts acquired, so that useful data in regard to forest questions may be accumulated for future guidance. Such varieties of foreign trees and shrubs as can be obtained will also be tested, for the purpose of ascertaining the relative value of each and every sort for timber and fuel as well as for shelter and ornamental purposes. Canada has been the last of the more important British colonies to undertake this useful department of public work, and it is hoped that by entering on it with vigour and enthusiasm, that although last, our country will not long remain least in this very necessary branch. There is no country where the knowledge obtainable in relation to tree culture can be put to more important and useful purposes, and the establishment of this section will prepare the way for the dissemination of much needed information regarding tree culture and the most serviceable trees to plant over this wide domain, which Canadians will not be long in turning to practical account. A large accumulation of suitable material for planting this arboretum, including many hundreds of varieties of trees, shrubs and plants, has already been made, and the stock will be materially increased during the coming summer.

Dow's Lake.

Along the northern front of the Central Experimental Farm there is a fine sheet of water, an enlargement of the Rideau Canal, known as Dow's Lake. The usefulness of this water stretch has in the past been much interfered with on account of the presence of a large number of unsightly stumps which protruded above the surface. As soon as winter had put an end to all operations in the field, and by the emptying of the canal the level of the water was lowered some four or five feet, choppers were set to work, and the stumps, over 2,600 in number, were cut down to the ice level and removed. As a result of this clearing the lake will in future be a beautiful sheet of water, affording a convenient and unobstructed approach to the farm and will also add very much to the attractiveness of its surroundings.

Bulletins.

During the year two bulletins have been issued, giving details of the work carried on in testing the vitality and germinating power of seeds, the importing and distribution for test of early ripening wheat from the northern part of Russia, and the results of the trial of a large number of varieties of spring wheat, barley, oats, potatoes and other field crops on the Central Experimental Farm. The bulletins also contain a brief summary of the work done in horticulture and forestry, showing that very large collections of fruit trees, vines and young forest trees have been obtained and planted on the farm for test. further particulars regarding the fruits will be found in the appended report of the Horticulturist, Mr. W. W. Hilborn. Reference is also made in the bulletins to the results of correspondence with institutions engaged in similar work in other parts of the world, by which means large collections of the seeds of useful and hardy trees, shrubs and plants have been obtained and sown, giving a crop which will add much to the interest of the collections at the farm, and provide for the testing of these useful products in other parts of the Dominion, especially in the treeless regions of the North-West. The demand for these publications has been so great that a much larger edition has been required than was at first anticipated. Several additional bulletins are now in process of preparation.

Acknowledgments.

In the arduous work of clearing, grading, preparation of the land and planting I have been ably aided. Valuable help has been rendered by Mr. Wm. M. Blair of Truro, N.S., the superintendent of the experimental farm for the Maritime Provinces, who directed portions of the work in progress during the early part of the summer, also by Mr. A. Mackay of Indian Head, N.W.T., superintendent of the experimental farm for the North-West Territories, who took charge of the planting of a large collection of the seeds of forest trees and shrubs. Able assistance was also given by Mr. S. A. Bedford of Moosomin, N.W.T., who undertook the forest tree planting and who subsequently pushed forward the clearing of the land with much vigour and ability, and by Mr. W. W. Hilborn who while carefully attending to his horticultural duties aided also in the oversight of other departments of the work in progress. But my acknowledgments are specially due to the farm foreman, Mr. John Fixter, who has been untiring in his devotion to the work and who has brought his practical knowledge to bear on the varied operations he has had in charge during the season with the best results, and to his persevering industry in carrying out the plans devised much of the present advanced condition of this part of the farm work is due.

Other Experimental Farms.

Since my appointment in October, 1886, as Director of the Canadian Experimental Farms I have been three times to the Maritime Provinces and twice to Manitoba, the North-West Territories and British Columbia. These journeys were undertaken for the purpose of gaining information as to the character of the soil, the nature of the climate and the present condition of agriculture in the several Provinces, also to examine the most promising of the sites offered for the proposed experimental farms, so that information might be available which would aid in determining where they might be best located, for the present and future benefit of the resident farmers. Although this labour has been beset with many difficulties, it is hoped that the careful attention which has been paid to this important part of the undertaking will prepare the way for the selection of suitable lands in desirable locations where the work contemplated can be carried on to the greatest advantage and where it will give that constant and needed stimulus to agriculture which is required.

For the Maritime Provinces.

A site for the experimental farm for the Maritime Provinces has been selected at Nappan, Nova Scotia; a very central point for the three Eastern Provinces. The farm consists of 302 acres in all, and combines a sufficient area of cleared land for all farm and horticultural experiments, with wooded land for shelter from prevailing winds. It has a suitable soil of varied character, and a sufficient proportion of both "English" and "broad leaf marsh" land to meet the requirements for stock. It has excellent railway facilities, the main line of the Intercolonial crosses the front of the farm, which is not more than half a mile from the railway station at Nappan. The central position of this farm, and its railway advantages will make it easy of access to visitors from all the Maritime Provinces, it is also so situated as to climate as to be fairly representative of the largest area of territory in the three Provinces. It is intended as soon as possession can be had that prompt preparations shall be made for spring work. New varieties of cereals, grasses and hardy fruits are much needed in some parts of the Maritime Provinces, these lines of experiments will early claim attention. It is hoped that the other experimental farms which it is proposed to establish will also be selected in time to admit of active operations as soon as the spring season opens.

WM. SAUNDERS, F.R.S.C., F.L.S., F.C.S.
Director Experimental Farms.

REPORT OF THE ENTOMOLOGIST AND BOTANIST.

(JAMES FLETCHER, F.R.S.C., F.L.S.)

To Prof. W. SAUNDERS,
Director of the Dominion Experimental Farms,
Ottawa.

SIR,—I have the honour to submit herewith a report of observations on injurious insects, chiefly during the year 1887, with the methods of prevention and remedy which I have suggested when their ravages have been brought under my notice. My last and second report as Dominion Entomologist covering the year 1885, was issued by the Hon. Minister of Agriculture as an appendix to his report in the spring of 1886. Since that time no opportunity has been lost to distribute information concerning injurious and beneficial insects amongst those engaged in farming and horticultural operations. Through the generosity of the Hon. Minister I was allowed to have 1,000 copies of my last report printed separately, for distribution amongst my correspondents. Th s number he again increased at the request of the Committee on Agriculture and Colonization to 11,000 in English and French. The whole of the issue has been exhausted, and I trust that the information distributed by this means amongst the farming community may have been found useful. I have to thank the press, particularly the French press of Lower Canada, for drawing the attention of their readers to this publication, also the clergy of the Province who aided me materially in this work. Although no report upon injurious insects was prepared last year, the Government has published in full some evidence upon the same subject which I had the honour of giving before the Select Committee on Agriculture and Colonization during the last Session of Parliament. As that report will be distributed widely amongst the constituents of Members of Parliament, I am in hopes that the facts there related may be found useful to those who may read them. Up to the 1st of July last, my work as Dominion Entomologist had to be performed in addition to my duties as accountant in the Library of Parliament. This necessarily curtailed my opportunities for gathering and disseminating facts concerning the injuries committed by insects and the most suitable remedies. Since my transfer to your department as Entomologist and Botanist at the Central Experimental Farm, other pressing work connected with the office has taken up the greater part of my time; but plans have been laid for execution during the ensuing season, by which it is hoped that some of the usual attacks by insects will be anticipated and the farmers reminded beforehand of such preventive remedies as have been found useful in the past. Up to the present this has been done chiefly by means of letters addressed to the press; but upon one subject, the Clover-seed Midge, which demanded special attention, it was thought advisable to issue a printed letter giving an enlarged figure of the insect, and the most successful method of dealing with it. This was sent to farmers in those districts where clover is grown for seed. For the future I believe that all information of this nature will be most advantageously conveyed to the agricultural classes in the way which you have proposed, namely, by inserting it in the Bulletins to be regularly issued from the farm. In this way it will come into the hands of all who receive these bulletins, which will be doubtless fully appreciated and carefully preserved.

During the past autumn efforts were made to gather together from the woods and fields in this locality, as large a collection as possible of the roots of our native plants. These were carefully removed and placed in nursery rows preparatory to such time as arrangements can be made for their permanent location in the Botanic garden. Large quantities of the seeds of our local forest trees were collected and planted in the autumn, as well as others received from different parts of the Dominion. A large collection of seeds of indigenous plants of all kinds has been got together, either collected by the officers or presented to the institution by sympathisers outside. As soon as circumstances will permit, the work of laying out such part of the Arboretum and Botanic garden as you may decide upon, will be pushed forward with vigour. The plants and seeds now in hand form the nucleus of a nice and interesting collection. Collections of seeds have been received from the Department of Agriculture, Washington, U. S. A.; the Arnold Arboretum, Boston, U. S. A.; the Royal Gardens, Kew, England; the Imperial Gardens, Tokio, Japan; and Dr. Regel, of St. Petersburgh, Russia.

Promises of co-operation and assistance, accompanied by collections of native seeds, have been received from Mr. J. Walker, of Calgary, Mr. N. H. Cowdry, of Macleod, N.W.T., and Rev. W. A. Burman, of Griswold, Manitoba.

Particular attention will be paid to the examination and cultivation of our native grasses. Many of the seeds collected by yourself in the North-West Territories last year, from apparently desirable species, are already planted, and give promise of satisfactory results. As relating to this subject, I beg to repeat some words used by Prof. Macoun, when transmitting a large collection of seeds and bulbs which he had gathered for us in British Columbia: "I am delighted that you are going to grow these plants. It is the only way to understand some of our difficult species, and I have no doubt that before very long you will be able to solve in this way, many of the difficult problems which now bother us. The botanist who often has to work with imperfect and badly-preserved specimens, will now be able to examine the plants at all stages of growth. I wish you every success, and believe that your farm will be a great benefit to the country and to science."

In addition to the above, reference collections of preserved entomological and botanical specimens will of course be necessary for the advantageous prosecution of entomological and botanical work. Temporary cases have already been provided, for the former, and no effort will be wanting on my part to build up, with all expedition, a collection, showing the injurious and beneficial insects which affect our crops.

The value of having an extensive collection of our indigenous Canadian plants is easily apparent. Already numerous enquiries have been received concerning the identity and economic uses of wild plants, and it is most desirable that all such enquiries should receive prompt answers. To further this end, which I consider one of great importance, I have much pleasure in presenting to the farm museum my own Herbarium, comprising upwards of 3,000 species, collected in Canada, mainly by myself.

I beg also to announce that Dr. Selwyn, the Director of the Geological and Natural History Survey, has kindly given Prof. Macoun permission to fill up many of the deficiencies from the duplicates of his own vast collections in the National Museum, as soon as our museum is built and we are in a position to receive and preserve the specimens. Similar promises have been received from Dr. T. J. W. Burgess, of Hamilton, and Mr. J. Dearness, of London, Ont. Some rare species have already been received from the latter gentleman.

The acknowledgment of the importance of economic entomology and the allied sciences is daily becoming more apparent. These investigations for many years (with the notable exception of Miss Ormerod's excellent work in England) were almost entirely confined to this continent. Now, however, systematic study of insects and plants is being carried on, with the object of obtaining remedies for injurious species, in many parts of the world. In England, by Miss Ormerod, who continues to issue her most excellent annual reports, as well as smaller pamphlets, whenever occasion calls for them. In the same country there has appeared from the pen of Mr. C. Whitehead, a series of five reports on insects injurious to the leading crops. These reports have a peculiar value, from the fact that their author is not only a good entomologist and botanist, but has also had a long experience as a practical farmer in one of the best farming counties of England. In Belgium, Germany, France and Russia, good work is now being done in this line. Nor are our sister colonies behind hand. In South Australia, Mr. Frazer S. Crawford has studied the fungous and insect pests which attack the apple and pear, and his admirable report is an important contribution to science. The fungous "coffee leaf disease," *Hemileia vastatrix*, so injurious in Ceylon, has been reported upon by Mr. Marshall Ward, and the same disease has been investigated in the island of Fiji by Mr. P. J. Storck, with the satisfactory result of discovering what promises to be a successful remedy. Briefly, this consists in placing vessels containing a mixture of carbolic acid and water at short intervals through the coffee plantations. Mr. Storck found that the vapour given off had a most destructive effect upon the injurious fungus. I mention this fact, because the *Hemileia* being somewhat of the same nature as the *Fusicladium* or "black spot" on the apple, I am under the impression that good results might follow its application here in years when this disease is prevalent.

The Government of New Zealand has issued its report of the Joint Codling Moth Committee, and in Surgeon General Balfour's "Agricultural Pests of India," published by order of the Secretary of State for India, the planters of that Empire have a concise and convenient source of reference concerning most of the diseases which attack vegetation.

In the United States, in addition to the varied and effective work which is being done at Washington by Prof. C. V. Riley and his staff of able assistants, of which it is not too much to say that it is the most important in the world, there is a vast amount of work being prosecuted in this line at the various State Agricultural Colleges and Experimental Farms.

In the Dominion of Canada I may perhaps be permitted to mention the Entomological Society of Ontario, from whose members I receive much assistance in carrying on the work which devolves upon my office. Their annual reports, published by the Ontario Government, are valuable repositories of the latest discoveries and most successful methods of treating insect enemies.

Besides Ontario the only other Province which has recognized the necessity of having economic entomology studied, is British Columbia. During the past year the Rev. Geo. W. Taylor has been appointed Provincial Entomologist and I anticipate much good from this selection. The appointment will naturally give the farmers of that Province a means of obtaining information much more quickly, than when they had to write and receive a reply from Ottawa. In some cases before an answer could be obtained the attack had proceeded too far for the successful application of any remedy. In addition to this there is always the possibility of error creeping in through correspondence, which would be avoided were it possible to visit the infested district.

The report submitted herewith covers the observations of the season of 1887; but it has, on some occasions, been found necessary to refer to correspondence which took place during the previous summer. In carrying on the investigations here recorded I have been much assisted by other students in the science of entomology, and I wish specially to acknowledge my indebtedness to Mr. W. H. Harrington, of Ottawa, not only for aid in the identification of *Coleoptera* and *Hymenoptera*, in which orders he is a high authority; but also for invaluable assistance which he with Prof. Guignard, also of Ottawa, rendered me in the work of correcting the proof and seeing through the press my last report. This had to be done at the time when I was absent from Canada officially attending the Colonial and Indian Exhibition, to lay out and arrange the Canadian garden in which were exhibited the useful and ornamental plants of the Dominion. To Miss Eleanor A. Ormerod, the entomologist of the Royal Agricultural Society of England, my thanks are also due for copies of many valuable reports and for advice on several points with regard to the treatment of insect attacks. To Prof. C. V. Riley and his assistants at Washington, particularly Mr. J. B. Smith, I am also much indebted for the identification of specimens, as also to Mr. Henry Edwards, of New

York, and Prof. A. R. Grote, of Bremen, Germany, who have spared no pains in determining for me some difficult species of moths.

Finally I beg again to thank my many correspondents for their assistance in the past and to request a continuance of the favour for the future. I am more than ever convinced that if my work is to be of use to the country, much of the information made use of and distributed through this means, must be derived from practical men, actually engaged in the cultivation of the soil. In this way *theory* as such, will be eliminated as much as possible and will make way for *practical experience*, the most important element of all success. Moreover, this experience will be gained under ordinary circumstances and with the usual methods which are found practicable on the average Canadian farm. Thus the most applicable remedies will be discovered and made known as promptly and widely as possible. If suggested remedies fail, the reason must be sought for, and if they prove useless, farmers must be warned against them, so that no time may be lost which might be better employed.

The subjects treated of in the following pages are those concerning which I have been most frequently asked for information. These in no way represent all the facts which have been contributed by correspondents from all parts of the country. These have been tabulated and will be of use at some future time when full credit will be given for all original observations.

I have the honour to be, Sir,

Your obedient servant,

JAMES FLETCHER, F.R.S.C., F.L.S.,
Entomologist and Botanist of the Dominion Experimental Farms.

CEREALS.

WHEAT.

Had it not been for the exceptionally good crop of wheat in Manitoba and the North-West Territories, the output of this staple crop would have been considerably below the average To the excessive drought which prevailed over the greater part of Canada this shortage was mainly due; but there were also many complaints of the fungous diseases, rust, smut, and bunt. The "Wheat Midge" attacked wheat more or less in every section heard from. The Hessian-fly was reported from a few localities, but it is probable that in some of these cases the true depredator was the Wheat-stem Maggot. This last named is apparently on the increase in the districts where it has been observed.

The Wheat Midge, "the Weevil" (*Diplosis tritici*, Kirby.)

Attack.—When the wheat is in blossom in the month of June, tiny yellow Midges with black eyes, may be found, particularly as evening comes on, flying over and laying eggs in the florets of the wheat. These eggs in about a week hatch into small reddish-orange maggots which lie inside the chaff and suck the juices from the swelling kernel. When mature they leave the ears of wheat and penetrate about an inch beneath the surface of the ground, where they remain for a time, and either produce the perfect Midges that same summer or remain dormant until the next spring. Prof. F. M. Webster, of Purdue University, Indiana, a close observer and energetic worker, writes: "It has been supposed that these larvæ when full fed either entered the ground and remained until the following June, or remained ensconsed in the heads ; in any case not further attacking the grain, although the latter might remain unthrashed until winter. But since I came to Indiana I have not only reared the adults from volunteer wheat until in November, but have found the larvæ on and about young wheat plants growing in a field sown among growing corn. Furthermore it is known that the insect affects the seeds of grasses also." In the report of the United States Entomologist for the year 1885, p. 319, Prof. Webster records having observed the adult flies from 20th May right through the season up to September. It would appear then that there are sometimes two broods in the season, the second brood subsisting on volunteer wheat.

Remedies.—Under this heading I would first of all draw attention to the careless practice of farmers in not destroying the dust and rubbish from the threshing machine, when they know their crop to have been infested with this insect. I have over and over again seen the ground beneath the machine coloured quite preceptibly by the pupæ which have remained in the ears when the crop was carried.

The greater part of these pupæ, although apparently much dried up, are yet in a condition to mature if left undisturbed on the ground. I would strongly recommend that the wise precaution taken by Nova Scotian farmers should be more widely adopted. Col. Blair, of Truro, N. S., tells me that "it is the usual custom in Nova Scotia for good farmers to gather up all the rubbish from the threshing machines, and take it out on to a cross road or other hard ground and burn it. This is a means not only of destroying the larvæ of the "Weevil" and other insects, but also the seeds of pernicious weeds."

Although so well known from its injuries, it would appear from late developments that after all the life-history is not yet thoroughly understood. It is to be hoped that now this is recognized, efforts will be made to fill up the missing links, and perhaps in this way a more practicable remedy may be devised than has yet been discovered, for that portion of the summer brood which hibernates in the ground. Deep ploughing directly the crop is cut has been advocated, and would probably be attended with good results, especially where the field can be left untouched until after the time that the perfect Midges mature the next year. Another method which should receive more attention is the cultivation of such varieties of wheat as are found to be least attacked. Most of these, however, partaking much of the character of the variety known as "goose wheat," are of poor quality; but it is within the bounds of possibility that by careful hybridizing, the quality might be improved without at the same time rendering them susceptible to the attacks of the Midge. Amongst the better varieties almost free from the attacks of this insect, the fall wheat known as the Democrat is one of the most highly esteemed.

For many years the Midge has been so bad in the Province of Nova Scotia that in some districts no efforts are made to grow wheat. Mr. James Clark, writing from Tatamagouche, N.S., writes concerning one variety of wheat which is not attacked : "It is five years since I began to grow 'Midge-proof wheat,' and in that time it has given me the best satisfaction of any variety I ever had, having never been infested with either Midge or rust, bothof which are very common here. It gives very fair returns. I have had as high as 20 to 1. The only objection I have to it is that it is rather coarse-grained, and if it could be improved a little in that way would be a great benefit to the farmers. I do not know of any other variety that is altogether Midge and rust proof."

The Wheat-Stem Maggot. "Wheat bulb-worm" (*Meromyza Americana*, Fitch.)

Attack.—Some time before the wheat should be ripe the ear and top portion of the stem turn white. Upon examination the stem will be found to be severed just above the top joint by a transparent green maggot.

There are probably three broods of this insect in a season. The egg is laid on the young plants of fall-wheat in the autumn, and the maggots work their way down the centre of the stem to the base where they lie all the winter, and turn to pupæ the next spring. During May and June the first brood of flies appears, and the eggs are laid on the young stems of the wheat plant. These in due time hatch to the green transparent maggots which produce the characteristic appearance of the attack described above, *i.e.* the withered and bleached ear, which has gained for it one of its local names, "Silver-top" This was the insect referred to in my last report as the "Joint worm," under which name it is probably better known in Canada than any other. The perfect flies of the second brood appear in the beginning of July. There was a gap in the life-history of this insect until quite lately, when Prof. Webster discovered that the gap between July and the time when the eggs were laid in autumn, was filled up by a brood which passed through its transformations in volunteer wheat; this brood probably also lives in some of our native or cultivated grasses. This is an important discovery, for if it be true that the fly will deposit at once in volunteer wheat, it suggests a trap which may be set by preparing beforehand near infested fields a strip of wheat to which the July brood will be attracted to lay their eggs, and which may then be ploughed in.

The perfect insect is a pretty little active yellowish fly about one-fifth of an inch in length with three dark stripes extending right down its back. It has a habit of resting with the fore part of its body very much raised up.

From the reports which I have received during the past two years I fear that this insect is decidedly increasing. Besides the operations of the July brood, which are easily recognized, I am convinced that much of the injury to fall wheat laid to the charge of the Hessian-fly, is in reality done by the autumn brood of this species. It is reported chiefly from Ontario, from Tuckersmith, Huron, by Mr. John Burgess, from Pembroke by Mr. A. T. White, and especially from the district around Ottawa. A severe attack is also reported by Mr. D. James, of Thornhill, York County, who says "It is working in the variety of wheat known as 'goose' spring wheat. In my fields it is three or four times worse than last year; at a rough estimate about every thirtieth head is affected."

OATS.

Oats as a rule have suffered little from insects. One attack of the grain Aphis, *Siphonophora avenæ*, Fab, was reported by Mr. D. James, of Thornhill: "There is an Aphis which is attacking my oats pretty badly in some places. They cluster around the stems of the head of oats, taking the substance that the grain should have."

In Vancouver Island Mr. Henry King tells of a serious attack of Wireworms by which he lost a whole field of oats, and from Manitoba it is reported that late oats were injured by grubs.

BARLEY.

Where reported on is stated to be free from all insect attacks, but a few cases of smut have occurred.

PEAS.

This crop still remains virtually exempt from the attacks of the Pea Weevil, (*Bruchus pisi*, L.,) but in some districts it was very seriously affected by the drought. In the County of Prince Edward, where peas are now largely grown for seed, there was much anxiety owing to a sudden failure in the pea crop. There were various theories rife at the time to account for the failure, and at the request of Dr. J. M. Platt, M.P. for Picton, I was instructed to visit the locality and investigate the trouble.

Upon arriving at Picton, Dr. J. M. Platt kindly gave me every opportunity for examining the pea fields and discussing the matter with the growers. The condition of the pea fields at the time of my visit (the first week in July), may be briefly summed up as follows:—

The early varieties were all ripe and nothing could be seen except that the crop was thin. The late varieties were just beginning to produce their fruit, the peas in the primary pods being well formed, but for the most part few others. The fields presented the following aspect. In low spots the vines, although somewhat faded from the great heat and want of rain, were healthy and well-grown, but on gravelly knolls or in sandy uplands were in some places quite dead, or were in such a state that recovery was considered impossible.

The plants themselves over large areas were found to have been injured at the collar, immediately on the level of the soil, and consisted in fact of an apparently healthy top and root, but having these two portions separated by a short piece of dead stem at the collar. This injury I attribute almost wholly to the heat of the sun. As the plants faded for want of moisture, they drooped and left their bases exposed to the direct rays of the sun as well as the heat refracted from the parched earth. Upon the roots of the leguminosæ, the natural order to which the pea belongs, are found tuber-like organs the nature of which until lately has not been understood. Upon the pea-plants in question these were found to be particularly well developed, but in many instances were in a state of partial decay. One of the theories prevalent in the district was that the trouble was due to a fungous disease, and there were certainly indications that this view might be correct. Upon the roots bearing decayed tubers, many showed a fungous mycelium emanating from those bodies and running along the adjacent roots. Another feature was the patchy nature of the fields, and further, most of the farmers stated that this "disease" showed itself first in small spots which then increased in an ever-widening circle; or again, that it would run in a straight line along the side of a fence. Now all of these would point to the ravages of a parasitic fungus. A microscopic examination of the tubers on the roots did not, as might have been expected, give an easy solution to the mystery, for the organization of these bodies is exceptional in vegetable morphology, and they contain bodies known as "bacteroids" which much resemble the reproductive organs of some fungi. In discussing the matter with Dr. Platt we came to the conclusion that these bodies might be normal structures of the plant, as, although disproportionately larger and of quite a different configuration, they bore a close resemblance to the tubers upon the roots of other leguminosæ. There were, however, several points which seemed to indicate that something more than drought was affecting the crops, such as the occurrence of a few dead plants together, amongst other healthy vines, and the reiteration by farmers of the fact that when once the disease showed itself in a field it spread rapidly from a given centre.

The nature of the information gathered from pea-growers in this instance was very contradictory.

Upon my return to Ottawa I despatched a series of specimens to my friend, Prof. W. G. Farlow, the eminent American authority of Harvard University, who upon this, as on many previous occasions, rendered me great assistance and kindly forwarded me an article detailing the recent discovery of the nature of the tubers referred to.

He writes: "I have examined your specimens; they are such as are found in a large number of leguminosæ. They have generally been supposed to be due to bacteria, but within six months or a year, papers have been published which throw new light on the subject, and seem to show conclusively that the tubers are not due to bacteria but are normal structures containing reserve material. With this I send by mail a copy of the 'Berichte der Deutschen Botanischen Geselschaft' for January, 1887, which contains a good paper by A. Tschirch, with a plate. This will give you the information you need." This article shows that these bodies are reservoirs for nitrogenous materials which are laid up during the active growth of the plant previous to the formation of seed. When, however, these latter are formed, a transfer takes place and the nitrogenous matter collected in the root tubers is drawn off and provides the large supply which is found in the seeds of leguminosæ. Now, applying this to the above case, all can be understood with ease. The large development of these tubers on the roots of the pea-plants in Prince Edward county showed what is well known, that this district is exceptionally well adapted for the production of good peas. The failure of the plants to produce seed was due to the injury in the stem mentioned above, by which the supply of nitrogenous material in the root tubers was cut off. These latter again being unable to perform their functions began to decay. Dr. Farlow wrote concerning some of these damaged tubers: "The tubers I examined were somewhat decayed on the outside and had on them some small mould like *Fusisporium* which, however, had nothing to do with causing the tubers."

With regard to the nature of the supposed attack alluded to above, I feel convinced that it was mainly a result of the exceptional drought, and the fact that it appeared upon gravelly knolls and uplands first, would merely be due to the greater aridity of the soil in those spots. The occurrence of a few dead plants, amongst healthy vines, might have been due to attacks by insects previous to the examination.

In confirmation of the above opinion as to the injury being due to the drought, I quote the following from the August agricultural returns of the Ontario Bureau of Industries: "This crop was, of course, more or less injured by the prevailing drought, but on the whole there are larger areas from which good reports come of peas than of wheat. Wherever the seed was sown early, and on good soil, the crop made progress sufficient to cover the ground, and in a measure retain the moisture before the severe drought set in, while what was sown later, and on poorer soil, grew sparsely and did not afford shade to the roots of the plant."

I may mention that some of the growers who had used salt upon their fields claimed that their crops were better than where this had not been used.

HAY AND CLOVER.

HAY.

Notwithstanding the dry weather the crop of hay in many localities is reported as up to the average in quantity and above it in quality.

Two reports only of serious injury to the hay crop have been received—one from New Brunswick of the ravages of the Army-worm, the other from various parts of the Provinces of Ontario and Quebec. The exact nature of this last attack is not yet understood, and I must again refer to it by the popular name used by correspondents and mentioned in my last report, viz., "Joint-worm." It is possible, however, that it may be due to the attacks of a mite

"Joint-worm."

Attack.—Exactly similar to the attack of the Wheat-stem Maggot, the top portion, together with the head, withering and turning white just before the seed is ripe.

In the first week of July I found at Deseronto, Ont., stems of Timothy hay (*Phleum pratense*, L.), and Kentucky Blue-glass (*Poa pratensis*, L.), injured in the way described. Upon examination it was found that the stem had been severed, and was decayed immediately above the top joint. In some of the stems small white mites were found, but in others were the larvæ of some minute hymenopterous fly. Unluckily, owing to the excessive heat which occurred just at that time, I was unable to get these specimens home safely.

Mr. W. Brodie, of Toronto, writes to me as follows:—" In addition to a dipterous larva which attacks the timothy, we have found here a mite very common and very injurious. We have collected the ova, the immature and the adult forms. It has been common in the counties around Toronto for some years, and has done much injury to timothy, 3 species of spear grass and to *Triticum repens*, L. Farmers knew of it and said it was 'the blight.' About June I demonstrated to all, that it was the work of a mite, and read a short paper on it before the Natural History Society of Toronto, and showed specimens of the injured culms and the living mites."

In the beginning of July, I received through the Hon. Minister of the Interior a letter and specimens of timothy injured in the manner described above, and forwarded by Dr. Ferguson, M. P. for North Leeds, with the statement that it had been common for years in all good seasons. "When there are great drought and a small crop the insects have not appeared, but when the growth is vigorous and there is a good deal of moisture, they have appeared almost invariably."

Remedy.—The remedy suggested by Dr. Ferguson is probably the best that can be adopted. He says: "When this attack is general the course here has been to put the mower in and cut the crop. Usually, however, the attack is not general, although sufficiently so to enable anyone looking at the field to see the white tops here and there where the insect has attacked the stem." And again, writing later, he says: "It always appears when we have a luxuriant growth resulting from frequent showers and followed by great heat. Many of our meadows are attacked I should judge, to at least, five per cent. of the stalks. The effects are never evident until after the head is fully out of the blade. As none of our spring wheat is sufficiently forward yet, I have not been able to get a sample in the grain stalk."

Dr. Ferguson is of the opinion, with many others, that the injury is done by a worm in the stem. If this view is correct, it may possibly be the "Wheat-stem Maggot" that is the culprit.

In the third report of Prof. Lintner, State Entomologist of New York, just issued, he describes a mite as attacking timothy, so that "the infested places looked as if they had been scalded." The mite he refers to, however, is black with red legs, whilst those referred to above, are white and transparent.

The Army-worm (*Leucania unipuncta*, Haworth.)

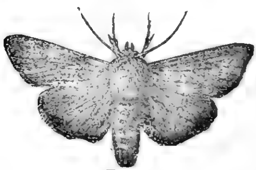


Fig. 1.

Attack.—A brown striped Caterpillar destroying all the leaves of grass and cereals. When occurring in large numbers, migrating in bodies from one food patch to another.

During the past summer sensational accounts appeared in the newspapers to the effect that the whole hay crop on the Sackville marshes in New Brunswick, was being demolished by the caterpillar known as the Army-worm. This caterpillar (Fig. 2) is produced from eggs laid by a light brown moth (Fig. 1), with a slight metallic lustre, about an inch in length, when the wings are closed, with a small white spot on each wing. I have never been able to trace more than two broods of this insect in Canada; but in the United States they have three. The eggs are laid in the autumn, and like many of the Cut-worms pass the winter as very small caterpillars. In the following spring they attack the young grass and grain crops. The moths from these caterpillars appear in July, and the eggs laid by this brood produce the moths in August and September.

Fig. 2.

Upon the appearance in the press of the items referred to above, I at once wrote to the infested district for reliable information, and through the kindness of Prof. Burwash and Mr. W. F. George, both of Sackville, N.B., I found that these accounts were much exaggerated. Prof. Burwash writes, after extensive enquiry amongst the farmers of Westmoreland County: "I find that reports vary considerably as to the extent of injury. The most careful and accurate observers say that two, or at most three per cent. of the whole hay crop would be a liberal estimate. Of course in some places the damage is much greater. All ag ee in saying that the worm does not touch the grass newly 'laid down,' that it is confined to the old meadows, of which we have a great many here; some of our marsh not being broken up for ten or more years. This year, in order to avoid its ravages, the farmers have ploughed a great deal, which they would not otherwise have disturbed."

"The worms 'work' about the lowest part of the stalk, among what they call here the 'moss,' that is the dead leaves, &c., which cover the ground, so that by far the greater part of them are out of sight. Indeed unless they are very numerous their presence is only detected by the unthrifty appearance of the grass, until a closer observation and 'rooting' about the grass brings them to light. However, when they are very numerous they may be seen climbing stalks, but they always look as if they were 'out of their latitude.'"

Mr. George writes: "In some localities they damaged the English grass to a considerable extent by eating all the fine grass and clover in some places, not leaving anything green standing. This did not extend over large areas and only occurred where the marshes are not well drained. I am quite confident that thorough drainage and good cultivation will prevent the ravages of the Army-worm in this locality."

Dr. T. J. Leeming, of Charlottetown, P.E.I., sends me the following dates for some of the stages of this insect in the Maritime Provinces: "August 19th, at Great Burin: Hay field entirely devastated by the Army-worm; caterpillars of all sizes. August 29th: On shore at Trepaney, Nfld., Army-worm abundant; they appear to avoid clover; on ground that has suffered from their depredations the clover patches stand out untouched. September 8th: The larvæ taken at Trepaney 29th August, pupated to-day. October 17th: Arrived at Charlottetown 6 a.m.; during the night the Army-worm moths obtained at Trepaney, August 29th, came out."

Remedies.—Although only complained of in certain localities, this insect is very wide-spread all over Canada, and may generally be found in low spots. This would show the reason why the attack is so severe in marsh lands where the caterpillars have a suitable habitat and an abundance of food. The remedies which have been found most successful are systematic drainage of low-lying lands, by which they become an unsuitable habitat for the young larvæ, and the moths are probably prevented from laying their eggs there. When the attack has been very severe in any locality much good may be done by burning the old grass and stubble in the autumn or spring; in this way not only are many young larvæ destroyed, but the old stems, which seem to be the favourite place for the spring brood to lay their eggs, are also removed. The conditions which seem most favourable for the undue increase of the Army-worm are a dry autumn, followed by a wet spring and summer. Whenever the first of these occurs, therefore, it would be well to adopt the precautionary measure of burning over the meadows.

The worms may be prevented from marching from one field to another by ploughing a deep furrow across their path. This should be cleaned out so as to leave one edge perpendicular, and holes may be dug in it at intervals, into which the worms may be shovelled and killed by covering them with earth and pressing it down. Prof. Riley also suggests dusting the plants on the opposite side of the ditch with a mixture of Paris Green and Flour or Plaster, so that if any worms succeed in crossing the ditch they will be killed by feeding upon the plants so poisoned. This mixture should be in the proportion of one of Paris Green to 25 or 30 of the other materials.

CLOVER.

Clover as a hay crop has been short, owing to the drought and to winter killing. There was little seed reaped, but I am pleased to find that this was not owing to the ravages of the Clover-seed Midge. Some complaints of injuries by this insect have come in, but most of my correspondents agree that losses by this cause are much less than they were a few years ago. This improvement is due to the general adoption through the clover seed districts of the method of feeding off their clover before the middle of June and reaping the seed from the second crop. Mr. T. Farrow of Bluevale, Ont. writes: "For the last two or three years there has been none, or scarcely any clover seed after mowing, but last season there was a little, not enough though to make it worth threshing out. The seed on the pastured fields has been exceedingly good. Alsike seed was very good and yielded well, notwithstanding the great drought of last summer."

Clover was, in the Ottawa district, considerably damaged by the larvæ of the common Clouded Sulphur Butterfly (*Colias Philodice*, Godt) which this year appeared in enormous numbers. The caterpillars were also destructive to a great number of other leguminous plants in the seed beds of the Experimental Farm, species of Cytisus, Caragana and allied plants, having to be constantly watched and kept clean by the use of Hellebore and Pyrethrum. Towards autumn large numbers of these caterpillars were found dead in the fields, bearing a cluster of the bright yellow cocoons of a small parasitic Ichneumon Fly (*Megorismus nubilipennis*, Ashm). I am indebted to Mr. W. H. Ashmead of Jacksonville, Florida, for the identification of this and many other microhymenoptera.

As usual during hot, dry, summers a large amount of injury was done to grass crops by grasshoppers, but there were no complaints of excessive injury.

ROOT CROPS AND VEGETABLES.

Root crops all over the country seem to have suffered more from the drought than any others, the result of the absence of autumn rains being very perceptible in the gross returns.

TURNIPS.

Turnip Flea-beetle "Turnip Fly," (*Phyllotreta vittata*, Fab.)

From all quarters come in complaints of injury by the Turnip Flea-beetle.

Attack.—Small shining black beetles, with yellow markings on the wing covers which eat the seed-leaves of turnips and all other crucifers, directly they appear above the ground.

These troublesome little beetles live in the larval state upon the roots of plants of the Mustard and Cress family, to which the Turnip belongs. The grub is described by Dr. Cyrus Thomas (Illinois Rep. VI, 159) as "a minute, slender grub, with six tiny feet on the anterior segments and an anal pro-leg; white, with a faint, dark medial line along the anterior part of the body; a horny light brown head and a brown spot on the posterior extremity. This state lasts about seventeen days when it changes into a naked white pupa in a little earthen cocoon near its feeding place, in which it remains but a short time From the observations made, Dr. Shimer is of the opinion that they live exclusively on the roots and underground stems of cruciferous plants."

Remedies.—These will come under three heads:

1. Selection of varieties the least liable to attack. One variety which has been recommended is the "Grey Stone," it is claimed that this is even obnoxious to the beetles and that if sown amongst Swedes it will keep the beetle away. I have not experimented in this line.

2. Judicious management in the time of sowing the seed. This will vary in different localities. Some of the beetles appear early in the spring and attack any cruciferous plants they may find. If turnips are sown too early they will be destroyed. There is then a short time when very few of the mature beetles are to be

seen. This is when the second brood is in the larval condition beneath the ground. This period is what the farmer must discover for his own neighborhood and take advantage of his knowledge to get his turnips up and "into the rough-leaf" before the beetles appear again. This period is, for this part of Canada, about the middle of June, a little later in the Maritime Provinces and earlier in the west.

3. Active poison. I have tried some experiments with Paris Green and have had most satisfactory results. A mixture was made of 1 part of Paris Green to 50 of Land Plaster and this was sown along the rows of turnips, directly they appeared. A single application was found sufficient and the plants soon pushed out their little bud of rough leaves and were not afterwards injured by the beetles.

A Turnip Aphis—(*Aphis brassicæ, L.*)

Attack.—Clusters of grey plant-lice, situated all round the bases of the stems and beneath the leaves of Swede turnips from which they suck the juices. Not noticed in numbers until late in the autumn when many of the turnips were found seriously injured and past recovery. Complaints of this injury have been received from Vancouver Island, Quebec and Nova Scotia, all of which were after the manner described above.

Remedies.—Of several remedies experimented with, the most satisfactory results were obtained with a Kerosene Emulsion made of the ordinary strength for general application, viz : Kerosene or refined coal oil 1 pint, common laundry soap ½ oz., rain water, ½ pint. The soap was boiled in the water till all was dissolved, then the boiling soap suds were poured into a watering pot containing the kerosene and churned with a garden syringe until the emulsion was complete. This generally takes about 5 minutes but sometimes longer. When this emulsion is made it can be bottled up for future use. When using it either as a wash for sponging trees or for spraying, it must be diluted with 9 times the quantity of water. Should the oil in the emulsion after a time separate it is well to warm it and by violently shaking the bottle it will again become fit for use. In diluting the emulsion use warm water. With the Aphides above mentioned the wash was syringed amongst the clusters and one application was found sufficient. Single experiments with Pyrethrum both dry and in solution were found unsatisfactory, but possibly the material experimented with may not have been fresh.

The Red and Black Turnip Beetle (*Entomoscelis adonidis,* Fab.)

Attack.—A showy scarlet beetle, with three black stripes down its back, and a black patch on the collar, about two-thirds as large as the Colorado potato beetle; but narrower in outline. Eating the leaves.

I collected on turnips at Regina in August, 1885, several specimens of this showy beetle. They were sluggish in their habits like most of the Chrysomelidæ, including their relative the Colorado potato beetle. They were not in sufficient numbers to do much injury, but were thick enough to show that with an increased cultivation of their food plant, they might develope into a troublesome pest. The specimens collected on the North-West prairies cannot be distinguished from specimens in my collection from Austria, in Europe. Should a remedy become necessary an application of Paris Green would be the most convenient.

POTATOES.

Potatoes have not escaped the effects of the dry weather in Ontario and Quebec, and although of good quality they are very small, and there is a serious shortage in the crop. Insect enemies have also levied tribute.

The Colorado Potato Beetle (*Doryphora decemlineata*, Say) has made itself apparent in Nova Scotia and Manitoba in such numbers as to demand the attention of farmers. Specimens of the true Colorado beetle were sent to me by Mr. E. H. Struthers which had been collected in St. James's west of Winnipeg. Paris Green still remains the standard remedy for this pest, and the most advantageous way to apply it is by mixing a teaspoonful in a pail of water and shaking it over the vines with an ordinary whisk. Wisps of straw and hay or small boughs which I frequently see used by farmers are a mistake, and waste more time and poison than would pay for many whisks. Of course all beetles which attack the plant in the same way as the Colorado beetle may be treated in a similar manner. Of this class are a small flea-beetle which Rev. G. W. Taylor reports as riddling the foliage of potatoes at Victoria, B.C., and also one of the Blister Beetles (*Epicauta maculata*, Say) specimens of which have been sent to me from different localities in the North-West Territories.

His Honour Lieutenant Governor Dewdney writes in July last: "I enclose herewith three specimens sent by our Indian agent at the Blackfoot Crossing, Gleichen, which he states were found in his garden. They appear to be in numbers and have been particularly destructive to his potatoes, having destroyed 50 hills in a very short space of time, apparently the potatoes are destroyed in a similar way as by the Colorado bug in the east; but much more rapidly."

About the same time in 1886 I also received specimens from Mr. Acton Burrows, then Deputy Minister of Agriculture for Manitoba, which had been "sent in by Mr. S. W. Chambers, farming instructor on the Blood Indian Agency, Fort Macleod, and which he said were working sad havoc in the gardens on the reserve."

In the larval state, the beetles of this family are parasitic on other insects, but in the perfect condition they eat vegetable food. The present species I have also taken in numbers at Stillwater, Montana, where it was feeding on the Grease-wood (*Sarcobatus vermiculatus*. Tor.)

Wire-worms, which are the larvæ of the Skip-Jack beetles (*Elateridæ*) have not been complained of as attacking potatoes, except in one instance, where they were very severe in their attack. Rev. G. W. Taylor, of Victoria, B.C., tells me of a farmer who lost nearly every tuber on an acre planted to potatoes. The best remedy for these troublesome insects is a frequent use of the hoe, by which all weeds are kept down, and care must be taken to remove all the injured potatoes at once when dug. If this be done, and the crop at once carted from the field, the Wire-worms are carried away with the potatoes, and as they very soon leave the tubers when the latter are removed from the soil, they can be gathered up from the bottom of the cart and destroyed.

CARROTS.

Carrots and parsnips are little troubled with insects as a rule. During the past year I have received from several quarters, the beautiful larvæ of the common Black Swallow-Tail Butterfly (*Papilio Asterias*, Fab.), which had been found commonly upon both of the above plants, as well as upon the fruiting stems of parsley. In addition to this, specimens of the leaves of carrots were sent to me by Mr. E. D. Arnaud, of Annapolis, N.S., in 1886, which were simply swarming with a species of Aphis. Again during the past summer, Mr. Josiah Wood, M.P., of Sackville, N.B, sent me leaves of both carrots and parsnips in exactly the same condition. Unluckily the species could not be identified from the crushed state in which the contents of both packets were received. All that could be seen were wingless females. I hope next year to get some winged specimens and identify the species. The first mentioned attack was cleared off by a visitation of large numbers of one of the beneficial "Lady-Bird" beetles (*Coccinella transversoguttata*, Fab.), and did nor appear again the following season. The most serious attack upon the carrot crop to be recorded was by the

Carrot Fly, "Rust Fly" (*Psila rosæ*, Fab.)

Attack.—1. Early in the season the leaves of young carrots turn reddish, and the roots will be found to be blotched with rusty patches.

2. Carrots stored for winter use will be found to contain long transparent white maggots, which bore holes in every direction.

During the past season I have received no report of injuries by this insect, but in 1886 it did a great deal of damage, particularly to roots stored for the winter. Mr. F. B. Caulfield, of Montreal, says, in February, 1887: "They must be pretty numerous in this district, for nearly all the carrots that I have seen exposed for sale are more or less attacked." Mr. Thomas Henderson, of Nepean, Ont., when enquiring for a remedy, states: "The Early Horn Carrots in my garden are badly attacked, nearly every root shows signs of their presence, at any rate two thirds are seriously injured for the market."

In a garden at Ottawa I found the young plants badly attacked in the spring of 1886, but the injury was checked and did not again recur.

Remedies.—The remedy applied above was as follows: Immediately upon the detection of the injury, sand saturated with kerosene (coal oil) was sown along the rows, this was repeated 5 or 6 times with one week intervening, and was always put on immediately after the carrots had been thinned out. Upon consulting Miss Ormerod, she was kind enough to send me the following advice which was subsequently adopted: "My view of the best way to prevent *P. rosæ* from doing damage is so to manage operations that there may be the smallest possible number of chinks or cracks in the ground down which the flies may travel to start mischief at the roots. I always advise that the greatest amount of thinning that can be managed should be done as early as possible, and give good waterings after thinning, and from time to time to drive the surface soil together."

Where carrots are stored during the winter in sand or earth this of course must be treated to destroy the pupæ which leave the roots and enter the soil to pass their last preparatory stage. Miss Ormerod suggests that this earth might be put into a wet manure pit or soaked with gas water so as to prevent the hatching out of the flies. Should neither of these methods be convenient, at any rate it might be buried in a deep hole dug in the ground for the purpose.

CABBAGE.

The value of the cabbage crop has been very seriously diminished during the past year or two. During the last season where no efforts were made to put a stop to their depredations, the caterpillars of the imported White Cabbage Butterfly utterly ruined whole patches of this vegetable. Nor were the Anthomyian flies or Root Maggots much less injurious.

"The Cabbage Worm," Imported White Cabbage Butterfly (*Pieris Rapæ, L.*)

Attack.—Velvety green caterpillars about an inch in length with a broken yellow line along each side and an unbroken one down the middle of the back. At first eating the outside leaves but eventually boring right into the heart of the cabbage. These, after three or four weeks, produce the white butterflies so common in gardens.

Notwithstanding all efforts to keep it down, and the great prevalence of the infectious disease known as *flacherie*, in all the districts to which it has penetrated in Canada, this injurious insect continues to spread. In every garden in the Ottawa district last season great damage was done, unless special efforts were exerted to prevent the loss. Nor were its ravages confined to the cabbage alone. Turnips and many wild cruciferous plants were attacked. Mr. A. T. White, writing from Pembroke says, "a year ago last summer I had a field of turnips that was so badly attacked that they literally stripped the leaves and left only the stalks. Last season, however, we had none or so little that they did really no damage."

A curious fact which has been observed by more than one correspondent is mentioned by Mr. R. Brodie, of St. Henry, Montreal, an extensive and successful grower of cabbages. "Strange to say, the green worm does not trouble me much where we have the cabbage and cauliflower in large fields, but if we plant a few convenient for the kitchen, especially where they are in any way shaded, the worm makes short work of them." Mr. Andrew Hickey, of Ottawa, also confirms this observation, saying "they only attack the outside rows of the field."

Remedies.—Several of the remedies which are from time to time recommended were experimented with. Iced water syringed right into the heads of cabbage had no effect whatever on the caterpillars infesting them. Boiling water was found to be almost impraticable for application on a large scale, although when used many of the caterpillars were destroyed without great injury to the plants. After trying several substances, the greatest satisfaction was given by a mixture of 1 part of Pyrethrum insect powder diluted with 5 times the quantity by weight of common flour, weaker dilutions gave good results, but this was decidedly the most successful.

The pure powder was used but was not appreciably more efficacious than the above. This powder can be quickly applied by means of one of the numerous instruments sold under the name of "insect guns," but these should have the tubes properly bent down so that they may not clog with the powder.

A sample packet of Hammonds "slug shot" was sent to me by the manufacturers for trial. This I found very useful against the caterpillars and propose to make a more extensive use of it next season.

The Cabbage Maggot (*Anthomyia brassicæ*, Bouché).

Attack.—One or more white maggots burrowing into the stem of young cabbages when freshly set out. About the beginning of July, freshly transplanted cabbages occasionally assume a bluish green appearance and the leaves become faded and flaccid during the heat of the day. This is generally a sure sign that the root is attacked by the maggot. When, as is sometimes the case, it is desirable to preserve some new or choice variety, the plants should at once be taken up and the roots examined. If they are only slightly injured they may be washed in strong soap suds and replanted, care being taken to remove the soil immediately around where the plant was growing before. Very successful experiments were carried out in this line during the past summer, the plants after two or three weeks showing no difference from those not attacked.

The parent of the maggot is a small fly, closely resembling the common housefly but smaller and with longer wings, which flies about close to the ground and lays its eggs close to the stem of the newly planted cabbage, thrusting its ovipositor beneath the soil.

This insect is one of the most troublesome pests the market gardener has to deal with. Mr. R. Brodie, of Montreal, says: "The Cabbage Maggot has been very destructive to our cabbages and cauliflowers in this neighbourhood these past few years, but especially the last season." The same information comes from almost every quarter. Mr. J. Lang, of Barrie, says: "A large number of people round this part complain of this grub which destroys their cabbages."

Remedies.—These consist chiefly in putting something round the young cabbages at the time of transplanting to destroy the natural odour of the plant. Sand saturated with coal oil (a large cupful to a pailful of dry sand), a little sprinkled round each plant has produced good results; and gas-lime when procurable, applied in the same manner, is even more efficacious. Late planting has also been attended with good results. Mr. Brodie, of Montreal, has also found the following treatment beneficial: "In 1885, I planted two acres of early cabbage and lost about half of them by the maggot. This was a great loss as I ploughed in about 75 tons of manure to the acre. The past season (1886) I put cabbage in the same land, and manured in the drill and applied a fertilizer composed of Superphosphate of Lime, Ammonia and Potash in the drill also; after the plants were set out I put about a tablespoonful of Nitrate of Soda around each plant, leaving one row without any Nitrate of Soda or the above mentioned fertilizer, and this was the only row that was any way destroyed by the maggot. I think, probably, it was the Nitrate of Soda that prevented the maggots from destroying the plants, for a field of cauliflower treated in the same manner, with the exception of the Nitrate of Soda, was partly destroyed by the maggot. I did not apply the Nitrate of Soda as a preventive of the maggot, but to give nitrogen to the plants when the land was cold in spring. I got this idea from an article in the *Rural New Yorker* by J. J. H. Gregory."

Fresh unrotted manure and particularly cow-manure seems to attract these flies to plants grown in soil so fertilized.

Onions.

Onions have again suffered from the attacks of Root Maggots, and Cut worms. Under the latter heading the only new item of important information is the successful use of a Kerosene Emulsion, as described in Prof. Riley's annual report for 1885, p. 272. "If the worms should appear in great numbers by migration from the surrounding fields, we would sprinkle the fields at night, while the worms are at work, with a diluted emulsion of Kerosene. Mr. J. B. Smith shows that pure Kerosene has been tried at Goshen with the effect of killing the worms, and simply blackening, but not killing the onion tips. We are not satisfied, however, that the free use of pure Kerosene would not seriously injure the plants, and we recommend instead an emulsion as being safer and much cheaper, while just as effective in killing the worms. For the proper preparation and application of the emulsion a good force-pump is needed, but beyond this no apparatus is necessary."

The best formula for this emulsion is given under the heading "A Turnip Aphis," p. 19, and is the one recommended by Prof. Riley.

The Onion Maggot (*Phorbia Ceparum*, Meigen).

Attack.—A white maggot which bores into the bulb of the onion from beneath and destroys it. When not feeding it generally lies outside the onion in a chamber of wet mud, which is kept moist by the juices of the decaying bulb.

Remedies.—The most successful remedies up to the present time are of a deterrent nature by which the perfect females are kept from laying their eggs on the young plants it is wished to protect.

Mr. E. Bell, of Archville, grew a very good crop of onions, which he considered were much protected by sowing broadcast over the bed, once a fortnight, a light sprinkling of gas-lime. Unluckily he was unable to keep the application up regularly throughout the season, and a proportion of the crop was lost. From what we saw of the effects of this remedy we feel confident that good results would follow a persistent application of this material. Great care must however be taken not to put it on too thickly, as it is extremely caustic, and a light sprinkling just enough to colour the soil answers the purpose.

A greater degree of success attended the application of a Carbolic wash detailed in the next paragraph.

The Radish Maggot (*Anthomyia raphani*, Harr).

Attack.—Very similar to the attack of the Onion Maggot.

Remedies.—The sprinkling of gas lime at short intervals over the beds had a like good effect in protecting radishes as was noticed with onions; but the best results were obtained by the use of the carbolic preparation mentioned in my last report, as devised by Prof. A. J. Cook, of Michigan. "Take two quarts of soft soap and boil it in rain water until all is dissolved, then turn in a pint of Crude Carbolic Acid. When required for use take one part of this mixture with fifty of water and when mixed well together sprinkle directly upon the plants. This was done once every week and perfectly clean radishes were obtained. The first application was made two days after the seed was sown and before any of the young plants had ppeared above the ground.

As a good effect probably due to not using green cow manure, I give the experience of Mr. G. A. Knight, of Mount Tolmie, Victoria, B.C., a careful and painstaking observer who knows most of the insect pests and has tried many experiments. He says: "I have used no cow manure this year, what I had was mostly horse manure bought from farmers. I have had better radishes this year than I have ever had in this Province before. My turnips are good but I had a great time with the Flea-beetle as usual. I sowed three or four times and sowed plenty of lime on them as soon as they came up and now I have a pretty good crop. I used no preventive on the radishes against the maggot."

Mr. Ferrier, of Barrie, has had successful results by treating these troublesome insects with a strong Kerosene emulsion. His method of applying it, was to pour the diluted emulsion along the rows with a watering can.

FRUITS.

The fruit crop of the year, with the exception of grapes, has been rather below the average. This deficiency too, it must be acknowledged, is largely due to the attacks of injurious insects. The most notable attacks reported are those on the apple tree. The Canker Worm and "Shot Borer" in the Maritime Provinces, the Tent Caterpillars from Quebec to the Pacific, the Codling Moth and Oyster-shell Bark-louse from the Atlantic to the Pacific, as well as many less important and more local attacks to other fruits. The Plum Curculio still does considerable damage. Perhaps one of the most important discoveries of late years in economic entomology is the application of Paris Green and other arsenical poisons for preventing the ravages of the Codling Moth and Plum Curculio.

APPLE.

The Codling Moth (*Carpocapsa pomonella*, L.)

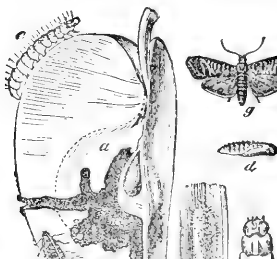


Fig. 3.

Attack.—A white or pinkish caterpillar, about $\frac{3}{4}$ of an inch in length, boring into the centre of the apple and injuring it considerably. (Fig. 3.)

Remedy.—This insect is so well known to fruit growers that very little need be said of it. Enquiries as to the best methods of treating it are received constantly. I have no hesitation in saying that for this, as well as for the Canker Worms (*Anisopteryx vernata* and *A. pometaria*, Harr.) and the Plum Curculio (*Conotrachelus nenuphar*, Herbst) the most economical and certain remedy is spraying the trees with Paris Green or London Purple. As being of a more uniform strength the former is preferred.

As to the efficiency of this remedy, if properly applied, there can be no doubt. Prof. Forbes gives the following as a summary of his systematic and thorough experiments for 1885 "attending only to the picked apples and condensing our statements of results to the last extreme, we may say that under the most unfavourable circumstances, Paris Green will save to ripening, at a probable expense of 10 cents per tree, seven-tenths of the apples which otherwise must be conceded to the Codling Moth." (Forbes Miscellaneous Essays on Economic Entomology, 1886, p. 41.)

Mr. B. Gott, of Arkona, Ont., says: "Notwithstanding a certain amount of trouble and the great care necessary in applying these poisons I am satisfied that with proper caution and if properly applied they may be used as deterrent remedies against the two chief enemies of our plum and apple crops."

There are however certain difficulties in the way of obtaining satisfactory results from this remedy. The amount of the poison to be used is so small that it seems almost impossible to induce fruit growers to use it only of the strength recommended and to stop applying it when the tree has received enough.

Then again there seems to be a difficulty in always obtaining the poison of a regular strength (*i.e.* containing always the same proportion of arsenious acid.) Mr. C. R. H. Starr writing from Port Williams, Nova Scotia, says. "We were less troubled with insects this season than in some previous years. Our chief enemy the Canker-worm has been kept in check by printer's ink or a substitute for that article and Paris Green or London Purple. Many of our orchardists have not had satisfactory results from the latter method, the great difficulty being in the uncertain strength of Paris Green. Take my own experience for instance. I made the attack when leaves and blossoms were about half or less out, the worms hardly visible, using $\frac{1}{4}$ lb. to a kerosene cask full of water. On some trees this seemed to be sufficient, at that early stage, but later finding in some quarters that they had grown and were doing much damage, I doubled the quantity (*i. e.*) $\frac{1}{2}$ lb. to the same cask, with the result of bringing off nearly all the leaves and of course fruit as well. Some of my neighbors about the same time used $1\frac{1}{4}$ lbs. to the same quantity of water without serious effects. Some of our farmers have decided they are liable to do more harm with Paris Green than to allow the Canker-worms to have it their own way. Many have gone back to the paper bands and ink, I have used a composition made of the component parts of printer's ink with satisfactory results, and at very trifling cost compared with the ink."

In the above experience Mr. Starr would have been wiser to repeat the weak application, rather than to double the quantity of poison.

The efficiency, and when properly applied, the safety with which these arsenical compounds can be used upon vegetation, have now been established without a doubt by the experiments of Professors Riley, Forbes and Cook. I therefore give below what I consider the most useful proportions of Paris Green, the only one of these compounds with which I have experimented to any extent. I regret that as yet I have not compared the different makes of pumps and nozzles for the distribution of these poisons, so I am not in a position to recommend any one above the others. Paris Green is an arseniate of copper said to contain about sixty per cent. of arsenious acid. It is therefore very poisonous and must be kept out of the way of children and domestic animals. It is also very corrosive and if used too strong or carelessly, will injure the foliage of plants. This material can be used as an insecticide in two ways, either as,—

(I.) A dry application:

One part of Paris Green may be mixed with from 25 to 50 of land plaster or common flour. This is useful on all plants of which the foliage is not used as food.

(II.) A liquid application;

(*a.*) For Codling Moth, Plum Curculio and the young Canker-worm, not more than from 2 to 4 oz. in a barrel of water (40 gallons) or in smaller quantity, $\frac{1}{8}$ to $\frac{1}{4}$ oz. in a pail of water. To be applied as a fine spray by means of a force pump. The foliage must not be drenched, but the spray should only be allowed to fall upon the trees until it begins to drip from the leaves.

(*b.*) For general use on mature foliage:—

$\frac{1}{2}$ ℔ Paris Green,
50 gallons water.

Or in smaller quantities the following formula may be used, which is almost in the same ratio as the above:—

$\frac{1}{2}$ oz. Paris Green.
1 pailful of water.

First mix the Paris Green separately with a small quantity of water, then add to the whole supply. All washes containing Paris Green must be constantly stirred to keep it in suspension or it will sink to the bottom.

For the Codling Moth, liquid application (*a*) should be sprayed upon the trees as soon as all the petals have fallen from the flowers. For the Canker-worms the eggs of which hatch out during a comparatively long period, two applications should be given of liquid application (*a*), one before the buds open, and the other as soon as the petals have fallen. For the Plum Curculio, liquid application (*a*) should be sprayed over the trees as soon as the young plum has formed. This may be repeated a fortnight later.

With the above, as with all attacks by injurious insects, the great secret of success is prompt action, and when making trial of this remedy let the spraying be done exactly at the time, and in the manner recommended. The spring applications are of the greatest importance. Prof. S. A. Forbes, State Entomologist of Illinois, who was one of the first to systematically investigate these remedies, in comparing his operations for 1885 and 1886, writes to me: "Our work of 1886 differed in the time and number of applications from one to three, early in the season. The general result was almost the same as the year before, going to show that these early applications are the only ones that are effective and necessary."

Frequent enquiries are made, and occasionally misstatements appear, as to the possible danger of poisoning the consumers of fruit and crops, protected with these arsenical poisons, which it is urged may be absorbed by the plants. These statements are however quite inaccurate as a very elementary knowledge of vegetable physiology will show. The two plants most frequently enquired about are the potato when treated for the Colorado beetle, when it is suggested that the tuber may absorb arsenic from the soil; and the apple when treated for the Codling Moth, when fear is expressed that the poison may be absorbed through the stigma and laid up in the seeds. With regard to the first it must be borne in mind that the tuber of the potato is not a root, but a repository of prepared nutriment for feeding the next year's growth, in fact a winter bud, a form of consolidated vegetation found in many plants as a means of carrying them over the winter. The starch with which it is stored is not laid up from anything that can be taken in through the roots; but is manufactured in the leaves from the liquid and gaseous food of the plant taken in through the roots and leaves, and is then passed down again through the tissues of the plant and laid up as starch in the tubers.

With regard to the second statement, it should be remembered that the stigma of a flower is without any epidermis and is exceedingly delicate, so that any corrosive poison like arsenic, in even a very week solution, would be much more likely to injure the stigma than to be absorbed, and further than this, even in the natural operation of fertilization, the stigma is a passive member and absorbes nothing. The activity is on the part of the pollen which pushes out its fovilla-bearing pollen tubes and protrudes them through the tissues of the stigma down the style into the ovary. In corresponding on this matter Professor Forbes says: "Of course you will have no trouble in proving by the highest authority that there is no possibility of the poisons being absorbed by the plants," which statement, with the following letter from Professor A. J. Cook, should, I think, set this contention at rest.

"22nd November, 1887.

"DEAR SIR,—In 1871 I used Paris Green on potatoes just as strong as I could and not kill the plants. I also put the poison on the ground where it would be washed to the roots of the plants. I had both vines and tubers analysed by a very careful chemist, and not a trace of arsenic was found either in foliage or tubers. In this case the opportunity for absorbtion of the poison was ten to one more favorable than in the common use for the destruction of the potato-bug. (*D. decemlineata.*)

"In 1881, six years ago, when I found the arsenites were a certain specific against the Codling Moth larvæ, I applied a very concentrated mixture of London Purple at two separate times to some apples. The foliage was totally destroyed by the application, so strong was it. It was made thus strong on purpose for a test. The middle of August the calyx of each of 100 (one hundred) apples was cut out; by holding the knife so as to remove a funnel-shaped piece. Two different analyses were made and not a trace of arsenic was found. I have now used the arsenites for eight years in this warfare and know that it is safe and wonderfully efficient. Yes, I think that less than 1 lb. to 100 gallons will do. My last recommendation is ½ lb. to 100 gallons of water. The important thing is to make the application early enough, as soon as the blossoms are well off the tree; and second, to make it so thorough that every apple—the calyx—shall receive its mite of the poison."

Upon this matter being brought under Professor Cook's notice, he wrote a letter to the *Rural New Yorker* (vol. 46, page 784, 26th Nov., 1887) which is well worthy of perusal by any one interested in the subject.

The Apple Aphis (*Aphis mali*, Fab).

Attack.—Green plant-lice clustered around the outside and in between the young leaves of the opening buds in spring; also in large numbers beneath the leaves in autumn.

Remedies.—This insect which frequently appears in vast numbers in spring is produced from small black shining eggs which are laid the previous autumn on the twigs and branches of the apple tree. This is apparently the only mode of hibernation and suggests the direction in which we may look for a remedy.

Before the discovery of the value of Kerosene emulsions, the usual method of treating this insect was to syringe the trees at the time the eggs were hatching with a strong soap or tobacco wash. This was attended with a large measure of success and may be used where it is not convenient to use the emulsion.

The efficacy of weak emulsions of Kerosene for plant lice makes it imperative that all fruit growers should become familiar with the best way to use them.

Prof. A. J. Cook, in Bulletin 26, of the Agricultural College of Michigan, states as follows:—

"I have found nothing so satisfactory in treating plant lice as the Kerosene and soap mixture. To make this I use one-fourth pound of hard soap, preferably whale-oil soap, and one quart of water. This is heated till the soap is dissolved, when one pint of Kerosene oil is added and the whole agitated till a permanent emulsion or mixture is formed. The agitation is easily secured by use of a force pump, pumping the liquid with force back into the vessel holding it. I then add water so that there shall be Kerosene in the proportion of one to 15."

(N.B.—This mixture although differently prepared gives the proportion of Kerosene to the water almost identical with that mentioned on page 19.)

"On Snow Ball * we find that this mixture in the proportion of one to eight, used just before the plant lice eggs hatch is astonishingly efficient. A twig not treated and one from the same bush that had been treated were each put into a glass bottle in a warm room. In a few days the one bottle was alive with the newly hatched lice, while in the other only one live louse was found. Bushes side by side, the one treated the other not, give equally satisfactory results. This early treatment is absolutely necessary in such cases as the Snow Ball, and is to be recommended on the score of economy in case of nursery stock and fruit trees. It is easier and requires less of the liquid to thoroughly drench a leafless tree than one in full foliage. It is also less difficult to make the application very thorough, which is all important. We have just applied this liquid to orchard trees where the buds were literally covered with lice, and we find the lice totally used up."

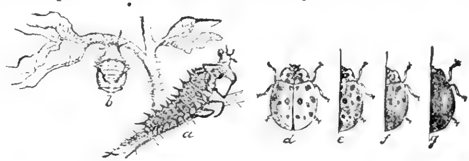
These plant lice are so exceedingly prolific that were there not some natural check imposed upon them, they would soon overrun all vegetation. We find, however, that they provide food for several kinds of predaceous insects and there is seldom a heavy visitation of Aphis without a corresponding appearance of its enemies. Some of the most useful of these are the following:—

Fig. 4.

The larvæ of the *Syrphidæ*, a class of beautiful and active flies marked with yellow and black (Fig. 4), which may be seen in the summer around flowers, poised apparently motionless in mid-air for a few seconds, then, darting a yard or so, stopping again, and dashing off suddenly in another direction. The larvæ are elongated brownish maggots, with the front segments much smaller than the rest and capable of being extended some distance to the right or left. These larvæ, which may generally be found crawling upon the stems of plants infested with aphides, destroy enormous numbers of plant lice.

Perhaps the most industrious and business-like destroyers of these injurious insects are the numerous species of the Lady-Bird Beetles (*Coccinellidæ*)

Fig. 5 represents the Fifteen-Spotted Lady-Bird (*Anatis* 15-*punctata*, Oliv) a large and abundant species. It varies much in appearance; at *d*, *e*, *f*, *g*, are shown four of the different forms under which it is found; *a* shows the larva devouring a grub of the Colorado potato-beetle and *b* is the chrysalis.



(Fig. 5.)

I frequently receive accounts of how much these active little friends have assisted the fruit-grower; but sometimes, unfortunately, their presence in numbers amongst infested crops is misunderstood and they are mercilessly destroyed by those who are not acquainted with their habits. Other beetles which have shown themselves vigorous assistants to the fruit-grower in British Columbia, are the Soldier-Beetles (*Telephoridæ*) Mr. G. A. Knight writes from Vancouver Island, "the amount of green flies this spring was awful, and they threatened small apple trees with complete destruction. I was preparing for war when an army of soldiers made their appearance and fought the fight for me. I never saw such quick work. In one week there was not a green-fly to be seen, and the beetles disappeared almost as suddenly as they came. They are the same kind† as cleared my black currant bushes when you were here in 1885. Since they went the Lady Bugs have kept the green-flies in check."

*Note.—*Viburnum opulus* or Common Guelder Rose.
†Note.—(*Podabrus comes*, Lec.)

Mr. P. T. Johnson, nurseryman of Victoria, B C., also speaks of the good offices of this same beetle. "I want to tell you about the Aphides on the apple and cherry trees this year. They came out in the spring in great numbers and I thought we were going to have the usual trouble; but almost immediately afterwards, I noticed a beetle something resembling a house fly but double as long and of a deep grey colour come out of the earth in myriads. They ascended every apple and cherry tree and quickly cleared them of the Aphis."

Besides these beetles there is a family (*Aphidius*) of small parasitic flies belonging to the *Braconidae* which feed entirely upon the green flies. In examining a colony of Aphides some will generally be found which are much larger, of a different colour, and with the body swollen and rounded. These after a time fasten themselves to the leaves and die, and a little later the parasite, a tiny four-winged fly, emerges through a hole in the back.

Tent Caterpillars (*Clisiocampa Americana*, Harr; *disstria*, Hubn, and *Californica*, Pack.)

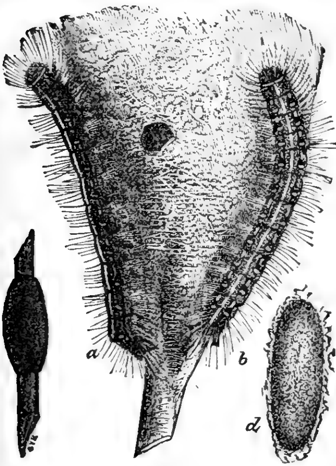


Fig. 6.

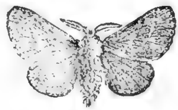


Fig. 7.

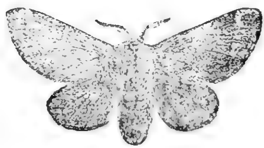


Fig. 8.

These caterpillars have appeared in great abundance all over Canada during the past season and seemed to attack the foliage of of almost every kind of deciduous tree. The apple, of course, came in for its share of attack.

The habits of these different species are very similar, and the same remedies will apply to all. The larva of the American Tent Caterpillar (*C. Americana*) Fig. 6*b* is known from the Forest Tent Caterpillar (*C. disstria*, Hubn) by having the white stripe down the back unbroken, while in the latter it is broken up into white blotches, each consisting of a large and a small spot joined at their ends, as shown at Fig. 9. There is one

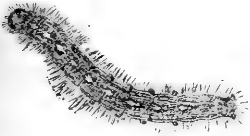


Fig. 9.

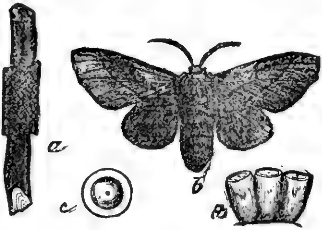


Fig. 10.

of these blotches on each segment. The Western Tent Caterpillar (*C. Californica*) is found in British Columbia and closely resembles *C. Americana*. The two eastern species differ in their habits. They are both found in orchards, but *C. Americana* forms in the fork of one of the small branches a tent-like web into which the caterpillars retire when they are not feeding, while *C. disstria* (Figs. 9 and 10) weaves a silken mat on the side of the tree to which the whole colony returns to rest. From these nests silken paths lead up all the main branches to the foliage. As the caterpillars approach maturity they take to wandering extensively, and as I noticed during the last summer they can traverse long distances. I have frequently observed in the same nests specimens of the two species of all sizes, a somewhat remarkable fact, considering the difference in their habits.

The western species was sent to me by Dr. Trew, of New Westminster, who states: "I send you some specimens of one of the pests of apple trees in this province, nor are its ravages confined to the apple, as the parent moth will lay its eggs on the twigs of plums, pears, roses and even raspberries at times; but the apple is its favourite, and so far as my observation goes, Russets and Red Junes are preferred, perhaps because of earlier foliage; although Pearmains are early they seem to escape visitation."

Remedies.—From the regular habits of these caterpillars, retiring to their nests when not feeding, they are, with a little care, comparatively easily dealt with, when they do not occur in overwhelming numbers.

During the winter all egg masses, which can then be easily seen, should be removed.

If this be not done the conspicuous nests of the American Tent Caterpillar should be cut off as soon as observed and destroyed.

The Forest Tent Caterpillars, which generally rest in masses on the trunks of trees, can be either crushed with any hard instrument or they may be swabbed with a mop dipped in coal oil.

During last summer an experiment was tried of puffing Pyrethrum powder into a nest of the American Tent Caterpillar, which was in the fork of a small apple tree in my garden, and a few of the caterpillars were killed. The larger number, however, remained perfectly still in a lethargic state inside the web for over a week. After that time they gradually began to recover and all left the nest, and two days later I found several of them, still thickly covered with the powder, on some raspberries about 60 feet distant, apparently none the worse either for their fast or for the powder.

This remedy then is not practically useful for these caterpillars.

Paris Green, sprinkled over the foliage where they were feeding, gave much more satisfactory results.

The Oyster-shell Bark-louse (*Mytilaspis pomorum*, Bouché.)

Attack.—Minute insects furnished with a beak and protected by a waxy scale, which is about $\frac{1}{10}$ of an inch in length and shaped like an elongated oyster-shell. Fig. 11. The young lice are hatched in spring, and are active for a few days. They then migrate to the young shoots of the apple, and inserting their beaks into the bark, remain there for the rest of their lives. They are gradually covered with the scale from which they take their name, and which is exuded from their bodies in a soft state as they grow. Under it the eggs are laid, after which the mother insect dies.

Fig. 11.

This pernicious insect is now found injuriously abundant in every Province of the Dominion. From its insignificant appearance and small size it is frequently overlooked; but there is no doubt that it does an immense amount of injury in our apple orchards.

Remedies.—There is only one annual brood of this insect in Canada, and the young lice emerge from the protecting scale about the 1st of June. This is the time they are least protected, and the greatest efforts should be put forth to reduce their numbers. By reason of their protecting scale, they are very difficult to treat with insecticides during the greater part of the year, few substances being sufficiently penetrating to reach them beneath their scales. The most effectual remedies have been found to be

Kerosene Emulsions (as described at page 19). During the winter the trees should be examined and the scales scraped off as far as possible. Small trees may also then be sponged with the Kerosene Emulsion preparatory to spraying them at the time the young lice appear. In Saunders's "Insects Injurious to Fruits," syringing with a solution of washing-soda in water is recommended, to be applied about the time the young lice leave the scale. "This solution is made by dissolving half a pound or more of soda in a pailful of water. Painting the branches and twigs with linseed oil, has also been found successful. As a precautionary measure, every young tree should be carefully examined before being planted, and if found infested, should be thoroughly cleaned."

An interesting observation was made at New Westminster, B.C. Mr. A. J. Hill, who has kindly assisted me in collecting and giving information concerning injurious insects in his neighborhood, sent me in April last, twigs of apple trees handed in by Mr. C. G. Major, of New Westminster, which were thickly covered with this insect. Noticing an old scale of the year previous had been perforated by a parasite, I placed the twigs in a glass jar, and soon after had the great pleasure of finding large numbers of the beautiful little Chalcid (*Aphelinus mytilaspidis*, LeBaron).

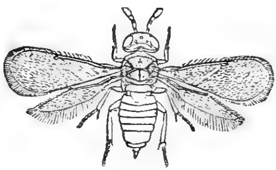


Fig. 12.

This is a minute yellow fly, which is parasitic upon the scale insect, and has in some instances largely reduced its numbers. It is shown greatly enlarged at Fig. 12.

Pear-blight Beetle, "Shot-borer," "Pin-borer" (*Xyleborus dispar*, Fab).

(*Xyleborus pyri*, Peck, of American authors.)

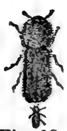


Fig. 13.

Attack.—A small, blackish beetle boring into trunks and limbs of apple trees. In the latter case generally entering at a bud and boring right round the stem in the wood near the bark, then inside this another burrow is run, after which a short perpendicular shaft is frequently sunk. Sometimes the first burrow runs in for a short distance, and then branches irregularly in different directions.

Fig. 13 shows the female of this beetle enlarged and of the natural size.

During the last three or four years frequent complaints have been received from the Annapolis Valley, in Nova Scotia, of the depredations of a small borer which was attacking the apple trees. This, from the size of the holes whence the mature beetles have emerged, has locally been described as the "pin-borer," or "shot-borer." During the past summer, owing to the kindness of Mr. T. E. Smith, of the Nova Scotia nurseries, Cornwallis, N.S., I have been supplied with a good series of the perfect beetles, as well as much useful information concerning this and many other injurious insects. I find that the culprit is the above named insect, which is a small dark brown beetle, not more that $\frac{1}{8}$ of an inch in length, with legs and antennæ of a much lighter colour, and having the whole body covered with short hairs.

Mr. Smith says: "I think the eggs are deposited early in June, as I have seen in the same burrows, eggs, larvæ in all sizes, and the beetle. The eggs and larvæ are white. I have seen the beetles fly from tree to tree in June, and I think they only attack diseased trees. I have not tried the soap wash recommended. I have had so few in my own nursery that I had no trouble in cutting off all the injured limbs and burning them. I have never found them trouble the pear."

From this full series of specimens the somewhat important scientific fact has been ascertained that this and the rare *X. obesa*, Lec., are the same species.

Mr. J. B. Smith, of Washington, who kindly confirmed the identification of the specimens, writes to me: "The Xyleborus is *pyri*, *i e.*, the female is; the male is *obesa*. This proves what Mr. Schwarz has long claimed, that *obesa* was but the male of *pyri*. Both of these are equal to the European *dispar*, Fab. *Obesa* is extremely rare, only two or three specimens being known thus far."

Mr. Schwarz also called the attention of the Entomological Society of Washington to the probability of the above identity on April 1, 1886.

In Jacquelin du Val and Fairmaire's "Genera des Coléoptères d'Europe," there are beautiful enlarged figures of both the male and female under the name of *Bostrichus dispar*.

The male and female differ considerably. In the female, fig. 13, which is about $\frac{1}{8}$ of an inch in length, the thorax is large, very convex and rounded, and comprises about $\frac{1}{3}$ of the insect, it is much roughened in front with coarse protuberances, the elytra are furrowed, and each one bears about six stripes of punctures and rows of hairs. They slope off slightly behind, but not nearly so perceptibly as in many insects of the same family. Each tibia, or shank, is much widened and flattened towards the end, bearing at the extremity a spine, and on the outer margin some teeth and bristles pointing outwards. These are no doubt a great assistance to the beetles in moving about in their burrows, which the mature beetles frequent much, retiring quickly out of sight on the approach of danger. The tarsi, or feet-joints, are very slender as compared with the shanks.

The male of this beetle is much smaller than the female, seldom exceeding one-tenth of an inch in length. The thorax is quite differently formed, being much flatter and instead of being higher than the base of the elytra, slopes sharply down to the head. The tibiæ, too, are less inflated. Altogether it is quite a different looking beetle and was as above stated at one time supposed to belong to a different species.

The injuries committed by this small beetle are very great compared with its insignificant size, and I have had the statement made to me several times that it seems to poison a large area of wood around its burrows when these are in the solid wood. In the young limbs the burrows cut through their tissues so that they are completely girdled. Some specimens injured in this way which were sent to me by Mr. Smith and Mr. J. D. Ells, of Sheffield Mills, N.S., had as many as five tunnels in a length of $4\frac{1}{2}$ inches. Mr. E. E. Dickie also sends specimens from Cornwallis, N.S. He says: "It is doing much damage to our apple trees in this part of King's County; we do not know it is in the tree until the leaf begins to fade." Mr. T. E. Smith writes from the same locality: "I send by this mail specimen of apple twig borer, of which we were talking last winter. One of my neighbors says he has lost about forty fine healthy apple trees, mostly Gravenstein and King of Tompkins. They attack the butt, and in some cases well into the limbs of young and bearing trees a foot in diameter,* mostly on the north side of the tree. I recommended plugging with wooden pegs such holes as were visible, to stop their supply of air. We found this too tedious and used fine cut nails. Those that were plugged in on Saturday were coming out in other spots on Monday. We are now going to try scraping and using a thick coat of whitewash with a mixture of Paris Green. Some are trying a coating of tar, others bore a hole and fill with paraffine and fill up."

The plugging up of the holes would, of course, be useless, as discovered by Mr. Smith, and the last two remedies would be very injurious to the trees. The thick coat of whitewash with Paris Green would probably be a useful remedy. I suggested applying at once a thick soap wash to be prepared as directed on page 19 of Saunders's Insects Injurious to Fruits, and known in my correspondence as "the Saunders Wash." It is as follows:—

* Mr. Smith has since written, "I think after all they only attack diseased trees."

"Soft soap reduced to the consistence of a thick paint by the addition of a strong solution of washing soda in water is perhaps as good a formula as can be suggested; this, if applied to the bark of the tree during the morning of a warm day will dry in a few hours and form a tenacious coating not easily dissolved by rain."

Some of the fruit growers in the Annapolis valley, who have considered this matter, state that the beetle attacks perfectly sound and healthy trees.

Mr. W. H. Hartwick, of Canard Station, Nova Scotia, "found them in young and perfectly sound trees." Mr. F. C. Johnson, of Port Williams Station, gives the same testimony: "I detected them first in a sound healthy tree by seeing the sap flowing from the wound. I plugged the hole up and stopped the attack." It is probable that the beetle was here killed by the plug. Mr. J. L. Gertridge who has studied this pest closely, is positive that he has found them in both old and young trees. Now I have received specimens of this borer in its burrows from several of these localities and there is one character noticeable about most of the specimens, viz., that the bark is hardly visible on account of being covered with the Oyster-shell Bark-louse. It has therefore occurred to me that the trees which are suffering so severely from this little beetle, had already been reduced to a low state of vigour by this last named pernicious and frequently overlooked enemy.

I am advising all the Nova Scotia fruit growers to use special efforts to rid themselves of the Bark-louse, when I believe some of the other pests will be cleared out at the same time.

Prof. Saunders tells me that during a journey made through Nova Scotia last summer he had the opportunity in company with Mr. C. R. H. Starr, Secretary of the Fruit Growers Association of Nova Scotia, of examining several apple orchards in which the trees were suffering from this pest, and in no instance did they find any traces of the ravages of these beetles in healthy trees; those affected had invariably been injured by bark-lice or borers, or had become stunted and diseased from some other cause.

The tenacity of life of this beetle is remarkable. I have found them alive in their burrows out of doors, during the winter, which is not very surprising; but of the samples sent me in the beginning of June by Mr. Smith some were put on one side as museum specimens, and as the beetles were showing in the central perpendicular tunnel described above, alcohol was poured over them and they were put away as dead. To-day (Feb. 25th)* in examining them I find to my surprise some of the specimens alive. These specimens were sent upon their first appearance in June, and have been kept in a heated study every since. Amongst the sections of apple wood sent me was part of a branch $2\frac{1}{2}$ inches in diameter, from which emerged not only the beetle under consideration, but several of the small and injurious Apple Bark Beetle (*Monarthrum mali*, Fitch). The habits of this last named are very similar to those of the above and the same remedies would be applicable to both. This is a very small, slender beetle about $\frac{1}{10}$ of an inch in length. It is shown much enlarged at Fig. 14.

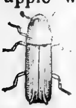


Fig. 14.

The Red humped Apple-tree Caterpillar (*Œdemasia concinna*, Sm. and Abb.)

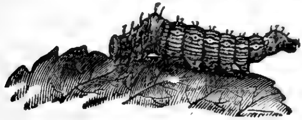


Fig. 15.

Fig. 16.

Attack.—Yellow and black caterpillars with red heads and a hump behind the

* They are still alive and active April 5th.

fourth segment, about one and a quarter inches in length when full grown. They all remain together from the time they are hatched until mature, and are very ravenous. When occurring on small trees they frequently strip every leaf before they are discovered. This is a particularly objectionable looking larva and emits a strong acid odour when touched. When full grown they fall to the ground and spin a light cocoon amongst the leaves on the gronnd in which they remain as larvæ until the next spring. The perfect insect appears about 1st July and is a brownish moth, expanding about an inch and bearing on each of the wings a conspicuous spot and several longitudinal streaks.

Specimens of the caterpillars have been sent to me from three or four localities, amongst others from Mr. C. A. Patriquin, of Wolfville, Nova Scotia, Mr. W. A. Macdonald, agricultural editor of the *Farmer's Advocate*, London, Ont., and Mr. A. McNeill, M. P., of Wiarton, Ont. The experience of the last named was that of all the rest, he says: "I enclose an exceedingly ugly caterpillar which has been very troublesome for a year or two among my apple trees, stripping the leaves from a young shoot, in an incredibly short time. It commences operations generally near the point of a branch, and if not observed for a few days works great mischief."

One collection of five specimens was sent in, of which all were found to be parasitised by the Ichneumon fly *Ophion purgatum*, Say, and at Ottawa several specimens of *Limneria Guignardii*, Prov., were bred from this species.

GRAPES.

The grape crop of the past season has been exceptionally good, and although a few specimens of injurious insects have been sent in, there have been no complaints of serious injury.

An interesting but severe occurrence of the "Tomato gall of the Grape" has been brought under my notice in the garden of Captain D. K. Cowley, of the Rich mond Road, Ottawa. This I hope specially to investigate for a remedy next year.

The Grape-vine Leaf Hopper (*Erythroneura vitis*, Harris.)

Attack.—Small four-winged active insects one-eighth of an inch long. The upper wings striped with deep brown and yellow. Generally keeping beneath the leaves, and sucking the sap, so as to leave them white and withered. This troublesome little creature has not been so abundant on the grape during the last year or two as upon the Virginian creeper (*Ampelopsis quinquefolia*, Michx.), for which in the Ottawa district it seems to a large extent to have deserted the cultivated grapevines. It shows a marked preference for the wild grape (*Vitis riparia*, Michx.), where that species is grown.

This grape-vine leaf-hopper, with one or two other species, generally found with it attacking vines, and all known by the inaccurate name "Thrips," hibernates in the perfect state and lays its eggs on the young leaves when they first open.

Remedies.—Destroying all winter shelters, such as dead leaves and rubbish, doubtless prevents the mature insects from hibernating in close proximity to vines; as they fly easily, however, this is insufficient. Several experiments have been tried for a remedy, and the one which gives the most promise of success is a weak Kerosene Emulsion in the proprortion of 1 of kerosene to 30 of water, to be applied at the time when the young bugs have just hatched. Mr. John Lowe, the Secretary of the Department of Agriculture, tells me that he has never failed to drive these insects off his grape-vines by simply applying powdered sulphur, which, when liberally applied to the vines, gives off, on warm days, a perceptible odour of sulphurous acid gas which keeps the insects away.

The Grape-vine Looper (*Cidaria diversilineata*, Hubn.)

Fig. 17.

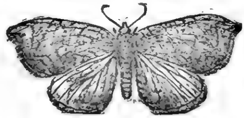


Fig. 18.

Attack.—Slender light-green or pinkish loopers (or measuring-worms)—Fig. 17 eating the leaves of the grape and Virginian creeper in June and July.

The moth of this caterpillar (Fig. 18) is very prettily marked with brown lines on a bright ochre ground. When at rest it much resembles a dead leaf. It has a curious habit of curving the abdomen up between the wings, which also gives it an unmothlike appearance.

Mr. T. E. Smith, writing from Cornwallis, N.S., says: "I send you some caterpillars which I have found for the last three years upon one lot of my grape-vines. I have watched and hand-picked them very carefully, but I find them increasing in numbers. While at rest they extend themselves from the edge of the leaf they are feeding on and resemble a small filament or the end of a tendril. When full-grown they attain quite a large size."

Remedies.—These caterpillars can be easily kept down by sprinkling either hellebore or a very weak mixture of Paris Green in water over the foliage.

The Beautiful Wood Nymph (*Eudryas grata*, Fab.)

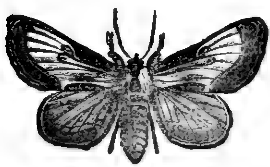


Fig. 19.

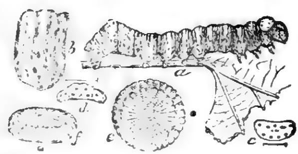


Fig. 20.

Attack.—Bright coloured, voracious caterpillars, destroying the leaves. The body is blue, crossed with broad orange bands and narrow black streaks. Head, orange. The perfect insect of this caterpillar is one of our most beautiful moths. It may be frequently found during the day time resting on the leaves of the grape, with two of its legs extended in front of it. The wings, when expanded, cover nearly two inches. The upper wings are pearly white, bordered with rich seal-brown, edged inside with green. The lower wings are orange, and have a broad, brown band along the hind margin. The body is orange, with a black stripe down the back.

These caterpillars are very voracious and have been numerous in some parts of Ontario during the past summer. Mr. Stanley Spillett, of Nantye, Ontario, says: "I take the liberty of sending you some worms which are eating the leaves of my grape vines here. If not interfered with they would destroy all the foliage. We do not know of any remedy for their destruction."

A mixture of Paris Green in water was recommended and proved quite successful. Hellebore or dry Pyrethrum powder would probably have answered as well.

RASPBERRIES.

Raspberries suffered much from the dry weather so prevalent last season. Early in the spring the Red Spider (*Tetranychus telarius, L*) showed itself in many places, and gave trouble all through the summer, although vigorously assailed by a small Lady-bird beetle, *Scymnus punctatus*, Melsh.

The young shoots were attacked by the larvæ of an Anthomyian fly. The eggs of which were evidently laid in the axil of a leaf, and when hatched the maggot ate its way down inside the stem, leaving a thin discoloured track for six or eight inches. When mature it turned into a brown puparium and passed the winter inside the stem (this was in the breeding jars). The mature insect which is a small black and extremely active fly about half as big as a house-fly has not yet been identified. The presence of this enemy is first shown by the tip of the young shoot fading and hanging over, much in the same way as when attacked by the Raspberry-cane borer (*Oberea bimaculata*, Oliv.) except that when stems are injured by this latter, the two rings made by the female, and between which she deposits her egg, are plainly visible. The only practicable remedy for both of these is at once to cut off the stem below the seat of injury.

The Pale Brown Byturus (*Byturus unicolor*, Say.)

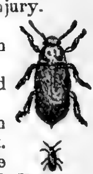


Fig. 21.

Attack.—An active greyish brown beetle about one-sixth of an inch in length, which eats into the buds and destroys the flowers.

Early this spring these little beetles appeared in numbers and assailed the Raspberry bushes, doing a great deal of harm.

Remedy.—The only remedy tried was hand-picking. It is nocturnal in its habits, and in the morning each flower seemed to have its occupant. In my garden at Ottawa, all the first flowers were destroyed. The beetle seemed to be particularly attracted to a seedling bush of the White-flowered Scented-raspberry, *Rubus Nutkanus*, Mocino, flowering for the first time last year. Not a single flower of the first blossoms was perfect. As this bush was separated some distance from the rest, Pryethrum was dusted over the buds in the evening, and by this means perfect flowers were obtained. No fruit, however, was formed on this bush, but whether this was due to the insect powder keeping away bees and other insects, I am unable to say.

Red Raspberries at Ottawa were in some spots severely attacked by an aphis, by which all the young flowering shoots were thickly covered. Observing that many of the aphides showed signs of being parisitised I collected some shoots and had the pleasure of breeding many specimens of the minute Proctotrupid *Lygocerus stigmatus*, Say, and two examples of a tiny midge, *Diplosis aphidimyza*.

These parasites were kindly identified for me by Mr. W. H. Ashmead. He says: "The Diplosis is a common parasite on aphides in the old country, but not before known in this country, Osten Sacken not recording it in his recent catalogue. I have reared another species here from an aphid on hickory, *Schizoneurus caryæcola*, Ashm, and I find a record of Prof. Comstock having reared a species from a coccid in California."

Currants.

Currants of all kinds were little troubled by insects. The value of Hellebore for the Imported Currant worm (*Nematus ventricosus*, Hartig.) is now universally known. Nevertheless there is frequently considerable loss from carelessness on the part of the growers who wait until the injury is done before they procure the Hellebore. An effort was made last season with good results to prevent this loss, by writing letters to the press in the middle of May warning fruit growers to be on the alert.

My attention has been drawn by Rev. C J. Young, of Renfrew, to the fact that an erroneous idea prevailed with regard to Hellebore. He writes: "Some people here have an idea that 'Hellebore' has a deleterious effect on the bushes and prevents them from bearing, so are shy in using it; as a consequence the currant and goose berry worms are worse than ever this year and have stripped many a bush of its leaves already."

White currants were again attacked at Ottawa by the Currant Weevil (*Antho-*

nomus rubidus, Say) and in a few instances black currants were also injured. The Spiny Caterpillar of the Currant (*Grapta Progne*, Cram.) appeared abundantly but readily succumbed to a weak treatment of Paris Green.

The Currant Bark Louse (*Lecanium ribis*, Fitch).

Attack.—Brown, polished, bark-lice thickly clustered on the stems; beneath these in their early stages are small lice bearing a beak with which they suck the sap of the plant.

One of the severest attacks reported by this large scale insect, which infests the red and white currants, occurred at Ste. Anne de Beaupré, P Q. Mr. Magloire Simard writes me that he procured a supply of young white currant bushes, and the next year they were entirely covered with these bark lice, of which he sent me some specimens. Upon the branch he sent me I was pleased to find that many of the insects had been destroyed by some small parasite, as was evidenced by the perforated scales.

Remedy.—Sponging or spraying the bushes before the leaves expand with a strong soap or alkaline wash, or with a kerosene emulsion (1 of kerosene to 15 of water), would be the best way to clear them of these pests.

STRAWBERRIES.

The only serious injury reported by insects to strawberries was from Cowansville, P.Q., and was referred to me by Mr. L. A. Woolverton, the editor of the *Canadian Horticulturist*, in the beginning of June.

The Strawberry Weevil (*Anthonomus musculus*, Say).

Attack.—Very small brown beetles, $\frac{1}{12}$ inch in length, with a black blotch, bordered with white, in the centre of each wing-case. The head extended into a beak, which is slightly curved and nearly half as long as the body. These beetles bite off the buds and flowers of strawberries, or injure them so much by puncturing the stems that they dry up.

Remedies.—Very little is known of the life history of this insect, so preventive remedies only were suggested. These were the Kerosene Emulsion (see page 19), and the Carbolic Wash (see page 23).

FOREST AND SHADE TREES.

HARDWOODS—MAPLES, OAKS, ETC.

One of the most remarkable visitations of the year was the appearance in enormous numbers of the Tent Caterpillars, already alluded to on a previous page. In the immediate neighborhood of Ottawa the forest presented a most peculiar aspect. The leaves were riddled and cut up so that on some trees there could not have been more than half the amount of green vegetation to perform the functions of the foliage. This was particularly the case on the Quebec side of the river and along the river banks. Considerable alarm was expressed by farmers who did not understand the habits of these insects, lest when they had consumed all the foliage of the maples, oaks, aspens, &c., they should destroy the grain crops. This was probably due to the fact that they were incorrectly spoken of as the "Army Worm." The idea, however, took such hold in the district that some of the farmers proposed burning their fences to kill the caterpillars and to remove their means of migrating from the woods to the fields, and I found it necessary to write to one of the leading farmers living in the district infested, to ask him to explain the nature of the insect and prevent such absurd destruction.

The colony of the Maple-Leaf Cutter (*Incurvaria acerifoliella*, Pack.) mentioned in my last report as present at Ottawa, still continues to increase to an alarming extent No parasites have as yet been observed.

CONIFERÆ.

PINES.

As a consequence of the hot dry summer, bush-fires have been very prevalent throughout the timber districts, and there is such anxiety amongst lumbermen that it is proposed, as soon as possible, to prepare a bulletin treating specially of the insects injurious to Pine timber. In this will be collected together as much as is known, or can be ascertained, as to the lives of the insects, and the most successful methods adopted by lumbermen to protect their property. Extensive correspondence is now being carried on, and it is hoped that before very long some useful information will be ready for distribution. The two insects which probably commit the most serious ravages on felled pine timber, or upon standing pine trees when they have been injured by fire, are the two Long-horned beetles known as *Monohammus confusor*, Kirby, and *M. scutellatus*, Say, the first is grey mottled with darker tufts of hair, and the latter is black with white marks. The life of these insects is briefly as follows: The egg is laid in a crevice or hole in the bark; when it hatches the grub eats its way into the cambium layer of the sap wood, and here spends the greater part of the first year. As winter approaches it penetrates into the solid wood. In the spring of the next year it eats further into the solid wood, and probably turns to the pupa or third stage the next spring and emerges as a perfect beetle in the summer of the third year.* Directly a fire passes through a forest the trees are brought into a condition suitable as food for these beetles, and it is marvellous how soon they discover them and begin to deposit their eggs.

The important point to discover then is how late in the year do these beetles lay their eggs, because when a fire occurrs after the period during which eggs are laid, the trees will not receive injury from the borers until the next year. Owing to the prevalence of early fires this year lumbermen are forced to employ many more men in the shanties to prevent their logs being destroyed.

There seems to be conclusive evidence that logs kept shaded during the summer are very much protected against the borers. In a recent visit to Lindsay and Fenelon Falls, Ont., through the kindness of Mr. J. A. Barron, M.P., I was enabled to meet several of the lumbermen and foremen of that locality, and obtained much valuable and practical information. I found that they had no confidence in the operation known as "rossing," which consist of cutting a groove along the top of the log as they say "to let the rain in," but all seemed to agree that keeping the rays of the sun off the logs, by covering them with boughs of Balsam Fir, as explained by Mr. W. G. Perley, M.P., of Ottawa, before the Select Committee on Agriculture and Colonization last year, does decidedly protect against wood-boring beetles.

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* NOTE.—Since writing the above, I have had an opportunity of examining standing pine injured by fire last spring, Larvæ of all sizes were found from half an inch to one and three-quarters in length. These latter, I should suppose, must be almost full-grown. Where they had been at work beneath the bark was plainly visible. After entering the solid wood they had penetrated to distances varying from one to ten inches. From the above observations it is now uncertain whether, under favourable circumstances, these large borers may not possibly pass through all their stages in one year Arrangements have been made for a further study of this matter during the ensuing season. My thanks are due to Mr Berkeley Powell (of the firm of Perley & Pattee) and Mr. W. R. Thistle, lumbermen of the Ottawa district, who have rendered me much assistance in this investigation. They themselves accompanied me to Pembroke and drove me through portions of their extensive limits which had been burnt at different times during the last year. By their kindness in placing horses and men at my disposal, I was enabled to visit distant points, and, when necessary, to fell trees for examination.

Any good effects which have been derived from "rossing," I am of the opinion are from the bark separating from the tree, and by the consequent drying up of the cambium layer, upon which the young and tender grub feeds.

The Red-Pine Gall-Weevil (*Podapion gallicola*, Riley.)

An interesting discovery was made at Aylmer, P.Q., last summer, upon the occasion of a visit paid to that locality with Mr. W. H. Harrington.

Upon the twigs of the Red Pine, we found large numbers of oval galls about ½ inch in length, in which upon examination we discovered specimens of this weevil, and I have since found that instead of being, as generally supposed, a very rare species, it is extremely abundant throughout the Pine forests in the County of Renfrew, Ont. In no instance could I find a tree of the Red-Pine which had not most of its small branchlets distorted by the swellings caused by this insect, and there was abundant evidence of its operations in former years. In the young cones of the trees at Aylmer were also found numerous examples of the small Scolytid, *Dryocœtes affaber*, Mann, which had destroyed probably two-thirds of the cones. This species also bores in the terminal shoots of the White Pine.

SPRUCE.

From British Columbia I have received some larvæ which have produced the moth known as *Halisidota sobrina*, Stretch, a pretty brown moth spotted with silvery white spots on the upper wings and with under wings almost wholly white. These larvæ were sent by Rev. George W. Taylor as committing great depredations on the spruces there. In the box with these caterpillars were twigs of the Douglas fir. I found, however, that they fed with perfect indifference upon either Canada balsam fir or white spruce, and all came to maturity except two specimens, which were parasitised. This will doubtless be treated of in full in Mr. Taylor's forthcoming report as Provincial Entomologist.

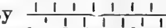
From the Province of Quebec comes a woeful tale of the destruction of the spruce forests.

The Spruce Bark Beetle (*Dendroctonus rufipennis*, Kirby).

Attack.—A small cylindrical beetle, with deep-brown wing cases and head and thorax almost black, which bores a hole through the bark of a healthy spruce tree, until it reaches the sap wood, here it runs a tunnel about two or three inches in length beneath the bark, and lays at short and regular intervals eggs which hatch into white grubs. These eat out channels at right angles to the primary tunnel, so as to destroy the sap-wood beneath a large square of bark.

I have received several letters on this subject, and have also had specimens sent me which, through the courtesy of Mr. Schwarz, of Washington, have been identified as the above named beetle.

The attack appears to be most prevalent in the townships of Orford, Newport and Eaton, and Windsor, Dudswell, &c., in the Eastern Townships. It is also most probably the same insect as is complained of in New Brunswick, and which was mentioned at page 30 of my last report. The following interesting letter, giving original observations, has been received from Mr. Joseph Andrews, of Windsor Mills, P.Q.:—

"I will give you the result of my observations for the last eleven years. In the month of June, 1875, I cut a spruce tree on my farm for the purpose of making shingle, and when I came to remove the bark I found the white or pulpy part of it one mass of white maggots, about ¼ of an inch in length. As the tree, to judge from the outside, was perfectly healthy, I was surprised to find such an amount of corruption inside, so I began to investigate, and in every part of the tree I found a great number of small beetles or borers still at work. Their manner of proceeding was this. They would bore through the bark until they came to the soft pulpy part of the new annular growth of new wood just forming and bore a tunnel from 1 to $3\frac{1}{2}$ inches. At very short intervals they would form a little cell on each side of the main passage and deposit a small white egg (in this way ), and do it with wonderful precision, and where tens of thousands of these borers would attack a tree you may be assured they made short work of it; but still there are some parts of the country that do not seem to suit them. I have noticed that in some parts where there is a deep, dry, light, loamy soil, every spruce tree of any size is totally destroyed, whilst on the other hand, where you find a wet, gravelly bottom, you will rarely find a spruce tree affected.

"I would also mention that although the borer works up to the tops of the trees, it is not the young shoots which are first attacked, but they begin near the ground first and work up."

The only remedy which can be suggested as yet for this evil is prompt cutting of the timber as soon as the injury is observed.

AMERICAN LARCH, OR TAMARAC.

The Larch Saw-fly (*Nematus Erichsonii*, Hartig.)

This insect is still found in large numbers in the Provinces of Quebec and New Brunswick; but the reports which come in appear to me to be satisfactory. It is true it is widening its area of destruction; but there are many places where two or three years ago it was plentiful in which it does not now occur.

In the Ottawa district last spring the perfect fly was very abundant, but although the larvæ were looked for very closely few could be found, and efforts to secure a supply for study were unsuccessful, even in an isolated grove where the females had been seen ovipositing. The egg-bearing twigs, in the summer, after the time the eggs should have hatched, showed very few cases of defoliation. All reports, however, were not of this nature. Prof. Saunders observed them as "very abundant in parts of Nova Scotia, especially in the County of Cumberland where the trees in many localities were almost entirely denuded of their foliage." Mr. G. U. Hay writes: "I am not so sure that the ravages of the worm which infests the larch tree are less this year in some parts of New Brunswick than in previous seasons. During a recent visit I made to Miscou and Shippegan, I observed a very large proportion of the trees wholly or partly defoliated. This also was the case along the Intercolonial Railway from Bathurst to St. John. At Norton, about 25 miles from St. John, many trees were wholly defoliated.

As an off-set against this intelligence I found, during the past summer, that a tamarac swamp at Dalhousie, N.B., which, in 1884, was almost defoliated, was entirely free of these larvæ.

BIRCH.

The Birch Saw-fly (*Hylotoma dulciaria*, Say).

Attack.—Yellow false caterpillars with orange heads and 6 rows of black spots down the back, and a short black oblique dash above each leg along the sides.

These larvæ were first observed in injurious numbers at Quebec in 1885 by Rev. T. W. Fyles, of South Quebec. During the past season Mr. H. M. Ami, of the Geological and Natural History Survey Staff, sent me specimens in September from Quebec, with the intelligence that they were taken at Chaudière Railway Bridge, seven miles from Quebec, where, as in Eastern Quebec, they were in myriads."

REPORT OF THE CHEMIST.

(Frank T. Shutt, M.A., F.C.S.)

Ottawa, 10th February, 1888.

Prof. Wm. Saunders,
Director, Dominion Experimental Farms,
Ottawa.

Sir,—I have the honour to submit to you my report on the character and extent of the work done by me since my appointment to the office of Chemist to the Experimental Farms of the Dominion in August last.

On 10th August, 1887, at the request of the Minister of Agriculture, I accompanied you on a short tour through the Eastern States, with a view to the inspection of the laboratories, both as to fittings and the latest forms of apparatus, of the more principal agricultural stations and universities; the object of gaining such information being that we might be able the better to equip our permanent laboratory (not yet built) with the most modern improvements for analytical work and work of research in all the branches of agricultural chemistry.

Proceeding first to New York, I was extremely gratified to find that the American Association for the Advancement of Science was holding its annual session. During my two days' stay in that city I was therefore enabled to hear read and discussed many valuable papers by some of the foremost men in science in the United States, and also to meet personally many of the chemists engaged in agricultural work in various parts of the country, many of whom very courteously invited me to inspect their laboratories and gave me every information in their power. My subsequent travels proved their kindness to be of great benefit to me in this respect, and to these gentlemen I would tender my thanks.

As emphasizing what I have just said with regard to the value of hearing read and discussed scientific papers upon subjects of almost universal interest and importance, and as this city has lately been visited with a severe epidemic of typhoid fever, I think it may not be out of place here to refer to a paper read on The Causes of Typhoid Fever, and the means of eliminating such causes, by Dr. Albert R. Leeds, of New Jersey. He instanced many cases of typhoid fever in various towns which he had traced to an impure and contaminated water supply. He clearly showed that in such cases as he had examined, the investigation proved that the water used by persons suffering from this disease was contaminated by the excreta of other victims of typhoid. In some instances the source of the trouble was many miles distant from its direful effects.

The cause of typhoid fever is generally believed to be due to a bacillus, of which usually there is a large number in water infected, and probably the most practical portion of this paper was the means proposed by the author to rid the water of these bacteria, rendering it fit and wholesome for drinking purposes. The process consists simply in adding half a grain of alum to each gallon of the water to be used. By this process all the peaty matter is precipitated along with the Bacteria, leaving a water brilliant and limpid, and better than distilled water. The alumina is all taken out by the precipitation, and chemical tests failed to reveal its presence in the supernatant liquid. A contaminated water from Mount Holly examined by the author containing 8,000 bacteria per cubic centimetre showed after this treatment only 8 bacteria per c. c., this water then passed through two sterilized filter-papers was rendered *entirely free* from bacterial life. Many other interesting and instructive papers and discussions were listened to, but the time at our disposal was altogether too short to reap such benefit as is obtainable by attending the full session of such an important scientific society.

Whilst in New York I visited the Chemical and Mineralogical Laboratories of the Columbia Schools of Mines, and found them admirably adapted and fitted up for work in all the branches of these sciences. It is here desirable to point out that necessarily, there is a difference in the appointment of those laboratories intended for teaching purposes only and those in which analytical work purely is carried on, remembering of course that in *many* features *all* laboratories must be similar both in arrangement and forms of apparatus. As of special interest in the laboratory just named, I would mention as worthy of notice a water-bath, about ten feet in length, which could be heated as ordinarily by Bunsen burners, or more quickly by a steam coil connected with the heating apparatus of the building. In less than two minutes after the steam was turned on, the water in this bath would be raised to the boiling point, thus saving a great expenditure of time and economizing fuel. Another feature was the slate-covered benches, which resisting the action of acids and alkalies, always preserve an even and untarnished surface, a condition very desirable but impossible to keep when the working benches are simply of wood. When, as here, there is a strong up-draft in the flue, an open draught cupboard can be used. This is very desirable, as when the front of the cupboard is enclosed with doors, the operator is always more or less hampered in his manipulations.

The Connecticut Agricultural Experimental Station at New Haven was next visited. The chemical laboratory here is about 36 feet by 29 feet with working benches on two of the sides and in the centre. As there were several chemists working in this laboratory the tables in the middle of the room made it much too cramped for comfortable work. Iron sinks were situated at the ends of the two central tables, from which the waste water was conducted to a cesspool and from thence over the land. A special room for the balances is here dispensed with, each chemist having his balance on the portion of the bench or table allotted to him. This arrangement although economizing time is not to be commendably endorsed, as a delicate balance must in a short time be seriously injured by the fumes necessarily present where a number of analysts are working.

Our next visit was to the Experimental Station at Amherst, Mass. Here a building has recently been erected which is entirely devoted to the chemical work of the station. The two laboratories are fitted up with all modern improvements, both as to apparatus and fittings. The larger laboratory is 19 by 16 feet, the smaller 17 by 12 feet. Wherever possible the arrangement of having two laboratories in the place of one, is most desirable, for many analytical operations cannot be conducted with success where other chemical work is being carried on. This is particularly necessary, for instance, in water analysis, which requires an atmosphere free from ammonia and hydrochloric acid, necessarily present in the air of a general working laboratory. A feature of special interest here was that the ceilings were lined with wood. The plan of lining both the walls and ceiling of our new laboratories with wood is one I would strongly recommend for the reason that plaster ceilings and walls are attacked by acid fumes, soon becoming dirty in appearance and small pieces of the surface whitewash scaling off may spoil an analysis by falling into vessels which are being used, a catastrophe which can be seen is not easily preventable where such ceilings are used. The gas in this laboratory, both for heating and illuminating purposes, is made from gasoline (light petroleum) on the premises. The plant is extremely simple and very nearly automatic. Air is drawn over the surface of gasoline which is placed in a tank sunk some feet below the surface of the ground at suitable distance from the building. The resulting mixture of air and gasoline vapour forms the illuminating gas. In order that such gas can be used economically as a fuel the carbon should be completely burnt, and a further supply of air is required to bring about a total combustion. In the Amherst apparatus the same arrangement which draws the air over the gasoline supplies an extra blast of air to the burners. Dr. Goessman, the director, assured us that the process had now been in operation for over a year and had given excellent satisfaction. Gas by this method costs about $1.00 to $1.25

per 1,000 feet, according to the price of gasoline. I have dwelt somewhat at length upon this method of manufacturing gas, as it does not seem improbable but that we shall have to adopt some such system for the laboratories of the farm.

The laboratory of the Bussey Institute, near Boston, is of good size, about 27 by 40 feet, and is furnished with a large fume cupboard of good width, the floor of which is of brick and the front enclosed with sliding glass doors.

It was thought desirable whilst in Boston to see the laboratories of the Institute of Technology. In all the branches of Applied Science this institution was found to be very well equipped as to apparatus, appliances and models. The laboratories intended for pupils are very large and capable of accommodating over one hundred students at once. There was no shelving for bottles upon the tables; the students keeping apparatus and chemicals in the drawers and cupboard assigned to each of them. The waste water, containing as a matter of course, often large quantities of corrosive chemicals, is conducted by means of an open pitched gutter, which can be examined at any time by removing certain of the floor boards. This arrangement obviates the expense of removing the pipes from time to time and has some features to recommend it where students are engaged in studying chemistry practically, but on the other hand it is to be noted that there would be a great likeliness of foul odours arising into the laboratory unless a large flow of water was continually kept running.

The question of the purity of the water supplied to our Canadian cities and towns I deem of such importance that I venture to bring before the Government, through you, the work of Mrs. Ellen H. Richards, who, at the time of our visit, was engaged in the laboratories of the above institution upon the analysis of a large number of the waters of the state, under the direction of the State Board of Health. This work is of a most useful and important character, and it can hardly be too strongly emphasized that such an investigation into the condition of our water supplies should be commenced and systematically carried on from time to time. In this connection I would also refer to the work in water analysis inaugurated some years ago, and since carried on, by the members of the Society of Public Analysts in England. The result of their labours has been to bring about greater uniformity in methods of water analysis, and with greater uniformity in methods has come greater uniformity and reliability in the interpretation of the results of such examinations. Standards of purity by which waters may be judged have been proposed in England and are satisfactory for English waters; but these can scarcely be applied with accuracy to a large number of Canadian waters, owing to the different character of the source of the supply, and before we can make and adopt standards for ourselves more data are required.

As pure water is an indispensable article of diet, without which health cannot be preserved, and as impure and contaminated water has been proven to be the source of so many diseases, it becomes a matter of the greatest importance that all public water supplies should be examined and reported upon by competent chemists, and that farmers and others not drawing from such supplies should have an opportunity offered them—perhaps at a small cost—of having their water examined. That wells in the country should be examined may, by some, be thought to be unnecessary, but I am convinced that there is much impure water drunk in the country, owing to the ignorance of many digging their wells in the barnyard or in close proximity to a source of contamination. In many instances where the soil is sandy the wells often act as a cesspool for draining a large adjacent area, and if in such area excreta or urine are allowed to lie, the consequence is that the water is but a more or less diluted sewage.

From Boston I went to Washington in order to see the laboratories of the Bureau of Agriculture, as well as to attend the Fourth Annual Convention of the Association of Official Agricultural Chemists. This association, as its name implies, consists of analytical chemists connected with the United States Department of Agriculture, or any State Experimental Station or educational institution having official control over fertilizers, and who are engaged in analytical work and research upon soils, cattle foods, dairy products, and other materials of agricultural industry. However, other chemists are welcomed to the meeting, and discussion invited from all who may be present. The result of these annual conventions and the publication of the proceedings has been fraught with much good; greater accuracy and uniformity in the processes and results of analyses has been brought about, and thus much benefit bestowed upon the agricultural population. Interesting and valuable reports were read by the chairmen of the several committees appointed at the annual meeting last year. These reports were on the analysis of cattle foods, fertilizers and dairy products.

Dr. W. H. Wiley, Chemist to the United States Department of Agriculture, very courteously conducted me through the laboratories, which are in the basement of the building and are now much too small for the number of chemists working and the amount of analytical work in progress. The tables ranging round the sides were amply supplied with water and gas, and being covered with white tiles about 6 inches square, presented a very clean and nice appearance. A central table, with a large sink in the centre, is furnished with filter-pumps of an improved kind to the number of ten, thus allowing the prosecution at the same time of a large number of analyses which require this useful and indeed indispensable adjunct. Special places were set apart for apparatus for the determination of nitrogen by Kjeldahl's method and Soxhlet's extraction apparatus. This method, where space allows, of setting up pieces of apparatus in a permanent manner saves very much of the analyst's time.

There were special rooms for photography, storing of chemicals, apparatus, &c. Distilled water is here continuously made in connection with the stean heating apparatus.

A short visit was paid to the Laboratories of the famous John Hopkins' University, Baltimore, but as they are intended and fitted up for students' work, I shall not go into details. There are here also special rooms for photography, gas analysis and combustion work—the latter supplied with large hoods over the furnaces to carry off the gaseous products of combustion.

On returning to Ottawa I elaborated plans as to the size and arrangements of our laboratories, and submitted them to you. They are now with the Government Architect. It was thought most desirable to have two laboratories—a large and a smaller, and in connection with them a balance room which could also be used as an office for the Chemist.

As the building of these could not be begun last autumn, it was deemed advisable to procure temporary accommodation for laboratory purposes in the city of Ottawa. A suitable room, though small, was obtained in the Russell House Block, the necessary gas and water fixtures were put in, and a certain quantity of chemicals and apparatus procured.

Besides the work incumbent upon one in superintending the fitting up and arranging of the new laboratory, I have been enabled to make the following reports —which will indicate the nature of the chemical work upon which I have been engaged.

REPORT No. 1.

OTTAWA, 31st October, 1887.

Prof. WM. SAUNDERS,
Director, Dominion Experimental Farms,
Ottawa.

DEAR SIR,—As requested by you, I have made a careful analysis of the marl sent in for examination by Mr. Holland, of Ottawa, and find its composition as follows:—

Calcium carbonate (carbonate of lime)	60·00
Organic matter	25·42
Sand and silicia	6·55
Alumina and oxide of iron	3·33
Moisture	4·55
Magnesia, &c	·15
	100·00

No phosphoric acid could be detected, and only traces of the alkalies were present.

The specimen, about 6 or 8 inches in size, is one of shell marl, showing a large number of small shells and also at one side a considerable amount of peat. The whole was fairly sampled and the analysis made on the quantity so obtained.

In commenting upon its value as manure, I would say that as a rule the fertilizing power of a marl depends, to a large extent, upon the amount of carbonate of lime it contains, although the value of those marls which contain phosphoric acid and potash would be enhanced thereby. The application of such marl as the one analyzed would be of especial benefit to a peaty soil which is deficient in lime.

Besides acting as a manure, marl is often useful in altering the mechanical condition of the soil. The addition of marl to a sandy soil has the effect of making the soil heavier and better adapted for holding manure and moisture, and conversely its action on clay is to produce a more pliable and easily worked soil. As carbonate of lime is not at all caustic, its application, even in excess of the amount needed, cannot result in any injury to vegetation.

I remain, Sir,
Yours very truly,
FRANK T. SHUTT, M.A., F.C.S.,
Chemist, Dom. Exp. Farms.

REPORT No. 2.

OTTAWA, 1st November, 1887.

Prof. WM. SAUNDERS,
Director, Dominion Experimental Farms,
Ottawa.

DEAR SIR,—As instructed by you, I have made an analysis of the alkaline water sent by Miller Christie, Esq., of Manitoba, for examination, and find as follows:—

Solid matter per Imperial gallon, 465·22 grains, the percentage composition of which is tabulated below:

Lime (CaO)	10·55
Magnesia (MgO)	7·25
Soda (Na_2O)	25·56
Sulphuric acid (SO_3)	22·15
Chlorine	28·08
Alumina and oxide of iron	·52
Water of hydration, small quantities of carbonic acid and organic matter undetermined	5·89
	100·00

Examination with the spectroscope showed sodium to be the only alkali present.

Calculating from these figures on the supposition that the chlorine is combined with the sodium, and the magnesia with the sulphuric acid, we arrive at the following:—

	Per cent.
Sodium chloride (common salt)......................................	46·27
Magnesium sulphate..	21·75

The other constituents would then be—calcium sulphate, calcium hydrate and sodium hydrate.

The water was slightly akaline to test paper, and on standing the supernatant liquid becomes quite clear, leaving a calcareous deposit at the bottom of the jar. This deposit effervesces strongly on addition of an acid.

Owing to the fact that lime had been added to this water, the composition of its saline matter has been altered from its original condition. The above figures, therefore, do not represent accurately either the actual compounds existing in the water in its natural state or in their true proportions.

In all probability the alkali exists to a large extent as carbonate, and the effect of adding lime to such water would be to produce carbonate of lime and caustic soda, thus rendering the water much more akaline than before the treatment.

With regard to the elimination of the akali, whether it exists as hydrate, carbonate or chloride, from the water, it may be pointed out that owing to the great solubility of the salts of the alkali metals, it is impossible to suggest any practical or economic method whereby the alkali may be got rid of by precipitation.

The addition of an acid would not be efficaceous in the removal of the alkali.

The only method for rendering the water free from this saline matter and consequently fit and wholesome for use, is, I believe, distillation.

In districts where such alkaline water only is obtainable, a small distillation apparatus might be kept constantly at work. This apparatus, if attached to the ordinary cooking stove in the kitchen, would entail but little extra expense. It might be of the simplest character, consisting of a vessel of tinned or galvanized iron. This vessel would be furnished with a lid, tightly fitting and large enough to allow the vessel to be easily cleaned when necessary. A suitable tube and condenser for the condensation of the steam, could be easily attached to this boiler. The water so obtained, while entirely free from saline matter, would taste rather flat, owing to the fact that it would have parted with its dissolved oxygen during the process.

I am, Sir,

Yours very truly,

FKANK T. SHUTT, M.A., F.C.S.,
Chemist, Dom. Exp. Farms.

REPORT No. 3.

REPORT ON THE ANALYSIS OF THE WATER SUPPLY OF THE CITY OF OTTAWA.

OTTAWA, 12th January, 1888.

Prof. WM. SAUNDERS,
Director, Dominion Experimental Farms,
Ottawa.

SIR,—At your request I have made an analysis of the water supplied to the city of Ottawa by the Waterworks, and have the honour to present you herewith my report thereon.

The samples were taken by Mr. Surtees, the City Engineer, and myself, on the 22nd December, as follows:

A.—From east side of slide channel, between 200 and 300 feet above mouth of aqueduct and about 600 feet from the north branch of the Rochester Creek, taken at a depth of about 5 feet below the surface.

B.—From mouth of clear water pine or inlet, in front of screen, at a depth of 10 feet below the surface.

C.—From the tap in pumping-house.

D.—From the tap in basement of City Hall.

CHEMICAL ANALYSIS.

The following table shows the results of the chemical analysis :

	Grains per Gallon.				Parts per Million.			
	A	B	C	D	A	B	C	D
Colour in 2-foot tube	Dark yellow.				Dark yellow.			
Smell at 100° F	Slightly peaty.				Slightly peaty.			
Chlorine	·035	·035	·035	·035	·5	·5	·5	·5
Phosphoric acid	None.				None.			
Nitrogen in nitrates and nitrites	·0080	·0103	·0126	·0109	·1152	·1482	·1811	.1564
Free ammonia	·0014	·0014	·0007	·0007	·03	·02	·01	·01
Albuminoid ammonia	·0091	·0084	·0084	·0084	·13	·12	·12	·12
Oxygen absorbed in 15 minutes	·1912	·1610	·1708	·1629	2·732	2·372	2·430	2·327
Oxygen absorbed in 4 hours	·3519	·3507	·3507	·3507	5·028	5·010	5 010	5·010
Solids	3·80	3·70	3·92	3·92	54·0	53·0	56·0	56·0
Hardness as $CaCO_3$	1·64	1·40	1·55	1·55	23·4	20·0	22·1	22·1

The first conclusion to be drawn from these results is that all the above samples are very similar as to their quality, that from the slide channel being somewhat the worst, owing no doubt to its containing a slightly larger quantity of suspended matter. The other three may, for all practical purposes, be considered identical.

Colour in the 2-foot Tube.—By this test pure water is colourless. The presence or organic matter, especially of a vegetable origin, in solution renders the appearance, under these circumstances, of a green, yellow or brown tint, varying in depth according to the amount of such matter contained.

Smell at 100° F.—The result of this examination may reveal the presence of an injurious quantity of organic matter, but on the other hand a very bad water may not have any objectionable odour. This test is only of importance as a supplementary one.

Chlorine in Chlorides.—The presence of chlorine in considerable quantities indicates the existence of sodium chloride derived either from this salt naturally present in the soil through which the water passes, or from contamination with sewage. The small amount found shows that all these samples of water are free from sewage pollution.

Phosphoric Acid.—Phosphoric acid, except in very slight traces, would indicate contamination with sewage. My results in this particular confirm the opinion as to the absence of sewage expressed in the preceding paragraph.

Nitrogen in Nitrates and Nitrites.—Oxidized nitrogen as nitrates or nitrites in a water points as a rule to contamination with animal organic matter or sewage. The abundance of vegetable life, however, may decompose and assimilate these salts, and hence the absence of such nitrogen cannot be considered as negative evidence as to such pollution. Analysts differ as to the value to be assigned to this datum in forming an opinion on the quality of a water, but the small quantity evinced by the analysis taken in conjunction with the other results adds an additional proof with regard to the absence of sewage pollution.

Free Ammonia.—A large quantity of ammonia, except in water from deep wells, would probably indicate the recent contamination with sewage. The exceedingly small amount present again shows this water to be free from pollution of this sort.

Albuminoid Ammonia—Oxygen absorbed in 15 minutes and 4 hours at 80° F.—By both of these determinations we are enabled to infer the relative quantity of organic matter present in the sample of water under examination. To estimate the exact amount of organic matter in a water or to ascertain with certainty what part of such is of animal or vegetable origin, is not only difficult, but impossible.* Organic matter of an animal origin is generally conceded to be more dangerous in a water than that derived from vegetable growth; yet that decomposing vegetable matter has a toxic effect has repeatedly been shown It is as yet an undecided question if decomposing organic matter, whether animal or vegetable, is of itself poisonous apart from those low forms of life which cause such decomposition, and which are held by many to be the direct cause of disease. Bacteria require organic matter for their growth and development, therefore we may argue that water containing a large quantity of such matter is likely to contain a greater number of these micro-organisms, than water possessing but traces of organic matter.

This so-called albuminoid ammonia is evolved when a water containing organic matter is boiled with an alkaline solution of potassium permanganate, and hence the quantity found is a measure of the organic matter present. Much albuminoid ammonia from a water giving but little free ammonia points strongly to the excess of vegetable organic matter. Many waters contain less than ·05 parts per million, and ·1 part per million causes a water to be looked upon with grave suspicion, while ·15 p. p. m. would, according to Wanklyn (the deviser of the process), condemn a water for drinking purposes. In applping this standard of purity to a water we must, however, take into consideration its source, and therefore we should not be justified in condemning the Ottawa water without additional data, because it yields ·13 parts of albuminoid ammonia per million, though we must judge it impure in this respect.

The amount of oxygen absorbed during a stated interval at a stated temperature from a given amount of an acid solution of pot. permanganate again gives us a measure of the organic matter present. The more oxygen absorbed the greater the quantity of the decompositing organic matter. The excessive amount of oxygen so absorbed by this water emphasizes in a most unmistakable manner the conclusion arrived at in the preceding paragraph.

Drs. Tidy and Frankland have suggested the following scale for classifying upland surface waters from results obtained by this method:

Section 1—Upland surface water:

Class—Water of great organic purity, absorbing from permanganate of potash not more than 1 part of oxygen per million parts of water.

Class 2—Water of medium purity, absorbing from 1 to 3 parts of oxygen per million parts of water.

Class 3—Water of doubtful purity, absorbing from 3 to 4 parts of oxygen per million parts of water.

Class 4—Impure water, absorbing more than 4 parts of oxygen per million parts of water.

Section 2 is a classification for waters other than upland surface. The limit of the amount of oxygen absorbed is exactly one-half of that in the corresponding class in Section 1.

Judged by this standard it is obvious that the Ottawa water in its present condition is unfit for drinking purposes owing to the large excess of dissolved vegetable organic matter.

That the organic matter is vegetable in its origin is borne out by the fact that the ratio of the amount of oxygen absorbed in fifteen minutes to that absorbed in

*Nichols' "Water Supply," page 36.

four hours is nearly as 1 : 2, whereas if the matter were of animal origin the ratio would approach 1 : 15.

Although vegetable organic matter, as before stated, cannot be considered as injurious as that of animal origin, yet the excessive quantity here found is quite sufficient to render highly necessary a purification of the water before being used for drinking purposes.

The absence of organic matter as derived from sewage may or may not be attributable to the fact that for several days previous to the 22nd of December the day upon which the samples were taken, the temperature was considerably below the freezing point, and consequently the water of the Rochester Creek had ceased to flow. If previously the city water was polluted from sewage matter brought down by this creek the larger volume of water, together with the swift current of the river would easily account for the absence of such contamination at this date.

We shall now apply the standard of purity proposed by Drs. Muter and Wigner, celebrated English analysts, in order to ascertain the relative degrees of purity of the Ottawa water.

Dr. Muter's scheme takes into consideration and assigns values to the amounts of free ammonia, albuminoid ammonia, and the oxygen absorbed in 15 minutes and four hours. He proposes that the following limits, "supposing no other consideration intervenes to modify the analyst's opinion of the sample," should be observed:

First-class water	up to ·25 degrees
Second class water	up to ·40 do
Undrinkable water	over ·40 do

By this classification the Ottawa water would rank as undrinkable, its value being 1·61.

Mr. Wigner's scale includes a value for each of the determinations enumerated in the table of results. The limits by this scheme are as follows:

Extremely pure water	15
First-class water	40
Second-class water	65
Third-class water beyond	65

The Ottawa water, according to this scale, gives a valuation of 134·5, being entirely condemned for drinking purposes.

We must, however, remember that those standards were proposed for English waters, the sources of which are altogether different from many of our Canadian waters, and therefore great care should be used in interpreting the results of an analysis by these standards. But even considering the source of the Ottawa supply we must look upon it with grave suspicion and strongly deprecate its use as a potable water without previous purification.

It may not be uninteresting to compare this water with that supplied to Toronto. Dr. W. Hodgson Ellis, Professor of Applied Chemistry and Public Analyst, Toronto, has for some time past made thorough analyses of the Toronto water, and in an exhaustive report to the Toronto City Council last June proposes for the comparison of waters a scale to illustrate the "average degree of impurity." Applying this scale to the results of his analyses, Dr. Ellis tabulates as follows:

	Average degree of organic impurity.
Bell buoy (Lake Ontario)	22
Pumping well	22
Reservoir	21
Hydrant	22
Eastern gap (Toronto Bay)	39

By this scale the Ottawa water would equal 188.

BIOLOGICAL EXAMINATION.

A microscopical examination of the deposit of this water, which has been allowed to settle in a suitable vessel, reveals the presence of vegetable débris, algae, diatoms and infusoria, but not insufficient quantities to condemn the water from this cause alone.

It has been before observed that the organic matter of a water serves as food for bacteria, and consequently the number of these organisms in water gives a measure of the organic purity of a water. For the purpose of this report we may classify bacteria into pathogenic and non-pathogenic forms. To distinguish between these is a matter of great difficulty and often requiring some months of arduous work. The number of bacteria, apart from their nature, in a given volume, is, however, of much value, as will be seen from the results of Prof. R. Ramsay Wright's investigation on the water of the Toronto supply. Some of his results are tabulated below.

Number of Bacteria per Cubic Centimetre.

No. 1—Bell buoy (Lake Ontario, mouth of inlet pipe).........	0
No. 2—Eastern gap (Toronto Bay)...............................	5,000
No. 3—Reservoir...	10
No. 4—Tap in School of Science	17

From these figures he draws, among others, the conclusions that the water No. 2 is unfit for drinking purposes; that the water at the Bell buoy is pure from bacterial life and sewage contamination; at the time of examination that the tap water in this respect compares very favourably with that of New York, London, Berlin and other cities.

I have subjected to such an examination the four waters enumerated above, the samples being taken on the 5th inst., with the following result.

	Bacteria per c. c.
A..	135
B..	100
C..	96
D..	145

From these numbers I am unable to make any distinction between these waters as to their degree of organic purity.

Those who have made such investigations the object of research give it as their opinion that water containing but 50 micro-organisms per c. c. would be ranked as very pure, while a water containing 1,000 per c. c. should be subjected to some cleansing operation before use for drinking purposes.

The present analysis shows that the Ottawa water is surcharged to a dangerous extent with vegetable organic matter. Whether this is temporary or not it is impossible to say from one analysis. It is very reasonable to suppose that the character of the water has been affected by the long continued drought of the past summer, and we may expect therefore that the water may improve rather than deteriorate, I would suggest that analyses be made of the water at regular intervals, in order to gain information on this most important point.

As the majority of the citizens have but the city water to draw from, it may not be out of place to suggest some means whereby they may render the water comparatively free from any noxious principle it may contain.

By far the greater number of bacteria in fluids are killed below the temperature of boiling water, and especially is this true of most of the pathogenic forms Their spores, as a rule, are capable of sustaining their vitality at temperatures which are fatal to the parent forms, yet, if the water is boiled for a few minutes, from 2 to 15, we may insure the death of nearly or quite all of these micro-organisms. This boiling, however, will not remove the dissolved organic matter. Effective filtration not only abstracts suspended matter, but removes by adhesion and oxidation much of this dissolved organic matter. Sand filtration on the large scale lessens the amount of organic matter in solution according to the thickness of the filtering medium, and the rate at which the water passes through the medium.

Some of the best filtering materials for domestic purposes are animal charcoal and spongy iron, which latter Bischop has shown to be capable of destroying bacterial life.

Dr. Albert R. Leeds, of New Jersey, in a paper before the American Association for the Advancement of Science, at its last session, upon the causes of typhoid fever, and the means of eliminating such causes, proposes a method to rid water containing the typhoid bacillus by adding one-half grain of alum to each gallon of the water to be used. By this method, he says, all the peaty matter is precipitated along with the bacteria, leaving a water brilliant and limpid. The alumina is all taken out by the precipitation, and chemical tests failed to reveal its presence in the supernatant liquid. In a contaminated water containing 8,000 bacteria per c. c., the author showed that after this treatment the water only contained 8 bacteria per cubic centimetre.

Respectfully submitted.

FRANK T. SHUTT, M.A., F.C.S.,
Chemist Dom. Exp. Farms.

REPORT No. 4.

CENTRAL EXPERIMENTAL FARM LABORATORY,
OTTAWA, 4th February, 1888.

"Saline water from boring 170 feet deep on base line in Section 31, Township 4, Range 1, west, Manitoba. Strong spring in abundant supply." Sent by Mr. John Lowe, Acting Deputy Minister, Department of Agriculture.

Prof. WM. SAUNDERS,
Director Dominion Experimental Farms.

SIR,—As the result of my analysis of the above saline water, I have the honour to report as follows:—

Constituents expressed in parts per 1,000 of the water—

Sodium (Na.)	6·573
Magnesium (Mg.)	·577
Calcium (Ca.)	1·180
Iron and Aluminium (Fe. & Al.), (traces).	
Silicon (Si.), (slight traces).	
Chlorine	10·785
Sulphuric Acid (SO_4)	2·122
Carbonic Acid (CO_3), (traces).	
	21·237
Total solid contents by direct experiment, dried at 180° c.	21·198

From the above it may be deduced that the principal compound is common salt, amounting to 17·153 parts per 1000, or 1200·71 grains per gallon. The remaining solid compounds consist of magnesium and calcium sulphates and chlorides, with small quantities of carbonates of these metals, the latter (carbonates) being held in solution as the more soluble bicarbonates.

The water is but faintly alkaline to test papers. Experiment shows no volatile alkali to be present.

To the query as to whether "if condensed, would products be useful as a fertilizer?"—I must answer that as a direct fertilizer, salt is not considered to be of any value. Most plants differ from animals in not requiring salt as an essential constituent of their food. On certain soils, however, salt is beneficial to some extent as an indirect fertizer, liberating lime and potash—essentials for plant growth. This, however, may be more economically brought about, in the majority of cases, by other compounds, *e. g.*, gypsum. Salt again is sometimes used to arrest rank growth in soils too rich in nitrogenous matter. To the second part of the question I would reply that as a source for obtaining common salt this water would not be of any commercial value.

With regard to the third question proposed, "could the salt be neutralized by any chemical substance?" my reply must again be in the negative. Salt is itself a neutral body; and being an exceedingly soluble one cannot by any chemical means be precipitated in order to render the water fit for drinking purposes.

The only method to obtain from this saline water a potable one would be by distillation—such as I suggested in my last report on saline water—the condensed product being free from all dissolved solid matter.

Respectfully submitted.

FRANK T. SHUTT, M.A., F.C.S.,
Chemist, Dom. Exp. Farms.

I am now conducting a series of analyses with a view of ascertaining the relative qualities of certain wheats, and also, if possible, to find out what effect, if any, climatic influences, variety of soil, &c., have upon the constitution or composition of the same wheat. The results of these analyses will also show the comparative values of the Red Fyfe wheat, as grown in our North-West, and the newly imported Ladoga (Russian) wheat, as grown in Russia and the several Provinces of our Dominion.

All of which is respectfully submitted.

FRANK T. SHUTT, M.A., F.C.S.,
Chemist, Dom. Exp. Farms.

REPORT OF THE HORTICULTURIST.

(W. W. HILBORN.)

Prof. WM. SAUNDERS,
Director Dominion Experimental Farms,
Ottawa.

SIR,—I have the honour to submit herewith a report relating to the progress made under your direction in the Horticultural Department of the Central Experimental Farm.

The cultivation of fruit, still in its infancy, is becoming of great importance in the Dominion.

The great variation in soil and climate in different parts permits of the growth of a very large number of varieties to great perfection. While we cannot grow the more tender sorts of trees in the colder portions of Canada, many of the small fruits can be grown profitably, and it is hoped that the limits within which large fruits can be grown will shortly be extended much further north and west.

With that end in view a large number of Russian fruits have been secured for trial at the Central Experimental Farm. A collection is also being made of hardy western and native seedling fruits, to which will be added a great number of seedlings originated on the grounds, many of them from seeds which have ripened as far north as such can be obtained. These added will make a collection of which much may be expected.

Possession of the farm was obtained so late in the autumn of 1886 that there was no time to prepare land for orchard planting, and being unwilling to lose one season's growth a very large and valuable collection was ordered of apple, pear, plum, cherry and other fruit trees, which were received in the spring and planted in nursery rows in suitable soil. There they received suitable cultivation, and notwithstanding the severe drought which prevailed during the whole season, the trees made a satisfactory growth and formed such a mass of fibrous roots that the transplanting of them to the orchards can be done with little or no risk, and with but slight check to their growth.

APPLES.

Canadian apples command the highest prices in foreign markets and are not surpassed in any part of the world for flavour, colour, keeping and shipping qualities, we need not, therefore, be afraid of successful competition.

The demand for the apples of this country for export is increasing much more rapidly than the supply, and will, it is believed, continue to do so as the knowledge of their superior qualities becomes better known; more attention should therefore be given to this fruit in those localities where it grows to such perfection.

The collection at the Experimental Farm already consists of 903 apple trees, 297 varieties, of which 174 are from Russia and other parts of Northern Europe. Of these trees 216 were planted out in orchard last autumn to test the relative merits of fall as compared with spring planting.

A fine piece of sandy loam was selected for the orchard; it was manured early in the season, well ploughed and the soil got into good condition for planting. This plantation will be extended early in the coming spring. Those which were put out last autumn were planted thirty feet apart each way, the trunks loosely wrapped in tarred paper and earth drawn up around the base of each tree to the height of from twelve to fifteen inches.

CRAB APPLES.

Of this fruit the collection contains 26 trees, of 12 varieties, chiefly of American origin, most of which should succeed in this locality.

PEARS.

Pears cannot be grown over as large a portion of the Dominion as apples, yet there are many localities where they can be produced in great perfection. The attempts at their cultivation in the Ottawa valley has not yet been attended with much success.

In order that a thorough test of them may be made on the Experimental Farm a collection has been secured consisting of 298 trees of 101 varieties, 45 of which are from Northern Europe. Further additions will be made to this list in the way of seedlings and supposed hardy sorts, and it is hoped that some at least will be found which will endure the severe winter weather in this locality and prove valuable not only here but also in other colder portions of the Dominion.

PLUMS.

Large crops of wild plums are grown in this vicinity; they succeed very well indeed, but to what extent the improved varieties in cultivation will prove hardy is yet an experiment.

The experience of fruit growers here would indicate that as far as tested there are none of the improved sorts that will endure more than a few years at most. In the course of the farm work that, however, will not be taken for granted, but specimens of many of the leading varieties have been obtained for trial and comparison with the native seedlings.

The collection at present consists of 197 trees of 72 varieties, 32 of which are from Russia and other parts of Northern Europe.

No pains will be spared in making a collection of native seedlings and in the endeavour to raise the standard of that fruit much above its present level.

CHERRIES.

Cherries have not been planted very extensively around Ottawa. Greater interest will, therefore, be felt in our collection of 155 trees of 71 varieties, 54 of which are from Russia and other parts of Northern Europe, among which are some very hardy and valuable sorts of the Ostheim and Vladimir families.

PEACHES.

It is not expected that peach trees will endure the severe winter climate in this locality, hence the number of trees planted of that fruit is small, 25 in all, of 11 American varieties.

APRICOTS.

Of this fruit seven trees only have been obtained consisting of four varieties, two Chinese and two European.

This completes the list of large fruits obtained in the spring of 1887. Most of the trees are large enough to plant in the orchards, which will be done in the coming spring.

A careful record will be kept of every tree, and such information as is gained which promises to be useful will be reported on from time to time.

SMALL FRUITS.

These can be grown over a much greater area than large fruits, in fact, wherever wheat or other grain will succeed many small fruits can be grown very successfully.

In the great North-West of Canada these desirable fruits should be tried extensively and may be planted in every settlement with good prospects of success.

GRAPES.

Grapes succeed remarkably well in the Ottawa Valley, although the seasons are somewhat shorter than in Western Ontario they appear to ripen earlier and are of the best quality.

All varieties must be laid down and protected during winter; in this way even the more tender sorts can be successfully grown.

The collection at the farm contains 891 vines of 127 varieties. The greater portion of them have been planted ten feet apart each way to be trained on trellis, a number have been planted to be trained in another form, and another lot in rows four feet apart and two to three feet apart in the row after the French system, these will be tied to short stakes, well pruned back so that the fruit spurs may be near the ground. A fine location has been selected for the vineyard on a high piece of sandy loam sloping to the south.

CURRANTS.

The currants are planted in rows six feet apart and four feet apart in the rows.

All of the leading varieties have been obtained in large enough quantities to test their value for market purposes. The collection consists of 865 bushes of 20 varieties of the standard named sorts of red, black and white, to which may be added nearly 100 new seedlings, some of which are very promising.

GOOSEBERRIES.

The plantation of this fruit contains 251 bushes of 30 named varieties and about 50 most interesting unnamed seedlings, many of which are of Canadian origin.

RASPBERRIES.

The raspberries were all planted in rows six feet apart and from two to four feet apart in the rows. 50 to 100 plants each of all the leading varieties were obtained to test their market value. A special plantation was also made to grow young plants from for future planting. In all 3,650 plants have been secured, containing 38 named varieties, and about 200 unnamed seedlings, most of which have been originated by Prof. Wm. Saunders, and among them are many hybribs between the black and red varieties.

Quite a number of these bushes produced fruit last season of a very large size and fine quality, showing also great productiveness. There was one worthy of special attention. The fruit was large, salmon yellow, of very fine quality and wonderfully productive. Should the plant retain these qualities on further trial, and prove to be healthy and hardy, it will deserve to stand high on the list of yellow raspberries. There are also some very interesting hybrids between the raspberry and blackberry in this collection, but none of them have yet fruited.

BLACKBERRIES.

Until recently there were no blackberries in cultivation hardy enough to prove valuable except in the most favourite localities. Among the newer introductions there are several hardy sorts that promise to succeed wherever raspberries can be grown.

The collection on the farm contains more than 500 plants of 20 named sorts; these were planted in rows six feet apart and from three to four feet apart in the rows.

All of the above small fruits except the grapes have been allowed full possession of the land to the exclusion of any other crop. The land occupied by them is a fine sandy loam, but was not in good condition, and was very weedy at the time of planting with a large number of Canada thistles. The one-horse cultivator was freely used between the rows and all weeds cut out with hoes from between the plants until the end of August, which had the effect of thoroughly destroying the weeds, and also caused the soil to retain moisture enough to keep the plants growing nicely; after this cultivation was discontinued to give the new wood time to ripen up in order to enable the plants to stand the cold and trying winter. For further protection the soil was ploughed up toward the rows of plants which will be worked down again in spring.

STRAWBERRIES.

The plantation of strawberries consists of 90 named varieties and about 50 unnamed seedlings. There are 20,800 plants in all. These have been planted in rows three and a half feet apart and one foot apart in the rows. Most of the blossoms and all runners that first made their appearance were cut off. When the plants gained sufficient vigor to send out several runners at once those were allowed to grow and form plants thus making the rows about one foot in width at the end of the growing season.

The weather was very dry and hot during the period of their growth, but the frequent cultivation they received enabled them to withstand the drought and make very satisfactory progress.

Late in the autumn after the ground had frozen to the depth of two or three inches they were mulched with coarse manure and straw, most of which was put between the rows with just enough over the plants to nearly cover them from sight.

Many varieties were planted in sufficient quantities to test their value for market purposes. They are in a favourable condition to give a full crop of fruit in 1888, when they will be watched with much interest, as a large number of the varieties have never fruited before in this vicinity.

W. W. HILBORN,

Horticulturist.

APPENDIX TO THE REPORT OF THE MINISTER OF AGRICULTURE.

EXPERIMENTAL FARMS.

REPORTS

OF THE

DIRECTOR - - - - - -	Wm. SAUNDERS, F.R.S.C., F.L.S., F.C.S.
CHEMIST - - - - - -	F. T. SHUTT, M.A., F.I.C., F.C.S.
ENTOMOLOGIST and BOTANIST - - -	Jas. FLETCHER, F.R.S.C., F.L.S
HORTICULTURIST - - - - -	W. W. HILBORN.
POULTRY MANAGER - - - -	A. G. GILBERT.
SUPT. EXPERIMENTAL FARM, Nappan, N. S. -	Wm. M. BLAIR.
do do Indian Head, N.-W.T.	Angus MACKAY.
do do Brandon, Manitoba	S. A. BEDFORD.

FOR

1888;

ALSO, BULLETIN 4 OF THE EXPERIMENTAL FARM.

Printed by Order of Parliament

OTTAWA:

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1889.

APPENDIX

TO THE

REPORT OF THE MINISTER OF AGRICULTURE

ON

EXPERIMENTAL FARMS.

OTTAWA, 30th January, 1889.

SIR,—I have the honour to submit for your approval the following report relating to the establishing and equipping of the several Experimental Farms in the Maritime Provinces, Manitoba, the North-West Territories and British Columbia, with some particulars of the work accomplished at the Central Experimental Farm during the year past.

Appended you will also find reports from the Chemist, Mr. Frank T. Shutt, from the Entomologist and Botanist, Mr. James Fletcher, from the Horticulturist, Mr. W. W. Hilborn, and from the Poultry Manager, Mr. A. G. Gilbert. Reports of progress are also presented from Mr. Wm. M. Blair, Superintendent of the Experimental Farm for the Maritime Provinces, at Nappan, Nova Scotia; from Mr. A. Mackay, Superintendent of the Experimental Farm for the North-West Territories at Indian Head; and from Mr. S. A. Bedford, Superintendent of the Experimental Farm for Manitoba at Brandon. In all of these I trust you will find much information useful to the farmers of this Dominion, and evidences of satisfactory progress in this important work of Experimental Farming in which you are so deeply interested.

I have the honour to be, Sir,
Your obedient servant,
WM. SAUNDERS.

The Honourable
The Minister of Agriculture,
Ottawa.

EXPERIMENTAL FARMS.

Since the last annual report was submitted, much progress has been made towards establishing the several Experimental Farms, and in their organization and equipment. In pursuance of this object journeys have been made eastward as far as Halifax, Nova Scotia, and westward to Victoria, British Columbia. The agricultural needs of the different sections in the provinces and provisional districts composing the Dominion of Canada enquired into, so that in the location of the Experimental Farms the positions chosen should, as far as is practicable, be representative of the larger areas of tillable land, and the soil on each farm of that varied character which would make it suitable for the many different classes of experimental work which it is desired should be carried on at each point.

EXPERIMENTAL FARM FOR THE MARITIME PROVINCES.

To obtain information of a character sufficiently reliable to justify recommendations as to the most desirable points for the location of an Experimental Farm to serve the purposes of the three Maritime Provinces jointly, three visits were made to these Provinces at different seasons of the year and farms were inspected in each province.

In Prince Edward Island the district in the neighbourhood of Charlottetown was visited, and the work being carried on at the Government Stock Farm near Charlottetown enquired into. In New Brunswick the lands lying along the route of the Intercolonial Railway from Sackville to St. John were examined, special attention being paid to the beautiful valley farms in Sussex, and to those in the immediate vicinity of Sackville. In Nova Scotia all the more important points on the lines of railway were visited, from the boundary line of New Brunswick to Halifax, from Spring Hill Junction to Parrsboro', from Truro to Pictou, and from Windsor Junction to Bear River. Much attention was given to the examination of the soil, to such topographical features of the country as would have a bearing on the prevailing winds, which in many districts materially modify the climate, and to other important features essential to the successful working of an experimental farm. Since for many reasons it was expedient that the farm for the Maritime Provinces should be within easy reach of the farmers in each province, special attention was given to inspecting lands in the border Counties of Westmoreland, in New Brunswick, and of Cumberland and Colchester in Nova Scotia. During most of these journeys I was accompanied by Col. Wm. M. Blair, whose intimate acquaintance with the agriculture of the Maritime Provinces, acquired by a life-long experience there, was of great service to me.

While many arguments could be presented in favour of the selection of an average farm, there were good reasons for seeking to combine in the land to be recommended points of advantage which would permit of experimental work being conducted which would be both generally and specially useful. The advantages sought were: Suitable soil of varied character; reasonable shelter from prevailing winds with comparative freedom from early frosts; a central location easily reached by visitors from each of the Provinces, and near the main line of travel. The land finally chosen was at Nappan, Nova Scotia, within half a mile of the station on the Intercolonial Railway, about eight miles from the boundary of New Brunswick, and a point easily reached from Prince Edward Island. The land consisted of two farms containing in all about 300 acres, nearly 100 acres of which is wooded with spruce, larch, beech, maple and other useful trees, the remainder cleared and almost free of stumps. The cleared land may be divided into three classes, approximately as follows: Marsh or dyke land, valuable for hay production, 50 acres; lower upland, 50 acres, and higher upland, 100 acres. The soil is chiefly clay loam, more or less mixed with sand, becoming heavy or light as the clay or sand predominates, with some parts gravelly; and with a subsoil in the main varying from clay to gravelly clay, with more limited areas of a sandy or gravelly character. Taken as a whole this farm fairly represents the better class of farms adjacent to the boundary of the two larger provinces, while at the same time the wooded land is so placed as to furnish excellent shelter for orchard and other purposes. Most of the upland lies on a commanding slope, facing the west, overlooking the inlet from the Bay of Fundy from which an extensive view can be had of the surrounding country. The Intercolonial Railway passes through the lower part of the property. Geographically its position is central for the three provinces, it combines the necessary variety of soil, with a fair proportion of marsh or dyke land to supply hay for feeding stock, while the uplands are very suitable for the growth of cereals, grasses, roots and fruits, or for pasture. Possession of the land was obtained early in the year and as soon as practicable after spring opened from 30 to 40 acres were got ready for crop, a number of varieties of cereals were sown and a large assortment of fruit trees, vines and ornamental trees planted. Plans were prepared for a stable and barn, and dwellings for the superintendent and farm foreman, and these buildings are now in course of erection. During the summer underdraining and general preparation of the land for future work has been energetically carried on, fuller details of which will be found in the appended report of the superintendent in charge, Mr. Wm. M. Blair.

THE MANITOBA EXPERIMENTAL FARM.

Prior to the selection of a site for an experimental farm in Manitoba, two visits were made to that Province, and the character of the land and the conditions surrounding agriculture there, carefully enquired into. The investigations extended from Selkirk, 21 miles east of Winnipeg, to the western boundary of the Province, including special inspection of farms about Selkirk, Winnipeg, Stonewall, High Bluff, Portage la Prairie, Carberry, Brandon, Oak Lake and Virden. The country north of Brandon was also examined as far as Binscarth, and from this point along the line of the Manitoba and North-Western Railway to Portage la Prairie. In addition to the railway journeys these inspections have involved over 500 miles of driving, which has given excellent opportunities for becoming acquainted with the character of the soil and the condition of the settlers over a large part of the Province. During most of these inspections I was accompanied by Mr. S. A. Bedford and Mr. Angus Mackay, both of them well known practical farmers, who have been successful in the North-West and have had many years of experience there. From these gentlemen I received much valuable information.

Among the primary requirements to be combined in a site for an experimental farm for Manitoba are a variety of soil, a sufficient supply of water of good quality and a situation within convenient reach of a railway. With these advantages secured there are good reasons for preferring a location near one of the larger centres of population, such as Winnipeg, Portage la Prairie or Brandon, and much time was devoted to the examination of farms in these districts, so that no points should be overlooked which might aid in forming a correct judgment. Among the farms which combined many advantages was one near Brandon, which was finally chosen for the purpose. This farm consists of 640 acres of land, lying north-west of Brandon, and within a mile and a half of the business centre of that place. It is a beautiful site; the land slopes nicely to the south, and the farm is well seen from the Canadian Pacific Railway for several miles, and can also be seen from the city. The land extends to the Assiniboine River, which is always a considerable stream, and from the higher land a fine view of the entire farm can be had. The lower portion, next the river, contains from 150 to 200 acres of excellent meadow land, which produces annually a strong growth of native grasses. The soil on this flat is a rich, dark, clay loam, from 2 to 3 feet deep, with a clay subsoil, and lies from 10 to 20 feet or more above the usual level of the river. Beyond this the slope upward is continued, beginning with a dark, heavy, clay loam, which gradually changes to a rich sandy loam, averaging 12 to 15 inches deep, with a subsoil varying from sandy to clay. This includes from 200 to 250 acres and leads to the foot of the bluffs which form the boundary of the valley. The bluffs vary in the angle they present to the land below, some of them rise with a gentle slope to the top, others are more or less precipitous, the spaces between them being broken up by ravines or coulées in which grow a great variety of shrubs and plants with a few small trees. These ravines will afford excellent sheltered locations for testing fruit or forest trees or shrubs. The soil on these slopes is a sandy loam, much of it of very good quality, from 9 to 15 inches deep, resting on a gravelly clay subsoil. On some of the heights, which include about 100 acres, the soil is of poorer quality, with more or less gravel mixed with the loam, on other parts is found a good, dark, deep sandy loam.

A never failing spring of excellent water issues from the higher land in one of the ravines in sufficient quantity to fill a 2-inch pipe, and the point from which this arises is high enough to admit of the water being carried to the upper storey of such buildings as may be erected on the lower slope. A second spring of almost equal volume arises from a bank on the road allowance adjoining this property which could also be utilized if required.

The river valleys in all parts of Manitoba and the North-West are more subject to frost than the higher lands, the difference in temperature usually varying from two to four degrees, but the Assiniboine valley at this point being nearly two miles wide, with gradually sloping banks, it would not probably be subject to temperatures as low as would prevail in valleys of lesser area. A slightly increased tendency to frost would make portions of this farm fairly represent the more frosty districts north while the height of land which would be freer from frost than the surrounding country, would better represent the more southern portions of Manitoba.

The advantages possessed by this site are many. It has a large area of soil which fairly represents the great grain-growing districts of Manitoba. The sheltered ravines in the bluffs represent to some extent the bluff country. It has every variety of soil needed for experimental purposes, and an abundant and never-failing supply of good spring water which can be conveyed to almost any part of the farm below the bluffs. It is very central for the larger number of farmers settled along the main line of the Canadian Pacific Railway, and when the railway now building from Brandon to Rapid City is completed, this farm will be easily reached from all the northern settlements in the Province. Should the proposed line to the south be built it will be equally accessible to that large farming district. Further, the quantity of land still unsettled between Brandon and the United States boundary to the south, coupled with the vast stretches of excellent land situated north and west of Brandon, offer homes for tens of thousands of settlers; probably in no part of Manitoba is there so large an unoccupied belt of almost uniformly fertile land. The farm is in full view of the passing trains, so that all travellers and settlers passing through can see it, and being but 1½ miles from the business centre of Brandon, it is within walking distance of that city.

Brandon is 132 miles west of Winnipeg, 76 from Portage la Prairie and 27 from Carberry. It is 32 miles east of Oak Lake, 48 from Virden, and 78 miles east of the Manitoba boundary.

Possession of this farm was not had until the beginning of July. Since then very satisfactory progress has been made under direction of the energetic superintendent, Mr. S. A. Bedford. The farm has been greatly improved, a large area of land ploughed and prepared for crop next year, between 3 and 4 miles of fence erected, roads graded, trees planted, buildings repaired and other important improvements made. Further details of this work will be found in Mr. S. A. Bedford's report which is appended.

EXPERIMENTAL FARM FOR THE NORTH-WEST TERRITORIES.

To acquire the information necessary to enable me to report on suitable sites for the proposed Experimental Farm for the North-West Territories two journeys were made to that country, one in December, 1886, the other in October, 1887. During these visits a wide area of country was traversed, careful examinations of the soil were made and diligent enquiries concerning the climatic conditions which have obtained since the first settlement of the country. The entire district from Moosomin to Fort Qu'Appelle, a distance of 121 miles, was driven over, frequent examinations of the soil made and inquiries instituted regarding the water supply and other conditions affecting agriculture, especially in the vicinity of Moosomin, Wapella, Whitewood, Broadview, Grenfell, Wolseley, Indian Head, Qu'Appelle and Fort Qu'Appelle. Similar investigations were also made in the neighbourhood of Regina, Moose Jaw and Calgary, Medicine Hat and other important stations along the main line of the Canadian Pacific Railway. Inspection was made of portions of the Moose Mountain settlement and the following Indian Reserves:—Crooked Lake, near Broadview, the Assiniboine, near Wolseley, Piapot's and Muscowpetung's, near Regina, and the Sarcee Reserve, near Calgary. While enquiring into the agriculture of the districts named, in addition to railway travel more than 400 miles of country was driven over, which afforded opportunities for accumulating many facts needed as aids in this enquiry. During the period of the latter visit an excellent opportunity was afforded of seeing the agricultural products of many of the localities named at the agricultural exhibitions then being held, twelve of which I had the privilege of attending.

Notwithstanding the excellent crops which have been obtained during the past year or two, at many points in the far west, it was thought best, seeing that the great bulk of the population is at present found in the eastern part of the Territories, that I should pay particular attention to that part of the country situated between the Manitoba boundary and Moose Jaw.

Since by far the larger part of the land open for settlement, probably two-thirds, or three-fourths within the limits named, is open prairie, it was deemed best to suggest that an open prairie section be obtained for the purpose of an Experimental Farm, rather than one with sheltering bluffs of trees, with the view of showing what can be done by tree planting to provide the shelter needed in the open country. Other important points were also considered, such as average condition of climate, character of soil, water supply, central location, accessibility, &c. In order that an Experimental Farm in that country may be seen and easily reached, it must be located near a line of railway. The settled portions of the plains in the Territories within the railway belt, may be said to lie within a distance of 188 miles, that is from the Manitoba boundary to Moose Jaw. Beyond this the settlements are few in number, are placed at long distances from each other with a comparatively sparse population, and by far the larger number of the inhabitants within the 188 miles referred to are settled in the eastern part of this area. For the first 20 or 30 miles within the boundary, the soil and the conditions of agriculture are similar to what is found in the adjoining lands in Manitoba, but west of this changes occur and the climate becomes gradually drier. The greater part of the soil, whether clay or sandy loam, is dark in colour and in most places rich in organic matter from the Manitoba line to within a few miles of Regina, where it changes to a heavy clay loam of a yellowish brown colour. This loam is strong and fertile, and when sufficient moisture is available, will give excellent crops of grain and roots. This soil covers a large area extending westward and southward, but is singularly uniform in character; north and west of this belt, much of the soil resembles that found in the eastern part of the Territories.

In conducting an Experimental Farm the work should eventually cover all branches of agriculture and horticulture which promise to be useful to the farmers in the territory or province in which it is located. The land should be suitable for the growth of a great variety of cereals, grasses and other field crops, roots and vegetables, also small and large fruits and forest trees of many different sorts. While some of these products will thrive on a heavy clay soil, others will not succeed on such soil, hence it is most important that such a farm should possess a variety of sandy and clay loams, so as to admit of the testing of all desirable classes of products. The furthest western point within the settled belt referred to along the line of railway, where suitable soil was found, associated with other necessary and favourable conditions was near Indian Head where several desirable sections of land were examined and with other sites further east duly reported on. Finally section 19, Township 18, Range 12 west, was chosen as the site for the Experimental Farm for the North-West Territories. The land adjoins the town of Indian Head on the easterly side, it lies north of the railway, which skirts its boundary for about a mile. The surface is slightly undulating, sloping towards the south, excepting at the north-east corner where the land inclines to the north, nearly all of this farm can be well seen from the railway.

Through this section, running in a winding irregular manner are two coulées or ravines, which occupy, including their sloping banks, probably 30 acres. In one of these a small creek flows during the early spring months fed by a chain of three lakes which are 6 miles distant: one of these is a mile and a half long, the other two about half a mile each. This creek dries up during the heat of summer, but by means of two dams built across this coulée a small lake is formed and a good supply of water is retained, ample for the requirements of stock and for general farm purposes during the season. At the date of my second visit, October 5, 1887, there was in this coulée a large reservoir of clear water, in some places several feet in depth. The other coulée has a running stream flowing through it during the spring months, supplied with water from springs in the Squirrel Hills, 6 or 7 miles south of the town. Good water is obtained in abundance in the town at a depth of from 25 to 30 feet, but on the Experimental Farm it has been found necessary to dig to the depth of 80 feet or more to obtain a good supply.

The soil is of excellent quality. The north half of the section is covered with a black friable clay loam, mixed with a little sand, from 1 to 3 feet in depth, with a yellowish brown clay sub-soil. The larger part of the south half has a heavy clay loam with a clay sub-soil. It has also about 80 acres of sandy loam, mixed with some gravel on the higher knolls. There are 40 acres unbroken along the railway track of sandy loam mixed with gravel, and the remainder of the section, excepting about 30 acres, included in the coulées has been under cultivation for several years past. Along the banks of the coulées the soil is variable, but chiefly sandy loam, and the inclination of the banks is such as to admit of cultivation to the water's edge, except in a few places, while the winding course of these ravines give gentle slopes with every aspect. There were no trees or shrubs growing on this land; it was all bare prairie.

The slopes in the coulées will be advantageous as starting points for tree planting, also for garden vegetables and fruits, because during the summer the soil in such situations is more moist during the dry period, and in winter the snow lies deeper in the ravines than it does on the exposed pairie. The ravines would also afford some shelter and good pasturage for cattle.

The town of Indian Head has a population of about two hundred, possesses fair hotel accommodation and has a flour mill and elevator. It is 104 miles west of the Manitoba boundary, 74 miles east of Moose Jaw, 44 from Regina and 105 north of the boundary of the United States. It is in the centre of a large and thriving agricultural settlement, extending to the Qu'Appelle River and north of this through the Pheasant Plains for about 20 miles and south of the Canadian Pacific Railway for about 10 miles. A good trail runs *viâ* Qu'Appelle to Prince Albert, and another through the Pheasant Plains to the Methodist Colony and the Montreal and York Colonies. Not only is the situation of this farm central, but the soil is of that varied character which would represent the sandy and clay loams which cover the greater part of the land east of this, also the area which lies to the north and north-west, while the heavy clay loam on the south half of the section, although different in colour and texture, would sufficiently represent the large belts of clay loam to the west and south. The supply of water, which is of much importance in the North-West, is ample, of good quality and not difficult to obtain. Its nearness to Indian Head, less than one mile, brings the farm within walking distance of hotels where visitors can obtain accommodation, also affording excellent facilities for obtaining mail matter and supplies in general.

The district has a good record of crops and it is rare to find so many desirable features for experimental work in agriculture, horticulture and forestry combined in a single section of bare prairie land as are found in the farm referred to. It may appear at first sight that a section of land comprising 640 acres is an unnecessarily large area to devote to experimental purposes, but when the requirements of pasture are considered, and the fact that in order to farm successfully in the North-West one-third at least of the cultivated land should be in summer fallow every year, also that the experiments in forest tree planting will in time cover a very large surface, it will be seen that much more land will be needed there than would be required in a farm for similar purposes located outside of the prairie country. The magnitude of the territory is such and the interests at stake so important that a sufficient quantity of land for satisfactory work in all these departments should be provided.

The relatively short distance between the two farms selected as sites for the Experimental Farms for the North-West Territories and Manitoba—182 miles by rail—will naturally raise the question as to the necessity for two farms so near each other. In the remarks on the Experimental Farm for Manitoba, the chief reasons are given which influenced that selection. The Brandon site fairly represents the Province of Manitoba also the country for nearly 30 miles into the Territories, beyond this changes begin to take place in the climate, which become more marked by the time Broadview is reached. From thence westward towards Moose Jaw the climate is very different from that which prevails in Manitoba, the rainfall is usually less and occasional hot winds prevail during the summer, which are, I believe, unknown further east. These and other climatic peculiarities, oblige the farmers in the Territories beyond the narrow belt to which reference has been made, to adopt different methods in treating the soil to prepare it for crop. There are also important differences in the soil itself as to texture and character. The farm at Indian Head has soil which represents these peculiar characteristics which the Brandon farm has not. Further the farm at Indiam Head is an open prairie section, was without a tree or shrub when purchased, while the Brandon site is partly a valley farm with sheltered ravines clothed with shrubs and small trees. The question of forest tree growing is of very great importance to that vast country included in the Territories as well as to Manitoba, but experiments carried on at Brandon, while reliable for Manitoba, would be no safe guide to the farmers on the wide stretches of prairie in the Territories. The differences of climate, soil and situation are abundantly sufficient to warrant the establishment of the two farms, and with experimental operations in agriculture, horticulture and forestry carried on at each, a vast amount of useful and practical information will soon be gained which will be of great value to farmers in every part of that country and meet in large measure the varying conditions to which they are individually subjected. Where the differences referred to clearly exist, the question of distance between the two farms is not a matter of much importance, as the special operations to be carried on at each point can be made quite as useful and instructive with the farms only 182 miles distant from each other as they would be were they 500 miles apart. The climate and other variations referred to, while important in their influence on field crops, fruits and forest trees, have comparatively little effect on stock, hence the work carried on in this direction, may, with judicious economy, be varied so as to avoid unnecessary repetition, and different lines of experiment with different classes of animals, conducted at each place.

Possession of the Indian Head farm was had early in the spring, when the superintendent, Mr. Angus Mackay, began the work. Evidence of the vigour with which this has been carried on will be found in Mr. Mackay's report, which is appended. The change in the appearance of the place is most marked, some very useful results in grain tests have already been obtained, especially with two rowed barleys, several varieties of which have been tried; the grain produced has been plump and bright, with an average weight of 54 pounds to the bushel and would no doubt command very good prices in the English market for malting purposes. Some very promising sorts of early ripening oats have been tested and several varieties of wheat, including the early ripening Ladoga from Russia. With the large acreage of land which has been summer fallowed and got into good condition for crop next year, there will be abundant facilities for carrying on many other important tests which could not be begun earlier for want of suitably prepared land. The forest tree and fruit tree plantations have stood the summer very well and it will be interesting to know how they will stand the test of the winter. The farmers of that country are also deeply interested in the results of the tests being made with different varieties of fall wheat, full particulars relating to all these points may be found in Mr. Mackay's report. Plans for suitable buildings for this farm were prepared during the winter, the contracts let and the work is being pushed forward as fast as circumstances permit.

EXPERIMENTAL FARM FOR BRITISH COLUMBIA.

Two visits were made to British Columbia, the first in December, 1886, the second in September, 1887, for the purpose of enquiring into the conditions of agriculture there and of ascertaining where suitable sites for an experimental farm for that Province could be found which would combine such advantages as were needed to make such an institution generally useful to the farmers of that country. During these visits I had the opportunity of examining many farms on Vancouver Island as well as on the mainland. On the Island, farms were inspected in the vicinity of Victoria, also in the farming districts of South Saanich, Somenos and Chemainus, travelling to the terminus of the island railway at Nanaimo.

On the mainland the fertile delta lands of the Fraser River were examined and diligent enquiries made into the character and capabilities of the land in many other districts which the time at my disposal would not permit me to visit, particularly with regard to those comparatively large areas of meadow and prairie lands on the south side of the Fraser River and extending to the United States boundary, including the Langley Municipality and the districts of Chilliwack and Sumas. On the north side of the Fraser River the country situated along the line of the Canadian Pacific Railway from Vancouver and New Westminster eastward to Fort Yale, a distance of about one hundred miles, was made a special subject of enquiry, and the land carefully examined at every promising point.

The requirements which it was thought desirable to embody in this site were:

1st. Land of good quality, combining an area of meadow land suitable for stock-raising and grain-growing, with higher meadow and bench lands suitable for fruit culture.

2nd. Land situated high enough above the banks of adjacent rivers to prevent its being overflowed during the highest floods.

3rd. Accessibility by rail and water.

4th. A central location which would be fairly representative of the greater part of the farming lands in the coast climate.

Of all the farms visited and examined none appeared to combine so many advantages as a part of the land composing the Agassiz farm, adjoining the station known as "Agassiz," on the mainland and also on the line of the Canadian Pacific Railway. The land offered here for the purposes of an experimental farm and which was finally chosen as a site for that institution, consists of about 300 acres immediately adjoining and opposite the railway station and fronting on the track for about half a mile. Along the western boundary runs the road leading to the Harrison Hot Springs, which are five and a half miles distant. About thirty-five acres of this land has been brought under cultivation, including nearly three acres of orchard, the young trees in which are coming well into bearing. There are about 200 acres of prairie land which was cleared many years ago and is now covered with a growth of fern and small underbrush. There are a few acres of higher bench land partly wooded, which would be well suited for fruit growing, and nearly fifty acres of timbered land, containing fine specimens of Douglas fir and cedar. The farm is protected on the north by a mountain which rises more or less precipitously immediately in rear of the bench land.

The soil, with the exception of that on the bench land, varies from a rich sandy loam mixed with clay, to a loam, almost entirely clay, from nine to twelve inches in depth, with a porous subsoil, in some places sandy, in others sandy clay, resting on gravel which is found from five to eight feet below the surface, and affords good natural drainage. The bench land inclines towards the south and is covered with a dark sandy loam of good depth and quality with a variable subsoil. All of this land is sufficiently elevated to prevent its being overflowed by the Fraser River, even in the highest floods.

Good water can be obtained anywhere at a depth of fifteen to twenty feet in the underlying gravel. There are also several small springs along the base of the mountain in the rear which might be utilized if required.

Agassiz is situated seventy miles east of the town of Vancouver and sixty-two miles from New Westminster near which are the fertile delta lands of the Fraser River, estimated at from 75,000 to 100,000 acres. It is 28 miles from Mission and 44 from Port Haney where by crossing the river the agricultural municipality of Langley is reached. There is also a steamboat landing within two miles of the experimental farm, where the river steamers call twice a week during the season of navigation, by which means the farming districts of Chilliwack and Sumas can be easily reached. Eastward the distance to Hope is 18 miles, to Fort Yale 32 miles, and 86 miles to Lytton, near which point the drier central area of tillable land in British Columbia begins. It will be seen that this site is very central, having clustering around it some of the best agricultural districts on the mainland. It is also on the railway which is the great highway for travel through that country and is accessible by water, while in the character and variety of the soil, its good natural drainage, the ease with which the greater part of the land can be brought under cultivation and its freedom from danger of flood, are advantages seldom found combined in one site.

The clearing of heavily timbered land in British Columbia is a most labourious and expensive undertaking, costing from fifty to one hundred dollars an acre and upwards, and occupying much time. Had an uncleared lot been selected the time required to bring such land into condition for tillage, would have delayed farm operations there to any extent for several years. With the selection made no such delay will be necessary, and the farm may soon be made useful to the agriculture and horticulture of that Province.

Delay which has been unavoidable has occurred in the acquiring of the property so that nothing could be done on it until very late in the season. Nearly 100 acres have been cleared of the small undergrowth, and about twenty acres ploughed, and thus sufficient land has been made available for such experimental work as it may be thought desirable to undertake there during the coming season.

CENTRAL EXPERIMENTAL FARM.

Seed Testing.

The work of testing the germinating power and purity of agricultural seeds for the farmers throughout the Dominion, afforded much occupation during the winter months, and there were many practical points arising out of these tests which involved much correspondence. The number of samples received for test during the winter of 1886-7 was 187, while the winter of 1887-8 brought 795, an increase which points to the growing usefulness of this part of the work, and the appreciation in which it is held by the farmers. The tests last year included 446 specimens of wheat, 80 of barley, 146 oats, 26 peas, 59 grass seeds, 6 rye, 5 Indian corn, and 27 of vegetable seeds.

The early autumn frosts which injured the grain in many parts of Manitoba and the North-West Territories, have left many of the settlers with nothing but frozen grain for seed. It has been frequently demonstrated that grain which has been frozen to some extent, does in the fertile soils of the western prairies, often produce very good crops, the fertility of the soil proving a sufficient offset to the weakened vitality of the grain, where the freezing has not been very severe, but to what extent the grain may be frozen without destroying its usefulness for seed, can only be determined by actual test in each case. Realizing the important bearing of this question on the harvest of next year, arrangements were early made for grain testing, and the farmers of Manitoba and the North-West Territories were invited through the press to send samples of frozen grain to the Central Experimental Farm, to be tested for vitality and vigour of growth. A large number of samples have already been received and reported on, and others are daily arriving. The tests thus far completed, indicate that nearly one-third of the frozen grain of which samples have been sent, would if used as seed next year be almost certain to result in partial or complete failure.

In the Maritime Provinces frequent rains during the harvest period have injured the vitality of much of the grain, especially of the oats and barley, which, in many instances, sprouted before it could be saved. Some samples have already been received for test, and more are expected; the importance of sowing good seed possessing a full measure of vigour and vitality is becoming better understood by careful farmers everywhere.

Seed Distribution.

This also has been actively carried on, involving much correspondence and labour. 2,150 sample bags were sent out by mail during the early part of the year; 1,529 of these were Ladoga wheat, the remainder barley, both two-rowed and six-rowed, also oats and forest tree seeds. Each sample was accompanied by a circular of instruction, and a series of printed questions with blank spaces for replies, which when filled and returned will supply much useful information regarding the varieties distributed for test. From the small bags of Ladoga wheat sent out by mail during the spring of 1887 many farmers have now a good stock for future sowing, ranging in the more successful cases from 20 to 100 bushels. Useful and prolific sorts of grain may thus in a short time be made available to the general public at comparatively small cost, and with new and promising varieties frequently introduced, and the information thus gained freely distributed, farmers in all the Provinces of the Dominion will be kept well informed as to the most prolific sorts for their respective district's and in this way, the average yield of the farms over the entire Dominion may soon be materially increased.

Experiments with Cereals.

During the past season forty-nine varieties of barley have been tested, including twenty of the two-rowed sorts. Twenty-six of these barleys have been grown in field plots, the dates of sowing, germinating and harvesting recorded, also the quantity of seed used and the yield. All of the varieties have also been grown as single plants, fifty kernels being planted in each instance in two rows of twenty-five each with one foot of space between each kernel and two feet between each variety. Several of the best examples of each sort were gathered for exhibition purposes, and one of each threshed and cleaned separately, the number of ears and individual grains counted and the percentage of yield thus ascertained. Three or four of the most vigorous of the remaining plants were similarly treated, and the others were all harvested together and like records obtained. Thus the yield of a single selected plant of each sort has been ascertained, also the average of three or four of the next in vigour as well as the average of the remainder.

A similar course has been pursued with seventy-four varieties of spring wheat, fifty-six of which have been grown in field plots, also with eighty varieties of oats, of which sixty have been tested in field culture. By these experiments a very large sum of most valuable information has been obtained relating to the earliness, productiveness and vigour of all these different sorts, the results of which will be given to the public as fast as they can be arranged and properly compiled.

Similar tests are in progress with more than 100 varieties of fall wheat sown as single plants and eight varieties of the same in field plots. Twenty different sorts of rye have been similarly sown, four of them in field plots.

The labour involved in the separate planting, care in noting time of germinating, relative vigour of plants, dates of ripening and in separately harvesting, curing, weighing, threshing and cleaning all these different sorts of grain has been very great, but all has been carefully and systematically done and the results reached will be reliable as to the outcome of this season.

Tests have also been made with different fertilizers on wheat on the permanent plots laid out for this purpose, of which there are twenty in all, of one-tenth of an acre each. These tests have included experiments with barn yard manure, both rotted and fresh; mineral phosphates raw and treated, wood ashes, ground bones, nitrate of soda, and mixtures of these fertilizers, with unfertilized plots for comparison; as this land was part of what was cleared last year and hence had never been under crop before, the experiments will need to be several times repeated before reliable deductions can be drawn from them. It is proposed to sow the same variety of wheat on these plots from year to year, using the same sort and weight of fertilizer each season, and to institute during the coming year similar experiments with barley and oats.

Experiments have also been carried on in hybridizing cereals, particularly wheat, and several crosses produced from which it is hoped that useful new varieties will eventually be obtained.

Corn.

Fifty-three varieties of corn have been grown, but since through delay in transit the seed did not arrive for two or three weeks after the usual time of sowing, these could only be tested for the weight of fodder produced up to a given period. Experiments have also been conducted with twelve varieties of corn planted in rows three feet apart two rows of each. In one row the grains were planted four inches apart, in the other one inch apart, and the relative weights of the product noted.

Experiments with different fertilizers and combinations of fertilizers were made on sixteen plots of corn of one-tenth of an acre each, one-half of each plot being sown with Mammoth Southern fodder corn in rows, the other half in hills with Canada Yellow corn. Records have been taken of the weight of the crop produced in each case. These plots are also intended to form part of the permanent experimental work of the farm.

Sugar Beets.

Four varieties of sugar beets have been grown side by side in plots of equal size and the weight of the crop on each plot ascertained. The seeds of three of these varieties were sent to the Central Experimental Farm for test by Wilfred Skaife, Esq., President and Manager of the Berthier Sugar Beet Factory at Berthierville, Quebec, under Nos. 1, 2 and 3. These were samples of the seed which had been imported for distribution among the farmers who were engaged to grow sugar beets for the factory. The seed from Wanzleben with which these were compared was obtained from Haage & Schmidt, seedgrowers, Erfurt, Germany, and is said to yield "the greatest percentage of sugar of all beets." Samples of the roots grown from each of these were submitted to the chemist of the Experimental Farms, Mr. T. F. Shutt, and an analysis made of them, the particulars of which will be found in his report. The Wanzleben variety yielded the smallest percentage of sugar, the other three were found to be fully up to the average in the proportion of sugar they contained.

Other Root Crops.

Seed of many different varieties of carrots and mangolds were obtained and sown on the 7th of May under similar conditions and in nearly uniform soil. They came up about the 22nd of May and were making promising growth when they were almost entirely destroyed by the severe storm which passed over the farm on the 6th of June. These plots covered about six acres of ground. Part of this land was subsequently sown with turnips and yielded fair crops. Another smaller field in which mangolds and carrots were sown for feeding purposes escaped the severity of the storm and produced good returns.

Hay.

The hay crop was fairly good, but the area had been much lessened by the ploughing up of such portions as had nearly run out, and the total product was about fifty tons. To provide for renewal of this crop some timothy was sown in the autumn, with rye, to which the clover will be added in spring, and more land will be seeded with grass and clover during the coming season, with spring grain.

Potatoes.

One of the special features of the experimental work during the past season has been the testing of a large number of varieties of potatoes. No less than 251 sorts of this useful tuber have been grown side by side under similar conditions. Notes have been taken on the weight of the seed planted, the growth of the plants, whether vigorous or weakly, and the yield of each. The process of testing the quality of these numerous varieties is still going on, and will take much time to complete. Careful notes are being taken on that important point. The result of this will be the accumulation of a large store of useful information, which will have a practical bearing on this crop. In addition 237 new varieties have been produced from hybridized seed, among which are some of much promise. These will require to be grown for one or two more seasons before their relative merits can be definitely ascertained. All of those varieties which have been grown and do not promise fairly well, will be discarded and the tests conducted next year with the selected sorts, supplemented by such of the newer kinds as may be obtainable.

Fruit Trees and Vines.

Several large orchards have been planted with standard varieties and new sorts of extra hardy fruits, chiefly from trees planted last year in nursery rows. Many of these have made fair growth and promise well. Additions of new varieties have also been made to the vineyard and to the small fruit plantations. and new plots of strawberries and raspberries planted. Full particulars of this work will be found in the report of the horticulturist appended.

Forest Trees.

Portions of the northern and western boundaries of the farm have been laid out for forest tree clumps, and some of these have been planted. They include two mixed clumps containing 1,321 trees, composed of ten or twelve different varieties, which have been put out along the northern boundary, and clumps along the western line of black walnut 618 trees, butternut 269, Scotch pine 415, and smaller groups of European larch and oak. Work will be continued in this direction in the spring, and additional clumps planted with young trees from the nursery rows.

A considerable degree of attention has been given to the question of growing forest trees and different methods are being tried. Young trees have been grown from seed, seedlings have also been purchased from nurserymen who make a specialty of growing forest trees from seed; young trees have also been taken from the woods and planted in nursery rows. Obtained from these three different sources there are now more than 100,000 trees on the Central Farm, many of them large enough for clump planting. It is proposed to send a good proportion of these young trees next season to the experimental farms in Manitoba and the North-West Territories.

Among the principal deciduous trees which have been grown from seed are black walnut, butternut, elm, ash, oak, maple, locust, chestnut, and catalpa. A special form of screen was built last spring for the purpose of growing evergreen trees from seed, as they need partial shade in order to grow them successfully. Under this screen there was sown beds of Riga pine, a very valuable timber tree from Northern Russia, a straight growing variety of the Scotch pine which is very hardy and promises to be useful in the North-West. The seed was obtained from trees in one of the Russian Government forests near Riga. A number of other promising varieties of pines and spruces have also been planted. Many thousands of young trees have grown from the seed sown, and it is hoped that a foundation has thus been laid for plantations of the hardiest sorts of valuable timber trees suitable for the colder parts of the Dominion. Two or three years more of growth will be required before these evergreen trees will be large enough to send out for planting.

Avenues, Hedges, &c.

The larger trees which have been planted out in avenues and rows bordering the main roads on the farm number 879, of which 287 are elms, 365 sugar and red maple, 66 Norway maple, 84 linden, 23 ash, 38 mountain ash and 16 catalpa. A hedge of Norway spruce composed of 1,427 trees, planted three feet apart, has been planted along the southern boundary, covering more than three quarters of a mile, while the hedges of Arbor Vitae contain 5,207 trees, planted fifteen inches apart, and extend in all to a length of nearly a mile and a quarter. A very large proportion of these trees have made fair growth, are now well rooted, and will probably make a good showing next year. The avenues and hedges will soon add much to the beauty and attractiveness of the farm. Groups of ornamental trees, both deciduous and evergreens, have also been planted about the several dwellings.

Draining.

This very necessary work has been continued during the year, and since the spring opened three and a-half miles and 189 yards of tile drains have been laid. Five main outlets each eight inches in diameter are now provided, which it is believed will be sufficient to promptly relieve the entire farm of surplus water. There are a number of small branch drains yet to be laid, but hereafter much of the work in this department can be done during the less busy periods in the year by the farm hands. The entire system of drainage thus far completed covers more than ten miles.

Road making and grading.

The numerous and unsightly stone piles which last spring greeted the eye at almost every point, have been turned to good account by burying them in the roads, the largest boulders have been placed in the bottom, these covered with smaller ones, reserving such stones as were easily broken for the top. These latter were broken and spread, the surface rounded and covered with sand or earth. In this way the main roads have been very substantially made, and the stone disposed of where it will always serve a good purpose. Some necessary grading for the roads and about the farm buildings and dwellings has also been done.

Buildings.

Since the last report was presented, much progress has been made with the buildings. The commodious stable has been finished and the farm horses comfortably housed, and in the barns there is now provided accommodation for stock. A new root house 100 by 25 feet has been built, and a poultry building erected and stocked with a good selection of the most promising breeds of fowls. The dwellings for the officers composing the working staff, and a cottage for a stableman have been finished, and the new chemical laboratory with the adjoining office building and museum are now approaching completion, so also is the structure to be used as a store house for seeds and for seed testing and propagating. The additional space which this will give for the important work to be carried on in seed testing is greatly needed; the increased accommodation soon to be provided will, it is expected, meet all the necessary requirements in this direction.

Pou try Department.

A special building of a substantial and convenient character has been provided for poultry, and a number of choice specimens of the leading varieties reared during the summer from eggs obtained in the spring. The great increase in the exports of eggs and poultry within the past few years and the ease and success with which fowls are kept shows that Canada is well situated for producing enormous supplies of these valuable commodities. Experiments will be conducted at the Central Farm with the object of ascertaining the relative merits of the different breeds for egg laying and especially winter laying and as table fowls, and, by crossing the more promising sorts, endeavour to find out what strains will be most hardy and profitable for farmers in different parts of the Dominion. This department is being managed by an experienced poultry breeder, Mr. A. G. Gilbert, whose report will be found appended.

Donations and Exchanges.

During the year, a further gift of a large collection of the seeds of trees, shrubs and plants of Europe and Asia have been received, through the kindness of the Director from the Royal Gardens at Kew. Mr. Chas. Gibb, of Abbotsford, Quebec, to whose liberality we are already so much indebted, has generously donated another large collection of seeds from Russia. An acknowledgment is also due to the Hon. Norman S. Coleman, U. S. Commissioner of Agriculture, for some new varieties of grain and fodder plants, and a further consignment of seeds of several varieties of trees have been received from the Royal Agricultural College at Tokio, Japan. Exchanges of publications have been made with nearly all the Experiment Stations of the United States, and with some of those in Europe.

Seed Grain from India.

Among the seed grain obtained for test at the Central Experimental Farm, the first season were 28 varieties which were selected from grain offered for sale at the Corn Exchange in London, England, representing the produce of the principal grain growing countries of the world; among these there were found different varieties of wheat from India, under the following names: Indian Kurrachee, Indian Hard Calcutta, Indian Red Calcutta, and Indian Club Calcutta. These varieties proved to be unexpectedly early in ripening, competing closely in this respect with wheat obtained from high latitudes in the northern part of Russia. The Indian wheats thus far tried do not, however, compare well in vigour or fertility with those of northern countries. Subsequently, though the courtesy of Col. T. C. Denison, of Toronto, I was permitted to peruse some correspondence between Arch Deacon Denison, of Taunton, England, and a Moravian Missionary labouring in the higher altitudes of the Himalaya Mountains, Mr. A. W. Heyde, of Kyeland, in the Kangra District. From the information contained in these letters, it was evident that there are in that country early ripening varieties of both wheat and barley, which it would be desirable to test in Canada. Under instruction of the Minister of Agriculture, correspondence was opened with the Government of India, and though the kind interest taken in the subject by the late Viceroy and Governor General of India, Lord Dufferin, enquiries have been instituted in the districts to which reference has been made, and also in a general way throughout the Empire, for the purpose of ascertaining what Indian grains are likely to be suitable for experimental cultivation in Canada.

A communication from the Under Secretary to the Government of India at Simla, under date of 9th October, encloses the following printed note prepared by the Reporter on Economic products to the Government of India, and also states that "the Governments of the North-Western Provinces, and the Panjab have been asked to instruct the directors of agricultural departments in their respective Provinces to obtain a supply of seeds of the grains mentioned in the note" to be forwarded to Canada.

NOTE ON INDIAN GRAINS, &c., LIKELY TO PROVE SUITABLE FOR EXPERIMENTAL CULTIVATION IN CANADA.

Written in connection with a correspondence recently before the Government of India.

Climate of Canada.

"I venture to think that the suggestion made by Professor Saunders for sending the seeds of plants grown in Spiti and Lahoul to the Dominion of Canada will not be found as hopeful a project as the sending of seeds of plants grown during the winter months at lower altitudes if not even from some parts of the plains of India. It is proposed to try the Indian seeds in Manitoba and in the plains to the north-west. The following table shows the mean temperature and rainfall of the summer or agricultural months in Manitoba:—

—	April.	May.	June.	July.	August	Sept.	October.
Mean temperature	30·2	51·2	63·6	65·9	64·8	51·3	40·0
do rainfall	0 80	2·72	3·84	2·75	2·12	3·73	0·54

By April the snow disappears and ploughing commences; and by the end of July, harvest has generally begun. In September night frosts occur, and often of such severity as to destroy the crops. The farmer of the north-western tracts of Canada has, therefore, to fear more the frosts of spring and autumn than the extremes of climatic changes between summer and winter. The snow is dry, and although not heavy, it is sufficient to protect fruit trees and winter crops; while the soil is rich and warm, and the summer nights have refreshing dews. Thus the agricultural season may be said to be from the latter end of April to the middle or end of August. There is a sudden rise in temperature and rainfall in May, the temperature steadily increasing until July and August.

Corresponding climates of India.

In India we have two crops, the *rabi* or spring crop, and the *kharif* or autumn. The former is sown in October and November and ripens in February to March; the latter is sown and reaped in the intervening months. The crops of the plains of India that might prove useful in Canada would, therefore, be some of the spring crops of the Panjab that mature in from three to four months. The depression of temperature in the middle of the rabi season might preclude crops that require a longer period such as plains wheat, but the minor crops that are sown in December and January and ripen in March to April are grown under a climate like that of Canada, viz., with an increasing temperature till harvest time. The autumn crops of the plains would be altogether unserviceable. This distinction of *rabi* and *kharif* seasons prevails throughout the lower Himalaya, the effects of a marked rainy season overcoming to a certain extent the influences of temperature. Above 10,000 feet the shortness of the warm weather and less monsoon influences force a summer season crop which, in some respects, resembles that of Canada; but the cultivation above that altitude is scanty and poor, so that it is doubtful whether any crops occur in Spiti and Lahoul (the regions specially mentioned by Professor Saunders, and which are above 10,000 feet in altitude) that would be worth sending to Canada, excepting the wheat and barley of those localities.

"Of the stations situated on the inner ranges, Kailang (the capital of Upper Lahoul) is on the one side or to the south of Spiti; and Leh, on the Indus across the middle or great Himalaya, is to the north of Spiti. The climate of Spiti is not systematically recorded, and hence the selection of Kailang and Leh. But it is believed these two points will exhibit the characteristic features of the higher Himalayan regions specially mentioned by Professor Saunders—or the Himalayan regions that have as a rule only one crop a year. Zanscar to which the Professor alludes is an unimportant valley between the two points selected.

Simla and Murree on the outer ranges may be accepted as representing the Himalayan tracts that have both a spring and an autumn crop. Of the Panjab plains, Sialkot and Multan have been chosen as having during the winter and spring seasons, a climate that closely resembles the summer of Manitoba; while Pithoragarh in Kumaon (in the North-Western Provinces) is intermediate between the plains and the higher Himalayan regions where a fairly good agricultural system prevails.

A comparison of these tables of temperature and rainfall will show that the crops that mature in Leh and Kailang during July and August might be sent to Canada; that practically all the crops grown in Murree and Simla, but more especially those sown and reaped from January to June, might also be sent; that of Multan and Sialkot it would be safe to send only the crops reaped in early spring, *e. g.*, those sown in October and November and reaped in March; and that of Pithoragarh, all the crops that are sown in October to January and reaped in April to May, might be sent. It will be thus observed that in the regions named both rainfall and temperature approximate, during the periods specified above, to those of Canada; so that the number of Indian agricultural products which might be grown in Canada is increased very considerably beyond the list that could be furnished were attention to be confined solely to Spiti, Lahoul and Zanscar.

"The following are the principal crops that might be sent to Canada, grouped under four heads, obtained by reducing the seven regions discussed above to four. Thus, by uniting Leh and Kailang into one, we have a representation of the upper agricultural Himalayan region; Simla and Murree corresponding to the second or intermediate Himalayan region; Pithoragarh, to the third or Lower Himalayan region; and Multan and Sialkot to the fourth, or the division of the plains which possess crops that might be found suitable for Canada. The high rainfall in the countries to the east and south-east of Kumaon would render it in all probability hopeless to procure crops from those parts of India even although in point of temperature they may have a winter climate not unlike the summer of considerable portions of Canada.

The following table displays the temperature and rainfall of four stations on the Panjab Himalaya, two on the outer and two on the inner ranges:—

	Usual Rabi Season												Usual Kharif Season.												
	Oct.		Nov.		Dec.		Jan.		Feb		Mar.		Apr.		May.		June.		July.		Aug.		Sept.		
	Mean average Temperature.	Rainfall.	Temperature.	Rainfall.	Temperature.	Rainfall.	Temperature.	Rainfall.	Temperature.	Rainfall.	Temperature.	Rainfall.	Temperature.	Rainfall.	Temperature.	Rainfall.	Temperature.	Rainfall.	Temperature.	Rainfall.	Temperature.	Rainfall.	Temperature.	Rainfall.	Altitude above the sea.
																									Feet.
Leh	40·1	0·42	30·5	0·03	23·2	0·08	17·8	0·23	19·3	0·23	31·0	0·19	40·8	0 09	47·1	0·10	56·0	0.20	61·6	0·46	60·2	0·40	52·4	0·13	11,500
Kailang	42·1	0·40	32·0	0·66	24·1	0·60	21·2	4·87	18·3	3·07	9 2	3 3	36·4	3·34	15·8	1·72	54·1	1·20	61·1	0·95	60·3	0·87	54·4	0 66	10,000
Simla	55·9	1·37	48·8	0·33	14 8	1 06	10·6	2 84	41·1	2·71	49·5	3·02	58 4	2·82	63·4	4·67	67·1	7·87	64·2	19·30	62·9	18·12	61·4	6·02	7,000
Murree	58·4	4·18	49·1	1·72	13·2	1·22	38·8	2 7	33 7	3·40	18 4	3 70	57·0	4·27	61 5	3 8	71·3	2·43	68·3	10·98	66·5	14·01	65·1	6·09	6,300
Multan	77·2	0·11	65·1	0·07	56·6	0·25	54·6	0·39	58·3	0 27	70 3	0·51	79 7	0·34	88·7	0·48	93·9	0 39	91·6	2·22	89·2	1·26	86·6	0·78	420
Sialkot	74·8	0·60	63·1	0·36	53·2	0 84	52·2	1·41	56 0	1·78	65 7	1 86	77·0	1·63	84·9	1·18	90·7	3·19	86·6	11·58	85·2	9·13	83·1	3·24	860
Pithoragarh (East of Almorah in Kumaon)	61·1	1·32	57·1	0·05	52·3	0 79	48 7	1·83	50·3	2·28	59·0	2·11	67·0	1·39	68 2	3·34	71·4	7·27	71·1	12 71	70·3	11·02	69·8	4·83	5,300

"1. The Chief Crops of the Higher North-Western Himalayan Regions that might be found suitable for North-West Canada.

In the upper tracts of Lahoul only one crop is got; it is sown in May and reaped in September. The crop consists of barley, wheat, and buckwheat--barley being the chief. But Lahoul is not self-supporting although Spiti is; wheat, barley and rice are regularly imported from Kulu. There are no vegetables or minor crops grown, peas are cultivated to a certain extent.

"*1st, Wheat.*—There is said to be grown a peculiar form with six tiers of grains to each ear; this is met with in the district of Patten in Lahoul and from Kibbar downwards to Spiti.

"*2nd, Barley.*—In some parts of Lahoul a double harvest is got, barley occupying the soil for only about ten weeks. This form of barley is known as *tangzad*, and is probably the best form to send to Canada. It is followed by the form of buckwheat known as ***bosotan***. This ripens in two months. In bad years the buckwheat does not ripen, so that the practice of taking only one crop is considered safer; a barley which requires a longer time to ripen is in that case sown in one field and the ordinary form of buckwheat in another, both sowings occurring in May. Parched barley flour made into porridge is the everyday food of the people of Spiti. It is also eaten boiled with butter and green herbs into a kind of soup; wheat flour is generally eaten in this way in Lahoul.

"*3rd, Buckwheat.*—There are two species of this grain grown in the Himalaya, with perhaps several cultivated forms under each, which are known to the hill tribes. The species are (*a*) *Fagopyrum esculentum* and (*b*) *F. tataricum.* Much confusion exists in the vernacular names given to these plants, and it is probable that the *orgal* or *darân* (referred, by Stewart, to *F. emarginatum*—a form now reduced to *F. esculentum*) may be *F. tataricum.* Stewart gives the following Panjab vernacular names for *F. esculentum*—*Kàla trûmba;* Chin, in the Jhelam basin (chin, china, or chena is by most authors given to Panicum miliaceum) *Karma, bres, Katú, Brapú, drawo* in the Chenab; *Bres, Katú, phaphra* in the Ravi; *Káthú* in the Bias; *Bras, pháphrá, ugoújal, tsabri* in the Sutlej, *Káthú tráo*, in Spiti; *Tráo, rjao,* in Ladak; *Kaspat* in the Panjab—the bazaar name.

"For the other form most of the above names are also given, but *orgal or úgal* seems more frequently applied to it.

"Buckwheat may be said to be the staple food with the Lahoulis; it is boiled whole and eaten as gruel, or roasted and made into flour, which is then baked into cakes and mixed with *chawg* beer and formed into dumplings.

"*4th.*—The inferior millet—*China* or (Chena?) *Panicum Miliaceum*—is said to be grown to a small extent in Spiti. But up to 7,000 feet most of the millets are also grown, and it may be doubted which might succeed best in Canada. Seed should be got in Kulu or Simla.

"There are no fruit trees to speak of in Upper Lahoul and Spiti; the apricot grows, but does not seem to fruit well, and the same remark may be made of the walnut. Both these fruits might, however, succeed in Canada, and although they doubtless are there already our higher Himalayan kinds might prove better suited to the colder tracts of Canada than the European forms of these fruits which are generally cultivated in Canada and America. The Himalayan horse-chestnut would also probably thrive; the fruits of the last mentioned tree are in the Himalayan tract sometimes used to feed horses.

"The system of cultivation pursued in Lahoul and Spiti is simple, and the produce not of the first quality. The field is artificially irrigated; when the water has soaked in, the seed is scattered broadcast and ploughed. Except perhaps a little weeding nothing more is done, although every now and then as required the field is flooded from the neighbouring rivulet. The irrigation pursued in these higher Himalayan tracts would perhaps not be so necessary in Canada, since in the latter country the rainfall is greater than in Lahoul and Spiti. Imported rice is used along with barley in the brewing of the beer known as *chang*. Many wild plants are eaten as vegetables, but none are cultivated. Thus there is nothing of much value in Lahoul; but, passing lower down the hills into upper Kulu, there are crops of greater importance which may be added to the above. About 24 per cent. of the cultivated area of Kulu produces two crops, but although every field is not twice cropped there is both a *kharif* and a *rabi* season. A spring or *rabi* crop is rarely grown in land to be cultivated in the *kharif* season with rice, of the *rabi* crop 92 per cent. consists of wheat and barley in the proportion of 3 of the former to 1 of the latter; of the remaining acreage 5 per cent. is under poppy and 1 per cent. under tobacco, leaving 2 per cent. for lentils and oil-seeds. Of the autumn or *kharif* crop 83 per cent. consists of the following crops: rice 25 per cent., maize 12 per cent. *sariári* (*Amarantus paniculatus*) 14 per cent. The last mentioned plant is known around Simla as *bathu* or *chau*. *Kodra* (*Eleusine corocana*) 8 per cent., *Káthú*, (*Fagopyrum esculentum*) 6 per cent., *Kodra* is one of the grains from which *Sur* (spirits) or *lugri* (beer) is commonly made; bread is also prepared from its flour, but for the purpose of Canadian cultivation, it may be doubted whether the *Amarantus*, buckwheat or millets, would ever likely meet with favor. They do not yield grains which Europeans would seem likely to eat readily, and it would therefore be desirable to send such crops as might be expected to meet with favour. Among these an important place should be given to :—

"*5th*, *Rice* (*Oryza sativa*).—This is the most important of the autumn crops in Kulu, but it can only be grown where water is plentiful. All irrigated land is devoted to this crop. The rice is first sown in flooded nurseries and then transplanted when some seven or eight inches in height. It is dibbled into the inundated ground, the plants being about six inches apart each way, and the field kept flooded for at least two months afterwards. There are three forms of rice met with in Kulu, and these are known as *basmati* *jitu* and *su-adas*, the first-mentioned being the finest and most expensive kind. But the rice from Yarkand would succeed far more likely in Canada than any Indian form. The winter in Yarkand is too severe for wheat and barley to be sown in autumn, but a summer wheat, barley and rice are sown and may be seen being reaped in adjacent fields.

"These remarks regarding rice are equally applicable to the hill rices of Simla, Murree and Pithoragarh, although it is probable that the rices from the higher altitudes of Kulu would be preferable to any others. In most parts of India a rice is known as the 60 days' rice because it only occupies the soil for that period. It is not known whether a form exists on the hills that possesses this property, but such rice, if it does exist at high altitudes, would be preferable for Canada to any others. Plains' rice would in all probability be quite unsuited unless Sialkot or Multan possess a form grown in sixty days during the coldest months.

"*6th*, Pulses.—There are several pulses grown at Kulu, and most of these would succeed well in Canada; but it is probable those from the plains or lower hills would grow equally well. In Kulu the following are grown *Kult* (*Dolichos biflorus*); *mah* (*Phaseolus radiatus*): *matar* or *kalon* (*Pisum arvense*); *masur* (*lentils, Ervum lens*); gram, *cholá* (*Cicer arietinum*). *Glycine soja*, the Soy bean, is said to be grown in Yarkand, and would perhaps do in Canada if seed from Alpine stock were procured. Of the pulses perhaps none would be so much appreciated as gram. Experiment alone will determine whether it will succeed, but as a cold season crop it is grown throughout India, and in Kulu it is also cultivated as a rabi crop; so that it seems possible it would succeed well enough in Canada if seed from Simla or Kulu were procured.

"The form most likely to prove suitable is the white kind generally known as Kabuli, but there is a truly Alpine species, *Cicer soongaricum*—a pure white seed much appreciated in India for sweetmeats—grown at altitudes from 4 to 12,000 feet, chiefly in Kulu and Ladak.

"*7th*, *Maize or Indian corn*.—This is a comparatively recent crop in India, having come originally from America; but as the result of Indian cultivation several well marked forms have been produced, the most striking being those which grow high up the Himalayas. It is doubtful, however, if even these would succeed in Canada, but as the grain could easily be procured in Simla, or better still in Kulu, it might be worth while sending a selection of samples. Maize from the plains would be quite useless, but if procurable Yarkand stock would be better than Himalayan.

"*8th*—In Kulu and in most parts of the hill stations *Ipomœa Batatas* sweet potatoes, are grown. In Kulu they are known as *Kachá ú*. It seems probable these may have been introduced into Canada already, but if not they might be worth trying.

"*9th*—The Jerusalem Artichoke (*Helianthus tuberosus*) grows so freely at 8,000 feet in Simla, that it is perhaps worth while mentioning it in this list.

"Potatoes are also of course grown all over the hills, even up to 12,000 feet at Kailang. An indigenous tuber that is even more extensively grown may be added to the above list of higher Himalayan products, namely:—

"*10th*—*Colocasia antiquorum*, the *ghuiya*, an aroid, the corms of which are largely eaten by the hill tribes, and grown up to 9,000 feet in altitude. After boiling they are rendered wholesome, especially if a little acid be added to the water in order to dissolve the mechanically poisonous crystals which are contained in the cells of most aroids.

II.—The Intermediate Himalayan Regions.

(Represented in these notes by Simla and Murree).

Having included Kulu in the previous remarks, the plants of the present region have been practically disposed of. Millets, rice and pulses occupy the land after the removal of the rabi (or winter) wheat and barley. It is commonly stated that several forms of *Chenopodium* are grown at high altitudes in Lahoul. This may be the case, but they seem more prevalent at about 7,000 to 9,000 feet. They are sown about midsummer and ripen in autumn.

11th.—*Chenopodium album* the *betu sag* of the plains of India; the *gua sag, lunak, irr*, or Kala bathu of the Panjab hills; and the *em* of Ladak, yields a small grain but the leaves are also eaten as a spinach. There are many very distinct varieties.

III.—The Lower Himalayan Regions.

"In addition to what has been said regarding Kulu and Simla rices, it may be here added that some of the forms of Kumaon rice hold a high place in point of quality. The *básmati* and *hunsraj* rices of Kumaon sell for 5 to 6 seers (12 lbs.) for the rupee (2 shillings.) The wheat of this region also might be sent with some hope of its succeeding. Millets, pulses and ground tubers and bulbs are also extensively grown, as well as a large number of forms of gourds, pumpkins, melons, and cucumbers. The cucumbers of the lower hills attain a large size (? according to some writers these are melons not cucumbers) and with the hill tribes constitute an important article of diet. Although Canada already possesses a large number of these vegetables, it is probable that some of the Indian forms would be esteemed as valuable *additions*. The seed might be procured from Kumaon. The Soy bean (*Glycine Soja* or *bhut*) is largely grown and ripens in October. This is perhaps the most nutritious of all pulses and the one that hitherto has commended itself most to Europe. It seems probable that Canada would be found too cold for it, but seed might be procured in Kumaon both of the black and of the white variety.

IV.—The Plains.

"The above remarks have to a large extent covered all that need be said here. It seems very doubtful if any of the plains' wheat, rice or barley would grow in Canada; but any of the other minor *rabi* crops which are sown in December and January, and ripen in March or April might be added to the list given, such as the *rabi* pulses, more particularly gram and glycine. It seems probable that of all the crops recommended gram (especially the white Kabuli form—*Cicer Soongaricum*) stands the best chance of proving useful, and therefore seed from all four regions might be furnished of that plant.

GEORGE WATT,

Reporter on Economic Products.

SIMLA, 21st May, 1888."

"In a letter since received from Lahore from E. B. Steedman, Esq., Director of Agriculture, Panjab, information is conveyed of the despatch of four boxes containing seven bags of wheat and seven of barley for experimental test, in this country and since then advice has been received of another box containing samples of barley and gram which has been sent from Calcutta. Mr. Steedman says "I also forward copies of notes received as to the cultivation of the different samples sent. It must be remembered that the conditions of cultivation in Lahoul and Spiti are very different from those in the other tracts of Kangra, Palampur, Kulu, Seoraj and Simla. In Lahoul and Spiti the wheat and barley are sown in the spring after the snow melts and are reaped at the end of the summer. In the other tracts they are sown in the autumn and are in the ground through the winter. Lahoul and Spiti are also almost beyond the area affected by the monsoon rains. They receive only a slight rainfall between 15th June and 30th September, while in the five other tracts the rain is heavy during these months. "Kungi," the disease mentioned, is rust and is brought on by damp, cloudy close weather. We do not suffer very much from it in the Panjab proper, but I am not able to say to what extent crops suffer in the Himalayan Districts. In one or two places the outturn seems to me to be put much too low in the notes. I expect that from 8 to 12 maunds—a maund of grain weighs 80 pounds—for wheat and 10 to 14 maunds for barley is a fairer estimate of the annual outturn."

The following are the notes referred to by Mr. Steedman:

BRIEF NOTE ON THE CULTIVATION OF WHEAT AND BARLEY GROWN AT HIGH ELEVATIONS IN THE SIMLA DISTRICT.

Wheat.

"About the 14th July the grass on the field is cut down with a sickle and scattered about. The grass rots within three weeks and serves as manure. From 15th August to 14th September the land is tilled, and from 15th September till 14th October the wheat is sown. The land is ploughed a second time before the sowing, sometimes a week before if time admits. The land is manured for a month and a half after the wheat sprouts. Reaping commences by 11th June, and ends about 28th July. The wheat is sometimes subject to a disease called "*Gàndi Garyim*" the effect of which is to make the grain round and black and to reduce it in weight. It is then useless for human consumption. Wheat is generally cultivated on Barani lands of high elevation. Three and one half seers* of seed produce about one maund (40 seers) of wheat.

* A seer is equal to two pounds.

Barley.

"The same remarks apply to barley, except that barley is not so subject to the disease above mentioned as wheat, and that five and one half seers of seed produces about two maunds of barley.

W. COLDSTREAM,

Deputy Commissioner.

SIMLA, 10th July, 1888.

NOTE ON THE CULTIVATION OF WHEAT AND BARLEY IN THE KANGRA DISTRICT, AVERAGE ELEVATION, 3,000 FEET.

Question.	Answer as regards Wheat Cultivation.	Answer as regards Barley Cultivation.
"Nature of land used	Is sown in both irrigated and unirrigated lands.	Is sown in both irrigated and unirrigated lands.
Sowing time.	From 1st November to 15th December If the rains are seasonable the crop is sown at once, but if the rains hold off the sowings are deferred till the third week in January, after which no wheat is sown.	From 15th October to 15th November in both kinds of land.
Harvest time.	From 1st to 20th May in irrigated, and from 20th April to 10th May in unirrigated lands.	From 20th to 30th April.
Manuring and irrigation	Both kinds of lands are manured, but only the irrigated lands are watered, namely, the lands are manured before ploughing and irrigated afterwards. After ploughing the seed is sown, and irrigation is not resorted to till plants are well up on the ground. If the January and February rains fail, further irrigation is called for.	Both kinds of lands are manured and irrigated as wheat land.
Average produce per acre.	The maximum produce per acre is eight maunds, and the minimum two maunds.	Same remarks as wheat.
Diseases.	In unirrigated lands the wheat crops are not subject to any disease, but in irrigated lands, if the January and February rains are heavy the crops generally suffer by a disease called "*kungi*" which dries up the grain and reduces it to dust.	No disease at all.

"NOTE ON THE CULTIVATION OF WHEAT AND BARLEY IN THE PALAMPUR DISTRICT, AVERAGE ELEVATION, 3,000 FEET.

Wheat.

"An acre of irrigated land yields about five maunds of wheat. Manure is used, but not in sufficient quantities. The time for sowing is the first three weeks of January, and for harvesting last week of May and first week of June. The wheat is subject to a disease called "*kungi*," which occurs when there is a failure of rain.

Barley.

"An acre of irrigated land yields about eight maunds of barley. Manure is not available in sufficient quantities. The corn is sown in Asanj, *i.e.*, September and October, and the crop is cut in May.

NOTE ON THE CULTIVATION OF WHEAT AND BARLEY IN LAHOUL, AVERAGE ELEVATION, 11,000 FEET.

"Sown in Besakh (March and April) cut towards the end of Asanj (beginning of October). For wheat a stony (pathreli) soil is preferred, and for barley a clean, clayey soil free of stones. For both crops the soil is abundantly manured, and the lumps of earth are broken down. Both are irrigated. When the shoots are six inches high, weeding is performed; a week after weeding is finished a watering is given, and afterwards waterings are given at intervals of ten or twelve days till the harvest is ripe. The crop is weeded again when the ears begin to form. The average outturn is fivefold. Both crops are sometimes, but rarely, attacked by a disease which blackens the ears and grain.

" In sowing, the pebbles are first cleared out of the soil ; then manure is applied: then the land is ploughed and the seed sown, and the soil levelled with a roller.

The seed now sent was grown in *Keirdang* and *Gookir* villages.

" NOTE ON CULTIVATION OF WHEAT AND BARLEY IN THE SPITI VALLEY.

The average altitude above the sea of the cultivated land in Spiti is 11,000 feet. The fields are irrigated by channels fed by the Mountain torrents. Both wheat and barley are sown in April ; if the snow lies late earth is thrown upon it to make it melt quickly. Both crops are manured plentifully with cattle, goat and sheep dung. The first watering is given 40 days after sowing, and thereafter waterings are given at regular intervals till the crop ripens. The harvest is reaped in August.

" The Nono (Governor of Spiti) puts down the outturn as 20 fold, but Major Hay's estimate is probably more correct, *i. e*, 14 to 1 for barley and 10 to 12 to 1 for wheat. The crop is liable to be injured by frost, but seems to be subject to no kind of disease.

NOTE ON CULTIVATION OF WHEAT AND BARLEY IN KULU.

The grain sent was produced at an elevation of 7,000 feet above the sea, about 100 miles to the North of the Village from which the Seoraj grain was obtained, in the Biss Valley.

" The barley is sown between 5th and 25th September, and reaped from 15th June to 14th July ; wheat sowings go on during the whole of September, the harvest is reaped at the same time as that of barley. Manure is thrown on the soil, and also sheep and goats are penned on the field before sowing, for both crops. The soil is not irrigated. A too heavy snowfall is fatal to the crop; heavy rain causes the disease called *Kungi*, before described ; and in case of drought in April or May a green insect (here called *Mangnu*) attacks the ear. The outturn of wheat averages from 5 fold in bad seasons to 10 fold in good; and of barley 8 fold to 16 fold.

NOTE ON CULTIVATION OF WHEAT AND BARLEY IN SEORAJ.

"The grain sent was produced at an elevation of about 7,000 feet above the sea, in the Sutlej Valley.

Wheat.

" Ploughing commences about August 15th. The seed is sown between 5th and 25th September, and the harvest reaped in July. A comparatively poor soil is preferred. The land is manured before sowing commences, generally by sheep being penned on it for some nights. No irrigation is used. The outturn is reported as 4 fold but is probably greater. The crop is subject to a disease called *Kungi* described as a red dust gathering on the ear, due to excessive moisture in the soil at sowing time.

Barley.

" Ploughing commences about 15th August. Sowing goes on from the end of September to the beginning of November. Reaping begins generally about the end of June. A rich soil is necessary. No manure is given till the young shoots are 5 or 6 inches high, when manure that has been collected and kept is thrown on the field as a top dressing. No irrigation is used. The outturn is reported 6 fold but is probably greater. *Kungi* (described above) is the only disease to which it is liable.

True Copy.

PESTOUJI, *Superintendent.*"

OFFICE OF DIRECTOR OF LAND RECORDS
AND AGRICULTURE, PANJAB,
LAHORE.

These agricultural products of India which have been collected with so much care by the Government of India for the benefit of Canada, will be distributed among the several Experimental Farms, where they will be carefully tested and reported on. It is expected that some of these varieties of grain so long and successfully cultivated in India, will prove useful in the provinces comprising this wide Dominion.

Exhibits of Farm Produce.

Special exhibits of the products grown at the Experimental Farms were displayed at the Provincial Exhibition at Kingston, the Industrial Exhibition at Toronto, the Western Fair at London and the Central Canada Fair at Ottawa. The collections contained specimens of the different varieties of grain grown at the Central Experimental Farm, about 200 sorts in all, including bunches of heads from the field plots, as well as single plants of each sort. Large collections of potatoes were also shown, as well as field roots, fodder plants and beans. Photographs were also displayed of many varieties of strawberries and raspberries grown on the farm and represented exactly of the natural size. Samples of grain grown on the Experimental Farm at Indian Head, N.W.T., were also shown and collections of native grasses from both the Manitoba and North-West Farms. A small display of fruit consisting of some fine specimens of apples, pears and plums obtained from a small orchard on the Experimental Farm at Agassiz, British Columbia, was also an attractive feature. These exhibits attracted much attention, the various articles were arranged so as to be as instructive as possible. This effort to convey practical information to the visiting farmers was much appreciated and very favourably spoken of; while none of the collections were entered for competition, that shown at the Industrial Exhibition at Toronto, was awarded by the Directors a silver medal and a diploma in recognition of its excellence and usefulness.

Acknowledgments.

My warmest thanks are due to all the officers of the Central and branch Experimental Farms for the willing aid they have rendered in carrying on the important work we have in hand. The records of what has been accomplished are shown more in detail in the several reports appended. On the Central Farm the growth of the different varieties of cereals and other crops have been watched with the most careful interest by the farm foreman, Mr. John Fixter, to whose accurate records I am indebted for much of the information gained.

WM. SAUNDERS, F.R.S.C., F.L.S., F.C.S.,

Director Experimental Farms.

REPORT OF THE CHEMIST.

(FRANK T. SHUTT, M.A., F.I.C., F.C.S.)

LABORATORY OF THE CENTRAL EXPERIMENTAL FARM,
OTTAWA, 1st December, 1888.

WM. SAUNDERS, Esq., F.R.S.C., F.L.S., F.C.S.,
Director, Dominion Experimental Farms,
Ottawa.

SIR,—I have the honour to submit to you the second annual report on the work of the Chemical Department of the Experimental farms accomplished by me since last February, the date of my first report. This report consequently contains but the result of nine months' labour. It consists of first an epitome of the chemical analyses made of various substances relating to agriculture, and secondly, an account of my inspection of English and Continental Laboratories, and of some of the Experimental Stations of Germany visited during the past summer.

WHEAT.

In the concluding paragraph of my last report mention is made of a series of analyses of various wheats, chiefly the Red Fife and Ladoga varieties—then just begun. The original Ladoga grain was imported from Russia and was grown in a latitude some 600 miles north of that of Ottawa, where the summer is consequently much shorter than in our North-West Provinces. During the summer of 1887 a large number of farmers in the various Provinces of the Dominion cultivated this wheat from samples supplied to them by the Experimental Farm at Ottawa. Accompanying the samples was a request to sent in a report on the growth, yield and length of time required by this wheat to mature. It was also requested that a specimen of the grain reaped from the sample be forwarded to the Farm. By this means it was expected that definite and reliable information would be obtained as to whether this wheat ripens earlier than the Red Fife and would thus be likely to escape some of the early frosts occasionally so detrimental to the wheat crop of the North-West. All important as the questions of yield and early ripening are, there remains another of equal consequence—the composition of the wheat. This could only be ascertained by chemical analysis. To arrive at the respective values of the Red Fife and Ladoga wheats from the chemical standpoint—was then the object of the investigation. In February, when the work was begun, we were unable to obtain the flour of the Ladoga wheat manufactured by the Roller process. The analyses of all the samples was consequently made on the whole grain, and are thus strictly comparable. My report on this work was completed last June, but publication has been deferred in order that the results of some direct determination of the gluten in Red Fife and Ladoga flours, from samples of these varieties of wheat lately ground might be added. This report will be issued in bulletin form for distribution among the agricultural population and others interested in this important matter. It contains, in addition to a full account of the constituents of the wheat, the deductions which may be drawn therefrom. I shall here, therefore, give but a synopsis of the extent of the work and the conclusions reached.

Twenty-eight samples of wheat were analysed, as follows: twelve of Ladoga, six of Red Fife, three of Saxonka, two of Kubanka and one each of the following varieties, Onega, Red Fern, Clawson, Wellman's Fife and Blue Stem. The Ladoga specimens include the original importation from Russia and grain grown from this seed in the North-West Territories, Manitoba, Nova Scotia and New Brunswick. One sample of the Red Fife was grown in Ontario; the others in the North-West Territories and Manitoba. Of the other wheats I need not here make further mention, as full and detailed accounts of their composition appear in my report before mentioned. After a thorough examination into the composition and physical qualities of these wheats I am enabled to draw the following conclusions :—

1. That the Red Fife and Ladoga wheats have an almost equal proportion of gluten, as determined by chemical analysis; the difference being however in favour of the latter variety.

2. That by the cultivation of the Ladoga grain in the North-West a marked increase in the percentage of gluten has taken place in some instances.

3. That there appears to be a direct ratio between the percentage of albuminoids and the weight of grain, viz., the heavier the individual grain the greater the proportion of albuminoids.

4. That with respect to size, weight and hardness of the grain, the Ladoga compares very favourably with the Red Fife.

5. That the Manitoba hard wheats (Red Fife and Ladoga) most certainly equal in value the best grown in the States of Minnesota and Dakota; and this deduction is made from my own and Prof. Richardson's results.

6. That the crude gluten as determined by mechanical means is present in the Ladoga and Red Fife flours in almost identical proportion.

Sugar Beets.

During the past summer several varieties of sugar beets have been grown at the Central Farm. Nos. 1, 2 and 3, are from seeds supplied by Wilfred Skaife, Esq., president and manager of the Berthier Sugar Beet Factory of Berthierville, P.Q. The Wanzleben variety was from seed purchased from Haage & Schmidt, seedsmen of Erfurt, Germany.

On analysis they are found to contain the following amount of sugar :—

No. 1	12·52	per cent.
No. 2	12·50	"
No. 3	12·00	"
No. 4. Wanzleben variety	10·88	"

The quantities of sugar in different varieties of sugar beets may vary much. The minimum percentage is about 8, and the maximum about 15; the greater number of specimens yielding between 11 and 12 per cent. The first three of those examined possess therefore an average amount, while the Wanzleben variety falls below the mean.

As the beet-root sugar industry promises to be one of great importance in Canada, the investigation into the value of the respective varieties of sugar beets will be continued during the ensuing year.

Marl.

During the past year several samples of this fertilizer have been received for analysis accompanied with a request for information as to its value and use. As large deposits of this mineral occur in different parts of the Dominion which are of easy access to agriculturists, I propose as soon as time permits, to write a bulletin that will put before the farming community the true worth of this substance and at the same time give full instructions as to the most advantageous methods of its use and application as a fertilizer. In the meantime I insert here the following reports lately issued as being of general importance :—

LABORATORY OF THE EXPERIMENTAL FARM,
OTTAWA, 8th November, 1888.

J. A. BARRON, Esq., M.P.,
Lindsay, Ont.

DEAR SIR,—I have submitted the sample of marl sent by you to chemical analysis, which shows it to have the following composition :—

Moisture	·20
Volatile and organic matter	1·61
Clay and sand	·50
Lime (CaO)	53·27
Magnesia (MgO)	·77
Iron and Alumina (Fe_2O_3. Al_2O_3)	·59
Alkalies	traces.
Carbonic acid (CO_2)	42·60
Phosphoric acid (P_2O_5)	·28
Soluble silica (SiO_2)	·12
	99·84

Carbonate of lime ($CaCO_3$) 95·12.

This is an exceptionally pure specimen of marl, consisting essentially of carbonate of lime. Phosphoric acid is present in small quantities, but the alkalies are to be found only in traces.

The value of marl as a fertilizer depends, 1st, on its chemical composition, and 2nd, on its mechanical texture.

The important ingredient of marl is lime, present in the form of a carbonate. The presence of phosphoric acid and the alkalies, especially potash, increases the value of this fertilizer, as both are essential ingredients of plant food. But besides supplying these elements (lime, phosphoric acid and potash) directly for the growth of plants, marl has a tendency to liberate the combined phosphoric acid and potash in soils that have been hitherto insoluble and unavailable for plant use. Marl also promotes, though slowly, the oxidation of humus in peaty soils, converting the inert nitrogen of the same into an active form.

Its mechanical condition should be such as to allow it to easily disintegrate when exposed to the weather, and thus be in a condition to mix thoroughly with the soil. Its application then to clayey soils is to render such mellower and lighter to work, and at the same time to allow the roots and rootlets of the plants more easily to penetrate and thus gain nourishment from an increased area. Its influence on sandy soils is to render them heavier and vastly improve their absorptive powers for moisture and manure.

Marl may therefore be advantageously and profitably applied to soils known to be deficient in lime and also to clays and sandy loams, both for the supplying of this element and the improvement of their mechanical condition.

The best time for application is in the autumn, the marl being then carted on to the fields and spread. The action of the atmosphere, the rains and frost during the ensuing winter should then thoroughly disintegrate it, and thus allow a perfect mixing with the soil in the spring.

FRANK T. SHUTT, M.A., F.C.S.,
Chemist, Dominion Experimental Farms.

Without giving *in extenso*, the reports written on the following specimens analysed by me, I will here simply state their composition, and add such remarks as may be necessary to a correct knowledge of their value and use, in addition to those contained in the foregoing report.

The following table shows the composition of a specimen of marl forwarded for examination and report by Mr. J. H. Vanderlip, of Erin, Ont. :—

Moisture	·30
Organic and volatile matter	2·29
Clay and sand (insoluble in acid)	·77
Iron and alumina (Fe_2O_3, Al_2O_3)	·50
Lime (CaO)	51·61
Magnesia (MgO)	1·32
Carbonic Acid (CO_2)	43·10
Phosphoric Acid (P_2O_5)	·20
Soluble Silica (SiO_2)	·24
	100·33

The large percentage of carbonate of lime, 92·16 per cent. and the small quantity of insoluble matter, make this a marl of great value as a fertilizer. Its easy disintegration by water will allow it, after exposure to the weather, to freely mix with the soil.

This sample was taken from a swamp, and it contains 2·29 per cent. of organic matter due to the accumulation of vegetable matter while the marl was being deposited. This would possess nitrogen in a form more or less readily convertible into plant food. The notable quantity of phosphoric acid, evidently derived from the same source, also enhances its value.

Mr. Robert Armstrong, Kirkfield, Ontario, sent in two samples of marl which he wished to have analysed and reported upon with the view of introducing them as fertilizers in his locality.

No. 1 :—

Moisture	16·68
Organic matter	6·01
Clay and sand	1·27
Iron and alumina (Fe_2O_3, Al_2O_3)	·40
Lime (CaO)	41·35
Magnesia (MgO)	·50
Soluble silica (SiO_2)	·11
Phosphoric acid (P_2O_5)	·26
Carbonic acid (CO_2)	33·00
Alkalies	·06
	99·64

Carbonate of lime ($CaCO_3$) 73·83.

This is a very fair sample of marl, though not equal in value to either of the foregoing examples.

No. 2 :—

Moisture	4·53
Organic matter	19·51
Clay and sand	8·82
Iron and alumina (Fe_2O_3 Al_2O_3)	·74
Lime (CaO)	36·69
Magnesia (MgO)	1·06
Soluble silica (SiO_2)	·03
Phosphoric acid (P_2O_5)	·05
Carbonic acid (CO_2)	28·70
	100·13

Carbonate of lime ($CaCO_3$) 65·53.

This marl is very hard and of a slaty nature, and does not disintegrate or crumble in water. It is therefore of little value to agriculturists in its present condition.

and could not be recommended as a remunerative fertilizer. If, however, the marl were first well burnt it would be found to be more amenable to the action of the weather. Its application, if easily and cheaply obtained, might then be attended with profit.

River and Swamp Muds.

Four samples of "mud" or "muck" from different localities in Prince Edward Island have been received and analysed. This investigation has established by scientific proof the great value of these materials as fertilizers. That it is well worthy of the attention of farmers, in whose neighbourhood these muds are found, can no longer be matter of opinion or speculation. From these remarks, however, it must not be inferred that all samples of mud or muck have the same value. As we have seen in the case of marl, specimens from different localities vary in their composition and hence the necessity and importance of a chemical analysis in each case before conclusions as to the intrinsic worth can be drawn.

The organic matter which swamp mud and like substances contain, is the result of the partial decay of plants. Organic matter as a food for plants, depends for its value upon the percentage of nitrogen it possesses. The nitrogen of such humus is, as has been already stated, more or less easily converted into forms which can be used by plants, according to the amount of rainfall, temperature and condition and composition of the soil, and the nature of the nitrogen-holding substance. The amount of nitrogen, therefore, in a sample, is of paramount importance, and this is only obtainable by means of an analysis. Although phosphoric acid and potash appear to be always present (and when in notable quantities certainly to its enhancement as a fertilizer) it is chiefly as a nitrogen supplier that this mud must be considered and valued. From the relatively high percentage of nitrogen that these samples contain, I have no hesitation in affirming that their application to all soils deficient in nitrogen, whether clays or sands, especially where wheat or other grain crops are to be grown, will be attended with marked success and profit.

The samples analysed are all from the vicinity of Cardigan Bridge, P.E.I. It would therefore be unwise to infer that all "muds" of that island or of the Maritime Provinces are of equal value. Before generalizations can be made many more samples must be examined, and these from various localities. The analytical evidence from those already investigated, however, points strongly to the fact that we have in these swamp and river muds, a very valuable nitrogenous fertilizer.

The analysis of sample sent by Mr. J. W. Alley, of Cardigan Bridge, P.E.I., gives the following results:—

Moisture	1·89
Clay	16·66
Sand	59·33
Organic matter	11·73
Oxide of iron and alumina	6·26
Lime	1·09
Magnesia	·63
Alkalies	·43
Chlorine	·66
Soluble silica	·29
Phosphoric acid	·14
Carbonic acid, &c.	·89
	100·00

Nitrogen in organic matter, ·254 per cent.
Insoluble in acid (clay and sand), 75·99 per cent.
Common salt corresponding to chlorine, 1·08 per cent.

Three specimens from Mr. F. D. McCormack, of the same place, are tabulated below:—

——	No. 1.	No. 2.	No. 3.
Moisture	2·28	1·57	12·34
Clay and sand (insoluble in acids)	68·22	76·30	4·07
Organic matter	14·68	7·32	72·06
Oxide of iron and alumina	10·16	7·68	3·60
Lime	·91	2·76	3·75
Magnesia	·89	·81	·25
Alkalies	1·02	·88	·99
Chlorine	·88	·40	Traces.
Soluble silica	·28	·20	·60
Phosphoric acid	·16	Traces.	·55
Carbonic acid, &c	·52	2·08	1·79
	100·00	100·00	100·00
Nitrogen in organic matter	·336	·243	1·70
Common salt, corresponding to chlorine	1·45	·66	

By a consideration of these figures it will be seen that Mr. Alley's sample and No. 2 closely approximate each other in their composition and consequently in their value. No. 1 stands higher than these two on account of the greater percentage of nitrogen, phosphoric acid and alkalies. No. 3 is the best of all, and must be ranked as a first-class nitrogenous fertilizer. Besides the large quantity of this element which it possesses there is present over three times the amount of phosphoric acid found in the other samples. Under the term alkalies are included the oxides of potassium and sodium, commonly known as potash and soda. The value of potash far exceeds that of soda from an agricultural standpoint, for potash is an essential component of, and occurs in considerable quantities in, all plant tissues, while soda is absorbed by plants only in very small amounts, and most certainly cannot be substituted for potash as a plant food. It is, therefore, of importance in most instances to ascertain the relative percentages of these substances present in a fertilizer, so that its correct value may be arrived at. Contrary to my expectations I found the amount of potash so small in comparison with that of the soda as to render a separation of the two of little value. We find a reason for this excess of soda when we notice the chlorine present—the two being evidently combined as common salt. This salt is, no doubt, derived directly or indirectly from sea water.

Besides supplying nitrogen, humus—a generic term used to denote the result of partial decay of vegetable matter whether in soils, peat or swamp muck—may be considered of value from the products of its ultimate decay in the soil; chief among which is carbonic acid, most useful in conjunction with water in rendering soluble other plant food. It forms an admirable absorbent of moisture and ammonia, and from its mechanical texture and lightness is of great value in mellowing heavy clays and in "binding" sandy soils.

Although the application of peat and allied materials directly to the soil must in most instances be beneficial, yet for profitable use such substances as contain humus should first be submitted to a process of fermentation, whereby, as has already been pointed out, the nitrogen may be converted into an easily assimilable form. This, to some extent, is brought about by a simple exposure to air in heaps, but much more quickly by compositing with dung, fish, &c. I would therefore suggest to farmers who live in the vicinity of these river and swamp deposits to compost it during the winter with farm yard manure and then spread the result on the fields in the spring before ploughing.

Since writing the above I have received the following information:—The sample sent by Mr. Alley is from the bottom of the Cardigan River, the deposit where it was dug being about six feet in depth. He reports that farther down the river there are beds which extend for long distances, some approximating 20 feet in depth. Mr. McCormack reports that samples I and II are river mud taken at different spots in the vicinity of Cardigan Bridge. Sample III is from a swamp, the deposit being about three feet deep. The swamp is flooded during the greater part of the year.

SOIL.

One sample of soil was analysed by me during the past year. It was forwarded by Dr. Bell, of the Geological Survey. I append the letter asking for my examination and report on the composition of the same, as both appear to me to be of sufficient general importance as to merit their insertion here.

Letter from Robert Bell, M.D., LL.D., Assistant Director of the Geological Survey of Canada.

GEOLOGICAL SURVEY, OTTAWA, 3rd May, 1888.

FRANK T. SHUTT, Esq., M.A., F.C.S.,
Chemist Dominion Experimental Farms,
Ottawa.

DEAR SIR,—I beg to send you a sample of soil from the Halibury Farm, on the west side and near the north end of Lake Temiscaming, and to ask if you will have the kindness to make a chemical examination of it. I spoke to our own chemist, Mr. Hoffmann, about it, but he said it was more in your line than his and recommended me to send it to you. I think it of importance to know something about the nature of the soil from a chemical point of view, as it prevails throughout a large tract around the above lake, and, in spite of its very light colour, it is capable of producing good crops. The sample I send was collected by myself immediately below the vegetable mould in a newly cleared piece of land. When ploughed up for the first time this soil looks hard and "cloddy" but soon falls to powder under the influence of the weather. It is not confined to any particular level, but is found at all heights and on both sides of the lake. Its almost white colour forms a singular contrast to the bright green of the vegetation growing upon it and I am curious to know if you can discover any chemical reason for the fertility of what might be taken for an unpromising soil. I shall, therefore, feel obliged if you can spare time to examine it and let me know the result, as I should like to refer to it in my report on the geology, &c., of the district. I may mention that attention is being directed to the country around Lake Temiscaming as a field for colonization. Many families have already settled there and some townships have been surveyed on both sides of the inter-provincial boundary.

I am, dear Sir, yours respectfully,
ROBERT BELL.

ANALYSIS AND REPORT.

Moisture	1·79
Clay and sand (insoluble in hydrochloric acid)	77·20
Volatile and organic matter	3·70
Iron and alumina (Fe_2O_3, Al_2O_3)	12·37
Lime (CaO)	1·12
Magnesia (MgO)	traces
Phosphoric acid	very heavy traces
Alkalies (K_2O, Na_2O)	·83
Soluble silica (SiO_2)	·03
Carbonic acid and undetermined	2·96
	100·00
Nitrogen in organic matter	·087
Carbonate of lime ($CaCO_3$)	2·00

Sulphates and chlorides are absent.

The soil is a clay loam of a light colour, and contains but little sand.

"I regret that the time at my disposal has not allowed me to make a more complete analysis, but from the figures already given the soil shows itself as one containing in fair proportions all the elements conducive to plant growth. Its mechanical condition or texture seems favourable to plant growth. I think it should be one that is sufficiently loose to allow the root fibres and air to freely penetrate and at the same time retain heat, moisture and fertilizing materials. The physical condition of a soil as well as its composition must be considered when endeavouring to ascertain its relative fertiitly. Indeed, the one is well nigh as important as the other; hence the value that is to be placed upon the latter portion of this report."

At the time of making the above report I was about leaving for England, and consequently could not make as full an analysis as I desired. Sufficient however was done to show that the soil is by no means an unfertile one, though not ranking as first class. Dr. Bell's testimony as to its fertility, bears out the result of my examination.

REPORT ON WELL WATER FROM ANTRIM P.O., ONT.

LABORATORY OF THE EXPERIMENTAL FARM,
OTTAWA, 2nd April, 1888.

WILLIAM SAUNDERS, Esq., F.R.S.C.,
Director, Dominion Experimental Farms,
Ottawa.

SIR,—I have the honour to report as follows respecting the quality of the well water of Mr. R. C. Sparrow, Antrim P.O. The well is said to be dug 25 feet and then bored to the extent of another 25 feet. Accurate information as to the nature of the soil and the proximity of the well to the barnyard or other source of contamination is wanting.

Chemical Analysis.

Free ammonia,	parts per million	2·18
Albuminoid ammonia	" "	·54
Oxygen absorbed in 15' at 80 F.	" "	4·58
" " in 4 hrs. at 80 F.	" "	7·82
Chlorine	" "	190·00
Total solids	" "	1,195·00

Phosphates, very heavy traces.

The water has a disagreeable odour, is slightly yellow and contains small quantities of sediment.

This water I must unhesitatingly condemn as a potable water, and would advise the immediate discontinuance of its use for drinking purposes and watering cattle.

Not knowing the exact position of the well, I am unable to say whether cleaning it out would be of much value. I am inclined to think, however, from the composition of the water, that the well acts as a cesspool to some degree, and in such case would probably have to be abandoned.

Respectfully submitted,

FRANK T. SHUTT, M.A., F.C.S.

Chemist, Dominion Experimental Farms.

It is hardly necessary for me perhaps to emphasize the tremendous importance both to man and beast of a pure water supply. I called attention to this subject in my last report, and suggested that an opportunity should be afforded to farmers (a small fee being charged if found necessary) of having their drinking water analysed. When the new laboratories are completed a special set of apparatus will be devoted to this work, and every facility for prosecuting this branch of chemical work will be furnished. Those desirous of having a sample of water examined should first write for instructions for collecting and sending the same.

TRIP TO THE CONTINENT FOR THE PROCURING OF APPARATUS, THE INSPECTION OF LABORATORIES, &C.

In the month of June last I left Canada for a short tour in England and Germany for the purpose of selecting the apparatus required in our new Laboratories and, at the same time, of inspecting the fittings and appointments of laboratories of universities, technical schools and institutions akin to our Experimental Farm, where analyses and experiments of an agricultural nature are carried on. At the same time it was intended to note the character and method of carrying out of agricultural experiments in these countries.

With regard to apparatus I may state that after visiting the chief houses in Germany I was enabled to make such a selection as was immediately required for use, and to such an extent as the means at our disposal would at present permit. I may point out that by thus ordering direct from the manufacturers not only is the quality guaranteed but also a great saving in cost effected.

As in my last report, I shall now give but an outline of the size and general appointment of the laboratories visited during the summer and pass over such details as would not be of interest save from a strictly scientific standpoint.

University College, Liverpool.

In England my first visit was paid to the Liverpool University College. The new chemical laboratories of this institution were erected in 1886, and have been so constructed and finished that for completeness, general arrangement and the introduction of modern improvements they stand among the very first in England.

The building is large and handsome, being constructed, in Romanesque style, of brick and terra-cotta. There yet remains to be added to it two large laboratories before the completion of the design. The cost as it now stands, exclusive of site, was £16,000.

On the ground floor there is a theatre for practical work—the only one of the kind I believe in existence. The dimensions are 48 ft. 6 in. by 42 ft. 6 in. and is 19 ft. 6 in. in height. Here a large number of students can perform simultaneously with the demonstrator all experiments in qualitative analysis, and for the purpose of teaching large classes in this work it is said to answer admirably. For this end the benches are arranged in ascending and concentric tiers—the demonstrator's table being so placed as to be in view of the whole class. The benches are in sections, and thus form segments of the tiers, each bench accommodates two students, being 8 ft. long. They are fitted with gas and water supplies, fume chamber and cupboard for the storing of chemicals and apparatus. The preparation room is connected with the theatre. A lavatory, sulphuretted-hydrogen room, rooms for gas engine, dynamo and storage purposes occupy the rest of this floor.

The lecture theatre is on the second floor and giving accommodation to 212 students. Apparatus and diagram rooms, a private laboratory and museum complete this floor. Still higher are to be found rooms for microscopic and spectroscopic work. The building throughout is supplied with warm, fresh air, heated in underground channels by means of hot water piping. The heated air rises in vertical flues or passages in the walls. Before entering to the rooms it passes through a spray of water to cleanse and moisten it—its currents being accelerated by a fan driven by the gas engine. Ventilation is secured by gas burners, and by means of a furnace at the base of a shaft, down which all fumes and vitiated air pass.

The organic laboratory, at present being used for quantitative analysis, is 28 ft. by 24 ft. Its walls are lined with glazed brick. The rooms throughout are supplied with hot and cold water, steam, hot air baths, fume chambers and evaporating niches. The working benches are of pitch pine with waxed walnut tops, presenting a very handsome appearance and at the same time withstanding the corrosive action of strong acids and alkalies. The gas and water taps are arranged in front of the benches, just below the top. The pipes from the same lead to nozzles issuing from the bench top at the back of the table; a most desirable arrangement and one we have adopted in the new Farm laboratories.

The details of the laboratory fittings, &c., were worked out by Dr. Campbell Brown, the Professor of Chemistry, who by his valuable counsel has enabled the architect, Mr. Waterhouse, R. A., to design and construct this model of laboratories.

Owens College, Manchester.

The laboratories here were also designed by Mr. Waterhouse, in conjunction with Prof. Roscoe. The College, of which the laboratories form a part, is a magnificent pile in stone. Two large laboratories, each 50 ft. by 30 ft., and 29 ft. high, furnish accommodation for qualitative and quantitative work, and afford working places for about 100 students. On the same floor are balance rooms, rooms for gas and organic analysis, library and organic-chemistry lecture room. The lecture theatre, holding about 400 students, has adjoining it a lecturer's laboratory and is supplied with sinks, draught closets, &c. A laboratory for medical and evening classes is in the basement, where are also a metallurgical laboratory furnished with furnaces, lavatory, dark rooms for photographic and spectroscopic work, store rooms, &c. Evaporation niches are placed at intervals in the walls of the laboratories, and porcelain hoods to carry off fumes, and sulphuretted hydrogen closets are on each bench. All these are connected by glazed earthenware piping with the draught of the main chimney, which also carries away the vitiated air of the rooms. Fresh air is supplied by a down shaft, being drawn over hot water pipes and entering the rooms through gratings in the walls. Prof. Dixon, ably assisted by Dr. Cohen, has charge of the chemical department.

Manchester Grammar School—Chemical Laboratory.

Here, although the area is limited, accommodation is afforded for about 90 students in the laboratory—the arrangement being apparently perfect. The usual draught closets are found on the tables and between the windows. A special room is devoted to operations with sulphuretted hydrogen. The lecture room, apparatus room, preparation room and balance room are on the same floor—the second. A foul air shaft with central smoke flue withdraws all noxious gases from the rooms and draught places.

Yorkshire College, Leeds.

This college, together with University College, Liverpool, and Owens College, Manchester, is affiliated with Victoria University—now so widely known for the excellency of its science degree. Applied science in all its branches, as well as the fine arts and languages is here taught. I shall, however, as heretofore, confine myself to a brief description of the accommodation for teaching chemistry.

On the ground floor is the chemical lecture theatre, 65 feet long by 37 feet wide. It will seat nearly 400 students. Its lecture table is 21 feet long, amply supplied with all necessaries, and behind it is a draught closet, blackboard and a diagram frame, which latter is let down through a slit in the ceiling from a room above by suitable machinery. The table in the draught closet just mentioned can be run either into the lecture room or into a preparation room behind it. A special laboratory, combustion room, metallurgical laboratory, museum and photographic room complete the accommodation devoted on this floor to chemistry.

On the first floor is the main chemical laboratory—the finest in the Kingdom. It is 62 feet long and 59 feet wide, and is used for both qualitative and quantitative work, the only division being a row of five columns—an arrangement highly spoken of. The benches provide room for about 50 students, and are furnished with water and gas, vacuum pumps, &c. At one end of this laboratory is the sulphuretted hydrogen room, distillation and engine rooms. The draught closets are situated between ten windows—there being none on the tables. Evaporation niches and places for distillation are ranged along one wall. Distilled water is conveyed by glass tubing from the still reservoir to glass taps in the columns before mentioned, from which it can be drawn off by the students. The walls of the laboratory are lined with white, glazed brick. The steam cupboards are of heavy brass and are of very substantial make. Dr. Arthur Smithells, the professor of chemistry, was away when I called, but through the kindness of the secretary I was shown over the college.

The City and Guilds of London Central Technical Institution, South Kensington, London.

This building was erected for the advancement of technical education, and by the adoption of the latest improvements in fittings, ventilation and heating is to-day one of the most efficient of all technical colleges.

As many of the details of the laboratories here are much the same as those already mentioned I shall not repeat them. The chemical lecture room, with attached preparation room, is on the ground floor. On the second floor are two large laboratories for advanced work, and also one for special operations. An electro-chemical laboratory, crystallography room, another lecture room and a room for experiments involving unpleasant smells, furnished with a large flue, occupy the rest of this flat. The third floor consists of a large laboratory for junior students, dark room, balance room, photometric and polariscope room and a laboratory for gas analysis. The chemical fittings throughout were planned by Dr. Armstrong, the professor of chemistry, and are excellent.

The Chemical Laboratory, Cambridge University.

This building was not quite ready for occupation when I visited it, nevertheless it had so far progressed as to be very evident that when finished this university would possess a laboratory furnished with all the facilities and conveniences required at the present day in all the branches of chemical work. Before deciding upon the plans Professors Dewar and Liveing visited all the newly erected laboratories on the continent. The architect, therefore, with their assistance, has been able to erect a well arranged building thoroughly equipped throughout, for as has been said "a careful study of the plans of the chief continental and English laboratories recently erected has led to the adoption of every appliance which has proved successful." Its estimated cost is about £31,000. There is laboratory accommodation for 175 students working at once. The draught closets are here placed in the windows, and each is furnished with a separate flue. This plan is in vogue at Munich. The drains from the bench sinks and wastes are iron troughs, pitched on the inside, and run just below the floor, the boards of which in such places are movable. This is to allow easy access at all times to any part of the drains which may be temporarily choked The bench tops are of finished teak, a wood very highly spoken of for this purpose.

To enter into a detailed account of the various rooms for chemical work in this magnificent building, would occupy more space than is at my disposal, I can therefore but say that in addition to lecture rooms and students' laboratories, there are provided rooms for special operations; as for instance, there are two rooms for conducting experiments with easily inflammable materials, distillation of ether, &c., and another for working with chlorine and bromime. The usual store rooms, preparation and specimen rooms are throughout the building.

The laboratories of the Universities of Oxford and King's were also seen, but require no special comment here.

AGRICULTURAL LABORATORIES, &c., IN ENGLAND.

In England among those visited were the laboratories of Sir John Lawes and Dr. Gilbert, at Rothamsted, of the Royal Agricultural Society, Hanover Square, London, Royal Agricultural College, Cirencester, the Agricultural College, Downton, and those of the Aylesbury Dairy Company, London.

Experimental Farm and Laboratory of Sir John Lawes, Rothamsted, Herts.

For the past fifty years, unassisted by Government aid, Sir John B. Lawes, associated with Dr. Gilbert, has carried out experiments in agriculture upon his estate in Hertfordshire. Such has been the work of these gentlemen, that one may say that its value is incalculable. It is consulted, not only in England, but throughout the world, as of standard authority in questions of agricultural practice and science. Investigations extending nearly over half a century, and conducted with great skill and the utmost thoroughness and accuracy, have yielded results which may be said to have revolutionized the science of agriculture.

The present laboratory erected in 1855, where the chemical portion of the work is conducted by Dr. Gilbert with the aid of ten assistants, is found now to be too small. Consequently a new laboratory is about to be built, as well as another store-room, where can be placed the almost innumerable samples, which having accumulated during so many years, fill to overflowing the present quarters.

I was conducted over the farm and laboratory by Dr. Gilbert, to whom I wish to return my best thanks for his kindness in explaining to me the nature of the various experiments they were carrying out. It would be impossible to give any detailed account of these here, and it must suffice if I now merely outline some of the more striking ones.

In wheat, experiments have been made by growing it consecutively in the same soil for forty-five years. To some plots have been added farm-yard manure, to others artificial fertilizers, and in one instance the wheat has been grown without any manure. This latter plot yielded last year 14⅞ bushels of wheat, an amount equal to the average of the first 18 years, obtained from the same plot, showing the immense amount of fertilizing material in the soil which is gradually and from year to year rendered fit for plant food by the various atmospheric agencies. The value, however, of fertilizers is demonstrated by the fact that from some plots on which they had been used, an average of 35 bushels was obtained. The experience here has been that other things being equal, nitrogenous fertilizers, and especially nitrates (as nitrate of soda), are of the greatest value to the wheat crop.

A very important and interesting experiment with wheat is one in which five years ago the plot was uncropped—the grain being left to fall when ripe upon the ground and sow itself. Two years ago a few stunted ears were to be seen, but now not a single one. The rapidity with which the weeds have grown and choked the wheat entirely out of existence is amazing. From this result Sir J. Lawes infers that our wheat of the present day is of artificial development, and if the land were left uncultivated, fields would soon become so overrun with hardy weeds that the artificial crops would become killed out.

Another interesting and important experiment is that with grasses. The field in which this is conducted is of seven acres, and is divided into 20 plots. When observations were first made, in 1856, the herbage was uniform. Since then by the application of different fertilizers, comprising farm-yard manure, super-phosphate of lime, ammonium and potassium salts, the growth of the true grasses and leguminosæ has been greatly modified. While on one plot there is now to be seen only a single kind of grass, on another we find several with one or two sorts predominant, and so on.

Much of the work undertaken at Rothamsted may be indicated as follows, but many investigations of a special nature cannot here be touched upon.

Field experiments, including comparative experiments with different fertilizers; rotation experiments, both with and without manure; experiments on growing the same crop year after year on the same land, with and without various fertilizers. The plants experimented with include those of all farm crops. Analyses, either partial or complete, are made of all the products of such investigations.

Experiments with soils. Over 1,650 samples of soil have been submitted to mechanical analysis. These specimens were taken at depths of 9, 18 and 27 inches, and, for special purposes, from two to four times this latter depth. Many have been subjected to full chemical analysis. Also the absorptive capacities for water and ammonia of many samples have been ascertained.

Rainfall and drainage experiments. To estimate the rainfall a gauge of one-thousandth of an acre and two other smaller ones are used. The nitrogen, present as ammonia and nitric acid, the chlorine and sulphuric acid have been determined in a number of the samples. Three drain gauges of one-thousandth of an acre are in use. The quantity of water percolating through 60, 40 and 20 inches of soil is ascertained. The water so collected is frequently analyzed. Besides these large gauges there are several series of smaller ones, arranged when special investigations are being carried on with fertilizers, &c.

Experiments with animals. Since 1847 several hundred animals have been experimented upon—chiefly oxen, sheep and pigs. Elucidation on the following points, amongst others, has been sought:

1. The amount of food, and of its several constituents, consumed in relation to a given live weight of animal within a given time.

2. The amount of food, and of its several constituents, consumed to produce a given amount of increase in live weight.

3. The proportion and relative development of the different organs or parts of different animals.

4. The proximate and ultimate composition of the animals in different conditions as to age and fatness, and the probable composition of their increase in live weight during the fattening process.

5. The composition of the solid and liquid excreta in relation to that of the food consumed.

6. The loss or expenditure of constituents by respiration and cutaneous exhalation.

Other investigations include the determination of the losses and changes which take place in the making of ensilage; the value of various substances as food-stuffs for fattening, production of milk, etc., etc.

Experimental Farm of the Royal Agricultural Society, Woburn.

At the Experimental Farm of the Royal Agricultural Society at Woburn, a similar work was begun in 1877. The primary object was to test by actual farm practice the accuracy of the estimated values of manures obtained by the consumption of different kinds of foods. Experiments on the continuous growth of wheat and barley, similar to those at Rothamsted, are also being made. A field of 16 acres is devoted to rotation experiments. There is also ground set apart for experiments in the growth of grasses and clovers, and a field for experiments with permanent pastures. Altogether there is about 50 acres under experiment.

Without inserting a large number of tables it is difficult to give an account of the results of these experiments. It is gratifying to learn, however, that similar results in the main have been obtained at Woburn as at Rothamsted. Thus, plots unmanured for eight years, produced last year 23 bushels of wheat to the acre, showing that the amount of reserve fertility is hard to exhaust. Where only ammonium salts or nitrate of soda is used alone an increase in the produce has been obtained. It would appear that on the season depend the relative values of these two forms of nitrogen; nitrate of soda being used with greater advantage than ammonium salts in dry weather, the reverse being true in a wet season. Mineral manures alone give no appreciable increase over the unmanured plots. A combination of mineral fertilizers and ammonium salts or nitrate give the best results. On certain plots the nitrogenous fertilizer was omitted for a single year, the result being that the yield scarcely exceeded that of the unmanured plots. The renewed application the following year gave in return again the same increased yield. The analyses of the farm are made by Dr. Voelcker and his assistant, Dr. Leather, in the Society's laboratory in London, where also samples of linseed cake, fertilizers and of all kinds of agricultural products are examined for the members of the Society.

Rotation experiments with the ordinary four course of roots, barley, seeds, (clover, &c.) wheat, were inaugurated in 1877, and a comparison made of the produce when manuring with various fertilizers, including decorticated cotton cake and maize meal. They also include the comparison between manuring with the dung obtained by feeding certain quantities of these latter materials, and artificial manure calculated to contain the same amount of fertilizing constituents.

The results show that the maize meal did not produce more than the cotton-seed cake, relatively much richer in nitrogen—owing, no doubt, to the unexhausted supply of the element in the land operated upon. There appears to be a slight advantage in favor of manuring with the materials direct rather than with the dung obtained by feeding these materials—the amounts of both being calculated to contain the same proportion of nitrogen, potash and phosphoric acid.

At neither of the foregoing institutions are pupils taken. Sir John Lawes says that "experimenting and tuition cannot run together successfully. Our work is in one direction; others must take up that of tuition." This conclusion has been arrived at by all engaged in strictly experimental work and the principle has rightly been adopted upon our Dominion experimental farms.

The Royal Agricultural College, Cirencester.

This college was established at Cirencester, in 1845, under Royal patronage. It is well equipped for teaching the principles and practice of agriculture, having attached to it a mixed farm of 500 acres—400 acres of which are arable. The college buildings proper include a museum, lecture theatre, class rooms, chemical and biological laboratories, private rooms, dormitories studies, chapel, dining hall, library, &c. The farm buildings, erected at a cost of £4,000, are furnished with modern appliances, are very compact and include stables, piggeries, cattle boxes, &c.

The dairy, built in 1885, is a separate building of substantial structure. It comprises rooms for (*a*) the cooling and setting of milk and raising of cream, (*b*) the mechanical separation of cream by centrifugal force, and the churning and making of butter, and (*c*) for the manufacture of cheese of various kinds. It is furnished throughout with the modern appliances and utensils supplied by the Aylesbury Dairy Company. The dairy is worked on strictly scientific principles, the milk of each cow being weighed every morning and evening. Milk analyses are made and a record taken of the feeding and milk produced. The cow house is a separate building, well equipped with double stalls, to which the water is laid on. The breeds are—Shorthorns, Jerseys, Guernseys, Ayrshires, Red Polls and Kerries, and are excellent specimens of dairy cattle. A herd of about 500 Cotswold sheep are maintained—the produce from which is regularly sold. The farm is managed by a rent-paying tenant, but the college reserves to itself its use for instruction of the students in practical agriculture. It is said that "the practical business character of the farm is more thoroughly ensured by undivided attention and large outlay of private capital." Classes are held every day upon the farm by the Professor of Agriculture and the Farm Bailiff.

A certain amount of experimental and research work with the cultivation of cereals, grasses, &c., and the comparative values of artificial fertilizers, in which the senior pupils assist, form a part of the work of the college, though necessarily where so much of the time of the professors is taken up in tuition, it cannot be prosecuted on any extensive plan. A botanic garden in which are representatives of the natural orders of plants, trees and shrubs, affords the students an instruction of great practical value.

The college course for the diploma extends over two years and one session, though there is a special course of one year for "out-students." An attendance of about 80 students is usual.

A very large staff of professors and lecturers is engaged in teaching agriculture and its allied sciences.

The College of Agriculture, Downton.

This college affords instruction in all the branches of agriculture, and possesses a large mixed farm for practical tuition in general farming and dairying. The farm, consisting of some 600 acres, is worked by the college,. About 120 acres are in pasturage, supporting a dairy of 40 cows. A heavy stock of Hampshire Down sheep is kept—the flock numbering in July about 1,200. Two hundred acres are devoted to wheat growing. The dairy is fitted with the newest appliances and is managed on business principles. Other features of the farm are the breeding of pigs and poultry.

The laboratories comprise one for chemical work and one for natural history, and are well suited for their purpose. The museum contains a collection of all substances related to agriculture. There is here also a botanic garden and aboretum. The academic course is for two years, but students are advised to stay another year in order to perfect themselves in agricultural practice. A fair amount of experimental work is done here, but necessarily it cannot be undertaken on any large scale owing to its interference with the tuition and affairs of the students. The professors and lecturers number eight, and among them are some of the highest authorities on agricultural subjects in England.

To Professor Wrightson, the president and professor of agriculture, I owe many thanks for providing me with all information regarding the college.

LABORATORIES AND EXPERIMENTAL STATIONS IN GERMANY.

Not a little of the time I spent on the continent was devoted to the inspection of chemical apparatus manufactured by the larger houses in Berlin, Bonn, &c., &c. As the result of this I have been enabled to make such a selection of apparatus—it being ordered from six different firms— as would best fulfil our present requirements and at the same time come well within the appropriation for the purchase of the same.

Berlin.

The famous laboratory of the university here, presided over by Dr. Hofmann, of world-wide celebrity, was first visited. It was erected in 1866 on Georgen Strasse, at a cost of £32,000. The laboratories are very large, two being 48 ft. by 31 ft., a third, for special work, 47 ft. by 24 ft., with combustion room attached. The arrangements here are somewhat out of date and inconvenient, many improvements in laboratory fittings having been made since the date of its erection. Thus there are no passages proper, the rooms being used for such. This causes great inconvenience and annoyance to workers—especially to those engaged in the "balance room." Like the great majority of German buildings it is built on all sides of a central "hof" or quadrangle, a plan which has been adopted recently in some large buildings in England as one that affords more light to the rooms than any other. The usual rooms for storage and for special operations are all found here, but as much better arrangements have already been described, I may now pass on.

The second chemical laboratory of the university, situated on Dorotheen Strasse, where Drs. Rammelsberg and Friedheim are professors, was also seen, as were also those of the Berg Akademie, Invaliden Strasse, and of the Landwirthschaftliche Hochschule, where Drs. Fernandez and Knorre respectively are professors. These laboratories are all well adapted to their purposes, and in point of furniture, appliances, apparatus, &c., leave little to be desired.

Special mention must be made of the laboratories of the Polytechnikum or Royal Technical High School, Charlottenburg, near Berlin.

Some idea of the magnificence of this building may be obtained on learning that its frontage is 670 feet, and the eastern and western wings 270 feet deep. The edifice is of stone, and four storeys high. It contains five hofs or internal open courts. The finishing of the interior is very handsome. Its erection and equipment cost over £400,000.

The chemical laboratory, together with the photo-chemical laboratory, constitutes another building, about 200 feet square, including two "hofs." The celebrated Professors Liebermann and Vogel have had their respective laboratories supplied with every appliance of modern invention for facility and convenience in prosecuting their researches and teaching their students. Everything here is of the best material, and bears the stamp of a high degree of finish. The beauty combined with the substantial nature, which both interior and exterior present, makes a visit to the polytechnikum a most pleasing and instructive one.

Halle.

The laboratory of the Chemisches Institut of which Professor Volhardt is president is old, and consequently does not present those features so characteristic of modern institutions. The Experimental Station here, however, is doing a most thorough and reliable work in original research in agriculture.

Leipsic.

The University of Leipsic, so justly celebrated, stands out as the most prominent institution of the city. Professor Stohmann, the professor of agricultural chemistry, most courteously showed me over his laboratories. He is engaged in a series of experiments on the heat of combustion of chemical substances, the result of which throw great light upon the value of feeding stuffs.

Möckern.

The Experimental Station at Möckern is devoted to experiments with animals, with the view of elucidating the relative worth of different cattle foods. Professor Kühn, assisted by six chemists, is engaged chiefly in what is known as "Respiration Experiments," for which a most elaborate and costly apparatus is provided. The foods are accurately analysed, as is also all the products after digestion. These researches require great care and skill, and time, but the results obtained are of universal importance to agriculturists. Kjeldahl's method for the estimation of nitrogen is solely used here. This process has become of general acceptance throughout Germany for the determination, both quick and accurate, of this element.

Göttingen.

The Experimental Station, under Professors Henneberg and Tollens, is part of the University system, though its buildings and grounds are distinct and separate. The laboratories, which are well suited to the work of a station, as well as those of the University proper, were inspected. Special forms of apparatus for extraction of fat by Soxhlet's method, the determination of nitrogen by Kjeldahl's process, and for estimation of fibre in plants, foods and agricultural products, were here seen, and so commended themselves to me that it is the intention to introduce them at our new laboratories. The relative value of potash, phosphoric acid and nitrogen as food for potatoes, wheat, rye, barley, Indian corn and grasses, is ascertained in the experimental plots. Other experiments conducted here are trials with subsoil, *i.e.*, growing plants in a soil devoid of humus. It is the practice here to leave on the outside of the plot a strip about two feet wide, the growth of which is not included in the experiment, thus avoiding any errors that might occur through the action of light, air, &c.

Among a host of different experiments on various lines, I noticed some in which a bearded wheat was being developed by selection and breeding. Such a wheat is required in Germany, where small birds in large quantities do great damage to the grain crop. It has been found that a heavily bearded wheat is proof to a large extent against the attacks of these marauders. The Wunderschön wheat, of which there are both summer and winter varieties, is a bearded wheat of great prolificness, and has been brought to its present marvellous state of perfection at this station.

A very convenient plan has been adopted here of laying tramways (upon which trucks are run) in the walks between the experimental plots. These tramways lead into the buildings where the produce of the plot is stored.

Stuttgart and Hohenheim.

The Polytechnikum at Stuttgart contains large chemical laboratories fitted up for teaching both qualitative and quantitative analysis. The usual lecture rooms and other rooms for special purposes are also found here.

Not many miles from Stuttgart is Hohenheim, where is a large Agricultural College and an Experimental Station. These are distinct and separate buildings. The college was a schloss or castle occupied by Duke Charles in 1768, and since devoted to its present purpose. A large number of students is in attendance. A well-tilled farm surrounds the college, upon which the students receive instruction in practical agriculture.

The experimental station, at some little distance from the college buildings, consists chiefly of chemical laboratories, under the control of Professors Wolff, Behrend and Riess. There is here a very large acreage under experiment—the plots being numerous and large. I noticed that trials with wheat, oats, barley, grasses and all kinds of root crops were being made. A label on each plot indicated the fertilizer and the amount of such, used. At a glance could be seen the effect of the omission in one case of potash—in another, of phosphoric acid, and so on. In another series was evident the result of soil exhaustion by continuously growing the same crop year after year. A day was spent here in taking notes on these instructive experiments.

Darmstadt.

There is a very well arranged and handsome laboratory at the experimental station here—now three years old. It may be looked upon as a model for chemical research in agriculture. It is well appointed, with plenty of light, and the apparatus and fittings are of the most approved kind. The special character of the work is ascertaining the value of different fertilizers as plant food, which is conducted by Professor Paul Wagner, assisted by a staff of expert chemists. The experiments are carried out for the most part in zinc pots of different sizes and of special construction.

The ground behind the station—some half acre—is laid out in plots, between which run tramways similar to those at Göttingen. Part of the lot is covered by a glass house, into which the tramways run. The experiment pots can thus be easily and quickly placed under shelter when such is required. As to the great value of a scientific investigation, in which the experimentalist has full control over all the circumstances, Prof. Wagner speaks as follows:—"We must obtain information about the whole process of the nutrition of plants and clearness as to the influence of every single factor on the action of manure, and clearness can only be gained through experiments which have been carried out on scientific principles, with full control over all influencing circumstances and with the employment of scientific expedients. Practical field experiments cannot do this, they can only, in conjunction with exact and critical investigation, help to enrich the science of exact knowledge." Again: "The farmer cannot examine into the correctness, or the reverse, of the experimental results, the investigator must do this himself; but the farmers ought to try, by extended observation, by judgment based on intimate knowledge, and, if necessary, by well devised, carefully executed and logically interpreted field experiments, in what way scientific investigation, on the conclusions or advice derived from this, are to be turned to good account under the special conditions of soil or of cultivation on his farm."

As a result of such detailed and scientifically conducted experiments I may refer to the recognition of the fact, which is now thoroughly established beyond doubt, that the leguminosæ can and do take their chief supply of nitrogen from the air. For many years this was disputed, and it was only by such means as I have alluded to that Professors Hellriegel, Wolff and Wagner have been able to prove incontestably that such is the case. This fact is of paramount importance to agriculture. It divides farm crops into "nitrogen increasers" (clover, peas, vetches, lupines, &c.,) and "nitrogen consumers" (cereals, grasses, roots, &c.,) the latter depending on the soil for their nitrogen, while the former increase the nitrogen already contained in the soil. We now see plainly how it is that a crop of clover benefits the succeeding crop of wheat—a plant that absorbs all its nitrogen from the soil in the form of nitrogenous salts. E. Bréal (Compt. rend. 107) has shown that the absorption of nitrogen by some leguminosæ is very great—the total nitrogen in the case of lucerne amounting to twenty-five times as great as that in the seed.

Bonn.

The experiment station at Bonn is entirely devoted to chemical research and analyses. Its director, Dr. A. Stutzer, conducted me over the laboratories, in which were all the necessary fittings and apparatus for carrying on the work of scientific investigations in agriculture. Some new forms of apparatus for the analysis of food-stuffs were seen here, which appeared to answer their purpose admirably.

The laboratories of the University here are commodious, and were erected on the same plan as those at Berlin, with slight modifications. As I have already indicated the nature of the Berlin laboratories, it will be unnecessary for me to describe those at Bonn.

Aachen (Aix-la-Chapelle).

Before bringing to a close this brief account of chemical laboratories in Germany, some mention must be made of the very fine laboratories in this city.

The plan upon which this handsome edifice is constructed is particularly good. The subsidiary laboratories and rooms are grouped about the central lecture theatre, the quantitative laboratory connecting directly with the balance room, with laboratories for gas analysis, organic analysis, &c., being to the right, and the qualitative laboratories to the left. The rooms are lighted from the roof as well from the sides, and additional light obtained from two open courts.

The structure presents a handsome appearance, being faced with stone, and was of costly erection.

The lecture rooms and laboratories under the direction of Prof. Landolt have been fitted up in the most complete manner; the tables being supplied with water, gas, exhaust, blast, steam and electricity. The ventilation and heating arrangements are especially good. The warm air is forced in by a fan and the foul air exhausted by a similar contrivance. The temperature of each room is made known to the engineer, who controls the appliances.

Ensilage Experiments.

Some time was spent in examining into the various methods now in use for the making of ensilage, the value of which as a fodder is now recognized. During the wet seasons, when it is impossible to obtain a properly sun-cured crop, it is now quite feasible to preserve it in such a condition as to be excellent food for cattle. The experiments carried out at the experimental farm of the Royal Agricultural Society, show that for feeding purposes, ensilage, properly made, equals in value the ordinary cured crop. During the next season we purpose inaugurating experiments in ensilage making and feeding at the Central Experimental Farm, the result of which will, no doubt, be of great value to Canadian farmers.

All of which is respectfully submitted,

FRANK T. SHUTT,

Chemist, Dominion Experimental Farms.

REPORT OF THE ENTOMOLOGIST AND BOTANIST.

(JAMES FLETCHER, F.R.S.C., F.L.S.)

To the Director of the
Dominion Experimental Farms,
Ottawa.

SIR,—I have the honour to submit herewith a report upon the more important insects and plants which have come officially under my notice during the year 1888. Those species of insects which have been unduly abundant and injurious since I last reported to you are characteristically Farm Insects. The injuries to fruit trees have all been by well known species. Tent Caterpillars have been reported as more than usually abundant in Nova Scotia, the Eastern Townships of Quebec, and in British Columbia. No new remedies have been discovered for a more successful mode of keeping these pests in check than those now in use.

The Pear-blight Beetle (X. *dispar*, Fab.) locally known as the "Pin-borer," and the "Shot-borer," is apparently extending its ravages beyond the Annapolis Valley in Nova Scotia, as I have received specimens and a report of damage done in the orchard of Mr. C. C. Gregory, Antigonish, N.S. Spraying apple trees with Paris green for the Codling Moth, is in all instances reported of favourably, where it has been tried. The Plum Curculio and the Black Knot are reported to be increasing owing to the neglect of growers to use the well known remedies.

Of insects injurious to forest and shade trees there have been no new attacks worthy of special mention. In accordance with your instructions I am making a particular study of the insects injurious to pine timber. There are some points not as yet cleared up, and the results of some experiments undertaken during the last summer cannot yet be seen. In view of the above I deem it advisable to postpone for a short time, the presentation of a report upon Timber-borers.

In June last I had an opportunity, through the kindness of Mr. Mossom Boyd, of Bobcaygeon, to visit some timber limits which had been burnt by forest fires, or cut over, in other months of the year than any I had before been able to examine. In this way I was able to clear up some interesting points of which there was previously some doubt.

In the Botanical Department preparations have been made for laying out the roads and beginning the work in the Arboretum and Botanic Garden as soon as spring opens. Large numbers of plants from northern climates have been grown from seed, and are now ready to be located in their proper places in the garden.

Large and valuable collections of seeds and plants have been received from the following:—

Mr. C. Gibb, Abbotsford, P.Q., chiefly Russian species.

Dr. G. M. Dawson, Ottawa, a collection of seeds of rare alpine plants from the Rocky Mountains, and also some living plants of *Pinus ponderosa* and *Pseudotsuga Douglassii.*

Miss Alice Williams, Victoria, B.C., a collection of seeds of wild flowers of Vancouver Island.

Major Walker, Calgary, a collection of seeds of native grasses.

Rev. W. A. Burman, Griswold, Man., a collection of native grasses, and various other plants as well as insects.

From the Arnold Arboretum, Boston, a collection of seeds of 123 species of plants suitable for a northern climate.

From Mr. R. W. Starr, Port Williams Station, N.S., seed of the Beach Pea, (*Lathyrus maritimus*) which he suggests may be useful for growing on sandy shores to keep the sand from blowing about.

From Prof. J. Macoun, roots of rare native plants for cultivation.

From Mr. N. H. Cowdry, collection of native plants and insects from the North-West Territories.

From the Imperial College of Agriculture, Tokio, Japan, seed of several species of forest trees.

From the Royal Botanic Gardens, Kew, England, a large collection of seeds of trees, shrubs and plants, natives of Europe and Asia.

More than 50,000 young forest trees were planted out in the spring, the greater part of which did well. One consignment which was delayed was badly injured thereby. On the western and northern boundaries of the farm there were planted by your instructions mixed clumps of forest trees, and most of the avenues and hedges were set out.

Upon the experimental grass patches, many of the best English pasture grasses as well as several of our native north-western grasses, were planted out for study. These were for the most part grown in the conservatory during the winter, and then pricked out in the spring, and thus a considerable saving of time was made. Careful notes have been taken of all these species; but it is too soon to make any report upon them until they have passed a winter in this climate.

In preparing the present report I have endeavoured as much as possible to make it useful to the agriculturist. All unnecessary technicalities have been eliminated and only such information has been included as I deemed would be useful. The terms by which the different stages of insects are known, are familiar to most people, but it may not be amiss to repeat that insects pass through four stages, the egg, the larva, the pupa or chrysalis, and the imago or perfect insect. The larva of a two-winged fly is called a maggot, of a four-winged fly or a beetle, a grub, of a moth or butterfly, a caterpillar. The larvae of the other groups have no distinctive names.

I have the honour to be, Sir, your obedient servant,

JAMES FLETCHER,

Entomologist and Botanist to Dom. Exp. Farms.

OTTAWA, 1889

CEREALS.

WHEAT.

The Wheat Midge, "The Weevil," "The Fly," "The Red Maggot" (*Diplosis tritici*, Kirby.)

Attack.—When the wheat is in the milk, small orange-red maggots may be found at the base of the scales of chaff lying against the forming grain, from which they suck the moisture and prevent it from filling out properly.

Although in some districts the Wheat Midge is reported as having been less troublesome than usual, the amount of annual loss attributable to its ravages is still very large. In Nova Scotia this is particularly the case, and enquiries concerning its habits are frequently received. In response to an application from the Farmers' Institute of Colchester, N.S., a short account was prepared of the habits of this pest—as far as known—and the best steps to adopt to reduce its ravages. This account was read at their annual meeting, and was afterwards published in the *Colchester Sun*, a newspaper which makes a specialty of agricultural topics.

The Wheat Midge is most widely known in Canada under the inaccurate designation of "Weevil" a term which must be discouraged because it belongs to another class of insects altogether. The Weevils are hard-shelled beetles, while the Wheat Midge in its larval state is a legless maggot, and in its perfect state a delicate gnat-like creature with gauzy wings.

I am assured that in some parts of Nova Scotia the cultivation of wheat has been abandoned, owing to the attacks of this minute foe. The life history of the

Wheat Midge as at present understood is as follows: During the month of June, just when the wheat is in blossom, tiny yellow Midges with black eyes and yellow bodies may be seen flying over the fields, particularly on dull days or towards evening. Large numbers also of the same Midges may be seen in houses as soon as the lamps are lighted. These are the Wheat Midge, and the parents of the Red Maggot of the Wheat.

The body of the female is prolonged into a long slender tube, which can be extended or drawn in at pleasure. With this tube, which is called the ovipositor, she pushes her minute eggs down between the chaff of the green wheat-ear. In about a week these eggs hatch into small transparent yellowish maggots, which at once attack the forming grain. Gnawing through the outer skin of the kernel of wheat they extract its juices and prevent it from filling out properly. As these larvæ grow older they gradually become darker in colour, until they acquire the tint which has given them the name by which they are best known in England "the Red Maggot of the Wheat." Grain injured by the Midge has a characteristic shrivelled appearance, known amongst millers as "fly struck." There are sometimes four or five maggots to each grain in an ear. As soon as the maggots are full grown they either work their way up between the scales of chaff and fall to the ground, or remain in the ears until after the crop is carried. Those which fall to the ground, and these are by far the most numerous, penetrate about an inch beneath the surface where they spin a small cocoon of exceeding thinness, which fits so closely to their bodies that it is sometimes thought to be only the skin hardened, in the same manner as takes place in many other flies when they pass through their pupal or quiet state. It was generally supposed until lately that the perfect flies from these pupæ did not appear until June in the following spring. This, however, is not always the case, for during last summer, on a warm damp evening in August, and again in the beginning of September large numbers flew into my study and were killed at the lamp. Prof. Webster, of Purdue University, Indiana, and a special agent of the United States Department of Agriculture, tells me that he, on one occasion, bred considerable numbers of perfect Midges in July, from heads of wheat which had been badly attacked by the Red Maggot during the previous month, and that off and on during the rest of the summer until November, he caught the perfect insects at large. In the Report of the Entomologist of the United States Department of Agriculture for 1884 the same observer records as follows:—"From the 4th to 15th September I not only found larvæ in considerable abundance under the sheaths of volunteer wheat, but adults, too, in the same situation, and also on the outside of the plants and hovering about the upper leaves. From a quantity of this wheat placed in a breeding cage, on September 7 appeared three or four adults." Not only then did these maggots of June produce perfect flies that same summer, but there was a second brood which had time to lay eggs in the young fall wheat. That these insects have a double life-history—living both in the ears and later in the season in the shoots of the young wheat plant,—is an important discovery made by Professor Webster and gives us another means of checking their ravages.

He writes, "Cecidomyid larvæ were found in volunteer wheat and I could only breed *D. tritici* from them. Larvæ found in other young wheat were also Cecidomyid and not distinguishable from those of *D. tritici*, but I did not rear the adults from them. They were under the sheath of the young plant, but I think near or just above the surface of the ground." It is a most important point to find out exactly what is the life history of this pest, because that is the only means by which we can hope to obtain a complete remedy. The condition and locality where it passes the winter are of course valuable items of information; we have seen that some of the maggots of the first brood leave the grain before it is cut, and it is probable that most of them pass the winter in the state of larvæ beneath the surface of the soil and that the emergence of the perfect flies in large numbers the same year is an exceptional thing due to unusual climatic conditions. Besides those which winter in the ground, others remain in the ears of wheat and are harvested with it. By far the larger proportion leave the grain before it is cut, and it is probable that all would follow this course if the crop were left standing long enough. I am led to this conclusion by finding that of those which are left in the harvested wheat, although many produce the perfect flies, a considerable number are dried up and do not come to maturity. This points to the advantage of cutting the crop as soon as it can be done without injury to the grain, so as to remove as many as possible of the insects from the fields. When the wheat is threshed the red encased larvæ are separated from the grain and fall down beneath the machine amongst the rubbish and dust, frequently in such numbers as to give a perceptible colour to the refuse. This should of course all be carefully swept up and burnt. If swept aside and left lying in a heap till spring, it will merely form a hotbed of mischief from which injury will be sown in every direction. Not only will these small insects endure a long period without moisture, but they can withstand the opposite condition of excessive moisture with impunity. Indeed, Dr. Fitch in one place speaks of them as amphibious. A moist warm season in June is always more productive of Midge injuries than a dry one, and their ravages are most severe in low lying fields.

Remedies.—1. Deep ploughing directly the crop is carried so as to bury the larvæ so deep that the flies cannot work their way out through the soil.

2. The burning in bad years of all the chaff, dust and rubbish known as "screenings," or "cavings" from beneath the threshing machine. If it is objected that this is too wasteful, it should be remembered that by the small loss thus sustained a much greater saving is made in the quantity of the crop the following year.

If not burnt it should at all events be used as litter for stables or as an absorbent of liquid manure, when it will be carried to the manure pile, or it may be put under cattle in yards.

3. Clean farming, including the brushing of all grasses along the edges of fields.

4. The cultivation of such varieties of wheat as are found to be least attacked.

The Army Worm (*Leucania unipuncta*, Haw).

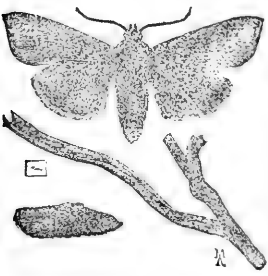

Fig. 1.

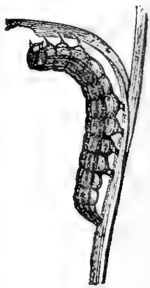

Fig. 2.

Attack. A brown striped caterpillar, eating the leaves and stripping the stems of grasses and many other low plants. When attacking cereals frequently cutting off the heads. When full grown over one inch and a-half in length, and when occurring in large numbers migrating in bodies from one food patch to another. When full grown the caterpillars burrow into the ground and turn to light brown chrysalids, from which in about two or three weeks the moths emerge. These are of a soft satiny-brown colour sprinkled with minute black specks and with a small but distinct white spot in the middle of each upper wing. They are very active. When the wings are closed the moth measures about an inch in length,

Of the many accounts which have been reported of injuries to grain crops by the "Army Worm," two only have proved to be the work of that species, one at Ottawa, the other at Lake Temiscaming. The term seems to be applied indiscriminately by farmers to any caterpillars which occur in large numbers. The Forest Tent Caterpillar, the Larch Saw Fly, the Clover Cutworm and various other Cutworms, all having been referred to during the past year, as "the Army Worm." The life history of the true Army Worm in Canada is probably as follows: The eggs are laid in the autumn and hatch in ten or twelve days, after feeding for a short time the small Caterpillars become torpid and pass the winter beneath tufts of grass and other low herbage. In the following spring they complete their growth, and I think produce the moths in June. Caterpillars collected on 15th July upon wheat growing on the Experimental Farm were then about half grown and increased in size very rapidly, pupating by the end of the month and producing moths in August. The eggs laid by the moths of this brood, I imagine, produced larvæ which were found hibernating in October. Although several caterpillars were collected from wheat at Ottawa, there was no serious attack, the caterpillars not being sufficiently numerous to "march," and the injury could hardly be perceived. Moreover a large proportion of those collected for observation were found to be parasitised by Tachina flies. In the fields too they were destroyed in large numbers by a small hymenopterous parasite, which Prof. Riley has decided is a new species (*Apanteles leucaniæ*, Riley M.S.S.) Small bundles of whitish silken cocoons could be seen in every direction, attached to the stalks of wheat, together with the emptied bodies of the dead larvæ from which the grubs had emerged before spinning their cocoons. There were sometimes as many as 17 of the parasites from one caterpillar.

The other occurrence of the army worm referred to, was of a much more serious nature. Mr. A. Laperrière, J.P., writing from Entremonts, Lake Temiscaming, on 6th August says: "You will find in a small box which I am sending you to-day, some caterpillars, which are by the millions in the grain of my neighbour, Mr. Alfred Miron. These caterpillars began by devouring the leaves of the grain, then they climbed up the stalk to the head and cut it off at the base. They also attack Indian corn and Timothy. More than half the crop is destroyed already, and before the rest is ripe it will also probably be lost. Made experiments with Dalmatian Insect Powder, and it killed the caterpillars at once; but of course this is much too costly for general application." The caterpillars sent by Mr. Laperrière arrived in good order and produced moths in September.

Upon the receipt of these larvæ, a short account of the habits and the usual remedies was despatched to Mr. Laperrière, but before they were received the insects had finished their work and disappeared. None of the caterpillars sent from Lake Temiscaming were parasitised; but from the large numbers present and the frequent experience of the past, I considered myself justified in encouraging the farmers in this new settlement with the hope that they would not receive another visitation next year. Professor Lintner in his first report, at page 147, writes as follows when speaking of another grass-feeding species which had suddenly appeared in vast numbers: "We may venture to record our belief that they will not continue hereafter. Indeed, many years may pass before we shall see it again in injurious numbers. Had it been as first supposed, a visit from the army-worm, we could have predicted that it would not recur the following year, for the immense hosts of that species are always attended by their parasitic foes, which so effectually destroy them that it seems impossible that two 'army-worm years' can follow in the same locality."

Remedies.—When the caterpillars appear only in moderate numbers, they have an abundant food supply and do not then acquire the habit of "marching" which is merely moving from one place where all the food has been devoured, to a fresh pasture, When, however, their appearance is excessive they must of necessity move on to some other place or starve. They may be prevented from marching from one field to the other by ploughing a deep furrow across their path. This should have the edge nearest to the field to be protected, perpendicular or slightly overhanging. Along the trench so formed, pits must be dug about twelve feet apart. When the caterpillars come to the trench they are unable to climb up the opposite side and after a few trials, walk along till they fall into the pits, when they may be destroyed by covering them with earth and tramping it down. If these pits are not dug, when the caterpillars occur in large numbers, the trench will soon be filled and they will walk over on the bodies of their fellows. In case any of the worms succeed in crossing the ditch, a narrow strip of the plants on the opposite side of the trench should be dusted or sprinkled with a strong mixture of Paris Green diluted either with 25 times its weight of flour, ashes, or land plaster, or mixed with water as strong as 1 ounce to a pailful of water. The plants so poisoned must of course be sacrificed as soon as the caterpillars disappear, and should be mown down and burnt.

A preventive remedy much relied upon, is the burning of all stubble and old grass in autumn and spring, in localities where the moths have been observed. The young caterpillars pass the winter beneath such refuse and many will thus be destroyed together with many other injurious insects. The moths of the early brood also lay their eggs by preference upon the old dead stems, and if these are removed they will seek some other place to lay. Systematic draining of low lands is very beneficial, the natural habitat of the species being thus rendered unsuitable for the young larvæ.

The Wheat-stem Maggot "Wheat Bulb-worm" (*Meromyza Americana.* Fitch.)

Attack —Some time before the wheat should be ripe, the ear and top portion of the stem turn white. Upon examination the stem will be found to be severed just above the top joint by a slender transparent green maggot $\frac{1}{4}$ of an inch in length. When full-fed it works up to the upper portion of the sheath and turns to a flattened pupa from which the fly emerges in July.

In autumn the same green maggots may be found low down in the base of the stems of fall wheat just above the root.

The perfect insect appears in the latter part of May and June, and is a pretty little greenish-yellow fly, one-fifth of an inch in length, with shining green eyes and three dark stripes extending right down the back. The hind thighs are thickened, and when the fly is at rest the fore part of the body is much raised.

In addition to the above two regular broods, Professor Webster has detected a supplementary brood in volunteer wheat.

The attacks of the summer brood of the Wheat-stem Maggot were not so manifest in the wheat fields last season as in the three previous years; but upon the experimental wheat plots here, where some fall wheat had been sown in the spring but had not headed out, great injury was done. Strong plants with from 50 to 75 stems being entirely destroyed. This destruction was mainly due to the attacks of *Meromyza*, but the plants were also found to contain many of the larvæ and puparia of the Hessian Fly. These larvæ are easily distinguishable. The larvæ of the latter being shorter and whiter with a dark green central stripe and not having the black horny mouth parts of the Wheat-stem Maggot, which also attacks the centre of the stem tearing the tissues and causing them to decay, whilst the Hessian Fly larvæ lie outside the stem beneath the sheath of the leaf. As noticed by Professor Webster plants attacked by the Hessian Fly do not turn yellow in the autumn, but assume a much deeper shade of green, whilst the leaves of shoots attacked by *Meromyza* turn yellow and die before winter.

My attention has been drawn by Prof. Webster to a very full and correct account of this insect by Prof. Forbes in the thirteenth report of the State Entomologist of Illinois, a copy of which I have only lately been able to procure.

Remedies. Natural—I observed with much pleasure in July last that a large number of the pupæ were the hosts of a parasite belonging to the Hymenopterous genus *Cœlinius*. A specimen of this beneficial insect was sent to Prof. C. V. Riley and submitted to Mr. L. O. Howard, who writes as follows: "This may be a new species if subsequent rearing of a series of individuals shows the points in which it varies from *C. meromyzæ*, Forbes, to be constant. From the single specimen submitted it would be rash to describe a new species, as the differences are entirely colorational. It differs from typical *C. meromyzæ* in having the head and prothorax dark honey-yellow (instead of black) and in having the parapsidal sutures of the meso-notum also bordered with dark honey-yellow. At present it may be considered a variety of *C. meromyzæ*, although rearing of additional specimens may prove the variation to be so constant as to deserve a specific name."

I have also bred the other species of the same genus, *C. meromyzæ*, Forbes, from specimens of infested volunteer wheat sent to me by Prof. Webster from Indiana.

Artificial—1. For the summer brood the affected heads may easily be collected by hand as they are very conspicuous in the fields. If it is thought that they contain parasites, instead of burning them they may be enclosed in any suitable receptacle and covered with fine gauze until the flies emerge. If parasites are present they are easily recognized by having four wings and slender horns or feelers in front of their heads.

2. For the brood which follows the summer brood and which has been detected in volunteer wheat and also probably occurs in grasses, a strip of wheat might be sown very late in spring so as to be ready for the July brood to lay their eggs upon, and this strip might be ploughed in during August.

3. Sowing late. Prof. Forbes writes (loc. cit.) p. 27: "The discovery of an autumnal brood puts us in a position to suggest more effective measures. For reasons detailed under the head of 'life history' (where dates of appearance are given) it is very likely that delay in sowing until after the first frosts of autumn will wholly prevent injury by this insect; and certainly the general substitution of spring for winter wheat, for even a single season, would greatly diminish in numbers, or perhaps, very nearly obliterate both this species and the Hessian fly."

The *Cœlinius* mentioned above was quite plentiful in the summer brood and I am inclined to think that the sudden diminution in the numbers of this pest must be due to its attacks. This favourable appearance of things is not only at Ottawa. Mr. D. James, of Thornhill, Ont., who was one of the first to assist me in the investigation of this insect, writes: "I am glad to say that the Wheat-stem Maggot is not nearly so bad this year as last. In fact there were so few 'silver tops' that it settled all uneasiness as to its spread. I can't account for its disappearing, it may be only temporary. I would be inclined to attribute the apparent declension to two things: 1st, the very small acreage of fall wheat (and, consequently very little stubble) grown in this county in 1887; 2nd, to the unusually dry fall of 1887, the farmers sowing very little fall wheat and the wheat on the stubble not sprouting, *i. e.*, what is called volunteer wheat not giving the brood any opportunity of being hatched."

The Grain Aphis—(*Siphonophora avenæ*, Fab.)

Attack.—Green, yellowish, or blackish plant lice attacking various kinds of grain on the leaves and roots in the early spring and late in the autumn. As soon as the grain heads out the plant lice crawl up and cluster around the ears, where they suck the juices of the stem, preventing the grain from filling. An occurrence of this insect in injurious numbers took place in July at Entremonts, Lake Temiscaming. Mr. A. Laperrière writes: "I send you a spike of bearded wheat taken from one of my fields. You will observe upon examining it that it is swarming with plant lice on the grains. All the crop of this spring's sowing is infested by it. Is it possible to get a remedy for this troublesome pest which attacks the standing crop?"

The specimen ear of wheat forwarded had certainly been severely attacked, no less than 39 dead aphides being attached to it. Every one of these, however, had been destroyed by parasites, probably a species of *Aphidius* from the appearance of the punctured skins. I have no doubt, therefore, that the attack in that locality was brought to an end by the agency of these useful little parasites.

Plant lice are remarkable for their fecundity and the rapidity with which they come to maturity. In the Annual Report of the Entomological Society of Ontario, for 1878, Prof. Saunders writes as follows:—"People are often puzzled at finding their trees or plants swarming with plant lice, where a week or two before there was scarcely one to be found. As a general rule an aphis, during the summer season, reaches maturity in ten or twelve days from birth, after which it produces every day two young ones, which, contrary to the general rule with insects, are born alive. This rate of increase is maintained for a considerable period, from fifteen to twenty days or more; the young begin to produce in like manner in from eight to ten days, and so on through the third, fourth, and sometimes up to the twentieth generation in one season. Some idea may be formed of the numbers which in a short time this rate of increase would produce, from a calculation of Curtis, a celebrated English entomologist, who has computed that from one egg only, there would be produced in seven generations, taking 30 as the average of each brood, the enormous number of 729,000,000, so that were they all permitted to live, everything on the face of the earth would in a short time be covered with them. Indeed sometimes the possible rate of increase is even greater than this. Dr. Fitch, the State Entomologist of New York, has ascertained by actual experiment that in the case of the grain aphis, the wingless females become mothers at three days old, and thereafter produce four little ones every day, so that even in the short space of twenty days, the progeny of one specimen, if all were preserved from destruction, would number upwards of two millions."

It might naturally be supposed that insects with such prodigious powers of increase do sometimes a great deal of harm. This is the case, but if we can keep them in check for a time, as a general thing, nature soon comes to our aid. These insects form the food of several predaceous kinds, and whenever the plant lice increase largely, their enemies are attracted. The small parasitic Ichneumon flies belonging to the genus *Aphidius* are particularly useful in reducing their numbers. The *Coccinellidæ* or Lady-birds devour vast numbers both when in the larval state and as perfect beetles. The Syrphus flies and other Diptera also help; so that as much surprise is sometimes called forth by the sudden disappearance of hosts of plant lice as is evoked by their sudden increase.

Remedies.—It is quite evident that no application can be made to the wheat plant by which these insects can be destroyed when the wheat is in ear.

Immediately a crop which was infested has been carried, the land should be cultivated and all grasses should be cut down from the edges of the fields. After an attack no grass or grain crops should be grown on that land for the next year.

As the Grain Aphis attacks cereals in the autumn, winter and early spring, fields should be examined at these seasons, to see if they are present. If detected, top dressings of guano, salt, or gas-lime are recommended.

Rolling or feeding off with sheep are also said to be useful.

Weeds in Grain.

Millers complain that there is a much greater proportion than there ought to be of "dirt" in the shape of weed seeds in wheat sent them by farmers. Of samples sent to me for identification, by far the largest proportion of this seed was found to be of the *Polygonum convolvulus*, or Black Bind-weed, sometimes called "Wild Buckwheat." This is a naturalised weed from Europe, and has now spread over the whole of Canada. Although only an annual, it seems to be extremely hard to eradicate, and is very troublesome. Great care should be taken to have all seed grain thoroughly cleaned. There is much foul seed which may be separated from seed grain with an ordinary fine sieve, if farmers will only take the necessary trouble.

Perennial Sow-thistle (*Sonchus arvensis*, L.)

Communications have been received from three different localities enclosing specimens of this plant for name. Mr. W. L. Herriman, of Lindsay, writes on 23rd June: "I wish you would tell me the name of the enclosed plant, and how it may be exterminated from cultivated fields. It is very persistent, the field where this grew was ploughed five times, so the man told me. It grows close and kills out everything else." On 23rd August, Mr. Hiram Doxsee, of Hoard's Station, sends a specimen, he says: "Enclosed please find a plant that has been for some three years spreading on low bottom land on my farm here. I find it difficult to exterminate." Mr. John Willock writes from Fenelon Falls on September 8th: "Enclosed you will find a weed about which we would like to know particulars, so far it is confined to about two rods square, the ground was in wheat the year before last, when we first noticed it. There was no wheat growing amongst it.

the leaves lay so flat to the ground. Last year it was turnip ground, and well attended to, but this spring was put in barley, and the weed sprang up as briskly as ever." This is also an introduced species which has been brought to America in seed grain. It is decidedly spreading. In Canada, Professor Macoun records it as "abundant along road sides and in fields from Newfoundland throughout the Maritime Provinces and Quebec, at Ottawa, London and Hamilton." The only remedy we can suggest for this pertinacious weed is constant vigilance and summer fallowing.

OATS.

The oat crop in Ontario was not reported to have been injured by insects; but smut and rust were mentioned by some correspondents. In some parts of Quebec late oats were injured by the wet weather, and locusts were also troublesome in the same crop. Mr. S. Mireault, writing from St. Jacques, County of Montcalm, and enclosing specimens of *Melanoplus femur-rubrum*, *M. bivittatus* and *Dissosteira Carolina*, says as follows: "As insects, and especially the grasshoppers, are doing much damage in this locality as well as in many others in the Province of Quebec, and as they threaten to destroy our crop of oats by their incessant depredations, I have thought it wise to obtain some exact and precise information concerning them, and with this end, send you some specimens of the injurious kinds. Grasshoppers appeared early this year. They were observed in considerable numbers in the beginning of June. At that time they were small, but since then they have increased much in size as well as in numbers. Hay has suffered little from these insects; but they have invaded our oat fields and destroyed them in an alarming manner. And they even threaten complete devastation. At this moment I believe that half the crop has been sacrificed to the voracity of these insects, and the only thing which can save the other half will be a concourse of providential circumstances which we pray for. This is how they behave: They attack the oat when it is in flower and cut the stem which supports the grain, and destroy even the whole panicle. We have observed in certain localities that all the spikes or panicles had succumbed to the voracity of these insects. We have remarked that these insects are of different colours and I send you specimens of each."

This kind of attack upon the panicles of oats has been noticed several times before and is done chiefly by *M. femur-rubrum* in this locality. The amount of the crop so wasted is sometimes very great. (*Vide* page 63.)

BEANS.

The European Bean Weevil (*Bruchus granarius*, L.)

Attack.—Small slate-coloured beetles found in hollow chambers beneath the skin of seed beans. Sometimes as many as three in one bean. Seed so injured will generally germinate; but produces only a sickly plant, and if known to be infested should not be used.

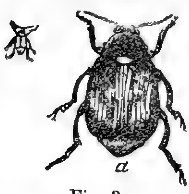

Fig. 3.

Some infested seed of the large Windsor Broad Bean was sent to me for examination. This seed was imported from England and was found to contain living specimens of the European Bean Weevil. Many of the beans had two beetles in them; but a few contained three. The ease with which these insects may be introduced into a country renders it essential that care should be taken not to sow infested seed.

The eggs are said to be laid by the parent beetle on the bean-pods while they are young and soft. The grubs feed inside the seed, sometimes destroying the greater part of the contents, but seldom injuring the germ. The grub is full grown by the time the beans are ripe and turns to a pupa inside the seed. Before it makes this change, however, it gnaws away the substance of the bean up to the skin and only leaves a thin film over its hole.

Miss Ormerod has observed that "the pupa is contained in a cell, a coating made apparently of small bits of bean agglutinated together. When the bean is dry this case or cocoon is very slightly observable, but when damped it parts from the wall of the gallery and you may quite readily pick out your beetle with this case clinging like a bag round it and only open at the mouth end." The perfect insect (Fig. 3) emerges in the spring soon after the beans are sown. It is a small black or dark brown beetle covered all over with a very short appressed grey pubescence and also has the wing covers ornamented with patches and dashes of white. The abdomen exceeds the wing-cases in length and bears upon its upper surface, just beyond their tips, two small black spots. The first pair of legs and three or four of the basal joints of the antennæ are reddish, the others black. Upon the hinder part of the thorax is a small fulvous patch.

The beetle resembles the well known Pea Weevil in shape, but is rather smaller, being only one-eighth of an inch in length. It is darker in colour and, like it, is a very active little creature.

From the habits of these insects, of remaining inside the seed until they are perfect, they are very liable to be carried from one country to another. This is illustrated by the fact that no less than eight species were collected amongst foreign produce sent to the Philadelphia Exhibition in 1876.

Remedies.—In the sample of Broad Beans referred to above, soaking them for twenty-four hours in water was found to drown every specimen of the weevils. When, therefore, a sample of seed is found to be infested, this simple expedient at the time of sowing the seed will be found efficacious. When the supply of seed on hand will permit it, it is better to keep the beans over until the following year in some close vessel. The beetles will emerge the first spring and die without injuring the beans further. A similar plan is that practiced with the Pea Weevil, of keeping the seed peas shut up in a close vessel in a warm room during the winter, when the weevils will emerge and die long before the seed is wanted for sowing. The remarkable freedom of peas in Canada from the attacks of the Pea Weevil, during the last few years, is attributed by some to the care taken by seed merchants to poison all weevils contained in seed peas, by subjecting them for some time, in large closed receptacles, to the poisonous fumes of bisulphide of carbon.

PEAS.

The pea crop throughout the districts where peas are most grown has been good and little troubled by insects, the most serious attack was by the Clover Cutworm, but this was complained of over a limited area only. The dry weather caused in some localities the condition mentioned at some length in my last year's report. Mr. F. Birdsall wrote on 25th July that many of the fields in the vicinity of Birdsalls, Ont., were badly affected. The top of the vines was green but the root dead. Numbers of the vines had only a single pod upon them and this seldom contained more than one pea.

The Pea Weevil (*Bruchus pisi*, L.).

Throughout the greater part of Canada the pea crop still remains exempt from the attacks of this once dreaded insect. Mr. T. B. Townshend writing from Aldershot, Ont., says: "The old enemy which used to be so fatal to the pea crop, the Pea Bug, or Pea Weevil, has not troubled us for some time, in fact has quite disappeared." It has not been entirely absent, however. In the Ontario Bureau of Industries return 24, we find a note that "the crop has been very free from bugs, excepting in the County of Essex, and in portions of Kent and Lambton." The ravages formerly committed by this insect have, however, put our pea growers and dealers upon their guard, and if the seed is subjected to the bisulphide of carbon treatment or kept over in closed vessels until another season, there is no reason why this insect should again develop into a "first class pest." Should there be any doubt as to whether seed peas contain weevils or not, before sowing the whole lot should be thrown into water when the injured seed will float, but the sound peas will sink to the bottom. All those that float should be burnt at once, or if in large quantities may be fed to pigs.

The Clover Cut-worm. The Cabbage Mamestra (*Mamestra trifolii*, Esp.).

During the month of August I received many enquiries concerning some green caterpillars which suddenly appeared in the counties around Hamilton, Ont. Specimens were sent to me from several localities and the following description was taken: They were thick green caterpillars with black or grey marks, very variable in the depth of the colour of the markings, some specimens appearing almost green while others were quite dark above. Length, two inches. General appearance—a dark green noctuid caterpillar with a very narrow dorsal stripe, a broken sub-dorsal stripe of yellow, edged above by velvety black blotches (the black line not quite as continuous as the yellow), a broad pink infrastigmatal band, narrowly edged with white above and below. Above the upper white, a black line which spreads out into a black blotch around each spiracle. The whole body mottled with white on a smooth green surface, giving a somewhat glaucous shade to the green. The narrow dorsal stripe consists of an aggregation of these mottlings, and the dorsal space has them shadowed with black, giving that area a darker appearance than the rest of the body. Legs and pro-legs concolorous with the body. Head, small, green bearing on the upper part of the face and on the cheeks clouds of white mottlings. Some of these caterpillars were simply pale green with fuscous markings, others were green, with clear brownish or black markings, some had the mottling all over the body so shaded with brown as to suggest the appearance of the Army-worm. Intermediately tinted specimens between all these colours occurred. The caterpillars sent to me were nearly all found to be parasitised either by a large yellow Ichneumon Fly called *Ophion purgatum*, or by a large Flesh-Fly which Prof. Riley has identified as a species of *Sarcophaga* near to *sarraceniæ*. When these caterpillars were first sent to me I took them for the Fall Army-worm (*Laphygma frugiperda*, Sm. and Abb.) a species which sometimes occurs much in the same way as this did in August. Of all the larvæ sent to me I only succeeded in getting three to the pupa and these will not emerge until next spring.* I am indebted to Prof. Riley for the identification of these caterpillars as the larvæ of *Mamestra trifolii*. Prof. Riley writes: "Your letter with notes on a noctuid larva is to hand. So far as I can judge from your description the larva which you have is that of *Mamestra trifolii*. It is certainly not that of *Laphygma frugiperda* nor of *Prodenia lineatella* The coloration of *trifolii* is quite variable though the general pattern of the more prominent markings is substantially the same as in the larva which you describe. The general colour varies from a pale yellowish green to a rather dark greyish or brownish green. The larva of *lineatella* differs from the description which you give in several important details. * * * *M. trifolii* is probably single-brooded with you. Here in Washington and in Missouri it is double and sometimes treble brooded. In Germany it is single brooded."

This injurious insect has been treated of under the name of Cabbage Mamestra (*M. chenopodii*, Albin) and illustrated upon a coloured plate by Professor Riley in his annual report as State Entomologist for the United States for the year 1883, p. 123. From this account we find that the species is common all over Europe and in North America and the caterpillars were not noticed as specially injurious on this continent until 1876, when they attacked many kinds of garden vegetables, and were particularly severe on cabbages; they however feed upon a variety of plants, amongst which are mentioned by authors: celery, lettuce, cabbage, asparagus, spinach, parsley, clover, sow-thistle, goosefoot (or "lamb's quarter's," *Chenopodium album*, L.), &c. The name of this insect is derived from its attacks upon the clover and it is also known to be very destructive to peas, which, belong to the same natural order. As will be seen by the following extracts, nearly all the attacks began upon peas. In a letter kindly for-

* These specimens have emerged in my study, since the above was written and prove to be *M. trifolii.*

warded to me by the Editor of the *Toronto Weekly Mail*, Mr. John Puckridge, writing on 9th August for himself and several other farmers, says: "I herewith enclose specimen of a caterpillar which is now seriously damaging our field peas. They began by first cutting off the stalk some four inches above the ground several weeks back. The pea plant apparently died; but in a short time two or three stalks shot up and after a time grew until they blossomed and podded well. The dry weather came again when this pest made a second attack, eating the foliage and even barking the pea-pod now full-grown and near ripening. We think of pulling ours for fodder although they should yield 20 bushels or more per acre. Kindly inform us if this is the Army Worm and the best means to be adopted for their extermination. The caterpillars are of different shades of colour and sizes; but we suppose that this arises from the various periods of hatching."

Mr. F. B. Carlow, writing 7th August from Warkworth, says: "I send you a caterpillar which is totally destroying the turnip crop in our neighbourhood. They were in the pea fields first and as soon as the peas were harvested they went directly to the turnip field. I have tried to kill them by applying Paris green and hellebore to the leaves. Our neighbour, Mr. Douglas, has sifted ashes over his crop of turnips, but all these experiments failed. This morning I have started to pull up the turnips that are the worst with them and draw them out of the field. I am then going to plough around the turnip patch."

Mr. John Kay, writing from Paris on 15th August, says:—"I send you a Caterpillar that has made its appearance here within the last week—a perfect glutton. They are very fond of Mangold Wurtzel and they strip the leaves on short notice, leaving the bare stalks. I have advised dusting air-slacked lime on the root crops. To-night I learn that they have made their appearance on the turnips. As they are in thousands their ravages may affect all our root crops," and later, 25th August, he writes:—"One farmer says I mixed 4 lbs. Paris Green with 200 lbs. of finely ground Paris Plaster (Gypsum) and sprinkled over 2 acres of Mangold when the dew was on the leaves, but it did no good. Another farmer says that these Caterpillars came off the peas, having eaten all the leaves they then stripped his mangolds, which are now worthless. The Caterpillars bore into the ground and make a cocoon, of which I send you some specimens. I am informed that the pupa remains here only a short time when they appear as light-coloured moths."

Mr. S Hinman, writing from Dundonald on 24th August, says:—"Enclosed I send you a specimen of a green worm that has been doing a great injury to the pea-crop in this vicinity; it has destroyed hundreds of acres in this part."

Remedies—As these Caterpillars had the same habits as the true Army-worm, ploughing a furrow across their path was recommended, and where the crop would allow it sprinkling with Paris Green. Ploughing late in autumn, was also recommended, because this insect passing the winter as a chrysalis, by this treatment the chrysalids would be brought to the surface or disturbed, and would probably suffer from the frosts of winter. However, from the remarkable way in which the larvæ were infested by parasites I feel confident that next season there will not be a severe attack. When attending the meeting of the County of Wentworth Farmers' Institute, at Oaklands, near Hamilton, on 29th August, several farmers spoke to me of this pest, and some specimens bearing the eggs of Flesh Flies were handed me by Mr. T B. Townshend. Writing on the 10th September, with reference to the same matter, this gentleman says:—"When you were at Oaklands the pea fields were literally swarming with the pests, and I could readily have sent you a bushel of them. The specimens I handed you were, however, a fair sample. You pointed out to me a small protuberance on the head of one of them as the egg of a parasite, which would eventually destroy the caterpillar. I find on enquiry that as the insect advanced to maturity many of them were observed to have these little lumps or protuberances on the head, and we hope this natural enemy may have performed a work that will free us from future trouble with this caterpillar. The appearance of the insect so late in the season enabled us to reap the bulk of our pea crop without any damage, and I am glad to say it is a good crop.

The later fields were but a small percentage of the whole, and but few of them escaped; indeed one of my neighbours had two fields literally destroyed After eating the leaves they appeared to feed on the fleshy part of the pods, leaving only the inner membrane covering the grain and soon after the pod would dry up."

HAY AND CLOVER.

The hay crop in most districts has suffered severely from climatic influences. The excessive drought of last summer and the light rainfall of this spring had a marked effect upon the hay crops in Ontario and parts of Quebec, while in the Maritime Provinces and Lower Quebec the crop was even more seriously affected by excessive rains. Clover in Ontario is reported as winter-killed in some localities, but this is generally attributed to the drought of 1887, owing to which the plants went into hibernation in a weakened condition. This lack of sap and a consequent fatality was noticeable amongst all plants, and even many forest trees succumbed in rocky districts. The drought of the whole summer of 1887 was exceptional, there was a very light snowfall in the winter and almost no spring rains. By the 1st of July the want of moisture began to be apparent, but it was not until about 10th August that any rain came. At this time a fall of temperature took place over the whole of Ontario and occasional showers occurred.

HAY.

"Silver-top of hay,"—An unknown enemy.

An attack of considerable interest, because up to the present time the depredator has escaped actual discovery, has for many years been observed in hay. Various conjectures have been made as to the cause of the injury, but so far it must be acknowledged that this is not positively known—spring frosts, the maggots of some grass-eating flies, mites, plant bugs and during the last summer, with perhaps more reason, species of Thrips have all been accused At first sight this injury is exactly similar to that of the summer brood of the Wheat-stem Maggot (*Meromyza Americana*). The top portion of the flowering stem turns white, before the time it should ripen, and dies without forming seed. Upon splitting the stem it will be found that the topmost section has been injured just above the top joint, but in a different manner to the stems of wheat, injured by *Meromyza*. Instead of the tissues being gnawed they are merely shrivelled and discoloured, as if the juice had been sucked out of them. This injury is only to the base of the top section of the stem and the enveloping sheath is uninjured. With a slight pull the culm parts at the injured spot and is easily drawn from the sheath. This attack is first apparent in the beginning of June, when the flowering stems of Kentucky Blue-grass (or June grass, *Poa pratensis*) turn white at the time of flowering. The injured stems are very noticeable at first, but soon become hidden by the other stems growing up and over-topping them. Later in the month Timothy (*Phleum pratense*) and Couch Grass (*Triticum repens*) are similarly attacked, and upon the Central Experimental Farm, *Poa serotina* and *Triticum caninum* showed the same injury to a limited extent. I failed to find any insect inside the stems, at the seat of injury, although examination was made early in the month. Various suspected species of Hemiptera or plant-bugs were caged over growing plants of grass and although several of these punctured the leaves and stems for food, none made an injury similar to that described above. I did not myself find any species of *Thrips*, but Prof. Saunders informs me that he did in a casual investigation he made. Upon a previous occasion I had detected in small numbers, both hymenopterous and dipterous larvæ in injured stems, as well as mites, but this season at Ottawa, none of these were found and I am therefore under the impression that these are not the cause of this attack. In Prof. Forbes's thirteenth Illinois report at page 22, the following appears as a note to his article upon *Meromyza Americana*:

"An injury precisely similar to that done to wheat by the Wheat Bulb-worm is extremely common in Blue Grass and Timothy throughout the State, and may possibly be due to this species; but the escape of the insect is so prompt that I have rarely been able to find it in any stage after the injury becomes evident through the whitening of the head of grass. Indeed a single pupa found beneath the sheath of a stem of Timothy which had been injured in this way is the only direct evidence I have of the character of the insect responsible for this mischief. This pupa was certainly dipterous and very similar to that of Meromyza, but differed in the proportions of the segments, and especially in the size and distinctness of the terminal ones. I am consequently doubtful if it was that of Meromyza, but think it more likely that it belongs to a species of Chlorops likewise very abundant earlier in the season. On the other hand the great abundance of the fly of Meromyza in May, in regions where very little winter wheat and not much rye are raised, makes it almost certain that the larvæ live in something else than these grains."

In my report for 1885 I quote some information given to me by Dr. Brodie of Toronto who succeeded in finding some larvæ which he felt sure were those of a species of *Chlorops*, and in 1887 he writes: "In addition to a dipterous larva which attacks the Timothy, we have found here a mite very common and very injurious."

Now, from the above observations and some others to be mentioned below, made by trained entomologists, it is perfectly certain that there are injuries to grasses by different insects, the effects of which are very similar in appearance and all of which would be classed under the head of "*Silver-top*"; but for each of which a different treatment might be necessary. In the same way Miss Ormerod tells me that there are attacks upon wheat in England, very similar to those we suffer from in the case of *Meromyza Americana*. During the past year the opinion has gained many adherents that one of these injuries, by which the panicle and top portion of flowering grasses is destroyed, is due to the attacks of a species of Thrips. These are minute, slender insects rarely exceeding two or three millimetres in length and are sometimes very active, leaping and taking flight with great agility. They have a habit of running about with the hinder portion of their bodies raised up when they are disturbed, in the same way as the *Staphylinidæ* or Rove beetles. Their structure is peculiar, so that naturalists have had difficulty in classifying them and they have been placed in various positions. In Prof. Comstock's new "Introduction to Entomology" the following description is given: "But the structure of the mouth and the character of the wing throw them out of any of the accepted orders. And now the majority of entomologists agree in assigning them the rank of a distinct order. As to the position of this order, it seems to me that it is the lowest living representative of one of the lines of development of winged insects, of which line the Hemiptera is the culmination.

"The body is long. The head is narrower than the thorax, without any distinct neck; the eyes are large, with conspicuous ocelli; there are also usually three simple eyes. The ventral side of the head is prolonged into a conical beak, which extends beneath the prosternum. The form of the mouth parts can only be made out by dissection and the use of the high powers of the microscope. The mandibles are long bristle-like, curved, and somewhat flattened at the base, and taper to a point; they are furnished with well-developed palpi; the labial palpi are distinct but less conspicuous; the labrum is furnished with a curious appendage at its tip; and the labium is deeply emarginate. The three thoracic segments are well developed. The wings are laid horizontally on the back when not in use; they are very narrow, but are fringed with long hairs, which diverging in flight, compensate for the smallness of the membrane. This fringing of the wings suggested the name *Thysanoptera* by which the order is designated in many entomological works. In some species the wings are wanting. The legs are well developed, but are furnished with very peculiar tarsi; these are two-jointed, and are bladder-like at the tip. This character suggested the name *Physopoda*. The abdomen is more or less spindle-form; it is terminated in some genera by a long slender segment; in others the females are furnished with a four-valved ovipositor, which lies in a groove on the ventral aspect of the abdomen. The larva resembles the perfect insect but has no wings and is sometimes red or a different colour from the imago. The pupa is more like the perfect insect with rudiments of wings and the antennæ are turned back on the head. It is much less active than either larva or imago."

There seems to be very little accurately known of the life-histories of these insects and there has been great difference of opinion as to their food and habits. Some observers claiming that they were carnivorous, whilst others maintained that they were herbivorous. In an excellent paper by Professor Osborn, of Iowa, read before the Entomological Club of the American Association for the Advancement of Science at the Cleveland meeting, and since published in *Insect Life*, No. 5, a résumé of our knowledge of these interesting insects is given, together with the opinions of some of the leading entomologists on their habits, and Professor Osborn's own careful investigations. From the study he has given the question, his conclusions are valuable as throwing light upon a question which must now be seriously considered by Canadian farmers, since the injury known as "silver top" is decidedly increasing, and may be due to the attacks of these insects. Professor Osborn's conclusions are as follows:—

"That the Thripidæ as a group are normally herbivorous, and their presence on cultivated plants is a source of danger.

"That they feed mainly on the exuded nectar or secretions of plants, when these are abundant, and on pollen, and at such times may do little or no damage. That they will upon occasion attack the tissues of the leaves or the essential parts of the blossoms and pierce them for their contents, and at such times may cause serious damage.

"That of the recorded species there are two, at least, which must be looked upon as carnivorous in certain stages at least."

Prof. Osborn also gives a list of 22 species which have been reported as injurious to vegetation, and Prof. Comstock has named one, from this habit, which there is every probability will prove to be the cause of one of the attacks upon our Canadian hay crop.

In June last affected stems of Timothy were sent to Prof. J. A. Lintner, State Entomologist of New York, for his opinion. His answer was as follows: "It is identical with what I have been investigating in our own vicinity—the whitening of the heads and the blackening, and shrivelling of the stalk just above the upper joint, the shrivelled stalk sometimes found on carefully removing the sheath, to be folded back upon itself for about one-twelfth of an inch. It is a *Thrips* attack, which is as exact as I can say at present, similar to that which has been for so long a time observed on June grass, and which I was not at first inclined to accept as Thrips attack, but of which there can now be no reasonable doubt. We do not know the Thrips of the June grass, nor is there any reason for accepting this one on the Timothy as the same. It may, however, prove to be identical, with its operations more recently extended to the Timothy."

Later Prof. Lintner writes on the same subject: "I cannot give you much additional information of the *Thrips*. The June grass species or an allied one did considerable injury to Timothy, in Albany County in June. It was probably the same that you had in Timothy, and is presumably the Grass-eating Thrips (*Limothrips poaphagus*) of Prof. Comstock, lately briefly described in his "Introduction to Entomology," 1888, p. 127. This description is as follows: "Another common species I have designated in my 'Notes on Entomology,' as the grass-eating Thrips, *Limothrips poaphagus*. The injury caused by this pest often attracts attention, although the insect itself is rarely observed. It infests Timothy and June grass, causing the head to turn yellow and die before maturity. These dead heads are very abundant every year. By pulling the head from its sheath, the stalk will be found to be shrunken in the tender part just above the joint, where the juice has been sucked from it; and in this place if the examination be made soon after the turning yellow of the head the insect can also be found. The adult female is light yellow in colour, measures from 1 m.m. to $1\frac{1}{3}$ m.m. (0·04 inch to 0·05 inch) in length, and is remarkable in lacking the long spines on the veins of the wings."

In Europe these little insects are charged without hesitation with serious injury, to hay and grain crops. In Mr. C. Whitehead's second report to the English Government, 1886, he says: "Although very small indeed, this little creature does an infinity of harm to wheat, oats and barley plants in some seasons and in some localities. Being so tiny its action upon cereals is frequently unnoticed, and the results are attributed to other than insect agencies or they are frequently called blight, or supposed to be due to an abnormal state of the plants.

"Upon close examination of affected plants, it will be found that the Thrips have taken up positions under the coverings or case or corolla, of the seed of corn* within the slits of the seeds, and are sucking the juices from them with their short, stout beaks. It has been supposed that they are attracted by the pollen, but it is certain that their chief attraction is the sweet fluid of developing seeds.

In 1886, Prof. Ch. Lindeman published a very complete article upon "Species of Thrips living on cereals in Middle Russia, which appeared in the Bulletin de la Société Impériale des Naturalistes de Moscou. In this the author states that his investigations have convinced him that only two, of five species he mentions, have an agricultural importance. These are

T. secalina. Of this the first generation appears in May and lasts till June, the larvæ living upon the ears of rye. The second generation appears at the end of June and lasts until the beginning of August, living upon the stems and ears of summer wheat and barley. The third generation appears at the beginning of August upon the stems, the same as the last.

The winged females lay no eggs in the autumn, but hibernate under stones, in hollow straws, &c. The eggs are large, $\frac{1}{4}$ mm. long, and are laid separately at some distance from each other. The larvæ remain on the same stem where they hatch from 5 to 15 together beneath the same leaf-sheath. Pupæ as well as the larvæ live only on the sap of cereals. A microscopical examination of the contents of the crop revealed no trace of cells or of vegetable tissue, only a thickish liquid with chlorophyll granules. Prof. Lindeman considers the species distinct from *T. cerealium*, which is the one referred to above by Mr. Whitehead.

The damage by *T. secalina* is much less than that caused by *Palæothrips frumentaria*, Bd., the other species which he mentions. This causes great damage by puncturing the ovaries of rye, wheat, barley and timothy. The females lay eggs in May and June, in heaps sometimes as many as 27 together between the paleæ or on the rachis of rye. Larvæ appear at the end of May, and like the adults feed upon the ovaries, destroying from 80 to 90 per cent. of them on the ears attacked. Pupæ were first seen on 4th July. The second and last generation appeared on 10th July. The grains of rye were then ripe, so the insects migrated to the ears of summer wheat. The larvæ were observed by 17th July, and the adults by the end of August, when they went into hibernation.

Dr. Lindeman recommends as remedies for these grain eating species, fall ploughing, burning of the stubble and heavy rolling.

Remedies.—A fact which has been generally noticed amongst my correspondents, who have reported this attack, has been that it was most noticeable upon old and exhausted meadows. This naturally suggests breaking these up and laying them down to some other crop. An old timothy field upon the Experimental Farm was found to be badly attacked by what for the present I prefer still to speak of indefinitely as "Silver-top." When no cause for this injury could be discovered, it was ploughed up, and the result will be noticed during the coming year. This is the only remedy which can be suggested, until something more definite is discovered. The cause of the injury must be looked for immediately the heads of grasses begin to turn white, and the description given above should enable a careful observer to detect whether it is a Thrips or not.

* This word is used in England in the same way that we use "grain."

Locusts—" Grasshoppers" (*Acrididæ.*).

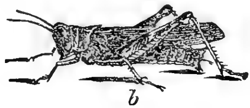

Fig. 4.—*Melanoplus femur-rubrum*, Burm.

One of the remarkable occurrences of injurious insects during the past season was the appearance of vast numbers of locusts of several species. This is frequently the case in dry seasons, not only these conditions check the growth of vegetation, but also are very favourable to the development of insects. They are usually spoken of as "grasshoppers," but all the short-horned species are generally designated "Locusts" by Entomologists. In the eastern part of Ontario they were very abundant, and during the month of August attacked every green plant that came in their path, even going into the woods and attacking the forest trees. Upon the Experimental Farm they were extremely troublesome. In Western Ontario they were reported as attacking clover and timothy. In Manitoba and the North-West Territories there was no excessive superabundance complained of; but in British Columbia, I am informed by Rev. G. W. Taylor, the Provincial Entomologist, that they occurred in large numbers and were very injurious. He writes "possibly the names of our Victorian species may be of interest to you. The specimens were identified for me by Mr. Lawrence Bruner, which is a guarantee of the correctness of the determinations.

1. *Circotettix undulatus*, Thos.
2. *Arphia tenebrosa*, Scud.
3. *Melanoplus scriptus*, Walk.

These three, particularly the last two, are to be found until late into November, the last named is one of our most abundant species, and is much like your eastern *M. femur-rubrum.*

4. *Melanoplus bivittatus*, Say. Abundant.
5. *Trimerotropis vinculatus*, Scud. This is a rare species which I have only collected in one place.
5. *Camnula pellucida*, Scud. Abundant.
6. *Dissosteira Carolina*, L. Not injuriously abundant.
7. *Tettix granulatus*, Kirby. Occasionally taken.
8. *Gryllus neglectus*, Scud. Very abundant.
9. *Ceutophilus castaneus*, Thos. Not uncommon.
10. *Myrmecophila oregonensis*, Bruner.

This last, scientifically, is an extremely interesting little species, but has no economic importance."

In some parts of the Province of Quebec locusts appeared in large numbers and enquiries concerning them were frequent. Their numbers gave rise to the impression that they were the Rocky Mountain Locust. The occurrence of this last species in that Province is however extremely improbable, if not impossible, although during the last few years the Lesser Locust, *M. atlanis*, Riley, has been one of the most abundant species as far east as Ottawa. The specimens sent to me for identification from the Province of Quebec were, *M. femur-rubrum, M. bivittatus, and D. Carolina.*

In the neighbourhood of Ottawa, the hay fields were noticed to be swarming with young locusts in the beginning of June, and trouble was feared from their numbers. By the beginning of July the first specimens of the perfect winged locusts were taken, and from that time on, until the frosts of autumn, countless myriads committed serious depredations upon almost every green plant. Hay was cut in the beginning of July, and they then forsook the meadows and went to the fields of grain and other produce. The foliage of bushes, fruit trees, and even forest trees was devoured by them; nothing seemed to escape. Their numbers were so great that ordinary remedies were useless. In an effort to protect the experimental grass plots and a large patch of tobacco, the mixture of bran, sugar and arsenic, as proposed by Prof. Riley, was used. It was readily eaten, and certainly killed large numbers, but the dead bodies were soon disposed of by the survivors, and when one was killed a thousand took its pace. Mechanical apparatus for catching and destroying the perfect locusts would have been the only way to deal with them. I am, however, strongly of the opinion, that, if the hay fields had been cut about the 20th June, instead of in the beginning of July, that the hay would have been just as good and enormous numbers of these locusts would have been destroyed. At that time they were in a condition when they require shade, and, moreover, have no wings with which to move from one field to another. In a close-growing crop, like hay which covers the ground thickly, there is very little active vegetation at the roots, and a great deal of moisture is kept from evaporating. As soon as the hay is cut, all that is left on the field, above the surface, is at once dried up by the action of the air and the sun, and the plant does not shoot up again for some weeks. In wet seasons, of course, this is a little sooner than in dry ones. The latter part of last June and the month of July were excessively hot and dry in this section, and what grass was left upon the fields after the hay was cut, could not possibly have supported the large numbers of locusts which afterwards devastated our crops. By leaving the hay standing until the 1st July, they had reached the final stage in which they can fly, and they were thus enabled to migrate from field to field, which they could not possibly have done in their earlier stages by hopping. It must be remembered that their wings do not grow gradually until they reach their full size, but appear suddenly after the last pupal moult in the same way as those of plant-bugs or butterflies. Amongst the Orthoptera the successive stages of development from the egg to the imago are somewhat different from what we see in other orders of insects. Locusts pass through seven stages. The egg, two larval stages, three pupal stages and the perfect form. In the larval stages there is no appearance of wings; after the second moult, however, small wing pads appear, which increase gradually during the two succeeding moults, but when the pupal life is completed, and just before the insect moults the last time and becomes a perfect locust, the wing pads, even in the large species, are only about a quarter of an inch long. When the last moult takes place, however, and this only takes a few moments when the time comes, from these short wing-pads are unfolded copious gauzy wings, over an inch in length. In a few hours these harden, and are ready to transport their bearer from place to place upon its mission of destruction.

CLOVER.

In the November bulletin of the Ontario Bureau of Industries Mr. Blue writes as follows: "The winter and spring were trying on fields already thinned by drought and the second dry summer left the crop in a very unsatisfactory condition, so far as any prospect of seed was concerned. The Midge was almost everywhere, and while a few correspondents in the Lake Erie and Lake Ontario Counties speak of a fair quantity of seed, the majority of returns describe the crop as a complete failure. Where any seed was obtained it was generally where fields were pastured until the middle of June."

The Clover-Seed Midge (*Cecidomyia leguminicola*, Lintner).

Attack.—Small footless, orange Maggots which eat out the contents of the clover pods and thus destroy the seed.

It is somewhat disappointing to find that the Clover-seed Midge instead of being reduced to the place of a second class pest by the concerted action of the growers of clover seed, has actually made headway during the past summer. This is the more remarkable because its life history is so well understood, and although it is well known by all that to secure a crop of clover-seed, the crop must be cut or fed off before the Maggots are full grown, yet farmers do not adopt this simple method. There are two broods of this midge in the season, corresponding with the two crops of clover-seed. The eggs are laid in the forming flower heads of the clover; when they hatch the maggots eat their way into the seed-pod and destroy the seed. When full grown, which here is about the end of June, they leave the heads of clover and penetrate a short distance into the grornd. Here after a time they change to pupæ and the perfect flies emerge in August, just at the time the clover is heading out again, and therefore just in the condition to serve their progeny as food. Now it is manifest that if the first brood can be destroyed in any district by the systematic and concerted action of all the growers, the second crop of clover-seed must be to a large measure exempt from the attacks of the Midge. It has been proved conclusively that if clover be either cut or fed off before the middle of June the young larvæ of the Midges are destroyed.

Mr. T. Farrow, of Bluevale, Ont., who has tried many experiments, in observing this insect for a succession of years, has written as follows:—"I am the only one in this section who has any clover-seed. I have 30 acres. Twenty acres I pastured until the middle of June. The other ten acres I left for crop. The hay on this was cut about the first week in July and then left for a crop of seed. The summer, as you know, turned out very dry, in consequence of which there was not as much growth as there would have been had the season been damper. However, the seed on the pastured 20 acres was very good and fine. No Midge at all."

Again Mr. Robert Wilkie writing from Blenheim, Ont., on the 4th January, 1889, says: "Very little seed has been threshed here as yet. I have heard of only two lots, one was pastured until early in June, when the stock was turned off and the crop allowed to go to seed. Thirty acres produced 50 bushels of seed; but another piece of ten or twelve acres which was cut for hay the first time produced about the same quantity of seed."

Now these are only two of a great many letters which might be cited to prove that by the adoption of this simple and inexpensive method one of our most remunerative crops may be saved. It is true that occasionally, even without taking this precaution, good crops of seed may be raised but they cannot be relied on.

FIELD CROPS AND VEGETABLES.

ROOTS.

Root crops in most districts are reported as good, and no new attacks of importance by injurious insects have been complained of. In some places potatoes were injuriously affected by rains in September and October, but as a general thing there was very little Potato Rot, and root crops were saved in good order.

TURNIPS.

Turnips were affected by the drought in June and July and the Turnip Flea. Beetle in many places destroyed the young plants so that they had to be sown again. After the middle of June dry weather set in and the plants could not get well started. Towards the middle of June a phenomenal appearance of Cut-worms occurred and it was only with the greatest difficulty that enough plants could be saved for a crop. These Cut-worms were chiefly of three species, *Agrotis subgothica*, *Hadena arctica* and *Agrotis volubilis*. Their attacks were most severe here on the farm in a sandy field, and turnips, mangold wurtzel, cabbage and cereals were most attacked. Paris green and finely ground apatite, 1 to 50 and later 1 to 25, were sown along the rows, but with no appreciable effect upon the Cut-worms.

Striped Flea-beetle, "Turnip Fly" (*Phyllotreta vittata*, Fab.).

Attack.—Small active shining black beetles, with yellow markings on the wing-covers, which eat the seed-leaves of turnips and all other cruciferous plants directly they appear above the ground. When disturbed they hop from the leaves to some distance. As is always the case in dry seasons many complaints have come in of the depredations of flea-beetles upon the turnips. These are not, probably, all by the Striped Flea-Beetle (*P. vittata*,) but as this is the commonest species, and the most successful treatment will apply for all, the description given above will serve to identify the attack.

Dr. J. T. Steeves, Superintendent of the Provincial Lunatic Asylum, St. John, N.B., writes in July last: "I enclose with this specimens of flies, millions of which have invaded our turnip field this summer and destroyed nearly all our young turnips, and also the mangolds and beets. We have sown early and late, in the same field three times; all were eaten up excepting our garden patch, a large patch which was sown very early, these were not touched. From these we obtained several barrels of plants, which we transplanted, and these a huge grub devoured.

"Is there any remedy that we can use against these enemies, they are very numerous and hop off like fleas when disturbed. Of course we shall lose our crop this year; but what can be done to prevent disaster next year? I have advised our farmer to prepare his drills this autumn and have them all ready to receive the seed as soon as the frost is fairly out of the ground in the spring, and sow early. Most, if not all, the farmers in Lancaster parish, situated on the west side of the St. John River, near its mouth, have suffered from the same foe."

In the Ottawa district the species which attacked the turnips was *P. vittata*, the same as was sent by Dr. Steeves, but I am under the impression it must have been some other insect which destroyed the mangolds and beets. The grub mentioned by him was undoubtedly one of the many species of Cut-worms. These are very partial to mangolds and may have been the culprits.

In the far west the same or a similar beetle occurred followed also by a Cut-worm. Mr. T. H. Fullerton, writing from Calgary, N. W. T., says: "The farmers in this vicinity have been greatly annoyed by flies this year on field turnips as well as on all garden stuff. What the fly left, a sort of grub took, eating the plant off close to the ground. I have some turnips four times sown and would be glad to hear of any remedy you may know of for another year." The life history of these Flea Beetles seems to be as follows:—The perfect insects pass the winter beneath rubbish or clods of earth in the fields. In the early spring they come forth and feed upon some of the many cruciferous plants which then have foliage, as various biennial weeds. The eggs are laid soon after and as stated by Dr. Thomas (Illinois, Rep. VI, p. 159) the larva feeds upon the roots of cruciferous plants and when full-fed makes a small earthen cocoon near its feeding place. From the time the egg is laid until the perfect beetle emerges, it takes about a month, and there are probably three or four broods in the season, for perfect beetles were taken upon cruciferæ in the seed beds at the farm right through the summer. The European Turnip Flea-Beetle (*P. nemorum*, Chev., is stated by Mr. C. Whitehead (Rep. on In. Inj. to Roots and other crops, 1887) to lay its eggs beneath the leaf, and he says that the young larvæ mine the leaves, when full-fed dropping to the ground and pupating in the earth close to the turnip plants. It is further stated that the beetles "arrive in a rapid succession of generations throughout the summer, if it is hot and dry and if other circumstances are favourable, when it is believed that there are as many as six generations."

Remedies.—In England agricultural methods of prevention are relied upon almost entirely. The land is ploughed and manured in the autumn so as to produce a good seed-bed. In the spring it is merely cultivated; this destroys weeds but does not open up the land, which would allow too much moisture to evaporate and would also make shelters for the insects after they had been attracted to the fields. Beneath the wing-covers of the beetles are folded-up ample gauzy wings with which they can fly long distances, and they are doubtless attracted to their food by the sense of smell. Mr. Whitehead advises that "rolling down the land immediately after the drill should be adopted, as it tends to keep in the moisture and to level the earth in the drills, so that the seed may come away as rapidly as possible." He also advises that "plenty of seed of the preceding year's harvest should be used, carefully examined as to its germinating powers, and as to its freedom from other and worthless seeds. From three to four pounds per acre may be put in. The importance of having seed of full germinating* power cannot be too strongly insisted upon."

*I draw particular notice to this statement of Mr. Whitehead's with regard to the value of seed-testing. Mr. Whitehead is an extensive and successful farmer, who has been all his life a practical farmer. Canadian farmers who can send seed of all kinds to the Exper mental Farm to be tested, free of all charge, even postage, have no excuse whatever for sowing or even buying bad seed. The returns as to the germinating quality of seeds can generally be sent back in about a week.

As the beetles pass the winter in the perfect state, early sowing in a district where they have been abundant the previous season is not always successful, although some of the Nova Scotian farmers have great faith in it.

In the Ottawa district the most successful crops have usually been grown from seed sown from 15th to 20th June. Judicious management in the time of sowing so as to get the young plant into the rough leaf, in between the broods of the beetle is one of the best methods of prevention. The great injury to the young plants is done by the beetles attacking the seed-leaves, which are stores of nourishment laid up in the seed for the use of the young plant. What an important office they fill can be easily seen by cutting them away from any young seedling. As soon as the rough leaves or true leaves are formed, in all ordinary seasons, the plants will grow more quickly than the beetles can destroy them. For this reason, as soon as the turnips appear above the ground some quick-acting fertilizer such as superphosphate should be applied so as to push on the young plants past the state when they can be destroyed by the beetles. A most satisfactory result followed the mixing of 1 lb. of Paris green with 50 of plaster and sowing it along the rows. Dusting with lime or dust when the dew is on the leaves is largely practised; but if Paris green is added in the above proportion all the beetles are killed which attack the crop. The time of appearance of the different broods will vary in different localities, and this can only be learned by observation in each locality.

The Turnip Aphis (*A. brassicæ*, L.) abundant upon Swede turnips last autumn, was only reported as injurious once; this was in Victoria, British Columbia, where, however, it confined itself to the Swedes, and did not touch other varieties.

POTATOES.

Fig. 5.

Potatoes in the west are reported to have suffered severely from the attacks of a Flea-beetle, but no specimens have been sent in. *Crepidodera cucumeris*, Har. (Fig. 5) a small black flea-beetle with yellowish antennæ and legs, frequently attacks potatoes in the way described, *i.e.*, by eating small holes in the foliage. This same beetle has been sent to me by Mr. E. D. Arnaud, of Annapolis, N.S., who found it in numbers upon his young tomatoes as soon as they were set out. He had tried a weak solution of carbolic acid, but without much effect. The Colorado Potato Beetle was very destructive in many districts. A correspondent writing from the Eastern Townships of Quebec in the beginning of June, says: "I never anywhere saw the potato beetles so thick. The beetles are upon every plant and the eggs are abundant on the other side of the leaves. Unless something is done there will be a total destruction of the potato crop." Upon receipt of this letter I at once wrote a letter for the St. John's *News* urging upon agriculturists the importance of destroying the first brood and recommending the application of Paris green in the proportion of a teaspoonful to a pail of water. There should be no trouble with this pest, the liquid Paris green mixture meeting all requirements of the most exacting practical farmer. The time required for applying it is short, the cost is small, the results are certain, and there is no injury to the plant. The potato beetle has been mentioned in reports from all the eastern Provinces of Canada and from Manitoba. One correspondent, writing from Lake Temiscaming, says: "The Colorado potato beetle has played great havoc with my potatoes; out of nine bags of seed sowed last spring I shall not have five bags of crop; this is too bad, but not expecting them to turn up here I had no Paris green by me. I have it now, though, and shall be ready for them next spring." Specimens of the grey blister beetle (*Epicauta cinerea*, Forst) have been sent for identification on several occasions, and Messrs. Thomson & Fraser, florists, of Winnipeg, sent me specimens of the black blister beetle (*E. Pennsylvanica*, De G.) as the perpetrators of "considerable damage amongst potatoes."

"Black-worms," Thousand-legged worms—(*Julidæ*).

A small species of Julus has been sent in twice during the season as injuring potatoes. This is the same species as in my 1885 report I indentified as *J. cæruleo-*

cinctus, Wood. It is a rather small species, scarcely an inch in length, and banded alternately with dark brown and bluish rings. It was stated that it had injured the surface of growing potatoes in August by eating out shallow furrows on the surface of the tubers, and Mr. R. Brodie, of St. Henry of Montreal, writes that he has had several different plants attacked by it. He writes: "Another thing which is getting to be a serious matter with us is the injury done by the 'black worm' mentioned in your 1885 Report. Our rotten manure heaps are full of them; they begin with our early potato sets in spring after they are planted, and the corn in the hills. We have to put shingles under the melons or they will eat into them when they are barely ripe. They also attack tomatoes and windfalls under our apple trees. I hope we will soon get a remedy for this troublesome pest. Some talk of using salt, but I am afraid the quantity of salt it would take to kill them would destroy the growth of plants also."

In June I received specimens of the same Julus from Principal A. H. Mackay, of the Pictou Academy, N.S. He writes: "I send you to-day a species of Julus found eating the seed corn of the young growing plants. They are very abundant in this particular corn patch in a garden here. I do not know whether they do much damage or are likely to do so; perhaps they only destroy the old exhausted grain of corn."

From what is known of the habits of these creatures I fear there is no doubt that they must be considered as injurious. After detailing several attacks, Miss E. A. Ormerod in her report for the year 1885, says: "From reports sent in during the last three years it appears that millipedes live on most of our common root crops, such as mangolds, potatoes, carrots, onions, &c., likewise on young wheat and on various crops, on which they feed as the case may be—at the roots, as of peas; or at what they can reach, as celery; or on ground-fruit as strawberries. The fact of their feeding on wheat was observed more than forty years ago in the case of *Julus Londiniensis*, and without entering at too great length on details, everything confirms the fact that they are general feeders, consuming living and decayed vegetable and animal substances."

Mr. Whitehead, in his report upon hop insects (1885), says: "It is commonly held that these thousand-legs are merely attendants upon decay and do not themselves create it; but the formation of their jaws adapted for gnawing and biting proves clearly that they are active sources of injury to plants."

These creatures are not insects but belong to the myriapods. They have no wings, and although so well provided with legs cannot walk fast nor for long distances. When therefore their habits are better understood a remedy should be forthcoming. It is quite exceptional their occurring in large numbers. It is stated in Nova Scotia that they are always abundant where sawdust has been used as a vehicle for liquid manure; this then should be discarded as much as possible. They are nearly always found in damp places which would point to the advantage of draining low lands. Frequent cultivating during the summer would also be beneficial.

Miss Ormerod found that salt and water killed *Julidæ* in a short time, and she therefore advises the treatment of land or manure heaps with salt, nitrate of soda, caustic lime or gas lime. Traps are also suggested, made by placing slices of mangolds, carrots or vegetable marrow upon the ground, an expedient which is tried with good results in Germany.

The large species of *Julus*, two inches and a-half in length by nearly a quarter of an inch in width which is sometimes found under rotten logs is named *Julus Canadensis*. It has never so far been found injuring vegetation.

CABBAGE.

Cabbage insects during the past season, with the exception of the work of cutworms in the spring, have not been so troublesome as usual.

The Anthomyian root maggots were decidedly less destructive in every locality reported from, not only in cabbages but also in onion beds. Where the earth was kept well hoed up to the collar much better crops of cabbage were grown than where planted in the ordinary way. The most serious pest during the past year in Eastern Canada has been

"The Cabbage Worm." The Imported White Cabbage Butterfly (*Pieris Rapæ*, L.)

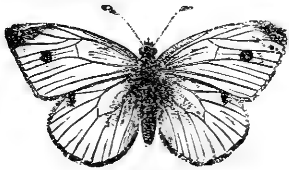

Fig. 6.

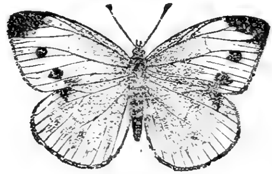

Fig. 7.

Attack.—Velvety green caterpillars, about an inch in length, with a broken yellow line along each side and an unbroken one down the middle of the back. At first eating the outside leaves, but eventually boring right into the heart of the cabbage. These, after three or four weeks produce the white butterflies so common in gardens. Fig. 6 male, fig. 7 female.

Renewed experiments with pyrethrum insect powder mixed with four times its weight of common flour, have proved to be most successful, and I consider this to be undoubtedly the best remedy for this insect. Cabbages treated three times were perfectly free from worms The applications were made by puffing a small quantity of the powder into the heads in the middle of July and at the beginning and end of August. Mr. R. B. Whyte, of Ottawa, writes: "Last spring, on your recommendation, I tried the effects of insect powder as a remedy for the ravages of the cabbage-worm. For several years previously I had great difficulty in growing cabbage, and always lost a large part of the crop. A few days after the first appearance of the worm I applied the powder by means of a small bellows, such as druggists sell for 15 cents. I walked along the rows compressing the bellows once and sometimes twice about 8 inches above each plant. One ounce of powder, costing less than 10 cents, entirely cleared 150 plants. On examining the plants three days afterwards, not a single living worm could be found. Three or four weeks afterwards I noticed that another brood was beginning to hatch out, so I applied the powder again, with the same results."

When attending a meeting of the Frontenac Farmers' Institute, held last June in Kingston, the statement was made that gardeners were giving up growing cabbages owing to the trouble they experienced with this insect. I strongly advised them to try the pyrethrum remedy, and some of those present said that they would do so. In a late letter from Mr. Alexander Ritchie, the Secretary of the Institute, the following encouraging words appear: "We have more cabbage this year than we ever had before, and scores of others say the same, all due to your remedy for the cabbage-worm."

A satisfactory discovery I have made during the past season is that the small parasite which is so useful in the United States, *Pteromalus puparum*, is present in many parts of Canada and at Ottawa in very large numbers. Mr. W. H. Harrington took it at Sydney, Cape Breton, Professor A. H. Mackay sent it to me from Pictou, Nova Scotia, and I found it in very large numbers in the conservatory of the Experimental Farm at Ottawa, infesting chrysalids of *P. Rapæ* which had fed upon mignonette. I was unable to detect the females in the act of stinging the larvæ; but frequently found them perched upon the newly formed pupæ, and I now have about 40 infested pupæ for distribution to localities where as yet the parasite has not been observed.

Club-root of the Cabbage (*Plasmodiophora brassicæ*, Wor.)

A disease of cabbages which is very little understood by farmers is Club-root. I have received three communications concerning it. It is usually supposed to be the work of insects, but this is not the case. It is a distortion of the tissues of the cabbage root owing to the presence of a parasitic fungus. In Mr. Worthington G. Smith's "Diseases of Field and Garden Crops," (1884) is given an elaborate account of this pest. In this he says: "until the last six or seven years no one knew the cause of Club-root; but in 1876, after three years constant attention, Mr. Woronin, a Russian botanist, as completely explained the nature of the Club-root in turnips and cabbages as the Rev. M. J. Berkeley expounded the murrain of potatoes in 1846."

"The observations made by Mr. Woronin, which have several times been confirmed by others as well as ourselves, seem to place the fact beyond all doubt that clubbing is caused by a fungus (p. 94). The family to which this fungus belongs is known by the name of slime-fungi (*Myxomycetes*) which are most remarkable from the fact that they do not form cells, tissues, nor mycelium, during the time of active growth; but the protoplasm remains during that time free and collected into small amœba-like masses. When mature, however, small pieces are separated from the mass, a cell-wall is formed and the small pieces become spores for the re-production of the plant." Fungi, it must be remembered, even the microscopic species, are plants. Spores of fungi are analogous to seeds in higher vegetables. I received from Rev. Mère Marie St. Augustin, of Sillery, P.Q., some roots of young cabbage badly infested with this fungus—the roots and the galls of the fungus were also attacked by the Cabbage Root-maggot, and these had naturally been accredited with all the injury. In the letter which accompanied the specimen is the following: "I send you in a small box a specimen which is commonly called 'potato of the cabbage' without doubt on account of the resemblance in the form of this excresence on the root of the cabbage to the tuber of a potato. It appears to be due to the presence of small white larvæ which are nourished on the juice of the plant stopping its growth and killing it. We shall be much obliged if you can suggest some means of destroying the injurious insect. If it is too late this season to stop its ravages, we shall be pleased to know its name and any remedy for its attack."

Mr. R. Brodie, of St. Henry of Montreal, who is considered one of the best growers of cabbage on the Island of Montreal wrote to me in 1887: "On some of our land we cannot grow cabbage or cauliflower two years in succession on account of the worm (?) which causes Club-root. I am doubtful if it really is, as supposed, a worm which causes this big root. I have cut the root away with my knife piece by piece and could never find one. Mr. Peter Henderson, in one of his books says it is the want of lime in the soil that partly causes the Club-root. Four years ago I used a quantity of hardwood ashes on a four-acre field of cabbage, but I had to leave twelve drills without ashes as I ran short of them; these twelve rows were almost a total failure, being Club-rooted, while the others were a splendid crop averaging ten pounds per head. I find there are far more fertilising qualities in ashes than in lime and it is a wonder to me that farmers do not use more of them when they are so cheap."

Again Mr. Brodie writes this year:—

"You ask me if my treatment to prevent Club root in cabbage was again successful. In our 9 acres of cabbage and cauliflower I do not think that we found one that was Club-rooted. We gave the land a heavy coat of ashes that we had gathered round the country. I suppose they would be mixed hard and soft wood ashes. These we mixed well with the soil. We had a man following the plough with a cart-load of ashes. In scattering them he stood in the cart and held a coal-shovel full of ashes over the side shaking them off as evenly as he could into the furrows as the horse moved on. The land was heavily manured the previous year. After the plants had started to grow I applied to each plant a small handful of a complete fertilizer I procured from the Standard Fertilizing Company, Smith's Falls. This gave them a vigorous growth. We very seldom plant cabbage two years in succession on the same soil, but one of the best gardeners in this neighbourhood, who pays a high rent for a small piece of land, has planted cabbage I am sure 20 years in succession. He uses large quantities of quick-lime, and also gas-lime from the gas-works, otherwise he could not grow them at all, for the nature of his soil is more subject to club-root than mine. I use the ashes as much for their fertilizing qualities as for their prevention of club-root, but quick lime has hardly any fertilizing qualities that I am aware of."

This experience of Mr. Brodie's is very valuable, because it can be tried by everyone.

Mr. Worthington Smith recommends such an alternation of crops for two or three years, that the spores of the fungus may be exhausted before a cruciferous crop is again cultivated on the same land. He says:—"Beyond all other things it is necessary that old club-root should not be allowed to remain on the ground where turnips or cabbages are to be grown. All the diseased material should be gathered into a heap and, if possible, burnt. No sane healthy person would remain in a place tainted with contagia of dead and diseased animals, and it is equally unsafe to place sound plants, tubers, or seeds amongst dead or diseased vegetable refuse. In one case, as in the other, certain individuals may, perchance, escape; but the general result is the healthy organisms are at length destroyed by the dead or diseased ones."

Cut-worms.

Of all the injuries committed year after year upon field and garden crops, there are none concerning which more enquiries are made, than of the various caterpillars known as Cut-worms. During the past season, however, possibly owing to the exceptional climatic conditions during the autumn of 1887 and the spring of 1888, various species of these caterpillars appeared in overwhelming numbers, in all directions. During the month of June letters and specimens poured in. There was no province in the Dominion from which complaints of their depredations were not received. From British Columbia I received the variegated Cut-worm (*Agrotis saucia*), and some chrysalids which turned to *Ag. obeliscoides*, Guen. From Manitoba, the W-marked Cut-worm (*Ag. clandestina*, Har.) and *Ag. declarata*, Mor. From New Brunswick, the Gothic Dart moth (*Ag. subgothica*, Haw.) From Nova Scotia came the last named and the Lance Rustic (*Agrotis ypsilon*, Ratt.), and from Cape Breton, the caterpillars of a moth, which has been kindly identified by Prof. Riley as *Ag. turris*, Grote. In addition to these, various letters described their ravages without sending specimens.

Rev. J. B. Hemmeon, of Wolfville, N.S., says: "The Cut-worm is very prevalent this year, destroying acres of cucumbers and other things planted for pickling factories."

Prof. J. Burwash, of Mt. Allison University, Sackville, N.B., sent specimens of two species of larvæ which, he writes: "Have been doing considerable damage in this neighbourhood and generally throughout the county of Westmoreland, N.B. They work under the ground at a short distance from the surface, and bite off the plants at the beginning of the stem. They prefer beets, mangolds, or carrots; but have also cut down peas, corn and onions. The beets have, in some place, been completely destroyed by them."

Dr. R. A. H. McKean, writing from Cow Bay, Cape Breton, N.S., says: "I send you a few specimens of a grub* which has been, for years, playing a great deal of mischief in our gardens in this county, and which is likely to ruin not only our gardens, but grain fields as well. When my peas, beans and mangolds were well up I noticed the peas cut off near the ground; examination showed the work to have been done by a grub similar to the specimen forwarded. One or two were found round some of the stocks, but in a day or two they increased in number, extending their operations to the beans, beets, squash, spinach, &c., and now I find a small piece of southern corn, put in as an experiment, also receiving attention. As it looks at present, gardens will be stripped of everything green and succulent. In the country districts, I hear that oat fields are suffering in the same way, and will have to be resowed. I tried a strong decoction of tobacco round my peas and beans; but I cannot say that the grubs objected to 'the weed.' Others have experimented with hellebore, but to no purpose. The fertilizer I used was a mixture of horse and cow

*These produced the moth *Agrotis turris*, Grote.

manure in some places, and well-rotted compost of the above with black bog-mud in others; but I could see no difference in the number of grubs or their activity. In one instance kelp has been tried; but with, if anything, more grubs in that garden than in others."

Mr. C. W. C. Bate also says: "My father writes me from Killarney, Manitoba, that his kitchen garden is being ruined by the attacks of what he takes to be the Cut-worm."

These are samples of a large number of similar letters, and in this district the same state of affairs occurred as is described above. In May and June the fields simply swarmed with these injurious caterpillars, and great injury was done to field crops. When Cut-worms only appear in their ordinary numbers, there are certain remedies by which their ravages can be kept within bounds; but when they suddenly occur in the countless myriads, as our fields were overrun by last spring, all ordinary methods of meeting their attacks prove entirely inadequate. Cut-worms are the caterpillars of dull-colored active moths belonging for the most part to three genera, namely, *Agrotis, Hadena* and *Mamestra.* Now, these three genera alone contain more than 340 described species. Of course the different species vary somewhat in their habits, but taken as a class they are very similar, and in the present state of our knowledge, it will be more convenient to treat them as a class, at any rate in a report like this, which is prepared particularly with the hope of helping farmers to overcome their insect foes. As Cut-worms are the caterpillars of so many different species of moths, the inaccuracy of speaking of them as *the* Cut-worm is apparent. Moreover, many other insects are sent in and reported upon as Cut-worms which do not belong to this class at all. Of these the White Grubs, the larval state of the June Beetles (*Lachnosterna*) are most often referred to. There is some reason in this, from their occasional habit of biting off plants in the manner of the true Cut-worms, which are the caterpillars of the moths referred to above, and may be described in a general way as smooth, almost naked, greasy-looking caterpillars of some dull shade of colour similar to the ground in which they hide during the day. The head is smooth and shining, and sometimes of a different colour from the rest of the body. On the top of the segment next to the head, is a smooth chitinous plate known as the thoracic shield. There are generally about six series of bristle-bearing tubercles along each side of the body, and when disturbed the caterpillars curl up into a ring.

Their habits are almost always nocturnal, lying hid by day just beneath the surface of the soil; they come out at night to feed. When, however, they develop in large numbers they frequently change their habits and feed by day, owing probably to the reduced food supply consequent upon their ravages. The habits of most Cut-worms are probably as follows:—The egg is laid in the spring, summer or autumn, and the insects may pass the winter either in the perfect moth state, as a young half-grown caterpillar or as a chrysalis. Those which hibernate as moths lay the spring eggs and moths are produced again before winter sets in. The eggs which are laid in the summer or autumn hatch soon after and the caterpillars either become full fed the same season and pass the winter underground in the chrysalis state or after feeding for a short time become torpid and pass the winter as half-grown caterpillars. In this condition they may be found late in the autumn under stones, logs or heaps of dead vegetation, in the roots of grasses, or in cells beneath the surface of the ground. The ravages of the young caterpillars which hatch in the summer and autumn, are seldom noticed then, on account of the abundant vegetation at those seasons. In the spring, however, not only are the caterpillars much larger and capable of more mischief but the land is cleared of all weeds and vegetation, other than the crop which is to be grown, and when the Cut-worms, revived by the warmth of the sun and the opening of spring, come from their winter retreats, there is nothing for them to eat but the farmer's early crops. They are particularly troublesome in gardens, cutting off young cabbages, tomatoes and other plants as

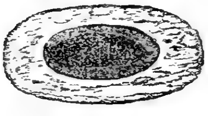

Fig. 8.

soon as pricked out. When the caterpillars are full-fed they burrow into the ground to a depth of a few inches and turn to brown chrysalids inside a smooth cell or a light cocoon (Fig. 8). From these after a few weeks the perfect moths emerge. They are very active at night, and when disturbed have the same habit as their caterpillars of dropping to the ground and remaining perfectly still as if dead. From their dull colour they are then difficult to find. When at rest their wings lie horizontally over their backs and the upper ones entirely cover the lower pair. The upper wings are generally crossed with one or more waved lines and always bear two characteristic marks, one about half way down the wing, orbicular in shape, the other, nearer the tip, reniform or kidney-shaped.

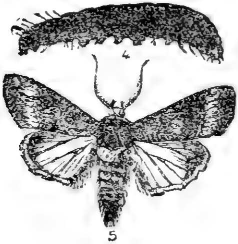

Fig. 9.

Fig. 9 shows a common and very injurious species, the Lance Rustic Moth (*Agrotis Ypsilon*) and its caterpillar, the Greasy Cut-worm.

From their nocturnal habits Cut-worms frequently do a great deal of harm to vegetation without being recognized as the cause. It is important in the view of discovering useful remedies to ascertain as soon as possible the habits of all these caterpillars.

Those of which the preparatory stages are known may be divided into three classes: 1. Climbing Cut-worms, or those which climb trees and destroy the buds. 2. Surface Cut-worms, or those which live on the surface of the ground and cut off herbaceous plants just beneath the level of the soil. 3. Those which combine both of these habits.

Of the first class we cannot have a better example than the Common Climbing Cut-worm (*Agrotis scandens*, Riley). This species was abundant last spring, but as a rule is rather a rare species here, although I have specimens from several localities in Western Canada. The caterpillar attacks the apple, and is sometimes very injurious, eating out the buds just as they are expanding. "It is of a light yellowish gray colour variegated with dull green, with a dark line down the back, and fainter lines along the sides; the spiracles or breathing pores are black. When full grown it is nearly an inch and a-half long." (Saunders, W. Insects Inj. to Fruits, p. 108.)

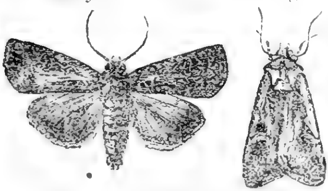

Fig. 10—*A. subgothica* showing wings expanded and folded.

Of the second class or Cut-worms proper, tchere are many species, perhaps the best known of which is the Dingy Cut-worm, the aterpillar of the Gothic Dart Moth (*Agrotis subgothica*, Haw.) There are, however, several species almost identical in general appearance and habits. Frequently observers collect several specimens, supposing them all to belong to the same species; but when the moths appear they find that they have been dealing with four or five different kinds. This was my own experience during the past season. From cages supposed only to contain one species I obtained specimens of *Agrotis campestris*, *A. Ypsilon*, *A. volubilis* and *A. subgothica*. I unluckily omitted to take exact descriptions of the larvæ and their colorational differences; but their habits were all similar and the same remedies would apply for all. The Dingy Cut-worm is found over a very large area. From the Atlantic to the Pacific in Canada, and it also occurs in Europe. The colours are very variable but may be described as follows: Head grey, shiny and speckled. Thoracic shield on first segment bearing three white stripes. General colour of the body grey with a wide brownish stripe down the back and three indistinct stripes along the sides. The bristle-bearing tubercles black and conspicuous. When full grown it is about an inch in length.

Of the third class which both destroy low vegetation and climb up trees and bushes and destroy the buds, no better example can be cited than the Variegated Cut-worm, the caterpillar of the Un-Armed Rustic Moth (*Agrotis saucia*, Treit.) This was a very abundant species last spring. Mr. E. Hutcherson, writing from Ladner's Landing, British Columbia, sent in June last specimens of this species, in both the larval and pupal stages. It is a large and most voracious species. Dr. Thomas in the Seventh Illinois Report says: "This is widely distributed and it is probable that we have no other species that is more voracious or is a more general feeder. While some kinds of Cut-worms are not found much out of certain situations, this may be sought in any place during its season, with a good prospect of finding it. There seems to be no cultivated crop that are free from its attacks, and when these are not at hand it feeds readily upon weeds that are found in the fields and by the roadsides."

I have taken this species also in Victoria, B. C., where it was most troublesome, attacking all kinds of vegetables in market gardens.

Mr. Hutcherson writes: "I send you several grubs which are doing great destruction here at the present time. As you will see they are ground grubs burrowing in the ground in the day time and working at night. I am eager to know the best remedy for destroying them as well as their history. Would gas-lime destroy them? If so how should I employ it and what danger would there be to vegetation?" And again later he writes: "I send you to-day a packet containing grubs in the chrysalis stage as I expect those sent before would reach you in such damaged condition as to be useless. I might say the ground is full of them, scarcely a square foot without a grub in it. They have damaged my grafts and one year old trees pretty badly by eating off the tips."

The caterpillar is large, nearly two inches in length when walking, of a light slate colour mottled or marbled with irregular pinkish, grey, and deep black elongated marks which make two broken and indistinct lines along the sides. Beneath the breathing pores a pale stripe. Head, grey, mottled. The moth is a large species of very variable appearance, expanding one inch and three-quarters, usually of a pale brown colour with a few indistinct black marks on the upper wings, the lower wings whitish in the centre and brown outside.

Another species with the same habit as the above, of occasionally climbing up trees and bushes is called the Yellow-headed Cut-worm, the caterpillar of the Amputating Brocade Moth (*Hadena arctica*, Bois.) Fig. 11.


Fig. 11.

This was remarkably abundant in the perfect state during the months of July and August flying into rooms at night by hundreds. The larva was not recognized amongst the injurious Cut-worms collected. It is described as "of a smoky or livid brown colour, with a yellow or chestnut coloured head, and a horny shield of the same colour on the first and last segments of the body. It grows to a larger size than most of the other Cut-worms, and is peculiarly destructive, because it severs the plant about an inch below the surface of the ground, thus destroying it irremediably. They also attack the corn till a later period than some others." (G. J. Bowles in An. Rep. Ent. Soc., Ont, 1887, p. 39.) The moth is a very beautiful creature expanding nearly two inches. The general colour is rich reddish brown, mottled with clear grey. In the centre of each of the upper wings is a bright red V-shaped space containing the ordinary round and kidney-shaped marks of the family. Exterior to this red space are two irregular bands, the first grey and a terminal dusky band. These are divided by a white line shaded with brown within. The thorax and the body are ornamented with reddish tufts.

Remedies—There are many remedies which may be tried for Cut-worms, some of which will usually answer the required purposes. When, however, as stated above, the caterpillars appear in enormous numbers and materially reduce their own food supply, no remedies except killing them will prevent them from attacking plants. There are a great many beneficial insects which help to keep these pests in check. Various Hymenopterous four-winged flies attack them as well as the parasitic Tachina flies and true Bugs. In addition to these, however, there are some large ground beetles known by the name of *Calosoma*. These should be known by sight by every gardener and farmer; they are amongst his best friends; but being usually found amongst the injured plants where they are hunting for the injurious Cut-worms their mission is misunderstood and they are frequently destroyed. Fig. 12 shows the Fiery Ground Beetle (*Calosoma calidum*, Fab.) a common and very useful species, the grub of which has been styled the "Cut-worm Lion."

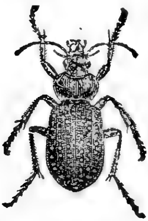

Fig. 12.

Artificial remedies will, of course, vary with the habits of the caterpillars to be guarded against.

For the Climbing Cut-worms the best remedy is to place round the stem of the tree or bush to be protected a strip of tin six inches wide; the lower edge can be pressed into the ground and the tubular shape is easily preserved by securing it above with a piece of twine. This will effectually keep all Cut-worms from the tree, for these heavy-bodied caterpillars are unable to crawl over the smooth surface. A similar expedient is to tie a band of cotton batting round the stem. The caterpillars being unable to crawl over this yielding material.

For Surface Cut-worms the most efficient remedies are the following:—

1. Keeping down all weeds in the late summer and autumn months, so as to deprive those species which hatch in the autumn of their food supply and winter shelter.

2. Late ploughing in autumn or winter so as to disturb them after they have gone into winter quarters. The value of this treatment lies chiefly in breaking the cell they have made as a protection from the cold of winter, at a time of the year when they will be unable to make another.

3. Burning off all stubble and rubbish as late as possible in the spring when many of the caterpillars and the eggs of some species will be destroyed.

4. Placing some substance with an obnoxious odour around young plants when first set out, as fresh gas lime, sand or sawdust saturated with coal oil or carbolic acid.

5. Traps.—Prof. Riley has found that they may be destroyed in large numbers by setting poisoned traps between the rows of the crop to be protected. These are made as follows, having procured a supply of some succulent plant as grass, clover, or "lamb's quarters," (*Chenopodium album*, L.), tie them in loose bundles and sprinkle them heavily, or dip them in Paris Green and water. These are placed between the rows. Tying the plants in bundles has the effect of keeping the traps green and fresh for a longer time. "Lamb's quarters" is a favourite plant with many kinds of Cut-worms and it will be noticed that where this weed grows, it is much more attractive than most plants grown as crops. This plant springs up everywhere in cultivated land. I believe that if strips of it were left at intervals in the fields, they would draw off the attack from the crops. A noticeable feature with this weed is the ease with which it can be destroyed. From the habit Cut-worms have of cutting off the stem of an attacked plant and remaining close to its root in the day time, and from the fact that when this plant is injured it fades quickly and turns to a whitish tint, the presence of Cut-worms in these rows can be detected at a glance, after a couple of hours of sunshine. The caterpillars should then of course be dug out and destroyed. After the season for the Cut-worms has passed by, these strips can be run over with the cultivator and will be of no further trouble.

6. Wrapping.—Young tomatoes and cabbages may generally be protected in a large measure from the attacks of Cut-worms, by simply wrapping a piece of paper around the stems at the time of planting, care being taken that it reaches above the ground for about an inch. This remedy usually answers well; but last spring not even paper saturated with a mixture of coal oil and linseed oil kept the hungry myriads from the young tomatoes and cabbages. The same remedy is sometimes used in a modified form by making a cornucopia of paper and after putting some earth in it, put in the plant and sink it in the ground and fill up, leaving two inches above the ground. In short the plant is planted in the cone of paper. By the time the roots have reached the paper it is decayed and forms no barrier to root growth.

A similar expedient is to place tomato tins, with the tops and bottoms cut out, over young plants, the caterpillars being unable to crawl over the smooth tin.

7. Ditching.—It must be remembered that Cut-worms are essentially vagrants. They never stay long in any one place, but crawl long distances at night from place to place. In years of very bad attack, it usually happens that certain fields are free from attack, whilst most of the others are badly infested. To prevent Cut-worms from leaving a certain field or to keep them out of another, ploughing a deep furrow has been found useful in confining their ravages.

All the above named remedies have been tried and found useful, but in years of great abundance they fail to protect the crop entirely. This fact is illustrated by our Ottawa experience of last season and by the following letter from Mr. G. A. Knight, of Mount Tolmie, Victoria, B. C. As I have received many enquiries as to the value of gas-lime, I insert the letter in full:—

"With regard to Cut-worms I am afraid gas-lime is a failure. In January I put it on very thick—1,500 lbs. on $\frac{1}{3}$ of an acre. I was afraid I had it too thick; but I ploughed it in, and in March I ploughed the land again. I then saw that the land was thick with the larvæ of a *Tipula*, and even where the lime was dumped they were there as well by the thousand. In some places I also saw earth-worms, but no signs of Cut-worms I sowed part with beet-root, carrots, and peas. Everything went splendidly until all the seeds were up about one or two inches high. The peas were sown sometime after the other seeds, so they all came up about the same time. I may say that before this we had had a lot of cold, nasty weather and things made scarcely any growth. All at once it cleared up and the sun came out hot for a week, and then as if by magic, the Cut-worms made their appearance. They were very small at first, but soon grew to be half an inch and one inch long. I had a lively time with them. In some places they cleared off everything. I sowed carrots three times, but the last lot did not come up until the middle of July, which is too late for them to do anything as it is too hot and dry then. My onions were all taken of the first sowing, and they served my nursery stock very badly. They would cut the plum and apple buds clean out. I mixed Paris Green with lime and put it on so thick that I killed the foliage and bark; but no dead Cut-worms could I find. I tried saltpetre and ashes, but that was no good. As for the traps you speak of they were no good with me either. What is to become of the cabbage plants when there are no leaves or clover for traps, and other things that are sown in March and are up and taken before there is anything to make traps with? The traps, too, soon wilt with the sun and wind, and Cut-worms, here at any rate, will not eat that stuff when they can get a carrot or an onion an inch high.

"I cannot altogether condemn the gas-lime, although I have no faith in it, because it did not kill the *Tipulas* nor the weeds. Chickweed came up by the millions before anything else, and I put no manure on the land. The Cut-worms might have come from the land on both sides, but I believe not, because they were so small At any rate it is a splendid fertiliser, whatever plants were left by the grubs grew very rank and strong."

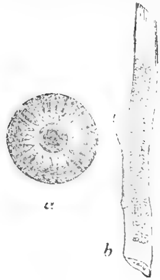

Fig. 13.

Specimens of Cut-worms sent to me by Mr. Knight, produced *Agrotis saucia* and *A. obeliscoides*. With regard to the first of these it was discovered by Prof. Riley, that the eggs (Fig. 13) were laid upon the twigs of trees, and he thinks it probable that the moth hibernates in the perfect state, so that while Mr. Knight may have destroyed many larvæ by the use of the gas-lime, those which attacked his crop might have been produced in the spring from eggs laid upon trees growing in his garden, after the gas-lime had lost its effect. A light sprinkling of fresh gas-lime amongst cabbages and onions has the effect of keeping off the flies which are the progenitors of the Root Maggots, and it seems probable that Cut-worms might have been kept from attacking these beds had they been treated with one or two light sprinklings in the spring.

Empusa (Entomophthora) virescens, Thaxter. A beneficial parasitic fungus.

In 1884, fields and gardens were over-run by vast hordes of a black velvety Cut-worm, with white lateral stripes and a red head. These turned out to be the larvæ of *Agrotis fennica*, Tausch. About the 22nd May, it was noticed that many of these larvæ were attacked by a fungous disease with such virulence, that but a small proportion could become pupæ. In certain fields they were to be seen in large numbers on stones, fences, stems of grasses and other plants up which they had crawled, and to which they were fixed by the fungus. This seemed in nearly all cases to emerge from the body just below the head, in the shape of a small tuft of white downy matter. After a short time the bodies dried up. Specimens of this fungus were sent to Mr. Roland Thaxter, Cambridge, Mass., who has just published a monograph of the Entomophthoreæ of the United States. "These are minute fungi possessed of an individuality of their own that renders them susceptible of consideration apart from all other forms of plant life. This peculiarity consists in an obligatory parasitism upon insects, which, although in some instances it exists without apparent injury to the insect host, is usually of such a nature as to cause its death; often resulting, especially amongst noxious insects, in widespread mortality."

A well known instance of these fungi is the *Empusa muscæ*, Cohn, which causes the death of house flies in the autumn, when they may be found attached to walls or windows by their tongues and surrounded by a white cloud of the spores of the fungus which had destroyed them.

Although so abundant at Ottawa in 1884, and notwithstanding that close search was made constantly since that time, no further specimens could be found until this spring, when a few specimens were discovered upon stems of grass in a hay field in June. When the specimens were sent to Mr. Thaxter he recognized them as belonging to an undescribed species and in the monograph referred to he describes it as follows:—

Empusa (Entomophthora) virescens, Nov. Sp.

Conidia, ovoid to oblong, of irregular shape; with bluntly rounded base and apex, the former often hardly papillate and not well distinguished from the apex; colour greenish yellow in dried material; containing numerous small, irregular, often rod-like fat bodies; measurements, 10 by 20 m.—16 by 36 m., average 14 by 30 m. *Conidiophores* digitate, arising indirectly from spherical hyphal bodies which germinate in all directions, giving rise to very numerous hyphæ which subsequently become conidiophores, *Cystidia* not observed. Secondary conidia like the primary. Resting spores unknown. Host attached to substratum by rhizoids.

Hosts. Lepidoptera: Larvæ of *Agrotis fennica.*

Habitat, Ottawa, Ontario.

REPORT OF THE HORTICULTURIST.

(W. W. HILBORN.)

Prof. WM. SAUNDERS,
Director of the Dominion Experimental Farms,
Ottawa.

SIR,—I have the honour to submit herewith a report on the progress made in the horticultural department of the Central Experimental Farm, Ottawa, during the past year. I have also added a list of the varieties of fruit trees planted on the farm.

As stated in my last report 216 apple trees, out of a collection of 903, were transplanted from the nu rsery rows in the autumn of 1887, to an orchard, with the view of testing the relative merits of fall and spring planting. Most of these were standard sorts such as are in general cultivation in Ontario, with a few Russian varieties. The summer and autumn were both unusually dry and unfavourable for newly planted trees and the lack of moisture in the soil at the time of planting was very unusual. The winter was severe, the thermometer having gone as low as 40 below zero.

When the snow disappeared in the spring it was found that nearly all these autumn planted trees were more or less injured, many of them killed down to the snow line. The fact that such varieties as Duchess of Oldenburg, Tetofsky and Fameuse, of which there are healthy bearing trees growing unharmed within a short distance of the farm suffered equally with the tender sorts, showed clearly that these failures were due to the unfavourable season for planting rather than to lack of hardiness in some of the sorts tested.

In the autumn of 1887, 200 apple trees were procured of the following varieties: 100 Wealthy, 50 Duchess, and 50 Tetofsky. These were got with the intention of planting them in the spring for top grafting with new varieties as soon as they should become established These trees were obtained from Fonthill where the soil had been more moist, they arrived in good condition, were "healed in" for the winter and in the spring were found in excellent order alive to the tops of the branches.

The trees left in the nursery rows did not suffer to nearly the same extent as those in orchard. Many of the larger trees were injured, but most of the smaller ones, among which were nearly all the Russian sorts, came through the winter in very fair order. These smaller trees, however, had the advantage of being more protected with snow than the larger ones.

The orchard of standard apples was replanted and enlarged, and it now contains 390 trees, most of which have made a fair growth. The trees have been banked up with earth in the same manner as last year to a height of 12 to 15 inches and good results are hoped for. It contains the following varieties:

APPLES.

American Pippin.	Nonpareil.
Baldwin.	Nodhead.
Blenheim Orange.	Orange Winter.
Bombarger.	Peck's Pleasant.
Belle de Boskoop.	Pewaukee.

Brewington.	Pomme Grise.
Beauty of the World.	Peach of Montreal.
Bottle Greening.	Plums Cider.
Chenango Strawberry.	Primate.
Canada Baldwin.	Richard's Graft.
Cooper's Market.	Red Astrachan.
Cranberry Pippin.	Roxbury Russet.
Duchess of Oldenburg.	Ribston Pippin.
Duke of Connaught.	R. I. Greening.
Early Strawberry.	Red Beitigheimer.
Fameuse.	Red Utters.
Fall Pippin.	Shannon.
Fallawater.	Sweet Bough.
Fall Jennetting.	Sutton Beauty.
Fanny.	Salome.
Grimes Golden.	St. Lawrence.
Gravenstein.	Snyder.
Hurlbut.	Saxton.
Haas.	Stump.
King of Tomkins.	Scott's Winter.
Keswick Codlin.	Swayzie Pomme Grise.
Lady.	Spitzenburg.
Lord Suffield.	Tetofsky.
Lawyer.	Talman Sweet.
Lady Henniker.	Wagener.
Maiden's Blush.	Walbridge.
Mann.	Warner's King.
McMahon's White.	Wealthy.
McIntosh Red.	Winesap.
Magog Red Streak.	Winter St. Lawrence.
Northern Spy.	Yellow Bellefleur.

The following collection of Russian Apples was procured from various sources, most of them in the spring of 1887; they were grown one year in nursery row, and then planted out in orchard twenty feet apart each way.

RUSSIAN APPLES.

No.	Adopted American Name.	Russian Name.
15	Avenarius.	Sussapfel von Avenarius.
60	Red Pine.	Ananasapfel rother.
122	Revel Borsdorf.	Borsdorfer Revaler.
153	Transparent Naliv.	Skvosnoi naliv.
157	White Naliv.	Bielui naliv.
161	Longfield.	Langerfeldskoe.
169	Green Sweet.	Zelenka sladkaya.
170	Revel.	Revelskoe.
181	Champagne Pipka.	Pipka champanskaya.
183	Burlovka.	Burlovka.
184	Arabka.	Arabkoe.
185	Anisovka.	Anisovka.
187	Green Glass.	Steklianka zelenka.
188	Yellow Arcad.	Arkad jeltui.
190	Tiesenhausen.	Tiesenhausenskoe.
200	Rosy Repka.	Riepka vosavaya.
202	Hare Pipka.	Saitchia pipka.
230	Titovka.	Titovka.

No.	Adopted American Name.	Russian Name.
236	Antonovka.	Antonovka.
240	Lejanka.	Lejanka.
242	Broadcheek.	Schirokolitchiko.
245	Borovinka.	Borovinka.
252	Aport.	Aport.
261	Repka Aport.	Rieptchatui aport.
262	Charlamoff.	Charlamovskoe.
264	Scented.	Duchovoe.
265	Gorko Pipka.	Pipka Gorkaya.
267	Pear.	Gruschovka.
268	Zakoritnoe.	Zakoritnoe.
274	Rosy.	Rosovoe.
277	Vargul.	Vargul.
282	Voronesh Reinette.	Renet Voroneshskui.
284	Kremer's Glass.	Steklianka Kremera.
290	Ukraine.	Ukrainskoe.
304	Switzer.	Suislepper.
313	Muscatel.	Muscatapfel (Livlander Rgl.)
315	Herren.	Herrenapfel.
316	Red Reinette.	Reinette rothe.
317	White Pigeon.	Golubinoe (bieloe not Rgl.)
322	Cinnamon.	Koritchnevoe.
324	German Calville.	Niemetskui kalvil.
(327)	Yellow Arcad (188)	Joltui arkad.
332	Early Prolific.	Plodovitka rannaya.
334	Yellow Transparent.	Skvosnoe jeltui.
337	Serinkia.	Sierianka.
338	Revel Pear.	Gruschevka Revelskaya.
342	Thaler.	Charlottenthaler gelber.
344	Sultan.	Sultanapfel.
352	Resonant.	Svonkoe.
361	Pointed Pipka.	Pipka ostrokonetchnaya.
362	Lead.	Svintsovka.
367	Red Streak.	Polosatoe.
368	Sugar Miron.	Miron sacharnui.
371	German Skrute.	Skrute Niemetskui.
375	Cinnamon Pine.	Koritchnevoe ananasnoe.
378	Hibernal.	Osimui.
382	Green Butskaya.	Butskaya zelenka.
387	Good Peasant.	Dobrui krestianin.
393	Imperial Citron.	Tsitronnoe Tsarskoe.
398	Enormous.	Krupneena.
406	Sweet Pipka.	Pipka sacharnaya.
407	Blackwood.	Tchernoe derevo.
413	Cross.	Skrijapel.
428	Fonaric.	Fonarik Nalivnui.
441	Rattle.	Gremuschka.
442	Yellow Calville.	Kalvil jeltui.
447	Keiv Reinette.	Renet Kievskui.
453	Beautiful Arcad.	Arkad krasivui.
469	Grandmother.	Babuschkino.
470	Lapouchoe.	Lapouchoe.
471	Prolific Anis.	Anisovaya plodovitka.
472	Ostrokoff.	Ostrokosvkays steklianka.
477	Christmas.	Roshdestvenskoe.

No.	Adopted American Name.	Russian Name.
478	Thin Twig.	Tonkovietka polosataya.
502	Rambour Reinette.	Russkui ramburovui renet.
580	Winter Livland.	Livlandischer winter.
5[illegible]7	Sandy Glass.	Pesotchnoe steklianovoe.
5[illegible]	Romenskoe.	Romenskoe, also Romnenskoe.
60[illegible]	Long.	Dlinnoe.
874	Sweet Borovinka.	Borovi[illegible]ka sladkaya
97[illegible]	Golden White.	Biel zolotovskaya.
984	Kursk Anis.	Anis Kurskui.
[illegible]85	Red Anis.	Anis krasnui.
987	Yellow Anis.	Anis jeltui.
985	Pine Apple.	Ananasnoe.
	Imported by Iowa Agricultural College from Moscow.	
7 M.	Osimoe.	Osimoe.
1[illegible] M.	Vargulek.	Vargulek.
1[illegible] M.	Anisim.	Anisimovka.
17 M.	Kruder.	Kruder oder blauer.
2[illegible] M.	Melonen.	Melonen oder nonnen.
[illegible]0 M.	Ledenets.	Ledenets.
3[illegible] M.	Anis.	Anis.
37 M.	White Borodovka.	Biel borodovskoe.
51 M.	Avenarius.	Pipka sladkaya.
53 M.	Blackwood.	Tchernoe derevo.
5[illegible] M.	Great Mogul.	Vilikui Mogul.
[illegible]	Broad Green.	Nalivnoe zelenui schirokui.
[illegible]4 M.	[illegible]	Bergadorvskoe.
97 M.	Marble.	Mramornoe.
107 M.	Serinkia.	Lehmapfel (Serin[illegible]ka).
11[illegible] M.	Cha[illegible]ne.	Champanskoe.
122 M.	[illegible]	Berezinskoe.
144 M.	Marmalade.	Marmeladnoe.
	Bogdanoff's Glass.	Steklianka Bogdanoff.
	Altriston.	Altriston.
	Red Jungfern.	Rother jungferr.
		Langer gruner gulderling.
	Nitchner's Strawberry.	Nitchner's erdbeerapfel.
	Stettiner's Kantapfel.	
	Cinnamon Streaked.	Koitchnevoe polosatoe.
	Jeltin biel.	
	Riga Naliv.	
	Nonnen.	
	Schwarze Gans.	
	H[illegible]lian.	
	Melana.	
	Malus Toringo.	
	Zaffed Prookan.	
	Red Serinkia.	Rother Serinkia.
	Danziger Kantapfel.	
	Russian Transparent.	
	Romenskoe.	
	Possart.	Possart's Nalivia.
	Strawberry Streaked.	Erdbeer Streifling.
	Simbirsk.	
	Rotta.	
	Rheinischer Bohnapfel.	
	Stettin.	

Citronat.
Foundling, of U. S.
Red Aport.
Red Sweedish.
Crimea.
Winter Citronen Apfel.

This orchard contains in addition to the 184 sorts of Russian apples given above, 16 varieties of crab apples, while adjoining orchards contain 68 sorts of pears, 67 of plums, 70 of cherries, 5 of apricots and two of peaches. Many of these are from Russia and other parts of northern Europe and are believed to be among the hardiest varieties obtainable.

These combined form a total of 362 named varieties to which must be added a number of seedlings, making 1,020 trees in all.

They have been planted 20 feet apart each way, well cultivated during the summer and earth drawn up around the base of them for protection through the winter. They consist of the following varieties:—

CRAB APPLES.

Bowman.
Dartmouth.
General Grant.
Hyslop.
Hesper Rose.
Lady Elgin.
Marengo.
Martha.
Orion.
Oblong.
Orange.
Quaker Beauty.
Red Siberian.
Transcendant.
Van Wyck.
Whitney.

PEARS.

Angouleme.
Beurre Hardy.
Beurre de Anjou.
Beurre Clairgeau
Beurre Easter.
Bartlett.
Clapps Favourite.
Countess Clara.
Cure Carnoy.
Coeman's Butter.
Doyenne d'Eté.
Doyenne Boussock.
Duchesse de Bordeaux.
Easter Belle.
Flemish Beauty.
Frederick Clapp.
Goodale.
Howell.
Indian Queen.
Josephine de Malines.
Napoleon's Butter.
Kieffer.
Lawrence.
Louise Bonne de Jersey.
Lucy Greive.
Margaret.
Mt. Vernon.
Mille Blanche Saunter.
Osband's Summer.
Peffer No. 2.
Peffer No. 3.
President.
President Drouard.
Ritson.
Sheldon.
Seckel.
Summer Belle.
Tyson.
Theresa.
Vicar of Winkfield
Zoe.

	Adopted American name.	Russian or foreign name
122	Autumn Bergamot.	Bergamot osennui.
345	Long-stem.	Dolgokvostka morosovskaya.
358	Juicy Gliva.	Gliva otschen sotchnaya.
361	Victorina.	Victorina mnogoplodnaya.
392	Kurskaya.	Gliva Kurskaya.
395	Red Bergamot.	Bergamot krasnui.

	Adopted American name.	Russian or foreign name.
396	Flat Bergamot.	Bergamot ploskui.
418	Early Bergamot.	Bergamot rannaya.
439	Double Beurre.	Maslitchnaya dvoinay .
508	Seedless.	Bessemianka.
513	Thin Twig.	Tonkovietka.
516	Lemon.	Limonnaya.
520	Sapieganka.	Bergamot Sapieganka.
4 M.	Dula.	Dula.
9 M.	Winter.	Osimaya.
12 M.	Saccharine.	Sacharnaya.
13 M.	Strawberry.	Semlianitchnaya.
15 M.	Czar.	Tsarskaya.
107 Vor.	Bear.	Medviedevka.
109 Vor.	Scented.	Duchovaya.
Orel, No. 16	Waxen.	Voskovaya.
	Large Sugar.	Zucherbirne grosse.
	Green Wine.	Weinbirne, grune.
	Junfer.	Junferbirne.
	Pound.	Pfundbirne.
	White Livland.	Butterbine weisse Livlandescho.
	Vinograd.	Vinogradnui.

AMERICAN AND FOREIGN PLUMS.

Admiral.
Adirondack.
Beauty of Naples
Botan.
Briton.
Belmore.
Bradshaw.
Bryanston's Gage.
Communa.
Coe's Golden Drop.
De Soto.
Early Red.
Forest Rose.
Gueii.
Golden Cluster.
General Hand.
German Prune.
Grand Duke.
Glass Seedling.
Hungary.
Imperial Gage.
Kenyon (No. 1).
Kansas Dwarf.
Luscomb's Nonsuch.
Lombard.
Langford.
Masters.
Moreman.
Maquoketa.
Mariana.
Moldavka, No. 44 Vor.
Niagara.
Nota Bene.
Newman.
Orel, No. 21.
Ogden.
Orange.
Prince Englebert.
Prune of Agen.
Pond's Seedling.
Quackenboss.
Reine Claude.
Rollingston.
Red Egg.
Red Winter.
Robinson.
Richland.
Shropshire Damson.
Speer.
Sweet Water.
Smith's Orleans.
St. Lawrence.
Wolf.
White Winter.
White Otschakoff.
White Nicolas.
Washington.
Weaver.
Wangenheim.
Yellow Egg.
Yellow Aubert, No. 115 Vor.
Yellow Gage.
5. Russian.
19. do
85. do
102. Voronesh.

CHERRIES.

Amarelle Hative.	Montmorency.
do Aboyet.	do Agne.
Abreende Bergaura.	do Ordinaire.
Abbesse d'Ognies.	do Longue queue.
Amarelle à Bouquet	Minn. Ostheim.
Belle Magnifique.	Ostheim.
Brown's Best.	Olivet.
Bender, Mo.	Royal Duke.
Brussels.	Reine Hortense.
Carnation.	Red Morello.
Cerise d'Ostheim	Schatten Amarelle.
Common red.	Spate Amarelle
Dychouse.	Steklianka (Glaskirsche).
Double Natte	Sasse Fruhe Weichsel.
Doppelte glaskirsch	Sithauri Weichel.
Early Richmond.	Vistula.
Empress Eugenie.	Voronesh, 27.
French.	Vladimir.
Frühes Amarelle.	[illegible]
Formige Hess Weichel.	Wragg.
Frauendorf.	Wiers, No. 2.
Gros Gobet.	do 12.
Grotto de Nova.	do 13.
Grotto Moul.	do 18.
Griotte de Buttner.	23 Orel.
Griner South Kirk.	24 do
Glaskuk Kinorm.	25 do
Githam (Ostheim).	26 do
Griotte Precose.	27 do
Griotte au Nord.	207 Russian.
Kirschen Amarelle.	16 Reg.
Louise.	62 Mi.
Lutovka.	62 Russian.
Leib.	203 Russian.
Montmorency Large.	

SMALL FRUITS.

The plantations of small fruits contain all of the leading varieties in general cultivation and most of the new sorts catalogued in America. No pains will be spared in testing all new kinds worthy of trial as early as they can be obtained. This portion of the experimental work has already become of great interest and will be of much value to all who grow these fruits either for home use or market. It is impracticable for a private individual to test all varieties as they are introduced, but such work can be successfully done at a public institution such as this, where careful records are kept of the relative merits of the different sorts and reliable information given to those interested.

SEEDLINGS.

Many new seedling small fruits have been brought together from various localities throughout Canada and the United States. Among the former may be mentioned a large collection of strawberries, raspberries, currants, gooseberries and grapes originated by Prof. Wm. Saunders at London and brought here for trial, among which are some very promising sorts which will be propagated and sent to the other experimental farms for further testing.

A number of the strawberries are very productive, of fine quality and size, with strong healthy foliage. A new plantation has been made from these, which will give a better opportunity to study their characteristics both with one and two year old plants. The raspberry seedlings number about 350, most of these have fruited, some being remarkably productive and of good quality.

Some seedlings of Davison's Thornless appear to be quite an improvement on their parent, particularly so in vigour and productiveness. A number of seedlings from other varieties have many valuable points.

Some hybrids between Gregg and Cuthbert were especially promising, they were of the Shaffer type; some were thought to be of better quality and equal to that valuable variety in every other respect. The weather being unusually dry at the time of ripening, all the raspberries were injured to such an extent that it was difficult to make comparisons of these new seedlings with named varieties which would be accurate and just, hence the experience of another season will be required to fully determine their respective merits.

Among the 140 black currant seedlings are several well worthy of an extended trial. One with very long racemes was shown at a meeting of the Ontario Fruit Growers Association, held at Picton, Ont.,in July and was thought well of by those best qualified to judge These currants were also affected by the drought to such an extent as to render comparisons difficult until more experience is obtained.

GRAPES.

In the spring of 1887 a vineyard was planted, containing 127 varieties of grapes. last spring 31 more were added, making a total of 158 sorts. The greater portion of these have made satisfactory progress. A large number of new and rare varieties are contained in this collection which will make it of great interest and very instructive to grape-growers generally. This locality is noted for the fine quality of grapes grown. During favourable seasons the crop is large and ripens well.

CURRANTS.

It was found necessary to remove the currant plantation last spring to another part of the farm, hence, no fruit of any consequence was produced during the past summer. There are in this collection 20 varieties, planted in rows six feet apart, and four feet apart in the rows.

They made a good growth during the summer and will be in condition to give a partial crop next season.

GOOSEBERRIES.

The plantations of this fruit contain 36 named varieties, and about 50 unnamed seedlings. These have been planted the same distance apart as the currants, and most of them have made fair growth.

RASPBERRIES.

The raspberry plants came through the winter in good condition and promised an abundant yield early in the season, but just before they began to ripen the weather turned hot and a dry scorching wind which prevailed for some time had the effect of drying up the fruit to such an extent that the crop was a partial failure.

A new plantation was put out in June, by transplanting from the older plants young shoots as soon as they had reached a height of twelve to fifteen inches, these subsequently made a good stocky growth.

Where such plants are near at hand this method will be found advantageous and if carefully done the plants will make a stronger growth by autumn than shoots of the previous year's growth put out in early spring.

This collection is made up of 43 named varieties and a large number of unnamed seedlings.

BLACKBERRIES.

Of the 26 varieties planted, Snyder appears to stand best, with Stones hardy next. Agawam and Taylor's Prolific not far in the rear; more time will be required, however, before any definite information can be given regarding the hardiness of these fruits for this locality.

STRAWBERRIES.

The plantation of 90 varieties referred to in my last report contained most of the standard and many new sorts. They came through the winter in good shape, blossomed freely and set a large quantity of fruit. The fruit began to ripen the latter part of June, the first being gathered on the 25th. The weather turned very hot and dry before the crop was half matured, not only was the fruit injured but in many places the plants were injured by the scorching winds that prevailed for some time; on this account the crop was materially lessened. There were 2,049 quart boxes of fruit gathered which were sold at good prices.

A new plantation has been made in which are planted 115 named varieties and many seedlings. These have been put in rows three and a-half feet apart and about one foot apart in the rows in the same manner as the old plantation. The land for this plot had been well manured. They were carefully cultivated during the summer and made a strong healthy growth. When cold weather set in a light covering of straw was given to protect them through the winter.

SEEDS.

The seeds of many varieties of fruits were gathered during the season of 1887 from choice specimens, and from these a large number of seedlings have been grown. A similar course has been pursued during the past year and it is hoped that some valuable new varieties may be thus produced.

Some attention was given to artificially crossing and hybridizing small fruits with partial success. The dry weather affected this work considerably, still a number of crosses were obtained. The seeds will be sown in season and the results reported on hereafter.

Respectfully submitted,

W. W. HILBORN,

Horticulturist, Central Experimental Farm.

REPORT OF THE POULTRY MANAGER.

(A. G. GILBERT.)

To Professor WILLIAM SAUNDERS,
Director Experimental Farms.

SIR,—I have great pleasure in submitting the first report of the Poultry Department of the Central Experimental Farm. Although the operations thus far have been on a comparatively limited scale yet some results have been ascertained which, it is hoped, will be of interest and benefit to the farming community and especially to those desirous of obtaining eggs and poultry for market or home use.

In the early part of the month of May last it was deemed advisable, in order to have a number of fowls ready for the occupation of the poultry building about to be erected on the Farm, to procure eggs of the most useful varieties and hatch them by means of sitting hens, a number of which had been secured. Accordingly 30 sittings representing 388 eggs, were purchased from the leading breeders of Canada, Great Britain and the United States. Eggs from the latter country were obtained for the purpose of securing different strains for breeding purposes in the forthcoming spring. The following table will show the number of eggs purchased and the results therefrom:—

EGGS Purchased and Chickens Hatched.

No of Sittings.	No. of Eggs Set.	Description of Eggs.	No. of Chickens Hatched.	Date when Chickens were Hatched.
				1888.
1	13	Buff Cochins	9	May 18
2	26	Andalusians	18	do 18
1	13	Black Breasted Red Game	8	do 30
2	26	Plymouth Rocks	15	do 9
2	26	Wyandottes	8	do 29
2	26	White Leghorns	19	June 7
1	13	Silver Pencilled Hamburghs	5	May 25
2	26	Bearded Golden Polands	8	do 25
2	26	Houdans	15	do 25
1	13	Black Hamburghs	7	do 25
1	13	Langshams	1	do 28
1	13	Black Minorcas	9	June 5
		From England.		
1	12	Indian Games	7	July 4
1	12	Red Caps	5	do 4
		From United States.		
1	13	Dirigos	5	June 2
2	26	Black Minorcas	12	do 27
1	13	White Leghorns	6	do 16
1	13	Houdans	3	do 16
2	26	Colored Dorkings	8	do 16
1	13	Buff Cochins	4	do 16
1	13	Black Java	8	do 16
1	13	Langshams	4	do 27
		Hatched in incubator	25	May 31
30	388		209	
		DUCKS.		
1	12	Pekin	4	June 13
1	11	do	3	do 29
2	33		7	

It will be seen from the above that 209 chickens were hatched, which was satisfactory, when the very unfavourable season and the long distance the greater number of the eggs travelled, are taken into consideration. It is worthy of notice that from twelve Indian game eggs, shipped by Messrs. Abbott Bros., of Norwich, England, seven chickens were hatched, and from twelve Red Cap eggs, shipped by the same firm, five chickens were the result. The eggs were sent from Norwich, England, to the agent of the firm in Toronto, and were by him re-shipped to Ottawa, so making a long journey by ocean steamer and railway, yet yielding a return of 50 per cent. thus proving that fertile eggs, properly packed, can be shipped a long distance and hatch well. In this case the eggs were packed in cut straw.

EGGS FROM CANADIAN BREEDERS HATCH BEST.

It will also be seen that the eggs supplied by Canadian breeders hatched better than those from the United States. The eggs furnished by our home breeders were wrapped in paper and packed in bran, while the eggs from the United States breeders were tightly packed in sawdust, a method strongly condemned by Canadian poultrymen, who assert that the turpentine contained in pine sawdust lessens the fertility of the eggs. There is room for interesting experiment here.

NEW BREEDS IMPORTED—INDIAN GAMES.

The Indian Game eggs were the first of the kind imported into Canada. It was thought best to give them a trial, as the Indian Game had earned a great reputation in Cornwall and Devonshire, England, as a market fowl, the male birds attaining to a weight of 9, 10, and 11 pounds. The cockerels are also highly spoken of for crossing purposes with the Plymouth Rock and Dorking. It was the 4th of July before the eggs were hatched, and that month being unusually chilly and raw, four of the chickens succumbed, notwithstanding the greatest of care, leaving three which never made much headway and died on the approach of wintry weather. These chickens were slow to feather, displayed no hardiness, and were content to brood when four months old. I would suggest another trial of this breed, the chickens to be hatched at an early period, so as to have ample opportunity to mature before the fall months.

RED CAPS.

The Red Caps, another late arrival from England, were also tried but with unsatisfactory results. Up to the age of two months the chickens grew rapidly and appeared hardy, but did not stand the cold and extremely wet weather of October, although well housed. As with the Indian Games, I would recommend another trial of early hatched chickens. A Black Spanish and Red Cap cross is recommended as producing a hardy fowl and great layer.

THE STANDARD VARIETIES.

The chickens of the other breeds made rapid progress, the Plymouth Rocks showing the earliest and greatest development, followed by the Wyandottes, Buff Cochins and Houdans in the order named. Two methods of feeding the chickens were adopted. Part were fed with bread and milk from time of leaving nest up to ten days, and after that with crushed corn, wheat and other grain. Another part were fed with hard boiled eggs and bread crumbs in the early stages and soft feed afterwards, with a liberal supply of grain to all in the evening. The two methods seemed to have equally good results. All the chickens were frequently and liberally fed and had one of the best grass runs it was possible for them to get access to anywhere. Shade and insects were abundant.

THE FOLLOWING RECORD

of the weights of four of the leading varieties will instance the progress made.

On the 5th of July a Plymouth Rock cockerel, hatched on the 9th of the preceding month of May, weighed 1 lb. 15 ozs.; a Wyandotte cockerel hatched on the

8th of the same month (May) weighed 1 lb. 5 ozs.; a Buff Cochin hatched on the 18th of same month (May), 1 lb. 1 oz.

On the 30th of July, twenty-five days later, the same chickens weighed as follows:—

	Lbs.	Oz.
Plymouth Rock	3	0[illegible]½
Wyandotte	2	04½
Buff Cochin	2	00
Houdan (hatched 25th May)	1	14½

On September 4th the Plymouth Rock weighed 5 lbs. 13 ozs., and the Wyandotte 3 lbs. 13 ozs.

On the 12th of November the weights of the same chickens were as follows:—

	Lbs.	Oz.
Plymouth Rock	7	05
Wyandotte	5	12
Buff Cochin	5	02
Houdan (hatched 25th May)	5	00

At date of writing (January 20th, 1889) the same chickens weighed in breeding condition:—

	Lbs.	Oz.
Plymouth Rock	9	05
Wyandotte	7	00
Buff Cochin	7	12
Houdan	6	02

INCUBATOR TRIAL.

On the 10th of May last a Bessey Incubator of 100 egg capacity was put into operation with a small number of eggs for a first attempt. Twenty-eight chickens were the result. Three died soon after being hatched. The remaining twenty-five were transferred at the proper time to the brooder and made rapid headway.

CROSSES.

Among the chicken so hatched were five male birds of a cross between a Brahma cockerel and Plymouth Rock hens. This cross was made with the view of ascertaining what sort of market fowl it would produce, and was successful. A cockerel of this cross (hatched on the 31st of May) weighed 6 lbs. 2 oz. on the 17th of October following, showing a gain of nearly 1½ lbs. per month.

Another trial was made of a cross between a Brahma cockerel and Black Minorca hens and resulted in the production of several very fine, large, dark pullets, which ought to make an excellent fowl for the farmer, embracing as they should the egg laying properties of the Minorca with the hardiness and size of the Brahma. The pullets will lay in a few days.

NEW POULTRY HOUSE COMPLETED.

By the middle of November the new poultry house was completed and the chickens were removed into it. Briefly sketched the building is 100 feet long, running north and south, with a middle compartment 20x20 feet, from which extend on either side two wings 40 feet each in length, each wing containing five pens 8x14 feet and capable of accommodating 20 or 25 fowls if required. There are four windows on the east (coldest) side of each wing and one window in each of the 10 pens to the west. The pens are separated by wooden partitions 2½ feet in height, and wire netting of 2½ inch mesh from this to the ceiling, giving the interior a light and cheerful appearance. Entrance to the pens is had from a roomy passage way four feet in width and through neat wire doors which swing inwards or outwards. The pens are furnished with platforms and roosts (which fold away in day time and are let into place again at dusk), nests of neat design, dust bath, box for oyster shells, gravel

&c. A slide operated from the passage way opens the way to the runs in the rear of the building. Two large ventilators in each wing are also controlled from the passage way. Above the wings are roomy lofts containing straw and chaff, which are let down to the pens beneath for the poultry to scratch in. A medium size base burner coal stove placed in the centre compartment heats the building as well as the water for soft feed, &c. The central room is also used as an office and for keeping feed. The upper room of the compartment is utilized for storage purposes and a portion is set apart for an hospital for sick fowls. A good dry cellar contains vegetables, gravel and other necessaries for the chickens, as well as coal for the stove. The building is substantially constructed, is fitted with double windows and storm doors, and answers the purpose admirably.

POULTRY LIST.

There are at present in the building birds of the different sorts as per following list:—

Left Wing.

Pen 1.—Black Minorca pullets, 10; White Leghorn do, 9	19
2.—Houdan pullets	11
3.—Black Hamburgh pullets, 6; Black breasted Red Game do, 3; Silver Pencilled Hamburgh do, 2; Wyandotte do, 2: Golden B. Polands do, 3; Dorking do, 3; Andalusian do, 2	21
4—White Leghorn hens, 10; Plymouth Rock pullets, 6; Dirigo do, 1; Black Java do, 2; 1 mixed hen	20
5.—Buff Cochin pullets, 6; Brahma do, 2; Langsham do, 2; Brahma-Minorca pullets, 5	15

Right Wing.

Pen 1.—White Leghorn cockerels, 8; Andalusian do, 8; Black Minorca do, 7; Brown Leghorn do, 2; B. B. R. Game, 1	26
2.—Wyandotte cockerels, 4; Buff Cochin do, 5; Houdan do, 5; Silver P. Hamburgh do, 3; Black Java do, 2; Black Hamburgh do, 1; Dorking do 1; Dirigo do, 2	23
3.—Brahma hens, 7; Dirigo do, 6; Black Minorca do, 1; Black Russian do, 3; Plymouth Rock do, 6	23
4.—Plymouth Rock cockerels, 5; Brahma-Plymouth Rock cross, 4; 1 Single Comb Wyandotte	10
	168
1 Dirigo cock; 1 Black Minorca do	2
Pen 5.—Wild Geese	5
	175
In hospital	5
	180

WET AND COLD WEATHER.

The fall was marked by continuous rain, the month of October was unusually cold and both combined proved fatal to many of the tender varieties, which pending the completion of the new house, were rather crowded in limited house room. Next to the Indian Games and Red Caps, the Black-breasted Red Game, Bearded Golden Poland, and Dorking cockerels proved the most susceptible to the fall weather.

DIRIGOS.

Among the varieties enumerated the Dirigos are yet new to Canada breeders. This comparative stranger, which owes its origin to the enterprise of Mr. Sumner Beale, New Hampshire, U. S, is the result of crossing a Canada Game Cock and White Plymouth Rock pullet (a sport) the progeny again crossed with a Light Brahma cock. The Dirigos make a large fowl, are hardy and excellent layers. In the new American Standard of Excellence they are classed as the Dirigo Strain of White Plymouth Rocks.

WILD GEESE.

The Wild Geese which occupy No. 5 pen have exhibited their characteristic hardiness in all seasons. They have been lively and have grown well in confinement. It remains to be seen whether they will breed in captivity mated to one of their own species, and with common geese, or others.

THE BEGINNING OF WINTER LAYING.

On the 12th of December the first egg in the new building was layed by a Wyandotte pullet hatched on the 29th May. The first hen to lay was a Dirigo on the 17th of December. The Wyandotte pullet, which first layed on the 12th December, layed again on the 15th and was followed on the 16th by the first egg from the second Wyandotte pullet hatched on the same date as the first layer. Other pullets layed first eggs in the following order:—

Houdan, hatched 25th May, first egg 23rd December, 1888.

Silver P. Hamburgh, hatched 25th May, first egg 24th December.

Black Minorca	do	5th June	do	26th	do
White Leghorn	do	7th do	do	30th	do
Black Hamburg	do	25th May	do	2nd January.	
Andalusian	do	18th do	do	4th	do
Plymouth Rock	do	9th June	do	6th	do
Buff Cochin	do	18th May	do	16th	do

NUMBER OF EGGS LAYED FROM 12TH DECEMBER TO 20TH JANUARY.

The following table will show the number of eggs layed by the different breeds from the time of laying first egg in December, 1888, to 20th January, 1889 :—

PULLETS.

Date.	2 Wyandottes.	11 Houdans.	2 Silver Pen. Hamburghs.	10 Black Minorcas.	9 White Leghorns.	6 Black Hamburghs.	2 Andalusians.	6 Plymouth Rocks.	6 Buff Cochins.
1888.									
Dec. 12	1	...	...	...	...	...	...	...	...
do 15	1	...	...	...	...	...	...	...	...
do 16	2	...	...	...	...	...	...	...	...
do 18	2	...	...	...	...	...	...	...	...
do 19	2	...	...	...	...	...	...	...	...
do 20	2	...	...	...	...	...	...	...	...
do 22	2	...	...	...	...	...	...	...	...
do 23	2	...	...	...	...	...	...	...	...
do 24	2	...	1	...	...	...	...	...	...
do 25	2	1	...	...	...	...	...	...	...
do 26	1	3	1	1	...	...	...	...	...
do 27	1	...	...	1	...	...	...	...	...
do 28	2	4	1	...	...	...	...	...	...
do 29	2	3	1	...	1	...	...	...	...
do 30	2	1	...	...	...	1	...	...	...
do 31	2	4	1	1	2	1	...	...	...
1889.									
Jan. 1	2	3	1	...	2	...	...	...	...
do 2	1	3	1	1	2	1	...	...	...
do 3	2	2	1	1	1	1	...	...	...
do 4	1	2	...	1	4	2	1	...	...
do 5	1	4	...	1	6	2	...	...	...
do 6	Broody for 7 days.	2	...	1	1	1	...	1	...
do 7		3	...	4	5	3	...	...	...
do 8		2	1	2	4	...	...	1	...
do 9		2	1	2	4	2	...	1	...
do 10		...	...	1	3	1	...	2	...
do 11		2	1	2	5	2	...	...	...
do 12		2	...	...	2	2	1	...	...
do 13	1	2	...	1	4	3	1	1	...
do 14	1	1	...	1	2	2	1	1	...
do 15	...	...	...	2	3	3	1	...	...
do 16	2	3	...	1	1	2	1	1	1
do 17	1	...	...	3	3	1	...	2	1
do 18	2	1	1	2	2	3	...	1	...
do 19	1	1	...	...	6	...	...	1	1
do 20	1	1	1	1	3	2	1	2	...
Totals	44	53	13	30	66	35	7	14	3

HENS.

Date.	6 Dirigos.	5 Brahmas.	3 Black Russians.	1 Black Minorca.	7 White Leghorns.
1888.					
Dec. 17	1	...	...	...	...
do 19	1	...	...	...	...
do 20	1	...	...	...	...
do 22	1	...	...	...	...
do 23	3	...	...	...	...
do 24	1	...	...	...	...
do 25	2	...	1	...	...
do 26	2	...	...	...	...
do 27	1	...	1	...	...
do 28	2	...	...	...	...
do 29	2	1	1	1	...
do 30	1	...	...	...	1
do 31	2	1	1	...	...
1889.					
Jan. 1	3	2	1	...	2
do 2	1	1	1	1	...
do 3	...	...	...	...	3
do 4	2	2	2	...	...
do 5	3	1	...	...	...
do 6	2	1	2	1	...
do 7	2	...	1	...	2
do 8	3	1		1	1
do 9	4	1	1	...	2
do 10	...	2	...	...	...
do 11	2	...	...	...	...
do 12	3	2	...	...	...
do 13	...	...	2	...	...
do 14	1	2	...	...	...
do 15	3	2	...	...	...
do 16	...	1	...	3	...
do 17	4	1	1	...	...
do 18	2	...	...	...	...
do 19	2	1	2	...	...
do 20	...	...	...	...	2
Totals	57	22	17	7	13

METHOD OF FEEDING.

The conditions as to temperature, feed, &c., were the same with the exception of the Brahma hens, which were given more oats than the others. The morning feed was varied, but always warm and known as "soft." It was composed of two parts shorts, one part cornmeal, and one part boiled wheat. The hot water the wheat was boiled in was used for mixing the feed. To the mixture was added, almost every morning, a small quantity of Cayenne pepper and bonemeal. Twice or three times a week meat scraps were substituted for the bonemeal and boiled wheat. At other times small potatoes and scraps of cabbage formed the greater part of the morning meal. On this variety the layers were fed barely enough to satisfy and never enough to gorge. Soon after, when the water was given for drink, a few handsful of small wheat or ground meat were thrown into the chaff, always on the floor for the fowls to scratch in, every effort to keep them in activity being of paramount importance. The noon meal was light and scattered in the chaff. The last feed of grain, also thrown on the floor, was liberally given, and the layers sent to roost with a full crop to carry them over the long night fast. A cabbage suspended from the centre of the pen was also used as an incentive to exercise. Oyster shells (ground) and gravel were also supplied.

The temperature varied from 30 to 45 and 50. On reaching the two latter figures the morning feed was greatly reduced and more dry grain given. At the lower figure the chill was taken off the water given to the layers.

MALE BIRDS SEPARATE.

The male birds, in all cases, have been, and are kept from the laying stock, for the reason that an impregnated egg is not so good in flavour, nor will it keep as well, as one from hens with which no male bird has been allowed to associate. The cocks and cockerels are also kept away from the breeding stock, and will be so kept until the breeding pens are made up. Their feed is oats and wheat with green food, gravel, &c., &c.

SICKNESS.

Several cases of sickness have occurred, among them five or six cases of virulent roup. The birds were most likely affected before coming into the new building. The sick were at once separated from the others, and the roup cases with the exception of two, were quickly cured. The exceptions, two cockerels, were so bad that had a cure been possible, they would have been useless for breeding purposes. Under the circumstances the birds were killed and the remains burned. Experiments as to the best remedies for the diseases of poultry are being made, as opportunity permits. I will be most happy, on enquiry, to give those desirous of knowing what has been found the most effective treatment in the different cases met with so far.

IN HOSPITAL.

There are at present in hospital one Black Breasted Red Game pullet; one Bearded Golden Poland pullet; one Black Russian hen, and two Black Minorca cockerels. Their ailment is cold, sometimes called catarrh.

FALL EXHIBITION.

According to your instructions 125 chickens of the different varieties were placed on exhibition at the Canada Central Fall Show in the month of September last, a space for the purpose having been allotted in the poultry shed.

PRACTICAL VISITORS.

Since the occupation of the poultry house there have been numerous visitors, among them several farmers who expressed their intention of establishing poultry departments in connection with their farms. Two of their number had already 75 to 85 hens, and one is making preparation for the housing of 500 winter layers. All the information desired as to the best methods of care, feeding, &c., was given.

PROPOSED CROSSES.

Among the crosses proposed for experiment, some of which it is intended to undertake in the spring, are the following:—

Dirigo—White Leghorn.
Brahma—Black Russian.
Plymouth Rock—White Leghorn.
White Leghorn—Brahma.
Plymouth Rock—Dorking.
do Wyandotte,
Brahma—Black Minorca.
Black Minorco—Black Leghorn.
Brown Leghorn—Buff Cochin.
Wild Goose—Common Goose.

The results from some of these crosses will no doubt prove of value and interest to all those concerned.

I have the honour to be, Sir,

Your obedient servant,

A. G. GILBERT,

Manager Poultry Department.

CENTRAL EXPERIMENTAL FARM,
20th January, 1889.

EXPERIMENTAL FARM FOR THE MARITIME PROVINCES.

REPORT OF W. M. BLAIR, SUPERINTENDENT.

To Prof. WILLIAM SAUNDERS,
Director Experimental Farms,
Ottawa.

SIR,—I have the honour to submit herewith the following report of the operations on the Experimental Farm for the Maritime Provinces at Nappan, N.S., during the year 1888.

Acting under your direction I took possession of the Farm on 12th May, having previously purchased such horses, harness, waggons, carts, implements, &c., as were immediately necessary to carry on the work successfully.

The farm consisting in all of about 300 acres, is made up of the following lots of land, viz.:—

32	acres of	English marsh.
18	do	broadleaf.
6	do	upland, under cultivation.
10	do	do in hay.
104	do	do in pasture.
20	do	unbroken, in stumps and small second growth.
110	do	woodland.

On this land is found a great variety of soil, including stiff and lighter clay, clay loams mixed with more or less sand and gravel, sandy loam of varying quality associated with gravel, also small patches of black bog mud.

The sub-soil also is variable, a considerable portion of the upland consisting of mixtures of clay, sand and gravel, which hold the surface water, thereby delaying the cultivation of the land until late in the spring and also interfering with farm operations during summer and autumn when heavy rains occur, suggesting very forcibly the necessity of under-draining.

MARSH LANDS.

The marsh lands have been formed by the action of the tide-waters of the Bay of Fundy, which rush up with great force with every tide. These waters are heavily charged with a sticky mud, a portion of which is deposited each time the waters cover the flats. In process of time these flats become so high that only the highest tides—which occur at the change and full of the moon—cover them. They are then considered high enough to be reclaimed, which is done by building a heavy dyke around them on the borders of the rivers and creeks which empty into the ocean. These dykes are of different heights and formed by throwing the mud up on each side. The dykes on this farm have been built about five feet high and nine feet wide at the base, they should average in this case not less than six feet high and ten feet wide at the base.

These lands are very fertile and grow heavy crops, and some of them have been growing hay continuously for over 150 years without any fertilizer and still produce from one and a-half to two tons and a-half per acre. In some places on the Experimental Farm the dyke was unsafe, and it was found necessary to rebuild 42 rods and repair some 65 more. It was also found necessary to open over two miles of surface drain and build a new aboideau to carry the water through the dykes.

Notwithstanding these precautions the unusually high tides of 5th December broke through in several places, carrying away in all 15 rods of dyke and flooding the entire marsh. The dykes of the adjoining marshes were also broken and the lands flooded. Fortunately, however, the soil was saturated with water from the recent heavy rains, also slightly frozen, and would not readily absorb the salt water; and the new drains lately opened enabled the water to run off quickly when the tides receded, thereby preventing much damage from the salt water, while the land will receive some benefit from the deposit of mud left on the surface from the always muddy tide waters. These tides overflowed the marsh for three days, and as soon as the water had sufficiently subsided the dykes were repaired in as substantial a manner as the weather would permit, and we trust they will be found sufficient to withstand the spring tides next year. The crop of hay cut during the past season from the marsh land, now being got in order, was from 60 to 70 tons.

UPLANDS.

About six acres of the upland were cultivated and in crop last year and ten acres in hay; 104 acres which had previously been cultivated and cropped have for many years been in pasture. These lands were divided into several fields by fences, which as far as practicable, have been removed and the rubbish from about them, together with some scattered stumps taken out, piled and burned. One or two useless buildings have also been taken down.

PLOUGHING.

Ploughing was begun on the 16th of May and continued as opportunity offered and the land and weather would permit until 16th November; during that time about 100 acres were turned over. Of this 40 acres were ploughed a second time after the crop of the season was removed. Five acres of the unbroken land were cleared by taking out the small second growth and stumps. These were piled and burned and the land ploughed.

MANURE.

Manure being greatly needed on this land 30 cords were purchased at Amherst and drawn up, a distance of seven miles. Besides this 700 loads of marsh mud, which is found to be an excellent fertilizer, were drawn from the adjoining unreclaimed flats which are accessible at low tides. A number of young cattle were purchased in the autumn for the double purpose of disposing profitably of the hay and straw produced on the farm and of making manure for next year's crop. These animals are making fair progress and when ready for the butcher in the spring will, it is hoped, realize good prices.

GRAIN.

Twenty-six acres of oats and three acres of barley were sown. Of the oats two acres were sown on the site afterwards selected for the new farm buildings and had to be cut out of season, as the land was needed for building purposes. The date of sowing these grains, viz., the "Black Prince Edward Island Oats," "Cream Egyptian Oats" and "Prince Edward Island Barley" ranged from 24th May to 7th June. From the 27 acres were threshed 830 bushels.

Two acres were sown in plots embracing four varieties of wheat, five of barley and ten of oats. The date of sowing, names of the different varieties and the time of ripening was as follows:—

WHEAT.

Sown.	Name.	Time of Ripening.
May 18.	Onega	101 days.
do	Ladoga, C.E.F	105 do
do	Ladoga (2nd importation)	108 do
do	Colonist or Saxonka	113 do

BARLEY.

Sown.	Name.	Time of Ripening.
May 18.	Poplar	98 days.
do	Petschora	99 do
do	Thanet	108 do
do	Chevalier	115 do
do	Beardless	113 do

OATS.

Sown.	Name.	Time of Ripening.
June 1.	Lincolnshire Poland White	86 days.
do	Victoria Prize	88 do
do	Flying Scotchman	91 do
do	Early Racehorse	92 do
do	Waterloo	95 do
do	Black Tartarian	96 do
do	Early Blossom	96 do
do	Onega	96 do
do	English Red	100 do
do	White Tartarian	100 do

The Cream Egyptian oats ripened in 100 days, while the Prince Edward Island Black took 113 days, both of these were sown on the 24th May. From the 24 acres there were threshed 765 bushels.

The season in the Maritime Provinces was most unfavourable for the ripening of grain, and it is quite probable that another year with more favourable weather all of these varieties would mature earlier. The samples of grain grown were very good, but accurate returns as to their relative yield cannot be given this season.

POTATOES.

A few plots of potatoes were planted, in all about one acre. One of the varieties viz., "Dorman's Seedling" which was grown from seed by Mr. Dorman in this county, gave 120 lbs. from 3 lbs. planted; another variety, the "Black Elephant," said to be a native of Montana, gave 3,600 lbs. from 120 lbs. of tubers.

In addition to these, other varieties were planted, which yielded in all 150 bushels.

FERTILISERS.

Not having any barnyard manure it was not thought desirable to sow many turnips, but with the aid of some special fertilisers, about half an acre was grown, which yielded fully 400 bushels. Some fertilisers were also used on part of the buckwheat and on two acres of oats; a statement of the results is given below:—1 acre without fertiliser produced 23 bushels of oats, 1 acre with \$4.00 worth of bone meal produced $28\frac{1}{4}$ bushels, a gain of $5\frac{1}{4}$ bushels, which at 40 cents per bushel= \$2.10, or an apparent loss of \$1.90 per acre; 1 acre with \$7.32 worth of Bowker's Fertiliser produced $41\frac{1}{2}$ bushels, a gain of $18\frac{1}{2}$ bushels, which at 40 cents=\$7.40, or a gain of 8 cents per acre. The effect of these fertilisers especially the bone dust will no doubt be seen on future crops. Twenty acres of buckwheat were sown for the purpose of enriching the land. Of this 13 acres gave a heavy crop, and when the seed was just beginning to form, the buckwheat was rolled with a heavy roller and turned under with a jointer-plough which covered it completely. The remaining 7 acres were sown later without any fertiliser, and the crop was not sufficiently advanced to plough under when the frost of 5th September cut it down.

FRUIT CULTURE.

About 2 acres were planted with fruit trees and vines, part of which were obtained in New Brunswick and part in Ontario.

On 24th and 25th May the large fruits were set out in nursery rows 4 feet apart, allowing two feet between each tree, these were well cultivated during the early part of the summer, and late in the fall they were banked up with 4 or 5 inches of earth firmly pressed down with the foot.

On 21st and 22nd May the grape vines and strawberries were planted. The former being set in rows 10 feet apart, with 10 feet between each vine; two rows of potatoes were planted between these rows of vines and frequently cultivated. Of the 70 vines, consisting of 20 varieties, the largest proportion grew well.

The strawberries were planted in rows 4 feet apart with 1 foot between the plants, and were well cultivated and kept clean. The vines were allowed to run and in some places completely covered the ground with strong healthy plants before the close of the season. As soon as the ground was frozen they were covered lightly with coarse horse manure. Of the 1,000 plants, of 10 varieties, nearly all grew. The Wilson and Captain Jack were the most healthy and vigorous growers.

On 22nd and 23rd May the gooseberries and currants were set out. These were placed in rows 6 feet apart with 4 feet between each bush, and were also kept well cultivated during the summer. Of the 325 bushes, consisting of 12 varieties, all but three or four made a healthy growth. The date of setting out the raspberries and blackberries ranged from the 21st to the 25th of May. These were planted in rows 6 feet apart, with 2 feet between the plants, and cultivated in the same manner as the other small fruits. Of the 450 plants, of 10 varieties, only about 25 per cent. grew. The collection of fruit trees and vines consisted of the following:—

		Varieties.
160	Apples	54
12	Crab Apples	4
46	Pear	21
5	Cherry	2
30	Plum	14
70	Grape	20
100	Gooseberry	4
150	Red Currant	6
75	Black Currant	2
75	Blackberry	3
375	Raspberry	7
1,000	Strawberries	10

Of the 253 trees referred to all with a single exception made a strong healthy growth.

FOREST TREES.

On the last day of May 2,800 young seedling forest trees, of 28 varieties, were set out. These were placed in rows 4 feet apart allowing from 9 to 18 inches of space between them, and received the same treatment as the fruit trees. A large proportion of these young trees grew.

Three varieties of rhubarb were also set out and made a rapid growth. The land on which the large and small fruits, forest trees and plots of grain were planted was under cultivation and had a dressing of manure last year.

DRAINING.

Much of the land on this farm requires draining to admit of early planting; a portion of this necessary work has been accomplished during the summer, and some five and a-half miles of tiles were laid on 24 acres of land. The land thus drained was afterwards well ploughed, and is now in good condition for spring planting.

BUILDINGS.

Building operations commenced on 15th August, but the work has been delayed by the almost continuous wet weather. The barn and horse stables are, however, now partially completed, and will be ready for occupation next season. The barn is 111 feet long and 50 feet wide, with posts 18 feet long; this frame rests on a stone basement, the walls of which are 2 feet thick and 10 feet high in the clear. The stable which it attached to the barn is 65 feet long and 32 feet wide, with posts 15 feet long and rests on a substantial stone foundation. A cottage for the stableman is also in course of erection.

HORSES.

Our teams consist of 6 young horses, 4 and 5 years old, purchased in Prince Edward Island on the first of May last, and when landed here weighed respectively (i) 1430, (ii) 1350, (iii) 1300, (iv) 1320, (v) 1250, and (vi) 1130 lbs., and now weigh (i) 1635, (ii) 1355, (iii) 1325, (iv) 1425, (v) 1340, and (vi) 1250 lbs. In the interval these horses have been kept busy with heavy farm work, having ploughed 140 acres, cultivated, harrowed and drilled 58 acres of crop, besides cutting and drawing in 80 loads of hay and 27 acres of grain, drawing tiles from the station, carting manure and marsh mud, and doing all other farm work.

ATTENDANCE AT AGRICULTURAL EXHIBITIONS AND FARMERS' INSTITUTE MEETINGS.

Some of the products of this farm were shown at the Exhibition held in Truro on the 24th and 27th of September last, including 18 varieties of grain both in straw and in glass bottles. These, being new varieties in this district, were closely examined and favourably commented upon by the farmers. The Exhibition held at Charlottetown in Prince Edward Island, on 4th October, was also visited. The weather was very unfavourable; but the show of horses was remarkably fine; there were some good cattle, a large show of fine sheep, a few nice hogs, and a good exhibit of grain, fruit, butter and vegetables. The subject of reclaiming large tracts of salt marsh was engaging the attention of the farmers on the Island, and was dwelt on at some length by Lieut.-Gov. McDonald in his opening address at the Exhibition.

The Exhibition held in Sackville, N.B., on the 17th October was also attended. At this show there were some good horses and cattle, but on the whole, it was below the average on account of the unfavourable weather."

I attended the sessions of the Farmers' Institute of Colchester County, held in Truro, N.S. on the 28th and 29th of November, when addresses were made and papers read on the following subjects:—

"Road Making," by Prof. H. W. Smith, Truro.

"The Necessity for a More General Knowledge of Veterinary Science among Farmers," by Dr. Jakeman, V.S., Halifax.

"Hints to Farmers," by Howard Trueman, Pointe de Bute, N.B.

"Dairying," by C. P. Blanchard, Truro, N.S.

"Winter Dairying," by P. C. Black, Windsor, N.S.

"Bee Keeping," by J. W. Black, Truro, N.S.

"The Wheat Midge or Weevil," by J. Fletcher, Entomologist and Botanist to the Dominion Experimental Farms.

"Experimental Farms," by W. M. Blair, Superintendent Experimental Farm, Nappan, N.S.

These subjects were all freely discussed and the meeting throughout was very interesting and instructive.

A meeting of the New Glasgow Farmers' Institute, held in New Glasgow, N.S., on the 4th January, was also attended. The following papers were read:—

"Horse Training," by J. A. Fraser, M.P.P., New Glasgow.

"The Standard-bred Trotting-horse," by Harry Townshend, New Glasgow.

"Thorough-bred Cattle," by A. C. Bell, New Glasgow.

"Grasses," by Prof. H. W. Smith, Truro.

"Ensilage," by Mr. McNaughton, Hopewell.

"Agricultural Education," by J. B. McKay, Pictou.

"Experimental Farm, Nappan," by W. M. Blair, Nappan.

I have the honour to be, Sir, your obedient servant,

NAPPAN, N.S., 31st December, 1888. W. M. BLAIR, *Superintendent.*

EXPERIMENTAL FARM FOR THE NORTH-WEST TERRITORIES.

REPORT OF A. MACKAY, SUPERINTENDENT.

INDIAN HEAD,
NORTH-WEST TERRITORIES,
DECEMBER 31, 1888.

Professor WILLIAM SAUNDERS,
Director Experimental Farms,
Ottawa.

SIR,—I have the honour to submit to you my report on the North-West Experimental Farm, the work done, and the improvements made on it, since it has been established.

This farm contains 682 acres, comprising the whole of section 19, and an angle made by the Canadian Pacific Railway of section 18 in Township 18, Range 12, West 2nd Meridian, and lies immediately east of the Indian Head town site, and less than half a mile from the Canadian Pacific Railway station. Indian Head is situated in Eastern Assiniboia, forty miles east of Regina, the capital of that province. The Canadian Pacific Railway forms the southern boundary of the Experimental Farm, from which a good view of the whole of it can be obtained. Along the east, west and north boundaries are public roads, from any of which the farm can be approached or seen equally well.

SOIL.

The soil varies from a sandy loam to a clay loam, with a porous clay subsoil. While the greater portion of the farm is a black clay loam, a considerable part is of a lighter nature and very suitable for testing fruit and forest trees.

STREAMS OR COULÉES.

Two streams or coulées pass through the farm in a north-easterly direction, in which there is running water in the spring and early summer, but which dry up later in the season. One of them is the outlet for Deep Lake, six miles south. The other is fed by flowing springs seven miles south-west. One enters the farm on the south and the other on the west, and after leaving it joins the Qu'Appelle river a few miles to the north.

These coulées, besides imparting beauty to the farm, are invaluable in supplying an abundance of water for stock, and affording desirable slopes for orchards, nurseries, &c., and should it ever be necessary to do so, almost the entire farm can be thoroughly drained into them.

In 1883 the Bell Farming Co. broke up nearly 600 acres out of the 682 acres now comprising the Experimental Farm, and since then that portion has been in crop each year, except a small area which in 1886 was fallowed.

The spring of 1888 was very backward, being at least two weeks later than any since 1882, and on account of there being a good deal of snow last winter, and it being retained by the stubble, work did not commence on the farm until the 24th of April, on which day ploughing was begun. A few days prior to this some Ladoga, Saxonka and Talavera wheats were sown on potato land, rented from Major Bell. This, with two acres, also rented, and afterwards sown with new varieties of barley and oats, were obtained in order that whatever grain might be grown, it would not be injured by a mixture of the volunteer crop, which would sure to have been the case had any portion of the Experimental Farm been used for this purpose. Forty acres of oats for feed were sown on the Farm, which, though light in the straw, gave a yield of 50 bushels to the acre. Ontario gang ploughs were used, the grain being first sown on the stubble and then ploughed in. Two acres of peas were also sown on the stubble, and though the return was only small, good samples have been obtained which will be put in next spring under more favourable conditions.

SPRING WHEAT.

The different varieties of wheat sown were: Ladoga, Saxonka, Talavera, Scotch, Defiance Red, and Scotch Square Head. The Ladoga, Saxonka and Scotch wheats ripened and were not injured by frost. The Talavera being later in maturing was considerably hurt, while Defiance Red was so badly frozen as to be useless. The Scotch Square Head never headed out. The following are dates of seeding, harvest and yield:—

Ladoga—Sown, 20th April; harvest, 21st August; yield, 29 bushels per acre; weight, 62 lbs. to the bushel. This wheat ripened from a week to ten days earlier than Red Fife sown at the same time on adjoining lands.

Saxonka—Sown, 20th April; harvest, 27th August; yield, 30 bushels per acre; 62 lbs. to the bushel.

Talavera—Sown, 21st April; harvest, 10th September; yield, 15 bushels; weight, 57 lbs. to the bushel.

Scotch—Sown, 1st May; harvest, 27th August; yield, $28\frac{44}{60}$ per acre; weight, 62 lbs. to the bushel.

Defiance Red—Sown, 21st April; not cut.

Scotch Square Head—Sown, 1st May; did not head out.

BARLEY.

Six varieties of barley were sown, five of which were two rowed, Golden Melon, Peerless White, Thanet, Chevalier, Polar and Common Two Rowed. The Polar ripened very early, but was a poor sample. All the varieties were very heavy in the straw.

Golden Melon, two rowed, sown 1st May, harvest 22nd August, yield 34 bushels per acre, weight 54 lbs. to the bushel; Peerless, two rowed, sown 1st May, harvest 22nd August, yield $33\frac{12}{48}$ bushels per acre, weight 53 lbs. to the bushel; Chevalier, two rowed, sown 1st May, harvest 22nd August, yield 24 bushels per acre, weight 53 lbs. to the bushel; Thanet, two rowed, sown 1st May, harvest 22nd August, yield $56\frac{36}{48}$ bushels per acre, weight 54 lbs. to the bushel; Polar, six rowed, sown 1st May, harvest 7th August, yield 33 bushels per acre, weight 41 lbs. to the bushel; Common Two Rowed, sown 10th May, harvest 17th August, yield $36\frac{37}{48}$ bushels per acre, weight 52 lbs. to the bushel.

OATS.

Seven varieties of oats were tested—Tartarain, Early Blossom, Victoria Prize, Improved Waterloo, Lincolnshire Poland, Early Race Horse and Flying Scotchman. On account of horses and fowls injuring the oats, and having no buildings for the grain, the yields given are not accurate, but are the number of bushels per acre saved. The oats were sown on beet land, ploughed and drilled in at the rate of two bushels per acre.

Tartarian, sown 1st May, harvest 24th August, yield $47\frac{20}{34}$ bushels per acre, weight 35 lbs. to the bushel; Early Blossom, sown 1st May, harvest 25th August, yield $55\frac{12}{34}$ bushels per acre, weight 40 lbs. to the bushel; Victoria Prize, sown 1st May, harvest 17th August, yield 49 bushels per acre, weight 42 lbs. to the bushel; Improved Waterloo, sown 1st May, harvest 17th August, yield 44 bushels per acre, weight 36 lbs. to the bushel; Lincolnshire Poland, sown 1st May, harvest 17th August, yield 35 bushels per acre, weight 41 lbs to the bushel; Early Race Horse, sown 1st May, harvested 17th August, yield 49 bushels per acre, weight $43\frac{1}{2}$ lbs. to the bushel; Flying Scotchman, sown 1st May, harvest 17th August, yield $56\frac{14}{34}$ bushels per acre, weight 42 lbs. to the bushel.

PEAS.

Three varieties were sown on stubble land, but wild buckwheat coming up very rank smothered a great many of the vines and reduced the yield.

Blackeyes, sown 2nd May, harvest 30th August, yield 12 bushels per acre, weight $62\frac{1}{2}$ lbs. to the bushel; Crown, sown 2nd May, harvest 22nd August, yield 16 bushels per acre, weight 65 lbs. to the bushel; Extra Early, sown 10th May, harvested 4th August, yield $18\frac{28}{60}$ bushels per acre, weight 61 lbs. to the bushel.

POTATOES AND FIELD ROOTS.

Twenty-three varieties of potatoes were obtained in Manitoba and the North-West and planted on stubble land, and though the yield was not large; sufficient good seed has been secured for next year. Other varieties will be added next spring. The following are the names of the different kinds grown:—Early Rose, Surprise, Beauty of Hebron, Morning Star, Lee's Extra Early, Lizzie's Pride, Brownell's Beauty, Carlo's Matchless, Dakota Red, Snow Flake, Genessee Seedling, Early Sunrise, Burbank's Seedling, Vick's Pride, Boston Market, Garnett Chili, Stonewall Beauty, Spray's Beauty, Burbees Empire State, Queen of the Valley, Early Conqueror, White Star and Empress Bell.

Several varieties of turnips and mangolds were sown early in June. Three methods of sowing were followed—broadcast, in raised drills and in rows on the flat, and in every case the roots on the flat did the best. A Turnip Flea-beetle was very numerous and did considerable injury to the young plants, especially to those first sown.

FRUIT AND FOREST TREES.

As it was deemed very important that something be done in fruit and forest tree culture without delay, some eight or ten acres of land was prepared as early and as well as possible, and during May and June 23,000 trees and plants were put out. The large fruits, as well as all the forest trees, were planted in nursery rows 3 feet apart so as to permit of cultivation with horse cultivators.

APPLES.

Two hundred trees of 60 varieties of apples were put out, in nursery rows, and received thorough cultivation. Every tree made a good growth though some were late in starting. Before winter set in the trees were wrapped with straw or tarred paper and earth heaped up around the base 10 inches high.

CRAB APPLES.

Of this fruit 12 trees of 4 varieties were planted; all did well and received the same treatment before the frost came as the apples did.

PLUMS.

Thirty trees of 8 varieties were planted; all lived, made a healthy growth during the season, and received the same attention at its close as the apples and crabs.

CHERRIES.

Thirty-four trees of 7 varieties of cherries were planted, and though they did not make as much growth as either the apples or plums, they made fair progress.

PEARS AND PEACHES.

In pears 20 trees of 7 varieties and 3 trees of peaches were put out. The pears made a very vigorous growth. Starting earlier than any other of the large fruit trees they did extra well during the entire season. Like all the preceding classes, the pears and peaches were protected by straw or paper and the earth heaped up around the base before winter set in.

CURRANTS.

Of this fruit 178 bushes of 8 varieties were planted in rows 6 feet apart and 4 feet apart in the rows. With the exception of two bushes every one lived and did well. Before winter set in earth was heaped well up among the branches and around the stalks, more to protect the bushes from rabbits than from the winter.

GOOSEBERRIES.

Seventy-four bushes of 3 varieties of this fruit were planted the same as the currants. Four bushes never made a start; all the others made rapid growth.

RASPBERRIES.

In this fruit 411 plants of 6 varieties were set out in rows 6 feet apart. Ten per cent. died, or never made a start, the remainder made only fair progress, but were healthy looking when winter set in. Some of the plants were laid down and covered with manure or earth before the frost became too severe, others were only covered on the tips.

BLACKBERRIES.

Seventy-four plants of 3 varieties of blackberries were put out in the same manner as the raspberries and similarly treated. Nearly 20 per cent. failed to grow, the rest doing fairly well.

STRAWBERRIES.

The bed of this fruit consisted of 1,300 plants of 13 varieties. A severe frost occurred two days after they were put out, which killed two-thirds of the plants, some varieties having only a few plants left, while the "Wilson" had only one killed. During October nearly all the blanks were filled in from runners. After the ground became frozen the plants were lightly covered with manure and straw.

GRAPE-VINES.

Sixty-four vines of 18 varieties were planted in rows 6 feet apart and 6 and 10 feet apart in the rows. Some of the varieties made an early start and good growth, while others only began to grow late in the season—one vine alone failed to grow. Before winter set in the vines were covered with earth.

WILD OR NATIVE FRUITS.

In addition to the cultivated fruits a collection of native currants, gooseberries, raspberries, cranberries, strawberries, cherries, Saskatoon berries and grapes were obtained and planted. Every bush or plant put out did well.

FOREST TREES, SHRUBS, &c.

Twenty thousand of the following varieties were planted in nursery rows three feet apart, and during the season received thorough cultivation:—

Five varieties of elm, 6 of ash, 5 of maple, 6 of pine, 4 of spruce, 2 of locust, 2 of birch, 2 of alder, 2 of cedar, 2 of catalpa, and 1 variety each of butternut, walnut, hickory, oak, beech, basswood, larch, fir, juniper, wild cherry, hornbeam, Russian, mulberry, hackberry, hawthorn, cranberry, Kentucky coffee tree, sycamore, ailanthus and wahoo. Among the elms, ashes, locusts, soft maples, Norway spruce, larch, cherry, ailanthus, catalpas, Russian mulberry and cranberry hardly a blank occurred. Among the cedar, butternut, walnut, oak, beech, basswood and sycamore 20 per cent. were failures, while of all the other varieties put out from 20 to 40 per cent. died; the greatest failures being in Austrian pine and Douglas spruce, but most of these were injured on the way up by delay in transit and being overheated. The black locust, butternut, walnut, catalpa and ailanthus were badly nipped by the first fall frost, while all the other kinds were none the worse even after repeated visitations.

TREE SEEDS.

During the latter part of May, seeds of native or ash-leaved maple, sugar maple, ash and basswood were sown in rows three feet apart. Between forty and forty-five thousand native maple came up and before their growth was checked had attained a height of from 10 to 20 inches. A large number of the ash also came up, but made slow progress. The sugar-maple and basswood failed to appear; possibly these may germinate next season. Four bushels of native maple seed were sown in October last. Before winter came several thousand maple trees, and a more or less number of all the varieties planted were taken up and placed in a cool cellar, to be set out again early next spring.

FALL WHEAT.

During the first week in August, three varieties of fall wheat were sown followed two weeks later by six more. The land having been fallowed and the weather very favourable, the grain came up in a few days, and before cold checked its growth it was covering the ground. In addition to the nine varieties which were drilled in, 165 other sorts were planted in rows, 50 grains of each variety set one foot apart. These were obtained too late to make much headway, and small birds, after they did come up, injured all the lots by eating off the green blades.

RYE.

Two varieties of fall rye were sown by drill early in August, and like the wheat covered the ground before the winter set in. Nineteen varieties were added by planting in rows 50 grains of each kind one foot apart.

GRASSES AND CLOVER.

The land being in an unfit condition, nothing was done towards testing forage plants until August, when some timothy and lucerne clover were sown by drill and 38 other varieties of grasses and clovers sown in small plots. None of these appeared above ground though a few varieties started to grow. Many additions of new, and especially all old and well-known grasses and clovers will be sown next spring. A collection of North-West grasses has also been gathered, the seed of which will be sown, and from which it is hoped good results will be obtained.

IMPROVEMENTS, &c.

During the summer a competent Dominion Land Surveyor, Mr. Wm. Thompson, of Qu'Appelle station, defined the limits of the farm, laid it out in fields, roads and plots, and prepared a plan of the whole section, including course of coulées, dams, building sites—number of acres in each field—number taken up by roads—coulées and water. Each field or plot being numbered on the plan, a record of all future operations can be conveniently kept.

FENCING.

On account of scarcity of men, and it being impossible to obtain suitable posts during the summer, nothing was done towards enclosing the farm, until frost put a stop to other work, when the regular staff was used, and something over one mile was put up. Sawn posts from British Columbia are being used, which, with 4 strands of wire, make a substantial and at the same time a creditable looking fence. The entire farm will be enclosed early next spring as nearly all the material is on hand to complete the work.

BUILDINGS.

There being no erections on the farm suitable for farming purposes, stabling and warehouse accommodations were obtained in Indian Head, which although the best that could be done, has been very inconvenient on account of the distance from the work. This will be remedied early next spring, when it is expected that all the buildings now under way will be completed. These comprise superintendent's, horticulturists and foreman's dwellings, a large stone basement barn, and horse stable.

ROADS—GRADING AND DAMS.

The farm having been laid out in fields, those on that portion summer fallowed, have been made accessible by roads. Two avenues to the buildings have been graded and planted and the grounds around the superintendent's house, laid out, graded and the roads made. Two dams, one on each of the coulées were widened and made higher, and new sluice-ways made to carry off all surplus water, should sufficient snow fall this winter, or water flow in the spring, lakes of 12½ acres and 3 acres in extent will beautify the farm next year. Besides this a good well has been sunk which yields a bountiful supply of excellent water.

LAND READY FOR CROP.

Two hundred and fifteen acres were thoroughly worked during the past summer, the greater portion being twice ploughed and several times harrowed and cultivated, 20 acres were only ploughed once, but all weeds were kept down by harrowing, so as to test the relative merits of the different ways of cultivation. Wild buckwheat, which had attained considerable hold of the ground, and the volunteer crop which grew very luxuriantly on the land fallowed, caused a large amount of extra work, but no doubt next year's crop will be all the better for the work done.

A space 100 feet in width, of the prepared land, along the western boundary of the farm, has been reserved for forest tree planting, and a strip around the entire farm for a like purpose.

TREE PLANTING.

In the beginning of October 700 fine ash-leaved maple trees were obtained in Brandon (Manitoba) and most of them planted along the western and part of the northern boundary and along the avenues leading to the buildings. The trees, which are from 5 to 6 years old, and have attained a height of 5 to 10 feet, were placed 20 feet apart on the boundaries, and 25 feet on the avenues.

EXHIBIT OF FARM PRODUCTS AT FAIRS.

During October many of the municipalities in the North-West held their annual fall exhibitions. It was thought advisable to exhibit the result of the first year's work on the farm, at as many of these as possible—accordingly, samples of wheat, barley, peas, oats in the straw, as well as the grain, native grasses, and the different varieties of potatoes and roots were prepared and were shown at Wolseley, Indian Head, Qu'Appelle station and Fort Qu'Appelle, where they received warm praise from farmers and others, while the press were unanimous in their approval. His Honour Lieutenant Governor Royal, on opening the North-West Assembly, referred to the exhibit as proof of the advantage the Experimental Farm will be to the North-West Territories.

On account of the harvest being backward, fairs held prior to those mentioned, could not be attended, but it is hoped that in the coming year many others will be reached.

I have the honour to be, Sir,

Your obedient servant,

ANGUS MACKAY,

Superintendent.

EXPERIMENTAL FARM FOR MANITOBA.

REPORT OF S. A. BEDFORD, SUPERINTENDENT.

To Professor WM SAUNDERS,
Director Experimental Farms,
Ottawa.

SIR, - I have the honour to submit herewith a report of the work accomplished on the Manitoba Experimental Farm during the past five months.

DESCRIPTION OF THE FARM.

The Manitoba Experimental Farm comprises portions of Sections 27 and 34, Township 10, Range 19, west 1st Meridian, 652 acres in all, about two-thirds of it is in the Assiniboine Valley, the remaining one-third is upland prairie, the greater portion of it is delightfully situated, the higher portions overlooking the Assiniboine Valley, one and a half miles from Brandon station and in full view of the Canadian Pacific Railway, it is in the centre of a thickly settled farming district, and is easy of access from all parts of the Province.

SOIL.

The soil is of a variable character, suitable for the purposes of an experimental farm, and consists of stiff clay and river sediment on the river flats, clay loam and rich sandy loam, from two to six feet deep on the higher portions of the valley, and light sandy and gravelly loam on the uplands.

WATER SUPPLY.

The Farm has an abundant supply of excellent water, the Assiniboine River, a navigable stream, forms a portion of its southern boundary, about the centre of the valley there is a lake of good water, three-quarters of a mile long and several feet deep, four spring creeks traverse the northern portions of the property, and several wells have been dug, which yield an abundance of good water at a depth of from 15 to 30 feet.

SHELTER.

On the borders of the lake and on the side hills and ravines of the northern portions of the Farm, there is a quantity of small timber and bushes which can be utilised for the protection of more tender shrubs and trees.

HAY LAND.

In the flats bordering on the Assiniboine River there is about 150 acres of excellent native hay meadow. In favourable seasons this will supply a large quantity of feed for stock and furnish land very suitable for carrying on a series of experiments with the view of determining the value of our native grasses for feeding purposes.

On my arrival here in the beginning of July last about 140 acres had been brought under cultivation, 100 of which was sown to grain. As no satisfactory arrangements could be made for the purchase of this crop, the owners were allowed to remove it. A large proportion of the cultivated land had been badly ploughed, and in the lower portions couch grass had taken a firm hold. On arrival the men and teams were at once started to plough the unsown portions, and before frost set in 110 acres were prepared for spring sowing. Owing, however, to my late arrival and to the condition the land was in, there was not sufficient time to give portions of it that thorough cultivation it required, hence about thirty acres will be better left for summer fallow, to be thoroughly cultivated during the coming season.

FALL GRAIN.

As the season was far advanced when I reached the farm, only a limited area of land could be prepared for fall grain, about the first week of September fifty grains, each of 184 varieties of fall wheat and rye were sown one foot apart for comparative test, but owing to the extreme dryness of the season only a portion of these germinated and their growth was slow. When winter set in the plants were only about three inches high and not as strong as I could have wished, the autumn here being generally cool and dry, better results are likely to be obtained by sowing early in August.

GRASSES.

Owing to the increasing scarcity of natural hay in most parts of the Province the question of suitable fodder plants is becoming an important one and my attention has been repeatedly called to the desirability of introducing some variety of grass suited to our soil and climate, with that end in view 37 varieties of cultivated grasses were sown during the month of September, an acre of timothy seed was also sown on the river flats, the seeds of some twenty varieties of native grasses were also collected, these will be sown early in the spring and their suitability for cultivation noted.

SOWING SPRING WHEAT IN THE FALL.

During the past season many volunteer crops of grain in this district were found to have entirely escaped the frost, while fields of spring sown grain in close proximity were injured; for the purpose of throwing further light on this subject an acre of Red Fyfe spring wheat was sown on the 3rd of November just before the ground froze up.

FOREST TREE CULTURE.

Early in November $\frac{3}{4}$ of an acre of native ash, basswood and maple seeds were sown, and a number of other varieties will be sown in the spring, 650 native ash-leaved maples from 8 to 10 feet high have been procured and a portion of them planted, the balance will be set out next season.

SMALL FRUITS.

The demand for all kinds of fruit in this Province is very large and yearly increasing. Judging from the number and variety of native small fruits found growing on this farm, its soil and situation promises to be well adapted to this branch of horticulture.

Just before the ground froze up 425 currant bushes, embracing 5 varieties, were received from the Central Experimental Farm, these were healed in ready for spring planting. A number of cuttings from native fruit trees were also set out and the effect of cultivation on them will be noted.

CLEARING OF SCRUB.

On taking possession of the Farm about 70 acres of the hay land bordering on the river was badly over-grown with roses, willow and ash scrub from four to nine feet high; during the past summer and fall this has all been cleared off, making an excellent meadow, fire has been run over a portion of this meadow and its effect on next season's crop will be watched and reported on.

DRAINING.

In former years the water from two of the springs rising in the uplands was allowed to spread itself over the lower land preventing early seeding and in wet seasons completely flooding portions of it; during the autumn 1,114 yards of open ditch has been dug conveying the water directly through the Farm and no further difficulty is expected from this source.

ROAD MAKING AND FENCING.

As the regular road allowances on both the north and south boundaries are impassable owing to the river and river banks, a public road, a chain wide and one mile long, has been laid out across the Farm from east to west; 507 yards of this road has been graded and well gravelled, the grade is 30 feet wide, leaving a sidewalk of 18 feet on each side which it is proposed to sow with permanent grasses. A row of native maple trees has also been planted on each side of this road giving it a finished appearance; during the coming season an effort will be made to complete this road and avenue, thus making a good approach to the Farm and greatly adding to its appearance.

FENCING.

A little over three miles of fencing has been erected, this is composed of round cedar posts from 5 to 10 inches in diameter placed 8 feet apart, 4 strands of barbless wire, and a 2 by 4 scantling mortised into the posts 4½ feet from the ground, this makes a substantial and at the same time an attractive fence.

A quantity of surface stone has been removed from the cultivated land, some of which has been used in repairing the temporary buildings, the balance will, no doubt, be found useful when the permanent buildings are erected.

TEMPORARY BUILDINGS.

When taken over by the Government there was a frame house 20 by 26 feet and a basement barn 26 by 36 on the property, both were in an unfinished condition and unfit for occupation; they have been thoroughly repaired and will serve a good purpose for a number of years to come; two temporary implement sheds 14 by 26 have also been built.

I have the honour to be, Sir,

Your obedient servant,

S. A. BEDFORD,

Superintendent Manitoba Experimental Farm.

BRANDON, MANITOBA, December 31, 1888.

CENTRAL EXPERIMENTAL FARM, DEPARTMENT OF AGRICULTURE, OTTAWA, CANADA.

BULLETIN No. 4.

March, 1889.

To the Honorable
The Minister of Agriculture:

SIR,—I have the honour to transmit herewith the fourth Bulletin from the Central Experimental Farm. This relates to the Ladoga wheat which was first imported under your instruction from Northern Russia in 1887, with the object of securing an early ripening variety of hard wheat, of such quality as would compare favourably with the best hard wheats now in cultivation in the North-West of Canada. The results submitted in the accompanying Bulletin indicate a gratifying measure of success obtained in this undertaking.

The first part prepared by myself treats of the earliness, fertility and quality of the wheat; the second part, which has been prepared at my request by Mr. Frank T. Shutt, Chemist of the Dominion Experimental Farms, relates to the chemical constituents and physical characters of wheat, and gives the results of the chemical analyses conducted by him of a number of samples of Ladoga, Red Fife and other varieties of wheat.

I have the honour to be, Sir,

Your obedient servant,

WM. SAUNDERS,

Director.

OTTAWA, 22nd March, 1889.

LADOGA WHEAT.

PART I.

By Wm. Saunders, F.R.S.C., F.L.S., F.C.S., Director of the Dominion Experimental Farms.

Importance of obtaining early ripening varieties.

The question of early ripening varieties of grain and especially of wheat, is one of the utmost importance to the future of Canada. The Provinces of Prince Edward Island and New Brunswick, the northern portions of Quebec and Ontario, and the great plains of the North-West, all have a short season, and the immense advantages which would accrue to the farmers in all these sections of our country from the introduction and dissemination of early ripening sorts of wheat, barley and oats, and the annual saving this would effect would be difficult to over-estimate. But the wheat problem is the subject of the present Bulletin, and it is to the needs of the

North-West settlers that we would at this time direct special attention. The soil of the great plains of Manitoba and the North-West Territories is stored with such an abundance of fertility that the capacity for production can scarcely be estimated provided that the difficulties associated with a short season can be partially or wholly overcome by the introduction of early ripening sorts. To meet the requirements in this case, not only must the variety of wheat be early in ripening, but it must also possess such superior qualities as will command for it a relatively high price in the markets of the world; otherwise the cost of transporting so bulky a product over long distances would leave but little profit to the grower. It is a singular fact that the northern countries of the world, where the difficulties surrounding agriculture are greatest, both in the way of production and access to markets, are the only countries producing wheat of the highest quality, and it is found to be a necessity by millers everywhere, who aim to produce first-class flour, to add to the softer wheats produced in temperate and southern latitudes a large proportion of the hard wheats grown in northern countries, and it is said that the larger the proportion of hard wheat used the stronger and better will be the flour. While India produces some hard wheat in limited quantities, most of the hard wheats which find their way to the markets of the world are the growth of the northern plains of Russia, the northern United States, and the North-West Provinces of Canada.

Fife Wheat.

The varieties of wheat known as Red and White Fife, grown in the Canadian North-West, deservedly rank among the best wheats in the world, and the high grades of flour produced from them command the best prices obtained for this product, and were the Fife wheats a little earlier in ripening, nothing better need be desired. In the northern parts of the United States the same or similar wheats are grown under the names of Fife, Saskatchewan Fife, and Wellman's Fife. The following account of the origin of Red Fife Wheat is given in the *Canadian Agriculturist* for 1861: "About the year 1842 Mr. David Fife, of the Township of Otonabee, Canada West, now Ontario, procured through a friend in Glasgow, Scotland, a quantity of wheat which had been obtained from a cargo direct from Dantzic. As it came to hand just before spring seed time, and not knowing whether it was a fall or spring variety, Mr. Fife concluded to sow a part of it that spring and wait for the results. It proved to be a fall wheat as it never ripened, except three ears, which grew apparently from a single grain. These were preserved, and although sown the next year under very unfavourable circumstances, being quite late and in a shady place, it proved at harvest to be entirely free from rust when all wheat in the neighborhood was badly rusted. The produce of this was carefully preserved, and from it sprung the variety of wheat known over Canada and the Northern States by the different names of Fife, Scotch and Glasgow."

Russian Wheats.

In Russia a number of different sorts are grown, but in the northern provinces the Saxonka and Kubanka varieties form a large proportion of the shipments. The Saxonka wheat is known also under the name of Colonist wheat, and it is alleged that it is the identical wheat which was distributed by Peter the Great among the colonists whom he forcibly placed on the great plains of Russia. It is rather small in grain, but hard in texture, and is held in esteem by millers in Great Britain as a mixing wheat, but does not command the high price which the best qualities of hard wheats from Canada and the United States readily bring. The Kubanka appears to be identical with what is known in Canada as Goose wheat, a variety of a hard ricy structure more or less transparent, which is regarded with much disfavour by millers in Canada who pronounce it to be one of the poorest varieties grown. In Russia it is highly esteemed and in the wheat markets of Europe it usually commands a price about equal to the Saxonka, which is usually about three-fourths the price of the best

American hard wheats. It is a variety held in some favour by Canadian farmers in localities where the wheat midge prevails, as a midge proof wheat, for the reason that the kernel hardens so early that the midge is not able to injure it much. The outer covering of this wheat is thick, and the proportion of bran to flour is greater than in most other varieties, and notwithstanding that it is fairly rich in gluten its growth should not be encouraged where wheats of better quality can be matured.

The Ladoga.

In Bulletin No. 2 reference was made to the importation of an early ripening spring wheat from one of the northern Provinces of Russia. The object sought in its introduction was to obtain a hard wheat of good quality which would ripen early enough to escape the autumn frosts which sometimes injure the crops in some parts of the north-west of Canada. This wheat was selected by a seed dealer in Riga who had made a special study of the cereals of northern Russia, but the exact locality of its growth, and the name under which it is known had not been ascertained at the time Bulletin No. 2 was issued.

It was grown in latitude 60° near Lake Ladoga, north of St. Petersburg, and is known under the name of Ladoga. The locality referred to is by latitude 840 miles north of the city of Ottawa, 600 miles north of Winnipeg and north of the northern boundary of Lake Athabasca, in the Peace River country. The Ladoga wheat is said to be highly esteemed in those parts of Russia where it is grown, and is in favour as an early ripening sort. The first consignment was brought to Canada in the spring of 1887, when 667 sample bags were distributed for test, from which 275 returns were received, and from these reports the average period of ripening was estimated from ten to fifteen days earlier than Red Fife, a gain in time of maturing which would if maintained materially lessen the risk of injury from frost. In the spring of 1888 a second distribution of this wheat was made, when 1,529 sample bags of 3 pounds each, were sent out, from which 301 reports have been received. These place the period of ripening, taking the entire Dominion, at 10 days earlier than the Red Fife.

Its Fertility.

The relative fertility of this wheat is also an important feature, and in this particular it will be seen from the following table that the Ladoga makes a very fair showing:

Returns Received for 1887.	No. of Returns.	Yield from 3 lbs. Sown.			Time from Sowing to Harvesting.
		Largest.	Smallest.	Average.	
		Lbs.	Lbs.	Lbs.	Days.
Manitoba	83	165	30	76½	102
North-West Territories	68	236	21	85	105
British Columbia	3	112	61	85	93
Ontario	67	60	10	27	90
Quebec	15	40	6	19	85
Nova Scotia	15	89	20	53	102
New Brunswick	24	60	8	30	97

Being an average yield of a little over 53 pounds from each 3 pounds sown.

The returns for 1888, as indicated by the reports received, may be thus summarized:—

Returns Received for 1888.	No of Returns.	Yield from 3 lbs. Sown.			Time from Sowing to Harvesting.	Number of Days earlier than Red Fife.
		Largest.	Smallest.	Average.		
		Lbs.	Lbs.	Lbs.	Days.	
Manitoba.	51	100	12	38	123	9¼
North-West Territories	69	178	12	63	122	10¼
British Columbia.	8	183	53	126	113	8½
Ontario	113	97	8	44	99	9
Quebec.	20	138	16	50	101	11½
Nova Scotia	14	44	10	26	120	10
New Brunswick.	11	94	34	59	107	12
Prince Edward Island.	15	199	15	46	115	9½

This is equal to an average yield of a little more than 50 pounds from each 3 pounds of seed, and compared with Red Fife it is just ten days earlier.

The summer of 1887 was exceptionally hot and dry in Ontario and Quebec, and the crops of all cereals were light and their ripening premature. On the Central Experimental Farm a field of fourteen acres of Ladoga wheat sown on the 7th of May was harvested in 76 days from the date of sowing, the Ladoga ripening eight days earlier than the Red Fife sown at the same time in an adjoining field. On the 17th of May, 1888, this experiment of sowing was repeated and the field of Ladoga ripened in 81 days, the Red Fife in 92 days, a difference of eleven days. During the past season the grain in Manitoba and the North-West Territories has been unusually slow in ripening, so also in the Maritime Provinces owing to the remarkably low average temperature during the growing season; the conditions in Ontario and Quebec have on the whole been more favourable. These circumstances will aid in explaining the differences in the results for the two years. The falling off in yield in Manitoba and the North-West Territories during 1888, was mainly due to the very backward season and to the advent of unusually early frosts which in many cases nipped the grain before it was mature and materially lessened the crop.

Relative Quality.

The quality of the Ladoga wheat is a very important consideration. The very high character of the Red Fife wheat grown on the western plains of Canada and the excellent quality of the flour prepared from it, has created a demand for this wheat at the highest market prices, and it is of the utmost importance that this good reputation be maintained; the introduction of any wheat of a manifestly inferior quality which would tend to lower the standard of Canadian hard wheat would be highly impolitic. The original Ladoga wheat has been submitted to a number of experts, the majority of whom place it in the next grade below No. 1 hard, and estimate its value at from 4 to 5 cents per bushel less than the best quality of Red Fife, but some of the samples grown from this seed have improved so much as to entitle them to grade with grain of high quality.

With the view of ascertaining the opinions of those who are held to be the most competent judges eight samples were chosen, representing the average quality of those received together with a sample of the original importation and a small sample of the Saxonka and Kubanka wheats, which had been received from a correspondent who had grown them in Manitoba. Subsequently three of the heaviest and best samples of Ladoga were selected, making 14 in all. A portion of each was sent to the Boards of Trade in Montreal, Toronto and

Winnipeg, to Mr. W. W. Ogilvie of Montreal, and to Mr. Frank E. Gibb, Dominion Grain Inspector at Port Arthur, for inspection, and to the Chemist of the Experimental Farms, Mr. F. T. Shutt, for analysis. The several Boards of Trade manifested a deep interest in the subject, and referred the samples in each case to a select committee of experts. Mr. W. W. Ogilvie kindly gave his personal attention to the subject, and Mr. F. E. Gibb reported fully on the first lot of average samples sent him, but through illness was prevented from reporting on the last and best samples.

The list of samples and the reports thereon are herewith submitted, with the numbers under which they were sent.

				Weight per bushel.
7	Ladoga—Original importation			61 lbs.
1	do	grown at	Lethbridge, N.W.T.	$60\frac{3}{4}$
2	do	do	Edmonton, N.W.T.	$61\frac{1}{2}$
3	do	do	Plum Creek, Souris, Man.	$60\frac{1}{4}$
4	do	do	Brandon Hills, Man.	60
5	do	do	Tatamagouche, N. S.	60
6	do	do	Guysboro', N. S.	$61\frac{1}{4}$
8	Kubanka—grown in Manitoba.			
9	Saxonka	do	do	
10	Ladoga—grown at		Wolseley, N.W.T.	63
11	do	do	Touchwood Hills, N.W.T.	64
12	do	do	Binscarth, Man.	65
13	do	do	Mowbray, Man.	$64\frac{3}{4}$
14	do	do	St. Mary's, New Brunswick	64

A letter was forwarded with each set of samples similar to the following, which was addressed—

"To the Secretary of the Board of Trade, Montreal.

"Dear Sir,—I desire to get the opinion of your Board of Trade regarding a wheat which was distributed last spring from the Experimental Farm in Ottawa for test in different parts of the Dominion. It is well known that farmers in the northern parts of Manitoba and the Territories have in the past suffered much loss from frozen wheat, and they are very anxious to obtain some variety which will ripen a few days earlier than the Red Fife, so as to admit of its being harvested before the early frosts occur. So strong is this feeling that farmers are willing to grow inferior varieties rather than suffer such losses as they have experienced in the past.

"In view of this condition of things, efforts are being made under instruction of the Minister of Agriculture, to endeavour to secure an earlier ripening wheat of *good quality* as nearly up to the standard of the Red Fife as possible. You will bear in mind that the object of this introduction is not by any means to displace the Red Fife; I think the growth of that variety should be encouraged in every practicable way, but the Minister desires that an earlier wheat of *good quality* should be secured to be grown where the Red Fife does not succeed, and thus discourage and prevent as far as is practicable the introduction of soft and inferior varieties of wheat, so that the present high standard of our North-West grain may be generally maintained and at the same time the necessities of the farmers met and the settlement of the country stimulated.

"After much correspondence and enquiry, it was decided to order a supply for the first experiment from Riga, Russia. This wheat arrived late last spring, and not having been advised of its correct name, it was distributed provisionally under the name of 'Northern Russian Wheat.' I have since learned that it is known in Northern Russia under the name of Ladoga.

"I send you a sample of the original importation under No. 7 and the samples from 1 to 6 and 10 and 11 inclusive, have all been grown from this seed. In considering these samples it should be borne in mind that the seed was not received by the growers until from two to three weeks after the usual time of seeding, hence the grain is not so plump and well developed as it would have been had it been sown earlier.

" No. 1	was grown at	Lethbridge, Alberta, N.W.T.
do 2	do	Edmonton do do
do 3	do	Plum Creek, Souris, Manitoba.
do 4	do	Brandon Hills do
do 5	do	Tatamagouche, Nova Scotia.
do 6	do	Guysboro' do
do 10	do	Wolseley, Assiniboia, N.W.T.
do 11	do	Indian Reserve, Touchwood Hills, N.W.T.

" I desire to have the opinion of your Board of Trade as to how these wheats would grade in the markets of this country and how they would compare with Red Fife in the price they would command. I also enclose, under Nos. 8 and 9, a few grains (I am sorry I cannot just now send more) of Kubanka and Saxonka wheats, which are being sold in Manitoba for seed. Kindly let me know how these compare in value with Red Fife and Ladoga and the prices these varieties would now command if placed on the market in quantities. I desire this information for the reason that frequent enquiries reach me from Manitoba and the North-West from farmers who seek information on these points.

" The reports which have been received show that the Ladoga wheat has ripened during the past season from 10 to 15 days earlier than the Red Fife. Should this early ripening habit prove permanent—which there is every reason to expect—and the wheat of a desirable quality, its further encouragement in the districts referred to is most important.

" You will I trust, in view of the importance of this subject to the whole country, pardon the liberty I have taken and obtain for me the information asked.

" Yours very sincerely,

" WM. SAUNDERS,

" *Director Experimental Farms.*

" OTTAWA, 30th January, 1888."

The three samples referred to under Nos. 12, 13 and 14 were forwarded on the 2nd of February to the several experts and Boards of Trade, with letters, explaining that these were the three heaviest specimens which had been obtained.

The following replies were received:—

" OFFICE BOARD OF TRADE,
" 10 St. John Street and 39 St. Sacrament Street.
" MONTREAL, 9th February, 1888.

" The Board of Examiners for wheat and other grain having taken communication of the letters from the Director of the Central Experimental Farm, Ottawa, dated 30th January and 2nd February, and having compared and examined the samples of wheat forwarded by the Director, reports as follows:—

" That the Board learns with pleasure of the action of the Government in endeavouring to secure, through the Director of the Experimental Farm, a hard wheat of good quality that shall ripen earlier than Red Fife, the Board believing that while Red Fife should most certainly be grown wherever there is no danger to be apprehended from early fall frosts, it is of the greatest importance that a choice hard wheat shall be found that will ripen earlier than Red Fife and so may be safely grown in districts where such frosts occur.

" That the samples of Ladoga wheat would, with the exception of No. 3 all grade as hard wheats and the Board consider that presuming the stated advantage of time in maturing is fully established, its introduction will be very advantageous wherever early harvesting is desirable.

" That a comparison of the Ladoga wheat samples with the Fife wheats, to be of any value can only be made by providing a miller with a sufficient quantity to be ground and afterwards baked. From a trade point of view, however, the Board considers that should any difference in favour of Red Fife be established, the advantage would be trifling as compared with the importance of securing to the farmer a wheat that would ripen from two to three weeks earlier.

"That the exception made by the Board regarding sample No 3, is because that wheat would not grade above ordinary spring wheat; and it would appear either that some mistake must have been made respecting the original seed, or in the product sent to the Director, for it seems scarcely possible that the samples of Ladoga wheat submitted could have so deteriorated in one sowing as to produce so inferior a grain.

"That with regard to the samples of Kubanka and Saxonka wheats, the Board condemns both as being very inferior grain, and quite unsuitable for seeding purposes.

"Signed on behalf of the Board of Examiners for wheat and other grain.

"HUGH McLENNAN,
"*Chairman.*"

"TORONTO BOARD OF TRADE.

"Report of the Committee of Millers, Grain Dealers, Grain Exporters and Grain Inspectors, to whom was referred the communications and samples sent to the Secretary of the Board by Prof. Wm. Saunders, Director of the Central Experimental Farm.

"To the President and Council of the Board of Trade.

"Your Committee sat on the afternoon of the 4th February, 1888, examined the samples and discussed the subject, which, in their opinion, is one of very great importance.

"The conclusions to which they arrived are as follows:—

"The most important test of commercial merit in a spring wheat sample is the percentage and quality of gluten it contains.

"The examination made by the committee of sample 7, the original importation, and of samples 3 and 4 (those grown at Plum Creek and Brandon Hills), shows that all three are very deficient in gluten, or strength, being not superior to the present standard of No. 2 spring of Ontario growth.

"No. 2 spring is at present worth 80 cents per 60 lbs. here; No. 1 Manitoba hard, which contains 85 per cent. of Red Fife, is worth 90 cents. The answer to the enquiry as to how these wheats would compare in value with Red Fife would therefore be: Pure Red Fife is worth 11 to 12 cents per bushel more than samples 7, 3 and 4.

"The committee selected samples 7, 3 and 4 for comparison for the reason that they were grown in the same section of Manitoba from which comes the bulk of the Red Fife with which they are familiar."

"Sample 8, Kubanka, is the wheat grown to some extent in Ontario, under the different names of Arnecta, Rice or Goose Wheat. The demand for this wheat is limited, and when the quantity grown in Ontario was large compared with the quantity grown in Ontario now, the price was 20 to 23 cents below the price of No. 2 spring, say 35 cents below the price of No. 1 hard Manitoba. This wheat is also a later wheat to ripen than Fife wheat."

"Sample 9, Saxonka, is a poor, thin sample, containing a small mixture of Kubanka or Arnecta. If free from this it would inspect No. 3 spring, worth 77 cents as against 90 cents for No. 1 hard."

"The Ladoga would be a fair marketable wheat of the soft variety and preferable to badly frosted Red Fife."

"If it is a fact that any section of the wheat-growing North-West cannot be made to produce unfrosted Red Fife by proper farming, we would recommend that the Ladoga be tried in such localities, if by further experiments you fail to find a more glutinous wheat, possessing all the early ripening quality of the Ladoga."

"In the interests of the North-West, however, it is to be hoped that every experiment will be exhausted in the direction of retaining pure Red Fife sowing before settling down to soft wheats of any variety."

"An exceptionally bountiful crop of Red Fife, and an exceptionally poor crop of winter wheat, in the same year might result in the price of the latter approximating the price of the Fife, because the flours from the two varieties are not interchangeable for many purposes. But no surplus of Red Fife and scarcity of such wheats as samples submitted, could bring the value of the latter to, or nearly to, the value of Red Fife. The Red Fife flour will answer in every case where flours from your samples will answer, and with greater satisfaction and economy."

"Instances are known to some members of the committee of No. 1 hard and No. 2 frosted, being ripened side by side, from the same field in Manitoba, the soil and seed the same; the only difference being, in the first case the ground was ploughed and harrowed in the fall, thereby admitting of a few days earlier seeding, than in the second case where the ploughing was done in the spring."

"In view of the great importance of keeping up the growth of hard wheat, important to all interests, but most important of all to the North-West farmers, the committee report that in their opinion the greatest efforts should be made to extend its growth, and if other varieties than Red Fife must be used, such varieties as contain the largest percentage and best quality of gluten should be given preference."

"For determining the percentage and quality of gluten, the committee would recommend chemical analysis of all samples proposed to be experimented with, this being the one reliable test for a small sample."

"The samples last received (12, 13 and 14), are excellent in their plumpness and weight, but are quite as soft and deficient in strength as the former samples, and in value would bring about 2 cents per bushel more if offered for sale in quantity, than the samples first received."

(Signed,) H. McLAUGHLIN,
Chairman of Committee.

COMMITTEE.

H. McLaughlin,	R. J. Stark,	J. L. Spink,
John Reed,	H. N. Baird,	J. Carruthers,
Thomas Flynn,	S. A. Chapman,	R. C. Steele,
Joseph Harris,	W. Taylor,	W. D. Matthews, Jr.

WINNIPEG BOARD OF TRADE.

SECRETARY'S OFFICE, CIVIC BUILDINGS,
WINNIPEG, Man, 16th February, 1888.

The Council Winnipeg Board of Trade.

GENTLEMEN,—Your Board of Grain Examiners have to report that they have carefully examined the samples of Russian wheat forwarded to the Board by Prof. Saunders, Director of the Government Experimental Farm at Ottawa, and which he requests the Board will express an opinion on.

After viewing the samples your grain examiners find as follows:

The original sample of Ladoga wheat, and some of its best matured products grown in Manitoba, would value with grades of the "Northern" classes.

We find that most of the samples submitted are not fully matured, and they are all lacking in good colour.

Sample No. 3 (grown at Souris, Man.), would seem not to belong to the Ladoga variety of wheat, being a wholly soft specimen which would grade as "No. 3 spring."

Nos. 1 and 11 (grown at Lethbridge, N.W.T., and Touchwood Hills, N.W.T., respectively), show the effects of frost action.

No. 2 (grown at Edmonton, N.W.T.), has a bleached look, which might arise from a very slight touch of frost or the effects of hot winds.

For seeding purposes we would recommend the original sample from Russia in preference to any of the others submitted.

The best sample, No. 13 (from Mowbray, Man.), and the original from Russia would be worth five cents less than No. 1 Manitoba Hard (containing 85 per cent. of Red Fife), for milling purposes. Necessarily this opinion must be subject to a milling test, or chemical analysis.

None of the eleven samples of the products of the Ladoga variety, bear any close resemblance to the original sample forwarded, and are, for the most part, unlike one another. This may be owing to the lateness in sowing or other unfavourable conditions, and we are of the opinion that a test, during another year or two, must be made before its value for this country could be positively ascertained.

Prof. Saunders has asked, also, for the Board's opinion as to the relative value borne by certain samples of Kubanka and Saxonka wheat (forwarded by him) to the Red Fife and Ladoga varieties.

In the opinion of this Board of Grain Examiners the millers and grain dealers of Manitoba would not purchase Kubanka wheat at any price, though it might, however, be useful for feed purposes. We understand that this variety of wheat is being sold in Manitoba this season for seed. In the opinion of your Examiners the sample submitted by Prof. Saunders is none other than "goose" or "rice" wheat and of little value.

The Saxonka variety belongs to the spring or soft class of wheats. The sample examined, however, is so poor that it would only grade as "rejected."

Your Grain Examiners are firmly of the opinion that the cultivation of Red Fife wheat should be persevered in, and that farmers will speedily discover the system of soil preparation by which they can insure early seeding with the early and safe maturing of this invaluable variety.

All of which is respectfully submitted.

(Signed) GEO. J. MOULSON,
Chairman.
CHAS. W. BELL,
Secretary, Board of Grain Examiners.

REPORT OF W. W. OGILVIE, ESQ.

MONTREAL, 3rd February, 1888.

Prof. W. SAUNDERS,
Director Central Experimental Farm,
Ottawa.

DEAR SIR,—Your favour of the 30th ult., with 11 samples of wheat, came duly to hand. I have examined them carefully and beg to submit the following report:—

The sample of Kubanka wheat grown in Manitoba is what is known as Goose wheat. Its growth should be discouraged as much as possible, as its value is fully 15 cents per bushel less than Red Fife wheat.

The sample of Saxonka wheat grown in Manitoba is also poor wheat that should not be encouraged for seed.

Sample No. 7, Ladoga wheat, being the original importation from Riga, is not pure hard wheat, having a mixture of soft wheat in it.

Sample No. 10, grown at Wolseley, shows the best result of last year's growth, and would inspect Extra Hard.

Samples No. 1, No. 2, No. 6 and No. 11 would inspect No. 1 Hard, and sample No. 5, grown in Nova Scotia, would inspect No. 2 Hard.

Sample No. 3, grown at Plum Creek would inspect No. 1 Spring, being the fourth grade of wheat. From the way this sample has degenerated in one year, would lead me to infer that the Ladoga wheat would not long maintain its hardness but will degenerate into ordinary Spring wheat.

I have had a good deal of experience in the growing of Russian wheat in Canada, my father having been among the first to import it. I have also visited the wheat fields of Russia and experimented upon its growth in this country. The Mennonites in Southern Manitoba also brought Russian wheat with them. My experience has proved that these wheats soon degenerate into ordinary Spring wheat in this country, and at best never had the bright shining gloss that you find on Red Fife wheat. The Russian wheat also grinds harsh, and the flour is not equal to Red Fife.

Notwithstanding all that has been said and written about early ripening wheat, after many experiments, my experience has been that Red Fife wheat will ripen as early and yield as well as softer wheats, and is worth 10 cents per bushel more than soft wheat. Many of these tests have been in Manitoba. The complaints from Red Fife wheat in Manitoba have been caused by late sowing, the richness of the soil, weather and cool nights in August; but I am of opinion that with early sowing and favourable August weather, these complaints will disappear.

We must also bear in mind that Manitoba and the North-West Territories are among the few countries that can grow hard wheat, and therefore we should discourage the growth of soft wheat that can be grown in more than three-fourths of the wheat fields of the world, while hard wheat can only be grown in Hungary, Russia, Dakota and Minnesota, the farmers in Dakota sow entirely Red Fife wheat, and its flour has attained a world wide reputation. The soil of Manitoba is better than Dakota and Minnesota and will grow Red Fife wheat better than any country in the world, so I hope you will realize the necessity of encouraging the growth of Red Fife as much as possible and discouraging all other varieties of wheat.

I have had many tests made of the value of flour ground from Red Fife wheat grown in Manitoba, and they have always been satisfactory. I enclose you a few copies of the last test taken in London, Eng., with other prominent brands of flour.

Many farmers who have gone from Ontario to Manitoba, have taken seed wheats of soft varieties with them, which affect many samples of Manitoba wheat and causing so much of it to inspect Northern. The complaint that has been made against Red Fife not ripening as early as any other wheat, I think is altogether a mistake and can be attributed largely to the farmers or cold nights in August, that would have had the same effect on soft wheat.

Yours truly,

W. W. OGILVIE.

MONTREAL, 7th February, 1888.

Prof. W. SAUNDERS,
Experimental Farm, Ottawa.

DEAR SIR,—Your esteemed favour of the 2nd instant to hand, with 3 samples of wheat. The 3 are splendid wheat, being brighter than those previously received, but still have not the gloss of Fife wheat, and would not make so saleable a flour. Sample No. 13 is the best, No. 12 nearly as good; both would inspect Extra No. 1 Hard. No. 14 shows too many soft grains for first sowing and gives indication that it would soon degenerate into soft wheat. Notwithstanding what Mr. Smellie reports, I am inclined to think that the weather between the 8th and 26th April, must not have been good sprouting weather, or the Fife wheat would have ripened as early as the Russian. I am very strong upon this point, after my past experience, and my anxiety to have Red Fife wheat sown for Manitoba, and no others, as I am satisfied it is the best wheat for the country.

Yours truly,

W. W. OGILVIE.

PORT ARTHUR, 24th December, 1887.

Prof. W. SAUNDERS,
Central Experimental Farm, Ottawa.

DEAR SIR,—Yours to hand with samples of wheat grown at different points in the Dominion from seed purporting to have been imported from Russia. I do not express any opinion as to the milling qualities as compared with Red Fife as grown at present in Manitoba, as you say you are to have that from the best millers. Judging from the samples I have from you I should think this Russian wheat is not likely to improve on any light soils, it will run into soft wheat. It is more adapted to heavy clay land, and I think when grown there will be found to produce a very hard berry, grading equal to the best Red Fife.

A comparison of No. 3 with No. 2 shows such extreme points that it is difficult to believe they were both grown from the same seed. I have seen the same thing occur when the points were only seven miles apart but different soils.

If the millers pronounce this Russian wheat equal in milling properties to the Red Fife, and the testimony as to its ripening from 10 to 15 days earlier, undoubted, there will be no question about its being the wheat for Manitoba to grow. The Red Fife was so good in quality for the crop of 1886, and both in quality and yield for 1887, that I doubt very much the advisability of trying anything else until that fails entirely. The Russian, however, if not the Red Fife itself, bears a very strong resemblance to it.

The "Kubanka" and "Saxonka" had better be left in their original fields, being simply "Goose" or "Rice" wheat. Herewith I append Inspection Grades on the different samples.

Yours truly,

FRANK E. GIBB.

INSPECTION OF NINE SAMPLES OF WHEAT RECEIVED FROM WM. SAUNDERS, CENTRAL EXPERIMENTAL FARM, OTTAWA.

7. Ladoga, from Riga, Russia, would grade No. 1 Northern. Resembles much of this year's crop in Manitoba

1. Ladoga, grown at Lethbridge, N.W.T., grade No. 1, frosted, all hard, outside bran blistered, bright kernel, fair milling sample.

2. Ladoga, grown at Edmonton, N.W.T., grade No. 2, Manitoba hard wheat, all hard, bleached.

3. Ladoga, grown at Souris, Man., grade No. 1, spring, over 50 per cent. soft.

4. Ladoga, grown at Brandon Hills, Manitoba, grade No. 2, Manitoba hard wheat, nearly all hard, bleached.

5. Ladoga, grown at Tatamagouche, N.S., grade No. 3 Northern, much bleached.

6. Ladoga, grown at Guysboro', N.S., grade No. 2, Canada hard wheat, bleached.

8. Kubanka, grown in Manitoba, grade No. 1, Goose.

9. Saxonka, grown in Manitoba, no grade, much bleached, thin, and principally "Goose" wheat.

FRANK E. GIBB,
Grain Inspector.

PORT ARTHUR, 24th December, 1887.

A sample of Ladoga, grown at Moosomin, N.W.T., was also sent to Mr. Gibb with the others, which, through an oversight, was not included in the subsequent distribution. This was graded by Mr. Gibb as "No. 1 Manitoba hard wheat, good."

Another sample of Ladoga wheat, which was grown on one of the Indian Reserves from seed sent from the Experimental Farm at Ottawa, of the first importation, was sent by Mr Wm. McGirr, of the Indian Department, Regina, to Mr. S. A. McGaw, of Ogilvie's Royal Mill, Winnipeg, which was submitted for examination by Mr. McGaw to the analyst employed by Messrs. Ogilvie in testing wheats. In a letter from S. A. McGaw to Mr. Wm. McGirr, dated 4th December, 1887 (which I am permitted to publish) he says: "Our analyst in Montreal reports very favourably of the Russian wheat, and states that it contains a large amount of gluten, and being in most respects nearly if not equal to Red Fife."

The suggestions of the Toronto Board of Trade regarding the importance of determining the proportion of gluten by chemical analyses has been acted on, and a full account of a careful series of analyses will be found in the appended report of the Chemist of the Experimental Farms, Mr. F. T. Shutt. Those of the Boards of Trade of Montreal and Winnipeg have also been carried out, by providing a miller with a sufficient quantity of the wheat to be ground into flour, and having this flour made into bread.

All the samples which have been referred to as submitted for inspection were carefully put up by myself, taken from the same bags, and were all exactly alike, but the several reports of the experts to whom they were sent are of a very contradictory character. The Montreal Board of Trade grade all the samples of Ladoga, excepting one, as hard wheats. The Toronto Board of Trade grade every one of them as soft wheats. The Winnipeg Board of Trade give a definite opinion on three only. One of them, No. 3 (the same lot as was graded soft by the Montreal Board), is pronounced soft; Nos. 7 and 12 are graded hard wheats, worth 5 cents less than No. 1 hard. Mr. W. W. Ogilvie gives an opinion on ten out of the twelve samples submitted to him. Of the original Ladoga as imported (No. 7), he says this "is not a pure hard wheat, having a mixture of soft grains in it." This opinion would probably entitle No. 7 to a place among the lower grades of hard wheat, but of the other nine samples No. 3 is the only one pronounced soft, and it is graded No. 2 Spring. Two of the others are said to be extra No. 1 hard, one extra hard, four No. 1 hard and one No. 2 hard. Mr. F. E. Gibb pronounces the original sample of Ladoga as resembling much of the Manitoba crop of 1887, and grades it as No. 1 Northern; of the other seven samples grown from this grain, which Mr. Gibb reported on, five were returned as hard wheat, and two as soft.

As one of the more striking examples of difference of opinion, the sample grown at Mowbray, Man., may be cited. This the Montreal Board of Trade pronounced to be hard; the Toronto Board of Trade, soft; the Winnipeg Board of Trade as a hard wheat, worth 5 cents a bushel less than No. 1 hard; and Mr. W. W. Ogilvie as extra No. 1 hard. It cannot be said that Mr. Ogilvie is in any sense unduly in favour of Ladoga wheat, for while he practically pronounces eight out of the nine samples on which he gives an opinion as marked improvements on the original, he argues from the one soft sample that this wheat is degenerating, and likely to degenerate to a soft wheat, apparently forgetting that the contrary argument could be sustained with an eight-fold force.

A better idea will perhaps be given of the differences of opinion throughout by placing the results in a tabulated form.

No.	—	Weight per Bushel.	Opinion of Montreal Board of Trade.	Opinion of Toronto Board of Trade.	Opinion of Winnipeg Board of Trade.	Opinion of W. W. Ogilvie, Montreal.	Opinion of F. E. Gibb, Port Arthur.
		Lbs.					
7	Ladoga, original importation	61	Hard wheat.	Soft Wheat, No. 2 Spring	Hard wheat, Northern, 5 cts. less than No. 1 hard.	Not a pure hard wheat.	Hard wheat, No. 1 Northern.
1	do grown at Lethbridge, N.W.T	$60\frac{3}{4}$	Hard wheat	Soft wheat.		No. 1 hard	Hard wheat, No. 1 frosted.
2	do do Edmonton, N.W.T	$61\frac{1}{2}$	Hard wheat	Soft wheat.		No. 1 hard	No. 2 Manitoba hard.
3	do do Souris, Man	$60\frac{1}{4}$	Soft wheat.	Soft wheat, No. 2 Spring.	Soft wheat, No. 3 Spring	Soft wheat, No. 1 Spring.	Soft wheat, No. 1 Spring.
4	do do Brandon Hills	60	Hard wheat	Soft wheat, No. 2 Spring.			No. 2 Manitoba hard.
5	do do Tatamagouche, N.S	60	Hard wheat	Soft wheat.		No. 2 hard	Hard wheat, No. 3 Northern.
6	do do Guysboro', N.S.	$61\frac{1}{4}$	Hard wheat	Soft wheat.		No. 1 hard	No. 2 Canada hard
10	do do Wolseley, N.W.T.	63	Hard wheat	Soft wheat.		Extra hard	
11	do do Touchwood Hills, N.W.T.	64	Hard wheat	Soft wheat		No. 1 hard	
12	do do Binscarth, Man.	65	Hard wheat	Soft wheat		Extra No. 1 hard	
13	do do Mowbray, Man	$61\frac{1}{4}$	Hard wheat	Soft wheat.	Hard wheat, 5 cts. less than No. 1 hard	Extra No. 1 hard	
14	do do St. Mary's, N.B	64	Hard wheat.	Soft wheat		Shows too many soft grains.	No. 2 Canada hard
8	Kubanka, grown in Manitoba		Very inferior grain	Goose wheat	Of little value	15c. per bushel less than Red Fife.	No. 1 Goose
9	Saxonka do do		Very inferior grain	A poor thin sample No. 3 Spring.	Soft and rejected	Poor wheat.	No grade

The only sample that all the authorities agree on as being a soft wheat is No. 4, and this is so unlike the other samples that there is good reason for believing that some accidental foreign mixture has occurred either in the seed sent out or the sample returned.

CHEMICAL ANALYSES.

We shall next consider the chemical analyses which, in the opinion of the Toronto Board of Trade, is the one reliable test for determining the percentage of gluten. In order to have good samples of Red Fife to compare with the Ladoga, the Boards of Trade were asked to send authenticated samples of No. 1 hard, of the best character, and a similar request was made to Mr. W. W. Ogilvie. These solicitations were kindly responded to, and among the six samples of Red Fife referred to in Mr. Shutt's report one was sent from the Toronto Board of Trade, one from the Winnipeg Board of Trade, and one from the mills of Ogilvie & Co., Winnipeg, all of them graded as No. 1 hard. Of the other three, one was from Indian Head, N.W.T., a sample from a bag of Red Fife which had been awarded a first prize at several of the North-West agricultural exhibitions; one was obtained from Whyte's mills, Galetta, Ont., which had been purchased as Manitoba No. 1 hard in 1886; the sixth being a sample of Red Fife grown near Galetta from the last named imported Manitoba wheat.

It is singular that the sample of No. 1 Red Fife from the Toronto Board of Trade shows a fraction less of gluten than any of the other five samples, one of which was grown in Ontario, and that both the specimens from the Winnipeg Board of Trade and the first-prize specimen from Indian Head should yield a fraction less of gluten than the Ontario sample grown at Galetta from Manitoba seed.

In Mr. Shutt's report, appended, the average proportion of albuminoids (a term held as synonymous with gluten) in 11 samples of Ladoga is 14·31, while that from the six samples of Red Fife is 14·00. But if the comparison is restricted to the samples of Ladoga and Red Fife grown in Manitoba and the North-West Territories the proportion would be as follows: Ladoga, 14·57; Red Fife, 13·98—an appreciable difference in favor of the Ladoga variety. No chemical tests have yet been devised for determining the quality of gluten in flour. That which possesses the greatest elasticity is most esteemed in bread-making, and flour in which this quality of gluten predominates is designated "strong;" while that containing gluten, which is more of a ductile or pliable character without much elasticity is not esteemed by bakers, but is sought for by the manufacturers of maccaroni, and some forms of pastry. It would appear that the gluten in wheats having a ricy structure, such as the Kubanka or Goose wheat, the Polonian wheat and others of the same nature, while existing in fair proportion in their composition, lacks that elasticity in its character which is necessary to make "strong" flour. This difference in the quality of the gluten may be recognized by chewing a few grains of these different sorts of wheat, and noting the relative character and volume of the plastic mass which remains in the mouth. The reports of the bakers who have tested the flour of the Ladoga wheat, show that the gluten it contains is not lacking in this desirable elastic or "strong" quality. Full particulars of the analyses of the Ladoga, Red Fife, and other varieties of wheat will be found in Mr. Shutt's report.

TESTS OF THE FLOUR.

On the 16th of November, 1888, sixteen bushels of Ladoga wheat, which had been grown on the Experimental Farm at Indian Head, was taken to the Qu'Appelle Valley Roller Mill at Fort Qu'Appelle, with a similar quantity of Red Fife, of the best quality, which had been grown in an adjoining field. The proportion of bran, shorts and middlings to the flour obtained could not be accurately ascertained, as there was much waste in grinding so small a quantity. The flour of the Ladoga, when compared with the Red Fife, had a slight yellow shade. Bread from both these flours was carefully made under my own supervision, all the ingredients weighed, and it was found that the Ladoga flour absorbed more water and produced a little over 2 pounds of bread more from each 100 pounds of flour than could be made from the same quantity of Red Fife. This had been anticipated by Mr. Shutt from the the smaller proportion of water found in the grain. The bread from both samples had a yellowish tint, but there was a more decided yellow shade in that made from the Ladoga.

A sack of each sort of flour was sent to two of the leading bakers in Ottawa to be made into bread, and samples from each lot examined, compared and tested, and it was found that the only disadvantage that the Ladoga flour had was in point of colour. With larger quantities available for milling, better results will no doubt be obtained, and by skilful admixture of some of the whiter soft wheats with this strong glutinous variety there is every reason to believe that this yellowish tint can be successfully overcome and a highly satisfactory flour produced.

The following letters were received from the bakers to whom the flour was sent :—

OTTAWA, 27th December, 1888.

Prof. WM. SAUNDERS,
Central Experimental Farm.

Dear Sir,—Having made bread from the two samples of flour sent me, I beg to say that the Red Fife is the weaker flour of the two, but it is a little better in colour than the Ladoga brand.

The Ladoga would, in my opinion, make a good flour if properly dressed, with a per cent. of low grade taken out. It is a strong flour, and would make more bread to the barrel than Red Fife.

Yours respectfully,
S. S. SLINN,
Palace Bakery, Ottawa.

OTTAWA, 18th February, 1889.

Prof. WM. SAUNDERS,
Central Experimental Farm.

Dear Sir,—We have baked at your request two samples of flour, one made of Red Fife wheat and the other called Ladoga. We are of opinion that the Red Fife would command the highest price, as it has the better colour, although neither of the samples are up to the mark in that respect. As to strength, Ladoga has more than the other, but the flour being darker, we consider the Red Fife the flour suited for our trade.

Yours truly,
R. E. & J. C. JAMIESON.

It would be unreasonable to expect that any variety of grain would succeed equally well on all the different soils and in all the varied climates of the Dominion, yet it is interesting to compare the reports of tests of the same wheat grown under so many different conditions. Both rust and smut have been much more common in 1888 than they were in 1887, and the Ladoga seems to have suffered more than some other varieties; yet the total number of unfavourable reports among the 301 returns is but 45, of which 26 were from Ontario, 1 from Quebec, 1 from Nova Scotia, 9 from Manitoba and 8 from the North-West Territories. The best results obtained with the Ladoga wheat have been on soils of medium character, not too rich and heavy, but on mixed sandy and clay loams, associated with more or less gravel. The Ladoga is very vigorous in its growth, and when sown on very rich soil it has rusted in some instances very badly. This, however, has been the case with Red Fife also during 1888; indeed rust has been very general and very injurious. The Ladoga seems to be much more affected with loose smut than the Red Fife is, but in many localities the Red Fife is seriously afflicted with the "bunt" smut, which is much the more objectionable of the two, and from this the Ladoga appears thus far to be free. In Bulletin No. 3, Mr. James Fletcher, Entomologist and Botanist to the

Experimental Farms, gives a very instructive account of the life history of these parasitic growths which every farmer should read. It is believed that both can be subdued, if not entirely got rid of, by soaking the seed for ten or fifteen minutes in strong brine shortly before sowing, draining off, and drying the seed with lime, plaster or ashes. Solution of blue vitriol (Sulphate of Copper) has also been found useful for this purpose, while immersing the grain in hot water at a temperature of 135 ° is said to have been entirely successful.

Mr. C. Montgomery, of Hilton, Ontario, uses salt very successfully for preventing smut, but in a different way. In a letter dated 12th December, 1888, he says: "I give you with pleasure my method of treatment for smut. I place my wheat on the barn floor and mix one bushel of salt to five bushels of wheat, mixing thoroughly with a scoop. Then moisten with sufficient water to dissolve the salt, after which add fresh air-slacked lime until no more will adhere to the wheat; put up into a snug pile and let it stand for a couple of hours, after which I put it in bags and allow it to stand one day before sowing. Grain so prepared can only be sown by hand." Mr. Montgomery says that he has used this remedy for many years past.

INDIVIDUAL RESULTS AND OPINIONS.

The following individual opinions are given as examples of the most successful results with the Ladoga wheat in the North-West Territories and Manitoba. Many more of the same character have been received, not only from the North-West but also from other Provinces in the Dominion:

Mr. Wm. Gibson, of Wolseley, N. W. T., a practical Scotch farmer, has the greatest record of success with the Ladoga of any person in the Dominion. From the 3 pounds sent him in the spring of 1887 he harvested 236 pounds, and from the second sowing has a few pounds over 150 bushels of clean seed. Another 3-pound bag was sent him in the spring of 1888 of the second importation from Russia. He says: "I sowed the same quantity of Red Fife, on the same day, 16th April, alongside of the Ladoga. The Ladoga was harvested on the 31st of August, the Red Fife on the 13th of September."

Mr. Wm. Summerton, of Moosomin, N. W. T., who received 3 pounds in 1887 has over 30 bushels this year. He sowed the Ladoga on the same day as the Red Fife, and alongside of it. The Red Fife was frozen, and brought 65 cents only on the Moosomin market, while the Ladoga was graded by the buyers as No. 1 hard, and \$1.05 was offered for it for milling purposes. Mr. John Day, of Fleming, N. W. T., received the same quantity in 1887, and has also over 30 bushels this year, of excellent quality.

Mr. G. L. Smellie, of Binscarth, Manitoba, received a 3-pound sample in 1887. In his report he says the Russian (Ladoga) wheat was sown on the 26th of April, while our Red Fife was sown on the 8th of April. The former was cut dead ripe on the 17th of August, the latter from the 23rd August to 3rd September. The sample sent by Mr Smellie was one of those submitted to the experts for inspection under No. 12.

R. B Chappell, of Moosomin, who raised 170 pounds from the 3 pounds sent, says: "I sowed the Ladoga on the 28th of April and sowed Red Fife alongside of it on the same day. The Ladoga was cut on the 18th of August, the Red Fife on the 26th of August." T. D. Stewart, of Carman, Manitoba, harvested 90 pounds from the 3 pounds sown in the spring of 1887. He sowed the Ladoga three and a-half weeks later than his earliest sowing of Red Fife, and the Ladoga was cut a week earlier, and was so ripe at that time that nearly one-third of the crop was lost by shelling.

David Craig, of Edmonton, N. W. T., threshed 105 pounds from 3 pounds of seed, found it to be from seven to ten days earlier than Red Fife. Duncan McCuaig, of Portage la Prairie, harvested 100 pounds from the same quantity of seed, and says it is ten days earlier than Red Fife. Hugh Munro, of Calgary, N. W. T., harvested 160 pounds from 3 pounds of seed, and says it was ten days earlier than Red Fife sown in the same field. Geo. D. Long, of Edmonton, harvested 100 pounds from a like quantity, and says that with him it is more productive than Red Fife, and ten days earlier. Thos. Miller, of Kirkpatrick, N. W. T., had a yield of 141 pounds, and says: "I am favourably impressed with the wheat; it is eight days earlier than Red Fife." Chas. Bowering, of Fleming, N. W. T., had a yield of 93 pounds, and says it is ten days earlier. Rev. L. Gaetz, of Red Deer, N. W. T., had 93 pounds from the 3 pounds sent him, and says it is ten to fourteen days earlier than Red Fife, and is more prolific.

Summary.

The Ladoga wheat has been subjected to a searching criticism, tables of the entire results of its growth have been given, the public have been advised of such defects as have been noted during the progress of the two years' tests, and making the most liberal allowance for these defects, it seems not too much to say that the evidence thus far obtained is sufficient to show: That the Ladoga is a productive and valuable variety of hard wheat, which has thus far ripened over the whole Dominion ten days earlier on the average than the Red Fife. That the better samples obtained are fully as rich in gluten as the best Red Fife, and while the cultivation of the Red Fife should be recommended in every section of the North-West, where it is likely, with early sowing, to escape the autumn frosts, the growth of the Ladoga may be safely encouraged wherever the ripening of the Red Fife is uncertain, without incurring the risk of materially lowering the reputation or the general quality of Canadian hard wheats.

PART II.

REPORT *on the Chemical Composition and Physical Characters of Ladoga, Red Fife and other Varieties of Wheat by Frank T. Shutt, M.A., F.C.S., F.I.C., Chemist, Dominion Experimental Farms.*

Objects of the Investigation.

This series of analyses was undertaken with a view (1) to ascertain the composition, and hence the relative value, from a chemical standpoint, of the different varieties of wheat hereinafter enumerated, and more particularly those of Red Fife and Ladoga; (2) to determine what improvement or deterioration, if any, had taken place in the Ladoga grain by its culture in the various Provinces of Canada; (3) to find out what such alterations in composition, if any, were due to, *i. e.*, what influence, soil, climate and cultivation had exerted upon the grain.

To answer *all* these questions fully and satisfactorily will necessitate, first, the analysis of a larger number of samples and an investigation extending over several years, with a full and accurate knowledge of all the conditions of growth. It is therefore proposed to continue this inquiry in the future as time permits; and as the Experimental Farms are now established throughout the Dominion we shall be enabled to do so with all the reliable information regarding the nature of soil, the extent of cultivation and the climatic changes necessary to the solution of such difficult problems. In most cases where farmers have grown the Ladoga wheat and sent back samples, only incomplete data as to soil, &c., have been furnished, and thus I am not in a position to draw conclusions, which I might otherwise have been able to draw.

While, therefore, at the present juncture and with such limited knowledge, it is impossible to offer a satisfactory solution to the third question, it will be my object in the present bulletin to indicate such conclusions as can be safely drawn from the analytical data for the elucidation of the first and second objects of this investigation.

From the results of the analyses satisfactory answers can, I believe, be given as to the relative values of the wheats, and also as to the effect on the composition of the Ladoga grain when grown in Canada.

Varieties Analysed.

Twenty-eight different samples of wheat have been analysed, including twelve of Ladoga, six of Red Fife, three of Saxonka, two of Kubanka, one of Onega, one of Red Fern, one of Clawson, one of Wellman's Fife and one of Blue Stem.

The specimens of Ladoga wheat are from the following localities: One from Riga, Russia, imported by the Central Experimental Farm in 1887, from which seed all the other specimens of this grain have been grown; four from the North-West Territories; four from Manitoba; two from Nova Scotia, and one from New Brunswick.

Of the Red Fife, one sample was grown in the North-West Territories; four, presumably, in Manitoba (two of these being graded as No. 1 Hard by the Boards of Trade at Toronto and Winnipeg, respectively, and a third as "No. 1 Hard" by the Ogilvie Milling Company, Winnipeg,) and one was grown in Ontario.

The Saxonka specimens include one imported direct from Russia, and one grown from this seed in the North-West Territories. The third was furnished by J. G. V. Field Johnson, Esq., of Manitoba.

The two samples of Kubanka comprise one grown by J. G. V. Field Johnson, Esq., in Manitoba, and one grown at the Central Experimental Farm, Ottawa.

The Onega grain was imported from Russia in the spring of 1888.

The Red Fern variety was furnished by the Citizens' Milling Company, Toronto, and was raised within five miles of that city.

The Clawson, the only winter wheat of the series, was obtained from Galetta, Ontario.

The Wellman's Fife and Blue Stem were kindly sent by Prof. Porter, of St. Anthony's Park, Minn., and were grown in that State. Prof. Porter reports these as the two best varieties in that district.

Detailed Analyses of the Wheats.

The following table shows in detail, and in percentage quantities, the component parts of the grains analysed. The results in all the columns, save those headed Carbo-hydrates and Albuminoids, have been found by direct determination. The amount of albuminoids is obtained by multiplying the quantity of nitrogen by the factor 6·25, and that of carbo-hydrates (principally starch) by subtracting the sum of the other constituents from 100. Besides indicating the chemical composition, I have thought it well to insert in tabular form certain other data of a physical character which must be taken into consideration, together with the chemical results, when endeavouring to find the solution of the problems for which this investigation was undertaken. These data consist of the weight of 100 grains in grams, the colour, hardness or consistency, weight per bushel, together with some additional explanatory remarks upon the nature of soil, &c.

The numbers under which the wheats are designated in the table are not the same as those which were used with them when they were sent to the experts for inspection.

In the following table, No. 1 is identical with No. 7 of Part I.

2	"	1
3	"	2
4	"	10
5	"	11
6	"	3
7	"	4
8	"	12
9	"	13
10	"	5
11	"	6
12	"	14
21	"	9
23	"	8

TABLE I.

DETAILED ANALYSES OF THE WHEATS.

Number.	Name of Variety.	Locality where Grown.	Spring or Winter.	Colour.	Consistency.	Year of Growth.	Weight of 100 Grains in Grams.	Weight per Bushel in lbs.	Water.	Ash.	Fat.	Fibre.	Carbo-hydrates.	Albuminoids. N x 6·25.	Nitrogen.	Remarks.
1	Ladoga	Riga, Russia	Spring	Red	Hard	1886	3·378	60¼	8·76	2·00	1·90	2·54	72·05	12·75	2·04	Original importation, C.E.F., 1887.
2	"	Lethbridge, N.W.T.	"	"	"	1887	3·897	60¾	8·12	2·00	2·20	2·56	69·94	15·18	2·43	Dark loam; ripened 122 d'ys.
3	"	Edmonton "	"	"	"	1887	3·217	61½	8·20	1·70	1·83	2·39	73·96	11·87	1·90	Sandy loam, laid by storm in August; frozen after cutting; 121 days.
4	"	Wolseley "	"	"	"	1887	3·855	63	7·00	1·65	2·00	2·12	71·30	15·93	2·55	
5	"	Touchwood Hills, N.W.T.	"	"	"	1887	3·450	64	7·93	1·40	2·07	1·71	69·52	17·37	2·78	Light and heavy loam; 104 days.
6	"	Souris, Man.	"	"	P. Soft.	1887	3·199	60¼	9·00	1·70	1·91	2·80	72·47	12·12	1·94	Dry, sandy loam; 105 days.
7	"	Brandon Hills, Man.	"	"	Hard	1887	3·240	60	8·38	1·70	1·89	2·38	73·40	12·25	1·96	99 days.
8	"	Binscarth, Man.	"	"	"	1887	3·450	65	7·88	1·53	2·07	1·60	70·11	16·81	2·69	113 days.
9	"	Mowbray, Man	"	"	"	1887	3·470	64¾	7·50	2·06	1·98	1·71	71·75	15·00	2·40	87 days.
10	"	Tatamagouche, N.S.	"	"	"	1887	3·167	65	8·74	1·84	1·96	2·63	70·08	14·75	2·36	Gravelly loam.
11	"	Guysboro', N.S.	"	"	"	1887	3·412	61¼	7·84	2·00	1·83	2·55	72·03	13·75	2·20	112 days; wet clay.
12	"	St. Mary's N.B.	"	"	"	1887	3·265	64	7·78	2·13	2·10	2·30	73·01	12·68	2·03	99 days; sandy and argillaceous soil.
13	Red Fife.	Manitoba	"	"	"	1886(?)	2·900	.....	8·84	1·53	2·15	2·35	70·38	14·75	2·36	Obtained from White's Mills, Galetta, Ont.
14	"	Ontario	"	"	"	1887	2·355	...	10·06	1·99	1·93	2·64	69·51	13·87	2·22	Grown from No. 13 in Ontario.
15	"	Manitoba	"	"	"	1887	3·105	.....	9·22	1·58	1·90	2·12	70·87	14·31	2·29	Graded No. 1 hard by Ogilvie & Co., Winnipeg.
16	"	Indian Head, N.W.T.	"	"	"	1887	3·194	.....	9·50	1·37	2·03	1·75	71·67	13·69	2·19	Grown near Indian Head.
17	"	Manitoba (?)	"	"	"	1887	3·075	73¼	8·76	1·61	2·12	2·02	71·99	13·50	2·16	Graded No. 1 hard by Toronto Board of Trade.
18	"	"	"	"	"	1887	2·936	.....	9·27	1·64	2·06	1·68	71·67	13·68	2·19	Graded No. 1 hard by Winnipeg Board of Trade.
19	Saxonka	Russia	"	L. Red	"	1886	2·515	.....	9·99	1·95	1·87	1·60	71·28	13·31	2·13	Original importation, C.E.F., 1887.
20	"	Broadview, N.W.T.	"	"	"	1887	2·750	.....	8·60	1·56	1·89	2·20	71·19	14·56	2·33	Grown at Crooked Lake Reserve from No. 19.
21	"	Manitoba	"	"	"	1887	2·097	.....	8·00	1·72	2·01	2·87	71·53	13·87	2.22	Obtained from Field Johnson, Esq.

22	Kubanka......	Ottawa, Ont...........	Spring .	Red	V. Hard	1887	2·755	....	8·73	1·90	1·93	2·16	71·80	13·43	2·15	From seed grown in Russia.
23	"	Manitoba	" ...	"	" ...	1887	3·612	.....	8·35	1·60	2·08	2·62	71·29	14 06	2·26	Obtained from Field Johnson, Esq.
24	Onega	Russia..	" ...	"	....	1887	1·750	......	9·23	2·00	2·32	1·54	71·48	13·43	2·15	Original importation, C.E F., 1888
25	Red Fern.......	Toronto, Ont........	" ...	D. Red..	M. Hard.	1887	2·275	....	9 36	2·07	2·20	1·94	70 18	14·25	2·28	Obtained from Citizens' Milling Co., Toronto.
26	Clawson..	Ontario......	Winter..	Y. White	Soft......	1887	3·534	...	9·45	1·84	1·69	2·96	72·44	11 62	1·86	Obtained from White's Mills, Galletta, Ont
27	Wellman's Fife	Minnesota	Spring ..	Red	Hard	1887	3 481	....	10·19	1·73	2·09	2·41	69 90	13·68	2·19	Obtained from Prof. Porter, St. Anthony's Park, Minn.
28	Blue Stem......	"	" ...	"	M. Hard	1887	2·954	..	8·73	1·90	2·13	2·62	72·87	11 75	1·88	Obtained from Prof. Porter, St. Anthony's Park, Minn

Albuminoids (Gluten).

The most important constituent of wheat is gluten, the amount of which in the different grains is found in the column headed albuminoids. I therefore propose to discuss, first, the relative qualities of the wheats from the quantity of this constituent they possess.

For practical purposes, the terms gluten and albuminoids may be considered synonymous. Scientifically speaking, however, gluten is regarded as a mixture of several albuminoids which behave differently to various solvents. Chemical analysis, however, has demonstrated that, though differing in physical properties these albuminoids are almost if not entirely identical in composition, and therefore may be viewed as one, under the generic term albuminoids. As already stated, the quantity of such is ascertained by the multiplication of the amount of the contained nitrogen (directly determined) by 6·25.

Government inspectors and milling experts grade wheats principally by the consistency or relative hardness of the grain, a character which depends almost directly upon the percentage of gluten—it being true, as a rule, that the greater the percentage of gluten the harder the wheat

To compare these wheats among themselves from this standpoint I have prepared the following table of averages. It shows the average percentage quantity of gluten in the different wheats, and also the percentage of this constituent in the same wheat when grown in the various Provinces, which latter is intended to bring out the effect of locality in increasing or diminishing the amount of gluten. Another column gives the weight of 100 average grains in grams, and the relation which this has to the quantity of gluten, will be discussed in a succeeding paragraph.

TABLE II.

Average Composition of the Wheats with respect to Gluten—Weight of 100 grains in grams.

Name of Wheat.	Locality where Grown.	No. of Analyses	Nitrogen.	Albuminoids, N x 6·25.	Weight of 100 Grains in Grams.
Ladoga	Russia	1	2·04	12·75	3·378
"	North-West Territories	2	2·415	15·08	3·605
"	Manitoba	4	2·25	14·06	3·335
"	Nova Scotia	2	2·28	14·25	3·289
"	New Brunswick	1	2 03	12·68	3·265
Red Fife	North-West Territories	1	2·19	13 68	3·194
"	Manitoba	4	2·25	14·06	3·031
"	Ontario	1	2·22	13 87	2·355
Saxonka	Russia	1	2·13	13·31	2·515
"	North-West Territories	1	2·33	14·56	2·750
"	Manitoba	1	2·22	13·87	2·097
Kubanka	"	1	2·26	14·12	3·612
"	Ontario	1	2·15	13·43	2·755
Onega	Russia	1	2·15	13 43	1·750
Red Fern	Ontario	1	2·28	14·25	2·275
Clawson	"	1	1·86	11·62	3·534
Wellman's Fife	Minnesota	1	2·19	13·68	3·481
Blue Stem	"	1	1·88	11·75	2·954
Ladoga, general average	Canada	11	2·29	14·31	3·420
Red Fife "	"	6	2·24	14 00	2·931
Saxonka "	Russia and Canada	3	2·23	13·91	2·454
Kubanka "	Canada	2	2·20	13·77	3·183

The average for the eleven Canadian grown Ladoga specimens is: Albuminoids, 14·31 per cent., the same for the six Red Fife being 14·00 per cent. These figures clearly demonstrate that the Canadian grown Ladoga fully equals the Red Fife variety, as far as gluten is concerned—in fact, slightly surpasses it. Although the samples of Red Fife do not number as many as those of the Ladoga, yet those examined are believed to be typical examples of the best grain—three of them being graded as "No. 1 Hard," by experts. We may therefore state that chemical analysis shows the Ladoga and Red Fife wheats to be almost equal and identical in value.

The Saxonka and Kubanka are both Russian varieties, though four out of the five samples analysed were grown in Canada. Like most of the Russian wheats they show a very fair proportion of abluminoids. As the number of specimens of these grains examined is much smaller than of those of the Ladoga and Red Fife, the averages of the former cannot be viewed in exactly the same light as those of the latter. A further mention of the comparative value of these wheats will be made, however, when speaking of the relation existing between the gluten and the weight of the grain.

Of the remaining varieties, but one sample of each has been analysed. They are all, however, believed to be typical specimens.

The Onega, recently imported from Russia, would appear to be a grain very similar in composition to the Saxonka obtained from that country.

The Red Fern sample was sent by the Citizen's Milling Company, of Toronto, and was spoken of very highly as worthy of growth and encouragement. Judging alone from the percentage of gluten, it appears to be a very desirable wheat, and one that compares favourably, from a chemical standpoint, with Ladoga and Red Fife.

The Clawson is the only winter variety in the series. It is known as a soft wheat, and was analysed in order to show a comparison between hard and soft wheat in the percentage of albuminoids. By its low percentage of nitrogen it takes a rank much below that of any of the varieties hitherto discussed.

Wellman's Fife and Blue Stem are two wheats furnished through the courtesy of Professor Porter, Director of the Minnesota Experimental Station, St. Anthony's Park, Minnesota. They are said by him to be typical samples of the best varieties grown there. Having analysed but one specimen of each it would be unwise to pronounce judgment upon them in emphatic terms, or to draw a close comparison between them and the Ladoga and Red Fife. Suffice it to say, therefore, that the Wellman's Fife equals in composition several of the Red Fife specimens, and that in other respects it bears a strong resemblance to that grain. The Blue Stem, if we may judge from a single analysis, is a much less valuable sort.

Effect of environment upon the percentage of Albuminoids.

The term environment is intended to embrace all the varying conditions of climate, soil and cultivation. Professor Clifford Richardson, of the Department of Agriculture, Washington, has shown that wheat is the most susceptible of all grains to the influences of environment. After an investigation extending over several years, he says: "The quality of the grain produced in any locality is dependent on several conditions, namely, climate, soil and cultivation. Each of these is made up of several elements." Having made analyses of grain from all parts of the United States he has been able, from the results of the same, to map out that country into divisions—each division having in its own peculiar effect upon the composition and physical characters of the grain. The influences which modify the wheat in each of those divisions are discussed, and satisfactory explanations offered to account for such modifications.

Following up this line of enquiry, let us see what the effect has been upon the Ladoga wheat by growing it in the various Provinces of Canada. An inspection of Table 1 shows us that in seven instances out of eleven there has been a well marked increase in the percentage of albuminoids; one specimen remains practically the same, and three have receded from the amount contained in the imported sample, the probable cause of which will be discussed later on. Taking all the Canadian-grown Ladoga specimens, we obtain an average of 14·31 per cent. albuminoids, as against

12·75 in the imported seed—indicating a well marked increase. Examining the effect produced in the different Provinces we perceive that of the four specimens grown in the North-West Territories only one (No. 3) falls below the imported seed in the proportion of albuminoids. This falling off is, I think, satisfactorily explained by the fact that the wheat was laid by a storm during its growth in August Prof. Richardson has shown that the composition of a wheat may be greatly modified and its albuminoids diminished by such an interruption in its development. Notwithstanding this sample (No. 3) the average for albuminoids of those grown in the North-West Territories is larger than that of any other Province (*vide* Table II.) Nos. 2, 4 and 5 all show high percentages of albuminoids, especially No. 5, which was grown on Poor Man's Reserve, Touchwood Hills, N.W.T. This sample contains the largest amount of gluten of any of the series.

The average for the Manitoba samples stands about midway between that of the North-West Territories and the quantity possessed by the Russian seed—though two of the samples fall below the latter. Unfortunately no data have been received respecting the conditions of growth of these two samples (Nos. 6 and 7), and consequently it is impossible to advance reasons why the albuminoids should have decreased to such an extent in them. Leaving these two exceptionally low samples out, the Manitoba grain stands equal to that of the North-West Territories.

The albuminoids of the Nova Scotia samples also show an increase over the quantity possessed by the original importation, and are a little higher than the average of the four Manitoba specimens. The conditions of growth during last season in that Province, or, at all events, in the districts where these were raised were evidently favourable to an improved development of the Ladoga grain.

The sample grown in New Brunswick is practically identical in its percentage of albuminoids with that of the imported seed.

The effect of environment on the Red Fife cannot be as well studied as in the case of the Ladoga, as we have no imported seed to compare it with. The cases of Nos. 13 and 14 are, however, of particular interest in this connection. No. 13 is a sample from Manitoba, and No. 14 is seed grown from it in Ontario. In the course of one year's growth it is seen that in this instance the albuminoids have diminished when grown in Ontario. Whether this would still further continue by successive croppings in this Province remains yet to be proved. It indicates, however, that in the North-West the conditions are more favourable to the perfecting of this grain, and that like all wheats it is susceptible to change of conditions. As might be expected, the samples of Red Fife show smaller fluctuations in their albuminoids than do those of the Ladoga, having had many years in which to adapt itself to its environment, and the average of 14·00 per cent. for albuminoids no doubt represents fairly its quality.

The Saxonka also shows improvement when grown in the North-West. No. 20, grown at Crooked Lake Reserve, Broadview, N.W.T., is the seed of No. 19, imported from Russia.

The same remarks, though in a modified manner, apply to the Kubanka. Though Nos. 22 and 23 bear no relation to one another, yet the sample grown in Manitoba possesses a larger proportion of albuminoids than that raised in Ontario. We have thus seen that in every case examined a decided improvement has occurred when the grain is grown in Manitoba and the North-West Territories, and particularly in the latter. Granting that the cultivation in these Provinces is about the same as in the older one—Ontario—and in Russia, we have to look for the explanation of such an increased absorption of nitrogen in either the peculiarities of the climate or the composition of the soil. As yet sufficient data are not to hand to justify one in drawing conclusions as to which of these causes affect the wheat most, though undoubtedly both contribute towards that end. The prairie soil of the North-West has long been noted for its exceptional fertility and its almost inexhaustible store of available plant food. But this of itself is not sufficient to account for the uniform difference observable between the wheats of Ontario and the North-West, and it is quite probable that Prof. Richardson is correct in his deduction when he says of the United States grain, that a high ripening temperature together with a short period of growth produces a grain with a relatively higher percentage of albuminoids than a long period of growth and moist climate—which latter conduce to the development of a plumper grain with a greater abundance of starch.

Relations between the weight of one hundred average grains and Albuminoids.

The weight of a grain of wheat depends on its size and its specific gravity, or density. Thus, it is easy to imagine that we might have a small grain of a close, hard texture that would equal, or perhaps surpass, in weight a much larger grain of a less density. The main difference between a hard and a soft wheat is that the former is richer in albuminoids while the latter contains more starch. This larger percentage of starch would lower the specific gravity of the grain,* and we should expect to find, bulk for bulk, the soft wheat the lighter grain. Let us go one step further. From what has already been said it is apparent that if we were comparing a hard and a soft wheat, both having grains of an equal size, the weight of 100 grains of the former would exceed that of 100 grains of the latter; but if, as is often the case, the soft wheat possessed the larger grain, then it might happen that the excess of starch made up for the difference of albuminoids, and the softer wheat per grain prove heavier.

From the foregoing we should predict that a ratio would be found to exist, when comparing different samples of the same wheat among themselves, between the weight of the grain (or 100 grains) and the albuminoids, and that the greater the weight the larger the percentage of albuminoids and *vice versa*. That this law—if so it might be called—would not hold good when comparing wheats of different varieties is obvious from the fact that the normal size and composition of all wheats are not alike. In discussing the relative values of any two or more kinds, even if they be all hard wheats, cognizance must be taken of this fact. One more point has to be noticed in this connection. Suppose that two wheats, the one small and the other large in grain, are identical in composition, the larger wheat would be the more valuable, because measure for measure it would yield more flour and less bran than the smaller grain.

Having made this preliminary explanation, let us first see if any ratio exists between the weight of the average grain and the percentage of albuminoids in the Ladoga wheat. An inspection of Table I shows that there is a well marked tendency for the albuminoids to increase with the weight of the grain. Thus Nos. 2, 4, 5, 8 and 9 contain a percentage of albuminoids over 15·00 per cent. and the weight of 100 of their average grains is equal to or exceeds 3·450 grams; while the remaining six have less albuminoids than 15·00 per cent. and the weight of 100 of their grains falls below in every case 3·450 grams. The original seed, which is not included in the above comparison, also shows this rule to be true.

Comparing the Red Fife samples among themselves, we notice, first, that there is more uniformity both in the weight of the grain and the percentage of albuminoids, and the differences being but small it is not a matter of surprise that this principle should not be so strikingly exhibited among them. The greatest difference between the two extremes in the weights of 100 of their average grains is but ·4 of a gram, while in the Ladoga the same difference is over ·8 of a gram. It is more than probable that if as many samples of Red Fife had been examined as of the Ladoga, this relation of weight of grain to gluten would have been more apparent.

In the case of the Saxonka and Kubanka, both recently imported grains, we see this ratio well exemplified, though with an exception in the Saxonka.

The four averages at the foot of Table II are very instructive. The Ladoga ranks first, both as to albuminoids and the weight of the grain, the Red Fife taking a second place, for the reason that it is slightly lower in its albuminoids and somewhat less in the relative weight of the grain. The Kubanka, of which unfortunately

*This has been experimentally proved. Thus, the specific gravity of No. 2 is 1·333, while that of No. 26 is 1·269.

we have only two examples to average from, is slightly lower in its albuminoids; but one of the samples being an exceptionally fine one as to size, the weight of its average grain is a trifle higher than that of the Red Fife. The Saxonka presents the smallest weight for 100 of its average grains, while its albuminoids are almost identical with the Red Fife. This may be readily explained, that like the other three of this series it is a hard wheat, but has a very small grain. The albuminoids in a wheat grain exist in a greater percentage in the outer coats. While, therefore, measure for measure, or weight for weight, the smaller grain yields more bran and less flour than the larger, the percentage of albuminoids in the *whole* grain may be equal in both cases. And further, where a variety of wheat has a very thick skin, such as the Kubanka (which produces less flour and more bran from a given weight than most other sorts), the percentage of albuminoids which would be found in the flour may be materially less than that shown to be contained in the whole grain.

Water.

T.king an average of the water contained in the twelve Ladoga samples we obtain the figure 8·09; the six samples of Red Fife in like manner give 9·27.

In Bulletin No. 4, Department of Agriculture, Washington, Prof. C. Richardson has shown a special feature of spring wheats to be their *dryness*. Thus, on page 57 of the above bulletin he gives the average water contained by eight Eastern States flours as 12·49 per cent., while the same for Minnesota and Dakota flours is 8·96 per cent. From these figures he rightly deduces that "other things being equal, a barrel of Western flour would make more bread than a barrel of Eastern." This is certainly an important factor in the consideration of the value of flours.

Arguing from the same premises, we conclude that a given weight of the Ladoga flour will make more bread than the same weight of Red Fife. It remains to be seen by an actual test of the bread-making powers of these two wheats whether this conclusion is borne out. The difference, however, between these two cannot be so great as between fall and spring flours, as the percentages of water more closely approximate each other in Ladoga and Red Fife than in the case of wheats known as fall and spring varieties.

Direct Estimation of Gluten in the Flour of Red Fife and Lodoga Wheats.

This operation consists in washing away the starch, the cohesive residue being dried in a water-oven until thoroughly dry, and weighed. This crude gluten consists of several closely allied albuminoids, chiefly gluten fibrin, gliadin and mucedin, besides small quantities of fat and mineral matter.

It has been shown by M. Bertrand (Comp. rend. xcvii, 496) that the same flour will yield different proportions of this gluten according to the method of operation and amount of washing. I shall therefore outline the process which I have used.

Ten grams of the flour were weighed out and kneaded into a dough with 5 cubic centimetres of water. This dough was then washed with successive portions of 50 cubic centimetres of water until the wash-water was free from starch. The crude gluten so obtained was spread out on a watch glass and dried in the water-oven until the weight was constant. To get figures as nearly correct as possible, four determinations of the gluten of each flour were made, and the mean of the resultant figures taken. They are as follows:

	Dry Gluten.
Ladoga	15·26 per cent.
Red Fife	15·35 "

From the nature of the operation, this direct determination of gluten must not be considered as accurate an estimation as that of the "albuminoids" obtained by multiplying the percentage of nitrogen by 6·25. For, as already stated, the proportion of gluten thus found varies according to the mode and time of procedure. Nevertheless, it forms confirmatory evidence as to the similarity in composition of these wheats, and together with the analytical data before given, bears out what I have said when discussing the relative value of Red Fife and Ladoga wheats in respect to the amount of albuminoids or gluten they possess, as determined by chemical analysis.

The flour used for this direct determination of gluten was not in either case made from wheat which had been analysed. The Ladoga flour is from grain grown on the Experimental Farm, at Indian Head, during the summer of 1888. The flour of the Red Fife was furnished by grain grown on an adjoining field, yielding a crop of 40 bushels to the acre, the wheat being of excellent quality, and graded "No. 1."

Ash.

The mineral constituents of the wheats are denoted under the term ash. Time did not allow of the detailed analysis of such; but as Prof. Richardson has shown that among the chief constituents, viz., phosphoric acid, potash and magnesia, there is but little variation for different wheats, this is not a matter of vital importance.

The average of the ash of the four principal varieties analysed is here tabulated:—

AVERAGES OF ASH.

Name.	Number of Analyses.	Per Cent. of Ash.
Ladoga	12	1·81
Red Fife	6	1·62
Saxonka	3	1·74
Kubanka	2	1·75

Whether the Red Fife, when it was first introduced into the North-West, contained a larger percentage of ash cannot, of course, be said. As they stand to-day, it would appear that the Russian varieties, and particularly the Ladoga, have the property of assimilating from the soil larger quantities of mineral food than the Red Fife. This may be an inherent property in the wheats, or due, in this case, to more favourable environment than they formerly enjoyed. The original Ladoga seed, however, contains 2·00 per cent. ash, which would go to show that the grain, as grown in Russia, has a higher percentage of ash than when grown in the North-West. The same also appears in the case of the Saxonka. If, then, the Russian wheats take less mineral matter from the soil when grown in the North-West than when grown in Russia, we have to look for an explanation in either the composition of the soil or in the climate which regulates, to such a great extent, the growth of the wheat plant. This interesting feature deserves further investigation.

Form, or Appearance, and Relative Hardness of the Wheats.

The Ladoga, is a red wheat, plump, and semi-translucent. The grains, on an average, are slightly longer than those of the Red Fife, and none of the better samples possess those opaque spots which betoken the presence of an increased development of starch. The figures show that the individual grain weighs heavier than that of the Red Fife. The Red Fife is also a red wheat, but even the best samples are not free from those spots of opacity just mentioned. In general characteristics these two wheats bear a very strong resemblance to one another. The Kubanka is yellower in colour than either of the preceding, and is certainly the hardest of the series. Its grain is long, and has the semi-translucency more marked than that of either Ladoga or Red Fife. Saxonka, as already stated, is a very small wheat, red in colour, and not very "bright" in appearance. The Red Fern is also a small wheat, of a dark red colour, and is not quite as hard as either Red Fife or Ladoga. Clawson is a yellowish white variety, and very soft. Its grains are of a very fair size, and plump. The Onega is small in grain, and dark red of colour. Wellman's Fife and Blue Stem are both red wheats, the former the larger of the two. Neither is free from opaque spots, the Blue Stem predominating in this respect.

Comparison of Ladoga and Red Fife with some American Wheats, as Analysed by Professor C. Richardson.

In Bulletins Nos. 1, 4 and 9 of the Department of Agriculture, Washington, D.C., Professor Richardson gives the results of a large number of analyses which have been made of wheats grown in many States of the Union. The series extends over several years, and both the analyses and the deductions drawn from them prove the exhaustive manner in which the whole question of the physical properties and chemical composition of wheat, as grown in the United States, has been treated by the author.

In concluding this bulletin, therefore, I think it will be of interest to compare some of these results with those of the present investigation.

The following are abstracted from the table on page 30, Bulletin No. 4, Division of Chemistry, Department of Agriculture, Washington, 1883–84.

Locality.	Number of Analyses.	Weight of 100 Grains	Albuminoids, N x 6·25.	Ash.
United States and British America	407	3·644	12·15	1·92
Atlantic and Gulf States	117	3·489	11·35	1·77
Middle States	91	3·537	12·60	1·85
Western States	177	3·763	12·74	2·06
Pacific States	20	4·091	9·73	1·87
Canada	6	3·325	10·87	1·56
Minnesota	13	3·245	13·19	1·77
Dakota	12	3·149	14·95	1·96
Manitoba	2	3·288	14·53	1·63

The following are from Table II of this Bulletin, and inserted for comparison with the above:—

Locality.	Number of Analyses.	Weight of 100 Grains	Albuminoids, N x 6·25.	Ash.
Canada Ladoga	11	3·420	14·31	1·81
" Red Fife	6	2·931	14·00	1·62

By reference to the table on page 20, Bulletin 1, we see of the six varieties of Canadian wheat analysed five were soft winter wheats, the remaining being Imperial Fife. I have already pointed out that the soft wheats contain very much less gluten than the hard, and thus we see how it comes about that the average of 10·87 per cent. albuminoids is here given for Canadian wheat.

If the quantity of soft wheat raised in Canada in 1883 was in excess of hard grain, and this average fairly represented Canadian wheat at that time, it certainly does not do so now; for of late years the growth of Red Fife has greatly increased in Manitoba and the North-West Territories.

The two samples of Manitoba wheat analysed by Prof. Richardson give an average in albuminoids slightly in excess of our results for Red Fife. Taking the Minnesota and the Dakota samples together, we obtain an average of 14·07 per cent. albuminoids—practically identical with our determinations for Red Fife. The grain grown in Minnesota and Dakota is the richest in gluten of that raised in the United States.

Conclusions.

1. That as far as gluten is concerned (as determined by chemical analysis) the Red Fife and the Ladoga are almost equal in value, with a small balance in favour of the latter wheat.

2. That a very well marked improvement has taken place in the Ladoga wheat by its growth in Canada, and particularly in the North-West, and that the same appears to be true of other Russian varieties.

3. That there appears to be a direct relation between the percentage of albuminoids and the weight of the grain, viz., the heavier the individual grain the greater the proportion of albuminoids.

4. That with respect to size, weight and hardness of the grain the Ladoga compares very favourably with the Red Fife, and judging from the samples analysed, ranks above this grain in these features.

5. That the Manitoba hard wheats (Red Fife and Ladoga) most certainly equal in value the best grown in the States of Minnesota and Dakota, and this deduction is made both from my own and Prof. Richardson's results.

6. That from a mechanical estimation of gluten in the Ladoga and Red Fife flours, the conclusion may be drawn that in the possession of this valuable constituent these flours are almost equal.

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REPORTS

OF THE

DIRECTOR			Wm. SAUNDERS, F.R.S.C., F.L.S., F.C.S.
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do	do	Indian Head, N.-W.T.	Angus MACKAY.
do	do	Agassiz, B.C.	Thos. A. SHARPE.

FOR

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1890.

APPENDIX

TO THE

REPORT OF THE MINISTER OF AGRICULTURE

ON

EXPERIMENTAL FARMS.

OTTAWA, 29th January, 1890.

SIR,—I have the honour to submit herewith for your approval the following report relating to the work accomplished at the Central Experimental Farm in Ottawa, as well as that carried on at the Experimental Farms in the Maritime Provinces, Manitoba, the North-West Territories and British Columbia.

Appended you will also find reports from the following officers of the Central Farm: from the Chemist, Mr. Frank T. Shutt: from the Entomologist and Botanist, Mr. James Fletcher; from the late Horticulturist, Mr. W. W. Hilborn; and from the Poultry Manager, Mr. A. G. Gilbert. There are also presented reports of progress from Mr. Wm. M. Blair, Superintendent of the Experimental Farm for the Maritime Provinces at Nappan, Nova Scotia; from Mr. S. A. Bedford, Superintendent of the Experimental Farm for Manitoba at Brandon; from Mr. A. Mackay, Superintendent of the Experimental Farm for the North-West Territories at Indian Head; and from Mr. Thos. A. Sharpe, Superintendent of the Experimental Farm for British Columbia at Agassiz. In all of these there will, I trust, be found much information which will prove useful to the farmers of the Dominion and helpful to them in the work in which they are engaged, and which will aid in advancing the great agricultural interests of this country, of which you are the honoured head.

I have the honour to be, Sir,

Your most obedient servant,

WM. SAUNDERS.

The Honourable,
The Minister of Agriculture,
Ottawa.

ANNUAL REPORT

ON THE

EXPERIMENTAL FARMS.

The progress made during the past year at the several Experimental Farms has been such as to attract the general attention of the agricultural community. The Central Experimental Farm, at Ottawa, on which work was begun in the spring of 1887, the farm for the Maritime Provinces, at Nappan, Nova Scotia, and that for the North-West Territories, at Indian Head, both of which were taken possession of in the spring of 1888, the Manitoba farm, at Brandon, on which work commenced during the summer of 1888, and the British Columbia farm at Agassiz, organized in August, 1889, have all been much visited by farmers, who have expressed themselves interested and gratified with what is being accomplished. Many useful experiments have been carried on, especially in those departments of farm work where reliable and positive information is most needed, and these experiments have been watched with much interest, especially by parties residing in the neighbourhood of the farms, many of whom have promptly taken advantage of the information which these tests have afforded.

Correspondence between the farmers of Canada and the Experimental Farms has greatly increased, and as it was intended from the outset to endeavour to make these institutions bureaus of information, where farmers should feel free to seek such advice as would aid them in carrying on their work, this gratifying increase in correspondence has been encouraged and the best efforts of the staff devoted to meet the demands for information. At the Central Experimental Farm alone there has been received during the year 6,864 letters, of which 3,653 have come to the Director, 1,700 to the Entomologist and Botanist, 359 to the Chemist, 247 to the Horticulturist, 195 to the Poultry Manager and 710 to the Accountant. The total number of letters despatched has been 5,428, and of pamphlets including reports and bulletins, 41,584, to which must be added 3,662 packages of grain and seeds, making a formidable total of mail matter. In the letters received, questions of the most varied character have been presented, some of them so difficult as to occupy much time in careful enquiry for their solution.

In addition to the work of organization on the several Experimental Farms, it has been my pleasure to visit many of the more important agricultural districts from the Atlantic to the Pacific for the purpose of ascertaining more fully the needs of farmers everywhere, noting the progress they are making and studying the advantages and disadvantages pertaining to the different climates and varied conditions of soil and situation under which farming operations are conducted in different parts of the Dominion. Invitations also have been freely extended to the officers of the Experimental Farms to attend the meetings of Farmers Institutes in the several Provinces and other gatherings of farmers, for the purpose of addressing them on agricultural topics and giving information regarding the work of the Experimental Farms. While I regret that it has been impossible for the members of the staff to meet all such demands upon their time, as many meetings have been attended in different parts of the country as could be reached in the time available for this purpose. Canadian farmers are making careful enquiries for more full and accurate information regarding the numerous and varied operations pertaining to their calling; they desire to have the mysteries which surround some of the operations of nature explained as far as this is practicable, and it is our object to foster and stimulate such a spirit of enquiry which will, it is believed, result in the speedy advancement of agriculture, and thus in material and lasting benefit to the country.

VISIT TO NEW BRUNSWICK.

In January I visited the Province of New Brunswick, with the object of meeting with some of the more progressive farmers of that Province, assembled under the auspices of the Local Government at the meeting of the "Provincial Farmers Association," held at Fredericton, on the 16th, 17th and 18th of that month. The meeting was attended by representative farmers from almost every county in the Province, nd much interest was taken in the proceedings. It was convened in the City Hall where the visitors were welcomed by the Mayor and aldermen. Lieutenant Governor Tilley was also present with other prominent citizens. During the afternoon, on invitation of the city authorities, a drive was taken to Marysville where an opportunity was afforded of inspecting the large cotton mill of Mr. Gibson and of seeing the town which his industries have built up. On returning to the city the address of the President of the Association, Mr. S. L. Peters, was delivered, which was full of practical suggestions and useful information, after which the Lieutenant-Governor, speaking not only for himself, but on behalf of the Government and citizens, warmly welcomed the visitors.

During the meetings much time was given to the consideration of dairying, sheep husbandry and fruit culture. Many practical papers were read, and the discussions which followed showed the keen interest which New Brunswick farmers are taking in these important subjects, while the facts brought out regarding the resources of the Province and its capabilities plainly indicated that there was plenty of room for extension in almost every department of farm industry. The farmers of that Province are evidently convinced of the fact that their climate and other conditions are such as to favor the production of excellent butter, and that by the introduction of improved dairy stock and the establishment of creameries their hay may be profitably consumed at home, and their lands enriched by the animal manures produced on their farms. Co-operation in the establishment of creameries was urged with much force as the only plan by which butter of uniformly good quality could be produced. The last census credits the Province with 103,965 milch cows, and allowing the average return from a cow to be \$20, this produces the sum of \$2,079,300. With good breeding and careful management this income might be greatly increased. The farmers were urged to keep more cows, to sell less hay and to combine together to make the best butter, such as would command high prices in the English and American markets. It was remarked that England imports annually more than \$40,000,000 worth of butter, of which Canada furnishes about \$700,000, while Denmark, with about half the population, supplies more than \$13,000,000 worth. If Canadian butter was brought up uniformly to the high standard which has been gained by Canadian cheese, there would be no difficulty in disposing of any quantity of it. The rich pastures and cool moist climate of New Brunswick afford facilities for much progress in this direction.

In fruit growing New Brunswick has made considerable progress, there are many localities where apples can be grown to advantage, while small fruits, especially strawberries, do remarkably well, and on account of the cool summer climate, the later sorts ripen there after the glut of berries coming in from other districts is over, when good prices are usually obtained for them. Considerable quantities of fruit are now sent from this Province to the Boston market. Opportunities were given at the meetings of the Association both to Col. W. M. Blair, superintendent of the Experimental Farm at Nappan and myself, for explaining the objects for which the experimental farms were established and the progress which had been made in the work; a deep interest was manifested in this subject by those present and resolutions were adopted expressing appreciation of the immediate and future benefits which the farmers of Canada are likely to derive from these institutions.

VISIT TO NOVA SCOTIA.

During the following week the farmers of Nova Scotia were met at an Institute meeting, held at Amherst, N. S., where topics similar to those which had been taken up at Fredericton were discussed with much enthusiasm. Improved dairying is making progress in Nova Scotia, where a Dairymen's Association has been organized and some fine herds of dairy cattle established. In addition to the butter and cheese made in this Province there is a condensed milk factory in Truro, where a large quantity of that useful product is made and canned. Much of it is supplied to sea-going vessels, and a considerable business in this line is carried on with the other Provinces in the Dominion. The trade in fat cattle is also on the increase, a good demand being found both in the local and foreign markets. The farmers here are more than ever awakened to the importance of feeding a large proportion of the hay produced on their fertile marsh lands to stock and with the manure thus obtained fertilizing the uplands, and by this means increasing their crops of grain, roots and fruit. Winter dairying and the subject of winter food for stock was warmly discussed, and the experience of some of the more advanced farmers with ensilage was given. Expensive silos are here no longer considered necessary; one farmer claimed that with forty dollars worth of lumber he could build a silo in his barn, which would hold enough ensilage to feed ten cows during the winter. Here also the importance of experimental farming and the action of the Government in establishing farms for the carrying on of systematic experimental work was warmly endorsed, and the hope expressed that as soon as possible after the farm buildings, then in course of erection at the Experimental Farm at Nappan, were completed, some first-class stock would be sent there, of such a character as would aid in improving the general dairy cattle of the Province.

I next visited the far-famed fruit regions in the Annapolis valley and attended a meeting of the Fruit Growers' Association of Nova Scotia, held in Wolfville, on the 16th, 17th and 18th of January, There was a very good attendance of the fruit growers of the district, and the time was profitably spent in discussing the results of the fruit crop of the past year, the most profitable varieties of fruit to grow in Nova Scotia, the capabilities of the province for the production of fruit, methods of storing, packing and shipping, the best markets for fruit and many other practical topics. The fruit interests in Nova Scotia are yearly becoming more important, and the area devoted to orchard is rapidly increasing, not only in the Annapolis valley but in many other parts of the province; for it is fast being demonstrated that good fruit can be profitably grown over large sections of Nova Scotia, while the facilities for reaching the European and American markets are unsurpassed. The association has done much to encourage fruit growing in the province, and by disseminating useful and reliable information to direct the efforts of those engaged in this work into profitable channels. Fruit growing here will admit of almost indefinite extension, and there seems no reason why apples, pears, plums, cherries and small fruits should not be more generally cultivated.

The relation of the Experimental Farms to horticulture was explained and some details given of the varieties of fruit now undergoing test at the Experimental Farm at Nappan. The importance of this work was promptly recognised and resolutions relating thereto unanimously passed.

MEETINGS ATTENDED IN ONTARIO.

During the first week in February the annual meeting of the Central Farmers Institute of Ontario was attended in Toronto. This is, without doubt, the most important and influential annual gathering of farmers in the province, where a large proportion of the Farmers Institutes scattered over the country are represented by some of their leading men. This meeting was largely attended, was continued for several days and the interest was maintained in the subjects under discussion to the last. A number of practical papers on topics of interest to farmers were read and ably discussed, the speakers generally showing by the way they handled the subjects that they possessed practical knowledge and a keen appreciation for information likely to be useful to them in their calling. An invitation was extended to the writer to explain to the meeting the progress being made in connection with the Canadian Experimental Farms, when some account was given of the work which was listened to with much attention, and met with the hearty approval and endorsation of those present.

The following week the opportunity was afforded of attending the winter meeting of the Fruit Growers' Association of Ontario, held in Hamilton. The fruit growers of the western part of the Province were well represented and two days were profitably spent in the reading of papers and discussing the subjects provided on the programme, bearing mainly on the fruit industries of Ontario. This association has been largely instrumental in developing fruit growing in Ontario by holding meetings in different parts of the Province to discuss fruit topics, by the publication of lists of such varieties of fruit as are known to be profitable in the thirteen agricultural districts into which the Province has been divided, by encouraging the growing of the best varieties of fruit, so as to gain for Ontario fruit a leading place for quality in the markets of the world, and by distributing among its members every year some promising variety of new fruit for test. It also publishes an excellent monthly periodical, the Canadian Horticulturist, which is sent to its members free of cost. Twenty-one years ago when this association began its work almost every farmer growing fruit in Ontario had what might be called an experimental orchard with a large number of varieties, many of them late summer or autumn apples, which because they would not keep were rushed into the market and sold for what they would bring, no matter how small the price. Now all this is changed, farmers have become careful in planting their orchards and endeavour to so select the varieties as to have the great bulk of them long keepers; fall varieties have been top grafted with winter sorts and now the crop of early apples in a good year is not much in excess of the needs of the community, and if unusually abundant, the excess is readily disposed of in most fruit districts to the manufacturers of evaporated fruit. Much of this change has been wrought through the influence of the Fruit Growers Association of Ontario whose discussions and deliberations have been widely circulated among the people. The association combines with its practical discussions on fruit-growing the consideration of other horticultural topics, the creation of shelter belts and wind breaks for orchards, the cultivation of ornamental trees, shrubs and plants, and the occasional papers presented on the rose, the dahlia, the chrysanthemum, or some other favorite flower or on some group of ornamental shrubs or desirable ornamental trees, and the animated discussions which sometimes follow give a pleasing variety to the meetings and help to encourage and direct that love of the beautiful in nature which is shared to a greater or lesser extent by almost every human mind. At the winter meeting in Hamilton the discussions, while mainly relating to the commercial aspects of fruit-growing, had a pleasing and instructive diversity. The Experimental Farm work there also was awarded a due measure of commendation.

During the subsequent winter and early spring months many meetings of Farmers' Institutes were attended by the officers of the Central Experimental Farm, and in this way all the time which could be spared from other duties was turned to good account.

VISIT TO PRINCE EDWARD ISLAND.

Early in July a visit was paid to Prince Edward Island, at the request of several of the agricultural societies there. During the seven days spent on the island, I had the privilege of addressing five gatherings of farmers, the places of meeting being so distributed as to cover the greater part of the island. Tignish, Summerside, New Glasgow, Charlottetown and Montague Bridge being the points selected. Audiences varying from 150 to 500 were in attendance, and much interest was manifested in the subjects under discussion. The land on the island is generally fertile, but having been under cultivation for a long period, most of it under a system of seven years' rotation, evidences are common of its fertility becoming more or less exhausted, and the farmers are much exercised on this important question. How best to maintain the fertility of the soil, was one of the subjects of discussion at almost every meeting, and the best methods of preserving and storing barn-yard manure so as to prevent any waste of its fertilizing constituents were carefully considered. The seven years' rotation of crops, which is almost universally followed in Prince Edward Island, is as follows:—The land is well manured previous to a root crop, either potatoes or turnips, following which a crop of wheat is grown, the land at the same time being seeded down to timothy and clover; hay is harvested for two years, then the land left in pasture for two years, when it is broken up and a crop of oats grown on the sod, completes the rotation.

It would appear that manuring once in seven years is not sufficient, and there is good reason to believe that the general adoption of a five years' system of rotation, in place of the seven years' course, would greatly improve the crops, and give the farmer better returns for his labour. It has often been a matter of surprise that the wheat-midge should be found invariably common, and more or less destructive, every year in Prince Edward Island, while in most of the other Provinces its occurrence is only occasional. A portion of this system of rotation has, I believe, much to do with this result. Many of the orange-coloured larvæ of the wheat-midge mature before the grain is harvested, and, escaping, fall to the ground, where they penetrate a short distance below the surface, and change to chrysalids, in which condition they remain during the winter. By the almost universal system of seeding down with wheat, the ground, which has been occupied by wheat this year, is left undisturbed by the plough the following season, thus affording this insect the most favourable opportunity for maturing, and appearing in full force to attack the neighbouring fields the next year. Were the wheat followed by a crop which would necessitate ploughing, a very large proportion of these insects would be buried deep enough to destroy them. By adopting such a course, and also burning the refuse from the threshing-machines, the great bulk of these insects would be destroyed and the annual loss arising from this destructive pest be greatly diminished.

There are not many farmers on the island who keep sufficient stock to produce manure in the quantity required to throughly fertilize their fields, hence substitutes for barn-yard manure are in much demand, and artificial fertilizers are probably more largely used on the island in proportion to the population than in any other part of the Dominion. In some localities there are large deposits of what is called mussel mud, which contains a considerable proportion of ground oyster and other shells, which have been pulverized by the action of water, together with a small proportion of decayed animal matter. A number of samples of this deposit have been analysed by Mr. F. T. Shutt Chemist of the Experimental Farms, who reports that some of them contain a good proportion of fertilizing material. Most of them, however, contain a large proportion of lime, which, when too freely used, unduly stimulates the soil by converting the store of plant food laid up there into available form, which is then rapidly taken up by growing plants; and on this account after realizing a few good crops, the farmer frequently finds that his land is left in a very exhausted condition, and particularly so in the case of light soil. But by using the mussel mud more sparingly in conjunction with swamp muck and barn-yard manure it serves a very useful purpose. With an increase of dairying on the island, the ploughing under of occasional crops of green clover: careful management of barn yard manure and the judicious use of special fertilzers the condition of the land might be greatly improved.

The growing of fruit is not so general on the island as it should be. The orchards found there are fairly successful. The trees are thrifty and promise well and there seems no reason why the farmers of this province should not become exporters of fruit. An enormous business is transacted in eggs, almost every farmer keeping a considerable number of fowls, and the merchants send out teams which go from house to house to collect them, paying cash for the eggs on delivery. They are then packed in cases and shipped to market. The quantity exported during the last year was 1,947,963 dozens which returned to the province in cash $261,845.

EXPERIMENTAL FARM, NAPPAN.

The Experimental Farm for the Maritime Provinces was also visited on this occasion, where the work was found to be progressing satisfactiorily. During the past year, the farm buildings have been completed, which are conveniently arranged and commodious, a substantial fence has been erected, and a large area of land broken up and brought under cultivation. The hay crop on the marsh land was excellent, but on account of the cold wet spring, the grain crops were not so forward as they usually are in July, but they were thrifty and the subsequent warmer weather brought them along rapidly. The young fruit trees had made excellent growth, and some of the small fruits were bearing well. Particulars of the progress made on this farm, will be found in the Superintendent's annual report appended.

VISIT TO QUEBEC.

Soon after returning from the Maritime Provinces, a visit was made to the Province of Quebec. A few days were spent in the neighbourhood of Les Éboulements and Murray Bay, many farms were visited, as well as several cheese factories in this district. It was a source of much gratification to find the dairy interest so flourishing in that Province, where the exports of cheese are becoming larger from year to year. Most of the factories were small, but well kept; the quality of the product was generally good, and the prices received by the makers encouraging. The milch cows are being improved in some districts by the introduction of new blood, but this is not so general as could be desired. The country in the neighbourhood of Chicoutimi was also visited. Many good crops were seen, but in some localities evidence was apparent of the partial exhaustion of the soil, and the need of more manuring and a proper rotation of crops. The usefulness of the work of the Experimental Farms is also being felt in Quebec; where a considerable distribution has been made of samples of seed grain for test, a special agent employed to visit the farmers and discuss agricultural topics with them, and a large circulation effected of the bulletins and reports of the farm both in French and English.

VISIT TO MANITOBA AND THE NORTH-WEST TERRITORIES.

On the 16th of September I left Ottawa for the West. Many improvements were noticed along the route between Ottawa and Winnipeg; new towns are building up, and in those localities where the land is fit for agricultural purposes many new settlers have located within the past year. Winnipeg itself is making satisfactory and solid progress and the farming lands about the city are being gradually taken up. In the journey from Winnipeg to Brandon the traveller passes through some of the finest wheat lands in the country and although the crops during the past year have in many parts been unusually light the land which has been prepared for next year's sowing seems to much exceed that of any previous year, showing that the settlers themselves have strong faith in the country.

EXPERIMENTAL FARM, BRANDON.

The Experimental Farm at Brandon, which is situated about a mile and a-half from the centre of the town, can be seen from every commanding point in the vicinity. All that part which lies in the valley of the Assiniboine and up its sloping sides being very distinctly in view. The changes which have been effected on this farm in a single season are very manifest. The pasture land adjacent to the river has been cleared of its unsightly scrub of willow, rose, and other bushes, and now appears as a smooth and even meadow, sufficiently capacious to furnish abundant food for a large herd of cattle. The farm has been entirely fenced with a neat and substantial post and wire fence, which extends for about six miles. The old trail which followed a winding course leading to the farms up the valley has disappeared and in its place is a straight and ample roadway, planted on either side with Manitoba maples, the centre of which was being gravelled with good material from a neighbouring hill. A large part of the higher valley land has either been brought under crop or is in summer-fallow, and a large field of about 80 acres lies fallowed on the higher part of the farm beyond the bluffs. The straight lines of stubble with regular divisions between them were all that was left of the experimental plots of grain, which must have looked very attractive during the summer when their green lines could be seen stretching up the hill slope.

On close examination it was gratifying to find that nearly all the Manitoba maples with which the avenues are planted were doing well, and that most of the young trees which compose the large shelter belt across the west side of the farm are living, notwithstanding the unfavourable conditions to which they have been exposed on account of the very dry season. Only a small percentage of the fruit trees have died even on the open prairie, while in the plantation which has been made in the scrub on the side of one of the bluffs there is not a single failure to record, and most of the trees have made vigorous growth. So encouraging a result is a stimulus to further effort in the same direction; hence other patches of scrub are being cleared so as to make room for several squares of about half an acre each, so arranged as to provide all around them a wide border of this low protecting growth of hazel, oak, &c.

With favourable conditions given, the prospects for fruit-growing in Manitoba are encouraging. The first desire of the new settler who wishes to grow fruit is generally to see about him some of the trees he has been accustomed to grow in less rigorous climates and a supply of these procured at considerable cost frequently constitutes his first experiment which is almost sure to be an entire failure. Too much stress cannot be laid on the importance of procuring hardy trees as one of the conditions necessary, and next a light or gravelly soil, where this is practicable, and some shelter. Fruit trees in a normal condition make what is known as a determinate growth each year of from one to three feet in length, this growth is usually completed early in the season, after which a gradual process of ripening or hardening of the wood takes place, and if these newly made branches can be thoroughly ripened before winter sets in, they are well prepared to endure severe cold. If, as is too often the case, the rich soil of the prairies stimulates the tree so that its growing period is unnaturally protracted, it makes a quantity of vigorous but succulent wood, which is too soft to endure the cold to which it must be exposed, and it frequently happens that in a rich soil, fruit trees start a second growth late in the season when there is not time for the wood to mature before cold weather comes. In most instances trees so situated kill down to the snow line every year. If grown on a comparatively poor soil the production of wood is limited, the growth early completed and the new wood becomes compact and well ripened before the summer is ended.

On the Experimental farm at Brandon, there are locations on the bluffs rising from the river valley which combine to some extent the conditions named. The soil is rather light and gravelly, with sufficient fertility to give reasonable growth. The scrub affords some shelter from prevailing winds and with hardy varieties selected for test the experiment promises well. An inspection of these trees after they have stood the test of a winter will be interesting.

While wheat will probably long continue to be the chief crop on the great western plains of Canada, a large majority of the farmers there are no longer content to depend solely on any one crop for their yearly returns, and mixed farming and the keeping of cattle for dairying and beef-producing is becoming very general. The production of butter is rapidly increasing and a vast number of cattle is now owned by the settlers; hence in any year when there is a partial failure in their grain crops they have something else to depend on for support. With this rapid increase of stock a very important question is looming up, that is the growing of winter food for stock. With a limited number of cattle in the country and an immense area of grass land unoccupied the settlers had fine pasturage for their herds, and at a trifling expense could lay up a store of hay from neighbouring meadow lands with which to to sustain their stock during winter. This condition of things is now rapidly changing and in many localities much of the unoccupied land is taken up and settlers are obliged to drive long distances, often as much as 30 or 40 miles to obtain the hay necessary for the winter sustenance of their cattle. In a very short time in the more thickly settled districts native hay will be no longer available in the quantities required and farmers must then grow on their own land such crops as will sustain the animals they keep. Experiments in growing grasses and clovers for the production of hay have not yet met with much general success, and while these will be continued on the Experimental Farms until all the varieties, both native and foreign, likely to be useful have been thoroughly tested, the main hope for the present is in the cultivation of those annual plants which produce a heavy weight of crop and mature in a short season. Among these are the different varieties of fodder corn, millet, Hungarian grass, and mixed crops of vetches, peas, oats, barley, &c, and cutting these while in a green state and drying them or packing them green into silos where they may be preserved in a succulent condition. A large quantity of such material can be grown on a few acres of land and when supplemented by the oat straw which is usually abundant, and a small quantity of bran or crushed grain, animals may be wintered in good condition at a moderate cost. The results of the past year's experiments with corn and fodder crops will be found in the report of the superintendent of the Brandon farm and although the season has been unfavourable a considerable measure of success has been achieved. The results of similar experiments are given in the report of the superintendent of the Experimental Farm at Indian Head, and it is proposed to continue these on a larger scale on both farms during the coming season.

EXPERIMENTAL FARM, INDIAN HEAD.

On this farm the grain crops have been better than at Brandon, but the forest and fruit trees have not succeeded so well, owing mainly to the very strong drying winds which prevailed during most of the growing period, and the lack of sufficient rain.

Some very instructive experiments have been conducted in order to demonstrate the best methods of treating the soil in preparing for crop. Grain grown on large pieces of summer-fallowed land has been compared with that grown on fall and spring ploughed land, and the results are greatly in favour of the summer-fallow. By this thorough method of preparation the soil is made capable of retaining moisture, and also of absorbing moisture from the air during cool nights, which carries the crop through even in the absence of rain in a remarkable manner. At the time of my visit the grain was all harvested, but the difference in the stubble was most marked, so that one could tell instantly when he stepped off the fallow land, the stubble on the fall and spring-ploughing being so much thinner.

A close examination was made of both fruit and forest trees, especially of those varieties which were planted in the spring of 1888, and hence had stood the test of two summers and one winter. There was obtained from Prof. Budd, of the Agricultural College, of Ames, Iowa, in the spring of 1888, a collection of Russian apple trees, numbering eighty-six in all, of twenty-six varieties, of these fifty-four are alive, and some of them are doing remarkably well, seven have died at the top, but have sent up shoots from near the base, and twenty-five have died entirely. Ten pear trees were obtained of two varieties, these have all died. The collection of plums included thirty-four trees of seven varieties; of these there are eighteen living, seven have died at the top and sent up shoots from the bottom, and ten died outright. Fifteen cherry trees were obtained of three varieties, two died at the top, but sent up shoots from the bottom, while eleven died entirely. These trees were nearly all of Russian origin.

Another collection of Russian trees was purchased from Stone, Wellington & Morris of Fonthill, Ontario, and consisted of 39 trees of 16 varieties; 31 of these are alive and 8 have died. A selection was also made from among the hardiest of the named varieties in general cultivation in the Eastern Provinces as follows: Apples, 65 trees of 18 varieties, of which 41 are alive and 24 dead; crab-apples, 12 trees of 4 varieties, 9 are living and 3 dead; plums, 10 trees of 5 varieties, 1 living and 9 dead; pears, 10 trees of 5 varieties, 1 living and 9 dead; cherries, 14 trees of 4 varieties, 3 living and 11 dead. Hence out of a total of 202 apple trees planted of 64 varieties, 135 are living, 7 have died at the top, and sent up shoots from the bottom and 60 have died outright. Pears, 20 trees of 7 varieties, 1 living, 19 dead; plums, 44 trees of 12 varieties, 22 living, 7 dead at top with shoots from bottom, while 16 died entirely; cherries, 29 trees of 7 varieties, 3 living and 22 dead. The proportion of deaths among the Russian trees was less than one-third, while among the hardy named sorts grown in the east it was nearly one-half.

Further collections have been secured and planted during the past season, some of which have been grown in Minnesota, some in the Province of Quebec and some at the Central Experimental Farm, these include a nnmber of varieties not before tested.

The gooseberries and currants, numbering between two and three hundred of the planting of 1888, have made fine healthy bushes with vigorous shoots, and plenty of them, from 1 to 2 feet long. The raspberries have also made fair progress. Of the strawberries many have died, but those that have survived look healthy and have made a quantity of runners, but not many of these have rooted on account of the very dry condition of the soil. Of 64 grape vines of 17 of the hardiest varieties, none have survived.

In 1888, nearly twenty thousand young forest trees and shrubs were planted, and during the past season over thirteen thousand more have been sent from the Central Farm at Ottawa, besides which there have been planted a considerable number of seedlings of native trees raised on the spot. Some of the trees have succeeded very well, while others have failed almost entirely. From the experience thus far gained, the following are among the most promising sorts for the Indian Head district. Of deciduous trees, Manitoba maple, American or white elm, rock elm, white ash, green ash, European and American mountain ash, wild black cherry, yellow birch, canoe birch, Russian mulberry European white birch, European alder, Norway maple and black ash. There are also several species of Russian poplars which may be safely added to this list. Of evergreens, Riga pine, Scotch pine, dwarf mountain pine, bull pine and white spruce. There are several ornamental shrubs which have done remarkably well, such as the Siberian pea, *Caragana arborescens*, Russian olive, *Eleagnus angustifolia*, several varieties of lilac, and the barberry. The farm buildings, now nearly completed, will afford excellent accommodation for stock, and it is expected that a sufficient number of animals will be forwarded in the spring to lay the foundation of useful herds of cattle, which will in future prove an important element in the general improvement of stock in the North-West.

VISIT TO BRITISH COLUMBIA.

The Experimental Farm at Agassiz, British Columbia, has also been organized and partially equipped. The work of clearing the brush and breaking up the land is being pushed vigourously forward. Some experimental plots of fall grain have been planted. A large number of different varieties of fruit trees have been secured, part of them from the nurseries in British Columbia and part from Ontario. A large orchard has been planned and partly planted and will be completed as early as practicable in the spring. Many strawberries, raspberries and blackberries have also been forwarded from the Central Experimental Farm, with a collection of grape vines. About 7,000 young forest trees, chiefly of the most valuable hardwoods, of the east have also been forwarded to test their usefulness in that country where hardwoods are almost entirely wanting. There is no reason to doubt that hickory, elm, ash, oak, walnut, cherry and other valuable hardwood timber trees will thrive and make rapid growth in British Columbia, and since there is much land on hill and mountain sides unsuitable for agriculture, but well suited for timber-growing, this line of work will be at once taken up at the Experimental Farm, young plantations made, the relative growth of the different varieties noted so that reliable information may be had as soon as possible for the guidance of those who may desire to engage in such tree planting. A beginning has been made with stock at the Agassiz Farm by the introduction of a well bred Durham bull and an excellent cow, both from good milking strains of that valuable breed of cattle. As soon as suitable buildings can be erected this department of the farm work will be considerably extended. In the meantime the introduction of a good bull will greatly aid the farmers in that district in their efforts to improve their stock. Several useful breeds of poultry have also been introduced and others will be shortly added.

While in British Columbia the opportunity was afforded of attending the Provincial Exhibition at New Westminster, where a large sum was offered in prizes. The fair was a very successful one and afforded convincing evidence of the progress which has been made during the past few years in that country. The exhibition of stock was much better than I expected to see, and included some excellent animals. Short-horns of milking strains, Holsteins and Jerseys appear to be the favourite breeds. Some very good horses were also shown for heavy draft and carriage purposes.

Some good samples of wheat, barley and oats were exhibited, and an excellent display made of hops, which were of unusually fine quality, large and fragrant.

Among the vegetable products were some very fine roots, enormous mangels and turnips from the delta lands on the Fraser, grown in the rich alluvial soil of that district without fertilizers. There were also very large potatoes, cabbage, cauliflower, squash, carrots, &c., and a fine display of plants and flowers.

The fruit display was perhaps the most attractive feature in the exhibition, although it might have been made much more instructive to the visitors had greater attention been paid to naming the varieties shown. Among the apples specimens of the Gloria Mundi were enormous, Ribston Pippin and Blue Pearmain very large, Gravenstein large and of wonderful colour, Northern Spy of grand size. The Spitzenburg, Fameuse, Golden Russet, Pomme Gris and many other sorts were first-class. Among the pears the Duchesse d'Angouleme, Bartlett and Beurre Diel attracted attention from their size, while Seckel, Beurre Hardy and Winter Nelis were larger than those usually shown at exhibitions in Ontario. The quinces were good, and peaches, although few in number, were very fine. Opportunity was afforded of testing the quality of some of the higher flavoured fruits and they were very good, but whether the flavor was quite as high as it is in Ontario fruit of the same variety could only be determined by careful comparison.

A few days later I had the privilege of visiting the exhibition of the British Columbia Inland Agricultural Association held at Ashcroft on the 10th and 11th of October, this was the first exhibition of agricultural products which had been held within the dry district of the Province east of the coast range of mountains and visitors living within the inland territory flocked to the town from all quarters, some of them from a distance of 200 miles. Here opportunity was given to inspect the products grown with the aid of irrigation. In the absence of a water supply much of the land is occupied largely by sage brush and cactus, with areas here and there of bunch grass and bull pine, (*Pinus ponderosa*), distributed with more or less frequency over the hill sides, but in the vicinity of the mountain streams, which are numerous, the water is ingeniously directed into many channels so distributed over the land as to afford desirable conditions of moisture, and the effect is most striking, the apparent barrenness is transformed into wonderful fertility, and the results as seen in the crops exhibited were quite a revelation.

There was a large assortment of squashes and cucumbers, good celery, very fine Swedish turnips from 26 to 33 inches in circumference and very solid, large cabbages with solid heads weighing from 15 to 25 pounds each, handsome solid white cauliflower from 14 to 15 inches across. Large mangels, long red, and round, excellent carrots in great variety, some specimens of intermediates measured 15 inches around; the parsnips also were unusually fine. Of potatoes, the samples were magnificent. There were tubers of St. Patrick, Early Rose, and several other varieties weighing from 2 to 3 pounds each. A seedling raised in the district by Mr. Walker, of Caché Creek, shown under the name of Blue Bell, attracted special attention on account of its regularity of form and fine appearance, several of these weighed 3 pounds each; there were tomatoes also which weighed from half pound to a pound each.

Of fruit there was a very good display and a few measurements were taken of some varieties. Gloria Mundi measured fifteen inches in circumference, Blue Pearmain 13 inches. Twenty Ounce 13 inches, Golden Russet, handsome clean specimens 9 inches, Blenheim orange 12½ inches, Greenings 11½ inches, Spitzenburg 11 inches, Weathy 11 inches, Roxbury Russet 12 inches. The examples of Northern Spy were very handsome and highly colored, Vanderere fine. Belle Angevine pears weighed from one to two pounds each, Swans Orange were very large and Vicar of Winkfield measured ten inches around at the widest part. There were fine luscious peaches, some of them 8 inches in circumference; excellent Concord grapes well ripened; also one of Rogers Hybrids, large Yellow Egg plums and some Red currants in good condition.

Excellent field corn was shown of the variety known as Canada Yellow with, ears well ripened and fully eleven inches long, also Horse Tooth corn with ears nine inches long well filled and fairly well ripened. Stalks of fodder corn were also shown measuring from 10 to 12 feet high. Some excellent grain was exhibited of Red Fife and Ladoga wheat grown from seed sent from the Central Experimental Farm also White Russian, Black Bearded and Centennial wheats. Good examples of both six-rowed and two-rowed barleys, the latter specially bright and plump. One of the finest of these was grown by Mr. E. Dougherty, of Clinton B. C., from a chance ear found three years ago growing with other barley, this yielded the second year a "milk-pan-ful" and this season three sacks. Alfalfa has done well in this district; bales of good alfalfa hay were shown by Mr. Pennie, of Savona, who has cut three crops a year, yielding him about 4 tons of dry hay to the acre. He has 22 acres giving this average, and finds the alfalfa to be excellent feed for his stock. Mr. Chas. A. Semlim, of Caché Creek, has 25 acres under the same crop, and has had very similar results.

There were a few entries of stock, but nothing deserving of special mention; a few good horses, and some fine poultry; some excellent butter both in tubs and rolls, and a good show of hops of very fine quality.

FAIR AT MEDICINE HAT.

Returning eastward the fair at Medicine Hat was visited. One of the chief features here was a large display of vegetables from the garden at the Canadian Pacific Railway Station. Among these were some very well grown cabbages weighing from six to ten pounds each; very good potatoes, some of the tubers weighing a pound or more each; Lima beans, and a great variety of other vegetable products. In the general exhibit there were cabbages from 12 to 16 pounds each; mangels, 9 pounds each, solid, well grown specimens; and fair-sized turnips from 6 to 7 pounds each. There were good examples also of carrots, parsnips, vegetable marrow, beets, onions, celery and citrons, with other products of the garden and field. There were samples of Squaw corn, well ripened, excellent peas, both Black-Eyed Marrowfat and Golden Vine; also, good examples of white beans and flaxseed. Mr. J. H. Hawk, a farmer residing near the town, exhibited a bag of very fine two-rowed barley, of the variety known as "Danish Chevalier," which weighed 56⅛ pounds to the bushel, and was very bright and plump, also one of Carter's Prize Cluster Oats which weighed 46½ pounds to the bushel; both of these were raised from samples of grain which had been sent to Mr. Hawk, for test, from the Central Experimental Farm. These were the finest specimens of grain on exhibition.

Some very good butter was shown, also a fair collection of potatoes and other vegetables of garden and field growth, and a good display of poultry including Plymouth Rocks, Light Brahmas, Buff Cochins and White Leghorns. There was no exhibit of cultivated fruits, but, in their place, samples of the preserved wild fruits of the country, including wild black currant, choke cherry, buffalo berry, and preserved cactus pods; this last makes a very agreeable preserve, reminding one of gooseberry.

FOREST TREES ON THE GREAT WESTERN PLAINS.

A wise policy has recently been adopted by the Canadian Pacific Railway of setting apart, at each of the more important railway stations through the sparsely settled portions of the western plains, about an acre of land for garden purposes in which are grown a number of different kinds of vegetables, small plots of grain and other products, the whole being brightened by a few flower beds. At the request of the Canadian Pacific Railway officers, a distribution of trees was made from the Central Experimental Farm to 25 of these experimental gardens located at principal points along the line between Moose Jaw and Calgary, a distance of about 440 miles, with the view of testing their relative hardiness and adaptability to this region. Twenty-five bundles were put up and forwarded, each containing 175 trees consisting of the following varieties:

Deciduous Trees.

10 Manitoba Maple.—*Negundo aceroides.*
10 American Elm.—*Ulmus Americana.*
10 Green Ash.—*Fraxinus viridis.*
10 White Ash.—*Fraxinus Americana.*
10 Locust.—*Robinia pseudacacia.*
10 European Larch.—*Larix Europea.*
10 Sugar Maple.—*Acer saccharinum.*
5 Red Maple.—*Acer rubrum.*
5 Soft Maple.—*Acer dasycarpum.*
5 Norway Maple.—*Acer platanoides.*
5 Black Walnut.—*Juglans nigra.*
5 Butternut.—*Juglans cinerea.*
5 American Beech.—*Fagus ferruginea.*
2 Wild Black Cherry.—*Prunus serotina.*
2 American Mountain Ash.—*Pyrus Americana.*
2 European Mountain Ash.—*Pyrus acuparia.*
2 Yellow Birch.—*Betula lutea.*
2 Canoe Birch.—*Betula papyracea.*
2 Rock Elm.—*Ulmus racemosa.*
2 European Alder.—*Alnus glutinosa.*
2 American Sycamore.—*Platanus occidentalis.*
2 Honey Locust.—*Gleditschia triacanthos.*
5 Russian Mulberry.—*Morus hybrida.*
2 Hardy Catalpa.—*Catalpa speciosa.*
2 Horse Chestnut.—*Æsculus hippocastaneum.*
1 Kentucky Coffee tree.—*Gymnocladus Canadensis.*
1 Ailanthus.—*Ailanthus glandulosus.*
1 Yellow Willow.—*Salix.*—?
1 Wisconsin Weeping Willow.—*Salix Wisconsiana.*
1 Tree Cranberry.—*Viburnum opulus.*
4 Barberry.—*Berberis vulgaris.*

Evergreen Trees.

10 Scotch Pine.—*Pinus sylvestris.*
10 Norway Spruce.—*Abies excelsa.*
5 Austrian Pine.—*Pinus Austriaca.*
5 Amer. Arbor Vitæ.—*Thuya occidentalis.*
5 White Spruce.—*Abies alba.*
4 White Pine.—*Pinus strobus.*

To these were added ten currant bushes in five varieties, four raspberry bushes in two varieties, and fifty assorted strawberry plants.

The trees and plants sent were all grown on the Central Farm, they were of medium size, well rooted and carefully packed, and they reached their destination in good order. During my journey, going and returning, I had the opportunity of seeing some of these trees and was gratified to find that in many instances they were doing well. A careful inspection was made of the trees sent to the garden at Medicine

Hat which is cared for under the direction of Mr. J. Niblock, superintendent of the Western Division of the line, who is an enthusiastic lover of trees and has met with encouraging success in his work. Reports are promised as to the results of these tests which will be watched with much interest.

CENTRAL EXPERIMENTAL FARM.

SEED TESTING.

The usefulness of the seed testing department at the Central Farm to the farmers of Canada is indicated by the increasing interest felt in that work, as shown by the number of samples sent for test. During the year, 933 samples have been received for this purpose. The results are given in the following summary.

Kind of Seed.	Number of Tests.	Highest Percentage.	Lowest Percentage.	Average Vitality.
Wheat, sound	320	100	30	89
do frozen	221	99	15	75
do total	541	100	15	83
Oats, sound	153	100	12	83
do frozen	21	94	2	47
do total	174	100	2	79
Barley, sound	98	100	15	86
do frozen	17	99	14	70
do total	115	100	14	84
Rye	5	95	81	85
Corn	3	90	42	73
Peas	9	99	39	67
Grass	23	96	0	40
Onions	3	82	58	69
Carrots	7	67	0	39
Flax	3	84	64	76
Turnips	2	98	80	89
Cabbage	12	84	4	51
Asparagus	6	86	0	39
Thyme	6	42	2	16
Lettuce	3	51	2	20
Radish	2	61	22	42
Tomato	6	63	38	49
Parsnips	1	....	....	68
Lentils	1	....	....	8
Celery	1	....	....	15
Cress	1	....	....	80
Egg plant	1	....	....	0
Parsley	1	....	....	17
Spinach	1	....	....	4
Red pepper	1	....	....	8
Sage	1	....	....	13
Summer savory	1	....	....	18
Sweet marjoram	1	....	....	10
Beet	1	....	....	100
Millet	1	....	....	83
Total number of samples of grain tested, highest and lowest percentage and average vitality	933	100	0	78

The tests of frozen grain have been especially useful to the farmers of the North-West and the timely information given has no doubt saved many from the disappointment which would in most cases have resulted from the use of inferior seed. For while occasional instances have been reported of good crops being obtained where frozen grain has been used for seed, the bulk of the evidence appears to be on the other side and few farmers care to run the risk which always attends the sowing of injured seed. In testing frozen grain not only was the percentage of germinating power returned, but information was also given regarding the vigour or weakness of the growth. It was often observed that where frozen grain had a fair percentage of germinating power its vitality was so far injured that a very weakly growth was made. These weaker plants sometimes gain strength and vigour rapidly in the rich soil of the prairies when the weather is favourable, but if unfavourable conditions prevail, their growth, is usually slow and stunted, and the crop uneven in ripening.

During the season of 1889, rust has prevailed to an alarming extent in Ontario and to some extent in Quebec and the Maritime Provinces. This parasitic attack has resulted in a shrivelling of the grain and a weakening of its vitality, which is especially the case with oats. The importance of sowing good seed is now generally recognised, and as there is no way short of actual test by which the value of a doubtful sample can be accurately ascertained, farmers should send such as they desire to have tested at an early date so that the needed information may be had in good season. An ounce or two is sufficient for the purpose, unless it is desired that the weight per bushel be ascertained when not less than one pound should be forwarded; packages may be sent to the Experimental Farm free through the mail, the information is given to the sender free of cost, and the time occupied in each test is usually about two weeks. The new building recently completed for this purpose gives almost unlimited capacity for the work, so that none need remain in uncertainty as to the vitality of the seed they are proposing to use.

SEED DISTRIBUTION.

There have been distributed during 1889 for test among the farmersof the Dominion 2,760 three-pound bags of seed grain of the following varieties:—

Wheat Ladoga	1,279
Barleys Two-rowed.	
English Malting	204
Carter's Prize Prolific	230
Beardless	165
Danish Chevalier	178
Danish Printice Chevalier	110
Peerless White	33
Thanet	27
Oats.	
Carter's Prize Cluster	179
Welcome	331
Early Blossom	24
	2,760

LADOGA WHEAT.

One hundred bushels of the Ladoga wheat was sold to the Quebec Government for distribution among the farmers in that Province, forty bushels was sold to farmers in New Brunswick and Nova Scotia, a like quantity to those in Prince Edward Island and sixty bushels to those residing in Manitoba and the North-West Territories.

Up to the time of the date of this report there have been received 142 reports of the results of the tests of this wheat for 1889; of these 117 are favourable and 25 unfavourable. The unfavourable reports are chiefly from Ontario and Quebec, where rust has been very general on all varieties of wheat, and it would appear that in these Provinces the Ladoga has suffered more from this cause than some other sorts. These returns give the average yield from the 3 lbs. samples sent as 46 lbs. The largest yield yet reported is from M. Saunby of Inderby, British Columbia, in which case 139½ lbs. was harvested. The average weight per bushel of the samples which have been sent of the grain produced is 60½ lbs. per bushel. The heaviest sample comes from Mr. Groat, of Edmonton, North-West Territories, weight 64½ lbs. per bushel. The Ladoga wheat continues to maintain its character for early ripening; the average experience from the returns made gives it 9½ days of an advantage over Red Fife in this respect, and in the Maritime Provinces, where White Russian is principally grown it is reported as being on an average 8 days earlier there than that variety. The following extracts are given as examples from the more favourable reports received from the several Provinces:

Daniel Collins, Mink River Road, Prince Edward Island, harvested 122 lbs. from the 3 lbs. sent him. He says: "The Ladoga is ten to fifteen days earlier than other varieties, and does not require such strong land."

James Corcoran, Piusville, Prince Edward Island, had 74 lbs. from 3 lbs. of seed, and says: "It is twelve days earlier than White Russian sown side by side, and about double the weight of grain, both getting the same chance. My opinion is that this country has been supplied with a long felt want."

Eli Thompson, of Whim Road Cross, Prince Edward Island, got 90 lbs. from 3 lbs. sown; he says there was "no rust, straw bright and clean, about ten days earlier than ordinary wheat; my other wheat showed signs of rust." Weight of grain 61½ lbs. to the bushel.

John Jennings, Newburgh, New Brunswick, had a yield of 102 lbs. from 3 lbs. 2 oz. of seed. He says: "The Ladoga is as early as the earliest grown here, say ten days earlier than the Manitoba Fife. If it does not rust, I think, it is a valuable addition to our wheat."

M. Rideout, of Mount Pleasant, Carleton County, New Brunswick, had 91 lbs. from 3 lbs. of seed, and says: "It was the best wheat I ever sowed. Weight of grain 62¼ lbs. to the bushel.

Robert Smith, of Pugwash, Nova Scotia, got 59½ lbs. from 3 lbs., and says: "It is about ten days earlier than other sorts. I am very much pleased with the wheat, it has a good hard appearance." Weight 59½ lbs. to the bushel.

William Andrews, of Stewiacke, Nova Scotia, who got 46 lbs. from 3 lbs. says: "It ripened ten days earlier than White Russian, which was sown on same day and under same conditions. I consider it a valuable wheat."

Joseph Seguin, of Point Fortune, Quebec, had 63 lbs. from 3 lbs. sown, and says: "It ripened about ten days earlier than other varieties; will sow crop next spring; much satisfied."

T. Lyster of Melbourne, Quebec, harvested 60 lbs. from 3 lbs. sown and says "it ripened one week sooner than White Russian."

Lazare Demers, of St. Julie, Megantic County, Quebec, got 40 lbs. of fine wheat which weighed 62½ lbs. to the bushel from 3 lbs. of seed. He says it is "about 10 days earlier than other wheat, the quantity obtained is about 33 per cent. better."

John C. Gurney, of Rockingham, Renfrew, Ontario, got 114 lbs. from 3 lbs. of seed. He says "I believe it to be 10 to 14 days earlier than any other kind that I am acquainted with, and believe the yield would be very large under favourable circumstances; yielded about 40 bushels to the acre, would have yielded 60 bushels if it had not been for rust." Weight 59¼ lbs. per bushel.

Henry Jennings, Victoria Square, Markham, Ontario, got 83 lbs. from 3 lbs. of seed and says: "It is a few days earlier than other varieties, no rust, but badly midged."

John Fitzgerald, Mount St. Louis, Simcoe, Ontario, had 61 lbs. from 3 lbs. sown. He says; "It ripened 10 days earlier than Russian or other spring wheats, yields equally as well, but grain is small, a little rusted, spring wheat very much rusted this year."

E. H. Dewart, Milford, Manitoba, got 63 lbs. from 3 lbs. of seed, and says: "It ripens about five days earlier than Red Fife, sown same day and place. I think it stood the test well."

J. R. Patterson, Pilot Mound, Manitoba, who got a yield of 60 lbs. from 3 lbs. says: "It is about eight days earlier than Red Fife. This was a very dry season, but if all grain had done as well as this I should have been well pleased."

Andrew Johnson, of Mowbray, Manitoba, got a sample two years ago from which he has now plenty of seed, he thinks very well of it and says: "I sowed 20 acres in same field as Red Fife."

A. Lennie, of Edmonton, North-West Territories, got 30 lbs. from 3 lbs. sown. He says: "It is 10 days earlier than other sorts."

A very fine sample has also been received from the Rev. A. C. Garrioch, of Dunvegan, Peace River, which weighs 64lbs. to the bushel; in this instance the yield is not given.

M. Saunby, of Inderby, British Columbia, had a sample of 3 lbs. Ladoga sent him in the spring of 1888, from this he got 80 lbs. which he used as seed this year and harvested 3,720 lbs. equal to 139½ lbs., from 3 lbs. He says: "It is one week earlier than other wheats, yield 62 bushels to the acre."

DANISH CHEVALIER BARLEY.

Two sacks of this very fine variety of two-rowed barley were obtained in the spring of 1888 from Copenhagen, Denmark, through the kindness of the president of the Danish Royal Agricultural Society, and was a fine sample of the celebrated barley which commands so ready a market in Great Britain at high prices. It weighed 57 lbs. to the bushel. This barley grown on the Central Farm this season weighs 50½ lbs. to the bushel, but the yield has been over 31 bushels to the acre. The same grain grown on the Experimental Farm at Indian Head, North-West Territories, weighs 55 lbs. to the bushel, and at Brandon, Manitoba, 54 lbs. The number of returns received to date is 19, all of which are favourable. The average yield is 63 lbs.

Fred. R. Mellish, Union Road, Montague Bridge, Prince Edward Island, got 42 lbs. from 3 lbs. sown. He says: "it will compare favourably with any other as to weight of crop, and it ripens in same period as other varieties sown here, am well pleased." The weight of this sample was 49½ lbs. to the bushel.

James Kerr, Summer Hill, Queen's County, New Brunswick, had 130 lbs. from 3 lbs. sown. He says: "The yield is great. I intend sowing all the barley I have next spring." Weight of sample, 47½ lbs. to the bushel.

John Murphy, of Dalling, Quebec, who had 45 lbs. from 3 lbs. sown, says: "The crop was very heavy, but later than the common barley." Weight 48 lbs. per bushel.

Geo. Fisher, Freeman, Ontario, got 125 lbs. from 2 lbs. 13 oz. of seed. He says: "It ripened about ten days later than common six-rowed, and is much heavier." The weight of the sample was 54¼ lbs. to the bushel.

Daniel Baxter, Belmont, Ontario, had 115 lbs. from 3 lbs., and says: "That the straw was bright and of reasonable length, earlier than other barleys and heavier than other sorts."

J. J. Coyne, of Chesterville, Ontario, got 96 lbs. from 3 lbs. sown. He says: "Straw excellent, tall and long headed grain, best I have ever seen in this line. I expect I would have had better grain and more of it but rain and wind destroyed it and left it coloured." Weight, 46½ lbs. per bushel.

A. W. Peart, of Freeman, Ontario, had 94 lbs. from 3 lbs. of seed. He says: "Sown 15th April, harvested 3rd August, no rust whatever, straw long, bright, pliable, tendency to lodge; compared with ordinary six rowed barley the two-rowed ripened two weeks later, compared with Russian a week later. Pound for pound in sowing, the two-rowed gave 31 for 1, the six-rowed 23 for 1. I sowed two-rowed at the rate of 1¼ bushels per acre and six-rowed at 1¾ bushels. As you see by sample the two-rowed is very fine barley, much larger than the six-rowed. The two-rowed was sown side by side with the six-rowed and I noticed it was several days longer in coming up. I am very much pleased with it. My six-rowed barley yielded 41 bushels per acre." The sample sent by Mr. Peart weighed 53 lbs. to the bushel.

Thomas Manderson, of Myrtle, Ontario, who had 75 lbs. from 3 lbs., says: "It ripened about ten days' later than common six-rowed." Sample weighed 53 lbs. per bushel.

J. L. Hawk, of Medicine Hat, North-West Territories, sends in the handsomest sample yet received, very bright and plump, weighing 56½ lbs. to the bushel. This barley took first prize at the Medicine Hat Fair. Mr. Hawk got 57 lbs. from 3 lbs. of seed. He says: "Straw a good length and very bright. I had no other barley sown, but think it not quite so early as the old kind."

Reports from the other Provinces are not yet received.

DANISH PRINTICE CHEVALIER.

This variety was also obtained from the Danish Royal Agricultural Society. Grown at the Central Farm this year it yielded 36¼ bushels to the acre and weighed 50 lbs. to the bushel. At Indian Head it weighed 53½ lbs., and at Brandon 53 lbs.

C. Newcomb, Weymouth, Nova Scotia, got 122 lbs. from 3 lbs. of seed. He says: "It is two weeks later than other barley sowed alongside. It took first prize at our County Exhibition."

Thomas Manderson, of Myrtle, Ontario, had 83 lbs. from 3 lbs. of seed. He says: "The straw is weak, rather on the short side; all blew down. Cut same day as other samples; too weak in the straw for this section of country." Weighed 53 lbs. per bushel.

J. Baxter, Pickering, Ontario, had 48 lbs. from 3 lbs. sown. He says: "Straw rather weak; broken down with a rain storm at time of ripening; later than the six-rowed varieties." Weighed 52 lbs. to the bushel.

Other Provinces not yet heard from.

ENGLISH MALTING BARLEY.

This was a very fine and bright sample of barley, which was purchased at the Corn Exchange, London, England, and weighed 54¼ lbs. to the bushel. Grown at the Central Farm this season it has yielded 34¼ bushels to the acre, weighing 50½ lbs. per bushel. The same variety, grown at Indian Head, weighs 53½ lbs., and at Brandon 53 lbs.

John McDonald, St. Peter's Lake, Prince Edward Island, had 50 lbs. from 2¾ lbs. of seed. He says: "No rust; straw fairly good; light growth; no other barley sown." The sample sent by Mr. McDonald is very fine, and weighs 54⅗ lbs. per bushel.

Donald McLennan, Indian Brook, Nova Scotia, who had 3 pecks from 2¾ lbs. sown, sends also a good sample, weighing 52½ lbs. per bushel. He says: "Straw very brittle. I think our ordinary barley does here just as well."

Wallace Oliver, Magog, Quebec, had 45 lbs. from 2¾ lbs. sown. He says: "Straw fair length, soft and limber. I think it is fully ten days later than the six-rowed. Weighed 51 lbs. per bushel.

Joseph Dubrieul, La Patrie, Quebec, harvested 30 lbs. from 2¾ lbs. of seed, and says: "Straw 2½ feet long; grain early and fine."

A. W. Brown, Rebecca, Ontario, had 130 lbs. from 2¾ lbs. sown. He says: "Sown 25th May; harvested 1st August; straw bright and good. I think it is a little later than the four-rowed barley, but think it would beat it in weight per acre. Some of it lodged and injured the sample." Weight 52¼ lbs. per bushel.

Mr. McNaughton, of Gourock, Guelph, had 102 lbs. from 2¾ lbs. of seed, and says: "Sown 18th April; harvested 3rd August. No rust observable; straw good, bright, clean; from ten days to two weeks later in ripening than our Canadian barley. The plot of ground was shaded by trees, and it did not have such a good chance to mature. As far as this sample of two-rowed English is concerned, the only drawback is its lateness of ripening." Weight 53¼ lbs. per bushel.

Major Boulton, of Shellmouth, Manitoba, sends a very good sample of this barley, weighing 52½ lbs. per bushel, grown by Denmark & Martin, of Russell, Manitoba. He says: "Straw short; rather coarse; no rust; about the same as other barley as to ripening; no means of ascertaining weight."

Donald Graham, of Spillamacheen, British Columbia, harvested 174 lbs. from $2\frac{3}{4}$ lbs. of seed. He says: "Sowed 19th April; harvested 29th July. No rust; straw very fair, but somewhat inclined to lodge. About as early as six-rowed, but yields better."

W. A. Johnson, Quesnelle, British Columbia, had 64 lbs. from $2\frac{3}{4}$ lbs. sown, and says: "Sown 30th April; harvested 25th August. No rust; straw short and weak; ripens later than other kinds; grain plump, bright and of good weight." Weighed $50\frac{3}{4}$ lbs. per bushel.

BEARDLESS BARLEY.

The seed of this variety was purchased from Oakshott & Millard, seedsmen, Reading, England. As imported in 1888, it weighed 56 lbs. to the bushel and was handsome and plump. Grown in the field at the Central Farm the past season, it has yielded a little over 50 bushels to the acre, weighing $51\frac{3}{4}$ lbs. to the bushel. The same grain grown on the Indian Head Farm weighs 55 lbs. per bushel, and at Brandon 52 lbs. This barley cannot correctly be called beardless, as it is bearded like other varieties, but sometimes sheds its beard when mature. The beard drops from it when touched if fully ripe, which is an advantage in threshing; 165 samples were sent out, but only seven reports are yet received, and in most of these the yield is not given.

J. Dearness Granton, Middlesex, Ontario, got 55 lbs. from 3 lbs. of seed. He says: "There is no noticeable difference as to the earliness; sample is unusually large, bright and good."

Joseph Lang, of St. Marys, Ontario, had 50 lbs. from 3 lbs. of seed. It was sown 20th April and harvested 16th July. He says: "It is not so early as the six-rowed."

Peerless White and Thanet barleys are not yet reported on.

CARTER'S PRIZE PROLIFIC BARLEY.

This new strain of two-rowed barley, recently introduced by James Carter & Co., Seedsmen, London, England, is claimed to be the most prolific barley in cultivation and one of the very best for malting. Seed was obtained from Carter & Co. in time for last springs sowing, and the weight of the grain as imported was $54\frac{1}{2}$ lbs. per bushel. From the character of the reports received from all parts of the Dominion where samples were sent for test, and the universal favor in which it is held, it must be regarded as very promising. The crop on the Central Farm was not particularly heavy, $31\frac{1}{2}$ bushels to the acre, but the season was not favorable, and the piece of land on which it was sown not in as good condition for a barley crop as were some other fields. It weighs $50\frac{1}{4}$ lbs. to the bushel. Through an error in shipping, the bag of Carter's barley, which should have gone to Indian Head for test, was sent to Brandon. On this account there is no report from Indian Head. The crop at Brandon weighed 54 lbs. per bushel.

Benjamin Cole, of Centreville, Prince Edward Island, got 95 lbs. from 3 lbs. seed, which weighed 56 lbs. to the bushel. He says: "Sowed 27th May; harvested 27th August; no rust; straw bright; heads long, but somewhat thin. Was late maturing; will sow earlier next year; am well satisfied with result."

H. T. Hall, Gagetown, Queen's Co., New Brunswick, got 47 lbs. from 3 lbs. of seed. He says: "Sown 21st May; harvested 21st August; no rust; straw not strong enough; lodged badly. Like the grain well; ripens about same time as our other barley; weighs $2\frac{1}{2}$ lbs. more." Sample weighs $48\frac{1}{2}$ lbs. to bushel.

Duncan Stewart, of Iverness, Quebec, who had 60 lbs. from 3 lbs. seed, says: "Sowed 6th May; harvested 2nd September. No rust; straw long and coarse; ripens about same time as other barley, but far heavier crop. If it will turn out as well in future as the sample did, it will be a great boon." Sample weighed $53\frac{1}{4}$ lbs. per bushel.

Henry Jennings, Victoria Square, Markham, Ontario, harvested 176 lbs. from 3 lbs. seed. He says: "Sowed 12th April; harvested 5th August. No rust or smut; straw heavy, coarse, and lodged badly; grain a great deal heavier than other kinds and 3 or 4 days later. I think this barley will be a great success; the heads were very long.

I have given it a fair trial, without any artificial manures." Sample weighed 53 lbs. per bushel.

Henry R. Wilson, Winona, Ontario, got 147 lbs. from 3 lbs. seed. He states that he "Sowed 15th April; harvested 1st August. No rust or smut; straw clean and bright; ripened about the same time as the six-rowed barley. The principal gain is its great weight, as it over-runs 6 or 7 lbs. to the bushel. The long continued cold rains in the spring and the dry hot weather at time of ripening was unfavorable." This sample was a very fine one, plump and bright, and weighed $55\frac{1}{4}$ lbs. to the bushel.

Duncan McDonald, of Glen Robertson, Glengarry, Ontario, who had 120 lbs. from 3 lbs. seed, says: "Sowed 2nd May; harvested 8th August. No rust or smut; straw very white. It took from 10 to 14 days longer to ripen than our common barley." Sample weighed $52\frac{1}{2}$ lbs. per bushel.

Colin Phillips, of Brougham, Ontario, had 110 lbs. from 3 lbs. seed and writes as follows: "Sowed 24th April; harvested 8th August; yield 110 lbs. clean, besides part lost in threshing. No rust or smut; straw long, bright, medium stiff; from 10 to 15 days later than other sorts in ripening. I took a sample to Pickering Harbor and had it tested for weight by Mr. Sparks, Inspector of Barley there. He made it 54 lbs. per bushel." The sample received was rather dark in color. The weight as tested by us was 54 lbs. to the bushel.

McKee Bros., of Heaslip, Manitoba, saved 67 lbs. from 3 lbs. seed, but they say "gophers and cattle destroyed about one-third," which would make the yield about 89 lbs. They report as follows: "Sowed 31st April; harvested 20th August. No rust or smut; straw strong, and about 18 inches high. In earliness, is about the same as other barley." Sample weighed 51 lbs. per bushel.

Duncan McCuaig, of Portage la Prairie, Manitoba, got 68 lbs. from 3 lbs. sown, and says: "Sowed 29th April; harvested 21st August. No rust or smut; straw good and long. It was a few days later than other barley, probably on account of its being thinner sown." Sample weighed $52\frac{2}{3}$ lbs. per bushel.

L. A. Agassiz, of Agassiz, British Columbia, reports the extraordinary yield of 365 lbs. from 3 lbs. of seed. He says: "Sowed 30th April; harvested 20th August. No rust or smut; straw light medium. Owing to wet weather at harvest it was discolored."

CARTER'S PRIZE CLUSTER OATS.

This new variety of white oat was also sent out by Carter & Co. It is claimed to be the heaviest, earliest and most prolific white oat in cultivation. The seed as received weighed 42 lbs. per bushel, and was very bright and handsome. Grown on the Central Farm it produced 50 bushels to the acre, but the weight, on account of rust, was deficient, being $34\frac{1}{4}$ lbs. per bushel. At Indian Head the yield was over 34 bushels to the acre, and the weight $45\frac{1}{2}$ lbs. to the bushel. At Brandon the weight was 42 lbs. per bushel. The reports thus far received are very encouraging, and indicate that the introduction of this new oat will be of great advantage to the farmers of the Dominion.

Geo. Baird, of Bairdsville, New Brunswick, harvested 115 lbs. from $2\frac{3}{4}$ lbs. of seed. He reports: "No rust or smut; straw bright and yellow. It is the heaviest oat I have raised, and as early as any except the White Russian. These oats are going to make a great improvement in regard to change of seed." Sample very fine; weighed 42 lbs. per bushel.

Robert H. Goggin, Elgin, N. B., had 90 lbs. from $2\frac{3}{4}$ lbs. sown. He says: "Sowed 10th May; harvested 16th August. The straw was tall and stout. This oat compares very favorably with other kinds." Sample weighed $38\frac{3}{4}$ lbs. per bushel.

H. H. Blois, of Gore, Nova Scotia, got 57 lbs. from $2\frac{3}{4}$ lbs. seed, and says: "Sowed 4th May; harvested 20th August. No rust to speak of; no smut; straw fairly good; lodged some with rain storms; not stiff enough to stand much top dressing; ripens about the same as our common black oats. The oats throughout this section of country were affected with rust this season—nearly ruined in some instances." Weight, 39 lbs. per bushel.

John Fleetwood, St. Ann's, N.S., had 34 lbs. from $2\frac{3}{4}$ lbs. sown. He says: "sowed, 25th May; harvested 28th August. There was some rust; no smut; straw was tall and turned of a reddish brown colour. It is a good deal earlier than other sorts, except the Welcome. This year was not favourable for testing any grain in this country, as there was a great failure in all grains." Weight of sample, 35 lbs. per bushel.

John Middleton, Point Fortune, Quebec, got 40 lbs. from $2\frac{3}{4}$ lbs. seed, and says: Sowed last of April; harvested last of July. No rust; nor smut; straw good; 6 feet long; earlier than other sorts, also a better yielder; was sown in a corner of a field where it was much eaten by squirrels, or would have yielded 5 or 10 lbs. more.

Samuel Lee, of Stoney Creek, Ontario, had 115 lbs. from $2\frac{3}{4}$ lbs. sown, and says: "Sowed 8th May; harvested 12th August. Some rust; some smut; straw very good, 6 days earlier than the rest of the oats on the farm." Sample weighed 39 lbs. per bushel.

Geo. E. Fisher, of Freeman, Ontario, got 112 lbs. from $2\frac{3}{4}$ lbs. seed. He says. "sowed 15th April; harvested 5th August. Considerable rust and a little smut; straw remarkably tall and quite soft; much inclined to go down; ripens with Welcome; grain quite as heavy as the Welcome oats." The sample received was very good, and weighed 43 lbs. per bushel.

Thos. Manderson, of Myrtle, Ontario, got 72 lbs. from $2\frac{3}{4}$ lbs. sown. He says: "Sowed 15th April; harvested 2nd August. No rust or smut; straw very good; stood up fine; they ripened same time as my other white oats. I think these oats will answer this country very well." Weight of sample, $41\frac{1}{2}$ lbs. per bushel.

Duncan McCuaig, Portage la Prairie, had 40 lbs. from $2\frac{3}{4}$ lbs. seed. He says: "Sowed 29th April; harvested 15th August. Some rust; good straw; has done well. The season being so dry our general oat crop was a failure this year with drought and rust." Weight of sample, $38\frac{1}{2}$ lbs. to the bushel.

A. S. Harding, of Whitewood, North West Territories, had 45 lbs. from $2\frac{3}{4}$ lbs. sown, and says: "Sowed 9th April; harvested 6th August. No rust or smut; straw tall and strong; valuable for feed purposes. This is evidently a superior kind in early maturing and size of heads and grain; have a very good opinion of it; very dry season here this year." Weight of sample, $33\frac{1}{2}$ lbs. to the bushel.

J. L. Hawk, Medicine Hat, North-West Territories, got 59 lbs. from $2\frac{3}{4}$ lbs. sown, and says: "Sowed 7th April; harvested 7th August; no rust, but a few heads of smut; straw long and bright; is about two weeks earlier than any other oats, and gives a better yield." This is the heaviest sample yet received. Weight, $46\frac{1}{2}$ lbs. per bushel.

L. A. Agassiz, of Agassiz, British Columbia, had 223 lbs. from $2\frac{1}{2}$ lbs. of seed. He writes: "Sowed 30th April; harvested 13th August; no rust; no smut; straw rather stiff; medium height; grain early and good. Owing to wet weather at harvest a great deal was lost; it was also discolored."

W. A. Johnson, Quesnelle, British Columbia, harvested 87 lbs. from $2\frac{3}{4}$ lbs. of seed. He reports as follows: "Sowed 30th April; harvested 18th August; no rust; no smut; straw long, apparently of sufficient strength to prevent lodging; compares favourably with other sorts, being ripe ten days earlier than any other oat on the farm." Sample very fine, weighing 43 lbs. to the bushel.

EARLY BLOSSOM OATS.

A few samples of this variety have been distributed, and in some districts it has given good results. On the Central Farm the yield was $30\frac{1}{4}$ bushels to the acre, but owing to rust the weight of the grain did not exceed 31 lbs. to the bushel. At Indian Head the weight was 42 lbs. to the bushel, and at Brandon 34 lbs.

John Corbett, of Summerhill, New Brunswick, got 41 lbs. from $2\frac{3}{4}$ lbs. of seed, and says: "Sowed 13th May; harvested 24th August; no rust; no smut; straw coarse, and bright in color. It is two or three days earlier than other oats sown on the same day, and compares very favorably with them." Sample weighed $37\frac{1}{2}$ lbs. per bushel.

E. Frechette, St. Julie, Megantic, Quebec, had 89 lbs. from $2\frac{3}{4}$ lbs. sown. He says: "There was no rust; no smut; straw stout and long; grain much better than any other varieties on the same ground." Weighs $39\frac{1}{4}$ lbs. per bushel.

John Leader, McIntosh Mills, Ontario, had 74 lbs. from $2\frac{3}{4}$ lbs. of seed, and says: "No rust; no smut; straw coarse and heavy; ripens six or seven days earlier than other oats. Is superior to any I have grown on my farm; ripens earlier and yields better, and the straw is very good." Weighs $33\frac{1}{2}$ lbs. per bushel.

Adolph Lundgrew, Scandinavia, Manitoba, had 57 lbs. from $2\frac{3}{4}$ lbs. seed. He says: "Sowed 4th May; harvested 3rd September; no rust; very little smut; straw 3 to 4 feet long, and up to $\frac{3}{8}$ inch in diameter; yield nearly double the quantity of other oats sown at the same time. A frost about the end of May, when the grain was 3 inches high, destroyed it. Otherwise, the result would have been better." Weighed $37\frac{1}{2}$ lbs. to the bushel.

A few reports on the test of Welcome oats have been received, some of them quite favourable; but as this is now a well known variety in most districts, it is scarcely necessary to occupy space here with the details.

TREE SEEDS.

A limited number of tree seeds have also been distributed, including many packages of Manitoba maple, or box elder, with some elm and white ash. There were also sent out 440 bags containing from 1 to 2 lbs. each of black walnuts and 117 bags of butternuts. Some interesting reports have already been received regarding these nuts and tree seeds, and many more to whom they were sent will no doubt yet be heard from.

STOCK.

During the months of June and July some purchases of cattle were made for the Experimental Farm of the following breeds: Shorthorns, Ayrshires, Holsteins, Jerseys and Polled Angus. Of the Shorthorns, two bulls, four cows and six heifers of milking strains, and three heifers of special beef strains. Ayrshires, one bull, five cows and one heifer; Holsteins, three bulls, two cows and five heifers; Jerseys, one bull, four cows and one heifer; and Polled Angus, one bull and five heifers-making in all forty-four animals—eight bulls, fifteen cows and twenty-one heifers. In making a purchase of three Holstein bulls these have been bought with the intention of sending two of them to the other Experimental Farms in the spring; the second Durham bull was also bought for a like purpose. Since these were purchased there has been the following increase by births. One Shorthorn bull calf, three Ayrshire bull calves, one Jersey bull calf, one Ayrshire heifer calf, one Shorthorn heifer, and one Jersey heifer. Hence there are in all fifty pure bred animals, to which may be added three grade cows and one grade heifer, making a total of fifty-four. On the other hand we have lost two Jersey cows from acute inflammation of the stomach. Much care has been taken in selecting these animals, and the endeavour made to combine as far as was practicable the most desirable strains in each herd, so that a good foundation might be laid from which surplus animals could be drafted to meet the requirements of the other Experimental Farms. All these animals have been bought within the Dominion, excepting two bulls and five heifers of the Holstein breed, which were selected from the celebrated herd of Smith, Powell & Lamb, of Syracuse, New York. The following particulars relating to the pedigrees of the individual members of the several herds will, it is hoped, be of interest, and enable anyone who desires to pursue the enquiry further to trace back in the several herd books the entire pedigree of each animal:—

SHORTHORN BULLS.

Rosy Prince 8th, No. 9,198, C. H. B. Date of birth 6th November, 1886; colour red, with a little white; bred by Richard Gibson, Delaware, Ontario; sire Wild Eyes Laddie, No. 67,992, E. H. B.; dam Rosy Princess 7th, by 7th Lord of Oxford, No.

17,586, E. H. B; 2nd Dam Rosy Princess 6th, by 22nd Duke of Airdrie, No. 16695, E. H. B.

Duke of Belvoir. Date of birth, 20th April, 1889; colour roan; bred by Gibson & Burch, Delaware, Ontario; sire 8th Duke of Leicester (Imp.), No. 9279, C. H. B; dam Waterloo 48th, by Duke of Oxford, No. 39770, E. H. B; 2nd Dam 43rd Waterloo by Oxfords Baron, No. 32,030, E. H. B.

COWS AND SHORTHORN HEIFERS.

Milking Strains.

Countess of Darlington 12th, No. 14,193, C. H. B. Date of birth, July 19, 1885; colour red and white; bred by Richard Gibson, Delaware, Ontario; sire Marquis of Kirklevington, No. 52,664; Dam Countess of Darlington 8th, No. 14,190; by Oxford Duke, 45,297, E. H. B.; 2nd dam Countess of Darlington, by 14th Duke of Airdrie, 41,348, E. H. B.

Elmwood Garland 3rd, No. 14,327 C. H. B., date of birth, August 1st, 1885, colour red: bred by T. D. Hodgins, London, Ont, sire (Imp.) Belooch; dam Lady Garland 4th, by Earl of Ulster, No. 29,488, E. H. B.: 2nd dam Glosters Garland 2nd, by 17th Duke of Airdrie, No. 6629 E. H. B.

Cherry Constance 3rd, date of birth, 7th November, 1887; colour red and white; bred by Gibson & Burch, Dalaware; sire Wild Eyes Laddie, No. 67992, E. H. B., dam 4th, Constance of Springbrook; 2nd dam, Lady Constance 5th, by Lord Mayor, No. 6969 C. H. B.

Flower of Berkeley, No. 14197; date of birth, 22nd September, 1886; colour roan; bred by Richard Gibson, Delaware, Ont; sire, Lord Kirklevington, of Erie 2nd; dam Fuchsia, by Cambridge Duke; 2nd dam Fidessa, by Red Duke.

Guelder Duchess, No. 14,360; date of birth, 2nd June; 1887, colour roan; bred by T. D. Hodgins, London Ont.; sire, Duke of Guelders, No. 47,740, E. H. B.; dam, Elmwood Duchess, by Buckhurst; 2nd dam Seraphina Duchess 5th; by 7th Lord of Oxford.

Wild Flower No. 14206.—Date of birth, 3rd April, 1886; colour red and white; bred by Richard Gibson, Delaware, Ontario; sire Wild Eyes Laddie No. 9192 C.H.B; dam Hermosa by Prince 3344; 2nd dam Rose by Viceroy of Richmond.

Columbine No. —Date of birth, 24th November, 1888; colour red; with a little white; bred by Richard Gibson, Delaware; sire Duke of Wellington; dam Wild Flower 14206 by Wild Eyes Laddie 9192 C.H.B.; 2nd dam Hermosa by Prince 3344.

Miss Elgins 5th No. 16647.—Date of birth, 23rd April, 1886; colour red; with a little white; bred by James Graham, Port Perry, Ontario; sire Minna Duke No. 2108 C.H.B; dam Miss Elgins 2nd No. 4018 by Royal Buck 2374; 2nd dam Miss Elgins 4017 by Fairfax 1779.

Cowslip 3rd No. 16646.—Date of birth, 13th October, 1886; colour red; bred by James Graham, Port Perry, Ontario; sire Prince Victor 5th; dam Cowslip 2nd, by Royal Buck 2374; 2nd dam Cowslip 797 by Senator 1058.

Wildame 2nd, No. 16648.—Date of birth, 8th November, 1886; colour, red; bred by James Graham, Port Perry, Ontario; sire, Prince Victor 5th; dam, Wildame, 8186, by Oakwood Duke, 3593; 2nd dam Blossom, 2521, by Royal Prince, 1041.

BEEF STRAINS

Maggie Bly 11th, No. 16917.—Date of birth, 28th January, 1887; colour, roan; bred by John Miller & Sons, Brougham, Ontario; sire, Vice Consul (Imp.), 4132; dam, Maggie Bly 5th, 7024, by Young Mayflower, 1197; 2nd dam, Maggie Bly, 7023, by Canadian Prince, 43.

Red Rosebud 2nd, No. 16918.—Date of birth, 14th November, 1887; colour, red and white; bred by John Miller & Sons, Brougham, Ontario; sire, Vice Consul (Imp.), 4132; dam, Rosebud (Imp.), 5205, by Gladstone, 43286; 2nd dam, Rosebud 6th, by Sir Christopher, 22895.

Ury 22nd, No. 16919.—Date of birth, 12th June, 1888; colour, red; bred by John Miller & Sons, Brougham, Ontario; sire, Vice Consul (Imp.), 4132; dam, Ury 20th by Royal Booth, 3817; 2nd dam, Victoria, by High Sheriff 2nd, 702.

HOLSTEIN FRIESIANS—BULLS.

Ruth Artis 2nd Netherland, No. 9451.—Date of birth, 29th July, 1888; colour two-thirds black, strip in face: bred by Smiths, Powell & Lamb, Syracuse, N.Y.; sire, Netherland Statesman, N.H.B. 3280, A.R. 38; dam, Ruth Artis 2nd, N.H.B., 10385, A.R. 487. by Netherland Prince, N.H.B. 716, A.R. 8. This cow has a three year old butter record of 13 lbs. 9½ ozs. in a week, and a milk record of 9,356 lbs. in 11 months and 1 day; 2nd dam Ruth Artis, N.H.B. 4517, A.R. 143; who has a two-year- old milk record of 11,016 lbs. in a year.

Netherland Pythias, No. 9,167.—Date of birth, 11th June, 1888; colour, white predominating, black spots and patches on head and body; bred by Smiths, Powell & Lamb, Syracuse, N.Y; sire, Netherland Prince, N.H.B. 716, A.R. 8; dam, Aaggie Cornelia 4th, N.H.B. 4443, A.R. 43, by Alexander N.H.B. 83. She has a three-year-old milk record of 13,818 lbs. in a year, and a butter record of 19 lbs. ½ oz. in a week; 2nd dam Aaggie Cornelia, N.H.B. 4410, A.R. 40, by Rooker. She gave in Holland 73 lbs. 3 oz. milk in one day, and first year after importation 14,562 lbs. in one year; butter record, 19 lbs. 1 oz. in a week.

"Onnetta's Edgely," No. 11308.—Date of birth, 8th October, 1888; colour, black, with white markings; bred by Smith Bros., Churchville, Ontario; sire, Duke of Edgely, H. F. 552; dam, Onetta, D.F. 1816.

HOLSTEIN FRIESIAN COWS AND HEIFERS.

Netherland Dorinda 2nd, H.F.H.B. 2604, A.R. 489.—Date of birth, 8th August, 1885; colour, two-thirds white, with black markings; bred by Smiths, Powell & Lamb, Syracuse, N.Y.; sire, Sir Henry 2nd of Aaggie N.H.B. 1451, A.R. 5; dam, Netherland Dorinda, H.H.B. 6894, A.R. 199, by Schreuder; milk record, 13,659 lbs. in a year; butter record, 24 lbs. 9 oz. in a week, 96 lbs. 2¼ oz. in thirty days—16$\frac{85}{100}$ lbs. of milk making 1 pound of butter; 2nd dam, Bontje, a very fine cow in Holland.

Netherland Dorinda 3rd, H.F.H.B. 4560.—Date of birth, 21st October, 1886; colour, mostly black, with small star; bred by Smiths, Powell & Lamb, Syracuse, N.Y.; sire, Netherland Prince, H.H.B. 716, A.R. 8; dam, Netherland Dorinda, H.H.B. 6894, A.R. 199; 2nd dam, Bontje. Netherland Dorinda 3rd gave as a two-year-old in 3 months and 17 days to the time of sale, 3,106 lbs. of milk, and made 11 lbs. 12½ oz. butter in a week.

Abi, H.F.H.B. 9831.—Date of birth, 5th July, 1887; colour, black, with white patches; bred by C. F. Sweezey, Marion, N.Y.; sire, Oatka 3rd Neptune, jr., H.H.B. 4531; dam, Snowie, H.F.H.B. 3114, by Empire Boy, H.H.B. 2615; 2nd dam, Rosalind, H.H.B. 577.

Aaggie Cornelia 2nd Netherland, H.F.H.B. 12217.—Date of birth, 4th July 1888; colour, two-thirds black, strip in face; bred by Smiths, Powell & Lamb, Syracuse, N.Y.; sire, Netherland Prince, H.H.B. 716, A.R. 8; dam, Aaggie Cornelia 2nd, H.H.B. 4341, A.R. 41. Milk record, 14,610 lbs. in a year; butter record, 19 lbs. 6 oz. in a week—21$\frac{79}{100}$ lbs. of milk making 1 lb of butter. She is by Alexander N.H.B. 83, 2nd dam, Aaggie Cornelia, H.H.B. 4410, A.R. 40. She gave in Holland 73 lbs. of milk in one day. In 1885 she gave 16,794 lbs. of milk in one year; butter record, 19 lbs. 1 oz. in a week. She is by Rooker, the sire of Aaggie H.H.B. 901.

Louverse 2nd Clothilde H.F.H.B. 13539.—Date of birth, 29th November, 1888; colour, three-fourths black, strip in face; bred by Smiths, Powell & Lamb, Syracuse, N.Y.; sire, Clothilde 4th Artis, H.F.H.B. 5488; dam, Louverse 2nd, H.F.H.B. 6710, A.R. 510. Butter record as a two-year-old, 11 lbs. 1½ oz. in a week; milk record, 6,381 lbs. in 8 months and 20 days, to 1st September; 2nd dam, Louverse, H.H.B. 6754. Two-year-old milk record, 477 lbs. in 10 days; three-year-old record, 402 lbs. in 7 days, which made 12 lbs. 4 oz. butter.

Bonnie Ethel's Mercedes, H.F.H.B. 11243.—Date of birth, 5th April, 1888; colour, black, with white markings; bred by Thos. E. Wales, jr., Iowa City, Iowa; sire, Mercedes Prince, H.H.B. 2150; dam, Bonnie Ethel, H.H.B. 9510.

Siepkje 3rd Queen.—Date of birth, 11th September, 1888; colour, black, with white markings; bred by W. A. Rowley, Mount Clemens, Mich.; sire, Macomb Boy, H.F.H.B. 8734; dam, Siepkje 3rd, H.F.H.B. 2387.

AYRSHIRE BULL.

MacDuff, No. 479.—Date of birth, 5th October, 1888; colour, red and white; bred by David Nicol, Cataraqui; sire, Norseman, 478; dam, Dora, 244, by Douglas 148; 2nd dam, Moss, 242, by Parker 144.

AYRSHIRE COWS AND HEIFERS.

Clara, No. 3590.—Date of birth, 6th February 1884; colour, red, with white on flank; bred by James Drummond, Petite Côte, Que.; sire, Promotion 3212, imported; dam, Maud 2356, by Sir Roger 2200; 2nd dam, Maggie 3rd, 1332, by Lord Douglas 2nd, 814.

Gipsy, No. 3979.—Date of birth, 15th August, 1886; colour, red, with white spots; bred by James Drummond, Petite Côte, Quebec; sire, Promotion, 3212, imported; dam Victoria, 2931, by Lorne, 2227; 2nd dam Effie 579, by Gordie, 26.

Countess No. 3838.—Date of birth, September 19, 1885; colour, white, spotted red, bred by James Drummond, Petite Côte, Quebec; sire Promotion, 3212, imported; dam Victoria, 2931, by Lorne, 2227; 2nd dam, Effie, 579, by Gordie, 26.

Eva No. 3828.—Date of birth, 15 September, 1884; colour, red, with white spots; bred by James Drummond, Petite Côte, Quebec; sire Promotion, 3213; imported; dam Bell, 3131, by Lorne, 2227; 2nd dam, Juno, 1,214, by Duke of Athole, 575, imported.

May, No. 3633.—Date of birth 25th July, 1883; colour, brown, with white spots; bred by James Drummond, Petite Côte, Quebec; sire Promotion, 3,212, imported; dam Ida, 1181; by Duke of Athole (Imp.) 575; 2nd dam Maggie, 32; by Garibaldi, 25.

Viola, No. 943.—Date of birth, 1st November, 1888; colour, white and red; bred by David Nicol, Cataraqui, Ontario; sire, Norseman, 478; dam, Dido, 942, by General, 155; 2nd dam, Dora, 244, by Douglas, 148.

JERSEY BULL.

Actor of Glen Duart, No. 18033.—Date of birth, 15th November, 1886; colour, solid fawn; from A. McLean Howard, Toronto, Ont.; sire, Actor of Hillhurst, 10454; dam, Rose of Hillhurst, 22806, by Browny; 2nd dam, Lady Mary, imported.

JERSEY COWS AND HEIFERS.

Oriondo's Girl, No. 40376.—Date of birth, 7th May, 1886; colour, mulberry fawn; from A. McLean Howard, Toronto, Ont.; sire, Oriondo, 10791; dam, Judy's Girl, 25189, by Judy's Prince, 5713; 2nd dam, April Girl 3rd, 16141.

Clenna Rex 2nd, No. 38999. Date of birth, 16th April, 1886; colour, dark grey fawn: from A. McLean Howard, Toronto, Ont.; sire, Pride's Orient, 15887; dam, Clenna Rex, 27741, by Queen's Rex, 4943; 2nd dam, Belinda 2nd, 9426.

Clenna Rex of Glen Duart. Date of birth, 11th April 1888; colour, dark grey fawn; bred by A. McLean Howard, Toronto Ont.; sire, Canada's John Morgan No. 16853; dam, Clenna Rex, 2nd 38999 ,by Pride's Orient 15857; 2nd dam Clenna Rex, 27444, by Queen's Rex, 4943.

POLLED ANGUS BULL.

King of Eastview, No. 8780.—Date of birth 3rd January, 1888; colour, black; bred by Late Hon. J. H. Pope, Cookshire, Quebec, sire, Piper of Eastview, 5612; dam, Queen of Eastview 3rd, 5587.

POLLED ANGUS HEIFERS.

Dolly Varden of Eastview, No. 6792.—Date of birth, 11th June, 1886; colour, black; bred by late Hon. J. H. Pope, Cookshire, Quebec; sire, Knight of Canada, 5622; dam, Dolly Varden 3rd, 3458.

Pride of Eastview, No. 6809.—Date of birth, 3rd October, 1886; colour, black, bred by late Hon. J. H. Pope, Cookshire, Quebec; sire, Knight of Canada, 5622: dam, Pride of Montbletton 3rd, 3473.

Stella of Eastview, No. 7638.—date of birth, 14th June, 1887; colour, black; bred by late Hon. J. H. Pope, Cookshire, Quebec; sire, Knight of Canada, 5622; dam, Stella of Ardconnon, 4929.

Gratitude of Eastview 4th, No. 7635.—Date of birth, 25th May, 1887; colour, black; bred by late Hon. J. H. Pope, Cookshire, Quebec; sire, Knight of Canada, 5622; dam, Gratitude, 1824.

Daisy of Eaton 4th, No. 8783.—Date of birth, 8th January, 1888; colour, black; bred by late Hon. J. H. Pope, Cookshire, Quebec; sire, Arminius, 6797; dam, Daisy of Skene, 2258.

The following are the births since the above animals were purchased:—

SHORTHORNS.

Bull calf from Elmwood Garland 3rd, by Rosy Prince 8th.—Date of birth, 30th July, 1889.

Heifer calf from Miss Elgins 5th, by Mazurka Duke 5th.—Date of birth, 31st December, 1889.

AYRSHIRES.

Bull calf from Clara, by Rob Roy 3971. Date of birth, 3rd August, 1889.

Bull calf from May, by Rob Roy 3971. Date of birth, 13th August, 1889.

Bull calf from Countess, by Rob Roy 3971. Date of birth, 23rd December, 1889.

Heifer calf, from Eva, by Rob Roy 3971. Date of birth, 2nd October, 1889.

JERSEYS.

Bull calf from Clenna Rex 2nd, by Canada's John Morgan.—Date of birth. 15th November, 1889.

Heifer calf, from Oriondo's Girl, by Canada's John Morgan, date of birth, 14th June, 1889.

EXPERIMENTS WITH WHEAT.

One hundred and seven varieties of wheat have been tested during the past year, eight of fall or winter wheat and ninety-nine of spring wheat—many of them in small quantities, others in larger plots. The details connected with the special tests made in small plots are too voluminous to permit of their being published in this summary report; hence, the results only of the field tests will be given here, reserving the fuller details for a bulletin.

The following table gives the dates of sowing and harvesting, yield per acre and weight per bushel of each variety.

——	Date of Sowing.		Date of Harvesting.		Yield per Acre.	Weight per Bushel.
Spring Wheat.					Bush.	Lbs.
American, Milwaukee	May	9..	August	20..	10	56⅓
American Hard, Duluth	do	3..	do	12..	19⅓	56¾
Blue Stem from Minnesota	do	13..	do	20..	8	55
Banater's Spring	do	13..	do	24..	6	55
Brown's New Wheat	do	17..	do	22..	8	54¼
Chilian White	do	9..	do	15..	3	51
Californian White	do	3..	do	11..	7 1/10	50
Defiance	do	3..	do	16..	9¼	57½
Early Essex	do	17..	do	24..	7⅓	54½
Eureka (same as Red Fern)	do	4..	do	13..	21¾	56
Fife Red	April	19..	do	10..	17	59⅓
Green Mountain	May	4..	do	14..	17¼	55¾
Hungarian Mountain	do	3..	do	15..	17½	56
Indian Karachi	do	9..	do	11..	4	53¼
Indian Club Calcutta	do	9..	do	9..	3½	57¼
Indian Hard do	do	9..	do	11..	5	58
Indian Red do	do	3..	do	5..	10⅓	57½
Ladoga	April	19..	do	3..	18	58
Mars	May	3..	do	8..	15	58
Medea	do	3..	do	18..	10	56
Magyar	do	9..	do	18..	3	50
New Zealand Long Berry	do	3..	do	19..	4½	55
Onega	do	3..	do	2..	12	52½
Red Fern	do	3..	do	18..	19	60
Russian Hard Tag	do	4..	do	12..	18	57½
Rio Grande	do	4..	do	20..	17	61¼
Saxonka	do	3..	do	8..	8	56¼
White Delhi	do	4..	do	6..	13½	57
White Russian	April	20..	do	9..	33	60
Campbells No. 1, Triumph	May	4..	do	12..	13¾	56¼
Campbells No. 2, White Chaff	do	4..	do	12..	36¾	56
Scotch from Nova Scotia	do	3..	do	17..	14¾	55½
Winter Wheat.						
These plots were injured by winter, patches here and there being entirely killed out. Had the ground been uniformly covered they would have yielded nearly, if not quite, 25 bushels to the acre.						
Democrat	Sept.	11..	July	31..	19	59½
Tasmania	do	6..	do	25..	17⅓	58
Manchester	do	11..	do	25..	17¼	58½

The spring wheats referred to as Campbell's No. 1 Triumph and No. 2 were kindly sent for test by David Campbell, Nottawa P. O., Ontario. The Triumph is a short, full, plump berry, rather soft and starchy. Mr. Campbell says: "This was extensively grown in our section last year, turned out much better than the old varieties, some samples weighing 65 lbs. to the bushel. Its only fault is that it shells from filling so well." No. 2: "A white chaff variety, with a large head, well filled to the top. These wheats both originated on my farm from one variety of seed."

As will be seen from the table, the Triumph did not do very well with us, but No. 2 yielded the largest crop of any variety we have tested this year. It must not be forgotten that the rust, which affected almost all varieties of grain at the Central Farm last season, materially lessened both the quantity and the quality of the crops, and that these field experiments were carried on under ordinary farming conditions.

EXPERIMENTS WITH BARLEY.

The field experiments with barley have been carried on mainly with two-rowed varieties, such as are in favour in Great Britain for malting purposes. Along with these, a few sorts of the six-rowed have been tried:—

——	Date of Sowing		Date of Harvesting.		Yield per Acre.	Weight per Bushel.
Two-rowed Barley.					Bush.	Lbs.
Selected Chevalier, O. & M.	May	6	Aug.	5	31⅕	51
Beardless	April	23	do	4	50⅙	51¾
California	May	10	do	17	21¼	49¼
Danish Chevalier	do	4	do	5	31⅛	50½
Danish Printice Chevalier	do	4	do	5	36¼	50
Early Minting	do	6	do	5	25¾	50¾
English Malting	April	25	do	7	34¼	50⅕
Golden Melon Improved	May	6	do	18	26	48¾
Carter's Prize Prolific	do	3	do	18	31½	50¼
New Zealand	do	10	do	17	26½	51
Saale	do	17	do	22	22	51
Peerless White	April	23	do	1	36½	51
Large Two-rowed Hulless	May	9	do	12	26	55½
Six-rowed Barley.						
Mensury	May	10	Aug.	10	22	46¼
Polar	do	10	do	3	34½	42
Petschora	do	10	do	5	30	43⅕
Russian	do	10	do	10	25¼	48¼

These field crops were grown without special fertilizers. The Beardless, Peerless White and English Malting barleys were sown on clay loam which was in hay in 1888, was ploughed soon after the crop was taken off, and well stirred by the cultivator in the spring, but received no manure. The Selected Chevalier and Early Minting were sown on a sandy loam similarly treated, also without manure. The Danish Chevalier and Danish Printice Chevalier were sown on mixed clay and sandy loam, after a crop of spring wheat, ploughed immediately after harvest, cultivated later in the season, which received a coating of barnyard manure, about 18 tons to the acre, in the spring, the land being lightly ploughed before sowing. The field in which Carter's Prize Prolific and Golden Melon barleys were grown, also had a crop of spring wheat in 1888, was ploughed soon after harvest, and lightly ploughed again in the spring of 1889 before sowing, these also had no manure.

RELATIVE TEST OF TWO-ROWED AND SIX-ROWED BARLEY FOR MALTING PURPOSES.

During the year an important test was made to ascertain the intrinsic value of two-rowed barley of good quality, such as is in demand for malting purposes in Great

Britain, as compared with a good sample of six-rowed barley of Canadian growth, the experiment being undertaken for the purpose of ascertaining how far the peference for two-rowed barley was founded on its actual worth. Five hundred bushels of best malting barley was imported from Scotland and malted; a like quantity of best Canadian barley was similarly treated, and the product in each case brewed. The test was made by a careful and competent maltster and brewer, and the result shows that the preference is well founded, and that the two-rowed barley yielded about 13 per cent. more of extract than the six-rowed. The following report was received:—

"CARLING BREWING AND MALTING COMPANY,
"LONDON, Ont., 14th September, 1888.

"WM. SAUNDERS, Esq.,
"Director Experimental Farms,
"Ottawa.

"DEAR SIR,—In compliance with your request. we beg to enclose statement of results obtained from the two-rowed chevalier barley received from Scotland, and malted by us in April last.

"The extract obtained from it exceeds that of the best Canadian barley grown in this district by 13 per cent., or, in other words. 320 bushels of malt of 36 pounds to the bushel (11,520 pounds) produced 584 imperial gallons more of ale (say gravity 22) than was made from the same quantity of the best Canadian six-rowed barley

One fault with some of the barley grown here, is the want of allowing it to get fully ripened before harvesting, consequently some of the grain is green when grown on the floor which is detrimental to the keeping quality of beer.

"Yours respectfully,

THOS. M. HEATHORN,

"Brewer and Maltster for the Carling Brewing and Malting Co."

EXPERIMENTS WITH OATS.

Thirty-six varieties of oats have been grown as field crops, and fifty other sorts tested in smaller plots. In field culture the following results have been obtained :—

—	Date of Sowing.		Date of Harvesting.		Yield per Acre.	Weight per Bushel.
					Bush.	Lbs.
Black Tartarian	May	8	August	20	51½	29
Black Champion	do	7	do	22	39¾	28¾
Carter's Prize Cluster	April	24	do	4	50	34¼
Canadian Triumph	May	6	do	14	19	39
Cream Egyptian	do	6	do	20	49	35½
Clydesdale	do	6	do	26	18½	31
Canadian White	do	10	do	26	15	37½
Egyptian White	do	6	do	18	55	37½
Early Calder	do	10	do	20	26¼	30½
Early Racehorse	do	8	do	10	22	37
Early Blossom	do	8	do	18	30¼	31
Glen Rothern	do	6	do	25	29	25¼
Flying Scotchman	do	7	do	10	21	34
Georgia Early White	do	10	do	20	27	35½
Giant Yellow French	do	13	do	20	40	25½
Hungarian White	do	10	do	26	39½	32¼
Lincolnshire Poland White	do	6	do	12	13	40
Longfellow	do	10	do	14	....	34½
Onega Black	do	13	do	18	48	26¾
Potato, Scotch	do	3	do	16	39	31
do English	do	6	do	12	38½	27
Pringle's Progress	do	9	do	18	29¼	27½
Rennie's Prize White	do	6	do	14	23	35½
Red Oats	do	7	do	20	36	30½
Siberian	do	9	do	24	44	35½
Small Black Naked	do	9	do	20	23	29½
Tartarian White	do	10	do	20	33½	28½
Scotch Hopetown	do	13	do	12	44	26
Victoria Prize White	do	10	do	20	29½	34½
Waterloo	do	6	do	18	43	30
Winter Grey	do	9	do	20	52	28½
White Bonanza	do	6	do	12	22	38
White Wonder	do	13	do	18	39½	33
Welcome	April	22	July	31	28¾	35¼
White Russian	May	6	August	12	39¾	36
Early English	do	17	do	20	18	30

INDIAN CORN.

Much attention has been given to the testing of different varieties of fodder corn now used so extensively for the winter feeding of stock, both cured and in the form of ensilage. Seventy varieties have been tested, and their relative earliness and productiveness, as grown side by side, ascertained; the product has been converted into ensilage. Tests have also been carried on with this important crop at the Experimental Farms in Nova Scotia, Manitoba and the North-West Territories. Some of the particulars will be found in the appended reports from these farms, but fuller details of these experiments will shortly be compiled and given to the farming community in convenient form for comparison and reference in a special bulletin.

ROOTS.

Turnips.

Carter's Elephant Swede.—This fine turnip, first offered by James Carter & Co., of London, England, in the spring of 1888, has yielded a heavier crop than any other variety tested, exceeding the best of the other sorts by nearly 3 tons per acre. The root is regular in form, projects well above the surface, is of a deep purplish colour outside, with creamy yellow flesh. Grown on sandy loam; sown 29th June; was up 4th July, and harvested 26th October; yield per acre, 16 tons 266 lbs.

Steele Bro.'s New Giant Swede.—On sandy loam ; sown 29th June; up 3rd July; harvested 26th October; yield per acre, 13 tons 759 lbs.

The above two plots had no barnyard manure, but a dressing of about 400 lbs. to the acre of a mixture of superphosphate of lime and nitrate of soda.

Steele Bro.'s Purple Top Swede.—Grown on sandy land, to which had been applied barnyard manure in the proportion of about 18 tons to the acre; sown 6th June; up 11th June; harvested 23rd October; yield per acre, 12 tons 1,096 lbs.

A second lot of Steele Bro.'s Purple Top Swede was sown on new land of a peaty character, without manure or other fertilizer. This was sown 14th June; up 18th June, and harvested 25th October; yield, 12½ tons to the acre.

Rennie's Purple Top Swede.—Was grown on similar soil, also without manure; sown 14th June; up 18th June; harvested 24th October; yield per acre, 13 tons 440 lbs.

Skirving's Swede.—Sown on mixed sandy and clay loam, which was dressed with a fertilizing mixture similar in quantity and composition to that used for Carter's Elephant Swede; sown 27th June; up 3rd July; harvested 28th October; yield per acre, 12 tons.

Mangels.

Carter's Golden Intermediate—Sown 16th May; up 22nd May; harvested 13th October; yield per acre, 10 tons 85 lbs.

Carter's Yellow-fleshed New Tankard.—Sown 16th May; up 22nd May; harvested 13th October; yield per acre, 8½ tons.

Pearce's Mammoth Long Red.—Sown 25th May; up 2nd June; harvested 13th October; yield per acre, 14 tons 200 lbs. These were sown on sandy loam, which had received a top dressing of about 18 tons of barnyard manure to the acre.

Carrots.

Steele Bro.'s Improved Short White.—This carrot has succeeded much better on the Central Farm than any other sort exceeding in crop the best of the others tested by 4½ tons per acre. It has proven very regular in form, of good size, and is easily lifted. The seed was sown 15th May; came up 22nd May, and was harvested 18th October. The yield was 20½ tons per acre.

Carter's Orange Giant.—Sown 15th May; up 25th May; harvested 18th Octotober; yield per acre, 16¼ tons.

Carter's Scarlet Perfection.—Sown 15th May; up 24th May; harvested 18th October; yield, 10 tons, 536 lbs. per acre.

Carter's White Belgian Improved.—Sown 15th May; up 25th May; harvested 19th October; yield per acre, 15 tons 1,160 lbs.

Carter's Giant Wiltshire White.—Sown 15th May; up 25th May; harvested 19th October; yield per acre, 12 tons, 1,262 lbs. These were all sown on sandy loam, which had received a dressing of about 18 tons of barn yard manure to the acre.

Sugar Beets.

White Sugar Beet.—Sown 30th May; up 9th June; harvested 14th October: yield per acre, 9 tons 600 lbs.

Vilmorin's Improved.—Sown 30th May; up 9th June; harvested 14th October; yield per acre, 9 tons 240 lbs.

Lane's Sugar Beet.—Sown 20th May; up 7th June; harvested 14th October; yield per acre, 11 tons 660 lbs.

Sugar Beet from Central Germany (seed importe l by W. Skaife, Esq., Berthierville, Quebec).—Sown 25th May; up 3rd June; harvested 14th October; yield per acre, 10½ tons.

Bohemian Sugar Beet (seed imported by W. Skaife, Esq., Berthierville, Quebec).—Sown 25th May; up 3rd June; harvested 14th October; yield per acre, 8 tons 856 lbs.

The percentage of sugar contained in these several varieties has been determined by analyses made by the Chemist of the Experimental Farms, full particulars of which will be found in his report.

EXPERIMENTS WITH PEAS.

Golden Vine peas were sown in the proportion of 1 bushel to the acre on 25th April; were up 4th May; harvested 6th August. Total yield of straw and grain, when dry enough to stack, 1,275 lbs. from two-ninths of an acre. When threshed the weight of peas was 480 lbs.; straw 795 lbs.; yield per acre, 36¼ bushels.

Golden Vine peas sown on the same day at the rate of 2 bushels per acre was also harvested 6th August. Total yield of straw and grain, 1,402 lbs. from two-ninths of an acre. When threshed peas weighed 497 lbs., straw 905 lbs.; yield per acre, 37½ bushels.

Golden Vine peas sown on same day, 3 bushels to the acre, harvested also 6th August, gave a total yield of straw and grain, 1,621 lbs. from two-ninths of an acre. When threshed peas weighed 539 lbs., straw 1,082 lbs.; yield per acre, 40¾ bushels.

Golden Vine peas in ordinary field crop, 2½ bushels to the acre, was sown 20th April; harvested 6th August; yield, 30½ bushels to the acre; weight, 63 lbs. per bushel.

Multiplier peas, in field crop, 2½ bushels to the acre; sown 26th April, and harvested 20th August; gave a yield of 50½ bushels to the acre; weight 63½ lbs. per bushel.

Black Eyed Marrowfat Peas.—3 bushels to the acre.—Sown 20th April; harvested 11th August; (the pods were fit for table use 9th July). Weight of peas per bushel, 60¼ lbs.

GRASSES AND CLOVERS FOR PERMANENT PASTURE.

Two plots of about two acres each were sown with the following mixtures of grasses and clovers without any grain or other protecting crop.

Plot No. 1.—6 lbs. Cocksfoot or Orchard Grass, 2lbs. Timothy 4 lbs. Meadow Fescue, 2 lbs. Perennial Rye Grass, 2 lbs. Crested Dogstail, ½ lb. Sweet Vernal, 2½ lbs. Italian Rye Grass, 2 lbs. Kentucky Blue Grass, 2 lbs. Red Top (*Agrostis Vulgaris*), 1 lb. White Clover, 5 lbs. Red Clover, 1 Alsike clover,—total, 30 lbs.

Plot No. 2.—4 lbs. Cocksfoot or Orchard Grass, 3 lbs. Timothy, 2 lbs. Meadow Fescue, 3 lbs. Perennial Rye Grass, 2 lbs. Crested Dogstail, ½ lb. Sweet Vernal, 4 lbs. Meadow Foxtail, 2 lbs. Rough Meadow Grass, 1½ lb. Hard Fescue, 1 lb. Tall Fescue, 1 lb. White Clover, 4 lbs. Red Clover, 2 lbs. Alsike clover—total, 30 lbs.

No. 1 was sown on the 29th of May, on peaty land, and by the 3rd of September, had made a closely matted growth from 2 to 2½ feet high, when it was cut and dried, and weighed 7,430 lbs., which was equal to a little more than 1½ tons tothe acre.

No. 2 was sown on the 29th of May, on soil partly peaty and partly sandy loam; by the 31st of August it had reached a height of about 2 feet, and had become thickly matted. It was cut on that date, and when dried weighed 6,590 lbs., equal to nearly 1½ tons per acre.

MIXED CROP.

A mixture of grain, consisting of 1 bushel each of oats, peas and barley per acre was sown for the purpose of furnishing green food for cattle. It was sown on the 27th May, and was fit to cut on the 10th July. The first was cut on this date, and the cutting lasted twelve days. The yield was $10\frac{1}{7}$ tons per acre. After this crop was taken off the land was ploughed, and an early maturing variety of white turnip sown, which produced a crop of $7\frac{2}{3}$ tons per acre.

SPRING RYE.

This was sown 7th May, was up 12th May; on the 21st of June it was headed out, and from 3 to $3\frac{1}{2}$ feet high, when a part of the field was cut to furnish green food for cattle. From this there was a second growth, which was cut on the 12th August, when it was from 2 to $2\frac{1}{2}$ feet high. Through an omission, these crops were not weighed. The remaining part of the field was allowed to ripen, and yielded $21\frac{2}{3}$ bushels per acre.

FODDER PLANTS.

Eleven varieties of fodder plants were sown in plots of one-tenth of an acre each, with a view of testing from year to year the yield of green or cured fodder they will give. One cutting was made late in the autumn from several of them, but the result was not weighed.

Trefoil.—Sown 25th May; came up 2nd June. When examined for comparison on the 15th October it was from 3 to 4 inches high.

White Clover.—Sown 25th May; came up 2nd June. Was from 4 to 5 inches high 15th October.

Extra Choice Red Clover.—Sown 25th of May; up 2nd June. By 15th October it had reached a height of from 1 to 2 feet, when it was cut.

Lucerne.—Sown 25th May; came up 2nd June. First crop was cut 15th October, when it was from 1 foot to 18 inches high.

Alsike.—Sown 27th May; came up 2nd June. First crop was cut 15th October, when it was from 1 to 2 feet high.

Scarlet Clover.—Sown 27th May; came up 3rd June. By 15th October, it had reached a height of from 1 to 2 feet when it was cut.

Bokhara Clover.—This was sown 27th May; came up 3rd June. First crop was cut on the 15th of October, when it had reached a height of from 3 to $3\frac{1}{2}$ feet.

Serradella.—Sown 28th May; was up 3rd June; and the first crop was cut 15th October, when it had reached a height of from 1 to 2 feet.

Mammoth Red Clover.—Sown 28th May; up 2nd June. By 15th October it had reached a height of from 1 to $1\frac{1}{2}$ feet, when the first crop was cut.

Broad-leaved Red Clover.—Sown 28th May; came up 2nd June; and the first crop was cut 15th October, when it was from 1 to 2 feet high.

Sainfoin.—This was sown 28th May; came up 5th June, and by the 15th October had reached an average of about 1 foot in height, when it was cut.

POTATOES.

During the season of 1889 a large number of tests were made with the leading varieties of potatoes, both American and European. Many of those grown in 1888 were discarded, either on account of their being poor yielders or for the reason that they have been unsatisfactory as to quality. In this way the 251 varieties in cultivation in 1888 were reduced to 116, to which were added 31 new sorts and a large number of seedlings, which have been raised on the Central Experimental Farm, so that the number of varieties of which records have been kept during the past year is in all 384. Among the newer potatoes the following deserve mention on account of their productiveness, Halton's Seedling, Dakota Red, Stray Beauty, Rosy Morn, Rural Blush, Lee's Favorite, Burpee's Superior, Early Albino and Carter's King of Russetts.

Among the seedlings there are quite a number of very promising sorts, both as to productiveness and quality; but the experience of another season will be needed before any comparative statement as to their relative merits can be given. The exhibits made of the new seedlings at several of the leading exhibitions last autumn attracted much attention, and numerous applications have been received for samples for test in different parts of the Dominion; but as these seedlings are only two years from seed, the quantity available is not in any instance sufficient yet to admit of any distribution outside of the Experimental Farms. The details relating to these tests will be reserved for a special bulletin, which will be prepared as soon as sufficient facts have been accumulated to make it useful.

SEED GRAIN, &c., FROM INDIA.

In the report for 1888 some particulars were given regarding a variety of cereals and other products which had been received from the Government of India for test on the Experimental Farms in Canada. Most of these products had been grown at considerable altitudes in the Himalayan Mountains, varying from 420 to 11,000 feet. At some of the higher altitudes the climate much resembles that of some portions of the Canadian Dominion, and the results of tests with important agricultural products from similar climates in a country so distant, and which have been so long under cultivation there, are of very great interest. Reference has already been made in Bulletin 6 to some of the results of tests of barley from India, and as the past season has been an unfavourable one, and some of the seeds were not received in time for early seeding—considering, also, that all of them are new to this climate—it has been thought best to have the experience of another year with them before submitting a full report.

FOREST TREES

Many additions have been made during the year to the experimental plots of forest trees. The planting has been continued on the belt across the rear end of the farm, which contains now the following clumps. Beginning on the north side of the central avenue on the farm, known as Elm avenue, they will be found in the following order:—

179 Scotch Pine—*Pinus sylvestris.*
21 Red Oak—*Quercus rubra.*
630 Black Walnut—*Juglans nigra.*
247 Scotch Pine—*Pinus sylvestris.*
288 Butternut—*Juglans cinerea.*
275 European Larch—*Larix Europea.*
38 White Elm from Manitoba—*Ulmus Americana.*
87 Hickory—*Carya alba.*
90 European Alder—*Alnus glutinosa.*
240 Sugar Maple—*Acer saccharinum.*
150 Soft Maple—*Acer dasycarpum.*
90 White Birch (European)—*Betula alba.*
120 Canoe Birch—*Betula papyracea.*
180 White Spruce—*Abies alba.*
150 Yellow Birch—*Betula lutea.*
120 White Oak—*Quercus alba.*
120 Red Elm—*Ulmus fulva.*
150 Rock Elm—*Ulmus racemosa.*
196 White Elm—*Ulmus Americana.*
198 Arbor Vitae—*Thuja occidentalis.*
115 Black Ash—*Fraxinus sambucifolia.*
120 Green Ash—*Fraxinus viridis.*
120 Red Ash—*Fraxinus pubescens.*
266 White Ash—*Fraxinus Americana.*
214 Austrian Pine—*Pinus Austriaca.*
30 Tea's Catalpa—*Catalpa hybrida.*
30 Japan Catalpa—*Catalpa kaempferi.*
158 Hardy Catalpa—*Catalpa speciosa.*

195 Black Walnut—*Juglans nigra.*
300 Norway Spruce—*Abies excelsa.*
83 Russian Mulberry—*Morus hybrida.*
206 Locust—*Robinia pseudacacia.*
219 Wild Black Cherry—*Prunus serotina.*
298 White Pine—*Pinus strobus.*
261 Box Elder—*Negundo aceroides.*

On the south side of Elm avenue the following have been planted:—

170 Red Maple—*Acer rubrum.*
110 Norway Maple—*Acer platanoides.*
100 European Mountain Ash—*Pyrus acuparia.*
50 European Ash—*Fraxinus excelsior.*
30 Hemlock Spruce—*Abies Canadensis.*
50 American Mountain Ash—*Pyrus Americana.*
120 American Sycamore—*Platanus occidentalis.*
150 American Beech—*Fagus ferruginea.*
240 Butternut—*Juglans cinerea.*
30 Riga Pine—*Pinus sylvestris rigensis.*
90 Horse Chestnut—*Æsculus hippocastaneum.*
210 White Ash—*Fraxinus Americana.*
189 Rock Elm—*Ulmus racemosa.*

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Many of these plots are irregular in form, and have been so arranged as to overlap each other, and thus relieve the stiff appearance which a number of square blocks of trees would present. The width of this tree belt is about 150 feet, ten rows of trees at the west end being planted 5 feet apart each way, and at the east end ten rows at a distance of ten feet apart. This has been done to ascertain the relative advantages of planting at different distances. The age of the trees from seed is recorded, the annual growth will be ascertained and other particulars regarding the progress of the different varieties noted, and thus there will be accumulated in a very few years much reliable information, which will be useful to future tree planters.

There has also been planted in mixed clumps, where ten or twelve different sorts of trees are irregularly distributed throughout, about 560 trees. These have been placed along the north boundary of the farm, where they will serve as an excellent wind-break and also afford material for comparing the growth and developement of those in mixed clumps, with trees planted in groups of one sort only.

In addition to the twenty-five bundles of forest trees already referred to as forwarded to the experimental gardens of the Canadian Pacific Railway on the western plains, more than 20,000 were sent from the Central Earm to the other Experimental Farms, besides a considerable number of mail packages of young trees and plants which have been forwarded to farmers, especially in newly settled districts in distant parts of the Dominion, where it has been thought desirable that certain sorts of trees should be introduced for test.

AVENUES AND HEDGES.

The trees on Elm avenue have grown very well, without a single failure, and on the avenue on the road approaching the entrance gate one tree only needs replacing. The other trees have not done so well. Of the sugar maples and soft maples about 15 per cent. have failed to grow, and of the lindens a still larger proportion. The hedges have done remarkably well; scarcely a tree has failed. The spruce hedge on the south boundary has been extended from the public road to the canal, 410 trees having been required for this purpose. Arbor vitae hedges have also been planted around the large poultry runs in front of the poultry building, for which 412 trees have been used, and some smaller pieces of the same have been planted near some of the other buildings.

Sample hedges in sections of 50 feet in length have also been put out of the following:—

Caragana or Siberian Pea—*Caragana arborescens.*
White Elm—*Ulmus Americana.*
Russian Mulberry—*Morus hybrida.*
Norway Spruce—*Abies excelsa.*
Honey Locust—*Gleditschia triacanthos.*
White Spruce—*Abies alba.*
Common Barberry—*Berberis vulgaris.*
Hemlock Spruce—*Abies Canadensis.*
Purple Barberry—*Berberis vulgaris var. purpurea.*
Prickly Ash—*Zanthoxylum Americanum.*

In addition to the above, it is proposed to test the value of a number of other shrubs and trees for this purpose. These hedges will serve as specimens, and be very useful for comparison.

DRAINING.

During the past year this useful work has been continued, and six and a-quarter miles of tile drains have been laid, the drains varying in depth from $2\frac{1}{2}$ to 5 feet or more. More than two-thirds of this has been laid with 3-inch tiles; the remainder 4 and 6-inch. This, added to the draining previously done, makes a total of $15\frac{3}{4}$ miles and 235 yards of tile drains and 489 yards, of box and open drains, or 16 miles 284 yards in all. A sufficient fall has been secured in all the drains to allow the surplus water which falls from time to time to find its way promptly off through the five eight-inch drains which form the main outlets. As results of this work, the land will all admit of early planting, and can all be usefully employed; whereas, at the outset much of it was too wet and cold to permit of successful cropping in rainy seasons.

GRADING AND ROAD-MAKING.

Much necessary grading has been done around the office building, seed-testing and propagating houses, poultry house and implement shed, which has greatly improved the appearance of the grounds about these buildings.

The making of roads around and through the farm was continued during the summer, more than four miles having been finished. The roads now completed on the farm afford a drive within the grounds of nearly five miles, and are so arranged as to enable visitors to see from them most of the more interesting features connected with the experimental field work.

BUILDINGS.

The new office building and laboratory mentioned in the report for 1888 as then approaching completion has been finished. The chemical laboratory, as will be seen from the report of the Chemist, is large, commodious and well fitted with such apparatus and appliances as are needed for carrying on the work efficiently. The four offices in the central part form convenient quarters for the other officers, and the museum room, which covers the second flat, is ready to receive the requisite fittings for storing and preserving samples of farm products.

The houses for carrying on the distribution of seeds and for seed testing and propagating are also completed. These have been conveniently arranged and afford ample facilities for seed distribution, for testing the vitality of seed grain, and for propagating trees and plants. Collections of economic plants, the sources of important articles of food and other products useful to man, are being made, to which will be added from time to time other interesting and curious plants, with the view of making this department both attractive and instructive to visitors.

A silo has been built, attached to the west end of the barn, in which was stored in good season about 200 tons of fodder corn, which is now being used as ensilage. A commodious implement house and granary has also been erected, where grain for distribution and farm use can be conveniently stored, and with sufficient space on the ground floor for storing all the farm implements. A work-room has been provided in this part, supplied with a blacksmith's forge and other tools, where needed repairs can be conveniently made. Two lodges have also been erected, one at each of the main gates, for the better protection of the entrances, and also to afford accommodation for those workmen whose duties requre their residence on the farm.

A dairy building for experimental work in dairying is urgently needed, and additional accommodation in the poultry department; also, a small engine house near one end of the barn for the steam engine, and necessary shafting through the barn to run the machinery required in connection with threshing, the crushing and cutting of food for stock, &c. A building will also be required for sheep, and another for pigs, as with both these classes of animals there is much experimental work of a useful character which should be undertaken.

EXCHANGES AND DONATIONS.

Exchanges of publications are now effected with the Experiment Stations in the United States, with some of those in Europe, and with the agricultural college at Tokio, Japan. During the year several packages of interesting seeds have been received from the Royal Gardens at Kew. From the Horticultural Division of the United States Department of Agriculture at Washington a number of very useful economic plants have been obtained, through the liberality of the Secretary of Agriculture, the Honorable J. M. Rusk. Further thanks are due to Mr. Chas. Gibb, of Abbottsford, who, in the course of his recent travels through Japan and China, has sent us many seeds and scions of promising vines and fruit trees from both these countries, among which are some which are likely to be both useful and interesting; also to the Fruit Growers Association of Ontario, through their secretary, Mr. L. Woolverton, of Grimsby, from whom we have received young plants of a very promising Russian cherry, known as the "Koslov Bush Morello." This is a new seedling cherry, of which some account is given in the *Canadian Horticulturist* for 1889, page 217. It is very hardy, and is held in high esteem in the colder parts of Russia, and promises to be a valuable acquisition especially for the colder districts of this country.

EXHIBITS OF PRODUCE OF EXPERIMENTAL FARMS.

Large collections of products grown at the Central Experimental Farm were shown at the exhibitions held in Toronto, Ottawa and Belleville, where they attracted much notice. Among the prominent features in these exhibits was a collection of seventy different varieties of Indian corn, grown under the same conditions, showing the different heights of the plants and stages of maturity reached at Ottawa; also, a large collection of seedling potatoes. A display was made of the products of the Experimental Farm of Nappan, Nova Scotia, at the exhibition for the Maritime Provinces held in Moncton, New Brunswick, also at the exhibition held in Amherst, Nova Scotia. Those of the Manitoba Farm of Brandon were shown at the exhibitions held at Virden, Oak Lake, Brandon, Rapid City and Minnedosa, while those of the Experimental Farm for the North-West Territories were displayed at the exhibitions held in Regina, Qu'Appelle, Indian Head and Moosomin. All these exhibits were arranged so as to make them instructive, and they were everywhere much appreciated by visiting farmers.

FRENCH INSTRUCTOR IN QUEBEC.

During the greater part of the year Mr. J. A. Chicoyne, of Sherbrooke, Quebec, has been employed as a special agent to visit different portions of the Province of

Quebec; hold meetings among the farmers, and to deliver lectures to them in the French language on agricultural subjects. This has been done with the view of instructing them in regard to farm work and of encouraging them in the improvement of their farms. From the reports which have been received it would appear that the services rendered have been appreciated by the people.

METEOROLOGICAL OBSERVATIONS.

During the year meteorological stations have been established at each of the Experimental Farms, where careful records are now being taken of temperature, rainfall, &c. The instruments have been supplied by the Meteorological Service of Canada, and the observations are being taken in accordance with instructions received from the Director of that Service, to whom regular returns are made. It is expected that some extension of the work will be made during the coming season in recording the hours of sunshine, and at some points in taking observations with pressure instruments. The question of weather is all-important in its bearing on agricultural operations, and accurate observations are much needed in association with experimental work.

ACKNOWLEDGMENTS.

My sincere thanks are due to the officers of the Central and other Experimental Farms for the zeal manifested in their different departments, and for the efficient discharge of their several duties. The reports herewith submitted bear evidence of the care and attention which has been given to the work undertaken. The foremen and employés are also deserving of eulogy for their faithfulness and prompt attention to the work with which they have been entrusted. Valuable help has been given me in the agricultural department at the Central Farm, by the farm foreman, Mr. John Fixter, whose zeal in the service is deserving of all praise, who has kept accurate accounts of all the work done under his management, and to whose careful observations and records I am indebted for many of the particulars presented in this report. I also desire to acknowledge my obligations to Mr. Wm. T. Macoun, who has had special charge of much of the experimental work during the past year, and who has been unremitting in his attentions, and has proved himself thoroughly reliable in his records and observations.

I desire also to bear testimony to the efficient services rendered by Mr. Wm. Ellis, who has had charge of the seed testing department, where the vitality and germinating power of grain and other agricultural seeds are determined.

W. SAUNDERS,

Director.

REPORT OF THE CHEMIST.

(Frank T. Shutt, M.A., F.I.C., F.C.S.)

To Wm. Saunders, F.R.S.C., F.L.S., F.C.S.,
Director, Experimental Farms.

Sir,—I have the honour to submit to you herewith the third annual report of the work done in the Chemical Department of the Experimental Farms.

A great part of my time during the early months of the year, was occupied in the personal supervision of the manufacture of the interior fittings, (work-tables, fume cupboards, &c.,) and of the gas and water arrangements for the new Laboratories, the designs for which I drew last year. Though this work was pushed on as rapidly as work of such a nature could be, it was June before the Laboratories were ready for occupation. The room we were using as a temporary laboratory in Ottawa was then vacated and the chemical work transferred to the more commodious accommodation afforded at the Farm. The apparatus previously ordered from Germany having arrived in good order, we have since been able to prosecute the analytical work to a greater advantage than heretofore with our limited space and apparatus.

After having occupied our new Laboratories for six months, I am pleased to be able to report that for convenience of arrangement, light, and all those other accessories necessary to good and quick work, they leave nothing to be desired. Since their completion, many chemists of note who have visited us, have commented highly upon them and their fittings, and already the plans have been copied more than once by those fitting up laboratories. As there have been many inquiries from chemists in the United States and other countries regarding them, I have thought it well to write an outline account of the details of the Laboratories in the accompanying report, trusting at the same time that such may not be altogether uninteresting to the non-professional reader.

During the past year much analytical work has been accomplished, and in the following pages will be found the results of such analyses as have been thought to be of general interest to the agriculturists of the Dominion. Notable among these are the "muds" from Prince Edward Island, of which a comparatively large number of samples have been chemically examined.

As these muds are the chief natural fertilizers available to the farmer of that island, the benefit to be derived from a correct knowledge of their composition, their value, use and mode of action in the soil will at once be obvious. Other analyses comprise those of wood ashes,—the worth of which as a fertilizer can hardly be said to be realized in this country as yet—swamp and black mucks, marls, soils, superphosphates, and other artificial fertilizers, potable waters, etc.

Among agricultural products analysed has been a number of samples of sugar-beets grown in various parts of the Province of Ontario. These analyses were made with a view of ascertaining the richness of the beet in saccharine matter when grown here from imported seed. A series of analyses of native grasses grown at the Central Farm and in the North-West has been commenced. Samples, at the Central Farm, were taken at two stages in their growth. The results of this work, when finished, will be published in Bulletin form, and it is confidently hoped that from them we shall be able to point out the more nutritious of our Canadian grasses, as well as to indicate the best time for cutting them. Analyses are also in progress of Indian corns, grown for ensilage at the Central Experimental Farm. The composition of the ensilage will also be ascertained.

Explanatory notes of the analyses are given to afford further information regarding the materials examined.

I have the honour to be, Sir,

Your obedient servant,

FRANK T. SHUTT,

Chemist to the Dominion Experimental Farms.

SOILS.

The composition of three samples of soil, analysed during the past year, is given in the following table. All of them are clay loams. No. 1 is from lot 39, 5th range, tp. of Ditton, Province of Quebec. Nos. 2 and 3 from the south-east quarter and the south-east half, respectively, of section 16, tp. 11, range 26, west 3rd, North-West Territories:—

ANALYSES OF SOILS.

——	No. 1.	No. 2.	No. 3.
Moisture	8·85	6·80	8·72
Organic matter	1·86	5·16	5·57
Clay and sand	76·43	73·65	72·52
Oxide of iron and alumina	8·46	9·75	9·02
Lime	1·69	·99	·37
Magnesia	·55	1·48	1·82
Potash	·25	·28	·39
Phosphoric acid	·14	·06	·13
Soluble silica	·48	·12	·14
Carbonic acid	1·33	·95	1·01
	100·04	99.24	99.79
Nitrogen in organic matter	·048	·125	·114

No. 1, forwarded through J. H. Chicoyne, Esq., Sherbrooke, Province of Quebec, was supposed to be a marl, and hence valuable as a fertilizer. Marls contain between 60 and 80 per cent of carbonate of lime; this sample contains but 3·02 per cent. It is a clay loam, of average quality as regards its inorganic constituents, but low in its percentage of organic matter and nitrogen. This would probably be most benefited by deep fall ploughing, in order to render it more friable, and a plentiful application of barn-yard manure to supply nitrogen. It would then, I consider, make a strong soil for the growth of cereals.

Nos. 2 and 3 were sent at the instance of Wm. Pearce, Esq., Superintendent of Mines, North-West Territories, by Dixon Bros., Maple Creek, North-West Territories. As might be expected from the proximity of the localities from which the samples are taken, they are very similar in composition. So close are the figures in many instances, that these soils may practically be considered as one sample. Comparing their analyses with that of No. 1, a great difference is at once seen in the amount of nitrogen they contain—the percentage in No. 1 being about one-third of that in Nos. 2 and 3. The nitrogen in the clay loam from Lake Temiscamingue, analysed last year, was ·087 per cent., about two-thirds the quantity possessed by the North-West soils. It is believed that these comparisons are being drawn between analyses of unmanured soils. If, therefore, future analyses bear out that there exists this difference, generally speaking, between virgin soils of the North-West and those of the eastern portion of Canada, we shall have scientific data to support the statements regarding the great fertility of North-West soils, and their peculiar suitableness for the growth of the cereals.

FERTILIZERS—NATURAL AND ARTIFICIAL.

THE MUDS OF PRINCE EDWARD ISLAND.

Continuing the work begun last year, several specimens of these materials have been analysed since the issue of the last annual report, in which, on pages 32 and 33, will be found remarks upon the chief uses of such substances as fertilizers and the best mode of their application. They are known as swamp, river, marsh and oyster muds, according to their source or the locality whence obtained, and are found to differ materially in their composition.

The swamp muds are essentially nitrogenous manures, holding the greater part of their nitrogen in a form not immediately available to plants, but rendered so by composting with some substance that assists the decomposition of their humus by setting up a process analogous to fermentation. Of these substances barnyard manure, wood ashes and lime stand out as the most easily obtainable and the cheapest. The continued use of these muds, without previous composting, cannot be of great value except to lands well manured otherwise, excepting, of course, their well-known mechanical effect on heavy clay and sandy soils. The river muds, as a rule, do not contain as much organic matter and nitrogen as the swamp muds. The marsh muds are very variable in their composition, sometimes approaching swamp muds in the amount of nitrogen they contain, and at other times largely composed of oyster and other shells mixed with greater or less quantities of clay, sand and organic matter. The chief fertilizing constituent of the oyster muds is lime, present chiefly in the form of carbonate. Several specimens received consist almost entirely of oyster shells in an almost unbroken condition. Unless such were broken fine or the mud composted, many years of exposure to atmospheric agencies would be necessary to make it valuable as a manure. By these means the notable quantity of phosphoric acid these shells contain would be rendered assimilable by plants. The debris of marine plants and the remains of marine animals supply the nitrogen-holding organic matter of these muds.

Analyses of Muds from Prince Edward Island.

Number.	Sender.	Address.	Nitrogen.	Water.	Organic Matter.	Clay and Sand.	Oxide of Iron and Alumina.	Lime.	Magnesia.	Potash.	Phosphoric Acid.	Soluble Silica.	Carbonic Acid, &c. (undetermined.)	Chlorine.	Soda.	Total.
1	Artimas Boulter	Little Pierre Jacques	·245	6·30	10·90	71·43	7·00	0·66	1·31	0·49	0·12	0·09	0·41	0·52	0·77	100·00
2	Michael Dillon	Kildare Capes	·30													....
3	do	do	·539													....
4	George Compton	St. Eleanors	·047	22·23	5·99	19·10	7·11	23·53	1·58	0·67	0·22	0·94	18·59			100·00
5	Richard Hunt	do	·480	55·17	18·05	21·56	3·63	0·64	0·30	0·16	0·27	0·07	0·15			100·00
6	do	Miminigash	·153	73·99	5·25	17·76	2·52	0·06	0·39	0·02	0·04					100·03
7	Curtis Lord	Bedeque		14·03	4·43	34·52	4·91	21·93	0·90	0·25	0·19	0·95	17·89			100·00
8	do	do	·88	5·80	31·81	53·02	7·40	0·11	0·49	0·14	0·36	0·40				100·80
9	W. A. Brennan	Summerside	·242	71·55	8·81	13·70	3·36	0·18	0·55	0·01	0·05	0·47	1·32			100·00
10	do	do	·245	72·23	9·37	12·52	3·07	0·16	0·55	0·01	0·09	0·38	1·62			100·00

No. 1 is a sample of river mud from Lot 8, Prince Edward Island, received May 10th, 1889. Although it contains a large amount of clay and sand, the percentage of nitrogen it possesses renders it of great agricultural value.

No. 2 is also a sample of river mud. Its percentage of nitrogen is very close to that of No. 1, and the value of both these samples may be considered about equal.

No. 3 is from a fresh water pond and corresponds to a swamp mud. As a supplier of nitrogen it is worth twice as much as No. 2. Mr. Dillon, who sent samples 2 and 3, asked which would be the better of the two for composting purposes. An estimation of their nitrogen was sufficient to answer this important question.

No. 4 is a specimen of oyster mud, and consists largely of the undecomposed shells of these and other bivalves in a matrix of clay. Its value as a fertilizer depends almost entirely upon the lime it contains. As nearly all the shells were entire, exposure to air, or, as it contains but little nitrogen, burning, would improve it. In its present condition it is of little value as a supplier of plant food.

No. 5 is a swamp mud, of which it is an excellent sample. Its value closely approximates that of No. 3.

No. 6, from Lot 3, Prince Edward Island, is a marsh mud, and we accordingly find it low in nitrogen compared with No. 5, also sent by Mr. Hunt.

No. 7 is described as burnt swamp mud. It is only valuable for its inorganic constituents, the nitrogen being destroyed in the process of burning. Its insoluble matter (clay and sand) amounts to one-third of the whole, and as potash and phosphoric acid are not present in large quantities, its principal value is as an agent for the supply of lime. This analysis goes far to prove what has already been said, that burning swamp mud is not an economical process.

No. 8, a swamp mud very rich in nitrogen, and hence exceedingly valuable as a nitrogenous manure. Burning this mud would have the effect of destroying almost its whole value.

Nos. 9 and 10, are marsh muds, between which the analyses show there is no practical difference in value. Mr. Brennan reports them as "doing good work in the raw state, but they are specially productive when composted." This is owing to the nitrogen during composting being converted into forms assimilable by vegetation.

BLACK MUCKS OF ONTARIO.

These are very rich in organic matter, containing a comparatively large percentage of nitrogen, which constitutes their principal value as a manure. To a great extent they are similar in their composition to the swamp muds of Prince Edward Island, and what has already been stated with regard to the benefit to be derived from composting them is specially applicable to these mucks. Several correspondents have lately asked for advice as to the treatment of land covered to a depth of a foot or more with peat or black muck, for crops on such soils make a good start but seldom attain to mature growth. It has been the practice with some farmers to burn off the peat for several inches, the result being that the small amount of ashes formed supplies mineral constituents for a year or two, when burning is again resorted to. Where the muck or peat exists for a depth of several feet this may be the only practicable method for increasing the productiveness of the land, at the same time it must be remembered that such a process is a wasteful one, as the nitrogen—the valuable ingredient of these materials—is entirely lost without a permanent advantage being effected. The great difficulty in putting out the fire when once it has got a headway in dry peat, and hence the danger accompanying this mode of treatment, render this plan, in addition to the reasons just urged, one that cannot be recommended and which should only be resorted to with the greatest caution. The more rational mode of treatment appears to be one by which the value of the muck would be retained. This might be effected by deep subsoil ploughing, especially if it is underlaid by clay, or by spreading a heavy dressing of lime or wood ashes. By these means a manure is formed in the soil capable of furnishing to the growing crops the food they require, while the tilth of the soil will be much improved. Peat soils are often too sour for vegetation, from the presence of humic and other acids; this sourness is corrected by the lime or wood ashes.

Mr. David Gascho, of Musselburg, Ont., forwarded three samples of black muck for analysis and report as to their relative value for agricultural purposes. Their composition is shown in the following table:—

ANALYSES OF BLACK MUCKS FROM MUSSELBURG, ONT.

—	No. 1.	No. 2.	No. 3.
Water, dried at 212° Fah.	30·60	10·77	15·66
Volatile and organic matter	42·20	48·10	62·08
Mineral matter (inorganic)	27·20	41·13	12·26
	100·00	100·00	100·00
Nitrogen	1·56	1·11	2·07
Phosphoric acid	·13	·58	·42
Potash	·73	·50	·40
Mineral matter insoluble in acids	16·14	28·00	16·70
" soluble "	11·06	13·13	5·56
Nitrogen calculated on dry substance	2·25	1·24	2·45

Regarding nitrogen, the most important fertilizing ingredient of these mucks, No. 3 is the richest, while No. 2 is the poorest. As, however, Mr. Gascho had No. 1 on his own farm, and as this sample closely approximates in value No. 3, which had to be bought and teamed three miles, I concluded that No. 1 would be quite as valuable , if not more so, to him for composting purposes.

Of the following samples of black muck, No. 1 is from Mr. H. R. Macdonald, Alexandria, Glengarry County, Ont., and No. 2 from Geo. H. Cornell, Carleton Place, Ont.

ANALYSES OF BLACK MUCKS FROM ALEXANDRIA AND CARLETON PLACE, ONT.

—	No. 1.	No. 2.
Water, dried at 212° F.	69·20	72·10
Volatile and organic matter	21·78	23·90
Clay and sand, insoluble in acids	3·29	·47
Oxide of iron and alumina	1 52	·56
Lime	2 27	1·68
Magnesia	·13	·16
Potash (K_2O)	·15	....
Soluble silica	....	·08
Phosphoric acid (P_2O_5)	·07	·03
Carbonic acid	1 81	1·12
	100·22	100·10
Nitrogen in organic matter	·689	·457
" " calculated on dry substance	2·266	1·638

Both of these are excellent for compost, No. 1 being the better of the two.

MARLS.

Three samples of this natural fertilizer have been received for analysis. Their composition is tabulated in the following table:—

ANALYSES OF MARLS.

——	No. 1.	No. 2.	No. 3.
Moisture	·70	·42	17·51
Organic matter	7·93	10·33	3·11
Clay and sand	4·94	·62	·25
Oxide of iron and alumina (Al_2O_3, Fe_2O_3)	·85	·45	·50
Lime (CaO)	45·45	47·70	43·61
Magnesia (MgO)	1·30	1·46	·23
Soda (Na_2O)	·37	·57	·39
Potash (K_2O)	Traces.	....	·06
Soluble silica (SiO_2)	·81	·58	·04
Carbonic acid (CO_2)	37·22	38·01	33·73
Phosphoric acid (P_2O_5)	Traces.	·15	·03
	99·57	100·29	99·46
Carbonate of lime, corresponding to lime	81·16	85·18	77·89

No. 1 is a specimen of shell marl from Mr. Aylsmith, Dorchester, Ont., 5th May, 1889.

No. 2 is from John Lennox, Boucesville P. O., Ont.

No. 3 is from the farm of J. D. Edgar, Esq., M.P., at Etobicoke, where it occurs in large quantities.

Nos. 1 and 2 are almost equal in value, and worth slightly more than No. 3. The texture of all was good, being such as to allow them to easily disintegrate on exposure to atmospheric agencies.

The application of marl supplies lime to the soil, and its value as a fertilizer depends principally upon the quantity of this element—which is present as carbonate of lime—that it contains. All plants require lime, and hence many clay, sandy and peaty soils are benefited by a liberal dressing of marl. Besides supplying lime and some other ingredients of plant food in small quantities, marl acts beneficially both chemically and mechanically, on many soils, liberating the locked-up store of plant food and effecting a better tilth or condition of the land for the spread of the plant roots and the retention of moisture.

Its use after burning is strongly recommended on peaty soils. The acid of the humus by this treatment is neutralized and the nitrogen of the decayed vegetable matter set free in a form available for crops; while at the same time, lime and other inorganic constituents, in which such soils are generally lacking, are supplied. Burned lime must, however, be sparingly used on ordinary soils, as it is much more powerful than marl. Its excessive use may destroy much valuable nitrogen-holding material.

The effect of marl on soils and its best mode of application have been treated at length in previous reports. It will therefore be unnecessary to repeat *in extenso* what has already been said on this subject.

FLUE DUST OR ASHES.

This sample was forwarded by Mr. John Croil, of Aultsville, who writes that "it is gathered in considerable quantities behind the furnace of a factory where hard and soft coal is used, being the lighter particles but too heavy to be carried up the chimney. Please say of what value, if any, you consider it for agricultural purposes."

ANALYSIS OF FLUE DUST.

Soluble in water	2·77
Soluble in acid	10·74
Residue insoluble in acid	86·49
	100·00
Potash. (K_2O)	·16
Phosphoric acid. (P_2O_5)	·76

Only traces of the phosphoric acid are soluble in water.

This sample may be considered one of coal ashes in a very fine state of division. In potash and phosphoric acid it is scarcely richer than many good loams. As a fertilizer, therefore, it cannot have any commercial value. From its mechanical condition, however, good results are often obtained upon its application to stiff clay and peaty soils.

WOOD-ASHES.

Of the three materials indispensable for plant growth—nitrogen, phosphoric acid and potash—Canada finds within her own bounds ample supplies of the two latter in the vast phosphatic deposits of Ontario and Quebec, and in the wood-ashes produced in the clearing up of new country, while nitrogen is supplied by the swamp and marsh mucks already referred to.

Wood-ashes are the mineral or inorganic constituents of plants which they, during their growth, have absorbed from the earth. If, therefore, we return to the soil such ashes, we are supplying future crops with the mineral food necessary for their development in the proportions that they require for the building up of their tissues.

The essential fertilizing ingredient of wood-ashes is potash—the secondary elements of value being lime and phosphoric acid. The crops specially benefitted by an application of potash, are clover, peas and other leguminous plants, potatoes, cabbages, beets and other leafy plants. Hence it is that wood-ashes are strongly recommended for these crops.

On account of the alkalinity of wood-ashes their use is also recommended for making composts with black muck and such like substances, for by this treatment the nitrogen of the latter is set free in a form readily assimilable by plants. Thus it is that wood-ashes act both directly and indirectly as a fertilizer. By their use the tilth of sandy soils may be much improved, for by virtue of their contained potash the particles of the soil be come more closely cemented, thus ensuring a greater retention of moisture.

As a potash fertilizer, wood-ashes in Canada take a front rank, yet it seems necessary to impress the value of their use for home consumption upon our agriculturists. Canadian ashes are sold and eagerly bought in the New England States for three times the price they can be purchased for in the home market. Notwithstanding this fact, the sale of ashes for agricultural purposes in Canada is very limited. It is to the lighter soils, in the older sections of this country, where cultivation for many years has exhausted considerably the original store of potash, that the benefit from a dressing of wood-ashes will be reaped.

Through the courtesy of the Honourable the Minister of Public Works, the Central Farm has the privilege of drawing the wood-ashes from the furnaces of the Parliament buildings. In order to arrive at a knowledge of their composition, samples for analysis were taken at different dates and submitted to chemical examination. As the woods from which they are produced are the ordinary hardwoods of this country, and as these ashes must represent a fair average of those made in

Canada, it is deemed that the publication of the results of these analyses, though primarily intended for our own guidance in experiment, will be of value to Canadian agriculturists.

ANALYSES OF CANADIAN WOOD-ASHES.

No.	Date.	Source.	Moisture.	Potash (K_2O).	Phosphoric Acid (P_2O_5).	Residue insoluble in Acids.	Residue insoluble in Acids after ignition.
	1888.						
No. 1..	February 15.....	Maple and birch	1·08	6·35	2·09	6·85	5·29
2..	do 16.....	do	·52	7·35	2·42	5·66	4·94
3..	do 17.....	do	1·11	8·89	2·08	5·06	3·31
4..	do 29.....	do	·96	4·47	2·15	6·69	5·03
5..	do 15.....	Maple, birch, beech, ash and elm	1·29	8·41	1·96	5.76	3·31
6..	do 29.....	Maple and birch	·97	4·87	2·06	6.46	5·52
Average	....	....	·99	6·72	2·12	6.08	4·57

POUDRETTE.

This material was forwarded from Toronto, where it was produced as a bye-product in a system of sewage purification by precipitation then under examination. An analysis was asked for to determine its value, if any, as a fertilizer. It is a brown or brownish-black powder, and emits no offensive smell. The analysis afforded the following figures :—

Moisture	3·94
Organic matter........	40·91
Residue insoluble in acids	34·05
Oxide of iron and alumina (Fe_2O_3, Al_2O_3)	13·65
Lime (CaO)	2·07
Magnesia (MgO)........	0·33
Potash (K_2O)........	0·21
Soda (Na_2O)	0·34
Phosphoric acid (P_2O_5)........	1·24
Soluble silica ($S\,O_2$)	0·82
Chlorine........	0·19
Sulphuric acid ($S\,O_3$)	1·53
Carbonic acid, &c ($C\,O_2$)........	0·72
	100·00
Nitrogen in organic matter........	2·04
Phosphoric acid soluble in water	0·08
Poudrette soluble in water........	9·68

The chief value of this material would be as a supplier of nitrogen, of which it contains a notable quantity. A large percentage of this nitrogen no doubt exists in a condition easily assimilable by vegetable life. The phosphoric acid (1·24 per cent.) is also an ingredient of value. Its mechanical condition is in its favour—being capable of ready application as a top dressing. Poudrette usually contains germs of the nitric ferment, which are necessary for the nitrification of the nitrogen of the soil, and it is probable that some part of the good results attendant upon its use are produced by this agency. Judging from the analysis, the fertilizing value of this poudrette is about equal to that of a good sample of black muck.

FISH WASTE OR REFUSE.

In June last C. F. Green, Esq., Fishery Guardian of Ladner's Landing, British Columbia, forwarded for analysis a sample of fish manure made from the refuse of the salmon canneries of that place. With regard to its manufacture, Mr. Green writes: "As soon as the oil is boiled out of the offal the residue is simply put into heaps for a few days to allow it to heat and sweat; after that it is spread out and allowed to dry in the sun, being turned over, but nothing is added to it." He also adds that several people in that locality have used it, and report it as a strong manure:

Water	5·19
Organic matter	46·99
Ash or mineral matter	47·82
	100·00

Nitrogen in organic matter	3·47
Potash (K_2O)	·69
Phosphoric acid, soluble in water (P_2O_5)	·12
Phosphoric acid, reverted (P_2O_5)	9·29
Phosphoric acid, insoluble (P_2O_5)	8·19
Total phosphoric acid	17·60
Mineral matter, soluble in water	1·14
Mineral matter, soluble in acids	40·98
Clay, sand, &c.	5·70

These figures show most conclusively that in this material we have a most valuable fertilizer, as a supplier of both phosphoric acid and nitrogen. The addition of wood-ashes or some other form of potash would make this a complete manure.

The process of fermentation to which it has been subjected in its preparation has converted to a large extent its fertilizing ingredients into forms readily available for plant nutrition. Further fermentation would no doubt improve it in this respect, and in order to affect this, moisture, warmth and air are required. Its most economical use would be as a manure for light, warm soils, where it might be harrowed in either alone, with barn-yard manure or wood-ashes.

GAS LIME.

A sample of this material was sent by Mr. John Croil, Aultsville, Ont., in November last. He writes: "Be kind enough to let me know of what value it is for manuring purposes, and if of any value, how much may be advantageously applied." On submitting it to analysis its composition was found to be as follows:—

ANALYSIS OF GAS LIME.

Moisture	35·20
Volatile and tarry matter	3·37
Insoluble matter in acids	1·24
Caustic, and carbonate of, lime	54·21
Sulphate of lime	·56
Sulphide and sulphite of lime	2·59
Oxide of iron and alumina	2·04
Magnesia	·79
	100·00

Gas-lime is a bye-product in the purification of illuminating gas. The gas in passing through or over beds of slaked lime loses the greater quantity of its sulphur, converting the lime into sulphide of lime. This sulphide, although a good insecticide and destroyer of fungi, is in quantities deleterious to vegetation. If, however, fresh gas-lime is exposed to the air this sulphide becomes oxidized into sulphite, and finally into sulphate of lime, or gypsum. The latter is valuable as plant food, as affording both sulphuric acid and lime—two essentials for plants, and especially those of clover and turnips. While, therefore, the application of fresh gas-lime to active vegetation is harmful, and should be only resorted to as an insecticide—when care should be taken that it does not come into actual contact with the living plants—the use of it after a lengthy exposure to air will be attended in most instances—and especially upon the crops above named and upon land destitute of lime—with beneficial results. To this end, therefore, it is advised that it be spread upon the fields in the autumn to the amount of two or more tons per acre and ploughed in the following spring, when it will have lost the greater portion of its water and the sulphur compounds will be converted into sulphate. The exact amount to be applied per acre must vary according to the circumstances. To land naturally deficient in lime five tons is not considered too much, but on ordinary soils, a dressing of two tons per acre may be used as above recommended, with perfect safety. Owing to the variation in the composition of different samples of this material, as produced at the gas works, more definite instructions as to the quantity to be applied cannot be given. For ameliorating the condition of stiff clays and liberating as plant food their inorganic constituents; for rendering more compact the texture of sandy loams and for rendering available the nitrogen of peaty soils gas-lime does good service, both chemically and mechanically.

SUPERPHOSPHATES.

Two samples of this fertilizer have been received for analysis this year:—

Shirley's soluble Phosphate.

	Per cent.
Moisture	1·20
Residue insoluble in acid (rock matter)	1·80
Calcium sulphate (gypsum)	21·60
Soluble phosphoric acid	9·59
Total phosphoric acid	20·95

The percentages of both soluble and total phosphoric acid are above the average, and show this to be a valuable fertilizer where phosphoric acid is required.

Plain Superphosphate.

This sample was sent for examination by E.A. Barnard, Esq., Secretary, Council of Agriculture, Quebec, who reports that excellent results have been obtained from its use:—

Moisture	9·13
Residue insoluble in acid	6·12
Calcium sulphate (gypsum)	47·27
Soluble phosphoric acid	7·72
Reverted phosphoric acid	1·62
Total phosphoric acid	12·34

This is also a good sample of superphosphate.

The function of superphosphate as a fertilizer is to furnish phosphoric acid. All virgin soils, or nearly all, contain a greater or less amount of phosphoric acid, since the rocks from which they are primarily formed, possessed a certain, though it may be small, percentage of calcium phosphate. Since, however, all plants need this material in order to come to mature growth, successive croppings, where the product is sold, have the effect of exhausting the land of its valuable plant food, without returning to the soil phosphoric acid in quantities concomitant to the extent to which it has been consumed. Such has been the practice in many parts of the older Provinces of the Dominion, and as a result we find to-day a very marked decrease in the yield, compared with that of the land when but newly cleared up.

The statement has been made before, that of all the constituents of plant food, it has been found necessary as a rule to supply but three—nitrogen, phosphoric acid and potash. As a result of experiment, it has been discovered that certain crops are more benfited by the application of one of these substances than by that of either or both of the other two forms of plant food. Thus, although clover, peas and other members of the leguminosæ contain a large percentage of nitrogen, their growth is not increased to any great extent by nitrogenous fertilizers, while the application of potash benefits such plants most characteristically. Again, the cereals (wheat, barley &c.), though absorbing but little nitrogen from the soil, find in nitrogenous manures that element which they need in order to produce remunerative crops. In like manner phosphates are found to be of special value for root crops, *e.g.* turnips beets, &c. Sometimes, however, as in the case of the more or less complete exhaustion of the land, exceedingly sandy soils, &c., a fertilizer containing all three is required. Hence, in the judicious use of fertilizers a knowlege of their composition is not only necessary, but also a history of the soil (its nature and previous croppings), and of the character of the crop which it is sought to benefit.

Plants absorb their food in a soluble form. Superphosphate contains a considerable amount of its phosphoric acid in a form soluble in water. This has been brought about by treating bones—or as is more commonly the case now, apatite (a mineral phosphate of lime) with sulphuric acid—the result being known as superphosphate. It is used most advantageously as a top dressing for turnips and other roots, and usually applied in quantities from 150 ℔ to 300 ℔ per acre. By such an application the development of the young plant is so stimulated that it is able to withstand the attack of the turnip-fly to a great extent, and the subsequent yield is largely augmented. In connection with nitrogenous fertilizers, superphosphate has also been found to benefit the cereals.

SUGAR BEETS.

The examination into the value of sugar beets as grown in Canada has been continued this year. To this end the amount of saccharine matter has been determined in samples of beets grown in various parts of the Province of Ontario from seed imported from Germany and Bohemia by Wilfred J. Skaife, Esq., President and manager of the Berthier beet sugar factory, Berthierville, Que. Most of these specimens were collected and forwarded by Robert H. Lawder, of Toronto, who is amassing data regarding the yield per acre &c. of the sugar beet as grown on different soils and in different localities. The series also contains samples of the sugar beet grown at the Central Experimental Farm.

The table subjoined shows that the samples analysed are for the most part rich in saccharine matter. They compare most favorably in the quantity of sugar-yield with those grown in France and Germany, where for many years the manufacture of beet-root sugar has been a staple industry, and where, by careful selection and breeding of the beets, the percentage of sugar has been so greatly increased.

In a few instances the beets arrived slightly withered. This would probably have the effect of concentrating the juice, and so increasing the percentage of sugar. Such increase, however, would not exceed .1 per cent. to .2 per cent. of the total percentage.

ANALYSES of Sugar Beets.

Letter or No.	Name of Grower.	Locality where Grown.	Percentage of Sugar in Juice.	Specific Gravity of Juice.	Source of Seed.	Soil.	Remarks.
A	W. Martin	Whitby	13·05	1075·4	Imported by W. Skaife		Grown in garden.
B	Jas. Reid	Lot 13, con. 1, Whitby	11·81	1068·0	"		
C	Thos. Pindar	Lot 14, B. F. con., Whitby	12·18	1075·2	"		
D	Chas. Bateman	Lot 13, con. 1 "	13·84	1077·5	"		
E	Jeremiah Sick	Lot 15, con. 1 "	9·47	1056·7	Central Germany		
F	"	" "	14·90	1077·5	Hungary		
G	Wm. Sinclair	Lot 17, B. F. con. "	15·69	1083·0			
H	Daniel Walker	Lot 17, con. 1 "	17·08	1088·5			
K	Geo. Lang	Lot 21, con. 1, Pickering	14·41	1080·0	Central Germany	Clay	12 roots weighed 32 lbs.
L	Wm. Trebell	Lot 18, con. 9, Reach	12·55	1066·1	California	Sandy loam	18 " 40 lbs. Had not been properly thinned out.
M	Thos. Forman	Lot 12, con. 4 "	14·40	1081·9	Bohemian seed	Clay, not stiff	14 " 32 lbs.
N	"	" "	15·65	1084·5	Central Germany		15 " 34 "
O	John Whitfield	Lot 16, con. 6 "	16·27	1083·0	"	Strong clay	18 " 20 " Never thinned out or weeded.
P	W. & G. Steele	Lot 26, con. 2 "	10·17	1060·3	Bought in Port Perry	Sandy loam	15 " 62 lbs.
Q	Jas. Graham	Scugog Island	12·35	1071·9	"		12 " 35 "
R	Bernard Earls	Town of Peterborough	14·29	1082·8	Imported by W. Skaife	Loam, with limestone	12 " 34 "
S	Wm. Graham	Lot 6, con. 4, Smith	16·87	1087·7	"	Clay loam	6 " 18 "
T	John Bowman	Lot 18, con. 6, Hamilton	14·78	1078·8	Central Germany	Sandy loam	13 " 37 " Unmanured.
U	John Russell	Lot 21, con. 1 "	16·18	1081·4	Bohemia	Heavy clay	13 " 37 "
W	John Wright	Lot 5, con. 3, Hope	15·99	1083·1		Stiff clay	15 " 14 "
Y	W. Smith	Lot 6, con. 7, East Whitby	13·51	1070·2		Clay, not heavy	
Z	J. & J. Wilson	Lot 23, con. C., Scarboro	16·51	1085·3		Clay	
P H	John Hume	Port Hope	13·30	1073·0			
	E. Holmes	St. Catherines	16·89	1085·1		Stiff clay	
1	Central Experimental Farm	Ottawa	14·91	1078·9	Imported by W. Skaife from Central Germany.	Sandy loam	5 roots weighed 5 lbs. 7 ozs.
2	"	"	16·38	1083·3	"	"	4 " 6 lbs. 4 ozs.
3	"	"	13·79	1072·2	Bohemian	"	4 " 7 lbs. 8 ozs.
4	"	"	13·70	1072·7	White Sugar Beet	"	3 " 5 lbs. 14 ozs.
5	"	"	12·95	1069·9	Vilmorin's Improved	"	3 " 8 lbs.
6	"	"	12·12	1065·8	Lane's Sugar	"	5 " 7 lbs. 6 ozs.

In all the above, the specific gravity or density of the expressed juice was determined by the Westphal balance; the percentage of sugar in the juice was obtained by mean of a Schmidt and Haench Polariscope.

The average percentage of sugar in juice of beets sent by Mr. Lawder is 14·25, that of those grown at Ottawa being 13·97. Both these figures approximate closely the average percentage of sugar obtained in Europe from beet roots of the best varieties grown for the factory.

At the request of Mr. Robt. H. Lawder the following analyses were made on beets sent by him in September, 1889 :—

No. 1.—Grown by Mr. Whitfield, Port Perry, Ontario, without phosphate.

Water	81·92
Organic matter	16·87
Ash	1·21
	100·00
Percentage of sugar in beet root	13·30
Percentage of sugar in juice, calculated,	14·15

No. 2.—Grown by Mr. Forman, Manchester Ont., fertilized by phosphate.

Water	81·04
Organic matter	17·86
Ash	1·10
	100.00
Percentage of sugar in beet root	12·00
Percentage of sugar in juice, calculated	12.77

The results of these two latter examinations must not in any way be interpreted as proving that fertilizing by phoshate has the effect of lowering the percentage of sugar in the beet root. Before any deductions on such an important matter could be made, tests, extending over several seasons, must be carried on, in which all the factors, *e. g.*, seed (variety), soil (nature and previous history), treatment or cultivation of the root, amount and composition of fertilizer, are known. It is more than probable that at the date when these two samples were pulled—the middle of September—they were immature. This may account for the rather low percentage of sugar, as it is well known that there is a rapid increase of sugar as the beet approaches maturity.

WATER ANALYSES.

OTTAWA WATER SUPPLY.

An analysis of this water in December, 1888, gave the following results :—

	Parts per Million.
Free ammonia	·02428
Albuminoid ammonia	·1881
Chlorine	1·0
Oxygen absorbed in 15 minutes, at 80° Fah.	3·164
" " 4 hours, at 80° Fah.	6·986

In my report for 1887 is contained a full account of the chemical and biological examination of this water, made a year previous. Comparing the above with the results then obtained, we find that the water has by no means improved during the year, yet the variation is not so great but what the same general characteristics may be traced. The figures point now, as they did then, to a large excess of dissolved vegetable matter.

The amount of "oxygen absorbed" during a stated interval at a stated temperature from a given amount of an acid solution of potassium permanganate gives a measure of the organic matter present. The more oxygen absorbed the greater the quantity of the decomposing organic matter. This test of the presence of organic matter was therefore used in order to ascertain the efficacy of Dr. Albert R. Leed's method of purification of water by alum. Dr. Leeds advised the use of ½ grain of alum per gallon to peaty waters, which he held should precipitate all the peaty matter, together with the alumina, leaving the water brilliant, clear and limpid. With a view of trying this process on the Ottawa water the above directions were carried out and the water allowed to settle for three hours. At the end of this time there was a brownish-white flocculent precipitate at the bottom of the vessel, while the supernatant water was clear and free from all yellow color. The water was then submitted to analysis, with the following result:—

	Parts per million.
Oxygen absorbed in 15 minutes, at 80° Fah.	·732
Oxygen absorbed in 4 hours, at 80° Fah.	1·440

Comparing these figures with those obtained from the untreated water, the fact is made clear that over three-fourths (¾) of the organic matter was precipitated and rendered insoluble by the alum. This result seems to point to a probable means for the purification of the water supply.

WELL WATER FROM WM. BROWN, RICHMOND, ONT.

This sample had a bad smell, and contained much floating vegetable *debris.*

	Parts per million.
Free ammonia	·753
Albuminoid ammonia	·16
Chlorine	50.00

This analysis was made on 7th January 1889. The quantity of water forwarded was not sufficient for a complete analysis. On 27th February another sample of the same water was received from Mr. Brown, and was submitted to chemical examination with the following result:—

	Parts per million.
Free ammonia	·59
Albuminoid ammonia	·08
Chlorine	48·00
Total solids	390·00
Loss on ignition of total solids	50·00
Oxygen absorbed in 15 minutes, at 80° Fah.	·772
" " 4 hours, at 80° Fah.	1·296
Nitrogen in nitrites and nitrates	·24

This water evidently varies in its quality, and the analysis shows that an improvement had taken place between the two dates above mentioned. I condemned this water on account of the large quantities of free and albuminoid ammonia associated with an excess of chlorine, which point unmistakably to contamination by sewage. To use such a water as this, either for the family or live stock, must be attended with a tremendous risk. The well acts, no doubt, to some extent, as a cess-pool for the barnyard or outbuildings. The importance of pure water for man and stock has been dwelt upon in a previous report. It is, therefore, only necessary for me to reiterate that great care should be exercised when deciding upon the location of a well, in order that no risk may be incurred from the drainage of barnyard, stables, privies, &c. Besides this, the condition of the well itself and its surroundings should be examined from time to time, and if any doubt be entertained as to the quality of the water a chemical analysis of it should be made. The latter must be insisted upon as the means for ascertaining the relative purity of a water. Sight, taste and smell are only of value in a confirmatory sense when pronouncing upon the quality of a drinking water. Farmers desiring an analysis of their well water should write for directions as to its collection, &c.

WELL WATER FROM TORONTO ISLAND.

(*Forwarded 6th July*, 1889.)

Appearance through 2-ft. tube.—Clear; very pale greenish yellow. Smell at 100° Fah., not marked.

	Parts per million.
Chlorine	7·00
Phosphoric acid—very slight traces	
Free ammonia	·03
Albuminoid ammonia	·042
Nitrogen in Nitrates and Nitrites	·235
Oxygen absorbed in 15 minutes at 80° Fah.	·168
" " 4 hours, at 80° Fah.	·280
Total solid matter	295·00
" " after ignition	220·00

Judging by the standards laid down by water analysts, this water is one of great purity, and one which can be strongly recommended as a drinking water. The amounts of free and albuminoid ammonia, and of the oxygen absorbed in fifteen minutes and four hours, all fall within the limits of a first-class water.

Compared with the water of Lake Ontario, however, this water takes a second place, though the quantity of organic matter is yet very small. The total solid matter and chlorine exceed largely those present in the lake water. This points to a larger quantity of inorganic matter, which, however, is not present in such an amount as to detract from the purity of the water for drinking purposes.

THE NEW CHEMICAL LABORATORIES.

The laboratories occupy the eastern half of the main building, the suite consisting of three rooms. The western half comprises offices for the Director, Entomologist, Horticulturist and Accountant, with a museum above for agricultural products. Admittance is gained to the main building by a central door, opening into a spacious hall, on the left hand of which are the double doors of the principal laboratory. This is 36 feet long and 24 feet wide, and amply lighted on the north and east sides by five large windows. Work-benches are arranged along the two walls under the windows, while two double work-tables occupy the central space. The southern wall divides the principal laboratory from the balance room (which also serves as the office for the Chemist) and the private laboratory. Along this wall are arranged the blast and blow-pipe table, the fume cupboard, and the large sink.

By a door on the right of the main laboratory the balance room and office is entered. This room is 12 feet wide and 16 feet long, and lighted by two windows from the south. Perfect rigidity is secured for the balances by the bench which supports them being fixed to the wall. Glass cases and shelving for specimens and instruments find a place here.

Passing from this room we find the private laboratory, which also has an entrance from the principal room. Here also are work-benches arranged along two sides under the windows. Its fume-cupboard is connected with a companion flue to that of the large one—thus the fume-cupboards stand back to back on either side of the partition wall. The dimensions of this room are as follows: 12 feet wide by 20 feet long.

The height of the suite is 11 feet 6 inches. The floors are of maple, the walls and ceilings of matched pine—the latter being worked out in panels.

WORK-BENCHES AND TABLES.

These are throughout of pine, with cherry tops, and stand at the uniform height of 3 feet from the floor. The width of the work-benches is 2 feet 6 inches, that of the central tables being 5 feet. The lower part of both consist of cupboards, above which, and projecting some 3 inches, are drawers of various depths, the table top surmounting these and projecting 2 inches. By this arrangement the unsightly toe-space has been rendered unnecessary. At intervals in the work-benches and tables are knee-spaces, the arched tops of which support the gas and water taps.

FUME-CUPBOARDS.

These are 8 feet long, 8 feet high and 2 feet deep. The lower portions are enclosed by cupboards and drawers, which support the base of the fume-cupboard proper, the latter lined with lead. Sliding glass doors with panels of glass above form the front and sides. The gas and water supplies are regulated by taps outside.

GAS SUPPLY.

The expense incumbent upon bringing the gas supply from the city of Ottawa would have been so great that it was deemed expedient to manufacture it upon the premises from gasolene. For this purpose a Springfield machine was put in, which furnishes illuminating gas for the whole building, as well as for heating purposes in connection with laboratory work. As this gas is very rich in hydro-carbons it does not draw in sufficient air when using the Bunsen burner to produce complete combustion, a *sine qua non* in chemical operations. A blast of air, blown by the same machine, and conducted to the tables, where it connects with the gas-pipes about 6 inches from the nozzles, was therefore devised. The nozzles issue from the table tops at the back, the supplies both of gas and air being regulated by taps in front immediately over the knee-spaces mentioned before. By this system perfect combustion has been obtained, while it allows the gas to be turned off and on without disturbing apparatus already set up.

WATER SUPPLY.

Water is supplied to the work-benches along the sides of the laboratory by goose-necks set on the table tops at the back opposite the knee-spaces—the water being turned off and on in front, as in the case of the gas. These work-benches have no sinks, but the waste water is carried off by means of waste pipes immediately beneath the goose-necks (the waters supplied being used only for distillation and the like purposes). The central tables have sinks at both ends, half their width being let into the tables. Over the large sink adjoining the fume-cupboard are arranged the following pieces of apparatus: an automatic still and condenser for making distilled water, a hot water generator and a blast and exhaust pump. A vacuum for rapid filtration is procured on the end table by means of a pipe carried from this pump, while a tube conducting a blast of air produced by the same machine is taken to the blast table. All three pieces of apparatus are connected directly with the water supply.

REPORT OF THE ENTOMOLOGIST AND BOTANIST.

(JAMES FLETCHER, F.R.S.C., F.L.S.)

To WM. SAUNDERS, Esq., F.R.S.C., F.L.S., F.C.S.
Director, Experimental Farms.

SIR,—I have the honour to submit herewith a report upon the work carried on in the Department of Entomology and Botany during the past season. In the division of Entomology this has consisted chiefly of field investigation of such pests as have occurred upon the Experimental Farm, including the trial of various insecticides and methods of agricultural treatment with a view of controlling insect ravages; of delivering addresses at Farmers' Institute meetings; of writing articles for the local press in such districts as any particular outbreak of injurious insects may have rendered it advisable; of naming specimens and of answering correspondence concerning insect injuries and advising remedies. In the division of Botany there has been a considerable amount of correspondence concerning fodder plants, particularly our native grasses. Much interest is shown in this subject by settlers in the North-West Territories and various species have been sent in for identification and report as to their probable value.

The experimental grass plots laid out by yourself previous to my appointment have been carefully watched and notes have been taken of the behaviour of various species under cultivation. There are in this collection, which has been very much increased during the past season, many species of promising appearance which have been grown at Ottawa from seed procured in different parts of the world, but particularly from our own North-West Territories. Several species not yet in cultivation as farm crops, give evidence of being worthy of that attention. In the Arboretum and Botanic Garden, work has been begun by locating and grouping some of the more important natural orders. About 200 species of trees and shrubs, two specimens of each, have been set out where they are intended to be grown. These are made up as follows:—

	Species.
Coniferæ	19
Rosaceæ	79
Oleaceæ	23
Juglandaceæ	3
Cupuliferæ	7
Urticaceæ	2
Caprifoliaceæ	22
Leguminosæ	14
Cornaceæ	8
Saxifragaceæ	15
Berberidaceæ	11
Elæagnaceæ	7

Next spring this number will be largely increased from stock already in hand, either in the nursery rows or in the botanical seed beds, which have been grown from seed procured from various sources.

Since I took possession of my office in the new Museum building, my own *hortus siccus* presented to the farm two years ago, has been unpacked and is now accessible to any students who may wish to consult it. This collection contains a complete representation of the phanerogamic flora of the Ottawa District and a large proportion of the wild plants of the rest of the Dominion. Valuable additions have been made to the collection during the past autumn, through the courtesy of the Director of the Geological Survey and by the kindness of Prof. Macoun, the Naturalist of the Geological Survey. A collection of the seeds of the wild plants and agricultural seeds of the Dominion has been begun, which will be preserved in small glass phials and placed in the Museum for reference.

Collections of seeds and living plants have been received from the following:—

Dr. G. M. Dawson, Ottawa.—A collection of seeds and roots of rare western plants from the Rocky Mountains and British Columbia.

Prof. John Macoun.—Seed of *Ferula dissoluta* from British Columbia.

Rev. C. J. Young, Lansdowne, Ont.—Living roots of the fern *Asplenium ebeneum.*

Mr. James Goldie, Guelph.—Seed and living roots of *Lithospermum canescens* and *Asclepias tuberosa.*

Mrs. Chamberlin, Ottawa.—Seed of English and Canadian plants.

Mr. L. A. Woolverton, Grimsby.—Roots of *Hamamelis virginica.*

Mr. Donald Kennedy, Bird's Hill, Man.—Seed of Muhlenberg grass (*Muhlenbergia glomerata*).

Miss Alice Williams and Miss Woods, Victoria, V.I.—A collection of British Columbian bulbs and seeds from the interior of British Columbia.

In the month of July last with the consent of the Hon. Minister of Agriculture I visited Washington for the purpose of examining the apparatus and collections in the Division of Entomology of the United States Department of Agriculture. In this Division, under the direction of the eminent United States Entomologist, Prof. C. V. Riley, particular attention has been given for many years towards the development and improvement of apparatus and methods for the successful treatment of injurious insects. The continuous study of these important subjects has resulted in the invention of many useful and simple machines for counteracting the attacks of our insect enemies. Prof. Riley was himself absent from Washington, attending the Paris Exposition; but I was most courteously received by Mr. L. O. Howard, the Assistant United States Entomologist and by the rest of the staff of the Division, who showed me every kindness and attention in exhibiting the machinery and explaining the uses thereof, as well as in throwing open for my examination the magnificent collections which have been brought together in the National Museum.

Nor was less courtesy shown me by the officers of the Division of Botany, and by request of the Hon. Edwin Willits, Assistant Secretary of Agriculture, arrangements were entered into during my visit for the mutual exchange of seeds of native grasses and fibre plants.

In conclusion, I beg gratefully to acknowledge the great assistance I have received in my work from Prof. Riley, the United States Entomologist, and his able staff at Washington. My thanks are specially due for specimens and identifications of insects, a set of three samples of the Riley cyclone nozzle and a Kutzner New Zealand triplet nozzle, which the United States Entomologist was good enough to present me with; from Miss E. A. Ormerod, Entomologist of the Royal Agricultural Society of England, for valuable advice, and from my many correspondents in all parts of Canada, who are too numerous to mention by name.

The subjects treated of in the following pages, are those which have been most prominently brought before my notice during the past season, or concerning which information has been specially requested. A great many subjects which have been dealt with in the large correspondence of the office are held over for future use in bulletins, or when the occasion may be more opportune.

For the use of some of the excellent figures which add materially to the value of this report, my thanks are especially due. For Nos. 1, 2 and 3, I am indebted to the kindness of Miss E. A. Ormerod; for Nos. 8 and 9 to Prof. Riley; and for No. 10 to Messrs. Blackie & Son, of Edinburgh.

I have the honour to be, Sir,

Yours obediently,

JAMES FLETCHER,

Entomologist and Botanist.

THE HESSIAN FLY.

(*Cecidomyia destructor*, Say.)

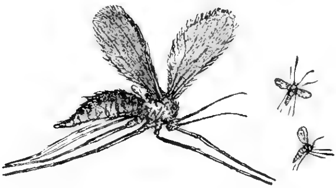

Fig. 1.—The Hessian Fly enlarged and natural size.

Attack.—In autumn two or three small whitish maggots, generally showing a green strip in the centre, may be found embedded in the crown of the root-shoots of winter wheat, or in summer just above the first or second joint of the stems of barley, rye and wheat, where they lie beneath the sheath of the leaf, but outside the stem from which they suck the sap, causing it to become weak and fall over (Fig. 3). When full grown these maggots harden and turn brown, when they resemble small flax-seeds (Fig. 2). They eventually turn to small blackish midges, with smoky wings, which appear in Canada in April and May, and again in August and the beginning of September. The females lay small scarlet eggs upon the inside crease of the leaves of barley, rye, and wheat plants.

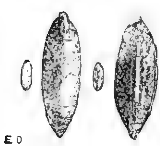

Fig. 2.—Hessian Fly puparia or "flax seeds," natural size and enlarged.

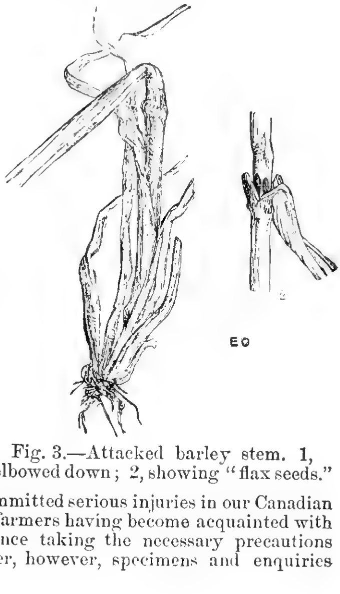

Fig. 3.—Attacked barley stem. 1, elbowed down; 2, showing "flax seeds."

It is many years since the Hessian Fly committed serious injuries in our Canadian wheat and barley fields, a fact largely due to farmers having become acquainted with the life-history of this pest, and in consequence taking the necessary precautions to avoid its attacks. During the past summer, however, specimens and enquiries have been sent in from different districts, which indicate that it has increased considerably in some places. In the neighbourhood of Ottawa it was noticed in a few fields, and it is mentioned as troublesome in some parts of the counties of Grey and Simcoe. Two of the packets of specimens which have been sent to me, are worthy of attention, on account of their containing large numbers of parasites. On 11th August Mr. G. F. Marsh writes from Thornbury, Ontario: "I send you some specimens of barley injured by a small brown maggot. From the description given in your reports, I would suppose that it is the larva of the Hessian Fly in the flax-seed stage, but I did not know that it ever attacked barley. I do not know of its having caused any damage to crops here before; but this year I should think that 1 or 2 per cent. of the barley crop is destroyed, and wheat to a less extent. Are they likely to increase next year, and what means would you advise for destroying them?" Mr. Marsh was written to, that the specimens sent were the true Hessian Fly, and he was requested to send a further supply of injured straws, so that parasites might be bred. The usual remedies of late sowing of winter-wheat, the destruction of rubbish and tailings at the time of threshing, the use of plenty of manure, and, if practicable, the burning of stubble, were suggested. The cultivation of certain varieties of wheat, such as Lancaster, Fultz, Clawson, Diehl and Underhill Mediterranean, which are reported to be less attacked than others, was also recommended.

On 3rd September Mr. Marsh writes further: "I have been making enquiries amongst the farmers of this neighbourhood, and find the extent of the injuries of the Hessian Fly much larger than I expected. Some say the wheat is almost a total loss; others not so much, and a few I have spoken to say that a great deal is lying down, but they do not know the reason. Most likely it is the same cause—the Hessian Fly. With regard to what you say about some of the varieties of wheat being more liable to attack than others, I may mention that the sample of Ladoga wheat received from the Experimental Farm, seemed nearly free from the Hessian Fly, while a small patch of Magyar wheat was nearly all destroyed. I send, as desired, a number of injured straws. I am a farmer and fruit grower, and wish to make a collection of insects for study, especially those injurious to orchard and farm produce. Will you kindly advise me what I need to begin, or recommend me some book on the subject."

In reply to the above, the following letter was sent: "I am very much obliged to you for sending the infested straws, and am pleased to tell you that I have bred from them, already, a large number of beneficial parasites. The presence of these parasites is a most important matter, as the diminution in the numbers of this pest from what they were some years ago is supposed to be due, for the most part, to these beneficial parasites. I am much pleased to hear of your determination to make a collection of injurious and beneficial insects, for I am confident that this is the only way to learn about them. The large amount of injury which can be prevented by even an elementary knowledge of economic entomology makes it most important that farmers should know something of the lives of the insects from the depredations of which they annually suffer so much. I shall always be glad to help you in any way in my power. There is an excellent small work lately published, which I think will give you all the information you ask for, about farm insects and the best way to collect and study them. It is 'Packard's Entomology for Beginners,' New York, 1888, published by Henry Holt & Co." The other parcel referred to above as having contained parasites came from Prince Edward Island, from the office of the *Pioneer and Island Farmer*, with the following letter: "Herewith I enclose you the joints of some wheat stalks. You will find on opening them that there is the larva of some insect which has destroyed many fields of wheat in the vicinity of Summerside. Would you kindly let us know what insect it is, and what means might be adopted to prevent its ravages. The gentleman from whose fields thes talks were taken, says that the stalks which missed being punctured by the fly came to maturity all right, but with the others—about three-fourths of the field—all vitality was destroyed. The joint where the larva mostly is, is the first from the ground, although sometimes they are found in the second as well."

The stems sent from Prince Edward Island produced only a few parasites; but these were sufficient to indicate that these valuable allies were present. The straws sent from Thornbury, however, produced large numbers. In fact, it is probable that not a single Hessian Fly larva was left unmolested in the straws sent. The contents of some of the "flax-seeds" have not yet emerged; but so far nothing but parasites have appeared. These have been kindly identified by Prof. Riley as *Merisus destructor*, and a winged form of *M. subapterus*.

The life-history of this pest has been studied very carefully by many observers, but particularly by Dr. Packard, Prof. Forbes and Prof. Webster in America, and by Miss Ormerod in Europe, all of whom have published valuable articles upon its habits.

In reply to the letter sent by the *Island Farmer*, the following answer was sent and was published in their issue of 26th September:—

"I beg to inform you that the wheat stalks enclosed in your letter have been injured by the Hessian Fly, a very injurious insect which some years ago committed enormous ravages upon the wheat crops of North America. Of late years, however, although reports come in annually of its depredations in some parts of Canada, the injury to the wheat crop of the Dominion from this cause is comparatively small. This diminution in the numbers of this pest, is due mainly to the operations of minute parasitic insects which destroy the insect before it reaches the mature state. I am glad to inform you that in the small packet of infested straw forwarded by you I have found several of these beneficial parasites. This, however, only shows that the parasites are present in the field from which the straw was taken, and it is very desirable that farmers should take the usual precautions to prevent the spread and increase of this dangerous insect. The life history is briefly as follows: The perfect insect appears in the spring and autumn, the exact time varying in different localities; but it is usually in the months of April and May in the spring, and August and September in the autumn. It is a small black gnat, about one-third the size of the ordinary mosquito. The body is black and the wings are smoky. Each female lays about twenty eggs. The eggs are laid in the crease of a leaf of the young wheat plant. They hatch in a few days into small maggots, which work their way down into the sheathing base of the leaf and remain between the base of the leaf and the stem, causing the stem to swell and become weak, so that it breaks very easily (Fig. 3). The spring brood from eggs laid in April and May, comes to maturity and a large proportion of the flies appear in August, although a few of them may not come out until the following spring. The brood which appears in August and September lays eggs upon volunteer wheat, young fall wheat and perhaps some grasses. When the maggots hatch they work their way down to the bases of the leaves and feed upon the juices of the plant. They become full grown before the winter sets in, and pass the winter either in the state of a naked larva or in the 'flax-seed' state, in which they may be found on removing the lower leaves, as little brown, smooth, oval and pointed bodies, somewhat resembling the seeds of flax. Inside these "flax-seeds" the larvæ remain unchanged until the following spring; on the return of warm weather they change to chrysalides, and the perfect flies appear in April, May and June."

In reference to the above, Prof. S. A. Forbes writes—Bulletin 3: "The Hessian Fly," 1887. "It was especially to test, for the latitude of southern Illinois, the details of the current biography of the Hessian Fly in America, that I commenced observations on the subject in southern Illinois in 1883. The results thus far established show that in that latitude a large percentage, at least, of the flies emerge as imagos before wheat harvest or immediately thereafter (28th May to 28th June); that, if opportunity offers, the fly will breed freely in volunteer wheat at a date earlier than its usual breeding season in wheat of the regular sowing; and that the greater part of this midsummer generation emerge as winged flies before winter and lay their eggs immediately, thus giving origin to a third brood which hibernates chiefly in the puparium."

The usual life history of the Hessian Fly in Canada is, I think, that which I sent to the *Island Farmer*, for I have never been able, so far, to find the larvæ or "flax-seeds" in volunteer wheat or barley. There is, however, a possibility of its occurring in Canada, for where the Hessian Fly and the Wheat-stem Maggot (*Meromyza Americana*) occur together, the life histories of the two insects agree closely.

If it were found to be the case here with the Hessian Fly, as it has with the Wheat-stem Maggot, that there is an intermediate brood which matures in volunteer wheat, which springs up in the stubble after the grain is cut, it would give a further opportunity of keeping this pest in check by treating the stubble, first by harrowing it directly the grain was cut to make the volunteer crop start, and then by ploughing this in before the larvæ were mature. With regard to the general impression current amongst farmers of infested wheat turning yellow, this is probably a mistake. Prof Webster, who has studied the matter carefully, writes: "Infested wheat does not turn yellow in the fall, but the leaves are darker in colour than those of a healthy plant, and proportionately broader. The central spindle-shaped leaf is missing, and the whole plant is only a bunch of rank-growing leaves. Dr. Lindeman, of Moscow, Russia, in his recent work on the Hessian Fly, uses this language: 'All the leaves of the plant wither at the same time, commonly changing but little of their green colour.' So you see that a yellow colour is a poor indication of fly, even in Russia. I am confident that 50 per cent. of what is known here as winter-killed grain is due to the attack of the fly. I am certain of this. Wheat will go into winter looking thrifty and even rank, though seriously infested, but so far as I have observed it is killed before spring. By explaining the difference between healthy and injured plants I hope to enable our farmers to detect the injury, possibly in time to re-sow, if the first sowing was done quite early."

Remedies.—The remedies for the Hessian fly are the following:—

1. Late sowing.—The postponement of sowing winter wheat until after the third week in September usually has the effect of delaying the appearance of the young wheat plant above the ground until after the Hessian Fly is flying.

2. Burning refuse.—Of great importance is the burning of all rubbish and "tailings" or fine screenings from the threshing mill, wherever barley or wheat have been known to be infested. A proportion, sometimes large, of the "flax-seeds" is carried with the grain, and in the threshing they are thrown down amongst the rubbish and broken straw beneath the machine. By burning this, not only will the Hessian Fly "flax-seeds" or puparia be destroyed, but also the seeds of many injurious weeds.

3. Treatment of stubbles.—As soon as the crop is cut, a harrow may be run over the surface of the fields, so as to make the volunteer crop, from grain which has dropped in harvesting, begin to grow quickly. If there be an intermediate brood of the Hessian Fly this will be easily destroyed by ploughing in the volunteer crop before the insects are full grown, and at any rate will attract the early flies of the autumn brood to lay their eggs, and will also be very beneficial in destroying the summer brood of the Wheat-stem Maggot. Another adaptation of this remedy is the sowing of a strip of wheat in August, which will attract the females to lay their eggs, and which can afterwards be ploughed under. The burning of stubble has sometimes been practised with good results. If fields are conveniently situated, away from barns, houses and stacks, stubble can be easily burnt over, in summer, as it stands in the fields, if a day be chosen when there is a gentle breeze. This should of course be done as soon after the crop is carried as possible. The "flax-seeds" being situated as a rule in the first or second joint of the stem, are all destroyed by this burning process.

4. Rotation of crops.—Neither wheat, barley, nor rye should be sown again the next season in fields where the crop has been infested this year.

A point of great interest in the life-history of this insect is the discovery made by Dr. C. Lindeman, of Moscow, of two of the varieties of grass which are sometimes attacked by the Hessian Fly. Miss Ormerod records (Rep. XII, p. 51): "Observations with which I have been favoured by Dr. C. Lindeman, of Moscow, during the past season, point to the importance of clearing the surface rubbish of infested fields as thoroughly as can be done. There has been doubt and difference of opinion as to the kinds of wild grasses which were liable to infestation by Hessian Fly, but during the past season Dr. C. Lindeman has been good enough to send me information of "Timothy Grass," *Phleum pratense*, having been found during 1887, in one of the Russian Governments (that of Tambor) to be severely attacked by Hessian Fly, in corroboration of which many specimens of Hessian Fly puparia were sent to him. In 1887 also, Dr. Lindeman received specimens of stems of Couch grass, *Triticum repens*, sent from the Government of Tambor and that of Woronetz, which were elbowed down by and infested by puparia of the Hessian Fly; and communication was made to him at the same time that the couch grass was so severely attacked that in whole districts covered with this grass it was destroyed."

When winter wheat is found to have been only moderately attacked by the autumn brood of the Hessian Fly, good results have still been secured by the use of special fertilisers in the spring, by which weak plants and uninjured shoots, even on infested plants, were strengthened sufficiently to give a fair crop.

THE GRAIN APHIS—(*Siphonophora avenæ*. Fab.)

Attack.—Green, yellow, red or black, plant lice with the antennæ, or horn-like feelers in front of the head, the knees and the tips of the shanks, as well as the feet, black. These insects may be found in clusters upon oats, wheat, barley and rye, and probably also upon some grasses — in the spring, upon the leaves, which turn first red and then yellow around and above where the clusters are situated — later in the summer they crawl up the stems and attack the flowers and forming grain, sucking out the juices by means of their beaks. They leave the fields of grain about harvest time and are not again found until September, in which month a few were found on voluntéer barley at Ottawa this season. Dr. Thomas found an aphis on wheat in the winter of 1875, which he had no doubt was this species. Speaking of their autumn operations he says: "They work upon the leaves and stalks singly, while the weather is not too cold, but when winter appears they move downwards towards the ground, some of them entering the soil and feeding on the sap of the roots."

The life-history of this insect is not yet completely worked out. The usual cycle of life in this order is for them to pass the winter as eggs, from which wingless viviparous females hatch in the spring; these by a process of budding and without the sexes pairing (there are no males at this season) give birth to fully-formed young, which in a few days mature and themselves bear young plant lice. There are several successive broods of females, until a certain time in the year (varying slightly in different species), when perfect females and also males are produced. This is the only time of the year when males appear. Some species of plant lice migrate at certain times of their development to some other plant than that upon which they had passed the summer months. Pairing now takes place, and as a result eggs are laid, which remain unhatched until the following spring. This is a general statement, only, of the life-history of plant lice, to which there are exceptions—a notable one of these being the Hop-Aphis (*Phorodon humuli*), the remarkable life-history of which has been so carefully worked out by Prof. Riley and recorded in his report of 1888 as follows: Of this species the winter eggs are laid by the perfect female upon plum trees in autumn; from these hatch the next spring wingless females, which have been called "stem-mothers;" these produce young plant lice by a process analagous to budding in plants, and known as parthenogenesis (from the Greek *parthenos* a virgin and *genesis* production), which means the production of young from imperfect and unimpregnated females, without the intervention of a male. There are three broods of these parthenogenetic females produced on various kinds of plum trees, the third becoming winged. This last is known as a "migrant," and it instinctively flies to the hop plant which has been free from attack up to this time. A number of generations of wingless females are produced upon the hop, until in autumn winged females, known as the "return migrants," again appear. These return to the plum and produce some three or more young. These have no wings, but are true sexual females. Somewhat later upon the hop the true winged males, the only males of the whole series, are developed. These fly to the plum, and towards the end of the season may be found pairing with the wingless females, which afterwards stock the twigs with winter eggs. The above life-history will show how complex and difficult to understand are the habits of some of our injurious insects. The importance, however, of this knowledge, cannot be over-estimated. By the treatment of plum trees near hop gardens, with a kerosene emulsion late in the winter or very early in spring, one of the most injurious insects which harass the English farmer can now, to a large measure, be kept in check. As stated above, there are still gaps in the life-history of the Grain Aphis; the male and egg-laying female are as yet unknown, as also the exact knowledge of how the species passes the winter in Canada.

It is recognised as being one of the most prolific of plant-lice, and although always present every year, to a greater or less degree, it seldom increases to such an extent as to cause an appreciable diminution in the cereal crops. Occasionally, however, this is the case, and last season was one of these exceptions, more particularly in the United States than in the Dominion, but still in some parts of Canada considerable alarm was caused by its appearance in vast numbers. Enquiries as to the habits and probable extent of the injury were received during July and August from many parts of Ontario and from the Hon. Col. Rhodes, Minister of Agriculture for the Province of Quebec. In the United States tales of its injuries went the rounds of the press, which were copied and exaggerated, until neither the insect nor the injury were recognizable. Its abundance demanded the attention of official entomologists in most of the Northern States.

Quite as frequent as enquiries concerning the habits of the Grain Aphis were others with regard to insects which were found associated with them; these were parasitic species, which were performing the useful work of destroying the injurious plant lice, but whose good offices were, without exception, misunderstood. These beneficial insects were in most of the instances reported: the larvæ or perfect beetles of lady-bird beetles (*Coccinellidæ*), of which *Hippodamia convergens* was the one most frequently sent in, the larvæ of the Syrphus flies and minute parasitic four-winged flies belonging to the genus *Aphidius*. Although least often noticed, owing to their small size, these last named are perhaps the most efficient helpers the farmer has, in ridding his crop of these insects. The egg is laid by the female in the body of the young plant-louse, and the grub grows to maturity inside its body, entirely consuming the liquid contents, and leaving it as a dry shell, which serves the pupa of the parasite as a cocoon. When mature the perfect insect, a small four-winged, dark-bodied fly, eats its way out of its host through a round hole in the back. The flies of this genus are all parasitic upon plant lice, and although so small, $\frac{1}{10}$ of an inch in length, are frequently the most important factor in reducing the numbers of these prolific plant-lice, which attack almost every crop that is grown. As yet no practical artificial remedy has been discovered for the grain plant-louse, a fact which makes it important that its full life-history should be worked out as soon as possible.

THE WHEAT-STEM MAGGOT.

"Wheat Bulb Worm," "Silver-top of Wheat." (*Meromyza Americana.* Fitch.)

Attack.—Some time before wheat, barley and some grasses should be ripe, the ear and top portion of the stem turn white. Upon examination the stem will be found to be severed and consumed just above the top joint, by a slender transparent green maggot, $\frac{1}{4}$ of an inch in length, pointed at one end and having black, horny mouth-parts. When full-fed it works up to the upper portion of the sheath and turns to a slightly flattened green pupa, from which the fly emerges about the end of July and during August. The perfect insects are active little greenish-yellow flies, $\frac{1}{5}$ of an inch in length, with shining green eyes, and three dark stripes extending down the back. The hind thighs are much thickened, and when the fly is at rest the fore part of the body is raised. Very soon after emerging the sexes pair and the eggs for a second brood are laid upon volunteer grain growing on stubble and in the root-shoots of various grasses. The flies of this second brood emerge late in September, and the eggs of an autumn or third brood are laid on young winter wheat and on the shoots of grasses. The flies from this brood do not appear until the end of May and in June of the next year.

Close observation of the operations of this insect during the past season settled conclusively, for this district, one or two questions concerning which there was previously some doubt. The three broods were plainly traced. Perfect flies of the first brood, in considerable numbers, being taken in the beginning of June; of the second brood at the end of July, and of the third brood at the end of September. They were found in small numbers of the first brood until the end of June, and of the second, flies continued emerging in the breeding cages from infested straws almost to the end of August. The larvæ from this brood were also found half grown, in large numbers, in the bases of volunteer barley, on the 10th of September. The empty egg shells from which the larvæ had hatched were also found adhering to the first leaf of the infested plants and the central leaf was dead, making it an easy matter to detect the injured plants. Larvæ were also at this time found in the root shoots of several grasses on the experimental grass plots, and upon some fine days at the end of September the flies were taken in large numbers upon the same grass plots.

Notes were taken of the varieties of wheat which were most attacked, and it will be seen from the appended list, that there was a decided preference shown for some of the varieties, whilst others were almost unmolested. This was also the case with the different species of grasses which were attacked. In addition to wheat, some varieties of barley also suffered, and a single instance only of attack on Welcome oats was observed. Prof. A. J. Cook, of Michigan, however, informs me that in his State oats of several varieties are severely attacked. With regard to the attacks of this insect upon grasses, it was found that while early flowering species, as *Poa serotina, Agropyrum caninum, A. glaucum*, &c., were injured in the flowering stems, in the same manner as wheat and barley, the late flowering species or perennial grasses of the first year's growth, which had no flowering stems, were injured in the root-shoots, after the same fashion as the attack of the later broods upon volunteer and winter wheat. The injuries to grasses were also largely augmented by another minute black species of fly belonging to the same family (*Oscinidæ*) as yet unidentified. This was not detected until the flies had nearly all emerged, when the empty brown puparia were found in large numbers in the dead shoots and between the sheaths of the grasses.

Remedies.—The discovery of the freedom with which this insect breeds in grasses which occur everywhere, complicates very much the problem of securing a satisfactory remedy. Those which should be tried, however, are the following:—

1. The collection (hand-picking) of the conspicuous "silver-tops" or injured stems in the beginning of July.

2. For the second brood, which attacks volunteer wheat and grasses, a strip of wheat or barley sown near infested fields early in July, will act as a bait to attract the females, to lay their eggs, as soon as they emerge. These succulent young plants would probably be more attractive than grasses at that time, and would also be in advance of the volunteer crop. This strip should be ploughed under in August to destroy the half-grown larvæ.

3. Late Sowing.—From what I have seen of this insect, winter wheat sown late, after 25th September, would, I believe, be free from attack. The remarkable similarity between the habits of the Wheat-stem Maggot and the Hessian Fly render the same remedies applicable for both. The following dates may be of interest, and will perhaps explain some points in the foregoing: "Spearing" of grain is the term used to indicate the time the flowering head appears above the sheath. Winter wheat is generally sown in this section about the first week of September—the third week of September is considered late sowing. Winter wheat sown 11th September, 1888, appeared above the ground 21st September. Winter wheat at Ottawa this year speared 17th June and was ripe on 21st July. Volunteer wheat was up on the stubble by 3rd

August. Spring wheat sown on 1st May speared 1st July, and was harvested from 2nd to 30th August. Barley sown 19th April speared 3rd July, and was cut 1st August. Volunteer crop on stubble was well up on 15th August.

Parasites.—In my last report I mentioned breeding large numbers of a *Cœlinius*, a small four-winged parasite of the Wheat-stem maggot. This year the same insect, which is probably a local variety of *Cœlinius meromyzæ*, Forbes, was particularly abundant, and destroyed large numbers of the larvæ. It differs from the type in having the head and shoulders (prothorax) reddish yellow. It attacks all the broods of the Wheat-stem maggot.

The following is a list of the different varieties of grain and grasses attacked by the Wheat Bulb Worm. Records were taken of the large fields on the farm, and the varieties grown were found to be attacked in the same ratio as in some plots of which the following is a record.

These plots were sown from the crop of fifty grains of each variety of wheat, sown separately, 1 foot apart, in the season of 1888, and the average size of each plot was about 22⅔ feet wide by 36 feet in length. In addition to these plots there was one of Ladoga wheat, 195 feet by 22⅔, and one of Judket wheat, 411 feet by 22⅔. All of these varieties were grown together upon similar soil, and were only separated from each other by a 3-foot path.

List A.—Varieties of Wheat which were decidedly more severely attacked than the varieties mentioned in List B.

Wheat.	Speared.	Attacked.
		Per Cent.
Judket	July 1	¼ of 1
Indian Club, Calcutta	June 18	½ of 1
Pringle's Champlain	July 1	¾ of 1
Bearded, from Peace River	do 2	1
Bearded Summer	do 6	1
Red and White (Campbell's)	do 1	1
White Tuscan	do 5	1
Indian Red, Calcutta	June 18	1⅓
Naples	July 6	1½
White Chaff	June 30	1½
French Imperial	July 3	2
Greek Summer from Andros	June 29	2
do from Russia	July 1	2
Indian Hard, Karachi	June 22	2
Indian Red do	do 20	2
Bearded March	July 1	2⅓
Russian Hard Tag	do 2	2½
Beardless, from Peace River	do 2	3
Californian March	June 30	3
do White	do 30	3
Indian Hard, Calcutta	do 20	3
Medea	do 27	3
Victoria de Mars	July 2	3
White Delhi	June 21	3
Algiers Summer	July 4	4
Torentino	do 1	4
Bearded Trimenia Sicilian	do 4	5
Greek Summer, from Atalanta	June 29	5
do from Missogen	do 30	5
do from Paros	July 3	5
Polonian	do 8	5

List B.—Varieties of Wheat which were very little injured, only showing a few heads of "Silver-top."

Wheat.	Speared.	Wheat.	Speared.
Australian	July 4	Heaney's Spring	July 5
Bearded Red	do 1	Herison's Bearded	do 3
Beardless March	do 8	do Beardless	do 6
Blue Stem (or Velvet Chaff)	do 5	Improved Summer Cob	do 2
Brown's New Wheat	do 2	Ladoga	June 29
Canada Club	do 2	Large-leaved from Cap	July 4
Chilian White	do 4	New Zealand Long-berried	do 6
Club	June 30	Noe	do 10
Eureka	do 30	Red Fern	do 3
Farrell's Early Sonora	do 30	Rousselin	do 7
Fife, American hard, Duluth	July 2	Russian, White	do 2
do do Milwaukee	do 2	Rye Wheat	do 17
do Red	do 2	Saxonka	do 1
do Saskatchewan	do 2	Scotch	do 1
do Scotch	do 1	Sicilian	do 4
do White	do 1	Summer Mars	do 6
do Wellman's	do 2	Triumph	June 29
Galician Summer	do 4		

The question as to what varieties of grain are least attacked is one of importance, and the records of last season, and of 1888, as far as they were taken, show an advantage in favour of the varieties mentioned in list A. Last season, however, was cool and damp, which would probably have the effect of lengthening the time of appearance of the perfect insect. It has been pointed out to me by Mr. William T. Macoun, who assisted me in taking the above record, that the varieties of wheat most attacked are of the character known as "ricey," and so little esteemed by millers in this country. The different varieties of barley were much less attacked than the wheats by the first brood of the Wheat-stem Maggot. Of these, however, three of the best varieties were chosen, viz., Peerless, Beardless and English Malting barley. The injury to these was not general nor widespread; but upon a clay knoll a few injured stems were observed constituting perhaps $\frac{1}{20}$ of 1 per cent.

The attack upon grasses grown in the experimental plots, was upon some species serious. The grasses most injured were the following, in the order they are mentioned:

In the flowering stem,—*Poa serotina*, 5 per cent.; *Agropyrum caninum*, 4 per cent; *Agropyrum glaucum* var *occidentale*, 2 per cent.; *Poa pratensis*, two or three stems only; *Poa cæsia*, two stems; *Panicum capillare*, one stem: *Setaria viridis*, two stems.

In the root-shoots during the summer, *Elymus Canadensis*, this plot was nearly destroyed, few plants throwing up more than one or two stems, and the same was the case with *Agropyrum tenerum* and a new bed of *A. caninum*. *Deschampsia cæspitosa* lost perhaps 10 per cent. of the root-shoots. *Deyeuxia neglecta* and *Elymus Americanus* about 5 per cent.

The mature flies in the seasons of their appearance could always be swept in considerable numbers from the beds of *Agropyrum glaucum* var *occidentale* and *Koeleria cristata*, but no injury could be detected in the root-shoots, either in the summer or autumn.

CUT-WORMS.

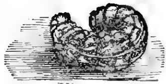

Fig. 4.

The W marked Cut-worm.

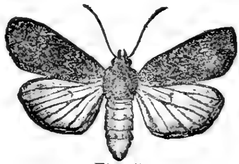

Fig. 5.

Agrotis Clandestina, Harr. the moth of the W marked Cut worm.

The attacks of these injurious caterpillars were very severe in many parts of the Dominion. Most of the complaints were received from central Ontario. From British Columbia only three reports have come in, all recording a diminution in the amount of injury. Mr. G. A. Knight, of the Mount Tolmie Nurseries, writes: "Taking it all through, we have been freer this year from cut-worms than we have been before for ten years past."

In the vicinity of Arnprior, Ont., some species were extremely abundant and destructive, the worst depredators being the Dingy Cut-worm (*Agrotis subgothica*, Haw.), and a grey cut-worm with a brown stripe down the back, from which *Agrotis campestris* was bred. Upon the farm of Mr. Charles Mohr, of Mohr's Corners, I was shown, in the beginning of July, a field of 15 acres, which was planted with corn, potatoes and turnips. Along the side of the field was a strip of wheat. The appearance of the field was remarkable. The corn was untouched, as also was the wheat, with the exception of the lower leaves on the outside edge of the plot which was towards the centre of the field. The potatoes showed an occasional stem cut off, but no serious injury. The turnips, however, except in one corner of the field, where there was a patch of about 50 feet square, were so entirely consumed as not to show a vestige of green foliage all over the rest of the field. Cut-worms were found in countless numbers. The ground was a rich, well-manured sandy loam, and had always required considerable labour to keep down the weeds. This year, however, Mr. Mohr assured me that not a weed had been touched. All through the corn and potatoes and all over the turnip field every weed had been eaten off directly it appeared above the ground. In the strip of wheat, likewise, the weeds were all destroyed on the side nearest the infested field for a distance of 12 or 14 feet from the outside. There is no doubt that this clearance of the weeds was done by the cut-worms which, luckily for Mr. Mohr, did not happen to be cereal-feeding species. At the time of my visit the turnips had been sown the third time, and were just beginning in places to appear above the ground. The poisoned trap remedy was recommended, and about 20 loose bundles were made of pepper-grass (*Lepidium virginicum*) and other weeds, by tying together some of these plants from a neighbouring field. After dripping them in a strong mixture of Paris green they were laid along the rows of turnips about 20 feet apart. Upon visiting the field the next morning an average of about 80 cut-worms was found under or near each trap. Most of these caterpillars were alive at the time; but from the intensity of the green colour of Paris green, its presence inside the alimentary canal was easily perceptible through the delicate skins. The specimens were put inside a large bottle and exhibited at the meeting of the Fitzroy Agricultural Society later in the day, when they were all found to be dead. Mr. Mohr afterwards made several more of these traps, and placed them at intervals along the rows of his turnip field. Mr. Mohr wrote to me on July 29th: "The turnips are all right now and look remarkably well. In the portion of the field which I sowed without disturbing the drills there has never been the slightest sign of vegetation, except the turnips, but in all the rest of the field the weeds have grown where I upset the drills. The corn is as high as my head now, but no weeds ever started. I put out a good number of traps and they did well." The reason the weeds did not grow where the ground was not disturbed, was probably due to the fact that all the seeds of weeds which were near enough to the surface to germinate, had grown at first and had been destroyed by the cutworms. Those brought to the surface later, in hoeing or cultivating the turnips, would be destroyed by the repetition of those operations. After very careful trial of this remedy during the past season, I consider it one of the most satisfactory for these injurious caterpillars, where the nature of the crop is such as will allow of easy access to all parts of the field. Almost any succulent plant answers for the traps, and the one mentioned above was only used because it was the easiest obtained. I would suggest the advisability of always placing a few poisoned bundles in gardens in the spring, a day or two before sowing seeds and after the ground is cleared. The labour is very small, and the benefits derived are decidedly great.

Cut-worms very similar to those found in Mr. Mohr's fields were sent to me by Mr. J. Armour, of Victoria Road, Ontario, who reported that the ground was literally alive with them, and that they were doing a great deal of harm to garden vegetables.

All efforts to breed the perfect insects from these caterpillars failed owing to the attacks of parasites; the caterpillars resembled closely those from which I have bred *Agrotis turris* Grote.

The Glassy Cut-worm, Fig. 6, the caterpillar of the Devastating Dart moth, *Hadena devastatrix*, Brace, Fig. 7 proved to be very destructive, and particularly so

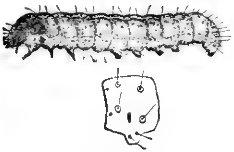

Fig. 6.

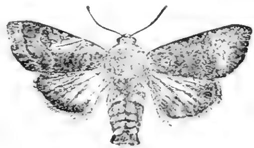

Fig. 7.

to fall wheat in some localities, notably in the Ottawa district and near Creemore, Ontario. Early in June Mr. J. B. Spurr, the editor of the Creemore *Star*, sent me specimens of the caterpillar, from which the moths were afterwards bred. He described their injuries as so severe that it had been necessary to plough up several fields of winter wheat. An article descriptive of the habits of the insect, and the best remedies, was sent, which appeared in the issues of 13th and 20th June, with some additions by the editor.

This species frequently attacks plants of different natural orders: but from what I have seen of its habits, I think it should be considered as being normally a grass-feeding species. The caterpillar is white, with a reddish head, and the body has several small bristle-bearing warts arranged over the surface in the position usually found in this family of insects. It is a subterranean feeder, sometimes doing much harm by lying at the heart of clumps of grasses and destroying the bases of the stems. The moth is extremely common, and but for the abundance of grasses of all kinds and their rapid growth, would be one of our most injurious insect enemies. The season of the appearance of this insect in the perfect state was last summer very prolonged. The first moths were taken on 27th June, and they in company with *Agrotis clandestina*, flew to the light in my study in large numbers until the middle of September.

THE TURNIP FLEA BEETLE, "Turnip Fly" (*Phyllotreta vittata*, Fab.)

Attack.—Small active, shining black beetles, with yellow marking on the wing covers, which eat the seed-leaves of turnips and all other cruciferous plants directly they appear above the ground. When disturbed they hop to some distance.

For the treatment of field crops of turnips I have nothing of importance to add to what I said in my last report. The application of Paris green in land plaster in the proportion of 1 to 50 or in flour 1 to 20 by weight, gives perfect satisfaction. The only precautions necessary are that the powder must be perfectly dry, so as to be easily distributed in an even manner and to throw it upon the turnips when the dew is on them.

The most difficult attacks to meet, of this insect, are those upon such vegetables as are to be eaten at once, as the radish, or of which the foliage is the part for which the plant is cultivated, as garden cress of several varieties. For radishes air-slacked lime, or road-dust or ashes, give a partial immunity; but these were never quite satisfactory. For garden cress the most successful treatment tried was covering the rows with strips of fine gauze stretched on light frames. This, however, is a somewhat clumsy remedy, and requires a good deal of attention. However, I have grown very superior cress in this way, but the plants were uncovered about 6 o'clock in the evening and left uncovered until 8 o'clock the next morning. Frequent watering and good soil of course help by producing a strong growth. The attacks, too, of the insects, are not equally severe all through the season. There will be times between the broods when the frames can be left off altogether.

A remedy which I have not tested, but which is well attested, is that mentioned by Prof. Cook on p. 32, Rep. X, Society for Promotion of Agricultural Science. It is a decoction of tobacco. He says: "The past season we tried ten different insecticides, both on the Striated or Radish Flea Beetle and on the Cucumber Flea Beetle (*C. cucumeris*), We found two remedies which seemed effective. The first is ashes. We tried these with and without London purple, and could not see that the poison was of any value. The ashes seemed to drive the beetles away. Yet to secure satisfactory results we had to fairly cover the plants. In some cases it seemed that the ashes did considerable injury to the vegetables. The other remedy, and a better one, was a strong decoction of tobacco. We took tobacco dust, which we got at a factory for little more than the expense of the sack and labour in filling it up. The decoction was made by pouring two gallons of hot water on a pound of the dust. This was applied to the plants with a force pump. In every case the beetles were driven off and we could see no harm to the plants. Indeed, from the dispersion of the beetles the plants at once put on new vigor. We used this on cabbages and radishes for the Striated beetle, and on potatoes for the Cucumber Flea Beetle, and with like favourable results in both cases."

If this remedy should prove, generally, as satisfactory as this first trial of Prof. Cook's, it will be a most useful addition to our knowledge of simple remedies, and will be very applicable for such plants as cress, of which the leaves are eaten. All taste, of the tobacco would, of course, be easily removed by a good washing in water.

THE MEDITERRANEAN FLOUR-MOTH (*Ephestia kühniella*, Zeller).

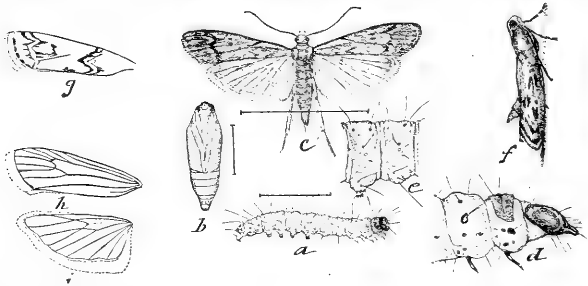

Fig. 8.—The Mediterranean Flour-Moth (*Ephestia kühniella*): *a*, larva; *b*, pupa; *c*, adult enlarged; *d*, head and thoracic joints of larva; *e*, abdominal joints of same—still more enlarged; *f*, moth from side, resting; *g*, front wing, showing more important marking; *h*, venation of fore-wing; *i*, venation of hind wing—somewhat enlarged (*a. b. c.* and *e.* (Riley) *d. f. g. h. i.* (Snellen).

Attack.—Slender white or pinkish, cylindrical, caterpillars. When full-grown, from ½ to ¾ of an inch in length, with reddish-brown heads, and having four conspicuous, and two smaller, dark bristle-bearing dots on each side of every segment. These caterpillars are found feeding in flour and manufactured foods prepared from wheat, rice, and Indian corn, through which they burrow, spinning silken tunnels and threads wherever they go. They also infest the mills where these grains are ground, doing much harm by clogging the apparatus and by destroying the fine silk gauze of the machines. When full-grown, the caterpillars spin close silken cocoons, about half an inch in length, inside which they turn to honey-yellow chrysalises, and from these again, in about three weeks' time, the perfect moths emerge. They are long, narrow moths, about half an inch in length, of a leaden-grey colour. When at rest they raise the front part of the body, and draw the wings close in to the sides. They are rather sluggish insects, and will remain still in the above position for hours. Sometimes the females assume a position something like that in which the moth of the Meal Worm (*Asopia farinalis*) may generally be observed when at rest (Fig—f). The wings are slightly parted, and the abdomen is bent backwards, so as to point upwards between them. The antennæ are folded back and, as a rule, crossed over the thorax, the first pair of legs being generally at the same time folded to the breast, and not used. The upper wings are deep grey, more or less sprinkled with black scales, and are crossed near the tip by a couple of waved angular blackish lines; about one-third of the way from the base there is another W-shaped transverse line. In the centre of the upper wings there is a black dot, which is sometimes double, as in (Fig.—c). The under wings are large and semi-transparent, of a pale drab colour, bordered by a dark line. All the wings are heavily fringed.

During the past summer a serious outbreak of this insect, which has been described as "the scourge of the Mediterranean ports," has occurred in one of our Canadian cities. On 7th August I received from the owners of a large mill some specimens of caterpillars and moths which were stated to be at that time in vast numbers upon their premises. Directly my attention was called to the matter, I feared that it might be the Mediterranean Flour Moth, and upon forwarding specimens to Prof. C. H. Fernald my suspicions were confirmed. Through the kindness of Miss E. A. Ormerod and Mr. O. E. Janson, of London, England, I have lately received typical specimens of *E. kühniella* from Germany, which Mr. Janson had carefully compared with Zeller's types in the British Museum, and these I find are identical with our Canadian-bred specimens. Immediately I received the first specimens I notified the owners of the mill of the serious nature of the visitation, and urged them to adopt extreme measures for the extermination of the pest. Later in the month the manager wrote to me as follows: "I send you some more specimens of the flies and worms. They have conquered us, and we have shut down. It is a great loss to us."

The matter was then brought officially before the notice of the Ontario Government, and under instructions from the Hon. Charles Drury, the Provincial Minister of Agriculture, prompt and vigorous steps were taken for the extermination of the pest. The investigation was placed in the hands of Dr. P. H. Bryce, Secretary of the Provincial Board of Health of Ontario, who made careful enquiries as to the introduction and possible spread of the insects from the infested mill to other similar establishments in the neighbourhood. Dr. Bryce subsequently published the results of these investigations and enquiries in a Bulletin, which was issued by the Provincial Board of Health on 19th October. This pamphlet, which is written in a clear, intelligible manner, and illustrated with figures of the insect in its various stages, will certainly be of great use to the miller, for whose use it was prepared. The history of the habits and extent of the depredations of this insect in the past are given, as to its European occurrence, from Miss Ormerod's Twelfth Report (1888), and in this country from statements made by the manager of the mill above referred to. A detailed account is then given of the habits and appearance of the insect in the different stages of caterpillar, chrysalis and moth, and of the steps which were taken to destroy the pest in the infested mill. Further measures, preventive and remedial, are suggested in case the moths should at any time appear again in other mills or feed stores.

During part of this investigation I accompanied Dr. Bryce to the infested district, and together we visited several mills and feed stores, as it was important to find out whether the insects had spread from the first mill, either by flying from the open windows or by being sent out in produce sold from the mill. We were pleased to find that it had not appeared in any of the other large mills, and that the smaller firms appreciated keenly the necessity of not keeping a large stock of farinaceous goods, and of not keeping on hand that which they handled for any length of time. It was only in one of these smaller businesses that we found any trace of the moth, and here the principal of the firm assured us that he only kept in stock such quantities of farinaceous foods as would be sold out week by week to consumers.

There was a general opinion amongst all those we visited that this insect was only the ordinary Meal-Worm (*Asopia farinalis*, L.) which may generally be found in small numbers in neglected meal or flour barrels, but which seldom does sufficient harm to be classed as an injurious insect. The present species, however, is a much more formidable enemy, and if, by the negligence of millers, it should be allowed to multiply and spread through our large American flour mills, it will be a calamity of enormous magnitude. The very facts connected with the single case which has occurred this year should be sufficient to put on their guard, all who are concerned in the milling industry. I sincerely trust that the prompt and highly commendable action taken by the Ontario Government may be attended with the success it deserves. That it may be fully understood how necessary these decisive steps were in the interests of the whole country, I give below some of the salient facts concerning this outbreak. Towards the end of August and in September I visited the mill four or five times and found the state of affairs very serious. Work had been stopped and the machines were being pulled to pieces and cleaned. The whole building, a large warehouse 25 feet wide by 75 feet deep, and four stories high, was completely overrun by the insects. Myriads of the cocoons were found adhering to the walls, joists, shelves and ceilings. Every nail-hole, crack or crevice of the woodwork, machinery and furniture throughout the whole building was found to contain one or more of the cocoons or caterpillars, and the moths were flying about in thousands. All the flour and prepared food in the establishment was found to be injured, being clotted and matted together by the webs of the caterpillars.

The following statement made by the manager of the mill, and taken from Dr. Bryce's pamphlet, gives a concise history of this outbreak, and is materially the same as was reported to me from time to time in correspondence:—

"The first appearance of the *Ephestia kühniella*, or Flour Moth, that we remember seeing was during the month of March last, 1889. The moth was seen flying about near a steam pipe in the basement of the mill and near the w. c. Little attention was paid to it, as from appearance it did not indicate any danger. In April there was an appearance of a few moths on the different floors of the mill, even at the top, but still there was nothing suspicious. In the month of May we were troubled with a few worms in some of our goods, and in June more of them appeared. In July they increased rapidly, and then we began to suspect they were from the fly which we had seen in the mill during the previous months, and which was steadily increasing in numbers. About the middle of July we shut down for a day or so, took the clothing from our bolting reels and cleaned it, and washed the inside thoroughly with soft lye soap and lime. We did the same with the elevators. When we started up again every corner and part of the mill had been thoroughly cleaned, as we supposed, and we commenced to work again; but after about four days we found our bolting reels, elevators, etc., worse than before. They were literally swarming with webs, moths and worms, even inside the dark chambers of the reels. We shut down again and made a more thorough cleaning by washing, etc. While this was going on we found there was no use to try and clear ourselves of the pest as the mill, walls, ceilings, cracks, crevices and every machine was completely infested with moths, cocoons and caterpillars, and there was no use going on. It then occurred to us that a plague like one of the plagues of Egypt was upon us. The moth was different to any of which we had had any knowledge or experience, and we decided to apply to the Dominion Government for relief and assistance. We addressed the Government Entomologist, Mr. Fletcher, and sent him samples of the moth, caterpillars, webs, etc., and received a prompt answer, which considerably alarmed us. This letter was followed by others almost daily from Mr. Fletcher and a visit from Prof. Saunders on the 17th of August. Mr. Fletcher visited us also on the 27th of August; but in the meantime Mr. Blue, the Assistant Minister of Agriculture for Ontario, visited us and took in the whole situation. It was explained to Mr. Blue that the Dominion Government had been appealed to by us, through Mr. Fletcher, the Dominion Government Entomologist, for assistance and remuneration for the loss we had sustained. Mr. Blue, considering it to be a matter with which the Local Government had to do, brought Dr. Bryce, the Provincial Medical Inspector, and submitted the matter to the Government for action. Afterwards Dr. Bryce and Mr. Fletcher came together, and finally the whole matter was left in charge of Dr. Bryce and the Provincial Board of Health.

"In the mean time we took down our machinery and subjected it to steaming. Every part was thoroughly steamed. The mill was swept down, and subjected to sulphur fumes. The walls, ceilings, etc., were cleaned, and elevator spouts and loose wooden work burnt up. Paper bags and hundreds of dollars worth of goods were burnt in the furnace, while the other bags, elevator belts and cups were boiled for hours in a cauldron of water. The machines and all parts that were not destroyed were then burnt by means of a kerosene torch, which flamed and smoked through and around every part of them until we considered we had everything clean and ready for putting together again.

"But on the 19th of September the Local Government passed an Order in Council compelling us to take more stringent steps, and on the 20th September we received an order from Dr. Bryce, which stated that before placing our machinery in position we should subject it to a thorough disinfecting process in a strong room, so arranged that steam under pressure might be drawn or driven into it.

"In compliance with this order we at once constructed a tight steam box 6 feet wide, 6 feet high and 12 feet long, and attached a steam pipe to it from the boiler. In this box we put every machine, and even our mill stones and iron rollers. This process was very expensive, and took up considerable time, as we were over a week at the process and were delayed in the placing of our machinery. The Board of Health visited us in a body during the time this process was going on and pronounced it a success. This was all done, not only in our own interests, as was pointed out in the letter of the 20th September from Dr. Bryce, but in the interests of the public health and commerce of the country.

"Having now got to the position which enables us to go to work again after two months loss of time and the loss of machinery, fixtures, stock and expense, we have arranged for remedial measures to prevent the reappearance or destruction of the pest should we ever be again attacked. We have erected a steam stand-pipe with hose or other connection on each flat of the mill building. By shutting up all doors and windows of each flat and turning on the steam simultaneously to each floor the whole building can be filled with hot live steam sufficient to kill anything. This will rust all bright parts of the machinery, but to remedy this we intend using oil on them, should we ever be under the necessity of resorting to the measure.

"Another purpose of this steam stand-pipe will be in cold weather to let on sufficient steam to moisten everything and part of the building at night, and then throw open the windows for the night and let the frost penetrate so as to kill any eggs or insects that may have become lodged in unseen parts.

"By these measures, with plenty of light, thorough cleanliness, a cold mill, and caution in taking in stock and old bags, we hope to keep free of a pest which has given us so much trouble and loss."

On the 11th December the manager of this mill writes: "I would say that we are absolutely clear of the moth, but cannot tell what the spring may reveal."

Notwithstanding all that has been done, as above mentioned, and the probable success in the mill treated, great vigilance must still be maintained, in case the pest should again start operations from another centre. Although the moths were only noticed six months before the time that they had increased in such numbers as to necessitate the closing down of the mill, there is, I think, no doubt but that they had been in the mill, but unnoticed, for some time previously. There seems to be some doubt as to the date and place whence the first specimens were introduced into Canada; but evidence seems to point strongly to a consignment of goods imported into Canada from Mediterranean ports, in 1887, consisting of "Indian cassava," "Italian semolina," Brazilian farina," tapioca and rice.

Upon enquiring if any particular kind of flour were more attacked than others, the manager of the mill writes: "If this insect strikes a mill where there is a variety of cereal products manufactured, it will work its way into every cereal product, though it likes glutenous substances best. It attacked everything we made, from pot-barley to fine farina, and milk food in tins. You ask about semolina, it is a product of Russian wheat, and is a very choice article, full of gluten."

The question as to the true origin of a new insect pest is one of some importance, because if an indigenous species which has suddenly increased in undue numbers; it is probable that this increase is due to some unusual cause, the removal of which will again bring the numbers down to the usual occurrence. If, however, the intruder be a foreign species, which has increased in numbers after introduction, owing to suitable environment, it is frequently more difficult to eradicate; but, at the same time, there is the satisfactory feature about such a visitation, that if the first occurrence be stamped out before it spreads, the injury ceases there.

Upon the appearance of Dr. Bryce's pamphlet a copy was forwarded to Washington, and the United States Entomologist was requested to insert a warning to American millers in the organ of his Department, "Insect Life." This he has done, and has published (Vol. II., p. 166) some interesting additions to the history of the insect in question. At the time of the outbreak of *Ephestia kühniella* in Canada, the only available literature of a practical nature was Miss Ormerod's excellent article in her Twelfth Report, 1888. Perhaps half a dozen articles had appeared in different publications, mostly, like the original description, in German. In publishing the note as requested in "Insect Life," Prof. Riley has added a valuable article of his own, "bringing together, in condensed form, a summary of the known facts concerning this pest," and a few points suggested by his notes and collections. With regard to its previous occurrence in America, he continues: "We had had in the National Museum collection, for some time, specimens of a moth indistinguishable from this species, from A. W. Latimer, of Eufaula, Alabama. On referring to our notes we find also that we had seen specimens from North Carolina in the collection of M. Ragonot, in Paris. These facts undoubtedly prove the occurrence of the insect in North America for at least some years back. Up to the present time the species seems to have been rare here, for every case of serious damage to grain by Lepidopterous larvæ, which has been carefully investigated, has shown that the author of the damage was either the Angoumois Moth (*Gelechia cerealella*), the Grain Moth (*Tinea granella*), or *Ephestia interpunctella* (= *zeæ*. Fitch), a congeneric insect, which was treated by Dr. Fitch under the common name of the 'Indian Meal Moth.'"

The Mediterranean Flour Moth seems not to have been known previous to the year 1877, when specimens were sent to Dr. Kühn, Director of the Agricultural Institute of the University of Halle, Germany, with the complaint that they had been very troublesome in the bolting cloths during the grinding of a quantity of American flour. These specimens were sent to Prof. P. C. Zeller, of Grunhof, and found to belong to an undescribed species of *Ephestia*, which was then named *kühniella* after its observer, Dr. Kühn.

In February, 1883. Prof. Zeller wrote to Dr. Riley: "This predaceous domestic insect appears to have died out here at Grünhof."

In 1884 and 1885 *E. kühniella* attracted much attention in Europe, and several papers were written concerning its ravages. There were five articles published in English periodicals in 1887. In one of these, by Mr. Sydney Klein, whose observations were made from May to September, 1887, on an immense colony of larvæ which had overrun some large warehouses in London, and of which fumigating with sulphur, and hot-liming the floors, did not prevent the spread—the interesting information is given that "a small ichneumom fly destroyed the pest by September." In speaking of the source whence the English outbreak was introduced into the London warehouses, Mr. Klein writes in the *Mark Lane Express*, 14th November, 1887: "Now, with regard to the origin of *E. kühniella*, I found that the larvæ originated in some meal shipped from Fiume, on the Adriatic, over two years ago"—that is in 1885.

At the end of his article Prof. Riley gives a list of the materials from which he has bred *Ephestia interpunctella* (Fig. 9), a species which might be confounded with *kühniella*, and which, indeed, was found in small numbers with it in the infested Canadian mill. To show the omnivorous nature of this insect I give Prof. Riley's list of substances from which it has been reared: Wheat, meal, corn, dandelion roots, chickasaw plums, sugar, dry opuntia, old books, pecan nuts, cinnamon bark, English walnuts. Prof. A. J. Cook also mentions it as a pest in bee-hives, and I have myself bred it in numbers from European almonds, of which the larvæ had eaten both the soft shells and the kernels. With regard to the life-history of *E. kühniella*, although the perfect insects might probably be found at any time of the year in heated mills, most authorities speak of two broods—one in spring, the other in autumn. This would probably be the case in mills and warehouses not artificially heated. Judging from caterpillars collected in September, which were then full grown, this insect hibernates as a caterpillar and turns to a chrysalis about three weeks before the moths emerge the following spring. Of a large number of caterpillars collected in the beginning of September nearly all spun cocoons at once; but although most of the specimens have pupated and given the moths, a few are still caterpillars and seem to be in a semi-torpid condition. Miss Ormerod writes, Rep. XII, p. 69: "The attack may be considered as going on constantly where temperature is suitable, for we have notes of appearance of the moths in May, June, July, November and December; and intermediate observations of larval or pupal presence point to this, which, when once established, is indeed a mill or flour *scourge* as being a year-round pest." And later on the same lady writes: "In answer to your enquiry regarding winter condition and number of broods, I should say that I gather

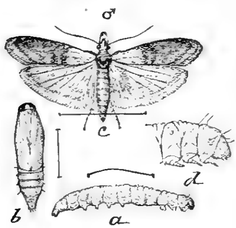

Fig. 9.

from reports sent in that where there is warmth (as inside a mill) that there is no definite succession of broods, but that the pests are present constantly in all stages."

In the month of September last, moths were found flying in large numbers in the infested mill, as well as caterpillars of all sizes, and in my study moths have continued to emerge and lay eggs until the present time (December 15).* The eggs are very small, $\frac{1}{40}$ of an inch in length, twice as long as broad, elongated and somewhat kidney-shaped; when first laid of a semi-translucent greenish white tint, which changes to a pinkish hue as the young caterpillar takes form within. The caterpillars emerge (at this time of the year and in a warm office) about 19 days after the eggs are laid, and are very slender, active little creatures, not more than $\frac{1}{16}$ of an inch in length, when first hatched of a pinkish brown colour, with dark heads, and are covered with long, slender hairs. The eggs are laid singly or in strings of from 3 to 15. They are supposed to be laid on the outside of sacks, through the meshes of which the young larvæ work their way as soon as hatched. They crawl about quickly until they find a place in their food which suits them. They then spin a few silken threads round them, and begin their life of destruction. The general appearance of the full-grown larva is given above, at the head of this article. Its habit of spinning a silken thread wherever it goes, and also of spinning silken tunnels to live in are characters which make this insect even more obnoxious than the injury it does by destroying produce. By these webs the grain-products are rendered unfit for sale, and the machinery of the mills is clogged up so as to cause a constant loss of time as well as a direct expense in cleaning the different apparatus. Prof. Riley in his paper in "Insect Life," already referred to, figures the stages of *E. interpunctella* in comparison with those of *E. kühniella* in order that both may be recognized. The excellent figures (No. 8 and 9), used herewith, have been lent to me by Prof. Riley for the illustration of this article. Speaking of the similarity of these insects, he says: "The early stages are rather similar, but the larvæ may be distinguished by the following characters: the larvæ of *kühniella* are more slender and of a more uniform diameter than those of the other species; the abdominal legs are longer, cylindrical, with a circular fringe of hooklets at the crown; in *interpunctella* the legs are short, conical, with the fringe of hooklets at the crown oval. All piliferous warts in *kühniella*, most of which are rather minute, are still rather prominent, readily observed, and of a black or brown colour; those most conspicuous are, the lateral ones each side in front of the first spiracle, the sub-dorsal one each side of the meso-thorax, almost completely encircled by a narrow black ring, interrupted only at its upper margin. In *interpunctella* all the warts while present, are con-colorous with the rest of the body, and can be distinguished only with great difficulty. The surface of the body of *kühniella* is almost perfectly smooth, while that of *interpunctella* is somewhat granulate."

The moths of the two species are quite different, *interpunctella* being slightly smaller, but having the wings yellowish fawn colour at the base and red mottled with purple at the tips, the two colours being separated by an abrupt line across the wings. (Fig. 9).

Remedies.—The remedies which were adopted in the outbreak recorded above have already been given. In addition to these some others were tried. Spraying gasoline was not found to be practicable. Fumigating with sulphur, to be successful, requires to be very thorough and often repeated. Bisulphide of Carbon was suggested, but was not tried. A kerosene emulsion was recommended, and would probably have been useful; but it does not appear to have been tested. The experience and final conclusion of all who have had the misfortune of being visited by this pest is, that, the only safeguard is scrupulous cleanliness. In Canada, where we have severel months consecutively of winter weather, when no insects breed, there should not be much difficulty in keeping this pest down, if millers will only recognise the danger of being indifferent. I do not think that any degree of cold will kill the insects if left undisturbed in their silken tunnels, but if by constant sweeping these

* Larvæ from these eggs are now (Mar 21) full grown.

are broken and the caterpillars left exposed, cold will certainly injure them. Four full-grown caterpillars were taken from their silken galleries and placed out of doors in a small phial when the thermometer was standing at 5 degrees above zero (Fah.), they were left there for half an hour, and when taken in again rattled like glass beads against the sides of the bottle. Of these, two never recovered at all, and the other two, although they retained their natural appearance for about a fortnight and moved their bodies a little, they never recovered.

The great difficulty, as shown above, of eradicating this moth when once it establishes itself, will, I trust, induce millers to pay attention to this matter and put a stop to its operations, before it becomes too numerous to manage. From the mill manager's report on the results of the above treatment, I believe it is not too much to say that the prompt and thorough measures undertaken by the Ontario Government and the owners of the mills which were infested by *Ephestia kühniella*, have succeeded in exterminating what threatened to be a national calamity.

Scrupulous cleanliness in every way seems to be most important, the moths preferring old, stale flour to lay their eggs upon. This, of course, will sift and blow into all cracks and corners, but every effort should be made to keep mills clean.

Miss Ormerod, upon being informed of the state of affairs in our Canadian mill, very kindly sent all recent information at her disposal concerning remedies which had been tried in England, and has sent a letter from the owner of mills in England, which were badly infested in 1888. Her correspondent writes: "Unfortunately, they are still here, but as I took measures in the spring, and in fact all along, to keep them under, I have not been troubled this year anything like what I was last. The measures I adopted were: in the spring, just before the moths begin to appear in any quantity, to have the mill and all machines thoroughly cleaned, and have since made it a rule to stove the place every Saturday night, or as often as necessary, with sulphur, burning 1 cwt. each time. This kills all the moths and acts as a great check on them, so much so that I am again hoping to get clear of them, by carefully watching for their appearance next spring and stoving them as they come out. I have not been troubled with the grubs this year, and were it not that I know from sad experience the damage they do, should not now trouble about them." Miss Ormerod, commenting on this, says: "I think, on the whole, you will consider the letter satisfactory. When the attack first came under my notice the caterpillars were absolutely clogging the machinery, and the steady improvement in the state of affairs also points to the benefit of great cleanliness."

GRANARY WEEVILS.

(*Calandra* (Sitophilus) *granaria*, L. and *C. oryzæ*, L.)

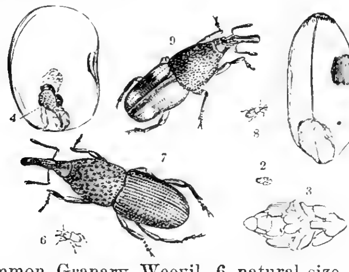

Fig. 10. The Common Granary Weevil, 6 natural size, 7 enlarged. The Rice or Spotted Granary Weevil 8, 9.

Attack.—Small, dark-coloured, narrow beetles, rather more than ⅛ of an inch in length, with their heads prolonged into a slender snout. These insects, both in the grub state and as perfect beetles, sometimes destroy large quantities of grain when stored in granaries.

Several enquiries are received every year concerning the habits of the "grain weevil". Many of these do not refer to the true granary weevil, the word "weevil being as a rule very inaccurately applied to almost any insect which attacks crops. Its use, should properly be limited to a class of beetles which have their heads elongated into a snout, at the end of which the mouth parts are situated. This inaccurate use of terms is frequently the cause of much loss of time. Information is asked concerning insects of which no description is given, except perhaps the name of the crop it feeds upon. The following are specimens of some of the descriptions which have been sent in to me: "A loathsome bug on my grapes;" "a nasty insect on my turnip crop, of a greenish colour;" "like the common slug, which hangs on a thread from shade trees." Now, such descriptions as the above simply mean that great loss of time is necessitated. First of all, a fuller description has to be written for, and then by the time this is received, the injurious insect is identified, and the proper remedy sent off, it is more than probable that it will be too late to save the injured crop. Above all things, it is necessary, when asking for information and remedies for injurious insects, to send specimens whenever possible.

The power of the granary weevils to destroy grain, when held for any length of time in warehouses, is enormous. These insects are not natives of North America, nor is it at all likely that that they will ever increase sufficiently in Canada, where we have such cold winters, to be rated higher than third-class pests. It is true they occasionally destroy samples or small quantities of grain kept in heated offices or stores, but this injury cannot compare with their ravages in hot climates. In the Southern States and in South America they have occasionally done considerable harm, but their ravages are most serious in India and the south of Europe. In the old times of long passages from the East the injuries to cargoes of grain were much heavier than at present, but even now care is necessary in the grain warehouses of England, lest stored grain should be destroyed by weevils introduced from an infested cargo.

The most extensive article upon these weevils, has lately been published by the Government of India, as "Notes on Economic Entomology." No. 1, "A Preliminary Account of the Wheat and Rice Weevil in India," by E. C. Cotes, in 1888. In this pamphlet not only is much valuable information given concerning the occurrence of the Rice Weevil in India, but full notes and extracts are given from the literature of the two species in all parts of the world. Mr. Cotes says: "The amount of loss occasioned by weevil (in India) every year is estimated by Messrs. Rallie Bros. at an average of $2\frac{1}{2}$ per cent., the maximum being 5 per cent., and the mininum 1 per cent. Taking the value of wheat exported at £6,000,000 sterling, the annual loss occasioned by weevil in exported wheat alone is £150,000 sterling. This sum, however, in reality represents but a fraction of the real loss, as it does not take into account the damage done to wheat consumed in the country, or any of the loss occasioned to rice, which is also attacked by the same weevil, besides the loss indirectly occasioned owing to the difficulty of storing the grain."

"In the Transactions of the Entomological Society, London, 1870, Proceedings, p. 15, is an account of Spanish wheat attacked by *C. oryzæ*; also of American maize attacked by the same insect. From 74 tons of the former 10 cwt. of weevils had been screened; from 145 tons of the latter 6 cwt. and afterwards 79 cwt. of weevils were screened." (*Cotes, Indian Wheat and Rice Weevil.* P. 23.)

The insects which caused the loss above referred to, belong to two distinct species. In general appearance, size and habits they are very similar, but may always be easily separated. *Calandra granaria*, the common "Granary Weevil," is slightly the larger of the two, the whole body is of a deep brown, sometimes almost black, and it has no wings beneath the hard wing-cases; while *C. oryzæ*, the Rice Weevil is paler in colour, has two yellowish blotches on each wing-case, and also possesses well developed wings.

Although their legs are short, they are very active little creatures, especially in warm weather or when the grain which they are infesting is disturbed. They will then come to the surface and run rapidly about in all directions. They seem very fond of warmth, and a high temperature is necessary for them to breed freely.

"As warmth is requisite to their breeding freely, everything which will keep down the temperature of the infested corn is useful, more particularly as where they are in great numbers, considerable heat is engendered (as is well known in the case of infested corn-ships), by the results of their accumulations of frass or workings. This is so well known that I have received enquiries from shippers as to whether the heat generated the beetles. This is certainly not the case. It is the beetles and maggots which generate the heat; but at the same time, the heat is so favourable to their reproduction that under such circumstances they multiply the quickest. In Germany "air-drains" are used to cool the heaps, and this is considered the surest way to prevent damage. Drain pipes are laid in various directions through the heaps, and the temperature of the heaps and the surrounding atmosphere is thus considerably lowered. (*Ormerod, E. A. Rep. XI., p.* 74.)

Samples of wheat, barley, pot-barley, malt and maize have been sent to me which had been injured by these insects, and in most cases contained the perfect beetles. The life-history is as follows: The eggs are laid by the females inside minute holes which she drills into stored grain of various kinds. This, however, always takes place inside granaries or storehouses, and never in this country, as has been supposed by some of my correspondents, in the grain as it stands in the fields. Even in India, where the Rice Weevil is indigenous, all the evidence is in favour of the view that it only attacks dry stored grain. As a rule, there is only one egg deposited in each kernel; this soon hatches into a fleshy, white, legless grub, with a brown head, which feeds upon the inside of the grain, and by the time it is full grown has usually reduced the seed to a mere shell. It passes through all its stages, from the egg to the grub, and from the grub to the chrysalis, and from the chrysalis to the perfect beetle, inside the grain in which it hatched. The minute holes which the female bores for the reception of the eggs are generally on the concave side of the grain, at the end occupied by the germ, where the outside is softest. In a colony of *C. oryzæ*, however, which I have now before me in a glass jar and which was imported from India last spring, I find that a few grains of American maize which were placed in the jar about September have been punctured indiscriminately all over the surface, but most of the grains are only bored at the soft germ-end. With regard to the deposition of the eggs, Prof. Riley as quoted by Miss Ormerod. (The Entomologist XII, page 207, 1879), says: The puncture is somewhat curved, rather less than $\frac{1}{16}$ inch deep, and rather narrower at the bottom than at the opening; the egg, which is 0. 5. mm. long, elongate, ovoid, and translucent, is pushed to the bottom, and the whole space above it is then filled in with particles of grain gnawed into fine powder-like flour, the orifice being pasted over with a little saliva."

As stated above, I do not think that we shall ever be seriously troubled in Canada by the attacks of granary weevils. This is mainly owing to our cold winters, for I have found that these insects, which are in other ways possessed of a most marvellous tenacity of life, are very susceptible to cold. With regard to their powers of vitality, I have now before me some specimens of both *granaria* and *oryzæ* which were taken out for examination and comparison. They were placed in methylated alcohol and left for two hours; I then took them out, dried them and mounted them, by sticking them with shellac varnish to slips of card-board. In an hour's time time they were all seen to be moving their legs. They were then placed for two hours in an exceptionally strong cyanide of potassium bottle prepared in the ordinary way for killing insects, and which killed specimens of the Mediterranean Flour Moth in 30 seconds. They were left in this bottle for two hours and then removed to a cabinet. An hour afterwards, to my amazement, they were again moving their legs about, as if nothing had happened to them. Low temperature, however, seems not only to prevent their breeding but actually to kill them. Of the two species, the Rice Weevil appears to be the more sensitive to cold. Miss Ormerod records (Rep. XI, 1887) that even in the cl mate of England, and in the temperature of a living room constantly used, very few specimens came to maturity, and of those which did, after fourteen months there had been only one small brood, of which many were dwarfed or imperfect. In cold climates, therefore, it would seem that there should be no great difficulty in keeping these weevils in check; but in India, from data given by Mr. Cotes, it seems almost an impossibility to keep grain for any length of time unless it be buried beneath the ground.

Remedies.—Owing to the fact that the granary weevils hibernate in the perfect state, and that they are easily killed by intense cold, the only remedies which need be considered in this country are those by which infested granaries are well ventilated, and thrown open to the frosts of winter.

Miss Ormerod quotes a correspondent as follows: "We unfortunately have had a great deal of experience of the mischief done by these animals. They breed very rapidly, we find, in warm weather, particularly in wheat from Russia, but can usually be got rid of by turning the wheat in frosty weather, if the warehouse is in an open situation with a good through draught. Sometimes during a mild winter it is impossible to get rid of them. This was the case in the winter of 1884-85; we lost between £1,000 and £2,000 on a single cargo of Russian wheat from this cause. As a rule, weevils are imported every year in Russian and Indian wheats, and do more or less harm in the autumn, but are got rid of in the first severe frost."

Last spring a consignment of various kinds of Indian grain was received at the Experimental Farm direct from India. Upon opening the samples many of them were found to be swarming with the two kinds of granary weevils. The parcels were exposed in an open barn for a week or two, during which time the thermometer several times went below zero (Fahrenheit). When the samples were afterwards examined every beetle was dead. For fear, however, that there might be eggs or larvæ in the grain, the samples were placed in large glass jars and subjected to the vapour of bisulphide of carbon. Not a weevil has been seen in samples of these grains which have been kept for the Museum.

The bisulphide of carbon treatment of seed grain of various kinds is now largely used by seed merchants on this continent, and with decidedly good results. It is probably due to the careful treatment of seed peas, more than any other cause, that the ravages of the Pea Weevil (*Bruchus pisi, L.*) have been brought down to almost nothing within the past few years.

The following is from Mr. Cotes's pamphlet: "Professor Church, in a memorandum issued by the Revenue and Agricultural Department, recommends the use of bisulphide of carbon. This would appear to be deserving of careful experiment, bisulphide of carbon having been utilized in a somewhat similar way against the Grain Moth (*Gelechia cerealella*) in America. He writes: 'The only cheap and perfect application for the prevention of the attack of weevil upon corn and grain consists in the employment of bisulphide of carbon. The quantity required, provided the grain is kept in closed vessels, is very minute, not more than 1½ lbs. to each ton of grain, so that 8d. is the cost of preserving a ton of wheat. The bisulphide leaves no disagreeable taste or smell behind, but the quality of the grain remains unimpaired.' "

A letter is also published from Mr. L. O. Howard, Assistant United States Entomologist, which gives the best method of using this substance:—

" In the absence of Prof. Riley, I beg to acknowledge the receipt of your letter transmitting specimens of ...—— *C. oryzæ*. Clearing up and disinfecting granaries, filling up cracks and crannies, and trapping the beetles in rags and wool, are all very well as methods of ridding the granary from these creatures. It is, however, considered a very good idea here, in America, to establish a large quarantine bin, into which all grain is put after receipt, and disinfected by means of a little bisulphide of carbon. It is then removed and stored away. The bin in question must be made as tight as is possible, and the method of using the bisulphide is to place a pound or so in a shallow vessel on top of the grain. The vapour of this rapidly volatilizing substance is heavier than air, and sinks through the mass, destroying all contained insects. Care should be taken in its use, on account of its extreme inflammability.

The airing which the grain will get in removing it from the bin will probably be sufficiently to rid it of the odour. This remedy was first proposed by Prof. Riley in 1879."

For the treatment of infested peas, large sheet-iron cylinders are specially made for the purpose, with close-fitting caps.

SPRAYING WITH ARSENITES.

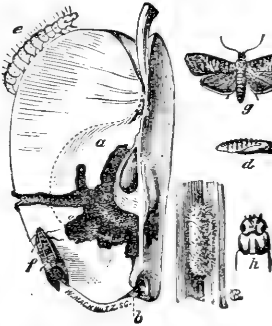

Fig. 11. The Codling Moth.

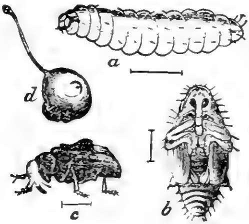

Fig. 12. The Plum Curculio.

The Codling Moth (*Carpocapsa pomonella*, L.) Fig. 11.

Attack. — A white or pinkish caterpillar, about $\frac{3}{4}$ of an inch in length, boring into the centres of apples, and injuring them considerably. These worms spin up and change to chrysalises inside close cocoons, in the crevices of bark, or when barrelled with the apples, in any crack or crevice of the barrel. The moth is a beautiful little insect, easily distinguished by a bronze mark towards the end of each of its upper wings.

The Plum Curculio (*Conotrachelus nenuphar*, Herbst.) Fig. 12.

Attack.—A small crescent-shaped mark, with a single hole in the centre, upon the sides of plums, apples, cherries and peaches. This injury is caused by the female beetle (Fig. 12 c), which makes these marks in the operation of egg-laying. An egg is laid in the central spot, from which hatches a white grub (Fig. 12 a). This soon destroys the fruit. Plums drop very soon, apples become distorted, and peaches either drop or become distorted and disfigured by large blotches of gum.

The injuries by the two above-named insects (Figs. 11 and 12) are amongst the most serious from which the fruit grower has to suffer. The remedies which are most satisfactory come under the head of "Spraying with Arsenites."

Undoubtedly one of the most important discoveries which has ever been made in economic entomology is that of the utility of the arsenites as insecticides. Although, of course, it is perfectly true that materials containing arsenic must necessarily be, not only poisonous to all animals which may eat them, but also, if unskilfully used, injurious to vegetation as well, these points cannot be, I think, successfully urged against their use when we consider the great benefits which are to be derived by the farmer and fruit grower, when he uses them with due care and in accordance with the instructions given by entomologists who have tried them. There is much available literature upon this subject. No one will to-day question the efficacy of Paris green as a useful remedy for the attacks of the Colorado Potato Beetle —and it has been lately proved that spraying the arsenites upon apple trees for the Codling Moth larva, which is commonly called the "Apple-Worm," and upon plum and cherry trees for the Plum Curculio, are practical and satisfactory remedies. My own opportunities for extensive experimenting with these substances have been somewhat limited. Although our orchard at the Central Experimental Farm contains now 1,300 trees, none of these are old enough as yet to bear fruit, but the subject is one of such importance, and such good results have attended my own and the careful experiments of other entomologists who have studied the matter, that I consider it my duty to draw the attention of our Canadian fruit growers to the subject: The advantage of spraying plum trees, &c., for the Curculio is not so pronounced as it is with the Codling Moth, for which insect I consider it the best remedy. In the report of the United States Entomologist for 1888 is a full article upon the Plum Curculio by Prof. Riley and Mr. Howard. In this report we find the following:—

"There can be no doubt but practical use has demonstrated that the jarring method is the most effective way yet proposed for destroying these insects (Plum Curculios)."

"*Spraying with Arsenical Mixtures.*—Testimony as to the efficacy of this remedy is variable, but theoretically it is a sound one, and such experiments as have been made indicate that it will pay to spray trees for this purpose.

"The testimony which we have so far given is all favourable, in a greater or less degree, to the use of the arsenical sprays against the curculio. The remedy has had to make its way to popular favour against great odds, and so many people have taken part in placing it before the public that it is useless to attempt to give any one individual particular credit. The successful use of arsenical mixtures against the Canker Worm and the Codling Moth has done away with a great part of whatever fear of the poisonous nature of these substances existed, and the objectors to its use have been, for the most part, those who were more or less familiar with the habits of the insects, and who decried the use of this remedy as inconsistent with what they knew of their habits.

"On the whole, the remedy is one which is a desirable addition to our list, although it will never become so great a success as the application of these poisons for the Codling Moth."

Since the above was written, several careful experiments have been made by leading entomologists, and the conclusions they have come to are all in favour of the treatment. Prof. A. J. Cook, of Michigan, has published a paper in the Proceedings of the Society for the Promotion of Agricultural Science (Meeting X), held at Toronto, August, 1889, in which he says: "I believe I am warranted in the following conclusions: The arsenites and carbolized plaster will protect against the Plum Curculio, if they can be kept on the tree or fruit; but in case of very frequent rains the jarring method will not only be cheaper, but much more effective. Again, as our wild fruits are more cleared away we must have plums in our orchards to protect the apples from the Curculio. When apples are seriously stung they become so gnarled and deformed as to be worthless. It will pay then to set plum trees near by or among the apple trees. Then we shall escape mischief among our apples from the Curculio, and shall only need to spray our apples once to destroy the Codling Moth, and can treat the plum trees three or four times with Paris green or carbolated lime in case we have only occasional showers, or can jar the trees when the rains are very frequent. For the apples, we can use London purple, 1 lb. to 200 gallons of water. For the plums we must use Paris green, 1 lb. to 200 or 300 gallons of water. If the carbolated plaster is preferred, we use 1 pint of crude carbolic acid to 50 lbs. of land plaster. This is thrown freely over the trees, so as to strike every plum on the tree which is being treated." "London purple is more injurious to foliage than Paris green. This is doubtless owing to the soluble arsenic which is quite abundant in London purple, and almost absent in Paris green. The coloured water after London purple fully settles is very destructive to foliage." London purple may be used on apple, plum, cherry, pear and most ornamental trees, but on these should never be stronger than 1 lb. to 200 gallons of water. If the application is to be repeated, as it must be for the Curculio, to prove effective, or if it is to be used in June or July, Paris green should be used in the same proportion as above, or else we should only use 1 lb. of London purple to 300 gallons of water. If the arsenites are to be used on the peach for the curculio, Paris green only should be used, and that not stronger than 1 lb. to 300 gallons of water."

In the same number of the Proceedings of the Society for the Promotion of Agricultural Science is a paper detailing some very careful experiments made by Prof. Clarence M. Weed, Entomologist and Botanist to the Ohio Agricultural Experiment Station. The following are his conclusions: "This series of experiments, carried on through two seasons upon two varieties of cherries and four varieties of plum trees, during which a grand total of 65,500 have been individully examined, seems to me to confirm the conclusions provisionally announced one year ago, which may now be put in the following form:—

"1. That about three-fourths of the cherries liable to injury by the plum curculio can be saved by two or three applications of London purple in a water spray, in the proportion of 1 oz. to 10 gallons of water.

"2. That a sufficiently large proportion of the plum crop can be saved by the same treatment to insure a good yield when a fair amount of fruit is set.

"3. That if an interval of a month or more occur between the last application and the ripening of the fruit, no danger to health need be apprehended from its use.

"4. That spraying with the arsenites is cheaper and more practical than any other known method of preventing the injuries of this insect."

In Bulletin 7, of the Iowa Agricultural Experiment Station, (Nov., 1889), Mr. C. P. Gillette gives an account of careful experiments carried on during the past season for making tests and comparisons of remedies for the destruction of the larvæ of the Codling Moth. Trees were treated with carbolized plaster, 1 pint of crude carbolic acid mixed thoroughly with 100 lbs. of land plaster. The application was made by throwing the powder over the trees early in the morning, when the dew was on the leaves. This treatment was the least successful, and the author wisely remarks: "This remedy could hardly be recommended, even if very good results were obtained, as it does not kill the insects in any of its stages, but simply repels the moths, which seek the fruit of neighboring trees on which to lay their eggs."

One tree which was treated with London purple, 1 lb. in 100 gallons, sprayed on it once upon 14th June, the time that the young worms hatched in Iowa, was about as well protected as any of those experimented with.

The experiment with Paris green and plaster proved very successful. Two trees were used (numbered 12 and 13). "Number 13, which was treated once, and which having a smaller number of apples is less valuable in the experiment, had ·02 of its fruit wormy, or an apparent saving of ·62 of would-be wormy fruit; while tree 12, which was well loaded and which received three applications, had but ·00⅓ of its fruit infested, an apparent saving of ·94 of fruit that without treatment would have been wormy. I think that in the above case two applications would have done nearly or quite as well as the three. Poisons cannot be applied by this method as rapidly or easily as by means of a force pump, but it has the advantage of costing nothing for apparatus, and the trees can be dusted quite rapidly from a waggon by driving on the windward side of a row. This method of applying the poisons would be specially useful where only a few trees were to be treated, and when it is thought that a pump cannot be afforded."

In addition to the above, I have received several letters from fruit growers in different parts of Canada, who have sprayed their trees to protect them from insect enemies. Mr. Alex. McD. Allan, President of the Fruit Growers' Association of Ontario, wrote to me on 12th January, 1889: "My experience has been most undoubtedly that judicious spraying with Paris green saved the plum crop from the Curculio. For some time I was strongly under the impression that the remedy did not kill the insect, but that possibly there was some odour which was so obnoxious that it left without further trouble. Lately, however, after closer observation, I am more inclined to think that the poison applied in proper season destroys the insect, which, I feel satisfied, feeds liberally upon the fruit, not of the plum alone, but other fruits as well, notably the cherry and apple. I know there are those who say they have no faith in the remedy, but I cannot help this. It is possible such are merely assertions based on some theory; but when we have practical results from practical experience we are apt to abide by the results rather than trust to theory." And later, on 17th

December, 1889, Mr. Allan writes: "I prefer Paris green to London purple, as it is generally more reliable in quality. I would specially urge growers never to use the poison when the bloom is on the trees, as it then accomplishes little if anything, and injures our interests by destroying our good friends, the bees. It should be used as soon as the fruit is fairly formed. The quantity to use depends on the quality. If good, I use a teaspoonful—not heaped—to a common patent pail of water."

Mr. Linus Woolverton, Secretary of the Fruit Growers' Association of Ontario, writes: "Spraying with Paris green is more or less done by all our best orchardists in an irregular manner, but not with the regularity and system which its importance demands. London purple is used very little indeed. I have used it for experiment in my orchard, but see no special advantage in it over Paris green. With regard to spraying with Paris green for Curculio, I am a strong advocate for it, both from my own experience and that of my neighbours. But to be effective it must be done very early, as it is the parent beetles we have to poison before eggs are laid. I have succeeded in growing fine crops of plums where the poison is applied immediately after the petals fall, but when neglected longer I have little success. I find that much caution is necessary in making the mixture, as the plum will not stand as much poison as the apple, and very often both plums and foliage will fall, as the result of spraying with a little too strong a mixture. One ounce of green to twelve gallons of water is strong enough for the plum foliage. The application will have to be repeated if followed very soon by a rain storm. I have hesitated about applying Paris green to my peach trees, for the foliage is still more tender than that of the plum, and is very easily affected. I would not like to apply more than 1 ounce in 20 gallons of water, but have no experince to offer. Even with the apple and plum I have caused all the fruit and foliage to fall when more than 1 ounce to 10 gallons of water was applied."

On the 5th July, 1888, Mr. Woolverton sent me some apples badly infested by the larvæ of the Codling Moth. "These," he said, "are from trees not sprayed; from those sprayed I cannot get any with worms, but those left without are worse than usual. Notice that the worm has not entered the calyx end, but on the side. I think this is the case in at least half the apples affected. I also send you samples of peaches, showing the alarming condition of the crop just now, a very large percentage being stung (by the Curculio), and dropping off."

Mr. W. H. Moore, of Peterborough, also writes: "Spraying plum trees with Paris green for killing the Curculio pest answered well on the trees upon which I tried it."

Mr. E. D. Arnaud, of Annapolis, Nova Scotia, found that one spraying was not sufficient, as, late in the season he found plums under his trees containing the grubs of the beetle. This is in accord with the usual experience of other observers. It is necessary to spray at least twice, owing to the known lengthened period during which the Curculio lays its eggs.

From the foregoing it can be plainly seen, that it decidedly pays to spray fruit trees as a protection against the various enemies which attack them. This should be done as soon as the petals have dropped, which in most varieties will be before there is a very large surface of foliage. This will not only destroy the young caterpillars of the Codling Moth but the larvæ of many other leaf-feeding insects, as the Canker Worm and the Leaf Rollers, although it is true these last are protected for some time by being supplied with food inside the leaves they have curled up before the spraying; but when these are consumed, fresh leaves, which have been poisoned, will have to be consumed. The Lesser Apple-leaf Folder, *Teras minuta*, Robs. (*Teras malivorana*, Le Baron) was sent to me from Abbotsford Que., by Mr. W. M. Fisk, where it was stated to have done "considerable damage in orchards for three years past. In some orchards they are so bad as to completely defoliate the trees, which now (28th May) have the appearance of having been badly scorched. This is particularly the case in a neighbour's orchard, where the trees have not been sprayed with London purple. They are most difficult to reach with poison, as they are so well protected by being rolled up in the leaf, that they feed for some time without coming to grief;

still, where prevalent, trees that have been sprayed are much freer from them than those which have not." For spraying the arsenites over trees some kind of force pump and spray-nozzle is necessary; but the saving in the crops saved in anything but a very small garden will much more than pay for the original cost in a single season. It is necessary that these arsenical mixtures should be thrown on to the trees in a fine spray, and only sufficient of the mixture to thoroughly dampen the leaves. As soon as the liquid begins to drip from the leaves the spraying must be stopped. If the operator does not possess a proper spraying-nozzle, for a small number of trees or for a short time, a spray may be made by holding the thumb or a finger over the outlet, this however soon becomes very tiresome, and is at best a clumsy substitute for a cheap instrument.

Of the materials mentioned, I think there is no doubt that the best results will be secured by using Paris green, and I do not think that it ever need be used stronger than 1 lb. to 200 gallons of water. I have used it much weaker than this with good results. It must not be forgotten that this material is very heavy, and must be constantly stirred to keep the particles in suspension when mixed with water.

"BLACK KNOT" OF THE GRAPE.

In May, 1888, I received from Mr. L. A. Woolverton the following letter and the specimen mentioned therein, which he considered the work of some parasitic fungus: "Find enclosed a small portion of diseased bark from one of my Salem grape vines. It first made its appearance last spring. I cut it off, and thought nothing more of it. Last fall when I was covering my grapes I found that it had spread on the two branches of the vine to the extent of 16 or 18 inches. It peals off with the old bark, and leaves the wood quite healthy. The vine is otherwise in good condition, and I would like to know what this is.—*T. Neelam, Port Hope, Ont.*"

The specimen enclosed was a solid soft excrescence, about an inch long by half an inch high. The tissues of the bark seemed to be torn asunder and the spaces filled up with a powdery corky growth. Being unable to detect any fungous cause for this injury I forwarded it to Prof. W. G. Farlow, of Harvard University, for an authoritative opinion. His answer was as follows. "The trouble is not due to a fungus. This peculiar kind of excrescence has in Germany generally been attributed to cold and severe weather in winter. How well that may apply to your case I do not know. The trouble, however, is climatic rather than fungous."

During the past autumn further specimens of this same disease have been received from Mr. G. E. Fisher of Freeman, Ont. who had found it in some abundance upon his Champion grape vines. He writes: "The Champion is the only variety I found it upon. It extends along the whole of the old wood from about four inches above the ground; the roots are quite clean, at all events I could not discover any traces of it on them. My Champion suffered more than any other variety from the late frost last spring, and had very little fruit."

This disease has been studied both in Europe and in this country. In Bulletin 8 of the Botanical Division of the United States Department of Agriculture, Mr. B. T. Galloway gives a concise account of the disease, which is known by the French under the name of *Broussins* and by the Germans as *Krebs* or *Schorf*. Mr. Galloway says under the action of the frosts of autumn and winter, and especially those of spring, peculiar malformations are developed upon the roots, the root-crown, the side branches and the shoots left after pruning."

The appearance and nature of the galls is then described and as a remedy cutting off the branches down to the healthy part is advised, which is the only means of arresting the growth of unhealthy tissue.

THE LARGE RED-HEADED FLEA-BEETLE, (*Systena frontalis* Fab.)

A very troublesome pest in the shrubbery and on the seed beds of the Botanic Garden, at the Experimental Farm during the past summer, was the Large Red-headed Flea-Beetle. Young plants and low shrubs of a great many orders were attacked.

Their ravages were particularly noticeable upon some species of *Althea*, *Hibiscus* and *Weigelia*, and upon some young grape vines. Few plants, however, seemed to come amiss to them. This injury was all done by the perfect beetles, which are black, with a red patch on the top of the head in front. The body is slender and elongated, about $\frac{1}{6}$ of an inch in length by $\frac{1}{16}$ in width at the widest part. The jumping legs are well developed, and when at rest stick out conspicuously from the sides. This beetle belongs to the *Chrysomelidæ* a large family of injurious beetles, including also the much smaller Cucumber and Turnip Flea Beetles.

THE MARGINED FLEA-BEETLE, (*Systena marginalis*, Ill.)

In the month of August the leaves of the Service Berry (*Amelanchier Canadensis*, T. and G.) upon the Experimental Farm were badly attacked by the above named species, the parenchyma being eaten and the ribs only left, giving the bushes a rusty and seared appearance. Oaks, and to a less degree, elms and hickories, also showed their ravages. This species is smaller than the last mentioned, and not so slender. Specimens varied from $\frac{1}{8}$ to $\frac{3}{16}$ of an inch in length. The mature beetle is honey-yellow in color, with a narrow black stripe running down the outside edges of the thorax and wing-cases.

Dusting the foliage with a mixture of 1 part of Paris green to 20 of flour was found to be a successful remedy.

FULLER'S ROSE-BEETLE, (*Aramigus Fulleri*, Horn.)

Attack.—Larva—A thick white legless grub, when full grown $\frac{1}{4}$ of an inch in length, the body curved, wrinkled above and flattened below, covered with short tawny bristles. Head yellow with dark, black-tipped, sharp mandibles, with which it consumes the young rootlets of various greenhouse plants.

Beetle—The perfect beetle is a brown weevil, a little more that $\frac{1}{4}$ of an inch in length, with a short thick snout, and long slender antennæ or feelers, bent abruptly in the middle. The wing-cases are indistinctly striate, and bear rows of large punctures and minute hairs. A whitish stripe runs along the sides of the thorax and half way down the sides where it terminates as an oblique white dash, reaching to the middle of each wing-case. These beetles lie hid during the daytime, but come out at night and feed upon the foliage of various plants.

On 12th December I received word from Alderman Charles Scrim, florist, of Ottawa, that he had discovered this insect in his extensive greenhouses at Stewarton. I immediately went to investigate the matter and found that in a large house, 150 feet long by 20 feet wide, where plants of various kinds were grown for winter flowers, the foliage of a great many species had been very much disfigured and eaten. There was in this house a collection of 1,700 rose bushes. These had been imported from a florist in the United States. Ever since they had been in Mr. Scrim's hands they had been sickly looking, and had never thriven as they ought to have for the attention they had received. The beetles had not been noticed until the present autumn, when their attacks upon the rose bushes as well as upon the foliage of some lilies which were being grown in pots attracted Mr. Scrim's attention. About the same time he discovered that the roots of the roses before mentioned and of some Begonias which had been planted in soil from which some roses had been removed, were being destroyed by large numbers of the larvæ.

Previous to my visit, a large quantity of white hellebore had been sprinkled over the plants in the house. This had been partly effective only, for of the perfect beetles which were found hidden only about 10 per cent. were dead. The beetles had been very destructive to a collection of lilies, as many as three or four being sometimes found in the heart of the terminal cluster of leaves. The roses in this house are planted in long wooden beds, and the soil is about 6 inches deep. An experiment was tried with bisulphide of carbon for the destruction of the larvæ, but owing possibly to the small depth of earth and openings for drainage in the bottom of the beds, this was found to be quite useless. The only remedy then was to remove entirely the soil from the infested beds, and re-plant in fresh soil such of the plants as were found to be sufficiently uninjured to make this worth while. At the same time, the plants frequented by the mature beetles for feeding were syringed with a weak mixture of Paris green. The beetle is nocturnal in its habits and hides during the day. Several were found hidden beneath leaves or against the sticks to which the stems of the roses were tied. The sticks were the small bamboos used for this purpose by florists. The open top joints of these bamboos proved convenient traps for catching the beetles, for in each of them there were usually from one to five specimens. As yet this troublesome insect only infests one of Mr. Scrim's greenhouses, but there are traces of its presence in one end of another. There is no doubt that it must have been present and gradually increasing for some time, although unobserved. It is a troublesome insect to eradicate, but if the above treatment of regularly poisoning the mature beetles is persevered in, so as to prevent eggs being laid, it must succumb before long.

This insect has been treated at some length in the report of the United States Entomologist for 1878, and by the State Entomologist of New York in 1885. Its history is an interesting one. It was brought to the notice of entomologists about 1874, when it was found by Mr. A. S. Fuller and others in the State of New Jersey, where it was injuring the foliage of Camellias and other plants in conservatories. In 1876 it was decided by Dr. Horn that it was a new species, and was named after the gentleman, who had first brought it to his notice. Since that time it has been found to occur in greenhouses from the Atlantic to the Pacific. Prof. Lintner says: (Rep. 2, p. 143): "Its greatest injury is committed upon roses grown under glass, by the larvæ feeding upon the tender rootlets, at first merely checking their growth, but finally, when their numbers have increased, destroying the plant. It has also been observed upon the roots of *Geranium* and *Hibiscus*, and in California, is reported as "very destructive to *Dracœnas* (and palms lightly), oranges, Cape Jessamine (*Gardenia*) and *Achyranthus*, in the order named. In Brantford, Canada, it has been found upon *Abutilon* and *Plumbago* in hot houses. From Massachusetts, it is reported upon the Azalea, "Cissus," and "Inch-plant." The best method by which to meet the depredations of this insect, so far as known at the present, is to hunt for the beetles upon their food plants and to destroy them. If this be persistently done the evil can be arrested." Until quite lately the only mention of this insect in entomological literature, has been as a greenhouse pest; but in "Insect Life" (Vol. 2, p. 90, Sept., 1889) there is a note of its having been found to be very destructive in the vicinity of Los Angeles, California, to the leaves of evergreen oaks, camellias, palms (*Washingtonia filifera*), *Canna indica* and several other plants growing out of doors. The experience of all those who have suffered from this pest, seems to be that destroying the mature beetles is the surest way of stopping its ravages. Prof. Riley quotes in his 1878 report from an account written by Mr. Peter Henderson, of New York, of the work of this beetle. After stating his belief that the failure of so many to grow roses is due to the unknown presence of the larvæ at the roots, he says as follows:—"Mr. John May, the gardener in charge of Mr. Slaughter's rose-growing establishment at Madison, New Jersey, which is probably the largest in the vicinity of New York, has given great attention to the rose bug, his roses for four or five years being much injured by it, but by persistent efforts in destroying the perfect insect, he has now got entirely clear of it. The symptoms of the grub being at the roots are a partial stagnation of growth, weak, pale shoots, and generally barrenness of flower-buds."

In the greenhouses where this insect has appeared at Ottawa, the plants in the house are of such a nature that Paris green can be used without injury or danger. The plants most resorted to for food appear to be some lilies which are just throwing up their stems, and some rose bushes which have no buds upon them. The use of only a very weak mixture ($\frac{1}{2}$ oz. to 3 gallons of water), has been advised, but every beetle that eats leaves sprayed with it must soon die.

Prof. Riley discovered that the eggs were laid close to the ground, at the collar of the rose bushes, and were secreted beneath any roughness in the bark, or other material placed there. He therefore suggested the value of placing traps, composed of rags, tape or paper, tied either round the stem or around pieces of stick, and placed close to the roots. In these the females would lay their eggs, which he describes as laid in flattened batches, consisting of several contiguous rows, and each batch containing from ten to sixty. The individual egg is smooth, yellow, ovoid, and about one millimetre in length. The female shows a confirmed habit of secreting her eggs. The eggs take about a month from the time they are laid until they hatch, so that if these traps are taken up every three weeks, and thrown into boiling water, all the eggs must be destroyed. If the plan of tying rags to sticks be adopted these need not be untied each time, but after being scalded can at once be placed back again at the roots of the plants.

INSECTS INJURING A WOODEN WATER-PIPE (*Macronychus glabratus ?*)

In the autumn of 1889 it was discovered that a large wooden pipe which was used to bring water from the Ottawa River to the Ottawa water-works was full of large holes. Upon examination it was found that there were innumerable larvæ of various kinds upon the surface of the pipe, and it became necessary to consider whether it would not be advisable to go to the great expense of laying a metal pipe in lieu of this wooden one, which was found to have been rendered useless, in a much shorter time than was anticipated. Specimens of the injured wood were submitted to me by the City Council, and I also visited the water works and consulted with the engineer. After careful examination, the following letter was written, which explains itself:—

"CENTRAL EXPERIMENTAL FARM.
"OTTAWA, 18th December, 1889.

'R. SURTEES, Esq.,
Engineer, City Water Works,
Ottawa, Ont.

SIR,—I beg to report that I have carefully examined the specimens submitted to me by you—1. Pine staves taken from the clear-water pipe of the Ottawa water works system.

2. Samples of oak slats taken from a rack through which the water passes before entering the water turbines.

The condition of these specimens is, briefly, as follows:—

1. The wood of the pine staves is almost uniformly $1\frac{1}{2}$ inch in thickness, in a few places possibly $\frac{1}{8}$ of an inch less, and perhaps a little thicker where knots occur. At the original point of contact, where the staves touched on each side those next to them, the edges, particularly of the inner surface of the pipe (but also to a much less extent of the outside as well), are much eroded between the staves for some distance towards the exterior of the pipe, causing a deep groove, varying between $\frac{1}{4}$ and $\frac{3}{4}$ of an inch across at its greatest width. In depth this groove varies in most places between $\frac{1}{4}$ of an inch and 1 inch; but at many points it has extended right through the wood to the outside, causing large holes from 4 to 6 inches in length, by 1 wide, thus entirely defeating the ends for which this pipe was originally intended.

If these staves were as stated, 2 inches in thickness when put down, it is evident that by some means about half an inch of the wood has been removed during the fifteen years which have elapsed since the pipe was laid down in the aqueduct.

In answer to your enquiry as to the probable cause of this diminution in the substance of the pipe and the probability of its being due to the operations of aquatic insects, I take the liberty of drawing your attention to the following points:—The condition of the wood of the staves is as follows:—The wood itself below the surface, and between the staves where these were in close contact, is perfectly sound, of good colour, and not injured in any way. On the other hand, all surfaces which have been exposed to the action of water, whether inside or outside the pipe, or in the grooves eroded between the staves, are discoloured and in a semi-decayed condition, *i.e.*, the wood is so soft and rotten that it can be easily removed with the finger-nail to a depth of at least $\frac{1}{16}$ of an inch. In and upon this thin layer of half-decayed wood the larvæ of various kinds of aquatic insects have taken up their abode, and some have made use of it as food, as is plainly seen by the numerous tracks which have been eaten out all over the surface. These tracks are irregular and winding in their course, going in all directions, as often across the grain cf the wood as with it. They do not penetrate the solid wood but frequently reach down to it and run along on the surface. The same track sometimes runs in one direction for some distance and then doubles back on itself and runs the other way, a fact which entirely disproves the suggestions which have been offered by some that the whole of the injuries to the pipe, as well as these tracks, are the effects of friction, current or suction. One particular track was observed to start on the inside of the waterpipe and work its way through one of the large holes out onto the outside surface. It is a notable fact that these tracks run over the whole surface of the wood, even to the bottom of every little depression.

I believe that the softened condition of the surface of the wood is due to the action of the river water, and I find that in some places, where the eroded groove stretches out in points from the inside towards the outer surface of the pipe, there is generally a discolouration of the wood beyond the point where the surface is actually eaten away, as if decay had already begun, although the tissues of the wood are still unbroken, but showing plainly that the water had effected an entrance between these discoloured surfaces. It is generally perceptible that there is in such spots a slight inequality of the exposed surfaces of the two contiguous staves, which may have been caused either by some slight unevenness in the planing of the wood at the time of building the pipe, or possibly from the wood having swollen unequally when it was placed in the water.

I am informed that at the time the pipe was constructed the edges of the staves were flush both inside and outside this pipe, which was built like a barrel, with the staves slightly bevelled at the edges, so as to procure the tubular shape, and that the whole was held together by iron hoops. This being the case, I can only suggest as a reason for the eroded groove being so much wider and deeper on the inside of the pipe, that unless the angles of the bevelling were perfectly true the outer edges of the staves would be much more tightly clamped together than the inner by reason of the iron hoops outside.

I would suggest then, as the cause of the destruction of the clear-water pipe—first of all—the decaying of a very thin layer of the surface of the wood through the chemical action of the river water; and, secondly, the breaking up and removal of this decayed surface by aquatic insects, so as to constantly expose a new surface of the wood to the action of the water.

It is probable that both of these operations were assisted by the strong current in which the pipe was situated—in the first place, by forcing the water into every minute crack or crevice, and then by carrying away fragments of the surface loosened or undermined by insects.

I am aware that it is held by many that sound pine wood, kept constantly submerged beneath the surface of water, is practically indestructible; and I have no doubt that under some circumstances, and for some purposes, this might be the case. It must, however, be remembered that more or less air, varying with the circumstances, is always dissolved in water. I am under the impression that water containing a large quantity of air, as the water of the Ottawa River necessarily does, after passing down the Deschenes Rapids, would be more destructive to wood submerged in it than water containing less oxygen.

With regard to the insects found upon the staves submitted to me, they were for the most part predaceous larvæ of Beetles and Dragon Flies or allied insects. Many of these live in silken cases, which they spin upon the surface of objects in the water, but into which they also weave fragments of the substance upon which their cases are fixed—as small pieces of stone, sand or wood. Upon portions of the wood submitted to me were vast numbers of these cases, which, when placed under the microscope, showed plainly that they contained fragments of coniferous wood. The time of year is not opportune for the exact identification of the many larvæ which occurred upon the injured wood, nor am I able to say with certainty which is the species that has eaten the tortuous tracks in the decayed surface of the pipe. This, however, is a point of no practical importance; but I think it probable that it belongs to the *Parnidæ*, a family of aquatic beetles of which very little is known of the life-history. To this family belong some small beetles, of which several were found on the injured wood, belonging to the closely allied genera *Dryops* and *Macronychus*, as well as some larvæ which I refer provisionally to these beetles.

As to the wood-eating habits of these beetles which live exclusively in water, Prof. Westwood, in his "Modern Classification of Insects," says of the genus *Macronychus*, as follows: "They are found in running water, appearing to prefer the under sides of stones, and especially on floating wood, burrowing beneath the bark. Their movements are very slow. When taken out of the water they do not survive more than two or three hours." I might mention that none of these insects have ever been known to bore into sound wood, but feed exclusively upon decaying vegetable tissues in water, and their appearing in large numbers upon the clear-water pipe may possibly be due to the unusual quantity of decaying bark which, I am informed, lies in the Ottawa River, near the inlet of this pipe, and which would attract these insects as a suitable breeding ground. They are in no way related to the ordinary timber-boring beetles which are so destructive to standing timber and manufactured lumber in all parts of the world.

I shall endeavour to breed those I have to maturity, so as to settle this question of identity, but there is great difficulty in breeding in confinement those insects which live in running water, on account of it being almost impossible to give them the same conditions as they have in nature.

2. The oak slats taken from the rack near the pump house, and which had only been in the rack for ten years, were proportionately much more destroyed than the pine staves. The slats were ½ an inch in thickness by 4 inches in width when put in the rack; but many of them are now so seriously injured that it is necessary to replace them. In most of the slats the greater part of the wood has been entirely consumed."

REPORT OF THE HORTICULTURIST.

(W. W. Hilborn.)

Wm. Saunders, F.R.S.C., F.L.S., F.C.S.,
Director Experimental Farms.

Sir,—I have the honour to submit herewith a report on the progress made in the Horticultural Department of the Central Experimental Farm, Ottawa, during the year 1889. The winter of 1888-89 was unusually mild, which was favourable to the orchards, the greater portion of the trees coming through in good condition and making a satisfactory growth during the summer. Small fruits, with few exceptions, wintered well, grew strong and vigorous in the spring, and produced abundant crops.

APPLES.

The trees in the apple orchards passed through the winter with but little injury to most sorts. Many trees were added to the orchards, some of them of the same varieties as those already planted, but grown farther north, so that their relative hardiness might be tested. Some of the older sorts not already in the collection, together with some new varieties, have also been added, most of which have made good growth and promise well for the future.

PEARS.

A number of pear trees were injured by the winter, some of them either killed outright or down to the snow line. A few of the standard sorts survived, and may recover sufficiently to form good trees. The Russian varieties escaped with but little injury and give evidence of being hardy. These have made a good growth, but more experience is required with them before a list of hardy kinds could be given that would be valuable to the planter in northern localities. Some pear trees were obtained that had been grown in northern districts with the hope that they would possess greater hardiness. A collection was also planted that had been grown from scions kindly donated by Chas. Gibb, Esq., of Abbottsford, Que., selected from his most promising hardy Russian sorts. These have made a satisfactory growth, and the outlook for establishing a pear orchard in Ottawa is more favourable than at first.

PLUMS.

Plum trees have suffered more from the winter than most other fruits, a large percentage of the trees being killed. A portion of this injury was probably due to the fact that the trees were transplanted from the nursery rows to the orchard rather late the preceding spring, and did not get sufficiently well established to withstand the winter. The vacancies have been filled in this orchard also by trees grown farther north, with the hope that they may prove more hardy.

CHERRIES.

Very few of the cherry trees were injured by the winter; most of them came through in excellent condition. They have made a good growth, and strong hopes are entertained for their future success.

GRAPES.

Grape vines succeed well in this locality when proper protection is given to them during the winter. All varieties require to be laid down and covered with earth before the ground freezes in the autumn. Care must be taken not to remove the covering too early in the spring. They will be better to remain covered until the buds begin to swell.

In the spring of 1887, 320 vines were planted on what may be called the "French system," in rows 4 feet apart, and 2 feet apart in the rows. These were trained to short stakes and pruned closely. They made strong, healthy plants, and some fine fruit was produced the past season. This plantation consists of the following varieties: Bacchus, Brighton, Concord, Clinton, Champion, Delaware, Early Victor, Niagara and Wilder. All the vines have succeeded nicely. Present indications would warrant further experiments in this direction, especially in the colder localities.

CURRANTS.

This plantation has not been out a sufficient length of time to produce much fruit. A slight frost which occurred at the time they were in bloom did some injury to the red and white sorts. Black varieties were but little hurt by the frost and produced a fair crop. Lee's Prolific, Black Champion, Black English and Prince Albert were nearly equal in productiveness. Black Naples was not nearly so productive as the others. Black Champion gave the largest fruit, and appears to be a desirable variety in every respect. Some of Mr. Saunders' seedling black currants proved quite productive, of good size, and are well worthy of a more extended trial.

RASPBERRIES.

The past season was a favorable one for the raspberry crop. The first plantation was put out in the spring of 1887, and consisted of the following varieties: *Black Caps*—Tyler, Souhegan, Chapman, Doolittle, Hilborn, Johnson's Sweet, Ohio, Centennial, Mammoth Cluster, Nemaha and Gregg; Shaffer's, a purple cap, and Caroline, a yellow cap. *Red Raspberries*—Rancocas, Hansell, Highland Hardy, Reider, Marlboro', Turner, Clarke, Herstine, Parnell, Hudson River Antwerp, Niagara, Cuthbert, Brandywine and Golden Queen. These ripen about in the order named. In making a selection of Black Caps, either for home use or market, the following will ripen at intervals during the season and give very satisfactory results: Tyler for first early, Hilborn for medium and late crop. Gregg is a fine, large, late sort, not as hardy as the others, but where it succeeds it is a valuable market berry, on account of its large size and firmness for shipping. Shaffer's is very much prized for home use, being of a dark purple colour, but they are not regarded as very attractive for market. Where they can be grown near the market in which they are to be sold, so as to reach the consumer in good condition, little difficulty will arise on account of colour. On the Ottawa market they were much sought after, and by many were preferrd to any other variety. Among the red raspberries there is more difficulty in making a selection. None of the early sorts fully meet the requirements either, for market or home use. Rancocas is the earliest, but no larger than Highland Hardy or Hansell. Marlboro' is large and quite early, but does not succeed in all localities. Turner is of first quality, but too soft, and not productive enough for market; but it is the hardiest variety yet tested. Cuthbert is the best late-ripening sort, either for home use or market. Golden Queen, the best yellow, somewhat hardier than Cuthbert which it much resembles, except in colour.

SEEDLING RASPBERRIES.

Among the seedling raspberries of the Director, Mr. Saunders, which were referred to in my last report, there are some very fine Black Caps of large size, good quality and very productive, worthy of further trial. But probably the most valuable berries in the collection were a number of red sorts. Some of these gave promise of being early, larger and more productive than any of the early standard sorts. These will be propagated and further tested at the several Experimental Farms. From present indications it is likely that some of them will be an improvement on any of the varieties now in cultivation.

BLACKBERRIES.

This fruit has succeeded well on the Central Experimental Farm. The hardy sorts passed through the winter in good condition and produced a fine crop of fruit. Snyder is perhaps the most hardy and reliable—strong, vigorous and very productive, with fruit of medium size and good quality. It ripens early and is valuable for market or home use. Agawam is larger than Snyder, of better quality, very productive, and worthy of more general cultivation for both home use and market. Taylor's Prolific, Gainor, Minnewaski, Western Triumph, Stone's Hardy and Wachusetts Thornless all came through the winter in comparatively good condition. Stone's Hardy and Western Triumph are productive, but too small in size for profitable culture; Wachusetts Thornless is not productive enough to be of value; Gainor and Minnewaski are large and productive, but not sufficiently hardy for this vicinity; Erie, Early Harvest, Early Cluster, Wilson Jr., and Knox, were all killed back nearly or quite to the ground.

STRAWBERRIES.

About 115 named varieties were in full fruiting this season, and the weather being favourable a large crop was gathered. All came through the winter in good condition, except a few which were planted in low places, where ice was formed on the plants. Most of these were killed, but the area thus destroyed was not large. All of the leading varieties were described in Bulletin No. 5 of the Central Experimental Farm, with methods of culture, &c.

SEEDLING VARIETIES.

A large number of seedlings were in bearing. Some of those brought to the farm by the Director, which were mentioned in my last report, produced fruit which was large and proved productive. Most of them were not firm enough for market, but a few were thought to be valuable for that purpose, and of these a number of young plants were put out for further trial.

VEGETABLES.

Some experiments were made in vegetables, principally with radish, lettuce, asparagus, and rhubarb.

RADISH.

Sutton's Rosy Gem, a round turnip radish, was the best of its class in the collection tested on the farm. It is very early tender, crisp, and seldom becomes hollow or pithy, as many varieties do when left standing a short time after they have become large enough for use. Early Oval, Dark Red and Early Scarlet Short Top, with the above, will give, perhaps, the best satisfaction of any of the earlier varieties. In addition to the above, the following sorts were tested:—Early Carmine Short Top, Arlington Early Long Scarlet, Improved Chartier, Wood's Early Frame, Market Gardeners' Early Long Scarlet, French Breakfast, New Early Oval Dark Red, Red Rocket and Garnet Turnip.

LETTUCE.

The following sorts were grown for trial:—Boston Market, Black Seeded Simpson, Black Seeded Tennis Ball, Boston Fine Curled, Buttercup, Burpee's Hard Head, Grand Rapids Forcing, Gold Nugget, Henderson's New York, Large Hanson, Landreth's Forcing, Marble Head Mammoth, New Premium, Gem and Salamander. Where it is desired to grow only one variety for family use, Black Seeded Simpson will give good satisfaction. It is of fine flavour, and remains a long time fit for use. Grand Rapids Forcing, Landreth's Forcing and Boston Fine Curled are valuable for early forcing. Buttercup and Salamander are good in quality and fine for summer use, as they withstand the hot sun at that season better than most kinds. Henderson's New York, forms the largest heads, but is rather too dark a green to sell well in the markets.

ASPARAGUS.

In the spring of 1888 strong two-year old plants of Conover's Colossal, Palmetto, Le Normandy and Early Purple Argenteuil, were obtained and planted in a rich sandy loam. They made a very strong growth the season they were planted, and little difference could be detected in the varieties. The past spring they were tested on the table, and the difference between them was so slight that there seems to be but little choice, they are all much alike.

RHUBARB.

Seven varieties were planted in the spring of 1888 in rich, sandy loam, in rows 6 feet apart and 4 feet apart in the rows, and good cultivation given them. In the past spring they made such a growth that the ground was nearly covered with their foliage. This plot consisted of the following sorts:—Egyptian Queen, Carleton Club, Linnæus, Paragon, Stott's Mammoth, St. Martin and Victoria. Carleton Club is the largest kind, producing very long and large stalks of good quality. Stott's Mammoth is equally large, but much shorter in length of stalk. A single leaf of this variety measured 31 by 38 inches. The quality is not of the best, and as it is one of the latest to start in the spring it would not be a profitable market sort. Egyptian Queen is of the finest flavor, stalks of medium size and freely produced; good for home use or market. Linnæus is one of the best for market or home use. It is of good quality, a strong grower, and remains fit for use a long time. Paragon starts into growth later than Linnæus, is not as good in quality, and the foliage sunburns badly during early summer. St. Martin is a very strong, rank grower, but the quality is poor, and hence not desirable.

All of which is respectfully submitted.

W. W. HILBORN,

Horticulturist, Central Experimental Farm.

REPORT

OF THE

POULTRY MANAGER.

(A. G. GILBERT.)

To WILLIAM SAUNDERS, F.R.S.C., F.L.S., F.C.S.,
Director Experimental Farms.

SIR,—I have the honour to submit to you the second annual report of the Poultry Department of the Central Experimental Farm. My first report included operations to the 20th of January last, at which date winter laying was going on satisfactorily, and so continued until such time as it was necessary to give the laying stock a rest, prior to making up the breeding pens. It is desirable, when practicable, to keep the breeding stock, male and female, apart, in compartments away from those containing the layers, and treated in such a manner that, while robust health is secured, the hens are not stimulated to lay until mated at the proper season. Chickens from hens which have been actively laying all winter, are not likely to be possessed of that vitality so necessary to vigorous growth. Again, the shells of the eggs from winter layers are apt to be so thin by springtime as to be unfit to put under early sitters. When the winter laying stock have to be used as breeders, they should be given a rest and run outside, if the weather permits, before the eggs to be used for hatching are laid. As the poultry building did not afford space for separate pens of breeders and layers, the hens were given the necessary rest, and in all cases the breeders were mated with a male bird of a different strain. It may be mentioned that it is, I believe, intended to provide such addition to the present poultry house as to allow of the laying and breeding stock being kept in different compartments. The male birds were not placed with the hens during the winter season, and should under no circumstances be permitted in their company. Apart from the fact that impregnated eggs lose their finer flavour, the male birds will not be in the desired condition when mated in early spring, besides the risk that no breeder would care to run of having fertilized eggs, from his best birds, sold promiscuously at the price of eggs for eating.

THE BENEFIT OF NEW BLOOD.

The benefit of having, at the first establishment of the poultry department, procured eggs from different strains with a view to future breeding, was particularly instanced in the case of the Buff Cochins, which, after laying during the winter months, were only eleven months old when mated, after a short rest and run, to a cockerel of the same breed and age, but of a different strain. The result was patent in a large percentage of the eggs producing hardy chickens of large size.

BREEDING PENS MADE UP.

Breeding pens were made up of the descriptions, numbers and at dates as follows:—

Breed.	Numbers.	Date when Mated.
Plymouth Rocks	1 cockerel and 9 hens	February 15.
Buff Cochins	1 do 6 pullets	do 18.
Brahmas	1 do 7 hens	March 15.
White Leghorns	1 do 11 do	do 15.
Houdans	1 do 11 pullets	do 15.
Black Minorcas	1 cock and 10 pullets	do 25.
do Hamburgs	1 cockerel and 6 pullets	April 6.
White Leghorns	1 do 5 hens	do 6.
Dirigos	1 do 6 do	do 17.
S. P. Hamburgs	1 do 2 do	do 13.
Crosses.		
B. B. R. G. { W. Leghorns.. B. Minorcas... }	1 cockerel and 7 hens	April 17.
P. Rock { Brahmas...... W. Leghorns.. Wyandottes... }	1 do 7 do	March 30.
Brahma { P. Rocks...... W. Leghorns.. }	1 cock and 7 hens	April 15.

In all cases, when possible, a yearling cock was mated with two year old hens, and males of two years of age with pullets. A few days after being placed with the hens the Silver Pencilled Hamburg Cockerel died suddenly and the pen was broken up. The Dirigo Cockerel became ill a week after being mated and continued so until late in the season. Few eggs were, in consequence, used.

SITTING HENS AND THEIR MANAGEMENT.

The first two hens to become broody were Wyandottes. One was set as early as the 2nd March, but the egg shells being thin broke frequently, and although the remaining eggs were carefully washed in lukewarm water and reset, only one chicken was hatched. The other Wyandotte was given eight Plymouth Rock eggs on the 17th of the same month (March) and the result was fairly satisfactory in the shape of four fine chickens, the remarkable progress of which is noted elsewhere. As other hens became broody they were given eggs as soon as possible. Every effort was made to rid the broody hens of any vermin that might be on their bodies before putting them on eggs. To effect this the nest, which was made of straw, in boxes specially arranged, was well dusted with carbolic powder. China eggs were placed in the nests and the sitter put on them for 24 or 36 hours. The china eggs were then taken away and the real eggs substituted for them. All lice meanwhile were most probably driven from the hen and she could then sit in ease for the remaining period of incubation. The nest boxes were made without bottoms so as to be placed on the floor of the building in early spring, or on the ground in the warmer weather. At another season it is intended to set a number of hens on the dry floor and others in nests on the damp ground in order to thoroughly test both methods, each of which have their enthusiastic advocates. In the early season it is beyond question that the dry floor is preferable to the cold ground. As the weather becomes warmer the cooler earth may be best. In order to arrive at a satisfactory conclusion, the eggs must be thoroughly tested and the unfertile ones removed. Unless the eggs are so tested, no definite result can possibly be arrived at, for some nests will be sure to contain a greater number of fertile eggs than others. The conditions must be the same in both cases. We have no statement from the advocates of either of the methods mentioned to show that any conclusive trials were even attempted. Corn in a trough, water and a dust-bath were always kept near the sitters. Some of the hens were confined to their nests and allowed out at a certain hour every morning to feed, drink and enjoy a dust bath. Others were kept in open nests and allowed to come off and return at pleasure. The former is the better way in the early season when the weather is cold and it is an object to get the hen on the eggs again before the latter are chilled. In the dust bath a small quantity of sulphur was mixed to aid in the prevention of lice. As previously stated, when eggs were broken under a sitter the remaining ones were carefully washed in lukewarm water and replaced in the nest.

The following table will show the number of eggs put under hens and the results therefrom.

EGGS set and chickens hatched.

Date when Eggs were Set.	No of Eggs Set.	Description of Eggs.	No. of Chickens Hatched.	Date when Chickens were Hatched.
1889.				1889.
Mar. 17..	8	Plymouth Rock	4	April 7
April 10..	9	5 White Leghorns, 4 Houdans	4	May 1
do 11..	11	Brahmas (from London, Ont)	4	do 2
do 30..	11	Houdans	5	do 21
do 30..	11	Brahmas	2	do 21
do 30..	9	White Leghorns (hen got sick on nest)	1	do 21
do 30..	11	5 Wyandottes, 6 Buff Cochins	6	do 21
May 1..	9	Game-Cross	4	do 22
do 2..	11	7 Plymouth Rocks, 4 Buffs	5	do 23
do 7..	11	6 Game-Cross, 5 Buffs	6	do 28
do 9..	11	Plymouth Rocks	5	do 30
do 9..	13	7 Buffs, 6 Game-Cross	8	do 30
do 15..	11	Black Hamburgs	7	June 7
do 15..	13	do Minorcas	9	do 7
do 17..	13	Redcaps (from London, Ont)	4	do 9
do 17..	11	Andalusians	5	do 9
do 20..	11	Houdans	9	do 12
do 23..	9	Wyandottes (purchased in Ottawa)	4	do 15
do 28..	11	6 Houdans, 5 Mixed	7	do 20
June 3..	11	Black Hamburgs	5	do 24
do 4..	9	Mixed	4	do 25
do 8..	11	9 Andalusians, 2 White Leghorns	7	do 29
do 11..	11	7 Plymouth Rocks, 4 White Leghorns	6	July 1
do 22..	13	Wyandottes (purchased in Ottawa)	11	do 13
do 26..	11	6 Leghorns, 5 Black Hamburgs	5	do 17
July 6..	11	Pekin Bantams (purchased in Ottawa)	3	do 27
May 26..	....	Incubator Chickens	6	June 6
			146	

With the exception of the eggs obtained from outside sources as stated above, all were furnished by the farm stock. A feature of the early breeding season was the scarcity of sitters, as much as one dollar being offered on the market for a sitting hen.

DEMAND FOR STOCK AND EGGS.

As spring advanced the demand for stock and eggs became brisk. It was decided after due consideration to sell eggs to farmers for hatching at a reasonable price, also spare cockerels for breeding purposes. This is done with the view of inducing them to cultivate a better class of poultry for eggs and sale on the market, care being taken that the interests of regular poultry breeders were not interfered with. In several cases thoroughbred cockerels were exchanged with farmers, in order to afford them opportunity to introduce new and better blood into their much inbred stock. A taste for a superior class of poultry once disseminated, it must result in a greater demand for thoroughbred stock, and the business of the high class poultry breeder cannot fail to be correspondingly enhanced.

EGGS SENT TO DIFFERENT POINTS.

Eggs and stock were shipped to different places in the Provinces of Ontario, Quebec, Nova Scotia, New Brunswick, the North-West and British Columbia, and the branch experimental farms at Indian Head, N. W. T., and British Columbia. It is to be regretted that in some cases the eggs sent to a distance did not hatch well, although packed according to the most approved method. There is always a certain amount of risk and disappointment attending the despatch or reception of eggs for hatching. So much so, indeed, that several breeders of note prefer to send live stock rather than eggs to their customers. The whole matter of egg carriage is likely to receive the serious consideration of the American Poultry Association at its next annual meeting. It may be remembered that in June of last year, eggs received from England, for the poultry department of this Central Farm hatched out fifty per cent., and the eggs sent by express to the branch experimental farm at Indian Head, in May last, did very well. In many cases eggs are not fertile when sent, and the carriage is blamed for disastrous results that would have been the same at home. All that can be done is to use every means to have the eggs fertile; pack according to best plan in a light basket with handle; apprise the carriers by conspicuous letters on package of the care required in handling and give the consignee to understand that he is to share a certain amount of the risk.

THE CHICKENS, THEIR GROWTH AND TREATMENT.

On the chickens hatching, they were allowed to remain for 24 or 26 hours under the hen until they were completely "nest-ripe." With the mother they were then placed in coops of improved pattern specially designed for the poultry department. The mothers were confined to the coops, but the chickens could run at large or return to brood at pleasure. The coops became the homes of the chickens until they were removed in the fall to winter quarters. On the chickens feathering sufficiently to keep themselves warm by nestling together at night (generally at the age of four or five weeks), the mother was removed to her quarters in the poultry house to resume laying, and each colony of chicks returned to their own coop without hesitation. The coops were so arranged that on being closed for the night the inmates were secure against all enemies in the shape of rats, weasels, skunks, &c., while proper ventilation was not lost sight of. In rainy weather a double roof on each coop was drawn forward and made an excellent shelter. It could also be used as a shade in the hot season Care was taken to prevent lice on the chickens. These pests are insidious and deadly foes to the young chicks and cannot be too energetically guarded against. A great deal of this precaution can be well observed at the time of setting the hen, by ridding her body of all such tenants. (See setting hens, above). In the early summer of the year 1888, two methods of feeding newly hatched chickens were tried, viz., the dry (hard boiled eggs and bread crumbs) and the wet (bread and milk), but with one or two exceptions in the past year the bread and milk system was adopted, and with excellent results. This method is particularly adapted to farms where large quantities of butter are made and there is plenty of curdled milk to feed. The bread was put into milk, squeezed nearly dry and so fed. It contained moisture enough to do for drink, and in consequence, water was not given to the chicks until they were several days old. Sour milk was left for them to take when desired and was always enjoyed with great relish. Feed was given as frequently as they would eat and as much as they would take. Too much importance cannot be attached to the fact that the first few weeks of the chicken make the future fowl. A chicken half starved, or stinted from any cause in the first five weeks of its existence never regains the loss afterwards. Chickens for table use should be pushed from the first day they are able to eat. As the chickens grew up the last feed in the evening was gradually changed to wheat and crushed corn, and pains were taken to see that every chicken went to its coop with a crop full. The bread and milk gave way to shorts, cornmeal, ground oats, bran, and other suitable materials mixed in boiling water with a handful or two of ground meat to the chickens which could not get grasshoppers or other form of insect life. The mortality among the earlier chickens did not reach beyond 5 per cent.

The growth made by the chickens of the different breeds is shown by the following table:

WEIGHT OF CHICKENS.

Plymouth Rocks—A cockerel hatched on 7th April, weighed, on 7th May (one month afterwards), 1 lb. 6 ozs.; on 7th June, 2 lbs. 15 ozs.; on 12th July, 4 lbs. 12 ozs. (making $4\frac{3}{4}$ lbs. in 3 months). On 24th of the same month (July) the same bird weighed 5 lbs. 8 ozs.; on 15th August, 7 lbs. 1 oz., and on 18th October, $8\frac{3}{4}$ lbs. Another Plymouth Rock, hatched on 30th May, made equally rapid growth, showing a weight of 8 lbs. 4 ozs. on the 30th October (5 months from date of hatching), thus making weight of nearly one and three quarter pounds per month.

Brahmas—Four chickens, hatched on 2nd May, from a setting of eggs from London, Ont., turned out pullets, so in this case we have to take the female; one, grew at the rate of 1 lb. 2 ozs. per month, weighing at the end of October, 7 lbs.; another, at same date, weighed 6 lbs. 8 ozs. A Brahma cockerel, hatched on 21st May, weighed, on 21st August (3 months later) 2 lbs. 15 ozs., showing a gain of a little over 15 ozs. per month.

Buff Cochins—Two cockerels, hatched on 21st May, weighed, on 21st August (3 months afterwards) 3 lbs. 6 ozs. and 3 lbs. 4 ozs., making progress at rate of 1 lb. 2 ozs. per month.

Wyandottes—Chickens hatched on 21st May, weighed 3 lbs. 7 ozs., on 21st August, (three months later), gaining a little over 1 lb. 2 ozs. per month. A White Wyandotte made the same gain during the same period. Eleven Wyandottes hatched on 13th July, did not make quite such rapid progress during the hot term, showing, on 20th August following, only 13 ozs., but on 23rd September, cooler weather, reaching 1 lb. 5 ozs., and, on 23rd October, 2 lbs. 14 ozs.

Houdans—Hatched on the 1st May, showed a gain of 1 lb. per month.

Game-Cross—Two cockerels of a cross between a Black Breasted Red Game male and Black Minorca hen, and hatched on the 22nd and 28th of May respectively, weighed, on 22nd August (three months), 3 lbs. 7 ozs. and 3 lbs. 4 ozs., making almost 1 lb. 3 ozs. per month.

Incubator Chickens—The chickens hatched in incubator on 16th June, and reared in the brooder made 1 lb. and 1 lb. 2 ozs. per month. The majority of these chickens were crosses between the Plymouth Rock and Wyandotte, except one, a White Plymouth Rock, which made 1 lb. 6 ozs. per month.

From the above it will be seen that the Plymouth Rocks made the greatest headway, reaching a development, in some instances of nearly one and three-quarter pounds per month, far distancing all others. The difference in progress made can be more easily seen by the following figures:—

COMPARATIVE RATE OF PROGRESS PER MONTH.

Breed.	Lbs.	Ozs.
Plymouth Rocks	1	12
Brahma Pullet	1	02
do Cockerel	1	00
Wyandottes (laced and white)	1	02
Buff Cochins	1	02
Houdans	1	00
Game-Minorca Cross	1	03
Incubator Hatched Chickens	1 1	04 02

EARLY LAYERS.

Of the four Plymouth Rock chickens hatched on the 7th April last three were pullets. The early development and laying of these pulletts are worthy of note, as showing what care and good feeding will do to bring about desired results. One of the pullets began to lay on the 28th of August, four months and twenty-one days from date of hatching. The second pullet laid three days after the first and the third a short time after. A number of pullets of the same precocity would give a supply of eggs when the older stock are moulting and eggs are becoming scarce and dear in consequence.

NUMBER OF EGGS LAID BY CERTAIN BREEDS.

The following will show the number of eggs laid in twelve months by nine of the best known of the standard breeds. It must be borne in mind that the majority of the layers were pullets, and that none of the laying stock were forced as much as they might have been, for the reason that the greater number were to be used as breeders in spring. As the sitters became broody they were given eggs, and the number of layers were correspondingly reduced. Twice during the later portion of the winter the Buff Cochins, Leghorns, Minorcas and Houdans were stopped laying on account of eating eggs. A certain number of hens were sick, some died, and some were sold. In the months of August, September, October and part of November few eggs were laid, because the hens were in full moult:—

Breed.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Totals.
15 White Leghorns	99	40	210	162	166	56	40	71	10	14	18	9	895
10 Plymouth Rocks	24	44	67	95	54	26	33	37	31	12	15	29	467
8 Brahmas	27	7	39	70	66	9	19	17	1	1	15	7	278
8 Black Minorcas	47	10	51	51	52	8	10	27	29	2	12	5	304
5 Black Hamburgs	53	31	59	16	39	9	45	65	12	1	17	12	358
5 Buff Cochins	8	10	36	49	25	.....	5	36	17	7	5	13	211
10 Houdans	43	6	56	77	92	.....	.....	15	2	3	.....	.....	294
2 Wyandottes	28	12	13	10	24	5	2	2	3	.....	3	9	111
5 Dirigos	49	21	28	41	87	14	8	12	.....	11	10	.....	281
Total													3,199

The result aimed at was to have the hens lay when eggs were high in price and the sitting breeds hatch chickens when the price was below eighteen cents per dozen. The early pullets should begin to lay when the older hens are in moult and new laid eggs are becoming scarce and high in price, as was done in the case of the three Plymouth Rock pullets hatched on the 7th April, 1889. (See sub-head Early Layers.) A point to be considered is, that all the laying stock had limited runs compared with what one or two breeds could enjoy on a farm where a poultry department is made a source of revenue.

WEIGHT OF EGGS.

From time to time the eggs laid by the different breeds were weighed singly and in dozens, as follows:—

—	Single Egg.	Per Dozen.	
	ozs.	lb.	ozs.
Plymouth Rock hens	2¼	1	11
do pullets	.....	1	09
Wyandottes, hens	.....	1	09
do pullets	2	1	07
White Leghorns, hens	2¼	1	10
do pullets	.....	1	08
Brahmas, hens	2¼	1	11
do pullets	.....	1	09
Buff Cochins, hens	2¼	1	11
do pullets	2	1	08
Black Minorcas, hens	2¼	1	11
do pullets	2	1	09
Black Hamburghs, hens	.....	1	06
do pullets	.....	1	04
Dirigos, hens	.....	1	10
do pullets	.....	1	08
Brahma-Minorcas, hens (not laying yet)	.....	....	....
do pullets	.....	1	14

It will be noticed from the above that the pullets of the Brahma-Minorca cross laid exceptionally large eggs. The hens have turned out larger than either the average Brahma or Minorca hen. The eggs were mostly weighed in February and March of last year (1889). Some of the eggs from White Leghorn hens, laid in the beginning of March, were remarkably large, as those who saw them on exhibition in the poultry house may remember. Taking two of the largest of these Leghorn eggs, one weighed 2½ ozs. and the other 2¼. The lesser weight has been put down, as best representing the weight of the majority.

MISHAP TO INCUBATOR.

On the 26th May last one hundred eggs were put into the Bessey Incubator. The hatching went on successfully until the sixth day when the lamp of the incubator burst into flames and was injured beyond immediate repair. The eggs were removed to another machine operated on the hot water principle without lamp, but in so doing several hours' delay unavoidably occurred and what eggs were not spoiled before were chilled by the long waiting. The machine was, however, attended to for the full period but only ten chickens came out. Four died within a week and the remainder were placed in the brooder where they grew rapidly. Examination of the unhatched eggs showed chickens in the first stages of development in most of the eggs, thus proving that the mishap to the incubator at the end of the first week had been fatal to the *embryo* chick. As enquiries by letter, and from visitors, are becoming more and more frequent, I would recommend more extended experiments in the way of arriving at the simplest and safest manner of artificial incubation. From what has been attempted in this way in the past two years, the hot water incubator without a lamp has been found the most reliable. If the eggs are properly tested at the proper time and the unfertile ones removed there can be no doubt, with proper attention, the incubator will hatch as great a percentage of chickens as hens set on the same number of eggs. Beyond doubt the chickens grow as well in the brooder as those brought up by hens.

HOW THE CROSSES DID.

Several crosses were tried with gratifying success in most cases. A cockerel of a cross, between a Black-breasted Red Game cock and Brahma hen, made a very handsome large bird. Hatched on the 30th May it weighed, when killed on the 19th December, $7\frac{1}{4}$ lbs. The cross between the same Black-breasted Red Game cock and Black Minorca and White Leghorn hens resulted in plump birds, game-shaped, and showing the markings and many of the characteristics of the male parent. One cockerel is so well marked as to be easily mistaken for a brown red. Several of the pullets of the White Leghorn cross, with same male bird, are very little different from the pure Black-breasted Red Game. All the Game cross pullets ought to make excellent layers, and when they begin to lay their record will be carefully noted. The cross between a Plymouth Rock male and Wyandotte and Houdan hens did not make as large birds as anticipated. The four Plymouth Rock Brahma crosses (males) of the year before, (May, 1888), turned out suitable market fowls, weighing, when killed, 8 lbs. 7 oz., 8 lbs. 3 oz., 7 lbs. 15 oz., and 7 lbs. 6 oz., respectively. The females of this cross matured into goodly proportioned fowls, laying large eggs. In the experiments made so far (two seasons) no cross has rivalled the pure Plymouth Rock, the nearest approach being the Plymouth Rock-Brahma cross of 8 lbs. 7 oz. and the Game-Brahma cross of 7 lbs. 4 oz. It is important that experiments in the way of crossing different varieties, calculated to make superior market fowls, should continue. The results cannot fail to be of interest to all who are desirous of having fowls of larger size and better quality of flesh placed on the market.

LIST OF POULTRY.

The number of fowls of both sexes on hand at present is as per list:—

	Males.	Females.
Plymouth Rocks	6	18
Brahmas	2	10
White Leghorns	11	23
Houdans	6	15
Wyandottes	9	9
Andalusians	6	6
Buff Cochins	6	9
Crosses	9	21
White Plymouth Rocks	1	6
Black Hamburghs	4	15
do Minorcas	4	12
do Russians	...	2
do Spanish	...	1
do Javas	1	1
Coloured Dorkings	...	2
G. B. Polands	1	2
Redcaps	1	2
B. B. R. Game	...	1
Silver Pencilled Hamburghs	...	1
Brown Leghorns	1	
Wild Geese	3	2
	71	161
		71
		232

A DISEASE WHICH WAS GENERAL IN THE CITY AND VICINITY.

Fowls in the city and vicinity were attacked during the summer months by a disease which appears to have been general in the locality, and which was the cause of many losses. A dairy farmer in the neighborhood reported the loss of forty fowls in a short period. Not far distant from him a farmer stated his loss at thirty-five, and many others were losers to an equal or less extent. Enquiries as to the nature of the disease and for treatment were frequent. Fifteen fatal cases occurred among the farm fowls. As soon as the first cases were noticed, and others in the neighbourhood were reported, particular attention was given to the phases presented by the disease. The fowls affected did not show any outward difference from the others, until they were noticed slow in coming to feed or refusing to eat and then it was too late to save them. On handling the ailing ones they were found to be mere skeletons, the breastbone sticking out with the sharpness of a knife. As quickly as noticed the sick fowl were separated from the others and given bread and milk with a few drops of Pain Killer in the drinking water. In some cases a condition pill was given, but despite every effort the invalids wilted away as in a rapid decline until death, generally attended by convulsions, followed. There was no discharge as in cholera, nor was the ailment caused by lice. The fowls had a fair run, and the premises and grounds were quite new. In two cases the fowls had become so weak from emaciation as to choke to death from inability to swallow the bread and milk they attempted to eat. One gentleman, well known in the city, besides writing for information, brought two of his sick fowls to the poultry house to show the condition they were in after being ill for some days. They were too far gone to benefit from the stimulating treatment given and died during the night. The whole of the farm poultry, although in the month of July, were at once given a generous allowance of soft feed—seasoned with cayenne pepper or ground ginger—in the morning in lieu of grain. A small quantity of tincture of iron was put in the water for drink. While this treatment did not cure any of the sick it certainly seemed to prevent others from being attacked. It may be stated that at first cholera was suspected, but in no case were there any symptoms to prove a case, nor was there any cause in the case of the farm fowls for an outbreak, the premises being new and the runs used for the first time. Any information from any quarter near or at a distance (not heard from) with an experience of this disease, will be gladly received with a view to further investigation.

BEGINNING OF WINTER LAYING.

Winter laying commenced about the 10th of December. One or two hens began to lay earlier, having got over their moult. The Plymouth Rock pullets, as already mentioned, laid through the fall, with a short stoppage, from time of first laying on 28th August. Other pullets laid as follows:—

Brahma,	hatched	2nd May,	laid first egg	22nd	December, 1889.
Game Cross	do	30th do	do	23rd	do
Buff Cochin	do	21st do	do	26th	do
White Leghorn	do	21st do	do	18th	do
Black Hamburgh	do	24th June	do	31st	do

Other pullets are expected to lay soon.

THE WILD GEESE.

The wild geese have grown to large size in captivity. They did not breed last season, but will probably do so next season, when they will be in their third year. In October last the largest gander weighed 15½ lbs., and the next in size was within short weight of being as heavy. During the hot weather water tanks were provided for them, and added much to their good condition.

ORDERS FOR EGGS.

During the exhibition of the Central Canada Association in September, 1889, among the farmer visitors to the city many seized the opportunity to visit the Central Farm, and while in the poultry department left orders for eggs for hatching, to be forwarded in early spring.

LETTERS OF ENQUIRY.

Numerous letters have been received since last report from different parts of the Dominion, enquiring as to the best breeds of fowls for egg-production and market, incubators, diseases of poultry, &c., &c. All the desired information was given in reply.

PACKING EGGS.

Several enquiries have been made as to the best manner for packing away eggs, in summer, when the price is cheap, and keeping them until the winter season. I would suggest, in view of the importance of the matter, that experiments should be made of certain well recommended methods, in order to ascertain the best and simplest.

ENQUIRING FARMERS—INFORMATION THAT WILL BE USEFUL TO THEM AND OTHERS.

During the past year numerous farmers from the locality and a greater distance, have visited the poultry department, with evident desire to gain all the information possible as to the most profitable sorts of poultry and the best methods of caring for them. It afforded me great pleasure to impart all the information in my power, and the interest displayed in the different points of merit in each breed was a source of great gratification. From the tenor of the questions asked on the occasion of such visits the following general information may be found of service and anticipate many questions others are desirous of having answered. As preliminary, I may state that the best authorities hold that the poultry department of the farm ought to be one of the best paying. The same authorities state that a hen will yield a profit of one dollar per annum. This result, however, cannot be obtained without a thorough knowledge of the best methods. A farmer can no more receive a return from neglected hens than he can from neglected fields. It is not a whit more unreasonable for him to expect paying crops from frozen ground than it is to anticipate a crop of eggs at winter prices from frozen hens. A profit from his fields can only be derived by the systematic, intelligent and industrious manipulation of the soil. So it is with poultry. He must understand what he is about. He knows that his fields must be properly fed to ensure a paying return. The laying stock must be as equally well fed. They must be comfortably housed in the cold season. They must be given food best calculated to furnish egg-forming material and to gently stimulate; material to furnish lime for the shell, meat to make blood. There is a constant drain on the resources of the regularly laying hen as there is on the fields from which successive crops are reaped. The farmer supplies the drain on his fields by a liberal supply of manure. He must supply the drain on the resources of the laying hen by similar generous treatment in food. In summer, when the hen can roam at large, she supplies herself with all the necessary egg-making material. But when she is confined to limited space, in winter, she must be furnished with all she has been accustomed to help herself to when abroad. And this is the whole basis of winter laying. Let the hens be supplied in the house as nearly as possible with what they can pick up outside, and what is it? We will speak about it directly. First, it is absolutely necessary that the laying stock should have good winter quarters.

A GOOD HOUSE NEEDED.

A comfortable fowl house can be cheaply and expeditiously made in the corner of a barn, shed or any outbuilding. It should be cheerfully lighted and face the south or west if convenient. Tarred felt paper makes a good lining and is obnoxious to vermin. The house should be divided into pens, lage enough to hold 20 fowls, and no more. Fowls do better in small colonies. The laying stock must not be crowded or they will not be layers long. The temperature in the coldest weather should be high enough to keep the water from freezing—at any rate, warm enough to prevent the combs of the layers from freezing. A wooden floor is better than any other kind. In the cold weather the best earthen floors will get damp, and keep so, and damp is disease and death to poultry.

WHAT SHOULD BE IN THE HOUSE.

The best roost is a 2 by 4 inch scantling, put broadside over two 12-inch boards, forming a platform to catch the droppings, which as manure is worth 75 cents to $1 per barrel. Heavy fowls should not have to jump more than 18 inches. Each pen should contain a dust bath, so that the fowls can roll in the dry dust and keep down lice. A small box to hold broken oyster shells, old mortar, gravel, crockery broken into small pieces, &c., &c. Some of these substances are absolutely necessary to furnish grit to grind up the food. They are the hen's teeth. A certain amount goes to furnish lime for the egg shell, but much of the lime for this purpose can be given in the shape of proper food.

TREATMENT OF LAYING STOCK.

The hens shold be kept in constant activity. A lazy hen is never a laying one. Cut-straw, hay, chaff or dry leaves should be scattered liberally on the floor of each compartment, and in this all grain fed should be thrown, so that the hens will be kept scratching for it. A cabbage suspended from the roof or ceiling high enough to make the hens jump at it is a capital way of keeping them busy. Occasionally substitute a piece of cow's liver, lights or any tough sort of meat for the cabbage. In very cold weather the chill should be taken off the water for drink. Laying fowls require plenty of fresh water, hence the importance of having the house warm enough to prevent water freezing. Take away all the male birds from the laying hens. The cock bird is a nuisance in the pen of layers. He not only monopolises the most of the food, but teaches the hens to break eggs, and so learn to eat them. Besides, the stimulating diet is too fattening for him, and will ruin him as a breeder.

THE PROPER FOOD FOR LAYING STOCK.

In the cold weather of winter a warm meal in the morning is necessery to start and keep up a steady supply of eggs. A good plan is to throw all the waste of the kitchen, in the shape of meat scraps, pieces of bread, uneaten vegetables, &c., into a pot; heat up in the morning till nearly boiling, and then mix bran, provender, shorts, or whatever is most abundant or cheap on the farm, into the hot mess, dusting in a small quantity of red pepper before mixing. Let the mixture stand for a few minutes until the meal is nearly cooked; then feed in a clean trough, with laths over it, to keep the hens from jumping in and fouling or wasting the feed in their eager anxiety. Feed only enough of this soft stuff to barely satisfy, never enough to gorge. When a hen has had so much food that she will go into a corner and mope, she has had too much, and if the overfeeding is continued will soon cease to lay. The laying hens are the active ones. If food is given at noon, it should be oats, and scattered among the litter on the floor. This meal should be light. The last feed in the afternoon should be generous. Each hen should be sent to roost with a full crop to carry her over the long night. Green food, in the shape of vegetables, usually grown on every farm, will be relished by the layers. Cabbages, turnips, carrots are generally the most convenient. Small potatoes boiled and mixed with provender or bran is a good change for the morning meal. Some of the above-named vegetables should always be in the pens of the layers. There is no danger of their eating too much. Red clover hay steamed, chopped and mixed with bran, and given while hot, is one of the healthiest foods for the morning meal. Meat in some shape must be given at least twice a week, to furnish blood-making material. Hens fed on meat lay well. If given no meat the hens will eat their eggs and pick feathers from one another. In cold weather warm the grain feed.

WHAT QUANTITY TO FEED.

Experience will teach the "happy medium" in feeding. It is desirable to feed well, but not so much as to make the hens too fat. And here the advantage of having small colonies of fowls, where different breeds are kept, will be evident, for what would be generous and stimulating diet for Leghorns, Minorcas and others of the Spanish family, would be too fattening for Plymouth Rocks or Brahmas. As before stated, give enough to keep the hens active. When meat is given, it is not necessary to give so much grain. For instance, if meat is fed at noon it will be only necessary to scatter a few handsfull of oats in each pen to keep the inmates at work. When a hen becomes too fat she will lay soft-shelled eggs. Where plenty of meat is to be had as one of the cheapest articles of food a greater quantity of oats may be given. Wheat is the best all-round food. The waste of the farm in conjunction with meat and the hot morning meal and exercise will bring plenty of eggs.

WHAT SORT OF FOWLS TO HAVE.

Beyond question, the best all-round fowl for the farmer is the Plymouth Rock. The best two breeds are the Plymouth Rock and the White Leghorn, for the reason, as the tables published in a preceding part of the report prove, that the Plymouth Rock puts on flesh more rapidly, and the White Leghorn lays more eggs than any other of the standard breeds. Closely following come the Wyandottes as an early flesh producer and layer. Then follow the Brahmas, but they are slower in development. Another advantage in keeping Plymouth Rocks and Leghorns is, that while the Plymouth Rock hens are hatching chickens, after laying all winter, the Leghorns (being non-sitters) will go on laying, and pay the expense incurred while the other breed is sitting. The common barn door fowl is a good winter layer, when not too old nor too inbred. Where a farmer has a large number of mixed fowls, and he does not care to get rid of them, he can do a great deal to improve the state of things by procuring a thoroughbred cock or cockerel, and breeding from him.

HOW TO BREED.

If his fowls are large he should get hold of a Leghorn, Minorca or Andalusian male; if small he should place a Plymouth Rock, Brahma or Wyandotte male among his fowls. It is best to breed from a certain number of his best fowls. By observation he will soon find out which are his best layers, and those he should breed from, and so a flock of good layers will be produced. A hen is at her best at two years of age. She does not lay so many eggs in her third year, and after that should be disposed of, unless of extraordinary worth as a breeder. One of the greatest drawbacks to a farmer keeping poultry successfully is that he allows his fowls to inbreed from year to year, until they are so reduced in size as to be unfit for table use, and their laying qualities are things of the past.

VICES.

Two of the worst vices which fowls in confinement are given to are egg eating and feather pulling. The first is caused by being kept in too great numbers in limited quarters; a craving for animal food; the nests not being dark enough, and the eggs exposed to view in consequence; the male bird being among the layers, and breaking an egg; hens laying soft-shelled eggs. The second vice is caused by the absence of blood food, such as meat; fowls being in too great numbers, and not kept busy enough. Both faults, once acquired, are very difficult to stop. Prevention in both cases is far better than any cure. The nests for the layers should be as retired as possible, and a little difficult to approach. Eggs should be gathered as soon as laid. If the habit becomes general, stop the hens from laying, by ceasing the soft food, and give nothing but oats. If convenient, move the hens to a strange pen, and that will aid in stopping the egg-production. If there is an incorrigible egg-eater in the pen she should be killed, or she will teach every companion to be as vicious as herself. In feather-pulling a "bit" is sold by dealers in poultry supplies to go into the mouth; another plan is to feed the pullers nothing but feathers, and separate them from one another. With care to have the layers kept in small numbers, with the proper variety of diet, neither of these habits should be acquired.

SITTING HENS, CHICKENS, &c., &c.

All information necessary for the proper management of sitting hens and tbe rearing of chickens will be found under their proper sub-headings in preceding pages of this report. The benefit of hatching chickens early will also be evident. The pullets hatched in April and early May should begin to lay when the older stock are in heavy moult and eggs are becoming scarce and dear. Early hatched Plymouth Rock cockerels will weigh 8 and 9 lbs. by the fall months.

POINTS TO REMEMBER.

A few points to remember are:—

1. Make hens lay when eggs are dearest.
2. Breed stock when eggs are cheap.
3. Keep a non-sitting breed to lay when sitters are hatching, and pay expenses of latter.
4. Breed as many chickens as possible and as early as possible. They all represent so much money.
5. Keep all the pullets. They are worth $2 each as prospective early winter layers.
6. Kill, or otherwise dispose of, all hens after three years of age.
7. Breed the best flesh-formers for market. Feed them up to as great weight as possible.
8. Well-fattened, well-dressed poultry will bring the best prices from the best customers.
9. If not accustomed to poultry, begin with a small number. Learn to make a success of the few, then go on with a larger number.
10. Do not neglect the little essentials to success, such as lime, gravel, meat, plenty of clean water, green food, dust bath, &c., &c., regularly supplied to layers.
11. Keep strict account of every cent of expenditure and receipts. Charge the poultry with all expenses and credit them with all receipts. The droppings at 75 cents. per barrel will go a long way to pay feed.
12. Market gardeners and dairymen are particularly well situated to permit of their dealing profitably in poultry. The former has spare time in winter; the latter is among the best customers in the city every day.

CHARACTERISTICS OF DIFFERENT BREEDS.

Some of the leading features of the best known breeds, as follows, may be interesting, viz.:—

Plymouth Rocks.—A hardy, vigorous breed, growing rapidly to large size. Small bones, great and rapid flesh-formers. Male birds go up to 10 and 12 lbs.; cockerels reach 8 lbs. in early fall. Females good layers, good sitters, good mothers. A breed well suited to climate. Chickens hardy. The best all-round fowl for farmers. Pullets lay from 4½ to 6 months of age.

Wyandottes.—A comparative new breed, of great merit. Cross of dark Brahma and Silver Spangled Hamburg. Matures rapidly, having small bones and putting on flesh easily. Males go up to 7, 8 and 9 lbs. Females are good layers, good sitters, good mothers; apt to become broody, but easily broken up and lay soon after. Chickens hardy. A good fowl for farmers. Pullets lay when 5 months old.

Brahmas.—A well-known and old-established breed, with many friends and admirers. Grow to large size and heavy weight, but take time to do so. Have large frames, and a good deal of feed is required to put flesh on them. Are very hardy, both as chickens and fowls. Are quiet, and bear confinement well. Females are fair layers of eggs of good size, but rather heavy for early sitters (when egg-shells are likely to be thin), and apt to be clumsy as mothers. After 7 or 8 months of age males make good table fowls. Pullets lay at 7 months of age.

Buff Cochins.—Another of the Asiatic family that has many friends. Like the Brahma, they grow to large size, but take time to do so. Are very quiet, and stand limited quarters well. The females are good sitters and careful mothers, fair layers of a large egg (when hens) of rich colour. Pullets lay when 7 months old; males grow to heavy weight; chickens and fowls hardy.

Houdans.—A breed of French fowls of some merit as layers, but do not grow to the same weight in this as they do in the country of their origin. Are non-sitters, and lay a white egg of rather more than average size. Chickens are hardy, mature rapidly and are great foragers. Are not so suitable to farmers as either Plymouth Rocks or White Leghorns. Owing to heavy crest on top of head are apt to fall easy prey to hawks and other enemies of the poultry yard. Crest will freeze and become solid with ice where water is not kept from freezing or fountain with narrow lip is not used. A good table fowl.

White Leghorns.—One of the best layers at all seasons, when properly handled and cared for, as all fowls should be. Are non-sitters, hardy, and mature rapidly. Will lay well in winter, in a moderately comfortable house. Chickens thrive well and feather quickly. Hens lay a white egg of large size (see table of weight of eggs). Pullets lay at 5 or 6 months, sooner if hatched early. The Brown and Black Leghorns are also great layers. They are good fowls for farmers when kept with a breed of sitters. Great flyers, like all the Spanish family.

Black Minorcas—An old English breed, comparatively new to this country, and fast taking the place of the Black Spanish. They are as good layers as the Black Spanish, and grow to much heavier weight, the males making fair table fowls. They are given weight allowance in the new standard of excellence (American). They lay well in winter, properly housed. Both fowl and chickens are hardy; the latter grow rapidly. The males have large and high combs, which must be kept from freezing. Pullets lay at 5 or 6 months of age.

Andalusians.—Another comparatively new-comer—to this side of the water—of the Spanish type, and as a breed of layers rivalling the Leghorns. They are likely to occupy a high position among poultry fanciers on their superior laying merits. They lay well in winter, when looked after, and are hardy, quick-growing chickens. They do not breed true to colour or markings in every case; but that is a matter of secondary importance to those who wish to keep them for their laying properties. Like the Black Spanish, they are not heavy-weights, and in consequence are not so good for table use as the heavier breeds. Pullets lay when 6 months old. Hens lay large white eggs.

Black Hamburghs.—Small tightly-feathered fowls. They lay small eggs, but a great many of them. Chickens grow fairly well, but all the family seem liable to cold and roup in the fall. There are other breeds of greater merit for farmers to choose from.

Silver-Pencilled Hamburghs.—Beautifully marked small fowls. Lay a large number of small eggs. Require great care, as they are subject to roup in rainy, cold weather.

Dorkings.—A breed very much prized in England for its table qualities. In this country they are sensitive, when chickens, to the fall weather, and are harder to rear than Plymouth Rocks or White Leghorns. The coloured are the best suited to this part of the Dominion. While a breed of great merit, they are not hardy enough for the farmers to take hold of. Crossed with the Plymouth Rock, an excellent result is attained.

Black Javas.—Grow to large size when in second year. They are not remarkable as layers, but are good table fowls. The eggs are large and of a rich colour. If better known would perhaps be better appreciated. They are fairly hardy as chickens and fowls.

Black Russians.—Have not been found to possess the hardiness nor winter-laying qualities claimed for them. They are predisposed to colds and roup in the cold wet weather of the fall months. The females make good, kind mothers. They do not possess the merits that other breeds do to make them suitable to farmers.

Games.—Are of many varieties. Some are more suited to the cold winter of this country than others. Black-breasted Red Games have been found rather hard to get over the first year, but are hardy and vigorous afterwards. As table fowls their reputation is world wide. Hens are fair layers. They are tight-feathered and weigh much more *than they look.*

There are several new breeds yet on their trial, and nothing decided can yet be said for or against them. A breed may have a reputation for laying qualities in a mild climate which on removal to a colder one they may not be found to display. Several crosses have been found to result satisfactorily, such as the Plymouth Rock male and White Leghorn female and *vice versa;* Brahma and Black Minorca hen; White Leghorn male and Brahma female.

DISEASES.

Poultry like all other animals are subject to disease. But with a run such as they should have on a farm, and proper care in the cold, wet weather, of a certain portion of the fall, disease should be rare. The disease most common to poultry in this portion of Canada is roup in its different phases of cold, catarrh and throat affections. The first symptoms are running at the nostrils and sneezing. In its more virulent form it is attended with swollen head and closed eyes, and a most offensive discharge. It is better on detecting a case to kill the bird at once and burn it. If neglected it will contaminate all the others in the pen by dipping its nostrils into the drink water, and so disseminate the virus. It is very contagious. A simple cold if neglected will develop into roup. Treatment for a cold is to inject with a syringe a small quantity of coal oil, and if handy a few drops (5 or 6) of carbolic acid added. Two or three injections ought to effect a cure. Isolate the fowl from the others. The most frequent causes of disease are keeping too many fowls together and filthy quarters.

The foregoing information on the most important points in poultry management can only be briefly given in the limits of a report. It is to be hoped all who have the opportunity will visit the Experimental Farm and see the methods and appliances in operation. There is no food given that the farmer has not in abundance, no treatment adopted nor appliances used that is not within his easy reach.

I have the honour to be, Sir,

Your obedient servant,

A. G. GILBERT,
Manager Poultry Department.

CENTRAL EXPERIMENTAL FARM,
OTTAWA, 3rd January, 1890.

EXPERIMENTAL FARM FOR THE MARITIME PROVINCES.

REPORT OF W. M. BLAIR, SUPERINTENDENT.

To Prof. WILLIAM SAUNDERS, F.R.S.C., F.L.S., F.C.S.,
Director Experimental Farms,
Ottawa.

SIR,—I have the honour to submit herewith the following report of the operations on the Experimental Farm for the Maritime Provinces at Nappan, N.S., during the year 1889.

WEATHER.

The year has been a fine one for farm work. We had a very mild winter, with much rain and sleighing only for 15 days. The spring was early. Farm work commenced on 6th May. Until 12th June the weather was dry and warm, with occasional showers, that made vegetation very rapid, after which there was 10 days of cold, damp weather. During this period much of the grain, especially that sown late, turned yellow, but whether this was caused by the weather or due to the presence of the grain Aphis that infested the grain in great numbers, more particularly the late sown, I am unable to determine. However, as soon as the weather became warmer the grain partially recovered from its sickly appearance and made as fair a growth as could be expected after being so seriously checked.

I may here say that the "Lady Bug" rendered valuable assistance in destroying the Aphis.

During the months of August and September the weather was unusually warm, the thermometer ranging for several days from 85° to 88° in the shade at 1 o'clock. The root crops suffered severely from drought during this period.

The autumn was fine and dry, with occasional showers. The first frost to interfere with farm work was on the 27th November, with 2 inches of snow on the 28th, which soon melted away with a south wind.

MANURE.

Owing to the scarcity of snow last winter we only succeeded in hauling 450 loads of marsh mud. This was put on four and a-half acres of sod land that had been previously drained and ploughed in the fall, and as soon as the first frost left the land in the spring, was evenly spread and well worked in with a two horse cultivator or grubber and a disc harrow, until it was thoroughly mixed with the top soil, and a good seed bed thus made. It was then sown to wheat with a seed drill. This wheat made rapid growth; the straw was free from rust and the grain well filled.

The manure from the cattle and horse stables was drawn to the fields every week during winter, and was well mixed together in a pile, and frequently turned over for a few weeks and then spread on the fields from a cart or sled. By this mode we succeeded in giving ten acres a fair dressing.

MARSH LANDS.

The high tides of December last that broke the dykes and flooded the marsh were a benefit to those parts of the marsh that were well drained, as the salt water ran off quickly but left a deposit of new mud and, as a consequence, a large crop of hay was cut this year, while on the portions that were not so well drained the water remained longer and a light crop of hay was the result. Taking it all together we secured from ninety to one hundred tons, where we only had from sixty to seventy last year. We have this year opened 741 rods of surface drains and strengthened the weak places in the dykes, and trust that they will now withstand the high tides.

WHEAT.

On the ninety acres of upland in crop this year we had, in addition to other crops, eighty varieties of wheat ranging in quantities of seed from 100 lbs. to 20 kernels. A statement of some of the most promising sorts is given below.

Name.	Quantity of Seed Sown.	Sown.	Harvested.	No. of Days Ripening.	Yield.	Weight per Bushel.	Character of Growth.
	Lbs.				Lbs.	Lbs.	
Rio Grande	60	May 8	Aug. 24	108	900	61	Bright, tall, stiff straw; very long heads.
Defiance	42	do 8	do 27	111	690	58	Bright, stiff straw.
Red Fern	100	do 8	do 21	105	1,080	57	Stout, strong straw; some rust.
Ladoga	60	do 9	do 19	102	660	58	Stiff do do
Onega	15	do 9	do 12	95	225	51	Rapid growth; short, stiff straw
Indian Hard Calcutta	6	do 9	do 14	97	60	60	do do
White Delhi	6	do 9	do 14	97	46	60	do do
California White	12	do 25	Sept. 2	100	46	57	Medium growth; rusty.
Gehum from India	2	June 3	do 5	94	13	60	

Some good seed, in small quantities, has also been secured from a number of the small plots. This will be sown another year and the results given.

OATS.

Some 60 varieties of oats were sown, the quantity of seed varying from 100 lbs. to 20 kernels. A statement showing the amount of seed, time of sowing, time of ripening, and amount of products, as well as weights per bushel, from the field plots is given below:

Name.	Quantity of Seed Sown.	Sown.	Harvested.	No. of Days Ripening.	Yield.	Weight per Bushel.	Character of Growth.
	Lbs.				Lbs.	Lbs.	
Longfellow	36	May 10	Aug. 19	101	561	33	Short, stiff straw; badly rusted.
English Potato	36	do 10	do 19	101	740	37	Very stiff, bright straw.
Rennie's Prize White	8½	do 10	do 17	99	350	35	Medium straw, stiff and bright.
Early English White	110	do 14	do 19	97	740	40	Bright, stiff straw.
English Red	79	do 14	do 21	99	768	32	Short, stiff straw; rusty.
Welcome	90	do 14	do 19	97	880	40	Soft straw; much blighted.
August White	24	do 16	do 26	102	388	37	Medium straw; some rust.
Flying Scotchman	80	do 17	do 19	94	627	28	Stiff straw; some rust.
White Tartarian	45	do 17	do 27	102	429	33	Small, stiff straw; rusty.
Early Blossom	55	do 17	do 20	95	612	35	Stiff straw; some rust.
Carter's Prize Cluster	100	do 10	do 12	94	1,216	38	Long, stiff straw.
Black Champion	80	do 14	do 24	102	1,152	36	Short, stiff straw; rusty.
Improved Waterloo	55	do 17	do 21	96	680	34	Fair straw; some rust.
Lincolnshire Poland White	32	do 17	do 19	94	180	40	Weak straw; some rust.
Imp. Black Tartarian	73	de 17	do 21	96	704	32	Stiff straw, but very rusty.
Victoria Prize	95	do 17	do 16	91	1,053	39	Bright, stout, strong straw.
Onega	60	do 17	do 19	94	960	30	Bright, stiff straw.

Some good seed, in small quantities, has also been secured from a number of the small plots. This will be sown another year and the results given.

BARLEY.

Of barley there were 60 varieties, ranging from 4 bushels to 20 kernels of seed. Some of the best are given in the following table:—

Name.	Quantity of Seed Sown.	Sown.	Harvested.	No. of Days Ripening.	Yield.	Weight per Bushel.	Character of Growth.
Carter's Prize Prolific	4 bush.	May 24.	Aug. 28.	96..	2,622 lbs..	52¼ lbs.	Short, bright straw.
Scholey's Imp. Chevalier	4 " ..	" 24.	" 28.	96..	1,410 " ..	52 " .	Bright straw.
Danish Chevalier	2 " ..	" 24.	Sept. 2.	101..	748 " ..	51⅓ " .	Short straw.
Danish Printice Chevalier ...	2 " ..	" 24.	" 3.	102..	644 " ..	52 " .	do do
Mensury	2 " ..	" 24.	Aug. 22.	90..	756 " ..	48 " .	do soft straw.
New Zealand..........	1 " ..	" 25.	" 28.	95..	350 " ..	52½ " .	do do
Polar	30 lbs...	" 25.	" 21.	88..	310 " ..	45 " .	do poor straw.
Petschora	1 bush.	" 25.	" 22.	89..	387 " ..	48½ " .	do straw.
Peerless White..............	3 lbs...	" 25.	" 27.	94..	40 " ..	52 " .	do bright straw.
Early Minting......	3 " ..	" 25.	" 27.	94..	41 " ..	52¼ " .	do do
Selected Chevalier	3 " ..	" 25.	" 27.	94..	41 " ..	52 " .	do stiff straw.
Barley of Bhagarmany Hills.	3 " ..	" 25.	" 15.	82..	11 " ..	55⅓ " .	do soft straw.
Saale Barley................	6 " ..	" 25.	" 27.	94..	74 " ..	51½ " .	do bright, soft straw

This grain was sown on rather poor, wet, land and succeeded well under the circumstances. Another year the land will, it is hoped, be in better condition. Some good grain from several smaller lots were secured for next year's planting.

The total amount of grain grown of all kinds was 1,790 bushels.

BUCKWHEAT.

Several varieties of buckwheat were sown. Those named in the following statement of yield, etc., were the most promising:—

Name.	Quantity of Seed Sown.	Sown.	Harvested.	No. of Days Ripening.	Yield.	Weight per Bushel.	Character of Growth.
	Lbs.					Lbs.	
Japanese Buckwheat........	12.....	June 11.	Sept. 4.	85..	14 bush...	48.....	Stout, strong straw, heavily loaded.
Silver Hull do	48.....	do 13.	do 7.	86..	17 bush...	48.....	Strong straw.
Gravel do	40.....	do 13.	do 11.	90..	24 bush...	48.....	do

About 20 acres of buckwheat has been sown each year for green manure. This was ploughed under just as it was in full bloom. Notwithstanding this, there has been much trouble with a volunteer crop the following season; hence it is proposed to abandon it for fertilizing purposes, and substitute clover in its stead.

CORN.

Eleven varieties of corn were planted, all of which did well, but the large scales were not set when it was ready to cut, and we were unable to determine the weight per acre. Roughly estimated, the varieties would range as to merit in about the following order:—

Giant Prolific Ensilage, 12 feet high.
Red Cob Ensilage.
Large White Flint.
Stowell's Evergreen.

Self-Husking.
Canada Yellow.
Angel of Midnight.
Longfellow.
Early Minnesota.
Compton's Early.
Moore's Early Concord.
Egyptian Sweet.
New Corey.

POTATOES.

One hundred and three varieties were planted. The quantity of seed yield, and the character of the tubers, &c., is given below.

No.	Name.	Quantity of Seed.	Planted.		Yield.	Character of Tubers, &c.
		lbs.			lbs.	
1	St. Patrick	5	May	24	122	Long white, some rot.
2	Richter's Elegant	5	do	24	66	Long flat pink, some rot.
3	Prime Minister	5	do	24	119	Long white, few eyes, some rot.
4	Centennial	5	do	24	73	Round white and pink, few eyes, sound, late.
5	Gleason's Late	5	do	24	48	Blue long round, much rot.
6	White Star	5	do	24	98	Long round white, very sound, late.
7	Conqueror	5	do	24	90	Large white rough, few eyes, sound, late.
8	Jackson's Imp	5	do	24	116	Small round white, sound, late.
9	Asparagus	5	do	24	26	Small white irregular, sound.
10	Schoolmaster	5	do	24	102	Large round white, rough skin, sound.
11	White Sprout	5	do	24	83	Round white, many small, sound.
12	Paterson's Victoria	5	do	24	76	Small white, ill shaped, some rot.
13	Adirondack	5	do	24	62	Flat white, many small, few eyes.
14	Erfurt Early Round	5	do	24	33	Small round, ill shaped, much rot.
15	Halberstadt	5	do	24	58	Small round white, some rot.
16	William's Early	5	do	24	53	Small kidney shaped white, sound.
17	Sukreta	5	do	24	106	Flat oblong white, few eyes, some rot.
18	Early Calico	5	do	24	78	Flat smooth white, early, sound.
19	Six Weeks Round White	5	do	24	60	Small round white, sound.
20	Thorburn	5	do	24	66	Medium size pink, many small, some rot.
21	Thorburn	5	do	24	109	Long flat pink and white, some rot, late.
22	Compton's Surprise	5	do	24	73	Blue, few deep eyes, many small, some rot.
23	Prolific	5	do	24	46	Large flat white, many small, some rot, early.
24	Six Weeks Round Blue	5	do	24	38	Blue and white, small round, sound.
25	Rose's New Giant	5	do	24	187	Large long flat white, sound, late.
26	Emperor William	5	do	24	57	White flat, rough skin, medium early, sound.
27	Richter's Gem	5	do	24	100	Smooth white, few eyes, some rot.
28	Beefsteak	5	do	24	52	Small white long rough, sound.
29	Rotherant	5	do	24	74	Long rough pink, much rot.
30	Clark's No. 1	10	do	24	249	Long pink with white eyes, sound, prolific.
31	Count Moltke	5	do	24	37	Small pink, some rot.
32	Burbanks Seedling	5	do	24	90	Long white rough, sound.
33	May Queen Early	5	do	24	56	Large pink, some rot.
34	Silver Skin	5	do	24	57	Large white, some rot, early.
35	Eye Carpenter	5	do	24	100	Smooth white, few eyes, some rot.
36	English Kidney	5	do	24	52	Small white long rough, sound.
37	Erfurt Incomparable	5	do	24	74	Long rough pink, much rot.
38	Empire State	10	do	24	249	Long pink with white eyes, sound, prolific.
39	Frame Early	5	do	24	37	Small pink, some rot.
40	Paragon	5	do	24	90	Long white rough, sound.
41	Rosy Morn	5	do	24	56	Large pink, some rot.
42	Thorburn's Late Rose	10	do	24	67	Large white, some rot, early.
43	Jumbo	5	do	24	99	Long pink, sound.
44	King of the Earlies	5	do	24	47	Long white, very small, some rot.
45	Niagara	5	do	24	65	Small white round, deep eyes, some rot, early.
46	Paterson's Albert	5	do	24	101	Large white oblong, sound, late.
47	Matador	5	do	24	46	Small white, unproductive, some rot.
48	Richter's Schneerose	5	do	24	35	Small kidney shape, white, unproductive.
49	Harrison	5	do	24	93	Large pink, early, much rot.

POTATOES—*Continued.*

No.	Name.	Quantity of Seed.	Planted.	Yield.	Character of Tubers, &c.
		lbs.		lbs.	
50	Beauty of Hebron	10	do 24	149	Large pink, early, some rot.
51	Thorburn's Paragon	10	do 24	75	Large round white, sound.
52	Large Callao	5	do 24	64	Large flat white, pink eyes.
53	Early Bird	5	do 24	69	Small ill shaped, pink, sound.
54	Amylon	5	do 24	71	Small white, sound.
55	Pride of America	5	do 24	87	Very round white, deep eyes, late, sound.
56	Price from Holland	5	do 24	107	Large long white, deep eyes, sound.
57	White Late Rose	5	do 24	57	Large white, sound.
58	Snowflake	5	do 24	50	Large flat white, rough skin, sound.
59	Algiers	5	do 24	69	Very small round white, sound.
60	Lira	5	do 24	70	Medium size, few deep eyes, sound.
61	Onion Early	5	do 24	83	Medium size, red deep eyes, some rot.
62	Late Goodrich	5	do 24	77	Large round rough white, sound.
63	Early Ohio	5	do 24	113	Large pink, very productive, some rot.
64	White Elephant	10	do 24	103	Large round white, sound.
65	Early Calico	5	do 24	82	White oblong with bright red stripes, sound.
66	Prince Bismarck	5	do 24	62	
67	Richter's Imperator	5	do 24	136	Very large productive round white, sound.
68	Brownell's Best	10	do 24	119	Large flat white, rough skin, some rot.
69	Matchless	5	do 24	17	Small, white and pink seed ends, some rot.
70	Brownell's Beauty	10	do 24	90	Large white and pink spotted, sound.
71	Telephone	5	do 24	73	Small flat white, sound.
72	Bliss' Triumph	5	do 24	92	Round red, sound.
73	Early Short-topped	5	do 24	29	Small smooth white, some rot.
74	Alpha	5	do 24	63	Small white long flat, early, some rot.
75	Sharpe's Seedling	10	do 24	136	Long flat pink, sound.
76	Fidelia	5	do 24	105	Long blue, prolific and sound.
77	Dalmahoy	5	do 24	64	Small round, white, deep eyes, some rot.
78	Giant Long Dutch	5	de 24	68	Large rough white, sound.
79	Sugar	5	do 24	65	White flat, medium crop, some rot.
80	Golden Early	5	do 24	89	Round white, numerous but small, sound.
81	Kidney August	5	do 24	50	Long white, some rot.
82	Early Rose	10	do 24	154	Large light pink, very prolific, some rot.
83	Lark's Eye	5	do 24	49	Small white, early, much rot.
84	Great Eastern	5	do 24	103	Very large, round white, few eyes, sound.
85	Brownell's Superior	5	do 24	38	Long flat, dark pink, some rot.
86	Member of Parliament	5	do 24	57	Long white, sound.
87	Manhattan	5	do 24	49	Large round, blue, with some white spots.
88	Wonder of the World	5	do 24	70	Large long light pink, with white eyes.
89	Chicago Market	10	do 24	180	Large pink.
90	Mammoth Prolific	5	do 24	46	Round white, few eyes, sound.
91	American Magnum Bonum	5	do 24	37	Small unproductive, round white. sound.
92	Montana Elephant	5	do 24	34	Black round, sound.
93	Silver Dollar				Large white, sound.
94	Durning Seedling				Long blue, sound.
95	Seal Feet				
96	Crown Jewel	15	May 21	330	Oblong white, pink between eyes, sound, early.
97	Halton Seedling	15	do 21	390	Light color pink blush, oblong, some rot.
98	Stray Beauty	15	do 21	360	Bright red, round, few eyes, sound, early.
99	Rural Blush	15	do 21	390	Light pink, nearly round, deep eyes, sound, early.
100	Early Sunrise	15	do 21	360	Pink oblong, very early, some rot.
101	Dakota Red	15	do 21	360	Bright red, hardy, round, sound, late.
102	Early Ohio	15	do 21	360	Pink oblong, very early, some rot.
103	Rosy Morn	15	do 21	385	Flat pink, very early, some rot.

The following results were obtained from planting whole and different cuts in plots of thirty hills each.

	Yield.
No. 1—Whole potatoes—An even lot, not very large or small	54 lbs.
2—Half do split from seed end—An even lot	32 "
3—Three eyes—Mostly small ones	28½ "
4—Two do Some large and some small	27¾ "
5—One eye—An uneven lot, some very small	18¼ "
6—Seed end—A good round even lot	37 "
7—Butt end—Some large and some very small	33½ "

TURNIPS.

Three and six-tenths acres of turnips were sown, the yield being 3,600 bushels.

Varieties.

Bangholm Swedes produced	1,000	bus. per acre.
Queen of the Swedes produced	950	do
Elephant do do	1,050	do
King of the do do	875	do
Carter's Prize Winner do	1,000	do
Steel Bros'. Purple Top do	1,100	do
Rennie's Prize Winner do	1,025	do

This land was very wet previous to being drained, so much so that, it could not be cultivated properly.

MANGELS.

Two hundred bushels of mangels were grown, and of the three varieties tested, "Carter's New Golden Intermediate" was the most productive, "Carter's Mammoth Long Red" came second, "Carter's New Tankard Yellow" third.

CARROTS.

About 220 bushels of carrots were also grown. The four kinds tried stood in the following order for productiveness:—

Short White	1st
Carter's Orange Giant	2nd
Giant Wiltshire White	3rd
White Belgian	4th

TOMATOES.

Seven varieties of tomatoes were planted, all of which did well. In point of excellence they rank as follows, viz.:—

Livingston's Favorite	1st
Livingston's Beauty	2nd
Dwarf Champion	3rd
Perfection	4th
Conqueror	5th
Canada Victor	6th
Early Mayflower	7th

FERTILIZERS.

In addition to the barnyard manure, several kinds of fertilizers were used on the different crops with apparent good effect in most cases. In order to ascertain, if possible, their relative value, a number of tests were resorted to, with the following results:—

In one instance a plot of land that had some years ago been ploughed and cropped but had not received any manure, was taken. This land was rough and uneven, and had the appearance of being but once ploughed, and was much overgrown with weeds. After it had been well ploughed and cultivated it was divided into eleven plots of $\frac{1}{10}$ of an acre each, with a space of three feet between each plot. On ten of these plots ten different kinds of fertilizers were applied, leaving one plot without any manure for comparison. Then the whole was sown with oats. The statement below gives the value of the fertilizers used, the yield in pounds of grain and weight per bushel:—

PLOTS for testing fertilizers, $\frac{1}{10}$ of an acre each.

No.	Name.	Value.	Proceeds.	Weight.
		$ cts.		
1	Barnyard manure	1 50	88 lbs. of oats	37 lbs. per bushel.
2	Mussel mud	1 50	47 do	33 do
3	Bone-meal	1 00	54½ do	34 do
4	Fine ground phosphate	1 00	44 do	34 do
5	Guano	1 00	49 do	34 do
6	Corn fertilizer	1 00	62 do	36 do
7	Superphosphate of lime	1 00	70 do	36 do
8	Nitrate of soda	1 00	61 do	35 do
9	Archibald fertilizer	1 00	69 do	34 do
10	"Ceres" superphosphate	1 00	68 do	34 do
11	No fertilizer	....	42 do	31 do

It is the intention to continue these experiments with oats on the same plots for several years.

The effect of different fertilizers on turnips was also tried. A plot to which twenty-five cartloads of barnyard manure was applied to the acre during the winter was selected. Different fertilizers were sown in the drills just before the turnip seed was sown, to the value of $18.00 per acre.

The bone-meal and guano were mixed in the proportion of 6 of bone-meal to 2 of guano.

The following were the results:—

EXPERIMENTS with different fertilizers on Turnips—1 plot of each.

No.	Name.	Cost per Plot.	Yield.
		Cts.	Lbs.
1	Archibald's phosphate	54	1,600
2	Rock guano (fine ground)	54	1,700
3	Raw phosphate	54	1,490
4	Superphosphate of lime	54	1,875
5	Nitrate of soda	54	1,415
6	No fertilizer	....	1,590
7	Plot from general field, bone-meal and guano	54	1,800

Stockbridge's "Special Corn Fertilizer" was applied to the corn at the rate of $10 worth per acre, and to buckwheat at the rate of $5 per acre. This was attended with the most beneficial results.

Raw plaster and guano mixed in the proportion of 4 to 2, value $5 per acre, was applied to buckwheat, with the effect of doubling the yield. Stockbridge's "Special Potato Fertilizer," at the rate of $10 per acre, was applied to potatoes, and in every case gave a large return. And although the results obtained from these special fertilizers this year were not taken with sufficient accuracy to warrant their publication, yet they were of such a character as to warrant a more careful and thorough test in the future.

PRICES OF DIFFERENT FERTILIZERS.

	Per ton.	Per lb.
Special potato fertilizer	$36 00	$1\frac{4}{5}$c.
Corn fertilizer	38 00	$1\frac{9}{10}$c.
Guano	50 00	$2\frac{1}{2}$c.
Nitrate of soda	50 00	$2\frac{1}{2}$c.
Fine ground phosphate	28 00	$1\frac{2}{5}$c.
Superphosphate of lime	26 00	$1\frac{3}{10}$c.
Bone-meal	40 00	2c.
Peruvian guano	60 00	3c.
"Ceres" superphosphate	40 00	2c.
Archibald fertilizer	38 00	$1\frac{9}{10}$c.

DRAINING.

This necessary work was pushed forward as rapidly as possible, and 26 acres were drained, at an average of 30 feet between the drains. The statement below shows the cost of draining per acre, price of tiles, &c. :—

31,405 ft. 3-in. pipe at $12 00	$ 376 86
3,670 ft. 2-in. do 8 00	29 36
396 ft. 4-in. do 16 00	6 34
618 ft. 6-in. do 36 00	22 25
36,089 ft. or 2,187 rods	$ 434 81

Cost of tiles	$ 434 81
do labor, draining	713 60
do freight	99 24
do trucking	52 35
	$1,300 00
Average cost of draining per acre	$50 00

BUILDINGS.

The buildings commenced last year are now about completed. The barn is occupied, and is found very convenient for storing hay, grain and roots, and also for stock. It will hold over 250 tons of hay and grain, with stabling for 60 head of cattle and 11 horses. The granaries are capable of holding 2,000 bushels, and the root cellars 4,000 bushels There is also a convenient feed room.

The workman's cottage was finished in the spring, and has been occupied during the summer.

The Superintendent's residence is also nearly completed.

A set of large scales have been placed in a convenient place for weighing bulky material, such as hay, grain, roots, corn, cattle, etc., which are found to be very useful in connection with our work.

CATTLE.

The cattle fed last winter have been sold at a profit, and others bought this autumn to consume the hay, straw and roots raised. They are now doing well and adding to our stock of fertilizers available for next year's crop.

WATER.

A well was dug near the barn, and a supply of good water is obtained by pumping.

FENCING.

Five hundred and sixty-eight rods of fence has been built this season with cedar posts 8 feet apart; 6 inches from the top a 2 by 4 scantling was let in 1 inch and spiked on. This, with 5 strands of barbless wire on the level, or in some places 4 strands, and a small dyke thrown up from each side, makes a good, substantial and handsome fence. The posts on each side of the main road, 414 in number, were turned, and, when the fence was completed, the posts and rails received two coats of paint.

FRUIT TREES.

All the fruit trees came through the winter safely and made a vigorous growth this season. It was intended to plant them out in the spring in orchard, but before the land was in suitable condition to receive them the trees were in leaf. It was, therefore, deemed more prudent to allow them to remain in the nursery rows another year. Thirty of the trees were set out in November and the balance will be planted in the coming spring. This will give us an opportunity to note the difference between fall and spring setting.

STRAWBERRIES.

All the strawberries wintered well and made rapid growth in early spring. But in order to have a good lot of healthy plants to set another plot, the vines were not disturbed, but allowed to run until all the new plants required were secured. Notwithstanding this, a small lot of good fruit was picked. In point of excellence they appeared to rank as follows, viz.: Crescent, 1st; Manchester, 2nd; Wilson, 3rd; Woodruff, 4th; Sharpless, 5th; New Dominion, 6th; Capt. Jack, 7th; May King, 8th; Maggie, 9th; Daniel Boone, 10th.

RASPBERRIES.

All wintered well. New shoots were allowed to grow to produce canes for extending the area for another year. Some fine fruit was produced, and in point of excellence would rank about as follows: Turner, 1st; Caroline, 2nd; Golden Queen, 3rd; Hansell, 4th; Philadelphia, 5th; Cuthbert, 6th; Highland Hardy, 7th.

BLACKBERRIES.

The blackberries wintered well and made a good growth during summer, and also produced some good fruit. New shoots were allowed to grow, as in the case of the raspberries. Their quality and excellence of growth would entitle them to rank as follows: Snyder, 1st; Taylor, 2nd; Lucretia Dewberry, 3rd.

GOOSEBERRIES.

The gooseberries grew remarkably well, the Houghton being the most vigorous and productive. The Downing came next, with the Smith's Improved a good third.

CURRANTS.

The currants made only a fair growth and bore very little fruit. They appeared to stand in about the following order: White Grape, 1st; Red Dutch, 2nd; White Dutch, 3rd; Victoria, 4th; Fay's Prolific, 5th; Raby Castle, 6th. The black currants grew healthy and strong, and rank as follows: Black Naples, 1st; Champion, 2nd.

GRAPES.

All the grapes that were healthy last year came through the winter safely and made a fair growth. There was some fruit on the Concords.

CABBAGE.

Eleven varieties of cabbage were planted, some of which grew very large. In point of excellence they rank as follows: Henderson's Early Summer, 1st; Winningstadt, 2nd; Early Jersey Wakefield, 3rd; French Oxheart, 4th; Large Drumhead, 5th; Fottler's Drumhead, 6th; Marblehead Mammoth, 7th; Late Flat Dutch, 8th; Savoy, 9th; Extra Blood Red, 10th; York, 11th.

CUCUMBERS.

Boston Market, Medium Green, Green Prolific, London Long Green, Long Green, and Nicol's Medium Green, were planted and did well.

GRASSES.

The following grasses and clovers were sown in plots, and so far are doing well: Of clovers—Bokhara, Trefoil, Large Late, White Dutch, Alfalfa, and Sainfoin. Of grasses—Creeping Bent, Red Top, Meadow Foxtail, Sweet Vernal, Tall Oat, Yellow Oat, Crested Dog's Tail, Orchard Grass, Tall Fescue, Sheep's Fescue, Hard Fescue, Meadow Fescue, Red Fescue, Fine Leaved Fescue, Water Meadow Grass, and Wood Meadow Grass.

EXHIBITIONS AND FARMERS' INSTITUTES.

Some of the products of the farm were shown at the Maritime Exhibition, held at Moncton, N.B., during the third week of September, and at Amherst, N.S., the following week.

The exhibits consisted of 66 varieties of grain in glass jars, and 82 varieties in the straw; 103 varieties of potatoes, 8 of turnips, 3 of mangels, 12 of cabbage, 8 of tomatoes, 6 of cucumbers, 3 of buckwheat, 9 of clover and grasses, and 13 varieties of corn.

The exhibition at New Glasgow, N.S., was visited, but we were unable to make an exhibit at that place, as the time intervening between the one held at Moncton and Amherst and this one was too short in which to arrange another exhibit.

I attended the "Farmers' Institute" of New Brunswick, held at Fredericton, during the month of January, where addresses were delivered and papers read by the following gentlemen, viz.: "Dairying," by Dr. D. M. Twitchell, associate editor *Maine Farmer;* "Butter Making," by W. G. Gilbert, Dorchester; "The Dairy Interest of New Brunswick," by G. E. Baxter, of Perth, N.B.; "Winter Dairying," by P. C. Black, Secretary Dairymens' Association of Nova Scotia; "Experimental Farms," by Prof. Wm. Saunders, Director of Experimental Farms, and W. M. Blair, Superintendent of Experimental Farm at Nappan; "Care and Management of Sheep," by C. H. Black, Amherst, N.S.; "Ensilage," by J. Baxter, M.D., Chatham, N.B.

These papers were all fully discussed, and a great interest was taken in them by those present.

I also attended the meeting of the Fruit Growers' Association of Nova Scotia, held at Wolfville, January last. Much enthusiasm was manifested in the proceedings, and fruit growing in all its details was earnestly discussed, as well as the difficulties encountered by the ravages of injurious insects, and how to overcome them. These discussions were taken part in by many prominent fruit growers of Kings and Annapolis, as well as by Prof. Saunders, Director of the Experimental Farms, who spoke at some length on the general question of fruit growing, and the work of the Experimental Farms in connection therewith. He also gave many valuable hints with a view to the prevention and destruction of insects injurious to fruits.

I was also present at a meeting of the Nova Scotia Dairymen's Association held at Truro in March last. The discussions were carried on by many prominent farmers of Nova Scotia, and Prof. Smith, of the School of Agriculture, Truro; W. F. George, of Sackville, N. B.; Howard Trueman, of Point de Bute, N. B.; W. H. Blanchard, of Windsor, N.S., and J. W. McKay, of Stellarton, gave a valuable paper on "Silage and Silos;" H. F. Page, of Amherst, on the "Holstein as a Dairy Cow;" W. W. Hubbard, Secretary of the Farmers' Association of New Brunswick, on "How to Maintain the Fertility of our Farms;" B. Eaton Paterson, B. S. A., N. B., on "Increasing and Improving our Butter Production;" "Creameries," by W. J. Gilbert, New

Brunswick; "Prevention and Treatment of Milk Fever," by Prof. F. C. Greenside; "A Plea for Butter Factories," by H. B. Hall, Nova Scotia; and "Feeding Calves and Pigs," by Jas. Cheesman, Boston.

A Farmers' Institute was attended at Amherst, on the 22nd January, where general farm topics were discussed by a number of leading farmers of Cumberland, assisted by Prof. Saunders.

I also attended several meetings of farmers in Colchester and Cumberland, and took part in the discussions, and from what I have seen and heard I am convinced that a growing feeling is manifested in favor of "Farmers' Institutes," and associations of a kindred nature, with a view to obtaining further knowledge in the art of agriculture.

I have the honor to be, Sir,

Your obedient servant,

W. M. BLAIR.

Superintendent.

NAPPAN, 31st December, 1889.

EXPERIMENTAL FARM FOR MANITOBA.

REPORT OF S. A. BEDFORD, SUPERINTENDENT.

To WM. SAUNDERS, F.R.S.C., F.L.S., F.C.S.,
Director Experimental Farms,
Ottawa.

SIR,—I have the honour to submit herewith the following report of the operations on the Manitoba Experimental Farm for the year 1889.

WEATHER.

The past season has been one of the driest this Province has experienced for a number of years, and the crops are in consequence generally light. In those districts favoured with local showers the yield has been good and in nearly all parts of the Province the sample has been excellent. On this farm at no time during the growing season has sufficient rain fallen to thoroughly moisten the roots of the grain.

WHEAT.

Owing to our not getting possession of the farm until late last season very little of it was in a fit condition for a wheat crop, and the field originally intended for this cereal was partly overflowed at seed time with water from the springs in the bluffs, and the field finally selected was not suited for a dry season.

Although the yield of wheat was very small, it is deemed advisable to give the returns and endeavour to throw some light on the suitability of the different varieties for a dry season.

Thirty-eight varieties of wheat were sown, and except in the case of the fall-sown grain the land was wheat stubble, fall ploughed, and the seed drilled in. The Red Fife sown in the fall was grown on fallow land. It did not germinate until some time after the spring-sown grain, but stooled out well and kept up a steady growth all the season. The experiment has been repeated this season with two varieties of spring wheat, and the same varieties will be sown next spring on adjoining land, receiving similar preparation.

Below will be found the results of the several experiments with wheat.

Variety.	When Sown.	When Harvested.	Bushels per Acre.	Weight per Bushel.
				Lbs.
Red Fife	Nov. 3, 1888	Aug. 14	$21\frac{55}{60}$	63
Red Fern	April 8, 1889	do 12	$7\frac{1}{2}$	63
Rio Grande	do 8, "	do 10	6	63
Club	do 8, "	do 12	$3\frac{1}{2}$	$62\frac{1}{4}$
Red Fife	do 8, "	do 12	$4\frac{50}{60}$	$61\frac{1}{2}$
Ladoga	do 8, "	do 8	$4\frac{5}{60}$	61
Eureka	do 9, "	do 10	8	$63\frac{1}{4}$
Old Red River	do 9, "	do 13	$7\frac{2}{3}$	$62\frac{1}{2}$
White Connel	do 9, "	do 13	$7\frac{1}{3}$	62
Red Connel	do 9, "	do 13	$7\frac{1}{5}$	$60\frac{1}{4}$
White Fife	do 9, "	do 13	$6\frac{1}{3}$	62
Saxonka	do 9, "	do 10	$6\frac{2}{3}$	$62\frac{1}{3}$
Russian Hard Tag	do 10, "	do 14	$7\frac{50}{60}$	$64\frac{1}{2}$
Judket	do 10, "	do 14	$7\frac{25}{60}$	62
California White	do 10, "	do 9	6	62
Golden Drop	do 10, "	July 31	5	61
White Delhi	do 10, "	do 31	$2\frac{50}{60}$	63
Indian Red Calcutta	do 10, "	do 31	2	$62\frac{1}{4}$

FROZEN VS. UNFROZEN SEED.

These samples of seed were all graded by the Winnipeg grain examiner. Plot No. 1 was located in the valley; soil, rather stiff clay loam. Plot No. 2, on side of bluffs, about 60 feet above the valley; soil, light sandy loam, seed drilled in, in every case.

Variety.	When Sown.	When Harvested.	Yield per Acre.	Lbs. per Bushel.
Plot No. 1.			Bush.	
No. 1 Hard Red Fife	April 11	Aug. 10	$10\frac{24}{60}$	61
No. 3 do	do 11	do 10	$6\frac{40}{60}$	61
No. 1 Frosted Red Fife	do 11	do 10	10	61
No. 2 do	do 11	do 10	$9\frac{36}{60}$	61
No. 3 do	do 11	do 10	$10\frac{24}{60}$	61
No. 4 Frosted or Rejected Red Fife	do 11	do 10	8	61
Plot No. 2.				
No. 3 Hard Red Fife	April 5	Aug. 1	6	$60\frac{1}{2}$
No. 1 Frosted Red Fife	do 5	do 1	$4\frac{1}{2}$	60
No. 2 do	do 5	do 1	$4\frac{1}{3}$	60
No. 3 do	do 5	do 1	$4\frac{1}{3}$	60
No. 4 Frosted or Rejected Red Fife	do 5	do 1	$3\frac{2}{3}$	$59\frac{1}{2}$

OATS.

Twenty-one varieties of oats were tested. The land used for this purpose was originally intended for wheat, and was in fair condition; soil, rich loam, with a southern exposure. The land was fallow in 1888, and a heavy crop of green weeds and volunteer wheat was ploughed in late in August of that year. Except where a test of broadcast against drilling was made, the seed was all drilled in. The plots were side by side, and the soil nearly uniform.

The results of the several tests are as follows:—

Variety.	When Sown.	When Harvested.	Yield per Acre.	Weight per Bushel.
			Bush.	Lbs.
Longfellow	April 16	July 31	$31\frac{10}{34}$	$33\frac{1}{2}$
Black Champion	do 17	Aug. 3	$30\frac{20}{34}$	34
do Tartarian (Ont. seed)	do 16	do 3	$30\frac{20}{34}$	39
August White	do 16	do 3	$30\frac{20}{34}$	37
Early Calder	do 17	do 3	$28\frac{28}{34}$	$37\frac{1}{2}$
Red Oats	do 15	do 5	$27\frac{21}{34}$	34
White Poland	do 16	July 30	26[illegible]	37
English Potato	do 16	Aug. 2	$26\frac{14}{34}$	37
Early Blossom	do 16	do 3	$24\frac{22}{34}$	34
Winter Grey	po 16	July 30	$24\frac{24}{34}$	$34\frac{3}{4}$
Flying Scotchman	do 16	do 30	$24\frac{12}{34}$	$38\frac{1}{2}$
Welcome	do 17	do 29	$23\frac{2}{34}$	$43\frac{1}{4}$
White Russian	do 15	Aug. 5	$21\frac{1}{2}$	41
Rennie's Prize White	do 17	July 30	$19\frac{21}{34}$	$44\frac{1}{2}$
Carter's Prize Cluster	do 17	do 29	$17\frac{22}{34}$	42
English White (Ont. seed)	do 17	do 29	$19\frac{21}{34}$	44
Glenrothern	do 16	Aug. 3	$16\frac{4}{34}$	31
Onega White	do 16	July 30	$16\frac{4}{34}$	$30\frac{1}{2}$
Cream Egyptian	do 15	Aug. 5	$13\frac{4}{34}$	40
White do	do 15	do 2	13	39

STUBBLE *VS.* FALLOW.

Variety.	When Sown.	When Harvested.	Yield per Acre.	Weight per Bushel.
			Bush.	Lbs.
Black Tartarian (fallow)................	April 30..........	Aug. 14.........	$49\frac{18}{34}$	$34\frac{1}{2}$
do (wheat stubble)........	do 30..........	do 14..........	30	39

DRILL *VS.* BROADCAST SOWING.

Welcome (drilled in)....................	April 18.	July 29..........	14	$43\frac{1}{2}$
do (broadcast machine)	do 18..........	do 29.......	$6\frac{26}{34}$	$43\frac{1}{2}$

DEEP *VS.* SHALLOW SOWING.

Black Tartarian, 3 inches deep.	April 18..... ...	Aug. 5.	$26\frac{23}{34}$	37
do $1\frac{1}{2}$ do	do 18.........	do 5..........	$23\frac{11}{34}$	37

THICK *VS.* THIN SOWING.

White English, 8 pecks per acre........	April 19..........	Aug. 6..........	$19\frac{5}{34}$	40
do 9 do	do 19....	do 6...	$17\frac{7}{34}$	40
do 10 do	do 19..........	do 6..........	$20\frac{27}{34}$	40
do 11 do	do 19..........	do 6.	$24\frac{1}{34}$	40
do 12 do	do 19	do 6........ .	$26\frac{29}{34}$	40

BARLEY.

Barley sown on fallow land yielded fairly well, but that sown on stuble suffered severely from drought.

The Danish varieties will be noticed as leading in yield on stubble ground. This new importation promises to be a vigorous grower and well adapted for a dry year. It will also be noticed that stable manure had no appreciable effect on this grain ; this was no doubt owing to lack of moisture. With our usual rainfall the result would in all probability be quite different. Nearly all varieties were a bright sample.

TESTS WITH BARLEY.

LATE AGAINST EARLY SOWING (FALLOW LAND.)

Variety.	When Sown.	When Harvested.	Yield Per Acre.	Weight Per Bushel.
				Lbs.
Prize Prolific..................................	April 17....	August 9....	26	$53\frac{1}{2}$
do	do 26....	do 9....	$19\frac{23}{48}$	$53\frac{1}{2}$
do	May 3....	do 14....	$27\frac{36}{48}$	54

WITH AND WITHOUT STABLE MANURE.

Prize Prolific, no manure........................	May 13....	August 23....	25	$53\frac{1}{2}$
do 12 loads per acre....	do 13 ...	do 23...	25	$53\frac{1}{2}$
do 24 do	do 13....	do 23 ...	25	$53\frac{1}{2}$

FALL AND SPRING PLOUGHING OF STUBBLE.

Variety.	When Sown.	When Harvested.	Yield per Acre.	Weight per Bushel.
English Malting, fall ploughing	April 26	August 16	7 4/48	53½
do spring ploughing	do 26	do 16	8 32/48	53
ON SUMMER FALLOW.				
English Malting	April 17	August 9	26 12/48	53
Prize Prolific	do 17	do 9	26	54½
ON WHEAT STUBBLE LAND.				
Danish Chevalier	April 30	August 15	13 43/48	56
do Printice Chevalier	do 30	do 15	12¼	55⅓
Two-rowed Duck-bill	do 30	do 9	10 12/48	54¾
Peerless White	do 29	do 16	8 35/48	54¾
Beardless	do 29	do 16	8 33/48	54½
Thanet	do 29	do 15	9 29/48	55
Golden Melon Improved	do 29	do 15	7 14/48	54½
Swedish	do 29	do 16	7 4/48	55
New Zealand	do 29	do 9	6 13/48	55½
Large two-rowed	do 29	do 9	5	54
Petschora	do 30	do 15	4 8/48	49½
Mensury	do 29	do 16	2 34/48	52¼
Polar	do 29	do 16	1	49½

HAY LAND.

The meadow of native grass, cleared of scrub last season, has proved quite an acquisition, and has furnished sufficient hay to feed the horses used on the farm during the year.

GRASSES AND FODDER PLANTS.

In view of the fact that the native hay meadows of the Province are becoming exhaused, considerable attention has been paid during the season to experiments with grasses, clovers and fodder plants. The dry season has affected the yield to a certain extent but it is quite evident that many of the fodder plants now extensively grown in the eastern Provinces can be introduced here with advantage.

NATIVE GRASSES.

Fourteen varieties of native grasses were collected on this farm in the autumn of 1888, and were sown in April last. Of these the following six varieties grew, and most of them compare favourably with the cultivated varieties sown beside them.

Variety.	When Sown.	Per cent. of Germination.	Height, 1st Nov., 1889.
	1889.	p. c.	inches.
Bromus Kalmii	April 15	100	14
Elymus Canadensis	do 15	100	24
Poa Serotina	do 15	100	20
Elymus Virginicus	do 15	100	16
Triticum Caninum	do 15	100	24
Muhlenbergia Glomerata	do 15	100	22

CULTIVATED GRASSES AND CLOVERS.

Thirty varieties of cultivated grasses and clovers were sown during the past season, but owing to the drought only the following germinated :—

Variety.	When Sown.	Per cent. of Germination.	Height, 1st Nov., 1889.	—
	1889.	p. c.	inches.	
Tall Fescue	April 15	25	8	Drilled.
Hard Fescue	do 15	25	6	do
Agrostis Dispar	do 15	10	6	do
Agrostis Vulgaris	do 15	50	7	do
Timothy	do 15	75	7	do
Fiorin	do 15	50	6	do
Meadow Foxtail	do 15	50	5	do
Perennial Rye Grass	do 15	50	8	do
Italian Rye Grass	do 15	40	14	do
Meadow Fescue	do 15	62	12	do
Orchard Grass	June 1	20	6	Broadcast.
Clovers.				
Lucerne Clover	do 1	90	8	do
Common Red Clover	do 1	50	12	do
Alsike Clover	do 1	40	4	do
White Dutch Clover	do 1	30	6	do

FODDER PLANTS.

Of fodder plants, 19 varieties were tested; all were sown in drills. For corn, the common two-horse wheat drill was used; the others were sown with a small garden hand drill. The land was kept free of weeds by means of a horse cultivator, and it now is in excellent condition for next year's crop.

Variety.	When Sown.	When Cut.	Height.	Yield per Acre.	Distance between Rows.
			Feet.	Lbs.	Inches.
Giant P. & S. Ensilage Corn	May 28	Sept. 6	6	17,511	40
Canada Yellow do	do 28	do 6	4	11,848	40
Red Cob Ensilage do	do 28	do 6	5	11,586	40
Horse Tooth do	do 28	do 6	4	10,759	40
Compton's Early do	do 28	do 6	3 5/12	10,672	40
Longfellow do	do 28	do 6	3 10/12	10,541	40
Early Eight-rowed Yellow Corn	do 28	do 6	4	9,670	40
White Flint Corn	do 28	do 6	4	8,929	40
Angel of Midnight Corn	do 28	do 6	3	8,450	40
Self-Husking Corn	do 28	do 6	3 10/12	8,058	40
Kaffir Corn	do 28	do 6	3 5/12	4,748	40
Millets, &c.					
Pearl Millet	June 1	Sept. 2	2 5/12	6,316	40
Large African Millet	May 30	do 2	3	3,789	40
White Millo Maize	do 29	do 2	3 3/12	3,655	40
Hungarian Grass	June 6	do 2	2	3,558	20
Millet (common)	do 6	do 2	2	3,189	20
Johnston Grass	May 30	do 2	3 6/12	2,831	40
Egyptian Rice Corn	do 30	do 2	3 5/12	2,700	40
Golden Wonder Millet	do 31	do 2	3 10/12	2,178	40

POTATOES.

The collection of potatoes grown this year consists of 96 varieties; 100 sets of each sort were planted. They were all ploughed in, in rows—soil, sandy loam.

It is evident from the variable yield under similar conditions that the productiveness of this tuber depends largely on the variety of seed used.

The quality of each of these varieties will be ascertained during the present winter.

Variety.	Yield from 100 Sets.	Variety.	Yield from 100 Sets.
	Lbs.		Lbs.
Pride of America	53½	Erfurt Incomparable	20
Thorburn	38½	Price from Holland	19½
Early Rose	36½	Prince Bismarck	19½
Saint Patrick	35	Bliss' Triumph	19½
Early Bird	35	Alpha	18½
Thorburn's Paragon	34	Williams' Early	18
Rosy Morn	34	Late Goodrich	18
Paterson's Albert	33	Silver Skin	18
Great Eastern	32½	Halberstadt	18
Chicago Market	32	Gleason's Late	17½
White Star	32	Empire State	17
Conqueror	31½	Brownell's Beauty	17
Brownell's Best	31	King of the Earlies	17
Golden Early	31	Amylon	17
Albino Early	30	Dalmahoy	17
Thorburn's Paragon	30	Algiers	16
Early Conqueror	30	White Sprout	16
May Queen	29½	Early Frame	16
Vanguard	29	Centennial	15½
Erfurt Early	28	Richter's Elegant	15
Richter's Imperator	28	Rose's New Giant	15
Wonder of the World	28	Beefsteak	15
Six Weeks, Round White	28	Jackson's Improved	15
Early Calico	26	Stewart	14
Clark's No. 1	25½	Giant Long Dutch	13½
Mammoth Prolific	25	Early Callao	13
Lark's Eye	24½	Brownell's Superior	13
Adirondack	24½	Early Calico	13
Member of Parliament	24½	Sugar	13
Manhattan	24	Richter's Gem	12½
Sharpes' Seedling	24	Prime Minister	12
Emperor William	24	Matador	12
Burbank's Seedling	23	Rotherant	11½
Thorburn's Late Rose	23	Marigold	11
Eye Carpenter	22	Matchless	11
White Elephant	22	Lira	10
Prolific	22	Gennessee Seedling	9
Telephone	22	Compton's Early	8½
Early Short	22	Paterson's Victoria	7½
Harrison	22	Morning Star	7
Jumbo	22	Six Weeks, Round Blue	6
Kidney August	21½	Asparagus	6
Richter's Schneerose	21	Count Moltke	5
Sukreta	21	English Kidney	5
Large Callao	21	H. & S. late White Rose	3½
Beauty of Hebron	21	Fidelia	3
Snowflake	20		

TURNIPS.

The following 13 varieties of turnips were sown in flat drills; 1 variety sown on a ridged drill failed to germinate: Soil, a deep rich sandy loam :—

Variety.	When Sown.	When Pulled.	Yield per Acre.
Early White Stone	June 5	October 12	280 bushels.
Purple Top Strap Leaf	do 5	do 12	279 do
Extra Early Millan	do 5	do 12	260 do
Golden Ball	do 5	do 12	254 do
Orange Jelly	do 5	do 12	254 do
Early Red Top Strap Leaf	do 18	do 12	226 do
Prize Hardy Swede	do 10	do 11	213 do
Early Purple Top	do 18	do 12	209 do
King of Swedes	do 6	do 12	$201\frac{1}{2}$ do
Queen of Swedes	do 5	do 12	181 do
Pomerian White	do 18	do 12	171 do
Carter's Elephant Swede	do 6	do 12	151 do
White Stone	do 18	do 12	$124\frac{1}{2}$ do

MANGELS.

Four varieties of mangels were sown, three in flat drills and one in both flat and ridged drills. Owing to the extremely dry weather a large proportion of the seed failed to germinate, hence the yield is small.

Variety.	When Sown.	When Pulled.	Yield per Acre.
Mammoth Long Red	May 23	October 14	116 bushels.
Carter's New Tankard	do 23	do 14	62 do
do Golden Intermediate	do 23	do 14	$57\frac{45}{60}$ do
Drill vs. Flat.			
Yellow Turnip Mangel, flat sowing	do 31	do 14	$71\cdot\frac{50}{60}$ do
do do drill do	do 31	do 14	60 do

FRUIT TREES.

Early in April of this year, 487 fruit trees were procured, 382 were apple, 27 pear, 42 plum, 25 crab apple and 11 cherry. In addition to the foregoing, 294 one year old apple trees were received from the Central Experimental Farm at Ottawa. Nearly all were hardy varieties, many of them of Russian origin. They were all planted during April in nursery rows 5 feet apart and 3 feet apart in the rows.

It has been observed that the wild fruits of the Province thrive best when protected by timber or scrub.

With this fact in view, two plots of thick oak, hazel and rose bush scrub were cleared and planted with fruit trees, grape vines and strawberry plants. This clearing involved considerable labour but the result so far has been highly satisfactory.

For comparison, a portion of the above fruits were also planted on the open prairie without protection.

Below will be found a description of the plots,also a list of the trees, etc., planted in each, and the number living when winter set in.

Plot No. 1.

Situated on the open prairie, slightly northern exposure, soil deep sandy loam, subsoil porous. In this plot were planted 130 apple trees, of which 10 died ; 10 crab apple, all living ; 13 pear, all living ; 35 plum, all living ; 5 cherries, all dead ; 13 grape vines, 10 living ; 1,350 strawberry plants, of which only 178 lived.

Compared with the other plots, the growth was quite small on all kinds of trees, and the foliage was much injured by hot winds.

Plot No. 2.

Situated on the side of river bluffs, southern exposure, scrub 4 to 9 feet high on all sides, soil rich sandy loam mixed with leaf mould.

The following were planted in this plot: 142 apple trees, 10 crab apple, 13 pear, 6 plum, 2 cherry, 22 grape vines, and 1,065 strawberry plants. All of the trees lived and made good growth ; 442 of the strawberries grew and produced a large number of new plants.

The growth of everything in this plot was more vigorous than in either of the other plots, and the hot winds had no appreciable effect on the leaves.

Plot No. 3.

Also on bluff side, but with a northern exposure. Scrub on north-east and west: planted with 59 apple trees, 1 dead ; 4 crab apple trees, all living; 1 pear dead, 2 plum, both living ; 3 cherries, all dead ; 810 strawberry plants, of which 152 lived.

STRAWBERRIES.

Early in May of this year, 3,225 strawberry plants were procured. They were planted 6th May, in rows 3 feet 6 inches apart and 1 foot between plants.

During the last week in May severe frosts destroyed a large number of plants. especially on the open prairie. All losses were, however, more than made up by new runners. A few plants were set out on 18th April, and all were destroyed by the frost of 21st April.

The results of the tests with this fruit are as follows :

STRAWBERRIES.

Variety.	Plants Set Out.	Old Plants living	New Plants.	Total Plants, Sept. 18, 1889.
Wilson's Albany	1,200	373	1,614	1,987
Crescent Seedling	750	131	1,528	1,659
Captain Jack	525	183	1,256	1,439
Manchester	300	55	203	258
Daniel Boone	225	17	62	79
Sharpless	225	13	49	62
	3,225	772	4,712	5,484

GRAPES.

Late in April thirty-five vines of nine varieties were planted in rows 8 feet apart and 9 feet apart in the row. The collection included five vines of each the following varieties: Champion, Worden and Moore's Early, four each of Early Victor and Concord, and three each of Ives Seedling, Rogers No. 3, Delaware and Lady.

One each of Early Victor, Ives Seedling and Rogers No. 3 have died ; the others all lived and made good growth ; one of Moore's Early fruited.

Before winter set in the vines were cut back and covered with earth.

CURRANTS.

The plantation of this fruit consists of 961 bushes, and includes four varieties of Black, five of Red and one of White. They were planted six feet by four feet; time of setting out ranged from 6th to 30th April.

The following percentage lived and made a fair growth, 95 per cent. of the Black, 74 per cent. of the Red, and 50 per cent. of the White.

Before winter set in 10 inches of earth was drawn around the bushes.

GOOSEBERRIES.

With the exception of one variety the gooseberries have stood the drought remarkably well.

The following sorts were planted the same distance apart as the currrants: 26 of Houghton Seedling, 25 Downing, 10 Woodwards Whitesmith. All these grew. Of 12 native, 11 grew; 10 Industry, only 2 grew.

RASPBERRIES AND BLACKBERRIES.

Of the 23 varieties of this fruit tested, a number were injured in transit, and all were seriously affected by the drought.

The Snyder, Hilborn snd Turner, in the order named, were most promising.

FOREST TREES AND SHRUBS.

There is an increased interest manifested in forestry and arboriculture throughout the Province. Several thousand ash-leaf maples were planted by farmers in this district last season, and enquiries for tree seed are received from all parts of the North-West.

Early this spring ,12000 forest trees and shrubs were received from the Central Experimental Farm at Ottawa. This collection consists of 118 varieties.

A strip of land 100 feet wide on the western limit, and extending the length of the farm, has been set apart for a permanent shelter belt. During the past season 585 yards of this has been planted with 31 varieties of forest trees, set 9 by 9 feet apart. The remaining trees have been planted in nursery rows, and will be set out permanently next spring. Of the trees planted this season all the alders, poplars and willows grew; of the other varieties the followng proportion were living when winter set in: 80 per cent. of pine, 60 per cent. of spruce and arbor vitæ, 90 per cent. of elm and maple,.86 per cent. of ash, 66 per cent. of birch, 60 per cent. of walnut, 34 per cent. of hemlock, and 48 per cent. of black cherry.

A plantation of native trees and shrubs has been started and additions will be made as opportunity offers.

SEEDLINGS.

During October of last year several bushels of native ash and maple seeds were sown in rows 3 feet apart. These came up in early spring, but were all destroyed by the wind storm of the 17th and the frost of the 20th April. Another sowing was made the last week of April. The 6,000 ash and 7,000 maples from this sowing have made good growth and will be available for permanent planting next spring.

AVENUE TREES.

The avenue of large ash-leaf maples commenced last season has been completed during the year.

Of the 100 trees planted in this avenue during October, 1888, 90 per cent. grew, of 471 trees set out in April last, 96 per cent. grew, and 66 per cent. of those planted in July.

Trees having about two-thirds of the length of their branches removed, when planted, have succeeded best. All the avenue trees, owing to drought, were watered four times, four pails to a tree each time.

FALL WHEAT.

One acre of Manchester fall wheat was sown on 26th August, followed by two other varieties on 2nd September. The seed germinated quickly, and before winter set in a good growth had been made.

BEES.

In June of this year two hives of Italian bees were procured. Reaching the farm late, very little surplus honey was obtained. Both hives swarmed in July, and when placed in the cellar on 1st November all four hives contained a full supply of honey for winter use.

FENCING.

Three and three-quarter miles of additional fence has been erected during the year, making a total of $6\frac{88}{100}$ miles. This, with the portion protected by the immediate banks of the river, completes the enclosure of the farm.

ROAD-MAKING.

The remaining three-quarters of a mile of the road crossing the farm from east to west has been graded and well gravelled. This road is now an excellent one, and makes a good approach to the farm.

DRAINING.

The open ditches dug last year proving satisfactory, 1,100 additional yards were opened during the past season. Square timber culverts were used where the drains crossed the roads.

EXHIBITS AT AGRICULTURAL FAIRS.

Samples of the products of the farm were prepared and shown at the following fall exhibitions: Brandon, Oak Lake, Virden, Rapid City and Minnedosa. The exhibits were well spoken of, and much interest shown in the work of the farms.

NEW BREAKING AND SUMMER-FALLOW.

About sixty acres of new land on the higher portions of the farm has been broken, backset and harrowed ready for the seed, and about twenty-five acres of the valley land summer-fallowed. The fallow land has been ploughed twice and harrowed several times.

BUILDINGS.

The buildings at present in use on the farm are small and inconvenient, and furnish no accommodation for cattle. During the past year the contract has been awarded and work commenced on a commodious bank barn, the basement to be used for horses and cattle, and the upper portion for storing grain, hay, &c. It is expected to be ready for occupation by next harvest. Arrangements have also been made for the erection of a house for the use of the Superintendent.

I have the honour to be, Sir,

Your obedient servant,

S. A. BEDFORD,

Superintendent.

BRANDON, Man., 10th January, 1890.

EXPERIMENTAL FARM FOR THE NORTH-WEST TERRITORIES.

REPORT OF A. MACKAY, SUPERINTENDENT.

INDIAN HEAD, N. W. T., 28th December, 1889.

WM. SAUNDERS, F.R.S.C.,F.L.S.,F.C.S.
Director, Experimental Farms,
Ottawa.

SIR,—I have the honour herewith to submit to you my report on work done on the North-West Experimental Farm at Indian Head—the crops sown and the returns so far as are yet known, the varieties and number of fruit and forest trees planted, their growth and present condition, and to submit the results of experiments with cereals and other agricultural crops.

The season just past has been one of great severity on all crops grown in the North-West Territories. It may justly be called a year of extremes. Last winter was one of almost unknown mildness. March was so very fine that thousands of acres of grain were sown during the last two weeks, and at no time in the history of the country was the ground in such favourable condition. No sooner, however, were the crops sown, than heavy winds commenced, followed all the summer by exceptionally dry weather. In many places the settler had his good prospects injured by winds, and finally almost ruined by succeeding drought. In some localities where soil was favourable and the farming done in accordance with the requirements of the country the crops did fairly, and considering the excessive dry weather, remarkably well.

The Experimental Farm suffered in company with every other farm in the country; perhaps very few suffered as much from winds, but dry weather, though reducing the yields, was not so disastrous as to many. In this portion of the Territories, at least, every settler knows the importance of properly preparing his land. For several years after the country became open for settlement everyone imagined that grain would grow, no matter how put in, but now the man is devoid of reason that thinks he is sure of a crop without any exertion on his part. It is true that we have had one year since 1882 that required little or no preparation to give a most abundant crop, but only too many know how little was received in the remaining years by poor cultivation.

Our seasons point to only one way in which we can in all years expect to reap something. It is quite within the bounds of probabilities that some other and perhaps more successful method may be found, but at present I submit that fallowing the land is the best preparation to ensure a crop. Fallowing land in this country is not required for the purpose of renovating it, as is the case with worn out lands in the east, and it is a question yet unsettled how much or how little the fallows should be worked, but as we have only one wet season during the year, it is found beyond doubt that the land must be ploughed the first time before this wet season is over, if we expect to reap a crop the following year. This wet season comes during June and July, at a time when every farmer has little or nothing else to do, and then this work should be done. Usually seeding is over by the first of May, and to have the best results the land for fallow should be ploughed from 5 to 7 inches deep as soon after this as possible. Land ploughed after July is of no use whatever, unless there is rain in August, which very seldom comes to any great extent. A good harrowing should succeed the ploughing, and all weeds or volunteer grain be kept down by successive cultivation. A good deal of uncertainty is felt in regard to a second ploughing, some holding that it is useless; others maintain that it is an injury, while others again have found it to give from five to ten bushels per acre more than one ploughing. So far the result on the Experimental Farm has been that two ploughings have given by far the best returns. Especially was this the case where the first ploughing was done in May or June. There is no doubt but that two ploughings cause more growth of straw, and consequently in a wet year the grain is longer by several days in ripening, and that the danger from frost is greatly increased by these few days delay; but taking the seasons so far passed, 1884 excepted, it can safely be recommended to plough twice, with as much surface cultivation between as possible. Above all, it is of the greatest importance that the first ploughing should be deep and done in time to receive the June or July rains.

Fall ploughing of stubble land has not given good results, and unless our seasons change there is no reason to expect anything but a poor return from land ploughed while in such dry condition as it always is in the fall. A much better way is to allow it to remain until spring, with as long stubble as possible to retain the snow, then sow on the stubble and plough in 3 inches deep. The seed, if put down on damp, hard soil, with a loose covering on top, will at once commence to grow and before dry weather sets in will have considerable top covering.

The foregoing remarks are respectfully submitted to settlers in the North-West Territories.

LAND IN CROP.

My last report stated that 215 acres had been prepared for crop during the summer of 1888. This was utilized as follows: Wheat, 74 acres; barley, 19 acres; feed oats, 40 acres; new varieties of oats, 19 acres; peas, 8 acres; nursery and wind break, 12 acres; roots, corn and patatoes, 7 acres; roads, 16 acres; around buildings and divisions between varieties of grain, 13 acres.

WHEAT.

Wheat being the chief and the most important product of this country, a larger acreage was given to it than any other grain. Thirty-seven varieties were sown, including 16 from India, the area ranging from a field of 24 acres of Red Fife down to plots of one-tenth of an acre. The land being in good condition and the frost out sufficiently, seeding was begun on the 25th of March.

In order to gain information on the early ripening qualities and difference in yield of as many of the varieties sown as possible, Red Fife, White Fife, Ladoga and Saxonka were chosen for the earliest test. These were sown on the 25th and 26th of March in as large quantities as two drills could overtake. The land had been worked in the same way; the same quantity of seed was sown to the acre, and the same number of acres of each variety sown in the two days; but, unfortunately, the winds did so much injury to the Ladoga and Saxonka plots, from their being on a more exposed portion of the farm, though alongside the Red and White Fife, that practically this test has been of no use.

On the 8th of April, Red Fife, White Fife, Ladoga, Saxonka, Eureka, Red Fern, Club and Judket were sown on measured acres, one acre to each variety. The land was in good order. All had been fallowed, except one-half of the Judket plot, which had a small crop of Millet the year before, of which the yield was only two bushels. All the plots were sown by drill, with one and one-half bushels each.

The grain came up very evenly together, and until about a foot high no difference could be observed. The winds had thinned all the varieties considerably, but all were treated alike, so far as could be detected, but afterwards the Eureka and Red Fern (which I think are the same wheat) pushed ahead, and finally gave the most straw, though not the most grain, as will be shown further on. In ripening the Ladoga was fourteen days earlier than Red or White Fife, ten days earlier than Eureka, Red Fern, Club or Judket, and four days earlier than Saxonka.

In testing new wheats nine varieties were sown on the 1st April, and eight varieties on the 6th. All were intended to be sown on the 1st and 2nd, but a snow storm delayed the latter lots four days. On the 1st Indian Karachi, Hard Calcutta, Club Calcutta, Bearded Red, No. 1756, Defiance, Chilian White, Paine's Defiance, and Improved Summer Cob, were sown. On the 6th Magyar, Greek Summer, Russian Hard Tag, Wright's Wheat, California White, and Onega, as will be seen in table of yields, &c. Two varieties, White Delhi and Red Calcutta, matured in four months and one day; three varieties in four months and two days, being the same time as the Ladoga in the acre plots sown seven days later. These five were very short in the straw, though extra good in the grain, as will be noticed by comparing weight per bushel. Future trials can only determine whether the early propensities will remain, and the deficiency in straw be improved with more favourable seasons.

FROZEN WHEAT.

Three grades of frozen Red Fife wheat were obtained, and sown by drill on same day, and under exactly the same conditions. No. 1 grade contained 10 per cent. frozen grain; No. 2 grade from 50 to 70 per cent. frozen, and No. 3 grade 90 per cent. frozen—in fact, No. 3 grade was very poor chicken feed. The grain was sown on the 9th April, on fallowed land, at the rate of two bushels per acre. All the grades came up together, and at no time could any difference be observed, except that Nos. 2 and 3 grades had more smut balls than No. 1. Through an error in drawing in no accurate account could be taken when it came to be threshed, but it is safe to say that allowing one bushel for smut in favour of No. 1 grade, there was no difference in, the yield of grain, and none whatever in the quantity of straw.

DRILL AND BROADCAST SEEDING.

Twelve acres of Red Fife wheat were sown by drill and twelve acres broadcast. Each plot of ground had been prepared in the same way; $1\frac{1}{2}$ bushels were sown by drill, and $1\frac{3}{4}$ broadcast. The winds were so severe on the broadcast grain that the result when threshed was useless as a comparison. The only instruction it affords is, that drilled grain did better last year than broadcast. This applies equally to all grain sown on the farm, except peas, which were sown by drill entirely. The other grains were tried both ways, and in every case the drilled grains stood the winds the best.

As both methods have advocates, and many fine crops grown last year from broadcast seeding, where somewhat protected from winds, one year's trial on the Experimental Farm should not be taken as indicating that drilling in grain is better than broadcast. Could any way be devised that the land could be left in drills in the fall 3 inches deep and 7 inches wide, broadcast seeding on this would be far preferable to drilling, on account of the ground being always too wet early in the spring for the drill to work properly.

INDIAN WHEATS.

Of the sixteen varieties of Indian wheat sown, two matured in four months and one day, three in four months and two days and two in four months and six days. Two varieties did not head out; in all probability they were fall wheats.

Eureka wheat gave the largest quantity of straw to the acre of any grain on the farm. Russian Hard Tag followed it very close; both are bearded. The Eureka being close, compact and long heads, with rather coarse straw. The Russian Hard Tag has open and medium-sized heads, with fine straw.

SMUT.

Smut, this year, was very prevalent all over the Territories. On the Experimental Farm several varieties of wheat were very much affected, Judket being so much so that one-fourth of the heads were entirely smut balls. Club wheat was also badly injured. Rio Grande, Scotch and Golden Drop were considerably hurt, while Red Fife, White Fife, Ladoga, Saxonka and Eureka were comparatively free. In the Indian wheats no smut was observed. Blue vitrol dissolved in water and mixed with the seed has been the only remedy so far tried on the Experimental Farm. One pound dissolved in one pail of water and thoroughly mixed with ten bushels of grain gives good results, though not perfectly efficacious.

CROP ON FALL PLOUGHING.

Two acres of land were ploughed last fall after a crop of millet had been taken off the ground. This spring three bushels of Red Fife wheat was drilled in on the two acres. The yield was not more than five bushels per acre. Along side these two acres ten were drilled in on fallow land which returned over twenty-five bushels per acre.

FALL WHEAT.

Nine varieties of fall wheat were sown in August, 1888. The fall being favorable most of the grain was covering the ground when cold weather set in. There being very little snow, the wheat was exposed the greater part of the winter; nevertheless it came through fresh and apparently in good condition. As soon, however, as the frost had left the ground and alternate thawing and freezing took place—which usually occurs during the first two weeks in April—a change for the worse was observed, and by the end of April all was dead.

This fall three varieties were sown, but the soil was so very dry that they had only appeared above ground when checked by cold weather. One-half of each variety has been covered with two inches of straw with the object of retaining the frost above the roots until as late in the spring as possible.

RYE.

Two varieties of fall rye were sown in August, 1888. Like the wheat, they apparently came through the winter safely, but in the end shared the same fate.

The following table shows variety, date of seeding, maturity, yield per acre and weight per bushel. The first eight varieties are the acre lots. The next nine are those sown on 1st April, and the following eight those sown on 6th. The balance were sown at various dates.

Variety.	When Sown.	When Matured.	Yield per Acre. Bush.	Yield per Acre. Lbs.	Weight per Bushel. Lbs.
Red Fife	April 8	August 24	28	20	64
White Fife	do 8	do 24	20	49	64½
Ladoga	do 8	do 10	21	30	64½
Saxonka	do 8	do 14	12	30	64¾
Eureka	do 8	do 20	24	00	65
Red Fern	do 8	do 20	23	16	65
Club	do 8	do 20	18	11	65
Judket	do 8	do 20	20	45	63
Indian Karachi	do 1	do 3	18	00	66½
Hard Calcutta	do 1	do 3	12	08	65½
Club Calcutta	do 1	do 3	11	40	63
Bearded Red	do 1	do 7	18	50	64
No. 1756	do 1	do 7	19	20	65¼
Defiance	do 1	do 13	25	36	64
Chilian White	do 1	do 13	35	40	66
Paine's Defiance	do 1	do 13	5	60	63½
Imp. Summer Cob	do 1	do 13	22	40	64
White Delhi	do 6	do 7	19	40	66
Red Calcutta	do 6	do 7	31	40	64
Magyar	do 6	do 27	30	10	63½
Greek Summer	do 6	do 13	10	00	64½
Russian Hard Tag	do 6	do 17	26	40	65½
California White	do 6	do 12	22	15	65¼
Wrights	do 6	do 10	23	18	64¼
Onega	do 6	do 8	10	26	60½
General Crop.					
Red Fife	do 1	do 16	25	00	65
White Fife	March 26	do 16	17	35	64½
Ladoga	do 26	do 10	13	00	64½
Saxonka	do 26	do 13	15	24	64¾
Rio Grande	April 9	do 15	12	04	65
Golden Drop	do 9	do 14	12	34	65
Talavera	do 9	do 20	19	00	63
Scotch	do 9	do 25	23	00	63¼
From High Elevations in India.			3 lbs. sown.		
Seoraj, 7,000 feet	do 15	do 26		20	65½
Kangra, 3,000 feet	do 15	do 26		27	64
Palampur, 3,000 feet	do 15	do 26		28	64
Simla, high elevation	do 15	do 26		48	63
Spiti Valley, 11,000 feet	do 15	do 26		40	62
Moultan, 7,000 feet	do 15	do 26		23	63

BARLEY.

As it was considered important that English Two-Rowed Barley should be tested in this country, with a view of ascertaining whether it could be profitably grown for exportation; a considerable portion of well worked fallow land was sown with 14 varieties of this grain. All were put in by drill on the 10th of April, 1¾ bushels per acre were sown, except the English Malting Barley, the grain of which was very large; 2 bushels per acre of this was used. Four varieties were greatly injured by winds, namely: Thanet, Peerless, Chevalier and Danish Chevalier. The remainder, though not seriously affected by winds, were mostly short in the straw from the dry weather. In looking at weight per bushel, in table below, it will be seen that our climate is well adapted to their development, though from the yields received per acre it cannot be said as yet, that they can be grown with profit. Yet the past year must not be taken as even a fair season for barley; in all probability it has been the worst in the last seven years. Twice the blades were split and torn by winds, and the dry weather was so severe and prolonged that the only wonder is, that barley would grow at all.

In addition to the above 14 varieties of English Two-Rowed, 19 others were sown at various dates, from the 10th April to 25th May. Twelve of these were new from India, and arrived rather late to give them a fair test. Two of the Indian varieties are hulless, weighing 64 and 67 lbs. per bushel, and give promise of being valuable for feeding purposes.

One variety of six-rowed barley was sown, but though fair in straw, and earlier in maturing than any of the two-rowed, was small and poor in grain.

The following table gives variety, date of seeding, harvest, yield per acre and weight per bushel.

Variety.	Sown.	Harvest.	Yield.	Weight.	Remarks.
				Lbs.	
Golden Melon	April 10	Aug. 22	17·33	55	
Thanet	do 10	do 22	21·17	52¼	
Peerless	do 10	do 22	16·16	53	
Danish Chevalier	do 10	do 22	12 36	55	
Chevalier	do 10	do 22	26 33	53	
English Malting	do 10	do 22	23 19	53½	
Swedish	do 10	do 12	24 31	55¼	
Danish Printice Chevalier	do 10	do 22	13 43	53½	
New Zealand	do 10	do 15	23 05	54	
Mensury	do 10	do 9	12 21	51	
Petschora	do 10	do 14	7 37	51½	
Two-rowed, from P. E. Island	do 10	do 14	13 27	53½	
Beardless	do 10	do 26	27 14	55	
Two-rowed	do 10	do 14	18 04	55	
Black	do 10				Eaten by gophers.
Six-rowed	do 10				Not threshed.
Saale	May 23	Aug. 31	19 27	53	
Early Minting	do 10	do 26	13 36	53½	
Selected Chevalier	do 10	do 26	12 00	52	
Peerless White	do 10	do 26	18 40	52	
Indian Barleys.					
Bhagarmany Hills	do 25	do 16		62	3 lbs. each of these barleys were sown. Yield ranges from 40 lbs. down to 12 lbs.
Khagan	do 25	do 31		51	
Moultan	do 25	do 16		50½	
Sialkot	do 25	do 16		49½	
Mardan	do 25	do 16		52	
Spiti, 11,000 ft. elevation	do 15	do 13		62	
Kulu, 7,000 ft. do	do 15	do 13		51	
Simla, high do	do 15	do 13		49	
Kangra, 3,000 ft. do	do 15	do 13		53½	
Seoraj, 7,000 ft. do	do 15	do 13		52	
Lahoul, 11,000 ft. do	do 15	do 26		64	
Palampur, 3,000 do	do 15	do 13		52½	

The small yield and light weight of Saale, Early Minting, Selected Chevalier and Peerless White, is no doubt owing to their having been sown so late. The seed was very fine, and had they been got in early would have made much better returns.

OATS.

Of all the crops on the farm, oats suffered most from frosts, winds and dry weather. Three varieties only escaped without much injury from winds, while all the rest were greatly damaged. Four were entirely blown out of the ground, and though seed was a second time harrowed in, were again so greatly injured, that to save weeds from going to seed, everything was ploughed under.

Carter's Prize Cluster, Welcome and Tartarian, suffered least from winds, but dry weather reduced the yields very considerably. The Prize Cluster oat gives promise of being a valuable grain for our short seasons, maturing in three months and 18 days.

Five acres of fallow land were sown with oats for feeding purposes, on the 22nd March. Ten acres of fall ploughing were sown on the 23rd also for feed; both these plots were so much injured by spring frosts, that winds soon after completely killed every blade.

The two plots were resown on the 20th and 10th May respectively. The return from the fallow is not threshed but will average 20 to 30 bushels per acre; from the fall ploughing not over two bushels per acre. The failure of the first seeding was caused mainly from a heavy frost four days after the grain was sown, and after it had become swollen and partially grown, and from winds baring the already enfeebled roots.

Twenty-two varieties in all were sown, 2½ bushels per acre broadcast, and two bushels by drill were used.

As will be noticed, several varieties give promise of being valuable for the North-West on account of their early ripening qualities, and good weight per bushel.

Variety.	Sown.	Harvest.	Yield.	Weight.
				Lbs.
Black Champion	April 9	August 26	26.2	30
Glenrothern	do 9	do 26	25·6	35
August White	do 9	do 26	19·29	40½
Early Calder	do 9	Blown out.		
Hallet's Pedigree Tartarian	do 9	August 26	15·6	36
Longfellow	do 9	do 26	16·6	37½
White Egyptian	do 9	do 26	15·18	42¼
English Potato	do 9	do 26	13·3	40
Welcome	do 9	do 10	25·31	44¼
Cream Egyptian	do 9	do 26	10·24	42
Early Race Horse	do 9	Blown out.		
Red	do 9	August 22	9·7	34
Early English White	do 9	do 22	14·24	43
Victoria Prize	do 10	Blown out.		
Poland	do 10	do		
Flying Scotchman	do 10	August 14	11·6	44½
Black Tartarian	do 10	do 17	32·15	39½
Lincolnshire Poland	do 10	do 15	15·00	41
Early Blossom	do 10	do 15	13·8	42
Carter's Prize Cluster	do 12	do 1	34·13	45½
White Wonder	do 23	do 15	13·6	42½
White Bonanza	do 23	do 17	27·6	45

PEAS.

Five varieties of peas were sown by drill at the rate of 2½ bushels per acre of small and three bushels large. Two were so badly injured by winds that to save the land from being filled with foul seeds, the whole of one and the greater part of the second were cut while green and the straw used for fodder.

The remaining varieties were also greatly damaged, but were left until ripe before being cut. The straw in no case being long, but was well podded and the peas plump and sound.

Several varieties of Indian peas were also sown in small plots. Three of these matured, while three never podded. Those that ripened are a dark grey color and small in size. The straw was very short and apparently dwarfed.

Black Eyes yielded $13\frac{20}{60}$ bushels per acre. Multipliers 21 bushels, Extra Early's $10\frac{21}{60}$ bushels, and Crown 12 bushels. Golden Vine cut while green.

GRAIN SOWN AS SINGLE PLANTS.

In addition to the grain already mentioned as sown, 71 varieties of wheat, 66 of barley and 76 of oats, were planted in rows two feet apart and one foot in the rows. Like all other grain these received a full share of the winds and were more or less injured. While some had $\frac{1}{4}$ to $\frac{1}{2}$ destroyed others were entirely blown out. On account also of the thinness of the grain on the ground only very few varieties ripened before frost came in September. These will be carefully threshed and counted, and although it is feared that no reliable record can be obtained as to the relative yield of the different sorts, some valuable seed may be secured for future trials.

GRASSES AND CLOVERS.

Knowing the great importance of grasses and clovers to the future prosperity of the North-West Territories, as many varieties as it was possible to obtain were procured and sown on well prepared land. Timothy, Alsike, Lucerne and Red Clover were sown with grain, these again with Perennial Rye Grass, Italian Rye Grass, Kentucky Blue Grass, Sanfoin, Meadow Fox Tail, Meadow Fescue, Sheep Fescue, Tall Fescue, Crested Dog Tail, Meadow Oat Grass, Sweet Vernal, Red Top, Orchard Grass and White Clover were sown in plots without grain.

I am sorry to report that hardly a blade of any of these grasses or clovers ever came up, being near the surface the wind swept all away.

As soon as possible after the damage was done a fresh supply of seed was obtained from Ontario, but it was well on in May before they could be sown the second time and several of the varieties did not germinate.

From the second seeding, Perennial Rye Grass, Italian Rye Grass, Orchard Grass, Meadow Fescue, Sheep Fescue, Crested Dog Tail, Red, Alsike, Lucerne, Sanfoin and White Clovers have done fairly well considering the dry weather. The remainder of the varieties have not appeared.

In addition to the foregoing, 33 varieties of grasses and clovers were sown in small beds, beside these 12 varieties of North-West native grasses were sown also in small beds. I regret to say that with the exception of two of the native grasses, all were entirely destroyed and could not be replaced in time to do any good the same season.

FODDER PLANTS.

Hay being scarce in many parts of the country, tests were made the past summer with different plants and grains, with the view of finding substitutes for fall and winter feeding. On account of the dry weather no great success has been obtained, though entire failure has not been the result of the trials so far made.

Thirteen varieties of corn were planted from the 24th May to the 1st of June. Some were planted in rows 4 feet apart and 3 feet in the rows, some in rows 2 feet apart and 1 foot in the rows, while others were sown by drill in rows 14 inches apart. The corn planted in rows 4 feet apart made the greatest length, that in rows 2 feet apart the most bulk, while the corn sown by drill was very poor; Red Cob Ensilage, Horse Tooth, Early Minnesota, Giant Prolific and Sweet Ensilage, making the greatest bulk. These five varieties were in tassle when cut down on the 6th September for fear of frost, which came two days after.

Early Corey and Early Marblehead were very short but much earlier than any other sort planted, and with a more favorable year would, no doubt, ripen. The remaining varieties planted were Angel of Midnight, Longfellow, Self-Husking, Eight-Rowed Yellow, White Flint and Canada Yellow. These were mostly planted in shelter belt among trees and left to retain snow. All were very poor and very late.

In addition to corn, 5 varieties of Millet were tested, Common, Golden, White, Yellow and Large African. The common Millet was entirely smothered by dust a few days after it came up, was sown a second time, making half a ton per acre. The other varieties did not head out, the best only making a growth of a few inches.

About half an acre of Rape was sown on the 1st of June, and notwithstanding winds and dry weather, made a very fine showing. Without a doubt this plant will make a most valuable fodder for summer or early fall feeding for sheep, and as we have little rains and no dews, no danger need be apprehended from cattle eating it.

Some Indian fodder plants were sown, but arriving late, and the season not being favorable, they made poor growth.

Spring Rye was also sown for fodder; from the rapid and strong growth made it will without a doubt make a valuable substitute for hay if cut before the straw becomes too hard. As it matures long before any frost comes, it is believed with a good silo, this cereal will make first-class ensilage—sown 9th April, harvest 29th July. A mixture of oats and peas were also sown for fodder; the oats so completely smothered out the peas that the field was left for an oat crop—$\frac{2}{3}$ oats and $\frac{1}{3}$ peas were sown at the rate of 3 bushels per acre.

FLAX.

A small plot of flax was sown on the 18th April—like the millet it was smothered with dirt—was a second time sown, but being late, frost injured it before fully ripe.

BUCKWHEAT.

Four varieties of buckwheat were tried—common, Japanese, and two from India. The common and Japanese were greatly retarded in their growth by winds injuring their tender leaves. The common variety stood the unfavorable weather best, and though very short in the straw ripened before frost came. The Japanese was cut down before maturing, while the two from India did not head out. All the varieties were sown on 13th May.

ROOTS AND VEGETABLES.

The past season has been the worst on roots and vegetables since 1882, and it is safe to say that not one settler in twenty in the North-West has any to use—very few ever attempt to grow field roots of any kind, yet they can be raised with as little trouble and less expense than in Ontario. Settlers generally plant a few potatoes. If the season is favorable a good crop is raised, if poor, failure is the result, yet in no country is a crop so sure, if the land is in proper condition. It is true the yield may not be large in a year such as just passed, but entire failure need never be apprehended. So far we have no bugs. Rot is unknown, and the only danger to be guarded against is dry weather. By planting on fallow land, and keeping the surface often stirred this may be greatly avoided, and a fair crop is almost absolutely sure, no matter how dry the season may be.

On the Experimental Farm seven varieties of turnips were tried. The land had been fallowed, and ten days before sowing the seed, was ploughed, harrowed and rolled. A new way of sowing the seed was tried, and, proving successful, can be recommended wherever dry weather is experienced. In making the ordinary turnip drill, the plough throws fresh soil up, and along this fresh soil—but on the ground not stirred—the seed was sown, the plough going back to complete the drill covered the seed two inches deep. When all was done, a heavy roller was used and the new soil packed firmly on the old. Three days after the seed was sown the plants were above ground, and not until their leaves covered the ground did dry weather or anything else retard their growth.

Seed was sown in the first week in June, two pounds per acre being used—drills 33 inches apart. Once a week the scruffler was used among them and the top soil kept well loosened. Over 300 bushels per acre were obtained, and but for the dry weather the crop would have been a heavy one. The varieties sown were Carter's Hardy Swede, Carter's King of Swedes, Queen of Swedes, Elephant Swede, Orange Jelly, Early Milan and Snow Ball. Elephant Swede did the best and Queen of Swedes the worst of any sown.

Three varieties of mangels were tried: New Golden Intermediate, New Tankard and Mammoth Long Red. These were sown in drills 33 inches apart in the last week in May. Like the turnips, they grew from the start. In the entire plot there was not a blank, and though, as with the turnips, dry weather lessened the yield, nearly 400 bushels per acre were secured. Mammoth Long Red 1st, New Golden Intermediate 2nd, and New Tankard 3rd, being the order in which the three sorts yielded.

CARROTS.

Two sorts were sown: Belgian and Orange Giant. Although the land was the same and had been worked in the same way as for turnips and mangels, yet the crop was a very great failure. As is well known, carrots take a long time to germinate. No doubt this and dry weather accounts for the poor crop.

POTATOES.

Six pounds each of 108 varieties of this root were planted on the 11th of May. The land had been fallowed and a few days before planting was ploughed, well harrowed and rolled. Early in the fall before, 20 loads of well rotted barnyard manure had been applied. When ready to plant, drills 33 inches apart were opened, the seed dropped 14 inches apart, then covered with the plough, harrowed and rolled down. When commencing to appear above ground the harrow was run twice over them, and once each week afterwards the scruffler was used and the soil kept loose on top. When nearly covering the ground earth was hilled up to the plants and then left until they were taken up.

Fourteen out of the 108 varieties ripened by the 25th August; 26 others were full grown, though not ripe, when frost on the 9th September cut down the vines. The remainder were in all stages of growth at this date and are evidently not suited to our season.

Though all the sorts are not yet tested as to their eating qualities, Early Rose, Beauty of Hebron and Morning Star are found to be as good, if not better, than any. Early Conqueror, which gave the largest yield and also had the greatest number of large tubers, is not so good a table potato as the three above mentioned.

The names of potatoes full grown at time of frost are given below: the first fourteen being those that were ripe on the 25th August. Color, size and yield are also given.

The 40 varieties returned 2,345 lbs. from 240 lbs. planted, an average in round numbers of 58 lbs. each. Each sort occupied a drill 75 feet long by 33 inches wide, or the 211th part of an acre, returning an average of 204 bushels per acre, Early Conqueror leading at the rate of 282 bushels per acre.

POTATOES.

Variety.	Color.	Size.	Yield.
			Lbs.
Early Rose	Brown	Large	64
Morning Star	do	do	60
Beauty of Hebron	do	do	54
Lee's Extra Early	Red	do	64
Stray Beauty	Brown	do	48
Early Bird	White	do	73
May Queen	Red	Medium	47
Gleason	Blue	do	50
Matchless	Red	do	40
Rosy Morn	Brown	Large	64
Wonder of the World	Red	Medium	60
Sharpe's Seedling	do	do	68
Bliss's Triumph	do	Large	58
Early Ohio	Brown	Medium	54
Richter's	White	Large	66
Brownell's Beauty	do	do	46
Clark's Triumph	Brown	do	56
Adirondack	White	do	46
Alpha	Brown	do	50
Richter's Gem	White	Small	62
Jumbo	do	Large	67
Member of Parliament	do	do	53
Great Eastern	do	do	60
Rose's New Giant	do	do	70
Empire State	do	do	65
Harrison	do	do	50
Conqueror	do	do	68
Goodrich	do	do	58
St. Patrick	do	Medium	62
Early Bird	do	do	68
Thorburn	Red	Large	63
White Elephant	White	do	52
Thorburn's Paragon	do	Medium	56
Early Conqueror	do	Large	83
Genesse Seedling	do	do	46
Snow Flake	do	do	48
Vick's Pride	do	do	56
White Star	do	do	76
Sugar	do	Medium	55

VEGETABLE GARDEN.

A good plot of ground was set apart for a garden, and at the proper season all kinds of vegetables were sown or planted. Before anything had made a start, the seeds were swept away, and afterwards were found growing a quarter of a mile off. After a fresh supply of seeds could be obtained from Ontario, the garden was sown the second time, but as it was late before this could be done, onions, carrots and parsnips were a failure, while beets, beans, lettuce and raddish were very good. Cabbage and cauliflower were set out four times and as often destroyed, but from the fifth planting a fair crop of medium-sized heads were obtained. Tomatoes were four times destroyed, but from a few plants set out in a protected place, a good crop was obtained, though only very few ripened before frost came. Citrons and cucumbers were of medium size. Peppers full grown. Watermelons, squash and pumpkins very poor.

FOREST TREES.

The season has been one of very great severity on all kinds of trees; most of March was very mild, and the frost going out of the ground nearly a foot, trees suffered greatly by the alternate thawing and freezing which took place from 27th March, up to 15th April. After this date winds commenced and twice cut all young leaves or buds that had before started. After the winds were over, dry weather set in and finished the destruction of many hundreds of trees set out in the spring, as well as retarding the growth of all that were planted last year and had survived the winter.

While no kind of tree was proof against so many enemies, some suffered much more than others. Norway spruce, which last year did remarkably well, is this year almost a total failure, arbor vitæ also suffered greatly. Austrian pine did very poorly last year, but much worse this. Native maple, (box elder) and native elm trees have stood by far the best of anything set out. It is worthy of notice that out of 982 young elm trees which were grown at the Central Experimental Farm, Ottawa, from seed obtained in Manitoba, 955 are living; while out of 600 American elms, sent also from the Central Experimental Farm, only 350 are alive.

Eleven thousand eight hundred and twelve trees were received from the Central Experimental Farm and set out in various places on the farm here, and great numbers were planted in a wind-break which is being formed along the western boundary, others were set out around Superintendent's house, while all seedlings and many entire varieties were planted in nursery rows. In addition to those received from the Central Farm, several thousands were transplanted from those put out the year before. The large majority of these had been taken up the fall previous and covered with sand in a cellar.

The following varieties of forest trees were received from the Central Experimental Farm and planted; the amount in each variety and number living when winter set in are also given:—

Variety.	No. Received.	No. Living.
White Spruce	1,018	602
Norway Spruce	675	100
Hemlock Spruce	153	21
Scotch Pine	421	198
Austrian Pine	400	158
Riga Pine	43	28
Arbor Vitæ	650	158
Red Cedar	50	48
Manitoba Maple	500	450
Norway Maple	875	652
Soft Maple	75	26
Rock Elm	135	125
Manitoba Elm	982	955
American Elm	600	350
Green Ash	95	60
White Ash	140	116
Black Ash	105	98
Mountain Ash	75	64
Yellow Birch	71	61
European Birch	50	43
Canoe Birch	100	80
Black Walnut	53	30
Locust	374	186
Catalpa	850	559
Black Cherry	114	89
American Beech	200	32
Cotton Wood	2,000	216
Barberry	118	104
European Alder	50	42
American Sycamore	41	34
European Larch	500	100

NOTE.—The Cotton Woods were received from Minnesota, United States, and were in a very damaged condition on reaching here.

FOREST TREES PLANTED IN 1888.

In reporting on the trees planted last year, I beg to say that native maple, mountain pine, Norway spruce, red cedar, American arbor vitæ, elm, ash, mountain ash, canoe birch, Russian mulberry, black cherry, barberry, cranberry, alder and wahoo came through the winter in a more or less damaged condition; mountain pine, canoe birch and mountain ash standing it the best. Norway spruce and the cedars apparently came out well, but have done poorly all summer.

Maples were all cut down and only the native variety and Norway maple making a start in the spring. Not a single soft, sugar, red or striped maple grew. White and black ash were cut down, but made a fair growth during the summer. Green ash was also cut down to the ground but many grew afterwards. Five varieties of elms were planted and made a nice growth during the summer of 1888. These were all greatly injured, only about one-third grew the past season. Russian mulberry and black cherry have stood the winter and dry summer well. Barberry, cranberry, alder and wahoo were damaged very little by the winter, but have done poorly since.

I regret to say that locusts, butternuts, walnuts, oaks, beech, basswood, hickory, sycamore, hackberry, hawthorn, hornbeam, ailanthus and catalpas were all dead when spring opened. Except one locust and four walnuts, not a tree of any of these varieties stood the winter. I may say that all the last-mentioned trees, hickory, butternut, &c., were dead before spring frosts visited us, while all the damage done to the first named varieties was mainly owing to these frosts; especially was this the case with Norway spruce, hemlock spruce and the cedars.

Before winter set in last year, I had a number of each of all the above varieties taken up, numbering in all several thousands, and placed in sand in the cellar, and this spring had them planted in wind-breaks and on banks of coulée. I regret to say that nearly all have died; though green and fresh when set out, they soon succumbed to winds and dry weather.

LARGE MAPLE TREES PLANTED.

Early in October, 1888, 700 maple trees (box elder) were obtained in Brandon. Of these, two-thirds were planted as soon as possible after reaching here, and one-third healed in and left until spring. The trees were planted along boundaries of farm and on avenues leading to buildings. With the exception of four, every tree of both fall and spring planting died down to the ground. At this point I had them cut off in June, and, without a single exception, all have made a most vigorous growth since then. The four that did not require to be cut down were entirely healed in or covered up, the branches being covered the same as the roots.

TREE SEEDS.

In the fall of 1888 some four bushels of ash-leaved maple seed, gathered in the Qu'Appelle Valley, were sown in drills three feet apart. This spring they appeared above ground, but before they could take much root were blown completely out of the ground. The same land with considerate addition was resown, and though late before this could be done have grown fairly well—though nothing in comparison to the growth of the same sort of trees the season before. Two bushels of hickory and walnuts were planted in May, forty-three young trees six inches in height is so far the result, but a large increase is looked for next spring. In September last several pounds of elm, and in October a large quantity of maple seeds were sown.

Maple tree seeds sown in spring of 1888 which attained a height of from ten to twenty inches last summer, were several times early in the season almost covered with dirt blown in from adjoining land. This considerably retarded their growth at first but during August and September good headway was made. Many thousands will be ready for transplanting next year.

Ash seed which was sown in spring of 1888 came up making slow growth that year, made also very slow this. Sugar maple and basswood seed failed to appear, but in all probability they were blown away.

WILLOWS, POPLARS AND SHRUBS.

Nine varieties of willow were planted in the spring in nursery rows. Forty-five out of the forty-six set out are alive and made good growth, and promise well for this country.

Twenty-five out of twenty.six poplars set out are living and made a thrifty growth. Eight varieties of this tree were planted of which Populus Certinensis Sargeant, and Populus Bolleana are the best. A considerable number of poplar cuttings were also set out, the greater part of which, took root and made a good top.

Seventy-one varieties, consisting of 1863 shrubs, were planted. Among these lilac, caragana, and eleagnus did the best. The two latter shrubs were planted also in 1888 and of tne trees or shrubs put out, stood the winter and dry summer by far the best.

Out of all the shrubs planted only 963 are living, of some varieties the entire number is lost.

LARGE AND SMALL FRUITS.

The failures in fruit trees the past year have been very great. In comparison with 1888 they are quite noticeable. Last year 200 apple trees were planted; every tree was alive when winter set in and 125 are living now. This year 352 trees were set out, and on the 1st October 92 were dead.

Twelve crab apple trees were planted in 1888, ten were living on 1st October, 1889, while out of 189 trees set out this spring 97 were dead on the same date.

In small fruits the failures are equally great among currants and raspberries, while strawberries were almost an entire loss. As the soil was in far better condition for trees or small fruits this year than last, and as much care taken in planting them and afterwards, there can be no doubt but that the severe winds and dry weather wholly accounts for the loss sustained.

APPLE TREES, 1889.

The following apple trees were planted last spring in nursery rows three feet apart. Number of each sort planted and living on 1st November are also given:—

	No. Planted.	No. Living.		No. Planted.	No. Living,
Arabka Dept...	25	20	Hibernal	4	1
Longfield	10	0	Yellow Anis	7	5
Mottled Anis....	11	6	Vargul	3	2
Repka Malenka	9	4	Sandy Glass	13	8
Whitney No. 20	19	18	Ukraine	3	3
Arabka	10	10	Liveland	7	0
Titovka	10	7	Russian Apple	6	2
Barloff	5	4	Plikanoff	10	7
English Borovinka	4	4	Red Anis	11	11
Red Anis	8	3	Autumn Streaked	10	9
G. Duke Constantine	4	0	Leiby	10	9
Zalotoreff	3	3	Yellow Anis	10	8
Bogdanoff	1	1	Getmans	4	2
Ostrakoff	6	3	White Borodovka	8	7
Enormous	8	5	Hibernal	10	8
Rennet	2	1	Titovka	10	10
Cross	7	5	Titus	10	8
Antonovka	19	19	Grandmother	10	10
Switzer, Dept	9	9	Red Duck	10	10
Golden White	9	5	43 varieties Russian apple trees	...	...
Babushkino	8	5			
Herren	4	3			
Red Repka	3	3	Total	342	257
Label defaced	2	2			

CRAB APPLES, 1889.

	No. Planted.	No. Living.		No. Planted.	No. Living.
Common wild crab	80	44	Orange	30	6
Stanley	22	21	Late Winter	9	3
Minnesota	8	0	Welcome	10	9
Briers' Sweet	10	2			
Gibb	20	7	Total	189	92

APPLE TREES PLANTED 1888.

Alexander	8	6	Mann	9	4
Wealthy	3	3	Duchess	5	4
Walbridge	3	1	Scott's Winter	3	1
Mackintosh Red	3	2	Grimes' Golden	3	1
Talmans Sweet	3	2	Tetofsky	3	1
Keswick Codling	3	2	Canada Baldwin	3	3
Red Astrachan	3	2	Fameuse	6	2
Anis	3	3			
Golden Russet	3	1	Total	64	38

CRAB APPLE TREES, 1888.

Hyslop	3	2	Whitney	3	3
Transcendant	3	3			
Red Siberian	3	2	Total	12	10

PEARS.

In 1888, 2 Beurré Hardy, 2 Clapp's Favorite, 2 Howell, 2 Flemish Beauty, 2 Seckel, also 5 of No. 392, and 5 of 347 Russian were planted. At present only one Flemish Beauty is living. All the other varieties died. No pears were set out this year.

PLUMS.

Two each of Golden Drop, Moore's Arctic, Lombard, Mariana and German Prune, and 5 each of Wolf Plum, Speer Plum, and Rollingston and 9 of Early Red were planted last year. Of these one each of Moore's Arctic, Lombard, Mariana, and German Prune, and 7 of the Early Red, are alive. None were added to the list this year.

CHERRIES.

Thirty-four cherry trees were planted in 1888, consisting of five each of Ostheim, Morella, Vladimir and Early Richmond. Two Vladimir and one Early Richmond stood the winter.

With a few exceptions, all the large fruit trees put out last year were wrapped up to the branches with oat straw or tarred paper and banked well up around the base. It was found in the spring that the few trees left uncovered were completely dead from the top of the limbs to the ground on the south-west side; the strip dead being about one half an inch in width. No tree covered was hurt in this way, those dying were killed later on after frost had gone from their roots and alternate thawing and freezing took place.

This year a good deal more straw is being used, the limbs, as well as the trunks, being covered. More earth is also put about the base and before winter is over coarse strawy manure will be spread thickly over the ground.

CURRANTS.

This year's plantation consisted of five varieties containing 744 trees. On the 1st November 555 bushes were alive. Last year 178 bushes of eight varieties were planted; of this number 153 were living when winter set in; with the exception of two dozen planted in a protected place, none of the bushes this year have done very well; many have died and those that have survived seem stunted.

Those that came through the winter of last year's planting have done very well the past season and give good promise for the coming year. Lee's Prolific, Red Dutch and White Grape, bore a few currants of excellent quality.

The ground was banked up around the trunks slightly last year, this year it is heaped up to the branches and the branches covered with coarse manure which will be left on until all danger from spring frosts is over.

The following are the varieties set out, in 1888 and 1889, number planted and living at present time :—

1888.

	No. Planted.	No. Living.		No. Planted.	No. Living.
Victoria	25	24	Lee's Prolific	24	20
Champion	12	10	Fay's Prolific	25	25
Raby Castle	27	20	Red Dutch	20	16
White Grape	20	15	Black Naples	25	23

1889.

	No. Planted.	No. Living.		No. Planted.	No. Living.
Lee's Prolific	325	246	Raby Castle	228	159
White Grape	165	129	Black Naples	19	19
Red Grape	7	6			

RASPBERRIES AND BLACKBERRIES.

Like the currants, great numbers of the raspberries set out in the spring, succumbed to winds and dry weather; winds did more harm than dry weather, for in a small plantation set out, protected from them, though the soil was quite as dry as any on the Farm, the growth of the vines was very gratifying.

The bushes planted last year were laid down on the approach of winter and covered with about two inches of earth or coarse manure. A good deal of this earth or straw was blown from off the vines, and wherever this was the case, the vines were quite dead as far as uncovered; all that had their covering on up to the 10th of April were quite green and perfect. Shortly after this, the vines putting forth leaves under the covering, I had them all stripped except a few vines of the Philadelphia variety, but it proved too early, as every vine so stripped was cut down a few nights after, and only those not uncovered until the 20th of the month bore fruit.

In the fall I had as much earth put over the vines, and in addition a heavy coating of strawy manure is now being applied over all.

Those of last year's planting have made a good growth this season, except Taylor and Lucretia Dewberry; Philadelphia making the greatest headway.

1888.

Varieties.	No. Planted.	No. Living.	Varieties.	No. Planted.	No. Living.
Golden Queen	26	20	Caroline	48	42
Turner	107	104	Cuthbert	104	100
Hansel	23	10	Philadelphia	99	96
Snyder	28	15	Taylor	25	10
Lucretia Dewberry	25	None			

1889.

Varieties.	No. Planted.	No. Living.	Varieties.	No. Planted.	No. Living.
Turner	249	227	Hilborn	53	45
Cuthbert	75	22	Mammoth Cluster	79	48
Doolittle	22	3	Rancocas	18	14
Taylor	8	None	Snyder	10	9
Parnell	8	3	Clarke	11	8
Reider	10	10	Marlboro'	9	7
Brandy-wine	20	14	Hornet	9	3
Hebner's Cluster	3	2			

GOOSEBERRIES.

During the spring of 1888 twenty-four Houghton, twenty-four Downing, and twenty-six Smith's Improved were planted. Four of Smith's Improved died before winter set in. With this exception all are living at present. Only a few bushes of the Houghton variety bore fruit the past season, but it is expected from the good growth made this year they will bear heavily next summer.

None were set out this season.

GRAPES.

Sixty-four vines of eighteen varieties of grapes were planted last year, but none lived through the winter though all were well protected.

STRAWBERRIES.

If poor success attended last year's planting of strawberries, it was still worse this year; out of nearly 3,000 plants only 100 are alive. All or mostly all made a start, but a very hot wind in May, followed by the dry weather afterwards, killed them by hundreds.

Last year May King, Wilson, Daniel Boone, Woodruff, Crescent, Manchester, Sharpless, New Dominion, Maggie, Capt. Jack, Cumberland Triumph and James Vick were planted. The Wilson made the best growth and was the most promising when winter set in; this spring, though all the plants were living, they bore no fruit and have made little or no headway all summer. New Dominion, Capt. Jack and Crescent stood the winter and spring fairly well, and each variety had a few imperfect berries this season. New Dominion, both in growth of plant and yield of berries, doing the best. Excepting these three varieties and the Wilson all were dead by the first of May.

A slight covering of straw was put over the plants last winter after the ground had become frozen, and left on until spring frosts were over. This winter the same course is being followed, but more straw is being put on.

WILD FRUIT.

In the spring of 1888 a collection of native fruit trees and bushes was obtained in coulées and other places, and planted on the farm, and though all made a most vigorous growth during that summer, none bore fruit this year except a few bushes of black currants. Spring frost, no doubt, was wholly the cause of this, and when we consider that wild fruit was an entire failure the past year, while other years thousands of bushels go to waste all over the country, we may easily conclude that the past season has been a very unfavorable one for all fruit trees.

It is, perhaps, worthy of notice here that all native fruit trees or bushes grow on the south bank of streams or in coulées protected from the early spring sun. The steeper the banks, and the more inaccessible they are to April or May suns, the more favourable situations they are for fruit.

GOPHERS.

In many parts of the North-West Territories, these destructive little animals were very numerous the past season. Wherever crops were light—from whatever cause—they did great damage, in many cases clearing off entire fields. In light, sandy soil or gravelly subsoil they are found in the greatest numbers, though no sort of land is exempt.

On the Experimental Farm poison was used to keep them in check, and except one small plot of black barley on the banks of the coulée, which was destroyed, no harm was done to the crops the past year.

Commencing in the spring, as soon as the animals come out of their winter quarters, strychnine is dissolved in water and wheat soaked in this, and placed in their burrows. As usually from eight to ten come at a birth, often more, it is very important that attention should be paid early to these pests.

WATER.

I am sorry to report that digging or drilling for water on the Farm has not been very satisfactory. Last fall two wells were put down—one at the superintendent's house, 65 feet, in which a good supply of water was obtained, but which cannot be used until first boiled; the second well was dug and drilled, to the depth of 108 feet, at the barn, without finding any water. This fall I have had the Provincial well-auger testing various places about the buildings, but have not as yet been successful in finding a sufficient quantity for stock, hence the only supply yet available is that in the dams in the coulées.

BUILDINGS.

All the buildings under way when my report was sent in last year have been completed. The horse stable is commodious and very comfortable. The basement of the barn is equally commodious, and will no doubt prove comfortable when we have stock to fill it. The barn is quite large enough for grain, but a storehouse or granary for the many varieties of grain when threshed, and an implement house, are greatly needed.

The superintendent's, horticulturist's and foreman's houses are comfortable, though the foreman's is not large enough for the purpose required of it.

FENCING.

Before winter set in last fall a little over one mile of fencing had been completed. As soon as seeding was over this spring, work was again commenced, and before harvest came on the entire Farm was enclosed. Sawn cedar posts from British Columbia, a top rail and four strands of wire compose the fence. Necessary gates for three sides have been provided, and a second coat of paint was being put on when winter stopped the work.

ROADS AND DAMS.

During the summer considerable additions have been made to the roads on the Farm. Two new dams for retaining water in the coulées have been built, and the old ones extended and made more secure. The erection of the buildings necessitated a great deal of grading, especially around the barn and stable, where wide approaches had to be made. This was accomplished as soon as the buildings were ready for use.

LAND READY FOR CROP.

On account of the great addition to the amount of horse work to do on the Farm the past summer, such as root crops, harvesting, grading, &c., the teams on the Farm were not able to overtake the same quantity of fallow as was prepared in 1888. One hundred and fifty acres have, however, been got ready, and twenty acres of stubble land ploughed for testing purposes.

HORSES.

In the month of September one span of horses was added to the working force, making now four teams.

METEOROLOGICAL.

During the summer, through the kindness of the Minister of Marine and Fisheries, there was sent from the Meteorological Office in Toronto to the Experimental Farm a set of instruments for taking observations of temperature and rainfall. Since the first week in September observations have been taken three times daily and returns sent weekly to head office. During this time on six days it has been 80 or over, 87 being the highest. September 9, 11, 12, 14, 16, 17 and 26th were below freezing, the lowest being on the 12th, when it stood at 20 below freezing. Rain has fallen during the time observations have been taken to only ·61 of an inch: snow from 4 to 6 inches. Prevailing winds have been south-west and north-west.

FALL EXHIBITIONS.

Four exhibitions were attended the past fall at which products of the Farm were shown. Regina on the west, Moosomin on the east, and Qu'Appelle and Indian Head in the centre, were found to be as many as could be overtaken after the grain and other exhibits could be got ready. Nearly 100 varieties of grain, including wheat, barley, oats and peas, were shown in 5 lb bags—50 varieties of these were exhibited in the straw; 104 varieties of potatoes were shown and proved very attractive to those attending the various fairs. At the close of the exhibitions all of the potatoes and much of the grain were distributed among the settlers.

I have the honor to be, Sir,

Your obedient servant,

ANGUS MACKAY,

Superintendent.

EXPERIMENTAL FARM FOR BRITISH COLUMBIA.

REPORT OF THOMAS A. SHARPE, SUPERINTENDENT.

WM. SAUNDERS, F.R.S.C., F.L.S., F.C.S.,
Director Experimental Farms,
Ottawa.

SIR,—I beg to submit the following report of the work done on the British Columbia Experimental Farm since taking possession, 19th September, 1889.

None of the land having been in crop since it was purchased by the Government, notwithstanding that much of it was underbrushed last year, it was covered again with a rank growth of ferns and underbrush. This we started to mow with brush scythes, and have gone over about one hundred and twenty acres, and the brush on about seventy acres has been burnt.

The orchard of three acres has been carefully and thoroughly gone over. It has been ploughed twice, the trees dug about and pruned, and all dead limbs, brush and grass removed and burned.

Of the land on the farm that had been previously under cultivation, about twenty-five acres has been ploughed and harrowed; sixteen acres of this has been ploughed twice and thoroughly worked up. We have also ploughed about twenty-five acres of land that had not been ploughed before. This has been a tedious job, as a considerable number of large fir stumps had to be grubbed out and in many instances the whole tree to remove. Some of these trees were over 6 feet in diameter and nearly 200 feet long. This work has been delayed by the rains, rendering the burning very difficult. About half of this field, say fifteen acres, has been thoroughly harrowed and the roots gathered up and taken off, and it is now ready for cross-ploughing as soon as the frost is out of the land.

It is intended to have this ready for fruit trees and other crops early in the spring.

We have received from the Central Farm about 1,500 small fruit plants, viz., strawberries, raspberries, blackberries, gooseberries, currants, etc., all of which have been carefully planted. From other sources also a considerable number of fruit trees and grape vines have been received, as follows:—

	Trees.	Varieties.
Apples	277	78
Pears	143	36
Plums	121	36
Peaches	84	26
Cherries	121	48
Apricots	21	7
Nectarines	3	1
Quinces	8	3
Grape vines	202	79

All of which have been put in nursery rows, and will be planted out as soon as the condition of the ground will permit.

About 8,000 forest trees, chiefly of eastern hardwoods, have also come to hand, which are planted in nursery rows, and as they are mostly of one or two years growth, will do very well in nursery until they are needed for shelter belts, etc.

Acting under your instructions, a number of grape vines and a variety of forest trees will be planted on the rocky hillsides on the east side of the farm.

If it can be shown that grapes, or such timber as the black walnut, butternut, elm, ash and maple can be successfully grown in such places, this will provide for utilizing a considerable area of land otherwise of no value, and be a source of future profit to land owners, and a great benefit to the Province.

About fifteen hundred young native cedars have been collected and planted in nursery rows, with the intention of using them for hedges and other ornamental purposes as soon as they are ready to plant out.

From the Central Farm and other sources there has been received a large number of ornamental and flowering shrubs, plants and bulbs, which have been put out in the nursery until land can be got ready for their permanent location. We also have a number of samples of fall wheat and rye, all of which have been sown on land carefully prepared, and quite a number of them have made a very satisfactory growth.

The live stock on the farm consists of two heavy draft teams and one medium team, bought in Ontario and brought out here. By working them carefully for a short time they have become gradually acclimated and have had no sickness as yet. There was also bought in Manitoba one registered short-horn cow and a bull calf. From the poultry department of the Central Farm was obtained four coops of different breeds of fowls of four each. They have grown well, but being young, have not yet begun to lay.

The old house and stable which were on the farm have been repaired, and answer a temporary purpose very well—the house for a boarding house for the men, and the stable for our stock and feed. A temporary poultry house has been built, 24 by 12 feet, divided into compartments, and an implement shed is nearly completed, 27 by 12 feet. This work has been done during stormy weather and at very slight expense.

The ground at present is frozen too hard to plough, but as there are a great number of large stumps to take out and fallen timber to burn, and the frost does not interfere with such work, although the winter is said to be unusually severe, there is plenty of work to be done.

As to the farm itself, I think it could scarcely be more suitable for experimental purposes, as there are all varieties of soil, from a rich clay to a gravel and on the eastern boundary the mountains rise several hundred feet, with narrow benches and slopes, giving a good opportunity to test the value of such places for different kinds of fruit and forest trees.

I have the honour to be, Sir,

Your obedient servant,

THOS. A. SHARPE,

Superintendent.

AGASSIZ, 10th January, 1890.

APPENDIX TO THE REPORT OF THE MINISTER OF AGRICULTURE.

EXPERIMENTAL FARMS.

REPORTS

OF THE

DIRECTOR			WM. SAUNDERS.
AGRICULTURIST			JAS. W. ROBERTSON.
HORTICULTURIST			JOHN CRAIG.
CHEMIST			F. T. SHUTT, M.A.
ENTOMOLOGIST and BOTANIST			JAS. FLETCHER.
POULTRY MANAGER			A. G. GILBERT.
SUPT. EXPERIMENTAL FARM,		Nappan, N.S.	WM. M. BLAIR.
do	do	Brandon, Manitoba.	S. A. BEDFORD.
do	do	Indian Head, N.-W.T.	ANGUS MACKAY.
do	do	Agassiz, B.C.	THOS. A. SHARPE.

FOR

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1891

APPENDIX

TO THE

REPORT OF THE MINISTER OF AGRICULTURE

ON

EXPERIMENTAL FARMS.

OTTAWA, 10th February, 1891.

SIR,—I have the honour to submit for your approval my report relating to some portions of the work which has been done during the past year at the Central Experimental Farm in Ottawa, with brief references to that which has been accomplished at the the branch Experimental Farms in different parts of Canada.

You will also find appended Reports from the following officers of the Central Experimental Farm: From the Agriculturist, Mr. Jas. W. Robertson; from the Horticulturist, Mr. John Craig; from the Chemist, Mr. Frank T. Shutt, and from the Entomologist and Botanist, Mr. James Fletcher; also from the Poultry Manager, Mr. A. G. Gilbert. Accompanying these are reports of progress from Mr. Wm. M. Blair, Superintendent of the Experimental Farm for the Maritime Provinces at Nappan, Nova Scotia; from S. A. Bedford, Superintendent of the Experimental Farm for Manitoba, at Brandon; from Mr. A. Mackay, Superintendent of the Experimental Farm for the North-West Territories, at Indian Head; and from Mr. Mr. Thos. A. Sharpe, Superintendent of the Experimental Farm for British Columbia, at Agassiz.

These Reports are very full of information on many topics of special interest to farmers and fruit growers, since they cover almost all departments of agriculture and horticulture. They are submitted with the hope that they may be helpful to all those engaged in cultivating the soil, and that they may contribute towards the furthering of the great agricultural interests of the Dominion.

A Report will also be found attached to that of the Horticulturist, from a joint committee of prominent fruit growers from the Fruit Growers' Association of Ontario, and the Montreal Horticultural Society, who were invited, under your instructions, to examine the fruit plantations at the Central Experimental Farm, and to enquire into the merits of some of the new seedling fruits growing there.

I have the honour to be, Sir,

Your most obedient servant,

WM. SAUNDERS.

The Honourable
The Minister of Agriculture,
Ottawa.

ANNUAL REPORT

ON THE

EXPERIMENTAL FARMS.

REPORT OF THE DIRECTOR.

The importance of continued experimental work in agriculture is recognized by thoughtful men in every civilized country, and State and Government aid to carry on the work is now liberally given, for it is generally admitted that from oft-repeated experiment the largest part of our most useful and accurate knowledge of agricultural subjects has been derived. It is also undeniable that many of the best agricultural products now in cultivation are the result of skilful experiments in the line of selection or of cross-fertilization, or both combined, and equally true that the products, thus somewhat artificially raised by unusual care to a position of high estimation have, when relegated to the hands of the average farmer, gradually deteriorated. There are but few varieties of grain, roots or other farm productions that were in general cultivation fifty years ago which still hold their place in the farmers' estimation; most of them have enjoyed but a short-lived popularity, and given place to varieties having greater vigour, greater productiveness or better quality. A large proportion of agricultural products appear to have a life period, some short, some long, after which their vigour or vitality becomes gradually impaired until their cultivation can no longer be continued with profit. While these varietal changes are constantly going on, the specific forms remain for the most part unaltered.

The six-rowed barley of to-day (*Hordeum hexastichum*) has the same general characteristics as when cultivated by the ancient Egyptians thousands of years ago, but the particular varieties of this plant now most in esteem are of recent introduction. The two-rowedbarley (*Hordeum distichum*) has also been long in cultivation, and was largely used as food by mankind from an early period in human history, but this variety of grain did not attain the position it now holds as one of the most profitable of crops until, by careful experiment and selection, the plump, heavy and prolific varieties of modern times were originated. The potato is the same species as when introduced into Europe from America more than three centuries ago, but the varietal forms which have since been produced are past numbering, and so rapidly do these run their course and become enfeebled as to vigour and fertility that very few survive a period of twenty or thirty years. They "run out" and give place to their betters.

Cereals hold any improvement which may be imparted to them with much greater tenacity than many other cultivated products. Possibly this may arise from their being invariably self-fertilized, which may result in a greater sensitiveness to external conditions, and lead to greater permanence in the changes which altered conditions sometimes bring about. When we consider how vastly important cereals are to mankind, and the great value to the agricultural world of every improve ment, however small it may be, it seems a marvel that more effort has not been made in this direction by those who are most familiar with the methods by which such favourable changes are most frequently effected. While a great number of workers are bringing much intelligence and long experience to bear upon the production of new varieties of flowers, fruits and vegetables, by cross-fertilization and careful selection, those engaged in the same course of work among cereals have been but few; additional observers were needed, and are now being provided, to carry on promising series of investigations, to carefully watch the changes being brought about in important food products by varying climatic and other conditions, so that advantage may be taken of such improvements as may be found to occur, and provision also made to lessen the losses which would arise from continuing the cultivation of such varieties as have become enfeebled and infertile. By carefully conducted experiments such observers may ascertain what crops can be produced best and cheapest, and what new lines of work can be undertaken by the farmer in view of available markets which will be likely to bring him increased returns.

From the accompaning reports it will be seen that the Experimental Farms of the Dominion of Canada have already done good service in these advanced methods of experimental work having so important a bearing on agriculture; the sphere of their operations is being rapidly enlarged, and a wide field of usefulness lies before them in the future.

Every farmer is aware that there are many influences at work every year which bear on his crops, and which do much to determine the proportion of profits which his labour and skill shall bring. Some of these influences are more or less amenable to his control, while others are not so. The general character of the season, whether favourable or unfavourable, as far as this depends on the weather, it is beyond his power to influence; but by varying his methods, so as to gain every possible advantage, he may materially mitigate the evils which always accompany unfavourable seasons. By getting his land into a thorough state of preparation in the autumn the farmer can sow his seed at the earliest opportunity, and early sowing has a very important bearing on the yield, and more especially so on grain crops, in an unfavourable year. The reason for this is not far to seek. The rapidity of growth and development in grain depends very much on the quantity of root surface employed in absorbing the food required for growth. In the early days of spring root development goes on very rapidly, even if the weather be so cold and backward as to retard growth above, recently sprouted grain, under such conditions, will usually be found to have a vigorous cluster of roots.

RESULTS OF EARLY, MEDIUM AND LATE SEEDING.

Some experience has been gained at the Central Experimental Farm during the past season on this subject, which shows the importance of more general attention being paid to early seeding. The particulars connected with the experiments undertaken have recently been published in Bulletin No. 8, and the results are believed to be of sufficient importance to be again summarized here. Six varieties of grain were chosen for the tests, two each of barley, oats and wheat, and sufficient land of a uniform character provided to allow of six plots of one-tenth of an acre each being devoted to each variety. Six of these were sown on the 22nd of April, which was as early as the ground could be worked, and six more every week until all the plots were seeded. The following are the names of the varieties selected for the test: Barley—*Prize Prolific* and *Danish Chevalier* (both two-rowed sorts); Oats—*Prize Cluster* and *Early Race-horse*; Spring wheat—*Red Fife* and *Ladoga*.

At the first sowing a new spring wheat, the Anglo-Canadian, was substituted for the *Race-horse* oats, because these plots afforded the best opportunity at command for testing the relative earliness and fertility of this new introduction alongside of the *Red Fife* and *Ladoga*. With this exception, the experiments were carried out as planned, and the results are given in the following table:

	Sown April 22nd. — Yield per Acre.		Sown April 29th. — Yield per Acre.		Sown May 6th. — Yield per Acre.		Sown May 13th. — Yield per Acre.		Sown May 21st. — Yield per Acre.		Sown May 28th. — Yield per Acre.	
BARLEY.	Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.	Bush.	Lbs.
Prize Prolific.............	40	30	24	38	16	22	14	03	10	15	11	02
Danish Chevalier........	33	26	22	14	19	38	15	10	10	30	9	28
OATS.												
Prize Cluster..............	37	02	33	23	30	20	27	17	20	10	17	22
Early Race-horse..........	..	..	35	05	31	26	28	13	18	18	19	04
SPRING WHEAT.												
Red Fife.......	11	00	9	00	8	15	4	20	3	00	2	35
Ladoga....................	10	45	9	15	8	00	3	55	2	50	2	30
Anglo-Canadian..........	5	50	..	..	..	..	..	..	..	..	..	..

While it must be admitted that such tests will need to be repeated many times, in order to reach averages which may neutralize the variations brought about in crops by varying seasons, there is nevertheless such a regularity in the falling off in yield week after week, as to carry with it convincing proof of the heavy losses which are almost sure to occur where late seeding is practised. The loss on *Prize Prolific* barley by a delay of one week in sowing is nearly 16 bushels per acre, and on *Danish Chevalier* a little more than 11 bushels, while a delay of two weeks shows an average loss of more than half the crop. The area under barley in Ontario in 1890 is estimated at 701,326 acres, and if but half of the average loss which was found to occur in the experiments with the *Prize Prolific* barley in Ottawa be taken as a basis for an estimate, it would appear that the farmers of Ontario may lose, by a delay of one week in the time of seeding, over two and-a-half millions of dollars on the barley crop alone, and by a delay of two weeks more than three and three-quarter millions, reckoning the barley at 50 cents per bushel.

The loss from similar delay in the wheat crop has proved proportionately less, being about one-sixth of the crop where seeding has been delayed one week, one-fourth where it has been deferred for two weeks, while a three weeks delay shows a loss of considerably more than one-half.

The oat crop appears to be less influenced by delay in seeding than either barley or spring wheat. In the case of the Prize Cluster it shows a falling off of about 3 bushels per acre for the first week, but with a delay of two weeks it is a little over 6½ bushels; but the oat crop is so very large that every bushel of loss per acre in Ontario alone, taking oats at 40 cents per bushel, is equal to $752,946.

DISTRIBUTION OF SEED GRAIN.

The efforts begun in the spring of 1888, shortly after the Experimental Farms were organized, to introduce among the farmers of Canada the best varieties of seed grain obtainable, have been continued, and a very general and lively interest has been awakened in this subject, which has already been attended with excellent results, and which must, in the course of two or three years more, bring about a marked improvement in the quality of the grain produced in Canada. It is also likely to lead to an increase in the average yield, and thus add to the prosperity of the farming community and to the general wealth of the Dominion. At the outset the distribution consisted mainly of early-ripening wheat for the Canadian North-West, and the Ladoga wheat was brought prominently before the farmers of Manitoba and the North-West Territories. Since then the distribution has become more general, and varieties of wheat, barley and oats, which promise to be useful in any of the Provinces, have been introduced and disseminated with the view of benefiting all parts of the country. These samples are sent free by mail, in strong cotton bags, containing 3 pounds each. The first season of distribution, the spring of 1888, they were sent to farmers in different parts of the country whose names were submitted to me by persons acquainted in the several districts as men likely to be interested in the subject. The number of samples sent that year was 2,150; of these 1,529 were Ladoga wheat, the remainder consisting of two-rowed and six-rowed barley and oats. In 1889 a different method of distribution was followed, and samples were sent only to those who applied for them. That year 2,760 three pound bags were distributed, consisting of 1,279 of Ladoga wheat, 947 of two-rowed barley and 534 of oats. During the past season, 1890, the same plan of distribution was followed—that of sending samples only on application; and the fact that requests were received and samples sent to the extent of 12,353, distributed among 5,896 individuals, will give some idea of the interest which farmers are taking in this branch of Experimental Farm work. The object aimed at is to influence favourably the entire grain crop of the country, by introducing better varieties than those now in common cultivation, and this, result I believe, can and will be accomplished within a comparatively short time. A few words will suffice to show that this object is worth striving for. The oat crop of Ontario alone for 1890 is estimated by the Ontario Bureau of Industries to have occupied 1,882,366 acres and to have yielded 52,768,207 bushels, an average of 28 bushels per acre. Every bushel per acre which can be added to this is a gain to Ontario, reckoning oats at 40 cents per bushel, of $752,946, while a pound per bushel added to the average weight of the grain is a gain of $620,802. Barley is said to have occupied in the same Province 701,326 acres, yielding 15,600,169 bushels, being an average of 22·2 bushels per acre. Taking barley at 50 cents per bushel, a gain of 1 bushel per acre in this crop adds $350,663 to the returns of the Ontario farmers, while a pound added to the weight would be a gain of $162,501. Again, spring wheat occupied 601,753 acres, yielding 7,683,905 bushels, or 12·8 bushels per acre. A gain of 1 bushel per acre in this case at 90 cents per bushel, adds $541,577 to the returns, while 1 pound per bushel gives on the short crop of the past year $115,258. Fall wheat has occupied an area of 720,101 acres, giving a crop of 14,267,383 bushels, equal to 19·8 bushels per acre. A gain of 1 bushel per acre here, with fall wheat at $1 per bushel, amounts to $720,101, while an addition of 1 pound per bushel gives $237,789. Taking into one estimate the entire acreage and yield of these four leading crops, we find that an addition of 1 bushel per acre all around would give to the farmers of Ontario $2,365,287, while an average gain of 1 pound per bushel in the weight of the grain would give $1,136,340.

The samples of grain sent out in 1890 were distributed as follows:—

Prince Edward Island.

Oats	223
Barley	242
Wheat	138
Peas	1
Total	604

Number of applicants supplied, 350.

Nova Scotia.

Oats	436
Barley	586
Wheat	244
Total	1,266

Number of applicants supplied, 584.

New Brunswick.

Oats	116
Barley	165
Wheat	101
Peas	3
Total	385

Number of applicants supplied, 132.

Quebec.

Oats	891
Barley	1,408
Wheat	699
Peas	41
Total	3,039

Number of applicants supplied, 1,457.

Ontario.

Oats	1,782
Barley	2,043
Wheat	766
Peas	51
Corn	2
Total	4,644

Number of applicants supplied, 2,278.

Manitoba.

Oats	481
Barley	478
Wheat	93
Peas	3
Corn	4
Total	1,059

Number of applicants supplied, 511.

North-West Territories.

Oats	525
Barley	530
Wheat	121
Peas	4
Corn	10
Total	1,190

Number of applicants supplied, 532.

British Columbia.

Oats	65
Barley	62
Wheat	38
Rye	1
Total	166

Number of applicants supplied, 52.

The following shows the total number of packages of the different varieties distributed :—

Oats

Prize Cluster	3,251
Victoria Prize	319
Flying Scotchman	204
Black Tartarian	198
Early Race-horse	143
Banner	21
Canadian Triumph	96
White Russian	277
Bonanza	8
Welcome	1
Hulless	1
Total	4,519

Barley—Two-rowed.

Carter's Prize Prolific	1,125
Danish Chevalier	2,139
Danish Printice Chevalier	793
Beardless	1,194
English Malting	74
Thanet	3
Saale	9
Peerless White	51
Swedish	1
Large Two-rowed Naked	83
Total	5,472

Barley—Six-rowed.

Rennie's Improved	5
Indian from Spiti Valley	23
Odessa Six-rowed	13
Total	41

Spring Wheat.

Ladoga	909
Red Fife	568
White Fife	329
Red Fern	291
Saxonka	53
White Russian	25
Campbell's White Chaff	26
Total	2,201

Peas.

Multiplier	99

Corn.

Mitchell's Early	9
Cinquantine	11
Total	20
Reading Giant Rye	1

Total number of samples distributed, 12,353.
Number of applicants supplied, 5,896.

REPORTS RECEIVED FROM SAMPLES DISTRIBUTED WITH SOME RESULTS OF FIELD CROPS

Prize Cluster Oats.

The results of field experiments with this promising variety of oats during the past year are as follows:—At the Central Experimental Farm the yield has varied on different soils (excluding those plots which were purposely sown late) from 37 bushels and 2 lbs. to 28½ bushels, weighing from 41 to 42 lbs. per bushel. On the Experimental Farm at Nappan, Nova Scotia, the yield has been 22½ bushels per acre, weighing 40 lbs. per bushel, at Brandon, Man., 54 bushels 14 lbs per acre, weighing 42¼ lbs. per bushel, and at Indian Head, in the North-West Territories, 63 bushels per acre, weighing 45 lbs. per bushel. In time of ripening it has generally proved from two or three days to a week or more earlier than most other sorts. In the following summary of results by Provinces extracts are given from a few of the reports from those farmers who have had the largest yields from the 3-lb. samples distributed last spring.

PRINCE EDWARD ISLAND.

Number of reports received, 24; average yield, from 3 lbs. 65¾ lbs.; average weight per bushel, 40⅗ lbs. The heaviest sample weighed 43¼ lbs. per bushel, and was grown by J. Wismer, of Monagan, P.E.I., who reports a yield of 70 lbs.

James Corcoran of Piusville, Lot 4, P. E. I., reports a yield of 180 lbs. from 3 lbs. sown, and says: "Sown June 3rd, on sandy loam (date of harvesting not given); no rust, no smut, straw bright yellow. I will sow all these oats another season." The sample sent weighed 37¼ lbs. per bushel.

E. T. Wright, of Middleton, P.E.I., had a yield of 110 lbs. from 3 lbs. of seed. He says: "Sown 6th May, harvested 25th August. Though our oats were all, or nearly all, rusted more or less, this was bright and clean—no rust. Straw medium length, and stronger and stiffer than some other varieties of white oats that I have grown. This is the earliest ripening variety of oats that we have sown, and is as heavy as any other white oat grown here. I think this is the very best variety of white oats that we have tested on our farm; am well pleased with it." The sample sent weighed 39¼ lbs. per bushel.

NOVA SCOTIA.

Number of reports received, 16; average yield, 38 lbs.; average weight per bushel, 38 lbs. The heaviest sample weighed 42¼ lbs. This was grown by R. McDonald, of Indian Brook, N.S., who reports a yield of 16 lbs.

Frank Lindsay, of Gay's River, N.S., harvested 83 lbs. from 3 lbs. sown. He says: "Sown 14th May, on gravelly loam; harvested 27th August. There was no rust; very little smut; straw medium height, bright and stiff; about eight days earlier than other varieties, and a better crop. I like this grain very well, and will sow it again next year. The aphis attacked it some, but I don't think much harm was done." Sample sent weighed 39½ lbs. per bushel.

Jacob Weismer, New Germany, N.S., had 66 lbs. He says: "Sown 1st May; harvested 13th August; no rust or smut; the character of the straw was excellent;

it compared very favourably with other varieties, ripened earlier and weighed heavier. I consider it a promising grain." The sample sent weighed 41 lbs. per bushel.

NEW BRUNSWICK.

Number of reports received, 6 ; the average yield was 48 lbs; average weight per bushel, 39$\frac{2}{3}$ lbs. The heaviest sample weighed 41$\frac{3}{4}$ lbs. This was grown by W. Jenkins, of Nashwaak, N.B., who had a yield of 40$\frac{1}{2}$ lbs.

Hiram H. Vesey, sr., North Lake, N.B., had 74 lbs. from 3 lbs. sown. He reports: "Sown 9th June on clay loam; harvested 13th September; no rust; a few heads of smut; straw tall and stout; it ripens in about the same time, but is a little heavier than other sorts that I had sown." Weight of this sample was 38 lbs. per bushel.

John Thomas, of Green Hill, Stanley, N.B., had 68 lbs. He says: "Sown 26th May; harvested 6th September; it was badly affected with rust, which was general all over New Brunswick with all varieties; straw strong and bright; stood up well. I cannot call it early, but would class it as second early; will be a valuable sort for New Brunswick, which is pre-eminently an oat growing country." The sample sent weighed 41$\frac{1}{4}$ lbs. per bushel.

J. C. Murray, Central Kingsclear, harvested 50 lbs. from 3 lbs. of seed, and says: "Sown 22nd May on clay soil; harvested 28th August; there was no rust or smut; straw bright and well headed; earlier than other sorts. From the samples sent to me and Mr. Humbel, of Stanley, we took first and second prizes at the Fredericton Fair." In this case no sample was sent.

QUEBEC.

Number of reports received, 30; average yield, 45$\frac{1}{2}$ lbs.; average weight per bushel, 35$\frac{3}{5}$ lbs. The heaviest sample weighed 42 lbs. per bushel, and was grown by A. E. McCarthy, of Henryville, who also had the heaviest yield.

A. E. McCarthy, Henryville, Que., had 102$\frac{1}{2}$ lbs. from 3 lbs. of seed. He reports: "Sown 23rd May on heavy 'grey' soil; harvested 24th August; no rust or smut; straw medium coarse and 4 feet 9 inches long; ripens six to eight days earlier than other sorts; heavier than common sorts. I find the Prize Cluster oats to be well adapted to this section of country." Sample weighed 42 lbs. per bushel.

E. Lafierre, of St. Sebastian, had a yield of 90 lbs., and reports: "Sown 17th May on good sandy soil; harvested 8th September; no rust; good straw. It ripens about the same time as other sorts. The season has been unfavourable, and this grain has suffered." This sample weighed 40$\frac{1}{2}$ lbs. per bushel.

T. S. Evans, of Trenholmville, reports a yield of 85 lbs., and says: "Sown 17th May on heavy loam; harvested 19th August; there was no rust or smut; straw bright and stiff, 4 feet high; it was about eight days earlier than our common white oats. I consider it a valuable variety, and it appears to yield well." Sample weighed 38$\frac{3}{4}$ lbs. per bushel.

ONTARIO.

Number of reports received, 161; average yield, 44$\frac{3}{4}$ lbs.; average weight per bushel, 38$\frac{1}{5}$ lbs. The heaviest sample weighed 44$\frac{1}{4}$ lbs. per bushel, and was grown by Mr. W. B. Hough, of Sillsville, Ont., who reports a yield of 40 lbs.

J. E. Noxon, of Hillier, Ont., had 156 lbs. from 3 lbs. sown. He reports: "Sown 18th April on clay loam mixed with limestone gravel; harvested 2nd August; no rust or smut; straw good length, coarse and strong; ripened early; a good, bright, heavy oat, which I thought yielded well." Sample weighed 43 lbs. per bushel.

Owen Robertson, of Mansewood, Halton County, Ont., had 130 lbs., and says: "Sown April 1st on clay loam; harvested August 5th; there was slight rust, but no smut; straw tall, very heavy, inclined to stool; ripens about same as New Zealand oats. A rough storm took them down two weeks before harvesting, otherwise the yield would have been immense." This sample weighed $40\frac{1}{2}$ lbs. per bushel.

R. M. Brown, of Clarksburg, Ont., reports a yield of 125 lbs. from 3 lbs. of seed, and says: "Sown 25th March and 1st April on loam, with a gravel subsoil; harvested 15th August; rust very bad, otherwise there would have been one-third more grain; no smut; straw very strong and tall, 5 feet, more like rushes than oat straw; some heads 17 inches long; equal, as to earliness, with other varieties, but had more rust." Sample weighed $38\frac{1}{4}$ lbs. per bushel.

MANITOBA.

Number of reports received, 27; average yield, $67\frac{1}{2}$ lbs.; average weight per bushel, $38\frac{1}{2}$ lbs. The heaviest sample weighed $43\frac{3}{4}$ lbs., and was grown by Mr. Steven, of Virden, Man., who says the blackbirds consumed a large part of the crop and left him only 49 lbs.

C. E. Porritt, of Treherne, Man., harvested 154 lbs. from 3 lbs. sown. He says: "Sown 29th May on strong black loam with clay subsoil; harvested 4th September; the straw was badly rusted, owing no doubt to the wet, dull weather; all oats in this section of the country were the same; straw very long and stiff. The past season was not suitable for testing grain as to early ripening, owing to continued cold wet weather in August. The weight per bushel is about the same as Clydesdale, but I think our land was too well worked, and that on old land a heavier sample of grain and less bulk of straw would be produced. I hope to have a better sample next year." The sample sent was very light, weighing only 26 lbs. per bushel.

E. McKeever, of Virden, Man., had 130 lbs., and reports: "Sown 6th May; on light loam, sandy subsoil, harvested 14th August,; there was a little rust; no smut; straw 5 feet 2 inches, very lank. They were the first to cut; the wind laid them flat to the ground, or I could have cut them a week sooner." The weight of this sample was 35 lbs. per bushel.

NORTH-WEST TERRITORIES.

Number of reports received, 36; average yield, $63\frac{3}{4}$ lbs.; average weight per bushel, 38 lbs. The heaviest sample, which weighed $44\frac{1}{4}$ lbs., was grown by John Stewart, of Red Deer, Alberta, who also had the heaviest crop.

John Stewart, Red Deer, N.-W. T.; reports a yield of 146 lbs., from 3 lbs., sown. He says: "Sown 29th April on sandy loam; harvested 18th August; no rust or smut; straw medium for coarseness, about 4 feet high. Ripened ten days earlier than Sandwich oats sown same time on same soil; only tried these two varieties. Heavy, fine grain; think very highly of it; shall sow all I have. I don't think the equal of it was grown in this settlement." Weight of sample, $44\frac{1}{4}$ lbs. per bushel.

W. Tingey, of Marieton, N.-W. T., had 120 lbs., and says: "Sown 26th April; harvested 13th August; no rust or smut; straw long, clean and bright, $3\frac{1}{2}$ feet in height; grain plump and heavy; ripens about same time as Welcome, and about eight or ten days earlier than Black or White Tartarian; one half this plot was eaten off close to the ground by cattle, just as it was heading out. This part was harvested 1st September, from second growth." The weight of this sample was 42 lbs. per bushel.

BRITISH COLUMBIA.

Number of reports received, 5; average yield, 125 lbs.; average weight per bushel, $43\frac{2}{5}$ lbs. The heaviest sample was grown by J. T. Hawks, Soda Creek, B. C., who reports a yield of 37 lbs. This sample weighed $46\frac{1}{3}$ lbs. per bushel.

Wm. Tasker, of Ladner's Landing, B. C., had 220 lbs., from 3 lbs. sown. He says: "Sown 5th May; on sandy loam harvested 5th August; no rust, some smut, strong straw, was one week earlier than Black Tartarian sown alongside, but do not think it will yield as well." The sample sent weighed $45\frac{3}{4}$ lbs. per bushel.

Thos. Morgan, of Cache Creek, B. C., had 208 lbs. from 3 lbs. sown. He says: "Sown 21st May on sandy virgin soil; harvested 23rd August; no rust or smut; straw tall, strong and bright; compares well with other varieties. I consider it excellent, and intend keeping it all for seed." Sample sent weighs 45¼ lbs. per bushel.

Victoria Prize.

This recently introduced variety of white oats resembles in many respects the Prize Cluster, but is a little larger and longer in the kernel, and two or three days later in ripening. Like the Prize Cluster, it is a branching oat, a vigorous grower, with a plump and heavy kernel. In field crops on the several Experimental Farms the record for this variety during the past year is as follows: On the Central Experimental Farm at Ottawa three different plots have been grown with a yield ranging from 36¾ to 38¼ bushels per acre, weighing 41 to 41¼ lbs. per bushel; and at Nappan, N.S., the yield has been 31 bushels per acre, weighing 42¾ lbs. per bushel.

Mr. Heber Rawlings, of Ravenswood, Ont., had 110 lbs. from 3 lbs. sown. He reports: "Sown 12th April on clay loam; ripe 4th August; was rusted (all oats were rusted here); no smut; straw very good; about 5 feet high. It was a very good crop; I can tell no difference between these and the Prize Cluster;" weight of sample, 40½ lbs. per bushel. The heaviest sample sent from Ontario was forwarded by Mr. J. Johnston, of Auburn, Ont., and weighed 41¾ lbs. per bushel. Mr. Johnston reports a yield of 72 lbs.

Mr. Louis Dussault, of Yamachiche, Que., reports a yield of 51½ lbs. He says: "Sown 8th May on black soil; ripe 22nd August; there was a little rust, but less than ordinary; straw of fair quality; ten to twelve days earlier than other varieties here."

The heaviest sample from this Province weighed 40 lbs. per bushel, it was sent by Mr. G. Suggett, of Mystic, Que., who reports a yield of 40 lbs.

Robert Williams, Long Reach, King's Co., New Brunswick, harvested 81 lbs. from 3 lbs. of seed, and says: "It was sown 26th April on dry, light loam; ripe, 15th August; there was no rust or smut; it was affected with red leaf, but not so bad as other oats; straw strong and bright; grain heavier than other sorts, and ten days earlier; other oats very poor as a rule." The sample sent weighed 38¼ lbs. per bushel.

John Butcher, Upper Musquodoboit, Nova Scotia, had 60 lbs., and reports: "Sown on 17th May, on deep loam, with clay bottom; ripe 2nd September; there was a little rust but no smut; straw strong and stout, quite long; was better than some other kinds. I think this seed would be a good change for this Province." No sample was received from Mr. Butcher. The heaviest specimen received from this Province weighed 40 lbs.; this was from Wm. Horton, of Upper Musquodobit, who reports a yield of 45 lbs.

Other Provinces not yet heard from.

Flying Scotchman Oats.

This is also a plump, white oat, which has succeeded very well in many districts. At the Central Experimental Farm it has yielded from 36¾ to 40¼ bushels per acre, weighing 40¼ lbs. per bushel; at Nappan, N.S., 39¾ bushels per acre, weighing 36¼ lbs. per bushel; at Brandon, Man., 71 $\frac{14}{34}$ bushels per acre, weighing 39¾ lbs. per bushel; at Indian Head, 53 $\frac{20}{34}$ bushels per acre, weighing 42 lbs. per bushel; and at Agassiz, B.C., 6 lbs. yielded a crop of 69 lbs., weighing 39½ lbs. per bushel.

W. B. Terry, of Keswick, Ont., had a yield of 100 lbs. from 3 lbs. sown, and says: "Sown, 17th May, on loamy soil, which had turnips the year before; harvested, 1st September; no rust or smut; straw good and bright, with reasonably good weight to support the grain. I think it compares favourably in all respects with other varieties. It was sown rather late, and the sparrows destroyed some of it, yet the yield was good." The sample sent weighed 33½ lbs. per bushel. The heaviest specimen received from Ontario weighed 37¼ lbs. This was sent by A. Stewart, of Kinmore, Ont., who reports a yield of 56 lbs.

J. B. Gauthier, of St. Irénée, Que., had 55 lbs. He says: "Sown 19th May, on sandy soil; ripe 22nd August; no rust nor smut; straw very good; fifteen days earlier than other varieties grown here."

Wm. Fox, of Middle Musquodoboit, Nova Scotia, had a crop of 72 lbs., and says: "Sown 12th May, on gravelly soil;"—date of harvesting not given—"there was a little rust, no smut; straw heavy; ripens about the same as other sorts, with a little better weight of crop; sample weighed, 36 lbs. per bushel."

Other Provinces yet to hear from.

Black Tartarian Oats.

A very fine lot of Black Tartarian was imported from Scotland in the spring of 1890, weighing 42 lbs. per bushel, but they did not succeed, on the whole, so well as was expected. At the Central Farm the yield was 26¾ bushels per acre, weighing 35 lbs. per bushel; at Nappan, N.S., 51 bushels per acre, weighing 33 lbs. per bushel; at Brandon, Man., the yield was 77 bushels, 14 lbs. per acre, weighing 34 lbs. per bushel; and at Indian Head, 74 bushels 30 lbs. per acre, weighing 40 lbs. per bushel. This variety was not tested at Agassiz, B.C.

From Ontario eight reports have been received, with an average yield of 54 lbs., weighing 31⅝ lbs. per bushel. From Quebec three reports, averaging 52½ lbs., weighing 34⅓ lbs. per bushel. New Brunswick, one report; yield, 31 lbs.; weight, 32½ lbs. per bushel. Prince Edward Island, six reports; average yield, 72½ lbs, weighing 33⅓ lbs. per bushel. From Manitoba, two reports; average yield, 51½ lbs.; weight, 34½ lbs. per bushel; and from the North-West Territories, one report; yield, 41 lbs.; weight, 31⅜ lbs. per bushel.

B. Birch, of Lambeth, Ont., reports a yield of 102 lbs. from 3 lbs. of seed and says: "Sown 1st May, on clay loam; harvested 10th August; no rust, no smut; straw large, strong and bright; a little on the late side, but a good heavy crop." The weight of the sample sent was 30½ lbs. per bushel. The heaviest specimen from Ontario weighed 36 lbs. This was from J. Marshall, of Pine Grove, Ont., who does not give the yield.

J. & C. Black, of Thurso, Que., had 64 lbs., and report as follows: "Sown 12th May, on clay soil; ripe 14th August; no rust, no smut; straw coarse, strong and bright." Sample sent weighed 36 lbs. per bushel.

H. Doney, of Johnston, N.B., had 31 lbs., and says: "Sown, 26th May, on clay loam; harvested, 30th September; leaves turned red, like all the oat crop about here; straw middling coarse. Oats were almost a total failure in this section of the country owing to bad weather setting in before they were fit to cut;" sample weighed 32½ lbs. per bushel.

A. E. Dewar, of Southport, P.E.I., had 120 lbs. from 3 lbs. sown. He says: "Sown, 12th May, on clay loam; harvested 14th September; no rust, no smut, straw very stout, later than other kinds; Prize Cluster gave 108 lbs. from 3 lbs. of seed. The season was the worst for oats we have had here for many years." This sample weighed 32 lbs. per bushel.

A. Grant, of Burnbank, Manitoba, reports a yield of 62 lbs., weighing 34½ lbs. per bushel, and A. S. Harding of Whitewood, N.W.T., 56 lbs., weighing 29 lbs. per bushel.

Banner.

This variety, grown on the Central Farm, gave on one plot a yield of 52¾ bushels per acre, weighing 32½ lbs. per bushel, on another plot 22¾ bushels, weighing 30¾ lbs. per bushel. At Nappan the yield was 47½ bushels, weighing 33 lbs. per bushel; at Brandon, Man., 73½ bushels, weighing 39 lbs. per bushel; at Indian Head, N.W.T., 58½ bushels, weighing 40 lbs., and at Agassiz 68 lbs were harvested from 6 lbs. sown

Very few reports have yet been received. Mr. Davy of Glendale, Ont., had 45 lbs. from 3 lbs. sown. He says: "No rust or smut, very stout straw, is the best oat in straw crop and the cleanest we ever sowed; will sow them again another year." The sample sent weighed 35 lbs. per bushel.

J. M. Crindle, of Ellershouse, Hants, N.S., had 36 lbs. and says: "Sown 14th May on a somewhat slaty soil, harvested 22nd August, badly rusted, a good deal of smut. The sample I send is very inferior. I had about an acre of Banner oats sown ten days later that did much better, not so much rust." The sample sent was very light, weighing but 24¾ lbs. per bushel.

L. O. Lemieux, of Oak Lake, Man., from 3 lbs. of the same lot of seed had a yield of 196 lbs. and says: "Sown 23rd May, on sandy loam, harvested 30th August, no rust, very little smut, straw very strong and long 5 ft. 1 inch, not so early as Prize Cluster, yield would have been better but for wet weather and wind which made it lodge." Weight of this sample, 33 lbs. per bushel,

But very few returns have been received of Bonanza, Early Race Horse, Canadian Triumph and White Russian, and a safe judgment can probably be formed of these varieties by comparing the yields obtained on the several Experimental Farms.

Two-Rowed Barley.

Prize Prolific (Carter's).

The yield per acre and weight per bushel of this promising variety of two-rowed barley has been as follows:—Central Farm on different plots, from 24 to 40½ bushels, weighing 52 lbs.; Nappan, N.S., 25 bushels, weighing 49¼ lbs.; Brandon, Man., 42½ to 59¾ bushels, weighing from 50½ to 51¾ lbs., and at Indian Head, N.W.T., 49⅛ bushels, weighing 52¼ lbs.

The average yield as given by forty-one reports from Ontario is 49 lbs.; of nine from Quebec, 57 lbs.; five from Nova Scotia, 48⅕ lbs.; one from New Brunswick gives 23 lbs.; thirteen from Prince Edward Island, 57¼ lbs.; nine from Manitoba, 70¾ lbs., twelve from the North-West Territories, 74$\frac{1}{12}$ lbs., and four from British Columbia, 132½ lbs.

M. Heselwood, of Londesboro', Ont., had a yield of 130 lbs. from 3 lbs of seed, and says: "Sown 25th April, on clay loam; harvested 4th August; no rust or smut: straw long and clean; not so early as some varieties. Am well satisfied with the barley." The weight of this sample was 53½ lbs per bushel.

D. Currie, of Queen Hill, Ont., had 108 lbs. He says: "Sown 5th May; harvested 1st August; no rust or smut: straw clean." Mr. Currie says that this barley weighs 54 lbs. per bushel, but the sample sent was not sufficient to enable us to determine the weight.

David Ferguson, of Constance, reports a yield of 5 bushels from 3 lbs. of seed, and says: "Sown 15th April, on well prepared clay loam; harvested 8th August; no rust or smut; straw bright and coarse; ten days later than other sorts; it is very good barley." The weight of this sample was 51½ lbs.

George Ashby, Ste. Marie de Monnoir, Que., had 170 lbs., from 3 lbs. of seed. He says: "Sown 12th May on clay soil, harvested 25th August; no rust, no smut. straw short." The sample weighed 52¼ lbs. per bushel.

A. E. McCarthy of Henryville, Que., had 67½ lbs. from 3 lbs. sown and reports as follows: "Sown 23rd May on heavy grey soil; harvested 3rd Sept.; no rust or smut, straw medium coarse, ripens 15 days later than common sorts, but weighs 3 to 4 lbs. more per bushel. As this has been an exceptionally poor year for barley, I consider this a fair yield." The sample sent weighed 48½ lbs. per bushel.

Rev. M. Le Curé, St. Joachim, Que., reports a yield of 1¾ bushels and says: "Sown 15th May on grey gravel soil, harvested 15th August, no rust, no smut, nice straw." Sample weighed 48 lbs. per bushel.

M. J. B. Alise, St. Marie de Monnoir, Que., had 40 lbs. He says: "Sown 26th April on clay soil, harvested 8th August, no rust, no smut, straw good; later than other kinds." This sample weighed 50¼ lbs. per bushel.

J. B. Lane, of Dorchester, New Brunswick, reports a yield of 75 lbs. from 3 lbs. of seed, but no sample has been received from him.

F. Lindsay, Gay's River, Nova Scotia, had 74 lbs. from 3 lbs. of seed, and says: "Sown 14th May on gravelly loam, harvested 27th August, no rust, some smut; straw short and bright; like this barley well and will sow it next year." Sample weighed 45 lbs. per bushel.

C. Newcomb, Weymouth, N. S., had a yield of 60 lbs. and reports: "Sown 10th May on heavy loam, harvested 10th October, no rust; no smut; straw bright but very short, compares favourably with other varieties." Sample weighed 50¼ lbs.

J. J. Wismer, Monaghan Road, P. E. I., reports a yield of 90 lbs. from 3 lbs. sown. He says: "Sown 17th May on clay soil (over rich, as one half of barley lodged badly); harvested 25th August, no rust or smut; straw dark on account of being lodged." Weight of sample, 49½ lbs.

John McDonald, West St. Peters, P. E. I., had 80 lbs. and says: "Sown 16th May on sandy loam; harvested 20th August; no rust or smut; straw good." Weight of sample, 50½ lbs. per bushel.

T. B. Gerry, of Sourisford, Manitoba, reports a yield of 135 lbs.,and says: "Sown 10th May on black loam, clay subsoil, harvested 25th August, no rust or smut, straw 3 feet long, stood up well for the year with so much rain; one week later than six-rowed sown same time, but gave much more grain, would have had one-third more, but the birds eat a great deal of it." Weight of sample, 52 lbs. per bushel.

C. Shaw, of Heaslip, Man., had 104 lbs. He says: "Sown 8th May on stiff black loam, harvested 20th August, no rust or smut, straw rather soft, it went down with the heavy rains." Sample weighed 51 lbs. per bushel.

Wm. Tingey, Marieton, N. W. T., reports a yield of 200 lbs. from 3 lbs. sown, and says: "Sown 7th May, on sandy loam, harvested 25th August, no rust or smut, straw strong and very bright; height 3 feet, ripens in about the same time as the common six-rowed; is a much heavier cropper; grows a larger and plumper grain. I think the Prize Prolific barley will greatly improve if grown again next year." Sample weighed 49¾ lbs. per bushel.

James Russell, of Longlaketon, N.W.T., had a yield of 130 lbs.,and says: "Sown 5th May on black loam with clay subsoil, harvested 20th August, no rust or smut, straw rank and soft, it may be a few days late, but nothing to hurt. I consider it far superior to any other sort." No sample was received from Mr. Russell.

Thos. Morgan, of Cache Creek, British Columbia, reports a yield of 218 lbs. from 3 lbs. of seed. He says: "Sown 24th April on sandy loam, with some gravel, harvested 9th August, no rust or smut, straw bright and tall. I like it very much." Weight of sample, 52 lbs. per bushel.

D. Gràham, of Spillamacheen, B. C., had 160 lbs., and says: "Sown 22nd April on clay loam, harvested 9th August, no rust or smut, straw very fair, stands up better than English Malting received last year; both very similar to Chevalier. Sowed about 110 lbs. of English Malting barley on two acres adjoining and threshed 5,500 lbs." Sample of Prize Prolific weighed 53½ lbs. and English Malting 54½ lbs. per bushel.

J. Tolmie, Cloverdale, Victoria, B. C., had a yield of 77 lbs. and says: "Sown 22nd April on red clay soil, harvested 11th August, no rust, 4 heads smut, straw clean and bright, some lodged, about the same as other barley for earliness." This sample weighed 55½ lbs.

Danish Chevalier.

The results of field crops of this variety on the Experimental Farms during the past season are as follows: Central Experimental Farm, from 23½ to 25⅗ bushels per acre, weighing from 51 to 52 lbs. per bushel; at Brandon, Man., 51½ bushels per acre, weighing 53 lbs. per bushel; and at Indian Head, N. W. T., 46$\frac{10}{48}$ bushel per acre, weighing 47¾ lbs per bushel.

The average yield, as far as given in one hundred reports from Ontario, is 52½ lbs.; of twenty-two from Quebec, 39¾ lbs.; thirteen from Nova Scotia, 52½ lbs.; three from New Brunswick, 33⅓ lbs.; nine from Prince Edward Island, 68⅓ lbs.; ten from Manitoba, 60¼ lbs.; twenty-five from the North-West Territories, 77⅛ lbs.; and one report from British Columbia, 33 lbs.

Henry Stall, Rob Roy, Ont., reports a yield of 160 lbs. from 3 lbs. sown, and says: "Sown 6th May on loamy soil in orchard, harvested 8th Sept., no rust or smut, straw tall and stout. It is later than other kinds, but weighs heavier, is a good barley to raise in this part of the country." Sample sent weighed 47¾ lbs., very light, probably due to late sowing.

R. M. Brown, of Clarkesburg, Ont., had 152 from 3 lbs. of seed. He says: "Sown 1st April, on loam with gravel subsoil, harvested 14th August, no rust or smut, straw large, bright but weak, twelve days later than six-rowed sowed same date. I never saw grain stool like it before, some plants had 27 heads." The weight of this sample was 52 lbs. per bushel.

J. E. Noxon, of Hillier, Ont., had 131 lbs., weighing 50 lbs. per bushel. R. W. Bass, of Oxford Centre, 110 lbs., weighing 53 lbs. per bushel, and Robert Martin, of Lucknow, 93 lbs, weighing 53¼ lbs. per bushel.

E. Laffierre, of St. Sebastien, Que., reports a yield of 100 lbs, and says: "Sown 31st May on new land, yellow and grey soil, harvested 2nd Sept., no rust, straw of good quality. This grain has suffered from bad weather in the autumn." Sample weighed 47 lbs. per bushel.

Mr. H. Batchelder, of Hatley, Que., had 62 lbs. He says: "Sown 20th May on medium light loam, harvested 20th August, no rust, no smut, straw rather short, firm and stands well, as early as any other varieties here and extra heavy weight." Weight of this sample 51⅓ lbs. per bushel.

John Foster, of North Kingston, N.S., had 84 lbs. from 3 lbs. sown, and says: "Sown 27th May, on deep dark loam; harvested 10th September; no rust or smut, straw good, heads long, well-filled, in every way satisfactory." Sample sent was very light, weighed only 45¾ lbs per bushel, due probably to late sowing.

Jacob Weismer, New Germany, N.S., had 76 lbs. He says: "Sown 10th May, on light loam; harvested 19th August; very slightly rusted, no smut, straw good. Ripened earlier than other kinds and better weight; consider this a choice grain." This sample weighed 48 lbs per bushel.

Robert Williams, of Long Reach, King's Co., N.B., had 52 lbs., and says: "Bag was torn on arrival, did not have 3 lbs to sow. Sown 26th April, on light dry loam; harvested 17th August; no rust or smut, straw rather weak, broke down considerably, earlier and heavier than other varieties; think very much of this grain." Sample sent weighed 51¼ lbs. per bushel.

Wellington Mutch, of Eldon, P.E.I., had 100 lbs. from 3 lbs. sown, and reports: "Sown 17th May, on light but fairly rich soil; harvested 28th August; no rust or smut, straw light and short; very little barley sown here, but think this better than barley generally sown here." The weight of this sample was 50 lbs. per bushel.

James Brown, of Stanley Bridge, P.E.I., had 85 lbs. and says: "Sown 5th June, on heavy soil, summer fallowed; harvested 9th September; no rust or smut; straw dark with continued wet weather." Weight of sample, 49¼ lbs.

T. B. Gerry, of Sourisford, Manitoba, had a yield of 130 lbs. from 3 lbs. sown, and says: "Sown 10th May, on black loam, with clay subsoil, harvested 25th August; no rust or smut; straw about 3 feet long; in ordinary years would stand up well, but this year much rain has partially lodged it; is a week later than the six-rowed, but a heavier yielder." Sample weighed 49¾ lbs per bushel.

L. O. Lemieux, of Oak Lake, Man., had 68 lbs., and says: "Sown 23rd May, on sandy loam; harvested 24th August, no rust or smut; good heavy straw; did not lodge as badly as some others." Weight of sample 48½ lbs per bushel.

Mr. C. H. Macwatt, of Royal, Man., sent a sample weighing 50½ lbs. per bushel, but did not give the yield, he says, however: "I have two bushels for seed, it made good growth and is a good bearer, but I prefer Carter's Prize Prolific.

John Dunn, of Ellesboro, N.W.T., had 168 lbs. from 3 lbs. of seed, and says: "Sown 19th April on black sandy loam; harvested 10th August; no rust or smut;

straw long and coarse; is hardly as early as other sorts, but bears double the crop." Weight of sample, 46 lbs. per bushel.

Wilfred Wilde, of Grenfell, N. W. T., had 144 lbs. and says: "Sown 20th May on black sandy loam with clay subsoil; harvested 24th August; no rust or smut, straw, strong, light colour about 3½ feet high, not any earlier but much better than other sorts; am very much pleased with it. I took four first prizes with it at four different Agricultural Exhibitions, and it was much admired by all who saw it." Weight of sample, 48¾ lbs. per bushel.

J. F. Hawks, Soda Creek, B.C., reports a yield of 33 lbs. from 3 lbs. of seed. He says: "Sown about 12th May, on gravelly loam, harvested about 1st September; no rust or smut; straw bright and of good length; had no extra care or attention." The weight of this sample was 54½ lbs. per bushel.

Beardless.

This variety has received the name of Beardless for the reason that when fully ripe many of the heads partly or wholly lose their beards. The yield of this variety in field plots on the Experimental Farms has been as follows: At the Central Farm, Ottawa, from 25¾ to 26¼ bushels per acre, weighing 51½ lbs. per bushel; at Brandon, Man., 48¼ bushels per acre, weighing 52¼ lbs. per bushel, and at Indian Head 45 bushels per acre, weighing 51½ lbs. per bushel.

Special prizes were offered by the proprietors of the Canadian Live Stock Journal, Toronto, for the largest yield and best quality of Beardless barley raised from a 3 lb. sample, which has had the effect of stimulating effort in this direction and hence larger yields are reported in Ontario for this barley than for any other variety.

The average yield as given in 65 reports from Ontario, is 70¾ lbs.; of 26 from Quebec, 34 lbs.; three from Nova Scotia, 25⅔ lbs.; one from New Brunswick, 76 lbs.; three from Prince Edward Island, 63 lbs.: four from Manitoba, 60¼ lbs.; and two from the North-West Territories, 42 lbs.

J. B. Lawrie, of Mongolia, Ont., reports a yield of 378½ lbs. from 3 lbs. of seed sown on a plot of 420 by 20 feet, in drills about 8 inches apart. He says: "Sown 24th April on clay loam; harvested 12th August; straw bright; pretty stiff and of fair length." Weight of sample, 53 lbs. per bushel.

Roger Wilson, of Goring, Ont., had 5 bushels and 14 lbs. (say 254 lbs.) from 3 lbs. of seed. He says: "Sown 3rd and 7th May on limestone loam in drills; harvested 22nd August; no rust or smut; straw long and bright, two weeks later than four-rowed." Sample weighed 50½ lbs. per bushel.

Banwell Foote, of Zephyr, Ont., reports a yield of 228 lbs.; John Renwick, of Lakenhurst, 155 lbs.; and George S. McKee, of 140 lbs. These very large yields from the 3 lb. sample bags show what can be done to increase a new variety rapidly by extra care and attention.

E. McMillan, of Notre Dame du Laus, Que., had a yield of 73 lbs. from 3 lbs. of seed. He says: "Sown 6th May on loamy soil; harvested 29th August; no rust or smut; straw short, not strong. The season was very wet and unfavourable; this barley was later in ripening than other sorts and did not ripen evenly." The sample weighed 46 lbs. per bushel.

A. F. Bower, of Learned Plain, Que., had 67 lbs. and says: "Sown 14th May on strong loam; harvested 29th August; there was a little rust, no smut; straw strong and bright; season very unfavourable." Sample weighed 47½ lbs. per bushel. The heaviest sample received from the Province of Quebec weighed 53 lbs. per bushel, this was sent by E. Dupont, of St. Sévére, who reports a yield of 22 lbs.

W. J. Symonds, of Linwood, N.S., had 40 lbs. from 3 lbs. sown and says: "Sown 3rd June on light loam; harvested 20th September; straw bright; as to earliness ripens about the same as other barley." Sample weighed 48½ lbs. per bushel.

Bayard Williams, of Long Reach, N.B., had 76 lbs. from 3 lbs. of seed and says: "Sown 27th May on sandy loam; harvested 23rd September; no rust or smut; straw good and heavy." Sample was light, weighing only 46¼ lbs. per bushel.

Hugh McQueen, of Orwell, P.E.I., had a yield of 40 lbs. and reports: "Sown 23rd May on a rich mellow soil; harvested 10th September; no rust or smut; straw white and clean." Sample weighed 49⅓ lbs. per bushel.

A. E. Cook, of Dundee, Man., had 86 lbs. from 3 lbs. sown: "Sown 9th May on black clay loam; harvested 21st August; no rust or smut; straw long and fine, lodged badly. I think if sown thin on good land it would be a heavy yielder, mine gave at the rate of 60 bushels per acre, and had I made it cover twice as much ground it would have gone 90 to 100 bushels." Weight of sample 49 lbs. per bushel.

The reports received concerning the other varieties distributed are comparatively few in number and may be briefly summarized as follows:—

Danish Printice Chevalier.—From Ontario seven reports have been received, the average yield being 30 lbs.; from Quebec thirteen reports with an average of 25 lbs., and from Prince Edward Island one report with a yield of 70 lbs.

Peerless White.—Two reports of tests of this variety were received from Quebec, the average yield being 57½ lbs.; one from Nova Scotia of 13 lbs., and four from Prince Edward Edward Island, yield 47¾ lbs.

English Malting.—Concerning this there were seven reports from Ontario with an average yield of 38 lbs., and one from the North-West Territories with a yield of 20 lbs. With this latter sample the statement is made that "there was much wasted as the harvest time was very wet."

Thanet.—Two reports were received from Ontario regarding this barley, the average yield being 69 lbs. There was one also from the same Province on the New Zealand barley, the yield reported being 55 lbs.

Large Two-rowed Naked.—The average yield of three reports from Ontario on this large grained feeding barley was 22⅓ lbs., and from one test in Manitoba 25 lbs.

Six-rowed Barley.

Rennie's Improved.—One report only has been received on this promising variety, it comes from Ontario and the yield is given as 62 lbs.

Spiti Valley Barley.—This is a six-rowed, hulless variety, the grain being of a bluish colour, and in some districts gives promise of being a valuable barley for feeding purposes. Four reports from Ontario give an average yield of 27½ lbs., one from Nova Scotia 23 lbs. and one from the North-West Territories 60 lbs.

Ladoga Wheat.

This early ripening wheat which was imported from Northern Russia, under instructions of the Minister of Agriculture, in the spring of 1888, is rapidly gaining in favour in the Canadian North-West, and while maintaining its relative earliness appears to be improving in quality and yield. In most parts of Ontario and some other localities East this variety seems very liable to rust, but from the northern parts of Ontario and Quebec and from Prince Edward Island the reports are much more favourable. At the Central Farm nearly all the leading varieties of spring wheat have given a poor yield, the Ladoga with its crop of 10¼ to 10¾ bushels per acre, weighing 56¼ lbs. per bushel, comparing favourable with many others. At Nappan, N. S., the yield has been 19 bushels per acre, weighing 62 lbs. per bushel, at Brandon, Man., 21⅓ bushels, weighing 59½ lbs. per bushel, and at Indian Head, N.W.T., 30 bushels per acre, weighing 59¼ lbs. per bushel.

From Ontario twenty-one reports have been received, giving an average of 30½ lbs., from Quebec twenty-three, averaging 29½ lbs., Nova Scotia eight, with an average of 32⅝ lbs., New Brunswick six, averaging 29⅚ lbs., Prince Edward Island five, giving an average of 59⅘ lbs., Manitoba three, with an average of 31⅓ lbs., North-West Territories eleven, averaging 68¾ lbs., and one report from British Columbia, where the yield is said to have been 634 lbs. from 3 lbs. of seed.

Jas. Madill, of Dunedin, Ont., had 90 lbs. from 3 lbs. sown. He says: "Sown 30th April on light clay soil, harvested 20th August, there was some rust and some smut, straw of medium length, rusted; weak, did not ripen earlier than other sorts." Sample sent was too small to determine weight per bushel.

Thos. Easton, of Acton West, Ont., had a yield of 52 lbs. from 3 lbs. sown. He says: "Sown 18th April on gravelly loam, harvested 31st July. There was a little rust and some smut, but not much, straw of fair length, a week earlier than other wheat in this neighbourhood and about the same weight of crop." Sample weighed 58 lbs. per bushel.

Owen Robertson, of Milton, Ont., had 50 lbs. and says: "Sown 17th April on clay loam, harvested about 18th August, rusted very badly, no smut, straw of good height, stood up well; the first spring wheat we have grown here." Weight of sample, 59 lbs. per bushel.

Edward McMillan, of Notre Dame du Laus, Que., had 61 lbs. He says; "Sown 6th May on high loamy soil, harvested 29th August; a little rust and a few heads of smut, straw long and even, is good for the season." In this instance the sample did not reach us.

T. G. Evans, of Trenholmville, reports a yield of 51 lbs. and says; "Sown 17th May, harvested 25th August; no rust whatever, no smut, straw good, stiff and bright; was about a week earlier than the White Russian, weight about 60 lbs. to the bushel." No sample received. The heaviest sample sent from Quebec was from M. Florent Dufour, of Baie St. Paul. This weighed $62\frac{3}{4}$ lbs., and the yield was said to be 20 lbs.

John Butcher, of Upper Musquodoboit, N. S., had 50 lbs., and says: "Sown 12th May on clay loam, harvested 24th August; it was rusted, but rust was very prevalent in the province. There was no smut, straw tall and hard. I think it will do well in good years." The sample sent was very light, weighing only 55 lbs. per bushel.

S. Landray, of Tracadie, N. S., had 44 lbs. from 3 lbs. sown and says; "Sown 24th May, on dry gravelly soil; harvested 4th September; there was no rust, but some smut; good straw." Weight of sample, $60\frac{1}{2}$ lbs.

Joseph de Grace, St. Louis, N. B., had $35\frac{1}{2}$ lbs. He says: "Sown 22nd May, on strong land; fairly rich; harvested 30th August; there was a little rust; no smut; fine straw; 8 to 10 days earlier than other varieties; I find the heads very short." Sample received weighed $59\frac{1}{2}$ lbs. per bushel.

W. Jenkins, of Nashwaak, N. B., had 35 lbs. and says: "Sown 8th May, on a light clay loam; harvested 3rd September; there was some rust, but none to hurt; no smut; straw much like other sorts but coarser; a heavy grain; think it is earlier than other kinds." This sample weighed $62\frac{1}{4}$ lbs. per bushel.

J. D. McIsaac, of Clear Spring, P. E. I., had 94 lbs. from 3 lbs. sown and says: "Sown 19th May, on new land; harvested 30th August; no rust, but considerable smut; straw not as rank as White Russian. I cut it six days earlier than White Russian and in crop it was far ahead." Sample weighed $57\frac{1}{4}$ lbs. per bushel, sent just as threshed, without cleaning.

John McDonald, of West St. Peters, had 90 lbs. He reports: "Sown 16th May, on sandy loam; harvested 29th August; no rust or smut; straw fairly good; heavy growth; 5 days earlier than Red Fife." Sample weighed 61 lbs. per bushel.

Wm. Hembroff, of Russell, Manitoba, had 49 lbs. He says: "Sown 18th April, on clay loam with a small proportion of sand; harvested 19th August; there was slight rust and some smut; straw long and strong, but not so hard as Fife; it was 10 days earlier than Red Fife, which was sown on stubble a week sooner. The yield was fully double the amount given, but the fowls and birds destroyed the balance. I like it well and think it will suit this country." Weight of sample, $58\frac{1}{4}$ lbs.

Maurice Wilson, of Pincher Creek, Alberta, N. W. T., had $90\frac{1}{2}$ lbs. from 3 lbs. sown. He says: "Sown 25th April, on dark sandy loam; harvested 1st September; no rust or smut; straw medium; had no opportunity of comparing it with other varieties as to earliness. This has been an unfavourable year for all grain, on account of drought." The sample sent was very light, weighing only $54\frac{1}{2}$ lbs. per bushel.

E. Fitzgerald, of Grenfell, Assa., N. W. T., had 73 lbs. and says: "Sown 3rd May, on light sandy loam; harvested 23rd August; no rust or smut; straw long, fine; ripened 15 days earlier than my earliest field of Red Fife; weight, 62 lbs. to the bushel; suits me well; if you have any to sell I would like to buy some."

H. E. Richardson, of Balgonie, Assa., had a yield of 60 lbs. He says: "Sown 1st May; on light sandy soil; harvested 15th August; no rust, very little smut; straw strong, 4½ feet long. It was ripe when Red Fife sown on the same day was still green. I think it is the best wheat for this country." This sample weighed 61⅓ lbs. per bushel.

Thos. Morgan of Cache Creek, British Columbia, reports an extraordinary yield, 634 lbs. (10 bushels 34 lbs) from 3 lbs. of seed. He says: "Sown 5th May, on rich sandy loam, on which potatoes were grown last year; in a high state of cultivation; sown broadcast on a little less than ⅙ of an acre; harvested 20th August; no rust or smut; straw tall, over 5 feet high; very strong; much earlier than other sorts. Parties who saw it before it was cut, said they never saw anything like it; all my grain is grown by irrigation." The sample sent was very fine and weighed 63½ lbs. per bushel. This is the largest yield ever reported from a 3 lb. sample, it is equal to nearly 70 bushels per acre—50 bushels of wheat per acre is not uncommon in that district on irrigated land.

In consequence of the injury done to wheat by early frost in the North-West during the past autumn more attention has been called to early ripening varieties, and the Ladoga has been much sought after for seed for next spring—for the reason that it has ripened early enough to escape all injury from frost. There must be many farmers now who have more or less of this wheat for sale, and its cultivation from this time forward promises to be more general. Mr. Samuel Hanna, of Griswold, Man., has been one of the most successful growers of this variety. He began with a 3-lb. sample the first year of its distribution from the Experimental Farm, and this has increased so rapidly, that during the season just closed, he has grown fifty acres which has given him an average yield of 30 bushels to the acre, or 1,500 bushels in all, most of this he is now offering for sale for seed. A sample of this grain sent for inspection weighs 60 lbs per bushel. Mr. Hanna's Red Fife yielded him an average of 30 bushels also, but most of that had the advantage of being sown on summer fallow, while the Ladoga was all put in on fall or spring ploughing. The Ladoga, he says, has never been injured by frost with him, and in his opinion it is ten days earlier than Red Fife. The wheat buyers have graded his samples as No. 1 hard, but they would prefer Red Fife if equally sound because it is more plump in the kernel. While Mr. Hanna is a strong advocate of Red Fife, he believes that every farmer in the North-West should have part of his crop in Ladoga, as it escapes frost, and the farmer can begin his harvesting of this grain at least a week earlier than Red Fife.

In the issue of *The Commercial*, of Winnipeg, dated 2nd February, reference is made to a very fine lot of Ladoga wheat grown in Prince Albert. The writer says:

"A representative of *The Commercial*, when in Prince Albert recently, came across a sample of wheat which was a surprise to him. He had seen nothing like it among hundreds of samples examined this season in other parts of the country. A bag of this wheat was procured by the publisher of *The Commercial*, and samples of the grain were forwarded to grain exchanges, milling publications, and leading wheat and flour dealers and experts in Canada, the United States and Great Britain. Replies have not yet been received from some who were forwarded samples, but will be published when they come to hand. The wheat we refer to was grown by William Plaxton, whose farm is six miles from Prince Albert. The samples sent out were not hand picked, as is usually the case with such, but just as it came out of the farm granary. The wheat was grown in 1890, which is generally regarded as the most unfavourable year experienced for almost a decade so far as producing a fine quality is concerned. The wheat is of the "Ladoga" variety, which was imported from Russia by the Dominion Government a few years ago, for testing in Canada. This wheat it is claimed ripens considerably earlier than Red Fife, which is an important factor in the northern region. By cultivation in the hard wheat region of Canada this wheat becomes harder and is generally improved in quality. This was shown by comparing the wheat grown each year in succession from the original seed. The sample sent out was a pure hard wheat, bright and clean, weighing 66½ pounds to the imperial bushel and yielded about 35 bushels per acre. We requested a statement from Mr. Plaxton as to his experience in growing the wheat, and following we give it in his own words :—

"'In 1888 I got three lbs. and sowed it on the 7th May, and harvested it on the 30th of August; thrashed 96 lbs. of good clean grain. In 1889 I sowed 96 lbs. on the 16th April, covering about an acre of land, sowed broadcast. Harvested it on the 6th of August and threshed 14 bushels 68 lbs. of first-class wheat. The crop was light this year on account of the drought. In 1890 I sowed five acres on the 22nd of April, sowed broadcast about two bushels per acre and harvested it on the 15th of August and threshed 172 bushels of which you have a sample. This year (1890) I had Red Fife wheat, White Russian and Ladoga, sown side by side on the same kind of soil. The Ladoga ripened and was cut five days earlier than White Russian and ten days earlier than the Red Fife.

"'Yours truly, Wm. Plaxton.

"Following are some of the replies received to the samples sent out :—

"From the *Northwestern Miller*, of Minneapolis, the leading milling journal of the United States : 'Truly a remarkable sample.'

"From *Daily Business*, the grain trade paper of the Chicago Board of Trade : 'The *Daily Business* has received from the Winnipeg *Commercial*, a sample of "Ladoga" wheat, raised in the Prince Albert district, territory of Saskatchewan, 350 miles north of the international boundary line. It is a beautiful wheat, weighs about sixty-five pounds to the measured bushel, and is said to be equal, for flouring purposes, to any wheat grown. It was raised on the farm of William Plaxton, and is the third crop raised from the imported seed. It was sown about 22nd April, and harvested 15th August. It has many of the qualities of Red Fife, but ripens ten to fifteen days earlier. With each year of cultivation the grain improves, growing thinner in hull and harder.'

"E. Seckel & Co., grain commission merchants, Chicago, write : 'Your favor received, and also sample of wheat, for which accept our thanks. We exhibited same on 'Change and it attracted quite a good deal of attention. We must say that it is the finest sample of spring wheat we have laid our eyes on. One of our millers here would like to know the value of this wheat in your market, and the rate of freight to Chicago, if you can kindly give us the same.'

"A. C. Buell & Co., a leading Chicago grain firm, write : 'I have your letter accompanied by a sample of splendid wheat. A country that can raise such wheat as that sample will be sought after before many years, as the product of Minnesota and Dakota is fast deteriorating.'

"Kirkpatrick & Cookson, grain commission merchants, of Montreal, say : 'Your favor duly received and noted, as well as the sample of "Ladoga" wheat. It is certainly a very handsome sample and has been greatly admired. Is the bulk all as clean as this sample ? At what could a car or two be sold, as an introduction of the variety ?—We might be able to use a little bye-and-bye.'

"From the publisher of the *Miller's Review*, Philadelphia : 'With reference to the sample of wheat grown in the Prince Albert district, my people at the office report it to be something entirely outside of their experience, and they know pretty well what fine wheat and large crops of it are. I desire to show this wheat on our Exchange, and I will report to you the opinions of some of its members. It seems to me the wheat matures in a remarkably short time from the date of sowing. I will be pleased to write you what our dealers have to say about it. Yours very truly,

"'H. L. Everell.'

"*Millers' Review*, Philadelphia, Pa.: 'Among the samples displayed by Hancock & Co., of the Philadelphia Commercial Exchange, recently, was a small one from the territory of Saskatchewan, nearly three hundred and fifty miles north of the boundary line between the United States and the British possessions. It excited considerable attention, partly from the fact that the samples on the tables of Hancock & Co. usually are of interest to buyers, and partly, too, from the fact that the grain in the little blue box was of an exceptionally fine type of red spring wheat. The letter appended gives the history of our getting it, and as we do not wish to keep the sight of such beautiful stock from the appreciative gaze of millers and commercial men, we submitted it to Maj. Hancock, and through his offices it was introduced to the Chamber and to the notice of the members on 'Change. The Major pronounced the wheat as handsome as any he had ever seen, and he was sorry that the machinations of freight combines and tariffs so effectually kept such stock away from millers and grain men in this section and prohibited any substantial investment in this fine product of the far North.'

"These letters speak for themselves. Prince Albert has established its claim, and further comment is unnecessary."

Mr. Plaxton has sent a sample of this wheat to the Central Experimental Farm it is the finest sample we have ever received and weighs 66 lbs. per bushel.

Wm. Gibson, of Wolseley, N W.T., another practical farmer to whom a sample was sent in the spring of 1888, has also had good success with this wheat. His 3-lb. sample produced him the first year 236 lbs. and his second crop thinly sown gave him over 100 bushels. In a letter dated 22nd November, 1890 he says: "My Red Fife wheat sown on the 8th of April was frozen and I think will grade No. 1 or No. 2 frozen, harvested on the 24th of August, this suffered from hail and yielded me only 13 bushels to the acre. The Ladoga wheat sown 10th April and harvested 18th August has escaped the frost, this also suffered from hail and yielded only 14 bushels per acre. This season's experience shows the necessity of every farmer sowing a part of his grain Ladoga. I shipped over 100 bushels to the United States last year for seed, as farmers here were willing to stick to Red Fife. This year I have had a lot of orders for Ladoga for seed next spring."

Similar favourable experiences might be multiplied, but enough has perhaps been said to show that the introduction of the Ladoga wheat has been a good thing for the North West-Territories, that it is probable that this wheat from its early ripening properties, will to a great extent afford a solution of the probelm of early frost, and from its high quality and productiveness in the northern portions of the great plains, help materially in extending the area for successful wheat culture, and in building up such a reputation for wheat-growing there as shall aid in the settlement of the country.

The reports received regarding the tests of other varieties of wheat may be summarized as follows:

Red Fife—Ten reports from Ontario show an average yield of 27 lbs. Sixteen from Quebec, 25½ lbs. One from Nova Scotia, 29 lbs. Two from New Brunswick, 48¼ lbs, and two from Prince Edward Island, 55 lbs.

White Fife—Eight reports from Ontario give an average yield of 24¼ lbs. and four reports from Quebec an average of 31¼ lbs.

Red Fern—Three reports from Ontario give an average yield of 20⅝ lbs. Six from Quebec, 33⅓ lbs.; two from Nova Scotia, 24 lbs.; one from New Brunswick 30 lbs., and two from Prince Edward Island with an average of 88½ lbs.

EXPERIMENTS WITH OATS.

During the past season 28 varieties of oats have been tested in field plots and 28 others in small plots, making 56 in all. Of these, 16 varieties were sown on plots of one-tenth acre each, alongside of each other, on the same day, on a clay loam of fairly uniform character. The results obtained from grain grown under such conditions may be compared, the one with the other, with much less probability of error than when comparisons are made between varieties sown at different periods and on different soils on the same farm. The field referred to was in hay when the farm was purchased; it yielded fair crops in 1887 and 1888; the sod was ploughed under early in the autumn of 1888 and a crop of oats taken off in 1889. The land was ploughed soon after the oat crop was harvested and sown with experimental plots of oats, barley and wheat in the spring of 1890. No manure or other fertilizer has yet been used on this land since the purchase was made. The results are given in the appended table, following which particulars will be found relating to larger field plots of these and other varieties. On all the tenth-acre plots the oats were more or less rusty, and in most instances they were much injured from this cause.

———	Date of Sowing.	Date of Harvesting.	Number of Days Maturing.	Yield per Acre.	Weight per Bushel.
				Bush.	Lbs.
American Triumph	April 25	Aug. 11	108	37¼	35¼
Banner	do 25	do 8	105	52¾	32½
Black Tartarian	do 25	do 12	109	28¼	25¾
Bonanza	do 25	do 5	102	42⅓	41⅓
Canadian Triumph	do 25	do 2	99	30¼	43½
Cream Egyptian	do 25	do 8	105	30¾	38
Egyptian	do 25	do 8	105	31¾	35½
Early Blossom	do 25	do 14	111	23⅓	31
Early Race-horse	do 25	do 5	102	30½	41
Flying Scotchman	do 25	do 5	102	36¾	38½
Giant Swedish	do 25	do 14	111	33¾	29
Poland White	do 25	do 5	102	33⅓	41
Prize Cluster, imp. 1889	do 25	do 2	99	33¾	41¼
do do 1890	do 25	July 30	96	34¾	41
Rennie's Prize White	do 25	Aug. 4	101	25¼	41
Victoria Prize	do 25	do 4	101	36¾	41
White Russian	do 25	do 16	113	34¼	32

It will be seen that the Banner heads the list in this series, but the grain is light. Bonanza stands next in yield, with a heavy sample, followed among the oats of heavy weight by Victoria Prize and Prize Cluster. The Canadian Triumph, although a smaller yield, gives the heaviest sample.

LARGER FIELD PLOTS.

American Triumph (Carter's).—On sandy loam; manured in spring of 1889; two acres. Sown 21st April; 2 bushels per acre; ripe 12th August; time to mature, 113 days; yield per acre, 31¼ bushels; weight per bushel, 36¼ lbs.

Banner.—On sandy loam; no manure; 2½ acres. Sown 29th April; 1¾ bushels per acre; ripe 12th August; time to mature, 105 days; straw bright and strong; very little rust; stands well; height, 3½ to 4 feet; yield per acre, 22¾ bushels, weighing 30¾ lbs. per bushel. A second plot, on sandy clay soil, no manure, ¼ acre, was sown 7th May; 1½ bushels per acre; ripe 12th August; time to mature, 97 days; straw dark; stands well; height, 3 to 3½ feet; yield per acre, 31¼ bushels, weight per bushel, 30¼ lbs.

Black Tartarian.—This seed was imported from Scotland in the spring of 1890. It was a very fine sample, weighing 42 lbs. to the bushel. On sandy clay soil, without manure; 7 acres; sown 9th May, 2 bushels to the acre; harvested 15th August; time to mature, 98 days; medium growth; poor colour; much rust, and red leaf; yield, 26¾ bushels per acre, weighing 35 lbs. per bushel.

Bonanza.—On sandy loam; no manure; 2½ acres. Sown 29th April; 1¾ bushels per acre; ripe 3rd August; time to mature, 96 days; straw bright, rather weak; considerably rusted; height, 4½ to 5 feet; yield per acre, 31 bushels, weighing 42½ lbs. per bushel.

Canadian Triumph.--On light, sandy clay; no manure; $1\frac{1}{4}$ acres. Sown 26th April; $1\frac{3}{4}$ bushels per acre; harvested 3rd August; time to mature, 99 days; even growth; straw bright; very little rust; yield per acre, $25\frac{1}{4}$ bushels; weight per bushel, 43 lbs;

Canadian White.—On sandy clay soil; no manure; 1 acre. Sown 24th April; $2\frac{1}{4}$ bushels per acre; ripe 5th August; time to mature, 103 days; straw bright; stands well; height, $3\frac{1}{2}$ to 4 feet not much rust; yield per acre, $28\frac{1}{4}$ bushels; weight per bushel 36 lbs.

Early Archangel.—On sandy clay soil; no manure; $\frac{1}{4}$ acre. Sown 3rd May; $1\frac{1}{2}$ bushels per acre; ripe 7th August. time to mature, 96 days; uneven growth; straw bright; stands well; a little rust and some smut; height 3 to $3\frac{1}{2}$ feet; yield per acre, $24\frac{1}{4}$ bushels; weight per bushel, 39 lbs.

Early Racehorse.—On sandy loam; manured in spring of 1889; $4\frac{1}{2}$ acres. Sown 21st April; $1\frac{3}{4}$ bushels per acre; ripe 2nd August; time to mature, 103 days; straw a little dark, lodged in some spots; considerably rusted; height, 4 to 5 feet; yield per acre, not ascertained; weight per bushel, 42 lbs.

Egyptian.—On sandy clay; no manure; one acre. Sown 24th April; $2\frac{1}{4}$ bushels per acre; ripe 5th August; time to mature, 103 days; even growth; very little rust; height, $3\frac{1}{2}$ to 4 feet; yield per acre, $36\frac{1}{2}$ bushels; weight per bushel, $41\frac{3}{4}$ lbs.

Flying Scotchman.—On sandy loam; manured in spring of 1889; 2 acres. Sown 22nd April; $1\frac{3}{4}$ bushels per acre; ripe 2nd August; time to mature, 102 days; even growth; very little rust; height, $3\frac{1}{2}$ to $4\frac{1}{2}$ feet; yield per acre, $40\frac{1}{4}$ bushels; weight per bushel, $39\frac{1}{2}$ lbs.

Georgia Early White.—On sandy clay soil; no manure; one acre. Sown 24th April; $2\frac{1}{4}$ bushels per acre; ripe 2nd August; time to mature, 100 days; even growth; straw bright; stands well; very little rust; height, $3\frac{1}{2}$ to $4\frac{1}{2}$ feet; yield per acre, $26\frac{1}{2}$ bushels; weight per bushel, 42 lbs.

Holstein Prolific.—On sandy clay soil, no manure, $\frac{1}{4}$ acre; sown May 7th; $1\frac{1}{2}$ bushels per acre; ripe August 10th; time to mature 95 days; straw weak and considerably rusted; height 3 to $3\frac{1}{2}$ feet; yield per acre, $19\frac{1}{2}$ bushels; weight per bushel $30\frac{1}{2}$ lbs.

Hazlett's Seizure.—On Sandy clay soil; no manure; $\frac{3}{4}$ acre. Sown 7th May; $1\frac{1}{2}$ bushels per acre; ripe 12th August; time to mature 97 days, straw dark; considerably rusted; height, 3 to $3\frac{1}{2}$ feet; yield per acre, $16\frac{3}{4}$ bushels; weight per bushel, 36 lbs.

Hungarian White.—On sandy clay soil; no manure; 1 acre. Sown 24th April; $2\frac{1}{4}$ bushels per acre; ripe 2nd August; time to mature, 100 days; even growth; considerably rusted; height, $3\frac{1}{2}$ to 4 feet; yield per acre, $24\frac{3}{4}$ bushels; weight per bushel, $40\frac{1}{2}$ lbs.

Longfellow.—On sandy loam; no manure; $3\frac{1}{2}$ acres. Sown 1st May; $1\frac{3}{4}$ bushels per acre; ripe 6th August; time to mature, 97 days; straw rather dark; a little rusted; height, $2\frac{1}{2}$ to $3\frac{1}{2}$ feet; yield per acre, $27\frac{3}{4}$ bushels; weight per bushel, $36\frac{1}{2}$ lbs.

Poland White.—On light sandy clay; no manure; $1\frac{1}{4}$ acres. Sown 26th April; $1\frac{3}{4}$ bushels per acre; harvested 4th August; time to mature, 100 days; even growth; straw bright; very little rust; yield per acre, 23 bushels; weight per bushel, $42\frac{3}{4}$ lbs.

Potato English.—On sandy clay soil; no manure; 1 acre. Sown 24th April; $2\frac{1}{4}$ bushels per acre; ripe 5th August; time to mature, 103 days; straw bright; stands well; height, $3\frac{1}{2}$ to $4\frac{1}{2}$ feet; not much rust; yield per acre, $34\frac{3}{4}$ bushels; weight per bushel, 39 lbs.

Prize Cluster.—On sandy loam and partly peaty soil; no manure; 8 acres. Sown 23rd April; $1\frac{3}{4}$ bushels per acre; ripe 4th August; time to mature, 103 days; straw bright, rather soft; more inclined to lodge than some other varieties; but little rust; height, $3\frac{1}{2}$ to $4\frac{1}{2}$ feet; yield per acre, $30\frac{1}{4}$ bushels; weight per bushel, $42\frac{1}{2}$ lbs.

Rennie's Prize White.—On light sandy loam; no manure; $1\frac{1}{4}$ acres. Sown 9th May; $1\frac{3}{4}$ bushels per acre; ripe 9th August; time to mature, 92 days; of even growth; straw very rusty; height, $3\frac{1}{2}$ to 4 feet; yield, 31 bushels per acre; weight, $42\frac{1}{4}$ lbs. per bushel.

Rosedale.—On sandy clay soil; no manure; ¼ acre. Sown 3rd May; 1½ bushels per acre; ripe 10th August; time to mature, 99 days; of uneven growth; straw rather weak; height, 3 to 3½ feet; yield per acre, 30½ bushels; weight per bushel, 36¾ lbs.

Siberian.—On sandy loam; 18 to 20 tons manure per acre; ¼ acre. Sown 16th May; ripe 14th August; time to mature, 90 days; yield per acre, 23¼ bushels; weight, 28¼ lbs per bushel.

Victoria Prize.—On sandy loam mixed with clay; no manure; 1¾ acres. Sown 22nd April; 1¾ bushels per acre; ripe 2nd August; time to mature, 102 days; straw stands fairly well; considerably rusted; height, 4 to 5 feet; yield per acre, 38¼ bushels; weight per bushel, 41¼ lbs.

Waterloo.—On sandy soil; no manure; 4 acres. Sown, 2nd May; 2 bushels per acre; ripe 13th August; time to mature, 103 days; straw bright; stands well; not much rust; height, 3 to 4 feet; yield per acre, 20½ bushels, weighing 34 lbs. per bushel. A second plot of 1 acre, on sandy clay soil, no manure, was sown 24th April; 2¼ bushels per acre; ripe 4th August; time to mature, 102 days; yield per acre, 26 bushels; weight per bushel, 34 lbs.

Welcome.—On sandy clay soil; no manure; 4 acres. Sown 28th April; 2 bushels per acre; ripe 29th July; time to mature, 92 days; straw rather dark, but strong; a little rust and some smut; height, 3 to 3½ feet; yield per acre, 38¾ bushels; weight per bushel, 42½ lbs.

White Russian.—On mixed sandy and peaty soil; no manure; 1½ acres. Sown 2nd May; 2 bushels per acre; ripe 12th August; time to mature, 102 days; straw fairly bright and strong; not much rust; height, 3½ to 4½ feet; yield per acre, 37¾ bushels, weighing 32½ lbs. per bushel. A second plot of 1 acre of mixed sandy and clay soil, no manure, was sown 24th April; 2 bushels per acre; ripe 5th August; time to mature, 103 days; yield per acre, 42½ bushels.

A third plot of 8 acres, on sandy clay soil, with from 18 to 20 tons of manure per acre, was sown 6th May; ripe 13th August; time to mature, 99 days; yield per acre, 36 bushels; weight per bushel, 32 lbs.

EXPERIMENTS WITH BARLEY.

TWO-ROWED VARIETIES.

Adjoining the one-tenth acre plots of oats, all sown the same day, was a similar series of plots of barley, consisting of eleven two-rowed varieties and five six-rowed. Particulars as to the character of the soil, treatment of the land and preceding crops will be found under "Experiments with Oats." The grain on all these plots was more or less rusted, and in most instances it was badly affected. The following table gives the results of these barley tests.

——	Date of Sowing.	Date of Harvesting.	Number of Days Maturing.	Yield per Acre.
				Bush.
Beardless	April 25	Aug. 14	111	26¼
Danish Chevalier	do 25	do 10	107	23¾
Danish Printice Chevalier	do 25	do 10	107	26¾
Early Minting	do 25	do 10	107	19
English Malting	do 25	do 14	111	24¼
Golden Melon, Imported 1888	do 25	do 14	111	20½
do do 1890	do 25	do 8	105	16
Goldthorpe do 1890	do 25	do 12	109	14½
Peerless White do 1888	do 25	do 10	107	22½
do do 1890	do 25	do 9	106	18¼
Prize Prolific do 1889	do 25	do 8	105	28
do do 1890	do 25	do 5	102	27½
Saale do 1889	do 25	do 8	105	24¼

For weight per bushel of these varieties see larger field plots.

In comparing the results here given it will be observed that in every instance where the material has been available for comparison, recently imported two-rowed barley, that of 1890, has produced a smaller crop than when grown from the same sort after being under cultivation here for one or two years. In former experiments results confirming this same point were obtained, from which we may gather that increasing crops may be looked for as these barleys become acclimatized. There are, however, two exceptions in the other field plots—one of Selected Chevalier, imported 1890, and one of Golden Melon, imported 1890, both of which gave a much larger yield. These two plots, however, were sown on an exceptionally good piece of clay loam, extending to a roadway and along the margin of the road; the land was manured in the spring to the width of about 10 feet. In point of productiveness the variety known as Prize Prolific heads the list. There is an unexpected difference in the time of ripening; the more recent importations mature in from one to six days less time, than those samples which have been grown in this climate for a year or two, which is another evidence of the importance of early seeding. The varieties named in the table are, from the English standard, all malting barleys, and most of them very highly esteemed for this purpose. With the exception of the Goldthorpe they are all of the Chevalier type, with long, pendulous heads. The Goldthorpe is more erect, and resembles the Duckbill, with a shorter and somewhat flattened ear.

LARGER FIELD PLOTS.

Beardless.—On sandy loam; no manure; 3 acres. Sown 23rd April; 2 bushels per acre; ripe 8th August; time to mature, 107 days; straw bright, stands well; very little rust; height, 3 to 3½ feet; yield per acre, 25⅝ bushels; weight per bushel, 51½ lbs.

Chevalier Selected.—Imported 1890; on good clay loam; a part of this was manured in spring of 1890, before sowing; ¼ acre. Sown 26th April; 2 bushels per acre; ripe 5th August; time to mature, 101 days; straw bright, stands fairly well; but little rusted; height, 3 to 3½ feet; yield per acre, 46½ bushels; weight per bushel, 51½ lbs. A second plot of 2 acres, on a soil of mixed sand and clay, was sown 2nd May, 1¾ bushels per acre; ripe 5th August; time to mature, 95 days; straw bright, stands well; considerably rusted; height, 2½ to 3½ feet; yield, 24 bushels per acre; weight per bushel, 51½ lbs.

Danish Chevalier.—On mixed sandy and clay loam, without manure; 1¾ acres; Sown 2nd May, 2 bushels per acre; ripe 12th August; time to mature, 102 days; straw dark; considerably rusted; height, 3 to 3½ feet; yield per acre, 25⅛ bushels; weight per bushel, 51¾ lbs. On same soil and adjoining, ½ acre sown at the same time was fertilized with 200 lbs. (400 lbs. per acre) of a special barley fertilizer; in this instance the yield was 25⅜ bushels. Another ½ acre adjoining received an application of 200 lbs. of odorless phosphate; this yielded 25 bushels per acre; while in the case of a fourth plot of ⅙ of an acre, which had received an application of 66 lbs. of fish manure, the yield was 23⅓ bushels per acre. The land on which these experiments were tried appeared to be very uniform and the results are certainly very puzzling.

Danish Printice Chevalier.—On mixed sandy and clay loam, without manure; ¾ of an acre. Sown 3rd May, 2 bushels per acre; ripe 12th August; number of days to mature, 101; straw rather dark, but standing well; height, 3 to 3½ feet; considerably rusted; yield per acre, 30 bushels; weight per bushel, 51¾ lbs. A second plot was sown on heavy sandy loam; no manure; 1¾ acres. Sown 24th April, 2 bushels per acre; ripe 9th August; time to mature, 107 days; straw bright; stands fairly well; very little rust; height, 3½ to 4 feet; yield per acre, 27¼ bushels; weight per bushel, 51¾ lbs.

Early Minting.—On sandy loam; no manure; 2½ acres. Sown 2nd May, 1¾ bushels per acre; ripe 5th August; time to mature, 95 days; straw bright, but soft; breaks easily slightly rusted, height 2 to 2½ feet; yield per acre, 25 bushels; weight per bushel, 51 lbs.

Golden Melon.—Importation 1890. On good clay loam, a part of which was manured in spring of 1890 before sowing, $\frac{1}{12}$ acre. Sown 26th April, 2 bushels per acre; ripe 6th August; time to mature, 102 days; straw bright, stands well; not much rust; height, 3 to $3\frac{1}{2}$ feet; yield per acre, $46\frac{3}{4}$ bushels; weight per bushel, 52 lbs. Another plot of 1 acre was sown with seed grown from importation of 1888 on sandy loam mixed with clay, without manure. Sown 24th April, two bushels per acre; ripe 2nd August; time to mature, 100 days; even growth; straw bright; stands well; very little rust; height, $3\frac{1}{2}$ to 4 feet; yield per acre, $35\frac{3}{4}$ bushels; weight per bushel, 52 lbs.

Peerless White.—Importation 1890. On good clay loam, partly manured; $\frac{1}{5}$ acre. Sown 26th April, ripe August 6th; time to mature, 102 days; straw bright; stands well; but little rust; height, 3 to $3\frac{1}{2}$ feet; yield per acre, $46\frac{3}{4}$ bushels; weight per bushel, 51 lbs.

Goldthorpe.—On sandy loam; no manure; $2\frac{1}{2}$ acres. Sown 26th April, 2 bushels per acre; ripe 6th August, time to mature, 102 days; straw bright, and stands well; height, $2\frac{1}{2}$ to $3\frac{1}{2}$ feet; yield per acre, $20\frac{3}{4}$ bushels; weighing 52 lbs. per bushel.

Prize Prolific.—On soil mostly clay, with some peat; no manure; 7 acres. Sown 30th April, $1\frac{3}{4}$ bushels per acre; ripe on higher land, 4th August, on lower peaty soil, 12th August; time to mature, 96 to 104 days: straw bright and strong; stands well; height, 3 to $3\frac{1}{2}$ feet; very even growth; yield per acre, 32 bushels; weight per bushel, 52 lbs. One-half acre of this plot was measured off and sown with 200 lbs. of a special barley fertilizer, (400 lbs. per acre) the yield from which was $31\frac{1}{2}$ bushels per acre. A third plot on another part of the farm, on heavy sandy loam; no manure; $1\frac{3}{4}$ acres; was sown 26th April, 2 bushels per acre; ripe 6th August; time to mature, 102 days; yield per acre, 24 bushels.

Saale.—On heavy sandy loam; no mauure; $1\frac{1}{2}$ acres. Sown 24th April, 2 bushels per acre; ripe 9th August; time to mature, 107 days; even growth; straw bright; stands well; very little rust; height, $3\frac{1}{2}$ to 4 feet; yield per acre, 30 bushels; weight per bushel, 51 lbs.

Large Two-rowed Naked.—This is a naked barley, not suitable for malting, but valuable for feed, producing a large, heavy grain. Grown on sandy loam; no manure; 2 acres. Sown 1st May, 2 bushels per acre; ripe 4th August; time to mature, 95 days; straw rather weak; considerably rusted; breaks down easily; height, 3 to $3\frac{1}{2}$ feet; yield per acre, $28\frac{1}{2}$ bushels; weight per bushel, $60\frac{1}{4}$ lbs This barley should be sown thicker, on account of the large size of the grain—not less than $2\frac{1}{2}$ bushels per acre.

SIX-ROWED VARIETIES.

The following were sown on one-tenth acre plots adjacent to those of the two-rowed sorts:—

——	Date of Sowing.	Date of Harvesting.	Number of Days Maturing.	Yield per Acre.	Weight per Bushel.
				Bush.	Lbs.
Baxter's Six-rowed	April 25	July 31	97	25	48
Indian, from Spiti Valley	do 25	do 25	91	$21\frac{1}{4}$	55
Mensury	do 25	do 31	97	$20\frac{3}{4}$	$44\frac{1}{2}$
Odessa Six-rowed	do 25	do 31	97	$18\frac{1}{4}$	$46\frac{1}{2}$
Petschora	do 25	do 29	95	$19\frac{1}{4}$	$43\frac{1}{4}$
Rennie's Improved	do 25	do 30	96	$25\frac{3}{4}$	$47\frac{1}{2}$

These are all of the ordinary type of six-rowed barley, excepting the Indian from Spiti Valley, which is a hulless sort, of a dark bluish colour and very heavy. It is one of the varieties of grain which was sent to Canada for test by the Government of India in 1888; it is an early ripening sort, rather short in growth, with a compact, heavy head, and, although it has not yielded heavily here, promises to be a valuable variety for feeding purposes.

LARGER FIELD PLOTS.

Indian from Spiti Valley.—On sandy loam; no manure; $2\frac{1}{2}$ acres. Sown 1st May; $1\frac{3}{4}$ bushels per acre; harvested 26th July; time to mature, 86 days; straw rather soft and weak; many heads bent over; height, $1\frac{1}{2}$ to 2 feet; very little rust; yield per acre, $16\frac{1}{2}$ bushels; weight per bushel, $54\frac{1}{2}$ lbs.

Guymalaye.—On sandy loam; no manure; $\frac{1}{10}$ acre. Sown 14th May; 2 bushels per acre; ripe 7th August; time to mature, 85 days; straw bright; stands well; very little rust; height, 3 to $3\frac{1}{2}$ feet; yield per acre, $36\frac{1}{4}$ bushels; weight per bushel, 56 lbs. This is also a hulless barley, which seems to be identical with what is known as "six-rowed wheat barley." It is a very productive variety, and promising for feed; the kernel is of a dark amber colour.

Hulless Black.—On sandy loam; no manure; $\frac{1}{4}$ acre. Sown 14th May, 2 bushels per acre; ripe 3rd August; time to mature, 81 days; straw very dark in colour; stands well; very little rust; height, $2\frac{1}{2}$ to 3 feet; yield per acre, 22 bushels; weight per bushel, 62 lbs. This is a very heavy hulless barley, with a black kernel, which is worthy of more extended trial as a feed barley.

Odessa Six-rowed.—On mixed clay and sandy loam; no manure; $\frac{1}{8}$ acre. Sown 15th May; $1\frac{1}{2}$ bushels per acre; ripe 14th August; time to mature, 91 days; straw bright, with very little rust; height, $2\frac{1}{2}$ to $3\frac{1}{2}$ feet; yield per acre, $31\frac{1}{4}$ bushels; weight per bushel, $49\frac{1}{4}$ lbs.

EXPERIMENTS WITH SPRING WHEAT.

The wheat plots enumerated in the following table, complete the series of one-tenth acre plots of grain on similar clay loam, all sown on the same day and without manure. The season proved to be very unfavourable for spring wheat, almost all varieties showing a light yield. In most instances the third and last maturing kernel in each group on the ear was empty, and those clusters forming the top of the ear were in a similar condition. This has probably resulted from unfavourable hot and dry weather, occuring just at the time when the floral organs within the husk were in a soft and critical stage of development, causing them to shrink and wither. In all these plots the straw was much rusted, in some instances worse than others.

——	Date of Sowing.	Date of Harvesting.	Number of Days Maturing.	Yield per Acre.	Weight per Bushel.
				Bush.	Lbs.
Campbell's White Chaff	April 25	Aug. 8	105	19	58
Campbell's Triumph	do 25	do 10	107	$11\frac{1}{4}$	57
Carter's Cross-bred I or Anglo-Canadian	do 25	do 14	111	4	$54\frac{3}{4}$
Green Mountain	do 25	do 16	113	$8\frac{3}{4}$	57
Indian Hard Calcutta	do 25	do 5	102	$10\frac{1}{4}$	$59\frac{1}{4}$
Judket	do 25	do 10	107	21	$58\frac{1}{2}$
Ladoga	do 25	do 7	104	$10\frac{1}{4}$	$56\frac{1}{4}$
Red Fern	do 25	do 11	108	12	$55\frac{1}{2}$
Rio Grande	do 25	do 16	113	17	59
Russian Hard Tag	do 25	do 8	105	$20\frac{1}{4}$	$60\frac{3}{4}$
Saxonka	do 25	do 11	108	12	$55\frac{1}{2}$
White Delhi	do 25	do 7	104	12	$56\frac{1}{2}$
White Russian	do 25	do 14	111	$10\frac{1}{4}$	$56\frac{1}{4}$
White Fife	do 25	do 12	109	$18\frac{3}{4}$	$55\frac{3}{4}$
Red Fife	do 25	do 12	109	12	$56\frac{3}{4}$

These plots show a wide difference in yield. The most prolific are Judket, Russian Hard Tag, Campbell's White Chaff and White Fife. The Russian Hard Tag is a bearded sort, with a ricy kernel of inferior quality, much like goose wheat; the other varieties named are all of good quality, and beardless. The Campbell's White Chaff is particularly promising, as will be seen from the records of the larger field plots. It also proved a heavy yielder in 1889, giving 36¾ bushels per acre, being 3¾ bushels more than any other sort tested. At the branch Experimental Farms it has done well during the past season, at Nappan, N.S., the yield has been 32 bushels per acre ; at Brandon, Man., 24 bushels 36 lbs. ; at Indian Head, N.W.T., 32 bushels 4 lbs.; and at Agassiz, B. C., 3 lbs. gave a return of 48 lbs.

LARGER FIELD PLOTS.

Campbell's White Chaff.—On sandy loam ; no manure; ½ acre. Sown 23rd April, 1½ bushels per acre ; harvested August 13th ; time to mature, 112 days ; even growth, straw bright; stands well ; height, 4 to 4½ feet; yield per acre, 21¾ bushels ; weight per bushel, 57½ lbs. One-half acre adjoining, sown at the same time, which was treated with 200 lbs. of special fertilizer (400 lbs. per acre) yielded 18¾ bushels per acre. A third ½ acre, next adjoining, treated with 200 lbs. of odorless phosphate, gave a yield of 14 bushels; while a fourth ½ acre in the same series, without fertilizer, yielded 17 bushels per acre. This soil was of variable character, which may account for these anomalous results. There is no doubt that had the soil been uniform in fertility the addition of the fertilizers would have increased the yield.

Campbell's Triumph.—On sandy loam ; no manure; 1½ acres. Sown 23rd April, 1½ bushels per acre ; ripe 13th August ; time to mature 112 days; even growth ; straw bright, and stands well ; height, 3 to 4 feet ; yield per acre, 12¾ bushels ; weight per bushel, 59¾ lbs.

Carter's Cross-bred I or *Anglo-Canadian.*—On sandy loam; no manure. Sown 23rd April, 1 bushel per acre; ripe 13th August; time to mature, 112 days; even growth; straw bright, and stands well; height, 3½ to 4½ feet; yield per acre, 5 bushels, weighing 51 lbs. per bushel. A third plot was that of one-tenth of an acre, already reported on among the series of plots sown one week apart to test the advantage of early seeding. This was sown 22nd April; was ripe 13th August; time to mature, 113 days; yield per acre, 5 bushels 50 lbs.

This new hybrid wheat, originated by James Carter & Co., of London, England, and which has produced such large crops in Great Britain, has made but a poor record here. It is of strong and vigorous growth, with a large bearded ear, which gave promise of a good yield early in the season, but as the time of harvest approached a considerable part of each head was found to be empty. The plants themselves were so promising that I look for much better results another year, when the conditions will probably be more favourable and the grain somewhat acclimatized. That the yield obtained at Ottawa is not normal is shown by the larger crops at the branch Experimental Farms. At Nappan, N.S., the yield was 29¾ bushels per acre; at Brandon, Man., 26 bushels; at Indian Head, N.W.T., 16 bushels 28 lbs.; and at Agassiz, B.C., 35 lbs. were obtained from 1 pound sown. In time of ripening it is six or seven days later than Ladoga.

Judket.—On mixed clay and sandy loam ; no manure ; 2 acres. Sown 12th May, 1½ bushels per acre ; harvested 16th August ; time to mature, 96 days ; fair growth ; not much rust; yield per acre, 11½ bushels ; weight per bushel, 59 lbs.

Rio Grande.—On sandy loam; no manure; 2 acres. Sown 23rd April, 1½ bushels per acre; harvested 15th August; time to mature, 114 days; straw bright, and stands well; height, 3½ to 4½ feet; yield per acre, 14 bushels, weighing 62 lbs per bushel.

SPRING WHEAT IN ROWS 2½ FEET APART.

It has been stated that wheat yields large crops when grown in drills 2½ feet apart, the land being kept clean with a horse cultivator. Nine varieties of wheat were sown in this manner on sandy loam, which was manured in the spring of 1890, with from 18 to 20 tons of stable manure per acre. Each variety occupied six rows, covering a space of one-twentieth of an acre. The following results were had:—

——	Date of Sowing.	Date of Ripening.	Number of Days Maturing.	Yield per Acre.	Weight per Bushel.
				Bush.	
Campbell's Triumph	May 2...	Aug. 11....	101	$5\frac{1}{4}$	$58\frac{1}{2}$
Judket	do 2....	do 12....	102	7	$59\frac{1}{3}$
Ladoga	do 2....	do 9....	99	$7\frac{1}{4}$	$57\frac{1}{4}$
Red Fern	do 2....	do 11....	101	$5\frac{1}{3}$	$59\frac{1}{2}$
Rio Grande	do 2....	do 13....	103	$7\frac{3}{4}$	60
Red Fife	do 2....	do 12....	102	$5\frac{1}{3}$	$59\frac{1}{2}$
Saxonka	do 2....	do 11....	101	$5\frac{1}{4}$	58
White Delhi	do 2....	do 7....	97	8	60
White Russian	do 2....	do 13....	103	$7\frac{1}{3}$	$60\frac{3}{4}$

The samples of grain grown on these plots weighed well for this season, but so much of the land being unoccupied the crop was relatively small.

EXPERIMENTS WITH WINTER WHEAT.

A few varieties of winter wheat were sown in field plots, but most of them were much injured by winter, and some were so badly winter-killed that the yield per acre could not be ascertained. A similar experience was had last year, which leads to the opinion that the climate of Ottawa is not favourable to the growth of winter wheats.

Democrat.—On sandy clay loam, no manure; $\frac{2}{3}$rds acre. Sown 6th September, 1889, 2 bushels per acre; ripe 1st August, 1890; straw bright; stands well; very little rust; height, $3\frac{1}{2}$ to 4 feet; yield per acre not ascertained; weight per bushel, $59\frac{1}{2}$ lbs.

Early Red Clawson.—On sandy loam; no manure. Sown 10th September, 1889, 2 bushels per acre; ripe 31st July, 1890; straw strong; very little rusted; height, 3 to $3\frac{1}{2}$ feet, yield per acre not ascertained.

Golden Cross.—On sandy loam; no manure. Sown 10th September, 1889, 2 bushels per acre; ripe 30th July, 1890; straw rather dark, but strong; considerably rusted; height, 4 to 5 feet; yield per acre, $26\frac{1}{4}$ bushels; weight per bushel, $61\frac{1}{4}$ lbs.

Manchester.—On sandy clay loam; no manure; 1 acre. Sown 6th September, 1889, 2 bushels per acre; ripe 30th July, 1890; straw dark, and rusty; height $3\frac{1}{2}$ to 4 feet; yield per acre, 25 bushels; weight per bushel, $61\frac{1}{4}$ lbs.

Martin's Amber.—On sandy loam; no manure. Sown 10th September, 1889, 2 bushels per acre; ripe 5th August, 1890; straw bright and strong; very little rust; height, $3\frac{1}{2}$ to $4\frac{1}{2}$ feet; yield per acre not ascertained.

Mediterranean—On sandy loam; no manure. Sown 10th September, 1889, 2 bushels per acre; ripe 31st July, 1890; straw rather dark; considerably rusted; height, $3\frac{1}{2}$ to 4 feet; yield per acre not ascertained.

New Monarch.—On sandy loam; no manure. Sown 10th September, 1889, 2 bushels per acre; ripe 31st July, 1890; straw bright and strong, with very little rust; height, $3\frac{1}{2}$ to $4\frac{1}{2}$ feet; yield per acre not ascertained; weight per bushel, $58\frac{1}{2}$ lbs.

Tasmania.—On sandy clay loam; no manure. Sown 5th September, 1889, 2 bushels per acre; ripe 1st August, 1890; straw bright; considerably rusted; height, 3 to $3\frac{1}{2}$ feet; yield per acre not ascertained; weight per bushel, 61 lbs.

Volunteer.—On sandy loam; no manure. Sown 10th September, 1889, 2 bushels per acre; ripe 31st July, 1890; straw dark; much rusted; height, $3\frac{1}{2}$ to 4 feet; yield per acre 26 bushels.

EXPERIMENTS WITH RYE.

WINTER VARIETIES.

Reading Giant.—On light sandy loam; no manure; 2½ acres. Sown 7th September, 1889, 1½ bushels per acre; ripe 30th July, 1890; straw strong and bright; very little rust; height, 5½ to 6 feet, of fine appearance, yield per acre, 14¾ bushels; weight per bushel, 55 lbs.

Finnish Wassa.—On light sandy loam; no manure; 2¼ acres. Sown 7th September, 1889, 1½ bushels per acre; ripe 29th July, 1890; straw rather soft, breaks down more than the other varieties, also more rusted; height, 5 to 5½ feet; yield per acre, 17¼ bushels; weight per bushel, 53 lbs.

Polar.—On light sandy loam; no manure; 2½ acres. Sown 7th September, 1889, 1½ bushels per acre; ripe 30th July, 1890; straw strong; 5½ to 6 feet high; considerably rusted; heads well filled; yield per acre, 16 bushels; weight per bushel, 51¾ lbs.

Common Fall Rye.—On light sandy loam; no manure; 1 acre. Sown 7th September, 1889, 1½ bushels per acre; ripe 30th July, 1890; straw strong, considerably rusted, yield per acre, 24¼ bushels; weight per bushel, 55¼ lbs.

SPRING VARIETY.

Spring Rye.—On poor, light sandy soil; 18 to 20 tons manure per acre two acres. Sown 22nd April, 1½ bushels per acre; straw bright and strong; height, 4 to 4½ feet; heads well filled; yield per acre, 24⅓ bushels; weight per bushel, 58¼ lbs.

EXPERIMENTS WITH PEAS.

Blackeyed Marrowfat.—On sandy loam; on which was applied 18 to 20 tons of manure per acre in 1890, ½ acre. Sown 8th May, 4 bushels per acre; ripe 9th August; time to mature, 93 days; yield per acre, 39¼ bushels; weight per bushel, 61 lbs.

Daniel O'Rourke.—On light sandy loam; no manure; ¼ acre. Sown 8th May, 2¾ bushels per acre; ripe 25th July, time to mature, 78 days; yield per acre, 37¾ bushels; weight per bushel 58¾ lbs.

Golden Vine.—On sandy clay soil; no manure; 5 acres. Sown 28th April, 3 bushels per acre; ripe 4th August; time to mature, 98 days; yield per acre, 36¾ bushels; weight per bushel, 65½ lbs.

Multiplier.—On sandy clay loam; no manure; 5½ acres. Sown 28th April, 3 bushels per acre, ripe 12th August; time to mature, 106 days; yield per acre, 35¾ bushels, weight per bushel, 65½ lbs.

Pride.—On clay loam; no manure; ⅛ acre. Sown 19th May, 2 bushels per acre; ripe 8th August; time to mature, 81 days; yield per acre, 30½ bushels; weight per bushel, 65½ lbs.

EXPERIMENTS WITH TURNIPS.

Seventeen varieties of turnips were sown in rows 2 feet 4 inches apart, and the yields per acre given in the following list have been calculated from the produce of two rows in each case 66 feet long. Estimates based on small plots almost always show a relatively greater yield than when founded on the results of larger areas, but since all the varieties were treated alike and the soil very similar throughout these figures form a fair basis for the comparison of varieties. They were all sown on the 30th of May and pulled the 21st of October. The soil was a sandy loam, rather light in character, which received a coating of from 18 to 20 tons of manure per acre in 1888, and a coating of unleached ashes, about 150 bushels to the acre late, in 1889.

——	Yield per Acre.		Yield per Acre.
	Tons.	Lbs.	Bush.
Lord Derby Swede (Carter)	46	1,060	1,551
Purple Top Swede (Rennie)	39	634	1,310$\frac{34}{60}$
Skirving's Improved Purple Top Swede (Steele)	39	492	1,308$\frac{12}{60}$
Selected Champion Purple Top Swede	39	210	1,303$\frac{1}{2}$
Highland Prize Purple Top Swede (Steele)	37	1,098	1,251$\frac{38}{60}$
Elephant Swede (Carter)	35	1,280	1,188
Marquis of Lorne Purple Top Swede (Bruce)	35	1,280	1,188
Queen of the Swedes (Carter)	35	855	1,180$\frac{55}{60}$
Purple Top Swede (Steele)	34	168	1,136$\frac{8}{60}$
Skirving's Swede (Carter)	34	168	1,136$\frac{8}{60}$
Skirving's King of Swedes (Steele)	33	1,744	1,129$\frac{4}{60}$
Sutton's Champion (Rennie)	33	188	1,103$\frac{8}{60}$
Hartley's Bronze (Pearce)	30	1,804	1,030$\frac{4}{60}$
Bangholm (Carter)	29	1,824	997$\frac{4}{60}$
Clyde Swede (Evans)	27	1,155	919$\frac{1}{4}$
White Swede (Steele)	26	1,601	893$\frac{21}{60}$
Pearce's Invincible (Pearce)	21	570	709$\frac{1}{2}$

In a second trial with 22 varieties on a poorer soil, without manure, later sown, the following results were had. The yield per acre was calculated from the same sized plots. The seed was sown on the 2nd June and the roots pulled 24th October:—

——	Yield per Acre.		Yield per Acre.
	Tons.	Lbs.	Bush.
Improved Purple Top Mammoth (Simmers)	32	350	1,072$\frac{1}{2}$
Hartley's Bronze (Pearce)	27	1,722	928$\frac{42}{60}$
Laidlaw's Swede (Pearce)	26	1,601	893$\frac{21}{60}$
Skirving's Swede (Carter)	26	611	876$\frac{51}{60}$
Bangholm Purple Top Swede (Rennie)	25	1,480	858
Highland Prize Purple Top Swede (Steele)	24	1,358	822$\frac{38}{60}$
Hazard's Swede (Evans)	24	368	806$\frac{8}{60}$
Purple Top Swede (Rennie)	24	227	803$\frac{47}{60}$
East Lothian Purple Top Swede (Bruce)	24	085	801$\frac{25}{60}$
Highland Prize Purple Top Swede (Simmers)	23	1,378	789$\frac{38}{60}$
Selected Champion Purple Top Swede	21	1,418	723$\frac{38}{60}$
Lord Derby Swede (Carter)	20	943	682$\frac{23}{60}$
White Swede (Steele)	20	872	681$\frac{12}{60}$
Skirving's Improved Purple Top Swede (Steele)	19	1,458	657$\frac{38}{60}$
Royal Norfolk Purple Top Swede (Bruce)	18	1,620	627
Purple Top Swede (Bruce)	17	1,074	584$\frac{34}{60}$
Sutton's Champion (Rennie)	17	508	575$\frac{8}{60}$
Purple Top Yellow Aberdeen (Pearce)	17	084	568$\frac{4}{60}$
Pearce's Invincible (Pearce)	16	1,942	565$\frac{42}{60}$
Sutton's Champion Swede (Bruce)	16	1,165	552$\frac{3}{4}$
Clyde Swede (Evans)	15	1,609	526$\frac{49}{60}$
Skirving's King of Swedes (Steele)	15	690	511$\frac{1}{2}$

In this second series of 22 sorts it will be seen that the relative positions of the varieties, as to yield, are somewhat changed. The 13th in the first series becomes second in this, the 10th fourth, the 5th becomes sixth, the 2nd eighth, the 4th stands eleventh, and the 1st twelfth, with the 16th almost equal.

Larger plots were sown on soil similar in character and treatment to that on which the first series of experimental plots were grown, with the following results:—

Bangholm Swede (Carter's).—Size of plot, 300x15 feet; yield per acre, 31 tons 338 lbs., or 1,038$\frac{58}{60}$ bushels.

Lord Derby Swede (Carter's).—Size of plot, 300x15 feet; yield per acre, 27 tons 498 lbs., or 908$\frac{16}{60}$ bushels.

Skirving's Swede (Carter's).—Size of plot, 400x15 feet; yield per acre, 25 tons 348 lbs., or 839$\frac{8}{60}$ bushels.

EXPERIMENTS WITH MANGELS.

Twenty-one varieties of mangels were sown in rows 16 inches apart, and cultivated by hand with a Planet Junior cultivator. The land was a good sandy loam and well prepared. Part of it was manured in the spring of 1888 and part during the winter of 1890, from 18 to 20 tons of barnyard manure being used to the acre.

There were two series of plots. The first was sown on the 2nd of May and pulled 16th October, and the second was sown 14th May and pulled 23rd October. The yield per acre in the first series was calculated from the results from two rows in each case 140 feet long, and in the second from one row 132 feet long. The remarks made under turnips, regarding the estimated yields per acre from small plots, will also apply here.

—	Yield per Acre.		Yield per Acre.
First Series.	Tons.	Lbs.	Bush.
Pearce & Co.'s Giant (Pearce)	53	1,366	1,789$\frac{26}{60}$
Warden Prize Yellow Globe (Carter)	51	1,133	1,718$\frac{53}{60}$
Yellow Intermediate (Rennie)	49	696	1,644$\frac{56}{60}$
Giant Yellow Intermediate (Steele)	48	1,320	1,622
New Giant Yellow Intermediate (Bruce)	47	6	1,566$\frac{46}{60}$
Chirsk Castle (Buist)	42	1,905	1,431$\frac{45}{60}$
Giant Half-long Yellow (Rennie)	42	1,395	1,423$\frac{15}{60}$
Mammoth Red or Norberton Giant (Simmers)	41	279	1,371$\frac{19}{60}$
Giant Yellow Globe (Rennie)	39	1,553	1,325$\frac{53}{60}$
Mammoth Long Red (Steele)	35	282	1,171$\frac{22}{60}$
Golden Fleshed Tankard (Steele)	34	821	1,147$\frac{1}{60}$
Mammoth Red (Buist)	31	36	1,033$\frac{56}{60}$
Mammoth Long Red (Evans)	30	1,479	1,024$\frac{39}{60}$
Mammoth Long Red (Carter)	29	1,586	993$\frac{6}{60}$
Red Tankard (Steele)	29	1,479	991$\frac{19}{60}$
Golden Tankard (Evans)	28	1,490	958$\frac{10}{60}$
Golden Intermediate (Carter)	28	601	943$\frac{21}{60}$
Mammoth Long Red (Rennie)	27	1,889	931$\frac{29}{60}$
Golden Fleshed Tankard (Simmers)	27	1,417	923$\frac{37}{60}$
Mammoth Long Red (Bruce)	27	1,206	920$\frac{6}{60}$
Mammoth Long Yellow (Carter)	23	796	779$\frac{56}{60}$
Second Series.			
Golden Fleshed Tankard (Steele)	52	1,584	1,759$\frac{44}{60}$
Warden Prize Yellow Globe (Carter)	46	998	1,549$\frac{58}{60}$
Giant Yellow Globe (Rennie)	45	1,105	1,518$\frac{25}{60}$
Mammoth Long Red (Bruce)	41	1,699	1,394$\frac{59}{60}$
Golden Intermediate (Carter)	39	408	1,306$\frac{48}{60}$
Pearce & Co.'s Giant (Pearce)	38	626	1,277$\frac{6}{60}$
Mammoth Long Red (Carter)	37	1,735	1,262$\frac{15}{60}$
Mammoth Long Yellow (Carter)	31	370	1,039$\frac{30}{60}$
Red Tankard (Steele)	30	1,256	1,020$\frac{56}{60}$
Mammoth Long Red (Evans)	30	477	1,007$\frac{57}{60}$
Golden Fleshed Tankard (Simmers)	29	1,920	998$\frac{40}{60}$
Mammoth Long Red (Rennie)	29	1,474	991$\frac{14}{60}$
Golden Tankard (Evans)	28	669	944$\frac{29}{60}$
Mammoth Red or Norberton Giant (Simmers)	26	1,906	898$\frac{26}{60}$
Mammoth Long Red (Steele)	25	175	836$\frac{15}{60}$

EXPERIMENTS WITH SUGAR BEETS.

These were sown with a Planet Junior drill in rows 16 inches apart on land adjoining that on which the experimental plots of turnips were grown. The soil was of the same character, and had received a coating of manure, about 18 to 20 tons per acre, early in the spring of 1890. They were sown on the 13th of May and pulled on the 18th of October. The yield per acre of the several varieties has been calculated from the product of two rows 66 feet long, a method of estimation which is fairly reliable for the purpose of comparing varieties, but one which usually figures up a larger yield than can be got where such roots are grown by the acre. The proportion of sugar contained in each has been determined by the chemist of the Experimental Farms and the particulars will be found in his report appended. Seed of three of the varieties was kindly supplied by M. Musy, Esq., of the Beet Sugar Works at Farnham, Que., and one by Wilfred Skaife, Esq., of Montreal.

———	Yield per Acre.		Yield per Acre.
	Tons.	Lbs.	Bush.
Seed from M. Musy, Esq., Farnham	35	950	1,182½
Red Top (Rennie)	30	1,215	1,020¼
Seed I.B.I.O. from M. Musy, Esq	28	1,585	959¾
Prize Nursery (Carter)	28	1,585	959¾
Seed I.B.D. from M. Musy, Esq	27	1,440	924
White Sugar Beet (Buist)	25	1,398	856 38/60
Seed C.P. 2 P.A. from M. Musy, Esq	25	1,150	852½
White Silesian Green Top (Rennie)	21	158	702 38/60
Seed from Wilfred Skaife, Esq., Montreal	20	920	682
Silesian (Landreth)	19	1,270	654½
Imperial (Bruce)	17	1,970	599½
Vilmorin's Improved (Pearce)	14	1,865	497¾
White Silesian (Steele)	14	50	467½
Imperial (Landreth)	13	400	440

EXPERIMENTS WITH CARROTS.

Of carrots there were two sets of plots sown in rows 16 inches apart, adjoining the experimental plots of mangels, on soil of the same character and similarly treated. The yield per acre has been calculated in the first series from the results obtained from two rows, each 66 feet long, and in the second series from one row, 132 feet long. Such a calculation, as already explained under "Sugar Beets," is of value when comparing varieties, but is not always a reliable basis on which to found expectation where large quantities are grown. The first set of plots were sown on the 1st of May and pulled on the 16th of October; the second were sown on the 8th of May and pulled on the 23rd of October.

In these experiments as well as in those of the mangels and sugar beets, the yield per acre has, no doubt, been much influenced by the short distance (16 inches) between the rows, whereas last year, they were put 2 feet 6 inches apart. At 16 inches many of the larger sorts of mangels were somewhat crowded, and 18 inches would probably be a better distance for these. In either case the rows would be too close for horse cultivation, but if the land is clean they can be conveniently worked with a "Planet Junior" cultivator. Whether the extra yield will more than compensate for the additional cost of hand labor has not yet been determined. Great variations are seen in the results obtained from the duplicated plots, showing that such tests would require to be repeated many times, under varying conditions, before they could be accepted as a reliable guide in the choice of varieties.

The first series of 25 varieties yielded as follows, arranged in order of precedence:—

——	Yield per Acre.		Yield per Acre.
	Tons.	Lbs.	Bush.
Improved Short White (Steele)	34	706	1,145$\frac{6}{60}$
Half Long White (Evans)	32	548	1,075$\frac{48}{60}$
Orange Giant (Carter)	29	1,301	988$\frac{21}{60}$
Large White Vosges (Rennie)	28	430	940$\frac{1}{2}$
Large White Belgian (Rennie)	27	1,539	925$\frac{39}{60}$
Early Gem (Rennie)	27	252	904$\frac{12}{60}$
Large Short Thick White Vosges (Simmers)	25	1,579	859$\frac{39}{60}$
Danvers Orange Intermediate (Vaughn)	25	885	848$\frac{5}{60}$
Half Long Scarlet Luc (Rennie)	25	95	834$\frac{55}{60}$
Chantenay (Rennie)	24	1,005	816$\frac{3}{4}$
Guerande or Ox Heart (Vaughn)	24	906	815$\frac{6}{60}$
Danvers Half Long (Pearce)	23	1,322	788$\frac{42}{60}$
Large White Vosges (Bruce)	23	629	777$\frac{9}{60}$
Mitchell's Perfect Perfection (Mitchell)	23	629	777$\frac{9}{60}$
Green Top Orthe (Pearce)	23	134	768$\frac{54}{60}$
James Scarlet Intermediate (Vaughn)	22	253	737$\frac{33}{60}$
James Intermediate (Pearce)	21	372	706$\frac{12}{60}$
St. Valery (Evans)	20	1,679	694$\frac{39}{60}$
Early Scarlet Short Horn (Vaughn)	20	1,283	688$\frac{3}{60}$
Long Red St. Valery (Pearce)	20	986	683$\frac{6}{60}$
Chantenay (Evans)	19	1,897	664$\frac{57}{60}$
Half Long Scarlet Nantes (Vaughn)	19	1,204	653$\frac{24}{60}$
Short Model (Pearce)	19	1,006	650
Long Scarlet Altringham (Vaughn)	19	16	633$\frac{36}{60}$
Chantenay Half Long Scarlet (Vaughn)	17	1,244	587$\frac{24}{60}$

The second series includes 24 varieties, and the yield is as follows:—

——	Yield per Acre.		Yield per Acre.
	Tons.	Lbs.	Bush.
Improved Short White (Steele)	34	1,498	1,158$\frac{18}{60}$
Large White Vosges (Rennie)	29	1,697	994$\frac{57}{60}$
Half Long Scarlet Luc (Rennie)	29	212	970$\frac{12}{60}$
Early Gem (Rennie)	28	1,420	957
Half Long White (Evans)	28	1,222	953$\frac{42}{60}$
Green Top Orthe (Pearce)	28	232	937$\frac{12}{60}$
Guerande or Ox Heart (Vaughn)	26	1,262	887$\frac{42}{60}$
Chantenay (Rennie)	26	1,262	887$\frac{42}{60}$
Danver's Half Long (Pearce)	25	1,380	856$\frac{21}{60}$
Large Short Thick White Vosges (Simmers)	25	292	838$\frac{12}{60}$
Large White Belgian (Rennie)	24	1,112	818$\frac{32}{60}$
James Scarlet Intermediate (Vaughn)	23	1,718	795$\frac{18}{60}$
Chantenay (Evans)	23	613	776$\frac{53}{60}$
Orange Giant (Carter)	21	1,981	733$\frac{1}{60}$
Mitchell's Perfect Perfection (Mitchell)	21	1,362	722$\frac{42}{60}$
Chantenay Half Long Scarlet (Vaughn)	21	1,164	719$\frac{24}{60}$
Large White Vosges (Bruce)	21	996	716$\frac{6}{60}$
Short Model (Pearce)	19	1,501	658$\frac{42}{60}$
Danver's Orange Intermediate (Vaughn)	19	1,402	656$\frac{42}{60}$
Long Red St. Valery (Pearce)	17	056	567$\frac{36}{60}$
Early Scarlet Short Horn (Vaughn)	16	1,462	557$\frac{42}{60}$
Long Scarlet Altringham do	16	472	541$\frac{12}{60}$
Half Long Scarlet Nantes do	15	1,482	524$\frac{42}{60}$
St. Valery (Evans)	15	294	504$\frac{54}{60}$

Two larger plots were grown on adjoining land with rows the same distance apart. These were sown on the 8th May and pulled on the 23rd of October. The varieties were Improved Short White (Steele's): size of plot, 420 x 23 feet; yield per acre, 35 tons 119 lbs., or 1,168$\frac{39}{60}$ bushels; and Orange Giant (Carter's): size of plot, 360 x 23 feet; yield per acre, 27 tons 976 lbs., or 916$\frac{16}{60}$ bushels.

EXPERIMENTS WITH POTATOES.

Ninety-four named varieties of potatoes have been tested side by side on a light sandy loam, which was in oats in 1889, and to which was applied a dressing of from 18 to 20 tons per acre of fresh manure in the spring of 1890.

The drills were ploughed out and the manure put into them, after which it was lightly covered with earth before the potatoes were planted.

The planting was done on the 16th of May. The size of the plots from which the yield per acre has been calculated varied. The measurements are given in a separate column. As the soil appeared to be very uniform and all the varieties were treated exactly alike, planted at the same time and given nothing more than ordinary field cultivation, the results are fairly comparable.

The Algoma Seedlings were obtained from Mr. Clifford, of Saulte Ste. Marie.

——	Size of Plot.	Yield per Acre	
	Feet.	Bush.	Lbs.
Algoma Seedling No. 3	44 x 3	319	00
Thorburn	261 x 3	306	54
Lee's Favourite	60 x 9	291	4
Rosedale	15 x 3	282	20
Delaware	216 x 3	271	7
Early Albino	60 x 12	268	43
Pearl of Savoy	126 x 3	268	00
Crown Jewel	126 x 9	266	00
Algoma Seedling No. 1	99 x 3	265	13
Beauty of Hebron	60 x 3	264	11
Late Goodrich	126 x 3	262	10
White Star	126 x 3	259	37
Chicago Market	60 x 3	256	7
Sharpe's Seedling	60 x 6	253	5
Rosy Morn	126 x 18	247	00
Empire State	126 x 18	246	00
Wonder of the World	126 x 3	245	45
Richter's Improved	126 x 3	245	00
Early Puritan	180 x 3	244	1
May Queen Early	126 x 6	243	20
Flower of Eden	60 x 12	242	00
Compton's Surprise	126 x 3	240	4
Rose's Beauty of Beauties	225 x 3	238	14
State of Maine	216 x 3	238	3
Halton Seedling	126 x 12	237	40
Algoma Seedling No. 2	102 x 3	236	4
Carter's Delight	126 x 6	232	52
Prairie Seedling	126 x 3	230	28
Ruby	60 x 3	229	54
Richter's Shneerose	60 x 12	229	54
Rural Blush	126 x 6	226	38
Vermont	126 x 3	225	40
Early Callao	126 x 3	225	40
London	279 x 3	224	39
Eye Carpenter	60 x 3	223	51
Rose's New Giant	126 x 18	223	45
Onion Early	126 x 3	223	43
Early Sunrise	60 x 39	223	10
Early Ohio	126 x 18	222	45
Clarke's No. 1	210 x 3	221	15
Vanguard	60 x 6	220	49
Ohio Gunner	60 x 6	220	49
Stray Beauty	126 x 12	219	12
Dakota Red	126 x 12	219	00

	Size of Plot.	Yield per Acre
	Feet.	Bush. Lbs.
Early Rose	60 x 3	217 48
Holborn Abundance (Carter)	126 x 6	217 00
St. Patrick	126 x 3	211 16
King of the Russets (Carter)	126 x 6	210 18
White Star	126 x 3	209 20
Rose's New Invincible	192 x 3	204 11
Early Eating	60 x 12	204 11
Select Magnum Bonum (Carter)	126 x 9	194 56
Dumfries Early White	126 x 3	191 6
Early Maine	60 x 12	191 4
Corona Beauty	222 x 3	187 29
Alexander Prolific	126 x 6	187 15
Bliss' Triumph	60 x 12	187 2
Six weeks Round White	60 x 3	185 32
Charles Downing	234 x 3	184 5
Surprise (Carter)	126 x 3	181 30
Sukreta (Carter)	60 x 6	181 30
Gleason's Late	126 x 3	181 14
Sugar	60 x 6	180 29
Great Eastern	126 x 6	178 00
Mammoth Prolific	126 x 3	175 44
Schoolmaster	126 x 3	174 46
Adirondack	60 x 3	173 26
Member of Parliament	60 x 3	173 26
White Sprout	60 x 9	171 25
Pride of America	126 x 6	167 30
Brownell's Winner	225 x 3	167 14
Conqueror.	126 x 3	164 12
Fidelia	60 x 3	163 21
Emperor William	126 x 3	158 30
Daisy	252 x 3	157 29
Thorburn's Paragon	60 x 6	154 16
August Kidney	126 x 3	152 41
Extra Ruper Crane	60 x 6	151 15
Scotch Champion	126 x 3	149 48
Prime Minister	60 x 3	147 13
Frame Early	60 x 3	147 13
Manhattan	60 x 3	147 13
Green Mountain	195 x 3	140 14
Cosmopolitan (Carter)	60 x 27	136 41
King of the Earlies	60 x 3	136 7
Telephone	60 x 6	136 7
Snowflake	60 x 3	133 6
Burpee's Superior	126 x 12	130 55
New Badger State	126 x 6	130 7
First Crop Ash Leaf (Carter)	126 x 6	96 00
Early Household	126 x 3	94 6
Alpha	60 x 3	66 33
English Kidney	60 x 6	66 33
Asparagus	60 x 6	3 1

INDIAN CORN.

In the report of the Experimental Farms for 1889 brief reference was made to seventy varieties of Indian corn which had been tested that year, and fuller details were promised in a special bulletin. After the information which had been gained was brought together it was thought best to continue this work another season before presenting the results. During the past year nearly eighty varieties were planted under similar conditions and in plots of uniform size, and the results of the two years' work on Indian corn will shortly be ready for publication.

SEED TESTING.

This useful branch of work has been actively carried on during the past season at the Central Experimental Farm, and the timely information afforded has saved many farmers much disappointment and loss. In 1889, 541 samples of wheat were tested, the growth of 1888, giving an average of 83 per cent. of vitality; while the average of 343 samples, the growth of 1889, is 84·3 per cent. A similar comparison with barley gives 84 per cent. for 115 samples in 1888, and 84·9 per cent. for 279 samples in 1889, while the average for 174 sample of oats grown in 1888 was 79 per cent. and for 345 samples in 1889 it was 90·5 per cent. showing but very slight variations in the results obtained from the tests of the wheat and barley, but a remarkable increase in the average vitality of oats, and this, notwithstanding the fact that rust prevailed in 1889 to an unusual degree. The total number of tests completed was 1245 and in the following table the results are given.

RESULTS of Grain Tests, 1889–90.

Kind of Seed.	Number of Tests.	Highest Per centage.	Lowest Per centage.	Average Vitality
Wheat	343	100	30	84·3
Barley	279	100	2	84·9
Oats	345	100	12	90·5
Rye	2	77	70	73·5
Corn	92	100	0	68.4
Peas	24	100	25	81·2
Grass	13	100	0	68·6
Clover	16	91	43	69·6
Turnip	38	100	58	83·7
Mangel	28	90	14	43·6
Carrot	30	100	10	51·8
Buckwheat	6	98	16	67·1
Tares	2	94	91	92·5
Rape	2	98	81	89·5
Beans	4	100	34	72·0
Millet	5	100	65	86·8
Beet	9	90	14	49·5
Onion	2	70	34	52·0
Cauliflower	2	81	67	74·0
Cabbage	2	84	3	43·5
Pumpkin	4	68	16	30·0
Tobacco	9	77	0	23·7
Flax	2	91	26	58·5
Lettuce	1	....	....	18·0
Parsnip	1	....	....	40·0
Sunflower	1	....	....	92·0
Cotton Seed	1	....	....	64·0
Sorghum	1	....	....	56·0
Sugarcane	1	....	....	33·0
Total number of samples tested, highest and lowest percentage and average vitality	1245	100	0	81·8

The season of 1890 in most of the Provinces has been characterized by unusally wet weather, which has caused the grain in some districts to sprout; rust has also been very prevalent. Such influences always lower the vitality of cereals, and greater care is necessary in selecting grain for seed. All doubtful samples should be sent in good season to the Experimental Farm for test.

GOVERNMENT IMPORTATION OF TWO-ROWED BARLEY.

During the Session of the House of Commons in February last, on the recommendation of the Minister of Agriculture, the Government agreed to place in the Estimates the sum of $25,000 for the purchase in England and distribution in this country of two-rowed barley for seed. In this the House concurred, and shortly after 10,000 bushels of Carter's Prize Prolific barley was purchased for this purpose, for the reason that this variety had already been tested in different parts of the

Dominion, on the Experimental Farms and by individual farmers with good results. This was purchased from the well known seed firm of James Carter & Co., of London, England, and brought out in 5,000 bags of 112 lbs. each—two English bushels. Arrangements were made for its disposal by the Director of Experimental Farms, and on its arrival in Montreal a number of bags were opened, the grain carefully examined and its germinating power tested. The bariey proved to be fairly uniform and plump, and weighed about 54 lbs. to the bushel, but many of the bags were found to contain a small percentage of foreign grain and seeds. To separate these and insure uniformity in the sample the whole of the 5,000 bags were opened and the grain passed twice through the cleaning machinery belonging to the Montreal Warehouse Co., when the bags were re-filled, weighed and prepared for shipment. This work necessarily caused some delay and entailed expense and loss, towards which Messrs. Carter & Co. subsequently contributed £50 sterling.

In the meantime, orders had been received from 2,606 farmers in different parts of the Dominion for 3,200 bags and these were forwarded as rapidly as possible; but notwithstanding that the utmost efforts were used to ensure prompt despatch, the grain in many instances did not reach its destination early enough to produce the best results.

The season proved unfavourable for barley in Ontario, Quebec and the Eastern Provinces, but this crop has been grown with fair success in Manitoba, the North-West Territories and British Columbia. In the central and eastern Provinces the six-rowed barley of the crop of 1890 is much lighter than usual, the Ontario crop being estimated at about 2 lbs lighter than the average of past years, and it may be fairly presumed that the two-rowed barley has suffered in a like degree. After harvest, circulars were sent to all those who had been purchasers of the imported barley, asking information concerning dates of sowing and harvesting, description of of soil, the preceding crop, manure used, yield per acre and total yield, leaving a larger space on the sheet for general remarks. A small cotton bag with an addressed tag was enclosed with each circular, and the parties were requested to forward a sample by mail of about 1 lb. in weight of the barley grown from the seed purchased. The number of reports and samples received up to the 30th of January is as follows: Ontario, 872; Quebec, 48; Nova Scotia, 13; New Brunswick, 23; Prince Edward Island, 11; Manitoba, 62; North-West Territories; 22; British Columbia, 1.

The following table shows the results in the yield per acre and total yield, the average weight of the samples as received and their weight after cleaning, by which from 12 to 18 per cent. of the lighter grain was separated. This cleaning was necessary, for the reason that many of the samples were forwarded just as they came from the thresher and hence were not in a marketable condition.

Table showing results of tests of Two-rowed Barley (Prize Prolific), imported by the Government of Canada for seed.

—	Number of Reports with Samples.	Yield per Acre.	Total Yield from 112 Pounds.	Weight per Bushel as Received.	Weight per Bushel after Cleaning.
		Bushels.	Bushels.	Lbs.	Lbs.
Ontario	872	$25\frac{1}{2}$	$28\frac{1}{3}$	$50\frac{1}{4}$	$51\frac{1}{2}$
Quebec	48	$20\frac{3}{4}$	$22\frac{3}{4}$	$48\frac{1}{4}$	$50\frac{1}{8}$
Nova Scotia	13	$26\frac{1}{2}$	$26\frac{1}{2}$	$47\frac{1}{10}$	48
New Brunswick	23	$22\frac{1}{4}$	$24\frac{1}{11}$	$47\frac{1}{3}$	$49\frac{3}{4}$
Prince Edward Island	11	$26\frac{1}{2}$	$27\frac{1}{2}$	48	49
Manitoba	62	39	$43\frac{3}{4}$	48	$50\frac{3}{4}$
North-West Territories	22	$27\frac{1}{2}$	$32\frac{1}{11}$	$46\frac{1}{2}$	$50\frac{1}{8}$
British Columbia	1	$45\frac{3}{4}$	$45\frac{3}{4}$	$50\frac{1}{2}$	53

In Bulletin No. 35 of the Bureau of Industries, issued by the Ontario Department of Agriculture, the statistics of crops in Ontario for 1890 are given. These are compiled from returns made by 1,015 correspondents and the average yield of six-rowed barley is there given as $22\frac{2}{10}$ bushels. The average yield in Ontario of the two-rowed, based on the returns made by 872 farmers, is $25\frac{1}{2}$ bushels, showing that the yield of the two-rowed has been superior to that of the six-rowed by $3\frac{3}{10}$ bushels. With such an increase on the whole barley crop of Ontario, taking barley at 50 cents a bushel, there would be a total gain of $1,157,187.

With reference to a market for this barley, there is every prospect of its finding a ready sale in Great Britain at remunerative prices, provided it can be produced to weigh 52 lbs. and upwards per bushel. As a rule, the plumper and heavier the sample the higher the price. It has been shown that 872 samples grown during the past unfavourable season in all parts of Ontario have weighed on an average when properly cleaned, $51\frac{1}{2}$ lbs. per bushel, and there seems no reason in doubting that in an average year two-rowed barley could be grown at least 1 or 2 lbs. heavier than this, particularly in the better barley districts of the Province. In the report of the judges at the Brewers Exhibition held last October in the Royal Agricultural Hall, London, England on the twelve samples of Canadian two-rowed barley shown there weighing from $51\frac{1}{2}$ to 55 lbs. per bushel, these experts say: "These samples compare very favourably with French, Saale, Danish or other European barleys, and if sent in good condition could be consumed in this country with great satisfaction to the brewers and to the consumers of beer." And further in their closing remarks. "The judges agree in speaking in high terms of many of the samples submitted and in very high terms indeed of some two or three of the best." Two of the samples specially commended by them were the Chevalier, which weighed $52\frac{1}{2}$ lbs.. and the Golden Melon, which weighed 52 lbs. A shipment of 50 quarters—400 English bushels—of Prize Prolific barley of this year's growth, weighing about 52 lbs. to the bushel, has been forwarded to London, England, to be malted and brewed by one of the leading brewers in England, so that correct conclusions may be reached as to its commercial value there. It is altogether probable that the brewers of the United States will continue to purchase a part of the Canadian barley crop notwithstanding the high duty imposed; and if so, are they not likely to prefer a barley which gives a larger proportion of extract, and hence, from a given quantity, makes more beer. With regard to the home market, many of our Canadian brewers would prefer the two-rowed if it could be had in sufficient quantity for separate malting; and if our farmers will use a portion of their barley crop for feeding purposes, as I believe they should do, in place of selling so much grain off their farms, then the two-rowed is to be preferred to the six-rowed, for the reason that it yields a larger number of bushels to the acre and the grain has a smaller proportion of husk to kernel. Further information connected with this important subject will be found in Bulletin 9 of the Central Experimental Farm, in which the individual opinions and experiences of a large number of farmers living in different parts of the country are given.

FORESTRY.

The plantations of belts of forest trees on the Central Experimental Farm have during the past season been extended. A large number of both trees and shrubs have also been planted in ornamental clumps along the sides and at the intersecting points of roadways and in other locations where needed. In a very short time these groups will add much to the beauty and attractiveness of the Farm. Nearly all the trees and shrubs hitherto planted have made thrifty growth and are already beginning to attract much attention from visitors. Within a very few years these clumps will be very useful for determining the annual growth of timber trees and the hardiness and adaptability of the many sorts under test for this district.

In the report of the Horticulturist some particulars are given regarding the distribution of about 1,000 packages of forest-tree seedlings, which were sent chiefly to farmers on the North-West plains for test. So widespread was the interest manifested in this subject last season that the supply was not half enough to meet the demand, and, under instruction of the Minister, a further and larger supply has been obtained, more than sufficient to supply all those who were disappointed last year. By this means it is expected that small plantations will be established at a large number of different points where, within a few years, the trees will be large enough to produce a liberal supply of seed wherewith to extend the planting.

The following paper, containing a summary of the work which has been done in this direction and notes on the trees which have been most successfully grown, was read at the meeting of the American Forestry Association, held in Quebec, on the 3rd of September, 1890:—

"FORESTRY ON THE WESTERN PLAINS OF CANADA.

"*By Wm. Saunders,*

"Director Experimental Farms, Ottawa.

"The experimental farms which have been established by the Government of Canada are five in number, located at the following points: Nappan, Nova Scotia; Ottawa, Ontario; Brandon, Manitoba; Indian Head, North-West Territories, and Agassiz, British Columbia. Experiments in tree planting were begun at all these farms as soon as possible after the selection of the sites, but on the farms on the western plains in Manitoba and the North-West Territories this work has been conducted on a more extensive scale than on the other sites, for the reason that the need of forest shelter is more keenly felt in the prairie districts. Work was begun on the farm at Indian Head during the summer of 1887, and the first trees were planted in the spring of 1888, about 20,000 in all, consisting of a large number of varieties. This farm is a section of bare prairie land of 680 acres, without any shelter whatever. In the spring of 1889, another consignment of about 12,000 trees was forwarded, and during the present season a few thousand more have been sent. A considerable quantity of seed of the box elder, with a smaller proportion of white ash and American elm has been sown each year, and thus more than 50,000 seedlings have been added to the stock. A portion of these seedlings have been distributed among the settlers in the neighbourhood but the larger part has been planted in shelter belts and forest clumps on the farm.

"The Brandon farm was selected during the summer of 1888, and tree planting was begun there in the spring of 1889. About 20,000 trees were sent that year and ten or twelve thousand more during the present year. A large number of seedlings of box elder, ash and elm have also been grown on this farm during both seasons referred to. The Brandon farm is situated partly in the valley of the Assiniboine River and partly on the bluffs which form the northern boundary of that valley. This farm is mostly prairie, but in the ravines in the bluffs, and also on the face of the bluffs, there are large patches of scrub, consisting of small poplars, scrub oak, hazel, eleagnus and other low bushes, while near the river bank there is a small grove of elm, ash, and box elder trees, with undergrowth of willow, rose, &c. From this brief description it will be seen that the land on these two farms is varied as to exposure, while the soil and the climatic conditions by which they are surrounded are such as to include within their area most of the difficulties which stand in the way of tree growing in the better farming districts in the Canadian North-West.

"During the spring of 1889 a considerable number of packages of trees were sent by mail and express to different parts of the North-West plains for test, and this work has been continued on a larger scale during the past season. The distribution outside of the Experimental Farms in 1890 consisted of over 100,000 seedling trees of one and two years' growth, which were sent by mail in about 1,000 packages of 100 each to as many different points, while larger bundles were forwarded by express to twenty-five of the experimental gardens on the line of the Canadian Pacific Railway from Moose Jaw to Calgary, to most of the agencies on the Indian Reserves, and the chief stations of the Mounted Police. By these several methods trees have been distributed for test over the whole area from the eastern part of Manitoba to the western extremity of the great plains of the Territories and along the foot hills of the Rocky

Mountains. On the Indian Head farm trees have had the test of two winters and three summers; on the Brandon Farm and at a few other points, including about twenty stations on the Canadian Pacific Railway, we have the results of one winter and two summers; while at a very large number of other points the summer drought and heat is the only test the trees have yet been subject to. This latter, however, is no mean test, for dry weather will often cause the death of more trees than will the cold weather of winter.

"The results of the tests on the experimental farms have been carefully noted each year, but the experience gained is too limited as yet to admit of very positive statements regarding many varieties of trees under trial. The following notes are submitted, with the hope that they may be of some interest to the American Forestry Association.

"Box Elder, (*Negundo aceroides*).—This tree promises to be the most valuable of all forest trees for the western plains, adapting itself to all conditions of climate and situation, and making thrifty growth under trying circumstances. No tree is so universally successful; but to get the best results the seedlings should be grown from seed collected from trees growing on the river banks and ravines in Manitoba or the Territories. If grown from eastern seed the young trees are often partly winter-killed. In three or four years from the time of sowing the seed this tree will usually attain a height of from 5 to 7 feet, with a nice bushy head, and after that the growth is quite rapid.

"Among the trees which promise to rank next in value are the American elm and green and white ash, when grown from Manitoba seed, but these often prove more or less tender when grown from seed produced in Ontario or the western States. The native poplars and some of the willows also make fine growth, and aid materially in the formation of shelter belts; some of the Russian poplars have also succeeded very well, notably *Populus Petrovska, certinensis, bertolinus* and *bolleana; Salix laurifolia* is also valuable. The American mountain ash, European mountain ash, yellow birch, European white birch and the variety of white birch, known as the *cut-leaved,* have also proved hardy, as far as they have been tried. Of the maples, the only ones which have succeeded thus far are the silver-leaved *Acer dasycarpum*, and the Norway maple, *Acer platanoides*, and these are only partially successful. The Siberian maple, *Acer ginnala*, has proven hardy at the Indian Head Farm, but this will rank rather as a shrub than a tree.

"Among the evergreens, the white spruce, transplanted from the sandy plains near Carberry, Manitoba, or the spruce from the foot-hills of the Rocky Mountains, succeed best. The Scotch fir and the European mountain pine are also hardy in many places, enduring the low temperatures of the winter better than the drying winds and hot weather of the summer months. The white spruce of the East, Norway spruce, arbor vitæ, Austrian pine, red cedar and European larches have failed in most localities in the Territories, but many of them have survived and made a little growth in some places in Manitoba. The same may be said of the basswood, European ash and Russian mulberry. The attempts to grow the sugar and red maples, sycamore, black locust, butternut, black walnut and western catalpa have so far been unsuccessful.

"Among the most valuable shrubs useful for ornamental purposes and as undergrowth are the several native willows, the wolf willow, *Eleagnus argentea*, the native wild cherry, Saskatoon and hazel, to which may be added the Siberian pea, *Caragana arborescens*, Russian olive, *Eleagnus*, and the several varieties of lilac. The wild rose also serves a similar purpose, and the Rosa rugosa from Japan, which has proved hardy and valuable at Indian Head.

By the free use of the trees and shrubs named effective shelter belts and forest clumps can in a few years be produced on the North-West plains, which will help to break the force of the winds and give a home-like beauty to the bare prairie. When sufficient time has elapsed to allow of more extended testing many valuable additions will no doubt be made to the list now given."

During my journey through Manitoba and the North-West Territories last summer it was found that the native forest trees were producing seed in great abundance. As this was an opportunity not often to be had for a most useful work, prompt arrangements were made for the collecting of a large quantity. Both the superintendents of the north-western Experimental Farms, Mr. A. Mackay and Mr. S. A. Bedford, entered heartily into the work, visited the districts where seeds were most plentiful and, with the help of settlers, Indians and half-breeds succeeded in securing between two and three tons of tree seeds. They consist chiefly of Manitoba maple, ash, oak and wild cherry. About seven acres have been sown on the Experimental Farm at Brandon, Man., and enough has been reserved at Indian Head, N.W.T., to cover a similar area. A few sacks have also been kept at each farm to supply any settlers in the neighbourhood who may apply for them. The remainder (about a ton and a-half) has been forwarded to the Experimental Farm for general distribution. Already more than 500 packages have been sent out by mail and the stock on hand will probably be sufficient for two or three thousand more, leaving sufficient to plant some large plots on the Central Farm. As each of the packages sent out will contain enough seeds to produce many hundreds of trees while the large areas sown at the several Experimental Farms will, if successful, be likely to produce several millions, the results of this years work in the collecting of tree seeds will in a short time do much to further tree planting on the western plains of Canada.

ANNUAL INSPECTION OF BRANCH EXPERIMENTAL FARMS.

NAPPAN.

During the summer the usual annual visits were made to the several Experimental Farms. The farm for the Maritime Provinces at Nappan was inspected during the latter part of July. Among other features of interest there was a large and instructive series of grain plots of many different varieties, illustrating the variations in individuals sorts, the effects of special fertilizers on their growth, also the influence of draining, which, by prompt removal of superabundant water, admits of early sowing and thus gives greater vigour to the plants. Useful facts were also being demonstrated regarding the growth of field roots, Indian corn, fruits and garden vegetables. This farm has had many visitors from the adjacent districts who have expressed surprise and gratification at the progress which has been made.

VISIT TO SOUTHERN MANITOBA.

The journey westward was undertaken early in August, when the grain was approaching maturity. Some parts of southern Manitoba were visited when in company with the Dairy Commissioner, Prof. J. W. Robertson, I had the pleasure of attending several meetings of farmers, especially at Pilot Mound and Glenboro, and also of driving through a very fertile range of country for about 100 miles through an almost constant succession of wheat fields laden with grain, almost ready for the reaper. At Glenboro' the opportunity was afforded of visiting the adjacent Icelandic settlement where pleasing evidences of thrift, comfort and prosperity were observable on every hand. The mixed farming carried on by these worthy settlers is evidently the best style of farming for that country and when generally adopted will result in greater prosperity. Praises of the useful work being carried on at the Brandon Experimental Farm met me here, and I found that many of these people had cheerfully driven the forty miles which separates them from this farm in order to take in some of the useful lessons taught there by the experiments conducted, especially those with varieties of grain and useful fodder plants.

BRANDON.

Arriving at Brandon on the 15th of August, the Experimental Farm there was found to possess many interesting features. The new buildings had made fair progress. These have since been completed. The avenue trees and belts of forest growth had made rapid advancement and will soon become a prominent feature. The fields of grain were most promising and the acre plots of different varieties of oats were the heaviest in crop I had ever seen. The crop of Indian Corn and other fodder plants was unexpectedly heavy. The plots of native grasses and some of the foreign sorts had made thrifty growth, and the plantations of small and large fruits which had been put out in clearings on the bluffs, amid the surrounding shelter of thick scrub were most promising. Much of the hay crop on the meadow lands had been cut and stacked. Heavy winds had partly lodged a few of the earlier sown plots of grain in the valley, but these were now ready for the reaper. The harvest promised to be an abundant one.

INDIAN HEAD.

Passing on to Indian Head on the 18th, the grain crops were truly magnificent and never more full of promise. Miles of waving golden-headed wheat greeted the eye at almost every point of view. Most of the Ladoga wheat was cut and stacked, but a portion, now over ripe, had been left for my inspection—this was cut on the day of arrival. In the fields the scene was a busy one; two binders, with their quota of men, were in constant use from early to late, cutting the early-ripening sorts of oats, barley and wheat, and good progress was being made. On the afternoon of the 20th a cold wind set in from the north, the temperature fell rapidly, and before night the possibilities of frost began to be discussed. At the time of the last observation at night the thermometer still stood above 40, and hopes were entertained of escape from impending danger, but the morning revealed the fact that there had been five degrees of frost. Many of the garden vegetables were more or less injured, the tomatoes were gone, the potato vines partially blackened and the foliage of the corn, which looked so thrifty and vigorous on the previous day, was now rapidly drooping, and it was feared that serious injury had been done to the standing crops of grain. The harvesting was pushed on with increased vigour; while the two binders felled and bound the golden grain willing hands cut and stacked the corn ere its leaves should wither and dry, and experiments were devised to make the most of the opportunity given by cutting plots of standing grain, which had been purposely sown late, at different periods, so that information might be had as to the best time to cut frozen grain in case such frosts should occur again. The conclusions reached will be found in the report of the Superintendent of the Indian Head Farm. Many differences of opinion were expressed as to the probable result of this severe visitation, some of the hopeful ones claiming that no harm was done; but subsequent experience has shown that the injury to all the late wheat, which was then in a soft condition, was serious, and that the effects on that which was well advanced, but still standing, was such as to lessen its value. There was no frost at Brandon that night, but it came soon after. The unfavourable harvest weather which followed, and which prevailed all over Manitoba and most of the eastern part of the Territories, attended with a most unusual fall of rain, caused further injury, and the bright outlook was darkened, and much of the grain, although in general a heavy crop, has brought very low prices. The necessity of early sowing, the selection of some early ripening varieties, so that the harvesting may begin earlier, and not come on all at once, and of devoting a larger proportion of the land to other crops than wheat, is forcing itself upon the minds of all thoughtful farmers, and it is believed that this visitation severe as it was will be followed by compensating advantages. These wonderful plains so marvellous in their fertility despite occasional drawbacks are being gradually occupied, and when once the farmers can be brought to fully realize the great importance of adopting mixed farming, its general practice will do much to lessen the injury caused by early frosts where wheat is the mainstay of the country.

VISIT TO SOUTHERN ALBERTA.

Leaving Indian Head on the 22nd, Dunmore was reached the following day, and *en route* opportunities were given for inspecting some of the experimental gardens of the Canadian Pacific Railwaw which had been supplied with bundles of forest trees from the Central Experimental Farm. The season had been very dry and unfavourable for growth ; still, the results in some localities were very promising. At Dunmore, a tour through a portion of Southern Alberta was planned, and leaving by a night train for the south, Lethbridge was reached the following morning. This town is very prettily situated on an elevated plain 300 feet above the Belly River, a rapid stream of considerable volume, its waters being clear and cold. The output of coal, the mining of which is the chief industry here, was then about 500 tons per day from the Galt coal mines. New shafts were being sunk in anticipation of increased demands as soon as the railway then building to Montana, should be opened. By the courtesy of the Managing Director, Mr. Wainwright, I was privileged to inspect the working of all the different departments and to enter one of the side shafts where the coal was being mined. The seam is about 4 feet in thickness, and has been traced for so many miles that the deposit seems to be practically inexhaustible. Through the kindness of the Commissioner, Col. L. W. Herchemer, instructions had been given to place one of the teams of the Mounted Police at my disposal. The officers commanding at Lethbridge and Fort Macleod, Capt. R. B. Deane and Major S. B. Steele, were exceedingly courteous, gave me much information and aided me in my investigations in every way in their power. Journeys were undertaken to Fort Macleod, a thriving town on the Old Man River; from thence to the reserve of the Blood Indians, where an opportunity was given, under the guidance of the obliging agent, Mr. W. Pocklington, to inspect the agency buildings, examine the fields and gardens under cultivation and to visit some of the Indian camps. A further drive of from twenty to thirty miles across the reserve brought me to the Mormon settlement at Lee's Creek, within 14 miles of the Montana boundary. I found the Mormon settlement to be a very prosperous one numbering from 400 to 500 souls. The energy and industry of the people are very marked. Late and early, busy hands were at work bringing in the harvest—which on account of drought, was rather light this year—cutting hay in the neighboring sloughs or in the valley of the creek or caring for the numerous bands of cattle and horses which roam the plains in the vicinity of the settlement. It is said that no liquor is used in this community and very little tobacco. I saw no evidence of the use of either. Frugality and industry seemed to go hand in hand; the settlement has made rapid progress, and, as far as could be ascertained from those in the neighbourhood who are not Mormons the laws of the country are being respected. A general store well supplied with goods is one of the main features in the settlement, and under their system of co-operation it seems to be well supported. The people have gained an excellent reputation for their butter, and have built a cheese factory, which will be equipped and in running order next spring. After enjoying for a day the kind hospitality of some of the people in the settlement the return journey to Fort Macleod and from thence to Lethbridge was safely accomplished after a ride of about 200 miles in all. Most of the district passed through is well adapted for ranching and many thousands of cattle and horses may be seen in bands on the plains, which stretch to the base of the Rocky Mountains, which are always in full view. Pleasant weather, an invigorating atmosphere and the uniform kindness of many new found friends, aided in making this journey a most agreeable experience.

A brief stay was made at Medicine Hat where the Experimental Garden of the Canadian Pacific Railway was inspected and notes taken on the growth and relative hardiness of many varieties of trees and shrubs. This garden is a most attractive one, and is gay with flowers from an early period in the summer until the time of frost. Its success is mainly due to the warm interest taken in it by J. Niblock, Esq., Superintendent of the Western Division, who is an enthusiastic lover of trees, shrubs and flowers. The remaining journey to Agassiz was made without a break.

AGASSIZ.

Quite a change had taken place in the appearance of the Experimental Farm at Agassiz within the year. About 50 acres of land had been cleared and brought under cultivation, and about as much more underbrushed. A vast amount of labour has been expended in removing immense trees and stumps. The clearing of land here and getting it into condition for crop is a very laborious undertaking, but under the energetic management of the Superintendent, Mr. Thos. A. Sharpe, rapid progress has been made. Several orchards have heen planted and a number of blocks of small fruits set out. Fruit and forest trees have also been planted on the bench land and on the slopes of the mountain. The usefulness of large experimental orchards in a country so eminently adapted for fruit culture can scarcely be over estimated, as these will furnish in a short time reliable sources of information to the settler concerning the most suitable and profitable sorts for him to plant. The varieties already brought together there may be summarized as follows:—

			No. of Varieties.
Apples	No. of trees	338	118
Crab apples	do	16	6
Pears	do	212	55
Plums	do	152	51
Cherries	do	140	42
Peaches	do	204	86
Nectarines	do	25	12
Apricots	do	42	18
Quinces	do	16	7
Figs	do	4	2
Grapes	No. of vines	207	79
Gooseberries	No. of Bushes	107	9
Currants, red and white	do	235	8
Black currants	do	112	15
Blackberries	do	1,007	21
Raspberries	do	879	26
Strawberries	No. of Plants	8,520	47

Summing these all together we have over 600 varieties of fruit, to which must be added 414 different sorts of ornamental trees and shrubs, inculding 16 kinds of edible nuts. Such a collection will shortly make this farm one of the most attractive places on the continent. Experiments with different varieties of grain, Indian corn, field roots and potatoes have also been conducted during the past season, the details of which will be found in Mr. Sharpe's report.

DRAINING, GRADING, &c.

Further progress has been made in these important departments of work during the past season, 1¼ miles of tile drains have been laid, making 17 miles in all since the farm was purchased. Much heavy grading has been required around the new dairy building and piggery, and in bringing to a proper grade some portions of the ground adjacent to the dwellings.

BUILDINGS.

A building for carrying on experimental work in dairying has been erected, and is now being fitted with the necessary appliances. A piggery has also been built, 100 by 20, and stocked, and under the superintendence of Prof. J. W. Robertson, Agriculturist and Dairy Commissioner, experimental work is now in progress to determine some important points in pig feeding, further particulars on these subjects will be found in his report. An engine house has been erected and the engine placed in connection with shafting which runs the whole length of the barn by which means power for the various machines required for carrying on the farm work can be conveniently supplied. An extension to the poultry building has been planned and the work begun. This it is hoped will be completed early in the spring. A suitable structure will also be required for carrying on experimental work with sheep.

CHANGES AND ADDITIONS TO THE STAFF.

Since the last report was published the vacancy caused by the resignation of Mr. W. W. Hilborn as Horticulturist at the Central Experimental Farm has been filled by the appointment of Mr. John Craig, who has by a long course of training in Quebec with the late lamented Chas. Gibb, and subsequently with Prof. J. L. Budd, of the Agricultural College in Iowa, become specially fitted for this work. By the appointment of Prof. J. W. Robertson as Dairy Commissioner for the Dominion and Agriculturist at the Central Experimental Farm, and Mr. J. C. Chapais, as an assistant Dairy Commissioner to labour among the French-speaking communities in Quebec and the other Provinces, the general agricultural interests of the country will be promoted and the facilities afforded by the Experimental Farm for experimental work in dairying can be fully utilized and information gained which will lead to the advancement of these great commercial departments, which now profitably occupy the attention of so many in the farming community in Canada.

EXHIBITIONS ATTENDED.

Exhibits of the products of the Central and other Experimental Farms, have been made at several points during the past season. Much as we should like to accede to the wishes of the many friends who extend invitations to make a display of farm productions at their fairs, it is quite impracticable at that busy season of the year, when the summing up of the details of all the work of the season begins, to prepare for more than two or three exhibitions. A satisfactory exhibit was made at the Central Fair in Kingston, an excellent display was got up for the Industrial Exhibition in Toronto, which, supplemented by other late-maturing products, was subsequently shown at the Western Fair in London. A good exhibit was also made at the Canada Central Exhibition in Ottawa.

The branch experimental farms have also undertaken similar work in the respective Provinces in which they are located, and in each case as many of the more important fairs as could be reached have been attended. Such opportunities bring many practical farmers in direct contact with the progressive work of the farms, and by the display of many useful and interesting products a general feeling of appreciation is awakened and facilities offered for giving information to many enquirers.

CORRESPONDENCE.

Probably no better evidence could be given of the increasing interest taken by the farmers of Canada in the work of the Experimental Farms than a comparison of the letters received during 1890 as compared with 1889. These letters have come chiefly from farmers sending requests for reports, bulletins or seed grain, or seeking information in reference to some branch of their calling, and the number and variety of the questions asked have involved much time and labour in answering them. There is no work more useful than that of stimulating enquiry, and information never benefits a man at any time so much as just when he feels the need of it. Farmers have been invited to correspond freely with the Experimental Farms, and it is hoped that they will continue to do so, and provision will, I trust, be made for the additional office assistance which will be required to overtake such rapidly increasing work.

——	Letters Received.	Letters Sent.	Letters Received.	Letters Sent.
	1889.	1889.	1890.	1890.
Director	3,653	....	11,739	11,460
Entomologist and Botanist	1,700	....	1,547	1,394
Chemist	359	....	569	551
Horticulturist	247	....	750	3,064
Poultry Manager	195	....	312	205
Accountant	710	....	958	1,625
Agriculturist and Dairy Commissioner	....	....	1,664	1,507
	6,864	....	17,539.	19,806

To this must be added :—

No. of grain circulars sent with grain distributed............	12,360
do 3-lb. bags of grain distributed............................	12,360
do packages of seedling forest trees and small fruits......	1,316
do bags of tree seeds..	563

There have also been received 2,152 samples of grain for inspection and report.

In 1889 the number of bulletins and reports sent out was 41,584; in 1890, 218,129.

The total number sent out of letters, reports, bulletins, grain, seeds, trees, &c., was 262,267.

The number of farmers who have by request been placed on the mailing list to receive the reports and bulletins of the Farm is 20,600, in addition to which there is a special dairy mailing list of 4,009.

FINANCIAL STATEMENT OF EXPENDITURE ON THE DOMINION EPERIMENTAL FARMS.

In submitting the following classification of expenditures on the several experimental farms established in Canada from the 1st of July, 1889, to the 30th of June, 1890, the object has been to make everything as clear as possible, and where a grouping of the items seemed necessary, to bring together those of a similar character.

CENTRAL EXPERIMENTAL FARM.

EXPENDITURES, 1ST JULY, 1889, TO 30TH JUNE, 1890.

	$ cts.
Horses, harness	386 43
Cattle	6,922 20
Implements, tools, hardware, &c	1,519 51
Draining and drain tiles	1,727 40
Grading, road-making, &c	1,266 00
Cattle and horse feed	693 79
Blacksmithing and repairs	281 70
Seed grain, trees, shrubs, &c	1,333 19
Stable manure, ashes and fertilizers	857 30
Exhibition expenses	247 77
Books, periodicals and newspapers	161 96
Printing and stationery	2,790 43
Telegrams and telephones	152 88
Travelling expenses	551 41
Chemical department	475 77
Poultry department	308 92
Seed testing and care of propagating houses	659 81
Grain distribution	1,637 61
Tree distribution	968 63
Salaries	11,238 14
Wages, farm work, including experimental work with grain and other farm crops	4,573 95
do care of stock	1,104 03
do horticultural department	1,223 36
do botanical department	386 78
do care of grounds, shrubbery and ornamental trees	414 86
do office help with correspondence, distributing reports and bulletins and messenger service	1,659 05
Water account, including excavations	386 71
Contingencies	937 67
	44,801 95

EXPERIMENTAL FARM, MARITIME PROVINCES.

EXPENDITURES, 1ST JULY, 1889, TO 30TH JUNE, 1890.

	$ cts.
Harness	5 15
Cattle	780 00
Implements, tools, hardware, &c	710 68
Draining and drain tiles	1,086 47
Grading, road-making, clearing	402 26
Land account	230 78
Cattle and horse feed	65 03
Blacksmithing and repairs	117 78
Seed grain, trees, shrubs, &c	37 54
Stable manure and fertilizers	254 84
Exhibition expenses	31 61
Travelling expenses	153 96
Salaries	1,200 00
Farm wages, including experimental work with farm crops, fruit trees, vines, &c	1,256 50
Care of stock	484 50
Office help	120 00
Contingencies	56 84
	6,993 94

EXPERIMENTAL FARM, MANITOBA.

EXPENDITURES, 1ST JULY, 1889, TO 30TH JUNE, 1890.

	$ cts.
Horses, harness	658 95
Cattle	35 00
Implements, tools, hardware, &c	1,438 17
Draining and drain tiles	297 35
Grading, road-making, clearing	954 72
Land account surveys	18 65
Horse and cattle feed	735 24
Blacksmithing and repairs	273 89
Seed grain, trees, shrubs, &c	390 12
Stable manure and fertilizers	198 50
Exhibition expenses	103 18
Travelling expenses	340 00
Forestry	684 35
Salaries	1,200 00
Farm wages, including experimental work with farm crops, fruit trees, vines, &c	2,982 57
Contingencies, including rent of dwelling	168 24
	10,478 93

EXPERIMENTAL FARM, NORTH-WEST TERRITORIES.

EXPENDITURES, 1ST JULY, 1889, TO 30TH JUNE, 1890.

	$ cts.
Horses, harness	651 70
Implements, tools, hardware, &c	869 93
Grading, road-making	144 07
Land account legal expenses	25 00
Horse and cattle feed	164 97
Blacksmithing and repairs	182 05
Seed grain, trees, shrubs, &c	281 87
Stable manure and fertilizers	166 75
Exhibition expenses	111 30
Travelling expenses	168 05
Forestry	278 37
Salaries	1,200 00
Farm wages, including experimental work with farm crops, fruit trees, vines, &c	3,376 94
Office help	90 00
Contingencies, including rent of stables, $100; sinking wells, $133.45	362 07
	8,072 07
By seed grain furnished for grain distribution and charged to that account in Central Experimental Farm	407 00
	7,666 07

EXPERIMENTAL FARM, BRITISH COLUMBIA.

EXPENDITURES, 1ST JULY, 1889, TO 30TH JUNE, 1890.

	$ cts.
Horses, harness	1,829 65
Cattle	235 50
Implements, tools, hardware, &c	1,116 62
Clearing, grading, &c	1,340 89
Cattle and horse feed	557 80
Blacksmithing and repairs	35 80
Seed grain, trees, shrubs, &c	756 10
Travelling expenses	656 80
Salaries	1,200 00
Farm wages, including experimental work with farm crops, planting orchards, &c	1,200 21
Office help	20 00
Contingencies, including house rent, $140	258 10
	9,207 47

SUMMARY.

TOTAL EXPENDITURE EOR EXPERIMENTAL FARMS, 1889–1890.

DR.		$ cts.
Central Experimental Farm, Ottawa		44,801 95
Experimental Farm for Maritime Provinces—Nappan, N. S		6,993 94
do do Manitoba—Brandon		10,478 93
do do North-West Territories—Indian Head		7,666 07
do do British Columbia—Agassiz		9,207 47
		79,148 36
CR.	$ cts.	
By Experimental Farm Vote	70,000 00	
Governor-General's Warrant	9,148 36	
	79,148 36	

In the estimates for the experimental farms for 1888–89 no provision was made for the purchase of stock, and the work which it was desird to accomplish could not be carried on without some expenditure in that direction. Notwithstanding that the purchases were limited as far as was practicable, the sum required for this purpose was $7,972.70. In consequence of the very large demand for bulletins and reports the printing account amounted to more than the sum provided, and the correspondence having increased more than three-fold, some additional office help was necessary. The outlay needed to meet these exigencies was $1,175.66, making in all $9,148.36 which was covered by a Governor-General's Warrant at the close of the year.

While the sum of $44,801.95 stands charged against the Central Experimental Farm as its cost for the year ending 30th June, 1890 for the reason that the money has been spent there, it should not be forgotten that a large portion of this sum is expended on items relating to the work in general or the requirements of the four branch farms. In the matter of salaries, there are six of the officers of the Central Farm whose work is of a general character and whose time is devoted about as much to the branch farms and to the interests of the farmers in the Provinces where those farms are located as it is to the work of the Central. Their salaries amount in all to $8,800, one-half of which would be fairly chargeable to the branch farms. The expenditures on each of the following accounts might very properly be divided between the Central and the other farms, for the reason that the benefits arising from the outlay incurred on work and material are shared by all. The purchases of seed grain, trees, shrubs and seeds are for the advantage of the whole Dominion. The distribution of samples of grain for test, of young forest trees, tree seeds and fruits as well as much of the regular horticultural work on the Central Farm, is of this same general character. So also are the outlays connected with the chemical laboratory, the special experiments on grasses and grain, the testing the vitality of agricultural seeds, the sum charged for stationery, which includes supplies for all the farms, the printing of reports and bulletins and their distribution and the office help needed for the large correspondence kept up with the farmers of the Dominion. The sum expended for stock, which is included in the amount referred to, properly belongs to capital account and has been purchased with the view of laying the foundation for good and useful strains of animals, the increase of which will be available for stocking the branch farms. By deducting the amount paid for stock and one-half of the sums charged to the Central Experimental Farm for the items enumerated, the expenditures on this farm would be reduced to a little more than half of the sum which is now placed against it.

ACKNOWLEDGEMENTS.

I gladly avail myself of this opportunity to acknowledge my obligations to all the officers of the Central and Branch Experimental Farms for the devotion they have manifested in their work and the efficiency they have shown in the discharge of their respective duties. To their faithfulness in this respect the reports submitted bear ample testimony. To the foremen and employees my thanks are also due for the interest they have taken in those branches of the work devolving upon them. To the farm foreman, Mr. John Fixter, and to Mr. W. T. Macoun, who have both assisted me in the experimental work, I take pleasure in again acknowledging my indebtedness. Their constant vigilance and reliability in recording observations has relieved me from the necessity of close attention to many details which in less careful hands would have required more frequent inspection, and entailed an additional tax on time already fully occupied. To Mr. Wm. Ellis, who has had charge of the seed-testing department, my thanks are also due for the trustworthy manner in which he has carried on the work of determining the vitality and germinating power of a large number of samples of grain which have been received from all parts of the Dominion.

WM. SAUNDERS,

Director, Experimental Farms.

REPORT OF THE AGRICULTURIST.

(JAS. W. ROBERTSON.)

To WM. SAUNDERS, Esq.,
Director, Dominion Experimental Farms,
Ottawa.

DEAR SIR,—The Order in Council by which I was appointed Dairy Commissioner for the Dominion of Canada, also designated me as "Agriculturist" of the Central Experimental Farm.

The time intervening between the date of my appointment, 1st February, 1890, and the middle of October, was given almost entirely to the discharge of the duties arising from and pertaining to my position as Dairy Commissioner. By your courtesy I was relieved from much of the superintendence of the farm work, in order to enable me to carry out the instructions of the Honourable the Minister of Agriculture, to the effect that I should visit the several Provinces of the Dominion for the purpose of delivering a series of lectures in each on "Dairy Farming" and kindred topics. My journeys enabled me at the same time to inform the farmers in the various localities where the meetings were held, of the nature, variety and extent of the service which it is the object of the Dominion Experimental Farms to render. The very full and generally correct reports of the meetings which the local newspapers inserted, gave a wide publicity to the facts which were mentioned in relation to them and that through channels that could not be used as fully by the issue of bulletins and correspondence.

The visits to the several Provinces were times of reaping for me as Agriculturist as well as times of sowing as Dairy Commissioner. In all the sections where I met the farmers and had opportunity for examining into their condition and the methods of agriculture which they followed, no chance was missed where suggestions could be gained or observations made that could assist further in the effort to make the work of the Agriculturist as practically helpful to as many of the farmers as possible, and that as speedily as is practicable. A brief yet fairly complete record of these journeys, lectures, etc., will be found in the report of the Dairy Commissioner, a copy of which will be furnished to farmers or others who are interested in agriculture upon their application to me at the Central Experimental Farm.

EXPERIMENTAL DAIRY BUILDING.

To enable investigations to be carried on to completeness into the economical methods for the production of milk, butter and cheese, an experimental dairy building was erected on the farm It was planned to be suitable in size and convenie nce for the carrying on of such researches as may be undertaken. The nature and direction of these may be outlined as follows:—

I. Investigations will be carried on in the feeding of milking cows, to discover what differences, in the marketable quantities and the commercial value per pound of milk and butter, result from differences in (*a*) "breeds," (*b*) "feeds," (*c*) "care and treatment of the animals." In this branch of work it is expected that service will be given to the farmers, through illustrations of the best practices that may be followed on any farm, rather than through the origination of new theories.

II. The care and handling of milk, from the time it is drawn until the finished product is ready for the market, will receive attention, in order to reveal and demonstrate the losses or the gains that result from treatments of milk, cream, butter, skim-milk and butter-milk.

III. A curing room for cheese has been provided, wherein lots of cheese, to be made under the direction of the Dairy Commissioner, will be kept and cured, in order to obtain further information on the most profitable practices and treatments in the manufacture and ripening of that article of food.

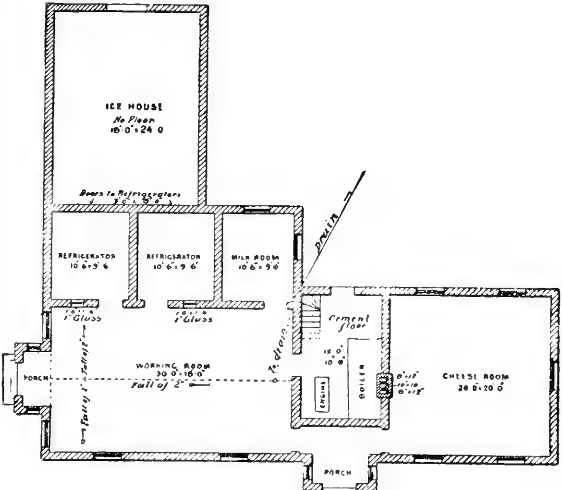
IV. The keeping properties of butter as affected by different treatments during the process of making will be tested ; and examinations will be commenced and continued regarding the suitability of certain packages for the preservation of butter for the foreign markets.

V. The use of dairy salt of Canadian manufacture will be continued, and its adaptation for the preservation of butter will be compared with other brands.

VI. Dairy appliances and apparatus of different sorts will be used and reported on, as far as time will permit, and the needs and interests of the public seem to require.

The following figures illustrate the plan and construction of the building :—

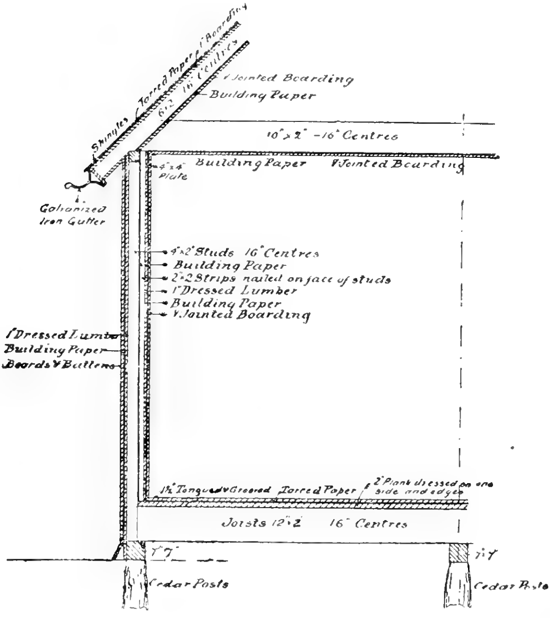
Fig. I; *Experimental Dairy Building.*



NOTE.—The *floor* of the working room is inclined to the middle and end where the drain is, as shewn on the plan, but there is no gutter. The floor is finished with two coats of oil applied hot.

The *ceilings* of the refrigerators are 7′ 6″ high and the ice is put over them direct from the ice house ; they are constructed with galvanised iron troughs between the ceiling joists.

Fig. II; *Experimental Dairy Building.*



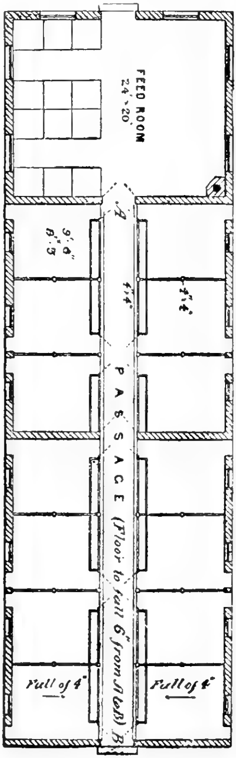
NOTE.—All the outside walls of the building are constructed according to the details shown ; the refrigerators and the ice boxes over them are finished in a similar manner, except that plain dressed lumber has been used instead of boards and battens.

PIGGERY.

The swine-feeding industry of the Dominion is capable of indefinite extension, with advantage to the farmers. To provide for the accommodation of this class of live stock on the farm, a piggery was erected during the summer. In the details of its construction an effort was made to embody those points in the building and arrangement of the pens which could be copied with advantage by farmers, and also by those who feed the by-products of dairies upon a large scale in connection with cheese factories and creameries.

The following figures illustrate the plan of the pens:—

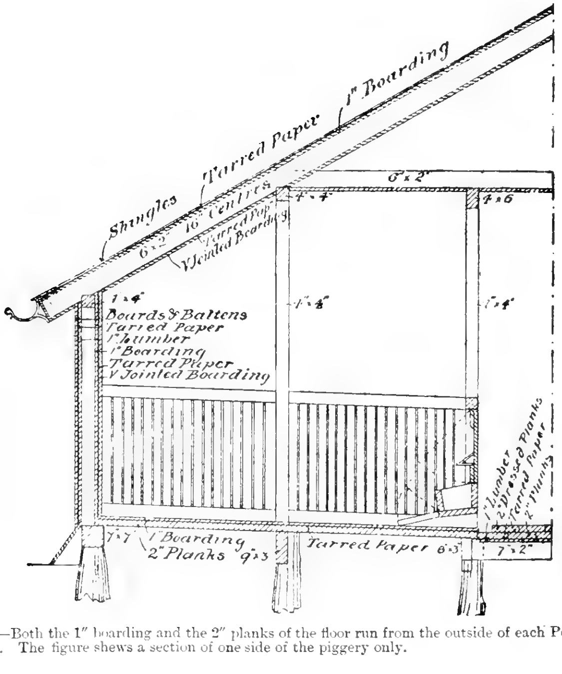
Fig. III; *Piggery.*



NOTES.—The feed room contains 12 bins; the flue in the corner accomodates the steam-heater. There are three large ventilators up through the roof.

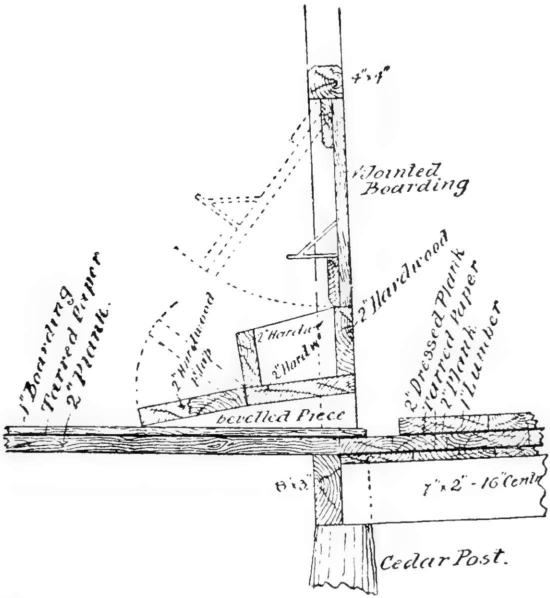
The floors of the Pens are all finished with two coats of oil applied hot; they have a fall of 2 inches towards the gutters on both sides of the passage. There will be a small yard outside for each Pen.

Fig. IV; *Piggery.*



NOTES.—Both the 1″ boarding and the 2″ planks of the floor run from the outside of each Pen towards the passage. The figure shews a section of one side of the piggery only.

Fig. V; *Piggery.*



NOTES.—This figure shews the details of the placing of the feeding-trough, the hinged foot-board in front of the trough, the swinging feeding-door over the trough, and the gutter which receives all the liquid from each Pen. The fall in the floor towards the feeding-trough permits the swine to lie on a dry bed at the back of each Pen.

The line of experimental work to be taken up may be indicated by a statement of what is being done :
Swine purchased :—

Berkshires—

One sow, from Mr. J. H. Davis, Woodstock, Ont.
One sow, from Mr. George Green, Fairview, Ont.
One sow, from Messrs. J. G. Snell & Bro., Edmonton, Ont.

Large Improved Yorkshires—

One boar, from Mr. E. M. Jarvis, Clarkson, Ont.
One sow, from Mr. Wm. Davies, Markham, Ont.
One sow, from Mr. J. Y. Ormsby, Springfield-on-the-Credit, Ont.

Essex—

One boar, from Mr. Jas. Main, Boyne, Ont.
One sow, from Mr. Jas. Main, Boyne, Ont.

Other breeds will be represented in the pens during the year.

Besides these, twenty-four young grade pigs were bought. They are now in six pens, under feeding tests. To some of them the feed is given warm, after being steamed by the use of a small "Royal Steam-heater."

Four pigs are in each of the six Pens.

—	Description of Pigs.	Feed.
Pen 1	White—3 barrows and 1 sow	A mixture of equal quantities of ground barley, peas and rye, *steamed and fed warm.*
Pen 2	White—4 barrows	A mixture of equal quantities of ground barley, peas and rye, *mixed with cold water and fed raw and cold.*
Pen 3	Black—4 sows	A mixture of equal quantities of ground barley, peas and rye and *pease ensilage.*
Pen 4	Black—2 barrows and 2 sows	*Pease ensilage only.*
Pen 5	Black—1 barrow and 3 sows	A mixture of equal quantities of ground barley, peas and rye, *steamed and fed warm and sugar beets.*
Pen 6	Black—4 barrows	A mixture of equal quantities of ground barley, peas and rye, *mixed with cold water and fed raw and cold, and sugar beets.*

The four pigs in Pen 1 are of equal age and of similar breeding to those in Pen 2; the pigs in Pen 3 to those in Pen 4 ; and the pigs in Pen 5 to those in Pen 6.

At this writing it would be imprudent to draw any conclusions from the comparative rates of increase in live weight. A Bulletin setting forth the results will be issued as soon as enough information is gained to warrant that its contents will not mislead any farmer. Conclusions regarding feeding experiments which are reached and published too hastily are not boons to the farmers, though they may boom for a time the name of the publisher.

CATTLE.

To our herd of cattle several new animals and breeds have been added. The stables are now filled to their utmost capacity. Experiments are in progress, and others are being prepared for and commenced, which will add to our knowledge of the comparative values of different feeds and treatments in the production of milk and beef. For much of the most valuable of the work, years of patient investigation will be required to amass sufficient information upon which to found conclusions which will be correct in principle. The *individuality* of each animal is such a potent factor, and a definite perception and recognition of the nature of the *individuality* is so elusive of even the most careful and painstaking study, that the results of comparisons between breeds must depend very much upon the capacity, constitution and tendency of the particular animals which are chosen to represent them. The qualities of each animal are not directly the expression of the sum of all the antecedent qualities of the ancestors on both sides, because the inherited capabilities may be much modified in every case by care, management and feeding during the period of growth.

Thus, while the feed consumed by every animal every day is duly weighed and recorded, also the weights of the milk from the milking cows every day, the live weights of the animals which are under particular feeding tests once a week, and the live weights of the other animals once a month, it is felt that the premature publication of records would lead to no real service for the farmers and might intensify the rivalries between the advocates of the different breeds without any compensating advantage. Every one of the breeds has particular adaptation for rendering peculiarly valuable service when it is used in the line of production for which it has been developed. Nobody who has given the meaning of "breeds" any discriminating attention would claim that they are all equal in their power and capacity for the economical production of milk, butter, cheese, beef or veal, under one similar and rigid system of keeping; neither could one assert assuredly that any one of the recognised breeds is behind the others in profit-making talent when the particular requirements of its peculiar characteristics have been provided for in the best way. Hence, from our experimental investigations, farmers may look for guidance as to the ways whereby the animals of the different breeds can be made to yield the best returns, rather than for competitive comparisons between the breeds.

The breeds of cattle which are now represented on the farm are :—"Shorthorns," "Polled Angus," "Galloways," "Holsteins," "Ayrshires," "Devons," "Quebec Jerseys" or "Canadian" and "Jerseys." These are named in the order in which they stand in our stable, and not with any reference to meritorious rank. There are also a number of steers and milch cows, mostly grades of Shorthorn. During the year there were purchased :—

Shorthorns.

From Mr. Thos. Güy, Oshawa, Ont:

One cow, Rose of Sydenham =16031=; red; calved 6th February, 1886; bred by Thos. Guy, Oshawa, Ont.; got by Samson=8787=;—dam, Red Rose,=4450=; by Enterprise 2nd =1769=;—Sally =4728=.

From Mr. J. N. Hortop, Kinsale, Ont:

One cow, Fashion Book=15918=; red; calved 12th January, 1887; bred by D. Birrell, Greenwood, Ont.; got by Eclipse (Imp.) [1251] (49526);—dam, Fashion 7th=6091=; by Lancaster=752=; —Fashion of Maple Hall 2nd=6102=.

From Mr. George Johnston, Ashburn, Ont.:

One bull Nappan=14042=; red; calved 14th May, 1890; bred by George Johnston, Ashburn, Ont.; got by Warfare (Imp.)=6452=(56712);—dam, Fashion 7th=6091=; by Lancaster=752=;—Fashion of Maple Hall 2nd=6102=.

Galloways.

From Mr. Thomas McCrae, Guelph, Ont.:

One cow, Violet III of Tarbreoch.

One heifer, Hannah B. of Guelph, No. 11080, S.H.B.; calved 23rd February, 1888; bred by Thomas McCrae, Guelph, Ont.; got by Stanley II, O.E.F., No. 2837, A.G.H.B., No. 4473, S.H.B. ;—dam, Hannah III of Castlemilk, No. 7699, S.H.B.; by Beaconsfield, No. 1344, S.H.B. ;—dam Hannah V., No. 1421, S.H.B.

One bull calf.

Holsteins.

From Messrs. A. C. Hallman & Co., New Dundee, Ont.:

One cow, Mina Rooker, No. 9893, H.H.B.; calved 3rd April, 1884; bred by K. Schagen, Medwoud, North Holland; got by Pieter, No. 209, N.H.B. ;—dam, Mina.

Ayrshires.

From Mr. James McCormick, Rockton, Ont.:

One cow, Maggie [1783]; red and white; calved 29th March, 1883; bred by Mr. James McCormick, Rockton, Ont.; got by Frank [1330] ;—dam, Primrose 4th [1305]; by Indian Chief [1174] ;—g.d. Primrose 3rd [400].

From Mr. Thomas Guy, Oshawa, Ont.:

One cow, Ida [1837]; white and red; calved 10th March, 1884; bred by Mr. John Lawrie, Malvern, Ont.; got by Lord Lorne [1406] ;—dam, Mary [1554]; by Carluke [744]; g.d. Martha [546].

Devons.

From Mr. W. J. Rudd, Eden Mills, Ont.:

One bull, Hero [982]; calved 10th March, 1889; bred by Mr. W. J. Rudd, Eden Mills, Ont.; got by Rose's Duke (929), (Imp.) ;—dam, Beauty [800] by Kempenfelt [719] ;—Cherry Pie, [578].

One heifer, Ethel [961]; calved 20th May, 1888; bred by Mr. W. J. Rudd, Eden Mills, Ont.; got by Lord Lansdowne [933] ;—dam, Rose [953]; by John A. [852]; —Beauty [713].

From Mr. Samuel Harper, Cobourg, Ont,:

One heifer, Fanny B. [960]; calved 9th March, 1888; bred by Mr. Samuel Harper, Cobourg, Ont.; got by Mike [920] ;—dam, Rose of Cobourg [897]; by Garibaldi 2nd [717] ;—Cherry [691].

Jersey.

From Mrs. E. M. Jones, Brockville, Ont.:

One cow, Barberry of Dorval, No. 44,816; solid light fawn; calved 13th January, 1887; got by Leonard of Dorval, No. 14,393 ;—dam, Mulberry (imported).

Canadians or Quebec Jerseys.

I take the following from the report which Mr. J. C. Chapais, Assistant Dairy Commissioner, St. Denis, Que., made upon the purchase of these.

"I have bought, according to instructions, 4 cows registered in the Herd Book of Canadian cattle opened by the Government of the Province of Quebec, 4 cows of the same breed not registered at the moment of the purchase, and 1 bull registered in the above mentioned Herd Book.

"Here are the notes respecting each of the registered cows:—

"Charlotte Noir," probable age 15 years; registered under No. 348, L.G.R.B.C.; bought from Cyprien Herriault, farmer, of the Parish of St. Jean Port-Joli, L'Islet County, P.Q. I have bought that cow, old as it is, on account of its individual value as a milch-cow, but chiefly because of the character of prepotency with which it transmits milking qualities to its offspring. It has given, itself, 30 lbs. of milk a day in a pasture of moderate quality, in the time of full growth of grass, towards the end of June, without any extra food. But its first merit is that it has transmitted its milking qualities to every heifer descendant. That cow has competed in the agricultural exhibitions with the best Ayrshires of the place, and has taken the first prizes. It can easily give yet 2 or 3 calves, which will, without any doubt, prove to be valuable stock for the experiments of the Farm, if the cow be bred to the bull I have bought, which will be mentioned later. Those are the reasons why I bought that cow.

"Alice," aged 6 years; registered under No. 358, L.G.R.B.C.; bought from Louis Blanchet, farmer, of the same parish as Cyprien Therriault. It is one of the best cows of the place, giving 30 lbs. of milk a day in a pasture of moderate quality, in the time of full growth of grass, towards the end of June, without any extra food. It has the great quality, common, moreover, to all Canadian cows well kept, of giving a good quantity of very rich milk during eleven months of the year, if well fed.

"Anna," aged 7 years; registered under No. 359, L.G.R.B.C.; bought from Louis Blanchet, above mentioned, and having the same character as its sister "Alice."

"La Lebrun," aged 9 years; registered under No. 196, L.G.R.B.C.; bought from François Gagnon, farmer, of the parish of St. Denis, Kamouraska County, P.Q. Mr. Gagnon has one of the best herds of Canadian cattle in the Province, and that cow was the best of his herd. It shows all the points of an excellent milch cow, and has given 32 lbs. of milk a day in a pasture of moderate quality, in the time of full growth of grass, towards the end of June, without any extra food. With special care that cow is apt to give from 38 to 40 lbs. of milk a day. It keeps in milk too, from calf to calf, if fed for that. It is in calf now, and has been served by Kamouraska, No. 27, L.G.R.B.C., one of the best bulls of the breed. The calf, male or female, cannot fail, then, to be an animal of good value.

For the four cows above mentioned were paid $50 each.

I come now to the cows not registered when they were bought. They have all been purchased from François Gagnon, above mentioned. According to your instructions, I had to choose these cows from amongst the ordinary cattle of French farmers, of good quality.

"Anquetille," aged 6 years. In my opinion that cow is equal, in all respects, to "La Lebrun" above mentioned. It is remarkable for the richness of its milk in cream.

"Velléda," aged 4 years. It is an excellent specimen of Canadian cattle, showing prominent points of Jersey.

"La Basque," aged 3 years. That small cow has been reared in the woods, and is one of the most hardy specimens of the breed. Before it had been bought by Mr. Gagnon it lived at its owner's, fed on straw in winter and pasturing in the woods in summer. It proved, however, a good milker, notwithstanding that absence of good care.

"Belle-du-Lac," aged 4 years. Has much of the character of the last mentioned, but is a little better as a milch cow, judging from the information given to me.

For these last four cows were paid $25 each.

They were all eligible for registration in the Herd Book of Canadian Cattle and are all registered now as follows:—

"Anquetille,"	6 years;	registered	L.G.R.B.C.,	under No.	373.
"Velléda,"	4 do	do	do	do	374.
"La Basque,"	3 do	do	do	do	375.
"Belle-du-Lac,"	4 do	do	do	do	376.

I will now give you the details respecting the bull:—

"Quintal," aged 18 months; registered under No. 30, L.G.R.B.C.; bought from Odilon Robichaud, farmer, of the Parish of St. Denis, Kamouraska County, P.Q. I consider that young bull as one of the best of the breed hitherto registered. Its father, "Kamouraska," No. 27, L.G.R.B.C., is the finest bull of the eastern part of the Province of Quebec, out of a most remarkable milch-cow. Its mother, "Ventre-Blanc," No. 171, L.G.R.B.C., was also one of the best milch-cows of the district. Though rather small, it is very well formed, and shows all the points of a good bull. For it has been paid $30.

I have to make the remark, before closing the report, that I had to buy that herd in that season of the year which is the most disadvantageous for such a purchase. It was impossible to ascertain by myself, otherwise than by the external points and the assertions of the owners, the milking qualities of the cows purchased. I had to rely as much as possible on my own judgment in making my choice.

Grades of Shorthorn.

From Mr. Wm. Hinde, Harriston, Ont.:

Six steers for feeding purposes.

Eight milch cows, for experimental dairy work.

These cows were all expected to calve in December and January, and were purchased to commence a series of investigations into some of the problems of winter butter-making, combined with the rearing of stock for feeding and fattening purposes.

The following are the rations which are fed to most of the cattle:—

Ration No. 1.

For Dry Cows:

	Lb.
Corn Ensilage	25
Turnips	25
Straw	12
Chopped Grain (barley and peas)	4

Ration No. 2.

Milking Cows:

	Lb.
Corn Ensilage	25
Carrots	25
Straw	12
Chopped grain (barley and peas)	6
Wheat bran	3

Ration No. 3.

First Lot Steers:

	Lb.
Hay	20
Turnips	40
Straw	5
Chopped barley	2
Chopped peas	2
Ground oilcake	1
Cotton seed meal	1

Ration No. 4.

Second Lot Steers:

	Lb.
Corn ensilage	50
Straw	5
Chopped barley	2
Chopped peas	2
Ground oilcake	1
Cotton seed meal	1

Ration No. 5.

Third lot Steers:

	Lb.
Corn ensilage	20
Turnips	20
Hay	10
Straw	5
Chopped barley	2
Chopped peas	2
Ground oilcake	1
Cotton-seed meal	1

These rations are not made up quite in accordance with the usually accepted feeding standards, which have been devised from and based upon feeding experiments and analyses of feeds that have been conducted mostly in Germany. The following table sets forth the quantities of "digestible protein," "digestible carbohydrates" and "digestible fat," which have been found on the average, in 1 pound each of the several feeding materials named, as calculated from the average analyses of these feeding substances, and the percentage of the several nutritive constituents which have been found by several experiments to be digestible by ruminants :—

QUANTITIES of Digestible Protein, Carbo-hydrates and Fat, in each pound of certain Feeds, from tests with ruminants—(Oxen and Cows.)

——	Total Dry Organic Matter.	Digestible Protein.	Digestible Carbo-hydrates.	Digestible Fat.
	Lb.	Lb.	Lb.	Lb.
Wheat 1 lb.	·89	·095	·588	·014
Barley do	·89	·094	·600	·026
Oats do	·87	·080	·440	·044
Peas do	·87	·201	·534	·029
Oilcake do	·92	·283	·368	·050
Cotton-seed meal do	·92	·336	·264	·070
Wheat bran do	·87	·117	·453	·027
Mixed straw, (wheat, barley, oat) do	·85	·035	·330	·004
Mixed hay do	·86	·051	·430	·012
Corn ensilage do	·25	·016	·230	·006
Corn stover do	·48	·033	·480	·008
Turnips do	·085	·010	·075	·001
Mangels do	·120	·011	·100	·001
Carrots do	·141	·013	·115	·002
Sugar beets do	·185	·010	·167	·001

By applying this table to the several rations, Nos. 1, 2, 3, 4 and 5, it will be found that they contain the quantity of nutrients mentioned under the several headings:

		Total Dry Organic Matter.	Digestible Protein.	Digestible Carbo-hydrates.	Digestible Fat.	Nutritive Ratio.
Ration No. 1.	Lb.	Lb.	Lb.	Lb.	Lb.	
Corn ensilage	25	6·250	·400	5·750	·150	
Turnips	25	2·125	·250	1·875	·025	
Straw	12	10·200	·420	3·960	·048	
Chopped grain, (barley and peas)	4	3·520	·590	2·268	·110	
		22·095	1·660	13·853	·333	1:8·8
Ration No. 2.	Lb.					
Corn ensilage	25	6·250	·400	5·750	·150	
Carrots	25	3·525	·325	2·875	·050	
Straw	12	10·200	·420	3·960	·048	
Chopped grain, (barley and peas)	6	5·280	·885	3·402	·165	
Wheat bran	3	2·610	·351	1·359	·081	
		27·865	2·381	17·346	·494	1:7·8
Ration No. 3.	Lb.					
Hay	20	17·20	1·020	8·600	·240	
Turnips	40	3·40	·400	3·000	·040	
Straw	5	4·25	·175	1·650	·020	
Chopped barley	2	1·78	·188	1·200	·052	
Chopped peas	2	1·74	·402	1·068	·058	
Oilcake	1	·92	·283	·368	·050	
Cotton-seed meal	1	·92	·336	·264	·070	
		30·21	2·804	16·150	·530	1:6·1
Ration No. 4.	Lb.					
Corn ensilage	50	12·50	·800	11·500	·300	
Straw	5	4·25	·175	1·650	·020	
Chopped barley	2	1·78	·188	1·200	·052	
Chopped peas	2	1·74	·402	1·068	·058	
Oilcake	1	·92	·283	·368	·050	
Cotton-seed meal	1	·92	·336	·264	·070	
		22·11	2·184	16·050	·550	1:7·8
Ration No. 5.	Lb.					
Corn ensilage	20	5·00	·320	4·600	·120	
Turnips	20	1·70	·200	1·500	·020	
Hay	10	8·60	·510	4·300	·120	
Straw	5	4·25	·175	1·650	·020	
Chopped barley	2	1·78	·188	1·200	·052	
Chopped peas	2	1·74	·402	1·068	·058	
Oilcake	1	·92	·283	·368	·050	
Cotton-seed meal	1	·92	·336	·264	·070	
		24·91	2·414	14·950	·510	1:6·6

The term "nutritive ratio" is one which is employed to designate the proportion which the *digestible protein* (called also the nitrogenous substances, or "flesh-formers") bears to the *digestible carbo-hydrates* and *fat*. The carbo-hydrates are the starch, sugars, gums, crude fibre and like substances; they are sometimes referred to as "heat-producers." To give to the fat an equitable starch value, the quantity of it is multiplied 2½ times before it is added to the carbo-hydrates proper, for the calculation of the nutritive ratio.

The dry cows on Ration No. 1 are fed twice a day, and are allowed as much of the mixture as they will eat up clean. The quantity varies from 40 pounds to 60 pounds per day for different animals.

The milking cows on Ration No. 2 are fed twice a day, with the exception of the Shorthorns and Polled Angus, which are fed three times. The cows consume from 40 pounds to 80 pounds each per day. To fresh-calved cows and those which respond to it, 1 pound of ground oilcake and 1 pound of cotton-seed meal per day are given in addition.

The two steers, Nos. 1 and 2, on Ration No. 3, have been consuming about 50 pounds each per day of the mixture which composes their ration; that is equal to 21·2 pounds of dry organic matter per head daily.

The two steers, Nos. 3 and 4, on Ration No. 4, have been consuming about 46 pounds each per day of the mixture which composes their ration; that is equal to 16·6 pounds of dry organic matter per head daily.

The two steers, Nos. 5 and 6, on Ration No. 5, have been consuming about 50 pounds each per day of the mixture which composes their ration; that is equal to 20·4 pounds of dry organic matter per head daily.

As has been mentioned already, it would be unwise to draw any conclusions or make any further reference to investigations which are only in progress; but this may be added with safety, the economic value of ensilage for cattle feeding is surprisingly high, and it is not yet appreciated by the masses of Canadian farmers.

For the current year, new investigations along lines for the practical service and guidance of the farmers are being commenced. Among others, it is considered expedient to illustrate, by the growth of crops suitable for soiling and the making of ensilage, how many cattle may be sustained under ordinary farming conditions, on the product from 20 or 40 acres of land. The needs of the farmers for the successful and profitable prosecution of cattle-raising, stock-feeding and dairying, appear to be in the direction of larger numbers of cattle per 100 acres, rather than for more acres of land.

Abortions.

During the year, what is commonly known as the disease of *epidemic abortion* prevailed in the herd. The unnatural and premature births usually occurred at from the fifth to the seventh month. Little reliable knowledge of the antecedent or even immediate causes of the disease or losses is yet in our possession. Ignorance of the nature of the disease has been hidden by draping the mention of it with the astutenesss of medical mystery, under the guise of an announcement that it owed its existence to "a germ."

The treatments which were adopted, might be termed empirical.

I. The stables were thoroughly fumigated by the burning of sulphur, saturated with alcohol, with the doors and windows closed for three hours. Of course all the cattle were out.

II. A wash was made up of 1 part of bichloride of mercury to 4,000 parts of water, into which solution were put 8 ounces of common salt; once a day the bare skin around the vulva, the anûs and the root of the tail of the cows in calf, and also of those which had aborted, were sponged with the solution.

III. After several weeks of that treatment the following was adopted as being preferable: 2½ drachms of bichloride of mercury were dissolved in 3¼ ounces of glycerine and 3¼ ounces of alcohol; after these had united, 4¼ gallons of rain water were added. (The mixture should be kept in a wooden vessel, out of the reach of irresponsible persons, and animals). The bare skin under the tail and around that part was moistened once a day with the solution.

IV. The cows, which formerly has been turned out into a large yard every day for water, were watered from troughs in front of their stalls.

V. When a pregnant cow showed any symptoms of approaching abortion,—and these are, slight relaxation of the muscles surrounding the vulva, restlessness and a continuous slight elevation of the tail,—she was at once put into a box-stall, where she was free from disturbance or causes of excitement. One-ounce doses of tincture of opium were given in the feed—even three times a day for one or two days—until a quiet and slightly sluggish condition prevailed. Drenching with medicine was avoided.

The result is—and it is mentioned with hesitation and fear, lest the dread abortions should occur again—that since the system of treatment has been adopted, 13 cows have given safe delivery to calves at the natural time, and only one case of abortion has occurred, and that could be accounted for satisfactorily. That covers a period of three and-a-half months. During the preceding ten months there were 13 births at the natural time, and 14 prematurely, at from four and-a-half to eight months.

NEW BUILDINGS.

A sheep building is needed for the accommodation of that class of stock. After it is erected, the three important departments of live stock for experimental farm work—cattle, swine and sheep—will be in full operation, without the hindering limitations which are entailed on investigations by the erection of buildings and preliminary work.

Permit me to refer farmers and others who may be seeking information on grain-growing tests and other agricultural work to your own report, as my connection with the Central Experimental Farm, with the exception of live stock management, has been as yet to a large extent advisory rather than executive.

I have the honour to be,

Your obedient servant,

JAS. W. ROBERTSON,

Agriculturist.

REPORT OF THE HORTICULTURIST.

(John Craig.)

Wm. Saunders, F.R.S.C., F.L.S., F.C.S.,

Director Dominion Experimental Farms,

Sir,—I have the honour to submit herewith a report on the work carried on in the Department of Horticulture since my appointment, 15th January, 1890. The characteristics of the past season were an unusually late spring—delaying somewhat outdoor operations—and a remarkably favourable summer for plant growth; this closed with an equally favourable autumn for the thorough and essential ripening of wood made during the season, leaving trees and shrubs in good condition to withstand the severity of winter.

I have endeavoured to bring together, as briefly and clearly as possible, in the following pages, information drawn from the experience of the year in most instances, and often corroborated by the experience of previous years. For the sake of clearness, the work has been divided and placed under the following heads:—

I. Large Fruits.—Bearing upon the number and condition of varieties in orchard; touching specially upon the Russian and hardier classes best adapted to the needs of northern planters, with cultural notes.

II. Small Fruits.—Touching especially upon grapes and strawberries, making the early varieties a feature of the former, the most reliable and productive of the latter; also summing up the records on other small fruits for three years, with hints on varieties.

III. Vegetables.— Outlining proposed work and that in hand; giving the names of the most successful varieties of those tested.

IV. Forestry—Tree Distribution—Fruit Distribution.—Touching on the importance of the question in Manitoba and the Territories. Giving an outline of the work of distributing forest-tree seedlings and possible results; also bearing upon the distribution of large and small fruits.

V. Fungicides.—Giving formulæ for their preparation and results of experiments on the apple scab.

VI. Report on Seedling Small Fruits.—Giving opinions of a visiting committee of experts on seedling raspberries, fruiting at the Experimental Farm—with descriptions of varieties.

I beg gratefully to acknowledge the following donations:—

Peter Henderson & Co., New York; a large collection of vegetable seeds.
Mr. S. H. Mitchell, St. Mary's, Ont.; corn and tomato seed.
Mr. M. Crawford, Cuyahoga Falls, Ohio; strawberry plants.
Mr. Julius Schnadelbach, Grand Bay, Ala.; strawberry plants.
Mr. David Greig, Cainesville, Ont.; strawberry plants.
Mr. P. E. Bucke, Ottawa; Northern Light grape.
Mr. N. C. Fisk, Abbotsford, Que.; grape cuttings.
Wm. Craig & Son, Abbotsford, Que.; scions of crabs and Russian apples.
Mr. Geo. Mitchell, Abbotsford, Que., scions of seedling apples
Mr. Abel Bresso, Abbotsford, Que.; scions of seedling apples.
Mr. C. R. H. Starr, Wolfville; apple scions.
Dr. T. H. Hoskins, Newport, Vt.; apple scions.
Mr. P. C. Dempsey, Trenton, Ont., apple trees and scions
Mr. R. W. Shepherd, jr., Como, Que.; apple scions.
Mr. J. J. Gibb, Como, Que.; apple scions.

Mr. Chas. Hardisty, Clarence, Ont.; seedling apple scions and fruits.

Rev. Robt. Hamilton, Grenville, Que.; apple scions, and trees of Populus nigra.

Mr. R. B. White, Ottawa; collection of seedling plums.

Prof. J. L. Budd, Iowa Agricultural College, Ames.; hardy fruits and shrubs, and many favours.

It was my privilege, during the year, to attend various meetings in agricultural circles—among them the meeting of the American Forestry Association, held in the city of Quebec the first week in September last. In a paper read before the Association I attempted to give an outline of the experimental work in forestry, in progress at the Dominion Experimental Farms. The system and policy of the Department was highly commended, and seemed to meet with the hearty approval of the many delegates present.

At the September meeting of the Montreal Horticultural Society a magnificent display of fruits—notably apples—was shown. Nowhere in the Dominion can a finer exhibit of seedlings be seen than at the exhibitions of this Association, many of which, it is to be hoped, will receive extended trial before long. This society is also paying careful attention to the merits of the Russian apples, now beginning to fruit in many localities about Montreal.

The summer meeting of the Ontario Fruit Growers' Association was held during July at Niagara on the Lake, where an opportunity was afforded of studying one of the most favourable peach-growing districts of Ontario. A lively interest was taken by all present in horticultural advancement, by means of Government experimental work.

I have the honour to be, Sir,

Your obedient servant,

JOHN CRAIG,

Horticulturist.

I.—LARGE FRUITS.

APPLES.

Nearly all varieties came through the winter without injury and have made a satisfactory growth the past season. A few have been replaced and several additions made.

Cultivation.—The trees have been banked up with earth to the height of 12 inches each autumn, which protects them from being girdled by mice, and prevents the swaying action of the wind. The orchard received a dressing of barnyard manure last spring, which was ploughed under, and the soil prepared for a crop of roots. A space of 4 feet was left clear on each side next the trees, which was carefully cultivated till the middle of July, or the end of the growing season, afterwards, care was taken to keep down the weeds, thus preventing any from seeding. Under the favourable conditions prevailing last autumn, the trees ripened up well and went into winter quarters in good shape.

As a preventive to scale and other bark insects, the stems and main branches were washed, early in June, with soft soap, to which was added a sufficient quantity of a strong solution of washing soda, which had first been dissolved, to reduce it to the consistence of a thick paint. This wash has the effect of keeping the bark green and healthy. It is a practice that should be followed generally by fruit-growers.

From careful notes taken the past two seasons varieties in the following list do not appear to be hardy enough for this latitude, and cannot be recommended for general planting: *Brewington, Gravenstein, Nonpareil, Peck's Pleasant, Warner's King, Yellow, Belle-fleur.*

The following may be assumed as a doubtful list, having been injured each winter in a greater or less degree: *Baldwin, Bottle Greening, Cooper's Market, Cranberry Pippin, Chenango Strawberry, Fall Jennetting, Fallawater, Lady Henniker, Maiden's Blush, Northern Spy, Ribston Pippin, Roxbury Russet, Shannon, Spitzenberg, Swayzie Pomme Grise, Wagner, Grimes' Golden.* There is no doubt that individual trees of varieties named in this list, and even in the first one, can be found doing fairly well in this locality; but they are exceptional cases, and probably under unusually favourable conditions. It is also doubtless true that we, in the colder sections, can obtain by *top-working on hardy stocks* a sufficient quantity of fruit for home use of many of these choice old varieties. Experiments in this line using different stocks will be inaugurated as soon as practicable.

RUSSIAN APPLES.

Most of the varieties, as given by Mr. Hilborn in the annual report of 1888 have made very satisfactory progress up to date. Thirty-five of the later importations of the Iowa Agricultural College were received from Prof. Budd last spring, and were added to the original planting, making in all 215 Russian varieties on trial. This orchard was the first to fruit on the Experimental grounds, a number of trees giving specimen apples this year. Some of them are large, and of fair quality, but further experience is needed before a true estimate can be made of their value. In this connection it may be added that the large and interesting collection of Russian fruit on the farm of the late Charles Gibb, of Abbotsford, Que. (now owned by Wm. Craig & Son) has been, by your instructions, under my observation during the fruiting season of this year. The planting of Russian fruits was begun by Mr. Gibb about ten years ago. Many varieties are now coming into bearing, and it is hoped that by careful observation of the success of the different varieties in that district, a reliable opinion will be arrived at in regard to their possible success and usefulness in the colder parts of the Dominion. The fruit-growers of the Province of Quebec, especially, had for years been watching with much interest the self-imposed task of fruit testing—"for the cold north"—undertaken by Mr. Gibb, and it will be a source of satisfaction to them, to know that the results which he came so near attaining, will not be lost to the people in whose interest he laboured. It is hoped that, with the added experience of another year, sufficient information will be acquired to enable such facts to be published in bulletin form, as will serve as a guide to planters along the northern limits of present apple culture; for this is the region where the Russian apple will be of greatest service. Another purpose which this race will serve, and which will be developed later, is that of giving us hardy stocks for top-grafting. Many varieties already fruited, judging from their poor quality, should be condemned, but will be retained, for the purpose just indicated, on account of their great vigour and hardiness. They will also undoubtedly be the progenitors of a hardier race of apples than we now have, by crossing with our American sorts, or by seedling production.

The following list is based upon the observation of four years on the grounds of the Iowa Agricultural College, and the experience of last summer at Abbotsford. The varieties mentioned are commended to the careful attention of fruit growers.

Zolotoreff.—Large, conical, rich carmine with light dots and stripes on the shady side. Calyx open, basin, wrinkled, stem short, cavity, deep, narrow. Flesh yellowish white, tinged with pink when over-ripe, rather coarse in texture, quality medium. Season early September. A fine handsome apple. The tree is a vigorous upright grower with large glossy leaves. Hardy as Duchess. Closely resembling this in tree and fruit, are Basil the Great, and Titovka.

Golden White.—Large, oblong, ribbed, yellow ground covered with bright red towards cavity, calyx open, basin slightly wrinkled, somewhat ribbed, stem short, thick. cavity small, in some almost closed. Flesh white, crisp, tender, juicy. Sub-acid sprightly, very good season, August to September. Keeps better than Duchess. Claimed by some to keep till mid-winter. Tree a good grower of upright habit. Very hardy.

Arabka (Imported by Ellwanger & Barry).—Large, oblong, irregularly ribbed, dull red on sunny side, shading to dark green. Calyx closed, basin shallow, deeply wrinkled. Stem short, thick set, in closed cavity. Flesh greenish, white, rather coarse, mildly acid. Season November to March. In the west the tree has been somewhat subject to blight, but it has not been affected this way in the east. In hardiness it may be graded with Wealthy. This will undoubtedly be valuable in the colder districts. Trees planted ten years ago at Abbottsford have been bearing heavily and regularly the last four years. The Arabka imported by the United States' Department of Agriculture is quite different—an early fall apple of the Duchess type, very vigorous and hardy.

Gipsy Girl.—One of the hardiest and most vigorous of all the Russians. Specimens were taken this season from trees planted two years ago on the Experimental Farm. The fruit is large, highly coloured, of fair quality, and keeps till February. Wherever this tree has come under my notice, it has been doing well.

Royal Table.—This apple is of North German origin, a later importation by Prof. Budd. The trees at Abbotsford, are compact growers, with round topped heads, slender twigs and medium sized leaves; they have made vigorous growth, and seem perfectly hardy. Fruit medium to large, conical, ribbed, greenish with dull red stripes on the sunny side, calyx open, basin wide, wrinkled, stem short thick, cavity wide shallow, flesh greenish white, inclined to be tough, quality fair. Season; at this date (January 25) specimens in my cellar are firm and in good eating condition. It should keep through February. As already stated notes were taken on a considerable number of varieties which fruited at the Experimental Farm and at Abbotsford the past year, but it is thought better to reserve such information for future publication.

IMPORTATION AND PROPAGATION.

Arrangements were made last winter by the Fruit-Growers Association of Ontario, through the Secretary, Mr. Woolverton, for the importation of a large collection of scions of Russian apples, pears and plums. By arrangement with Mr. Woolverton this consignment was placed in my hands to be propagated, for trial on this and the branch Farms, and for distribution to the members of the association. Owing to the length of time in transit, the scions were not in good condition when received in March. They were root grafted at once, and set out at the proper time in spring. Last fall it was found, that 44 out of 45 varieties of apples had grown, giving in round numbers 1,350 trees. Specimen trees of 6 out of 7 varieties of the pears were obtained—in all 78 trees; 15 trees of one variety of plum also made a satisfactory growth. It is proposed to increase these as rapidly as practicable for dissemination, and trial at different points in the Dominion. A number will be top grafted next spring, with a view to obtaining specimens of the fruit at as early a date as possible. This work of distribution of rare plants and new fruits, which the Ontario Fruit-Grower's Association has practiced among its members during a number of years past, is one highly to be commended, and is productive of valuable results.

SEEDLINGS, NATIVE AND RUSSIAN.

Of the seedling apples raised from seed imported under your direction from Russia, about three thousand have been planted in a special "seedling orchard." They have been set 5 feet apart each way and will remain there until some idea of their probable value can be formed, when the more promising will be transplanted to permanent positions for more extended trial. Smaller assortments of these have been sent to the branch Farms for testing in a similar manner.

Efforts have also been directed towards gathering in, all the native seedlings which have been reported as worthy of propagation, or have come under my notice, as possessing good points.

Thus far, thirty seedlings have been collected, principally from the older apple growing districts of the Eastern Townships, from Montreal and Northern Ontario. Those received in spring were crown grafted, most of which made satisfactory growth ; others received during the summer were budded. The whole collection with additions as received, will constitute an instructive group when contrasted with the seedlings of Russian origin.

PEARS.

Very few of the cultivated varieties of American and West European pears prove hardy in this section. Nearly all belonging to this class have been more or less severely injured by winter since planting in the trial orchard. This injury has mainly consisted in the loss of part or the whole of the growth of the preceding year. Others, however, have been killed outright. The orchard has been treated in the same manner as the apple orchard, and the soil is well suited to pear culture.

The following varieties have shown least injury from the cold of winter thus far, indicating that,under favourable circumstances, they might be grown to a limited extent in this and similar latitudes : *Flemish Beauty, Bartlett, Beurré Hardy, Beurre d'Anjou, Doyenné, Boussock, Goodale, Josephine de Malines, Seckel, Vicar of Winkfield.* It is probable that other varieties will be noted later, as developing hardiness in an unexpected degree, as the work of testing goes on. Pears have been almost wholly untested in this vicinity up to the time of planting them on the Experimental Farm.

In this connection, it may be added that interesting results are looked for, when the work now in hand—that of top-grafting the hardiest Russian sorts with the best varieties of the present cultivated pears—has been brought to an issue. This is a line of experiment that has not yet been entered upon in America, and from which it is hoped the colder sections will reap much benefit.

RUSSIAN PEARS.

Nearly all varieties of this class have come through the last two winters uninjured, and strong hopes are entertained for their future usefulness. Through the kindness of Prof. Budd, I have been able to make a considerable addition to the collection already in orchard, and expect to be able to extend the work in this line next spring.

The following notes are made on trees planted eight years ago at Abbotsford, all of which have grown vigorously, and give every indication of perfect hardiness :

Beesemianka (No. 508 and 3 M).—Tree a strong upright grower, with remarkably bright green healthy foliage. It has shown no sign of blighting in the east, but has been affected to a limited extent by this disease in the west. A few specimens of fruit were borne this year, but dropped before an idea of the quality could be ascertained.

Sapieganka.—This is even a stronger grower than the last and more spreading in habit. The twigs are thick, bark a bright olive in colour. This would appear to be a grade less hardy than the last. It has not come into bearing yet.

Gakovka.—This seems to be the hardiest of the class. From close observation of its habits in widely separated localities I believe it will succeed wherever the Duchess apple can be grown. It is a rapid grower of upright habit and strictly determinate in regard to ripening its wood in the fall. I cannot speak of the fruit. Prof. Budd says : "The fruit is large and handsome, but is mainly valuable for culinary use, for which it is not excelled. Though pleasant in flavour the flesh is too firm for desert use until over ripe."

Lemon.—The characteristic of this tree is the fact of its having almost invariably a central leader from which the side branches are thrown. This forms an ideal head. Annual growth has been strong. Shoots large. It is said to be a cooking pear. Not fruited yet.

Limber Twig.—Prof. Budd says this succeeds best on dry, upland soil. It has done well at Abbotsford on gravelly soil. The bark is light green, buds peculiarly long and sharply pointed. Not fruited.

Kurskaya.—This is said to have been first introduced by the Mennonites of Minnesota. In general appearance and habit of growth it much resembles Bessemianka. The fruit has not come under my notice.

Autumn Bergamot (No. 122).—This has been very satisfactory in point of hardiness and vigour at Abbotsford. The fruit is said to be small and highly flavoured.

SEEDLING PEARS.

As a product from the pear seed imported from the region of the Volga in Russia—a district in which the pear is found growing wild—one hundred and twenty-five of the most vigorous seedlings were transplanted in the same manner, and adjacent to the apple seedlings already mentioned. A number of seedlings from other sources have also been added and the whole will make a very interesting and, it is hoped a useful collection. The late Chas. Gibb, advocated frequently the wisdom ot growing seedlings from the wild pear of the Volga region, for the purpose of introducing a hardier fruit stock than we now have in the French pear seedlings. Owing to the difficulty of obtaining seed in quantity, this line of work has not been attempted by fruit growers, outside of a few pear specialists.

PLUMS.

The majority of the older and finer varieties of this fruit first planted have not succeeded as well as was expected. The partial failure of this class in the first planting was no doubt very much increased by the planting as an experiment a number of varieties in the fall. A severe winter followed, resulting in the death of a considerable number. These failures have, however, in most cases, been replanted and all will receive a fair trial. While many may not make long lived trees, yet they will be useful in furnishing pollen which may be used in the work of crossing with hardier varieties.

The following list contains those kinds which thus far have stood the test of winters in this vicinity with least injury. They have all originated from the European plum, *Prunus domestica* and have been in cultivation for a number of years in the fruit growing districts of Ontario and the Eastern States: *Reine Claude, Magnum bonum, Yellow Egg, Richland, Glass Seedling, Washington, Nota Bene, Bryanston's Gage, Newman, Pond's Seedling, Lombard, Bradshaw.*

Another class of plums which are more promising in point of hardiness, though they have not fruited to any extent thus far, belong to the same species as the last, but are derived mostly from East Europe. The following have come through uninjured by winter killing and give promise of vigour and longevity; *Early red, Late red, White Nicholas, White Otschakoff, Trabische, Voronesh, Hungarian, Moldavka.* Most of these have fruited in the Western States, in many cases the fruit will be found very useful, and in some instances of high quality.

For a number of years past, a few experimenters in the Western States, have been developing selected varieties of the native plum of that region—a fruit which has too long been neglected—*Prunus Americana.* A number of promising varieties are now on the market and will be of much service along the northern limits of plum culture. *De Soto,* which has so rapidly sprung into popularity of late, is a notable representative of this class. An effort has been made to secure as large a collection of these as possible. Among them are the following, which appear to be the most valuable: *Hawkeye, Speer, Wolf, Wyant, Rollingston, Forest Garden, Forest Rose, Jas. Vick,* and *Garfield.*

Prunus Chicasa.—This is native to the south-west, is less hardy than the preceding, and sometimes fails from imperfect fertilization. As a cooking plum it is unsurpassed. Among the prominent representatives on trial, may be mentioned *Mariana, Milton, Weaver, Maquoketa, Moreman* and *Pottawattamie.* The last three, are late introductions.

Japanese plums.—These have not succeeded here, and while their usefulness for the colder sections is doubtful, yet for the milder portions they are at least worthy of trial in a limited way.

Seedlings.—A seedling plantation has been started wherein tests in this line are being conducted, and to which constant additions will be made.

Selected seed and plants of the Americana and Chicasa types have been secured from the west, both north and south.

Some very interesting seedlings have been collected through Mr. Aug. Dupuis, Village des Aulnaies, north of the city of Quebec. These are grown from pits of the Blue Damson and Orleans plums. They have been cultivated in that rigorous climate by seedling production for years. Judging by samples of fruit received last fall they are well worthy of propagation.

Through the courtesy of Mr. R. B. White, of Ottawa, who has for a number of years made a specialty of collecting hardy and promising plum seedlings, I have obtained a considerable number of specimen trees, which have succeeded well with, and are thought favourably of, by that gentleman.

CHERRIES.

It was not expected that varieties derived from the Mazzard stock would succeed in this locality, but in order to arrive at definite conclusions, a collection of the principal members of this class as well as those belonging to the Dukes and Morellos was planted in orchard. Experience thus far has justified the above opinion in regard to the Mazzards, and indeed many of the Dukes might be included in the same division as far as hardiness is concerned.

Of the Duke and Morello varieties the following catalogued varieties have come through the winters with comparatively little injury thus far:

Dyehouse, Belle Magnifique, Large Montmorency, Royal Duke, Early Richmond, Late Morello.

It is being generally admitted that as profitable market cherries—except in the extreme south—the Morello varieties are, on account of their hardiness and productiveness, growing in popularity. For this and similar sections we will have to depend mainly on them for our supply of this much appreciated fruit. There appears at present no other line in the culture of large fruit so promising in immediate and beneficial results, as will be attained by the propagation and dissemination of members of the Morello class, which have been imported by the Iowa Agricultural College. A considerable collection of these varieties were obtained, and have been on trial since 1888. With one or two exceptions they have shown every evidence of hardiness, growing uniformily with thrift and vigor. Specimens of fruit were had from 12 varieties last season giving indications of early bearing habits. The fruit in all instances was very good; in a few cases really excellent. These varieties are also included in the collection at Abbotsford, where they have fruited the past two or three years. The following list, with short descriptive notes, includes those which bore fruit on the Farm last season. The dates of ripening are given as occurring this year:—

Wragg.—This tree, which is now being distributed from the west, is an only survivor of a lot of cherry trees sent out there, which were selected from an importation made by Ellwanger & Barry from Germany some 18 or 20 years ago. The tree is of the Morello type, round-headed and vigorous. Fruit ripe this year 5th August. Large, round flattened, colour dark red, stem long, rather acid, slightly astringent, very juicy. A promising late variety.

Ostheim (of Minnesota).—Size of Kentish, dark-red, roundish obtuse, highly coloured juice, good quality; about a week earlier than Wragg; differs from the next in season and quality. Tree is open topped; a free grower.

Ostheim (of Morris).—This is a small dark-coloured cherry, round, compressed, fair quality, pit large, somewhat lacking in juciness; ripens with Wragg, about 6th August. Is not as free a grower as the last.

Lithaur Weichsel.—Small dark-red, when fully ripe almost black, roundish obtuse, flesh firm, pleasant sub-acid, pit rather large, ripe 31st July; tree close, round topped, quite hardy. Were this a little larger, on account of its earliness, it would be very valuable.

Voronesh 27.—A promising variety imported under this number from Voronesh, Russia. Fruit very large, bright red, round, flattish, flesh juicy, sub-acid, pit small, ripe 4th August; tree hardy, vigorous.

Gruner Glas.—In appearance of tree and fruit resembling the last, but later. Fruit large, bright-red, slightly more acid than last, ripe 8th August; very productive.

Bessarabian (or Russian 62).—Tree a spreading grower, twigs slender, with prominent buds; very hardy; fruit large, about same size as Wragg, round, depressed, stem long, colour, dark-red when fully ripe, good quality, ripe 5th August.

Russian 207.—Medium to large, round, flattened above, bright-red, long stem, fair quality, juicy; tree upright, one of the most vigorous growers; ripe 6th August, resembles Voronesh 27.

Vladimir.—Here again as in the case of Ostheim there seems to be two varieties under the same name. This one, imported by Prof. Budd, is a very early cherry, the earliest of all here, ripe 28th July. Fruit medium size, nearly black when ripe, roundish oblate, mild sub-acid, very pleasant, tree vigorous and hardy.

Vladimir. (Imported by Mr Gibb from Moscow).—Is distinguished by its slender twigs, and more conservative habit of growth; shows every sign of perfect hardiness. I cannot speak of the fruit. Still another Vladimir is on trial here. This was introduced by a later importation of the Abbotsford Fruit-Growers' Association. It differs entirely from the two foregoing, resembling the Mazzard family in leaf and habit of growth much more than the Morello. This one has not yet fruited.

Montmorency Ordinaire.—This is of the Morello type, but is not a late importation. It is one of the hardiest of the catalogued sorts and is worthy of more extended cultivation than it now receives. Fruit about the size of Early Richmond, dark-red, mildly sub-acid, very pleasant. Ripe, 2nd August.

Observations on the behaviour of the above selections and a number of others growing at Abbotsford on gravelly soil for several years, were made this season. They had made a most satisfactory growth and, as already stated, with one or two exceptions, had not suffered from the cold of winter. Fuller information will be published later. Due attention is being given to seedling production in this as well as the other lines of fruit culture.

RUSSIAN APRICOTS.

In answer to a letter from the editor of *American Garden* last August, asking for my experience and opinion on the behaviour and value of these fruits, the following note was written, which so nearly covers the ground that it is not considered necessary to add anything further at present:

"The Russian Apricots, as a class—and they do not appear to differ much in variety as far as tested here—seem to rank in hardiness with the Lombard plum. The trees lost several inches of young wood last winter, and also show evidence of injury to the stems. Alexis and Catherine appear to be most promising. They have good foliage and are vigorous growers. The soil and treatment depend somewhat on the stocks upon which these apricots are worked. They are doing well in many places on sandy loam, which tends to hasten maturing of the wood in the autumn.

In advance of more extended tests, it would not be safe to call them "a valuable acquisition." I do not think they will be grown to any extent in peach-growing districts, and it is questionable if they are sufficiently hardy to do well north of the peach line. They bud and graft readily on the myrobolan and American plum (*P. Americana.*) The latter, on account of its hardiness, I consider the most desirable stock. Crown grafts on this have made a growth of from two to three feet since spring, when they were set out."

II.—SMALL FRUITS.

GRAPES.

The importance of grape-growing in the Province of Ontario can hardly be overestimated. From small stations in the Niagara district there have been shipped the past season, in many instances, as much as four or five hundred tons of this delicious fruit. The season has been a profitable one in the older grape-growing districts. In Eastern Ontario and Quebec however, the reverse has been the case, many varieties failing to ripen owing to the unusually late spring, followed by the cool weather of summer and autumn.

In the Ottawa Valley it has been one of the most unfavourable seasons yet experienced, the wet and cold weather being very productiveof mildew and fungous diseases.

The vineyard of the Experimental Farm was planted in greatest part during the seasons of 1887 and 1888. Annual additions have since been made till, at the present time, there are on trial 165 varieties. The soil in which these are planted is a light sandy loam sloping, with a southern aspect. It has received yearly dressings of wood ashes till last spring, when a coat of barnyard manure was applied. Rains during the blossoming period prevented the thorough fertilization of a few varieties. Soon after the fruit began to develop downy mildew appeared, and would, doubtless, have destroyed the greater part of the crop had not preventive measures been promptly instituted. On its appearance the vines were sprayed with the fungicide known as ammoniacal copper carbonate. This was prepared by dissolving 2 ounces of copper carbonate in a quart of ammonia (20 per cent.), and diluting with water to 25 gallons. By two applications of this fungicide, and care being taken to remove and destroy all affected berries, the spread of this disease was finally checked.

In this section as well as in all portions of Quebec, Eastern and Northern Ontario, it is necessary to lay down the vines and cover with earth after pruning in the fall. I think it would be profitable for growers in districts where vines are not winter killed, but are often weakened by exposure to the vicissitudes of winter, to at least pin the canes to the ground covering with sufficient earth to hold them in this position, as well as to protect the crowns from the frost. A vine, though not actually winter killed, may be so enfeebled by a long and trying exposure, as to make but little growth the following season and mature a lessened quantity of fruit of inferior quality. This principle should always be borne in mind.

Part of the vineyard has been planted after what is known as the "French system." This is practically a renewal system, having the vines set four feet apart each way, and trained to stakes. Near cities where land is valuable, and high culture is given, this method can be practised with success. Results here the past season show that varieties grown in this way, were from five to eight days later in ripening, than the same varieties grown eight by ten feet apart, and trained to the trellis on the fan system.

As already stated there are now on trial 165 varieties. Of these 94 fruited last season; many, however, did not ripen. The weather on the whole being so unfavourable, the season can fairly be considered as a test one, in regard to the important points in grape culture—of early ripening and immunity from disease.

The following varieties ripened in the order given, beginning 2nd September and closing 29th September: *Florence, Champion, Cottage, Moore's Early, Brant, Green Mountain, Early Victor, Peabody, Lady, Janesville, Delaware, Berckman's, Gaertner, Norwood, El Dorado, Wilder, F. B. Hayes, Barry, Herbert, Worden, Lindley, Potter, Roger's* 36, *Northern Muscadine, Mary, Vergennes, Dracut Amber. Marion* was the first to colour, but the summer heat seemed insufficient to ripen it fully. This list contains the most promising varieties for northern growers.

In advance of more extended trial it would not be wise to speak positively as to the merits and desirability of many of the newer sorts.

The following did not ripen thoroughly, but are commended for trial in the more favorable grape growing districts of Ontario:—*Alma*, large white, ripens with

Concord. *Amber*, white, medium size, a few days later than Concord. *August Giant*, large red, late. *Challenge*, red, fair quality, late. *Etta*, white, medium size, season of Diana. *Grein's Golden*, large white, good quality, later than Concord, *Grein's No.* 4, large white, fine quality, later than Concord. *Imperial*, pinkish white, fine quality, season of Isabella. *Oriental*, resembles Catawba. *Roger's No.* 2, very large black, season of Concord. *Roger's No.* 30, red, large, fine quality, later than Concord. *Transparent*, large white, juicy, late. *Wilding*, later than Concord.

Cuttings were taken from those giving evidence of probable future value, which will be planted next spring with a view to testing them in various parts of the Dominion—should such a course be deemed advisable.

STRAWBERRIES.

The winter of 1889–'90, was unusually severe on small fruits, strawberries especially, owing to the repeated freezing and thawing and consequent accumulation of ice in low places, which characterized the winter. On examination after the disappearance of the snow in the spring, it was found that roughly estimated an average loss of 50 per cent. of plants, in the strawberry plantation had been sustained. The relative loss of the different varieties varied widely, as will be hereafter noted, and in this respect the experience of the season is very instructive. The injury, too, appeared to be inproportion to the vigor of the plant when it went into winter quarters as indicated by the number of runners made the preceding autumn. Again, the older plants with weakened vitality, suffered more than the younger plants possessing better roots and greater vigor. This is an important argument in favour of the frequent renewal of strawberry beds. With good cultivation, not more than two full crops should be taken from the same plantation, and many growers advocate a change after each full crop has been picked. This rule, however, is not generally practised outside of specialists in the line.

The following selection based upon the experience of the past season, has been made from those varieties reported on by Mr. Hilborn in Bulletin 5, and have been planted in a new trial plot. The planting was done in August, and will give interesting data as to the relative advantages of fall and spring planting :—

Bubach,
Black Defiance,
Black Giant,
Belmont,
Crescent,
Capt. Jack,
Cohansick,
Crimson Cluster,
Daisy,
Early Canada,
Eureka,
Garibaldi,,
Green Prolific,
Gandy,
Haverland,
Hoffman Seedling,
Itasca,
Jersey Queen,
Jas. Vick,
John Little,
King of the North,
Logan,
Manchester,
Mrs. Cleveland,
Miller's Seedling, No. 2,
Miller's Seedling, H. 11,
New Dominion,
Norman,
No. 1001,
Nicanor,
Old Ironclad,
Osceola, (Mitchell's early)
Photo,
Parker Earle,
Prince of Berries,
Pine Apple,
Pearl,
Ruby,
Royal Hautbois,
Sharpless,
Seneca Queen,
Stayman No. 1,
Shirts,
Surprise,
Turner's Beauty,
Woodruff,
Windsor Chief,
Wonderful,
Warfield, No. 2,
Woodhouse.

The following varieties, most of them not yet introduced, were received and planted last August:—

Alabama,	Muskingum,
Beder Wood,	Nunan Charlston,
Bessie,	Parker Earle,
Ivanhoe,	Regina,
Martha,	Viola,
Middlefield,	Woolverton,
Williams,	Yale.

Showing per cent. of injury by the winter to the different varieties:—

Under 10 *per cent.*

New Dominion, Downer's Prolific, Crystal City, Excelsior, Pearl, Cohansick, War Field No. 2, No. 1001, Haverland.

10 *to* 20 *per cent.*

Grand Duke, Crawford, Miller's Seedling No. 2, John Little, Mrs. Cleveland, Bordelaise, Crimson Cluster, Logan.

20 *to* 30 *per cent.*

Seneca Queen, Nicanor, Legal Tender, Bubach.

30 *to* 40 *per cent.*

Gandy, Hampden, Mammoth.

40 *to* 50 *per cent.*

Crescent, Capt. Jack, Covill, Jessie, Jas. Vick, Amateur, Garretson, Golden Defiance, Windsor Chief, Fairy, Snowflake, Daisy, Itasca, Monmouth.

50 *to* 60 *per cent.*

Old Ironclad, Early Canada, Mount Vernon, Photo, Jewell, Ontario, Royal Hautbois, Ruby, King of the North.

60 *to* 70 *per cent.*

Daniel Boone, Jumbo, Woodruff, Cumberland, Kentucky, Summit, Pine Apple, Bancroft, Champion.

70 *to* 80 *per cent.*

May King, Emerald, Chas. Downing, Norman, Sterling, Belmont, Wilson (selected), Ohio, Shirts, Jersey Queen, Green Prolific, Lida, Eureka, Turner's Beauty, Surprise.

80 *to* 90 *per cent.*

Wilson, Sharpless, Manchester, Mary Fletcher, Mrs. Garfield, Black Giant, Parry, Hoffman's Seedling, Garibaldi, Bright Ida, Henderson, Miller's Seedling H. 11, Moore's Prolific, Black Defiance.

90 *to* 100 *per cent.*

Maggie, Cornelia, Prince of Berries, Atlantic, Sunapee, Triomphe de Gand, Boyden's No. 30, Anna Forest, Montreuil, Connecticut Queen.

Among the older varieties the following are the most reliable for general planting in this locality, given in order of ripening:—*Crescent* (P), *Wilson* (B), *Capt. Jack* (B), *Daniel Boone* (P), *Sharpless* (B), *Manchester* (P) and on heavy soil, *New Dominion* (B).

Of the newer varieties which can be safely recommended for trial in order of ripening are:—*Michel's Early* (B) (*Osceola*), *Haverland* (P), *Miami* (P), *Bubach* (P), *Crawford* (P), *Logan* (B), *Pearl* (B), *Cloud* (P), *Seneca Queen* (B) *Enhance* (B), *Eureka* (P), *Gandy* (B).

The following varieties do not seem worthy of extended cultivation and can be profitably omitted except possibly in such localities as they seem specially adapted:—*Pocahontas, Cohansie, Pine Apple, Surprise, Crimson Cluster, Legal Tender, Bordelaise, Royal Hautbois, Sunapee, Early Canada, Hathaway, No. 5; Bancroft, Cornelia, Ray's Prolific,, Prince of Berries and Nicanor.*

SEEDLING STRAWBERRIES.

While with our already extended list of varieties it hardly seems wise to add to it by seedling production, yet as time goes on the standard of excellence will be constantly rising and there will be always room for a berry with well marked characteristics. We cannot expect to find in a single berry all the desirable points of excellence. It is, therefore our aim in this work to develop strong growing varieties having one or more distinguishing qualities, which shall be superlative in these particulars, whether this be in point of earliness, lateness, hardiness, vigor, productiveness, size or quality. This should be the aim of every grower. Our strawberry lists are already crowded with varieties, many of which are almost indistinguishable, and without any prominent characteristics.

Prof.Green, Horticulturist of Ohio Experiment Station, says in a recent bulletin:—"It will be found that varieties which have failed to become favorites, either have no pronounced characteristics,or have been wanting in qualities required to fit them for general cultivation. It is commonly believed that a variety may do well in one locality and yet fail in another, and *vice versa.* There is some truth in this and also much error. It is true that varieties vary more or less on different soils, but it is also true that the most variable sorts are the least valuable. In fact if a variety varies greatly on different soils, it may be set down as unreliable, sooner or later it will fail even where it seems most at home. To believe that because a variety exhibits a defect in one locality it may not in another, is almost always a fatal error. If a variety lacks vigor, is susceptible to disease, is tender when in bloom, or is unproductive, there is no ground for hope that even under favourable conditions it will become generally popular, and remain so. Some such have been favorites in certain localities for a time, but sooner or later have been discarded. To hope to find varieties suited to certain sections only is a delusion. The only varieties that stand the test in particular sections are those that succeed over wide areas."

Out of 650 seedlings fruited the past season 40 were selected and replanted for further trial. The seed from which these plants were grown was selected from vigorous individuals exhibiting marked characteristics in one or more particulars, such as earliness or lateness, firmness and fine quality. Others were grown from the earliest berries of the season's crop and still others from the latest, of the same variety. It cannot be said that there was a corresponding general or marked disposition on the part of the offspring of either of these classes to imitate the peculiarities of their parents, although in a few cases the variations were striking. All such were carefully preserved, for the purpose of carrying on the work of selection. Many were of good size and fine quality but some lacked firmness, or were defective in foliage.

RASPBERRIES.

Comparatively few varieties came through the winter entirely uninjured, and all the tender sorts suffered more or less severely. With a view to test the advantage as well as cost of protecting during winter by laying down and covering with sufficient earth to hold them in position, half of the plants of each variety were pruned and treated in this manner. The remaining half were unpruned and allowed to stand without further protection. The relative returns from the two sections will be carefully noted next year. For convenience raspberries may be readily divided into two classes according to their methods of propagation. 1st, Upright varieties, increasing by suckers from the roots. This includes mainly our red and yellow sorts. 2nd. Drooping canes, rooting from the tips, commonly called "tip varieties." These with one or two exceptions are all black or purple in colour. Of the first class considering the red ones only; 21 varieties fruited the past season.

The following are the most reliable, for market purposes, of the older kinds in order of ripening: *Hansel, Turner, Marlboro, Cuthbert.* For home use, with winter protection and good culture, the following is a desirable list: *Turner, Herstine, Clark, Cuthbert.*

Among the yellow caps, *Brinckle's Orange* is unsurpassed in quality, but is not a profitable market berry and needs protection, except in the milder portions of the country.

Golden Queen. A beautiful yellow berry, is earlier than Cuthbert; like it a strong grower, equal to it in quality and a good bearer. This should be a profitable market berry, and is also well adapted for home use.

Among the later introductions, the following seem specially worthy of mention:—

Herstine. Large, bright red, quality good, rather soft, productive, season late, needs winter protection.

Heebner. Large, dark red, high flavoured; has the same fault as the last, lacking firmness, a good bearer, fairly vigorous, might be valuable for near market.

Thompson's Early Prolific.—Ripened with Hansel last season. The fruit is larger and finer and gives promise of a longer picking season. Plant fairly vigorous and productive.

Royal Church.—This has not been sufficiently tested here to speak positively, but from past behaviour it would seem to be a promising medium early variety, of good size and quality, but not firm enough for distant shipment.

CLASS II—TIP VARIETIES.

Few additions have been made to the general list of black caps, most of which are under cultivation for a number of years. From the twenty varieties which fruited last year the following are noted as the most reliable:

Souhegan, Tyler and *Doolittle* are practically identical, and are the earliest to ripen. One of these should be included in each planter's list, to connect the strawberry and raspberry season.

Hilborn.—A medium early sort, of good quality and a heavy bearer. This is an excellent berry for near market, but is specially valuable for amateur growers; it is also valued for canning.

Shaffer.—Sometimes known as Shaffer's Colossal. Is a fine strong grower, an immense bearer of large purple berries, which are rich and juicy, putting it at the head of the list as a canning berry. Its dull colour and lack of firmness prevent it taking a high place as a market variety, but where well known it is highly appreciated.

Gregg.—Completes the season. It is also vigorous, productive, and ships well. It does not, however, rank as high in quality as Hilborn, but is indispensable in the list of the market gardener.

Among those not fully tested here may be mentioned *Palmer.* If it succeeds, according to present indications, it will supersede Tyler or Souhegan, which is its season of ripening.

Muskingum.—Is of the Shaffer type, but does not seem to be any improvement; perhaps a trifle firmer. With present experience positive statements cannot be made.

Earhart.—Will be of value in the milder portions of Ontario where the season will admit of a second crop, which, under favourable conditions, is usually borne before growth is checked by frost.

Attention is called to the report (inserted at the close of mine) of a visiting committee on a collection of seedling raspberries, black and red—as the notes have been made by experienced growers of small fruit.

BLACKBERRIES.

The cultivation of the blackberry in Canada has not received the attention which the quality and excellence of this fruit demands. Again the varieties which were first introduced, from lack of hardiness and without winter protection have not succeeded outside of peach-growing districts. This, coupled with the great abundance in some districts of the native species (*Rubus Canadensis*) has hindered the introduction and cultivation of varieties of more recent origin and greater hardiness. They should be planted in deep, rich soil, and liberally mulched in dry seasons; with a careful selection of varieties and good cultivation, paying crops will be obtained. In the colder fruit-growing districts the practice of laying down the canes in the fall is generally adopted with profitable results. The canes should be pinched back occasionally during the growing season to induce a stocky growth and aid the process of ripening the wood.

Of the 20 sorts on trial—unprotected last winter—the following were badly injured: *Gainor, Tecumseh, Bonanza, Early Cluster, Wilson, Jr., Early Harvest, Crystal White,* Kittatiny.

The following suffered, but in a less degree than the last named:—*Dorchester, Taylor's Prolific, Wachusett, Wilson's Early, Minnewaski, Erie, Lucretia Dewberry.*

The following came through with slight injury: *Snyder, Agawam, Stone's Hardy, Western Triumph.*

For the colder sections this last selection will be generally found most reliable, ripening in the order named. It is difficult to give a list of the hardier varieties covering the whole season, as these nearly all ripen early. Agawam and Snyder, are close competitors in point of earliness, hardiness and productiveness, but the former has the advantage of greater size and better quality. A good succession for the milder districts is *Early Harvest, Agawam, Wilson, Minnewaski.*

The *Lucretia Dewberry,* a trailing form of the blackberry, has not been productive on light soil, nor has it sustained its reputation for hardiness. From present experience it cannot be recommended for other than garden culture.

CURRANTS.

Twenty-two varieties are on trial, made up of black, red and white sorts. The season was a favorable one, and a fair crop was gathered from all varieties, although they have not been planted long enough to give full returns yet.

The currant worm (*Nematus ventricosus*) was very troublesome, three broods appearing. The first was treated effectually with Paris green, the second and third when the fruit was larger were destroyed with white hellebore. This was applied very quickly with the ordinary orchard barrel pump. As a rule the grower does not apply the insecticide soon enough to save the foliage, and growers forget, too, that defoliation this year means a short crop next; hence the importance of prompt action as soon as the presence of the larvæ is detected.

Nearly all varieties of the Red and White Currant suffered from loss of foliage in August, probably due to fungous troubles: *White Dutch, Victoria, Raby Castle* and *Prince Albert* were partially free from injury of this kind.

The following of the red varieties have been most satisfactory in point of vigor and productiveness, and ripen in the order given, though there is very little difference between the earliest and latest:—*Victoria, Fay, Red Dutch, Versaillaise, Prince Albert.* Among the newer introductions, *Wilder,* and *Moore's Ruby,* seem promising. The former is large and of good quality; the latter is of good quality, but somewhat lacking in vigor.

There has been practically no change in the list of White Currants, *White Grape* being rather larger and more productive than *White Dutch* which is better suited for market purposes. *White Dutch* is the richest and finest flavored of all the currants.

BLACK CURRANTS.

Lee, though rather small in bunch, was most satisfactory of those tried this season. It is also the earliest to ripen.

There appears to be little difference between *Black Naples* and *Champion. Prince of Wales*, a later introduction, seems worthy of extended trial, though its foliage has been somewhat defective.

Black English resembles Black Naples in habit of growth, quality and size of fruit, but is later.

Crandall is a variation of the Missouri flowering currant (*Ribes aureum*) which has been extensively advertised and disseminated. Its strong points seem to be vigor of plant and productiveness; its weak points, unevenness in size and time of ripening of fruit, and poor quality. As a crossing stock, it will probably be of value.

SEEDLING CURRANTS.

The large collection of seedlings brought here by Prof. Saunders from London, made a fine show of fruit and attracted much attention while in bearing. There are about 150 seedlings in the collection. A selection of 25 of the most promising was made, based upon the notes collected by Mr. Hilborn, supplemented by the experience of last year. Cuttings were taken from those specially noted, and were set out early in August. They were well rooted before cold weather, and will make suitable plants for starting trial plantations on the branch Farms next spring. It may be added that some of these thought well of by Mr. Hilborn were propagated last year, and have already been distributed.

GOOSEBERRIES.

Owing to the first planting of gooseberries having to be removed from their original location, on account of unsuitable soil, sufficient time has not elapsed since in which to arrive at any definite opinions regarding the value of the different varieties in this section. Last season was a favorable one, all varieties making a fair growth, though very little fruit was borne. As noted previously the currant worm was specially active; this fruit receiving the same attention with Paris green and white hellebore very little injury was sustained.

A large number of the European varieties are on trial, but owing to unsuitable soil, unfavorable seasons and their natural tendency to be affected with leaf mildew, they have not yet given evidence of future usefulness. They will hardly prove useful except in favored locations, and with special treatment.

Among the newer varieties which have fruited here and elsewhere are *Pearl*, a seedling originated by Prof. Saunders, specially to be commended as an immense bearer and comparatively free from mildew. *Smith's Improved*, with high culture and careful pruning, will be generally satisfactory; it bears well, the fruit is large and of good quality.

III.—VEGETABLES.

The constantly and rapidly increasing number of varieties in all classes of vegetables, including many worthless new ones and many old ones re-named, renders the task of making a satisfactory selection for home use quite a formidable one. Very often a satisfactory selection is not arrived at till after considerable expenditure of time and money has taken place in testing the many "best" kinds.

It will be a feature of the work of this branch to make each year in certain lines such tests of varieties (1) as will tend to eliminate duplicates; (2) give experience upon which to recommend those sorts which have succeeded best here; (3) adding such hints on the methods of cultivation as will be deemed useful to the gardening public It is beyond all question true that farmers, as a rule, do not grow in sufficient quantity and variety these healthful products.

On account of press of other work consequent upon the inaugural duties of a new position, the experiments with vegetables were not as full and complete as I hope they will be in future.

The soil in which the following varieties were grown was not the ideal soil in the market gardener's opinion, being a light sandy loam, thought by many to be of too light a character to give good results in testing vegetables. A moderate dressing of barn-yard manure ploughed in, and a subsequent top dressing of ashes, gave most satisfactory results with all the vegetables on trial.

CABBAGE.

Of this vegetable there were fifty varieties on trial last season. As the test was a comparative, one the seed of all the varieties was sown in boxes in the propagating house on the same date, 14th March; after being twice transplanted they were set out 19th May. Observations were made on the following points, besides records of seed-sowing, appearance above ground, transplanting, and setting out, viz.: Date of heading: lighest head (in lbs.); heaviest head; average weight of head; number of immatured heads; also notes on form and solidity.

The subjoined tabulated statement gives the period of heading, and average weight of those varieties, which have been most satisfactory last season. Set out 19th May.

Variety.	Heading July.	Heading August.	Average Weight. Lbs.	Ozs.	Remarks.
Very Early.					
Early Jersey Wakefield.......	20	....	2	14	The standard early sort.
Express	22	....	3	2	Is usually earlier than Wakefield.
Large Jersey Wakefield........	22	....	3	13	An improvement on E. J. Wakefield.
Early French Oxheart..........	22	....	4	5	One of the best old varieties.
Early Dwarf York...........	22	....	2	9	Heads small; firm, sure header.
Early York..................	29	....	3	4	Heads evenly and well.
Medium Early.					
Chases Excelsior..............	29	....	8	8	Good sized solid, flat heads.
Early Summer................	....	1	7	12	Good market variety.
Early Sugar-loaf..............	....	1	6	2	Tall-growing, conical.
Fottler's Improved Brunswick.	....	1	8	14	Large, flat; good market variety.
Filderkraut..................	....	8	8	0	Tall, pyramidal, solid.
Cannon Ball..................	....	12	8	10	Sure header; round, good variety.
Market Gardeners............	....	12	8	8	Large. firm; bursts soon after maturing.
Succession..................	....	14	7	10	A new variety; not well selected.
P. W. & Co. Excl. Flat Dutch.	....	14	12	0	One of the best market sorts.
Marble Head Drumhead.......	....	14	10	9	Rots when planted early.
Late Varieties.					
Luxemburg...................	....	18	6	7	One of the best late varieties.
Large Early Schweinfurt.....	....	22	14	7	Uniformly large, firm, market.
Bridgeport Drumhead.........	....	25	7	6	Much resembles next one.
Sel. Large Flat Dutch........	....	26	8	10	One of the standards.
Quintal Drumhead............	....	26	6	11	Head flat, rather soft.
Premium Flat Dutch..........	....	28	5	12	A selected strain of the old flat Dutch.

The following varieties will make a satisfactory succession for home use:—

Early: Express, Large Jersey Wakefield. *Medium Early:* Fottler's Improved Brunswick, Cannon Ball. *Late:* Large Early Schweinfurt, Select Large Flat Dutch.

It is not thought advisable at this time, to give a list for market gardening purposes, though it might not differ materially from the above.

CELERY.

It is a matter of regret that this wholesome vegetable is not more generally cultivated by farmers. Indeed, it is difficult in many districts in the Province of Quebec to find it in gardens, except in or near the larger towns. The fact of the seed germinating slowly, and the extended period of time between seed-sowing and setting out the plants, probably deters many from growing it—causing them to look upon it as a lengthy operation. The usefulness of the product, however, far outweighs any trouble incurred in raising it. Sow the seed early, in rich ground. Set out in July, choosing moist, rich soil (trenching is not necessary). Bank up part of those set out for early use about middle of September, being careful that the soil is kept from between the leaves: the remainder towards the end of the month.

The following selection of the thirty varieties tested the past season were most satisfactory. Field notes are appended:—

Paris Golden Yellow (Steele Bros.)—A dwarf variety, though resembling Golden Self-Blanching was earlier. Heart large for an early sort; very crisp and fine flavored.

White Walnut (Henderson.)—One of the larger-growing kinds; medium early; crisp; very fine flavour. A good market variety.

Half Dwarf (Henderson.)—Was fit for table soon after White Walnut. Large hearts; blanches well; crisp; good flavour. As a medium early variety it was not excelled.

White Plume.—Introduced by the late Peter Henderson in 1884. It has become exceedingly popular, and is now more widely grown than any other variety. It is advocated occasionally by seedsmen that with this as well as other partial self-blanching kinds earthing up is unnecessary; but the improvement in quality will always repay the grower for the extra labour.

Sandringham.—Was one of the most satisfactory among the later kinds. It should be profitable for market. The Dwarf variety of this does not seem to be as yet well selected.

Giant Golden Heart (Vaughan.)—Very large; late, but somewhat lacking in flavor.

Red Giant Solid.—Probably the best red celery for market purposes; flavour good; a little inclined to be stringy.

CORN—SWEET.

Like other plants of this class the early-ripening varieties of corn were much retarded by the cool weather of late spring and early summer. Thirty-three sorts were tested, planted 26th May in small plots containing twenty-four hills of each kind. Notes were taken on the following points, viz.:—Date of planting; time of blossoming; ready for table; size of ear; productiveness; smuttiness; height of stalk; when ripe.

Early Varieties.

Northern Pedigree (Steele Bros.)—Planted 26th May; ready for table use 10th August, 75 days from planting; sweet; ear medium to small; well filled; eight-rowed; a dwarf variety, about 4 feet high; productive, and free from smut.

Mitchell's Extra Early (Pearce).—As grown here, a small white ten-rowed flint; quite sweet, and pleasant in flavor; cob small; planted 26th May; ready for table 11th August.

Burbank's Early Maine (Vaughan).—An eight-rowed sweet corn, with roundish kernel; very small cob; ready for table 10th August.

Early Cory and *Early Adams.*—Old and well tried sorts; were ready for pulling 14th August. Where one is grown the other may be omitted.

Second Early.

Among these may be mentioned—

Early Minnesota.—Ear medium in size ; usually well filled ; ready for table 24th August ; sweet; good flavor.

Perry's Hybrid (Henderson).—Ear medium to large ; with us twelve-rowed ; well filled ; large, sweet kernel ; grows to a height of 6 feet ; fit for use 24th August.

Late Varieties.

Roslyn Hybrid (Henderson).—Ear large ; well filled ; in flavor one of the best tall-growing and productive ; ready for use 1st September.

Evergreen (Livingston.)—Sweet ; ear large ; well filled ; one of the most productive sorts tried here ; table 4th September.

Stowell's Evergreen (Henderson).—Sweet, medium to large ; one of the standard sorts of the West, probably one of the best for late market. Ready for use 10th September.

Black Mexican.—Another old and generally satisfactory variety ; ear medium ; always well filled ; sweet ; good.

Mammoth Sugar.—For very late use ; this has some value, but the ears and kernels are generally not well filled.

LETTUCE.

The collection of this vegetable consisted of forty-four kinds. It was intended to make a comparative test of varieties ; also to compare the effect of transplanting and sowing, as shown by the size and duration of the heads. To determine these points two sowings of each kind were made on the 2nd of May. Lot No. 1 was sown in a cold frame, and when of proper size, 18 plants were transplanted to the field plots. Those of lot No. 2 were sown directly in drills, where they were to remain without further removal, after being thinned out. The experiment promised interesting results, but was invalidated by the persistent attacks of cut-worms, chiefly on those sown in drills.

The main points noted were date of maturity; size of head ; quality ; length of period of maturity—in other words, the period during which the variety was fit for table use before the seed stalks appeared. No experiments were made in forcing lettuce, so that the remarks following on the varieties apply particularly to out door culture:—

Early Curled Simpson (Henderson).—This was very satisfactory in regard to size of head and quality ; retained its crispness well ; early.

Tomhannock (Vaughan).—Was ready for use a few days after the above ; equally satisfactory in other respects.

Toronto Gem (Steele Bros.)—Follows the last very closely in time of maturing. Fair size ; crisp ; and remarkably free from bitterness.

New York (Henderson).—One of the very largest summer varieties of the solid heading kind ; good flavor, remaining a long time in condition for table use.

The *Cos Lettuce* is quite a striking variation from the ordinary form, heads elongated, conical and large ; often completely blanched. This is a favourite among European gardeners, but it is said to have a tendency to run to seed.

Paris White Cos—Showed no greater inclination to run to seed than varieties of the common form ; very strong grower. To obtain the best results the outer leaves should be drawn in and the whole tied up to ensure blanching.

Among others which showed many points of excellence may be mentioned *Black-seeded Simpson, Boston Curled, Oak-leaved* and *Deacon.*

PEAS.

In the test of peas, was included 56 varieties. They were planted on the 2nd of May in double rows, 3 inches apart and 32 feet long. They germinated evenly ; in no case was there observed a difference of more than two days : neither trellises nor stakes were used, which probably had the effect of diminishing the yield of the taller growing varieties. Careful record was taken of the time of blooming, podding; first picking; last picking; total yield; character; quality of peas and height of vine. These tests will be repeated next year as with other vegetables tested, when it is hoped more complete and accurate imformation can be published. With the experience of the season, the following are among the most reliable :—

Early.

Laxton's Earliest of All (Vaughan).—Half dwarf; smooth; about 2 feet in height, bearing short, thick pods, well filled; gave the highest yield of the very early kinds; picked 30th June.

Carter's Lightning (Pearce).—Same season as above; half dwarf; is not a heavy bearer, but gives nearly the whole crop at one picking.

Dan'l O'Rourke (Henderson).—Tall-growing; 36 inches and over; one of the earliest of this class; picked 1st July.

Philadelphia Extra Early.—Tall-growing; 36 inches; smooth. This may be omitted when the last is in cultivation.

Alaska (Pearce).—An old variety, too well and favourably known to need comment; very productive.

American Wonder (Henderson).—One of the best dwarf early-wrinkled sorts; unequalled in its class for home use; pods very large; not very productive; picked 3rd July.

First of All (Henderson).—Half dwarf; smooth; gave the largest yield of any of the early varieties on trial the past season; picking beginning 4th July; pods medium size; well filled.

Second Early.

Those giving most satisfactory results of this season were *Market Garden, Stratagem, Advancer* and *Blue Mohawk.*

Among *late* varieties may be mentioned *American Champion,* very tall-growing and productive; *Sanders' Marrow,* and *Hairs Dwarf Mammoth.*

RADISHES.

The great number of varieties of this vegetable now offered by the trade is quite puzzling to the amateur grower when selecting his supply of seed for spring planting. Again, the number of duplicates add to the confusion.

The value of a radish very largely depends: 1. On its earliness; 2. Its quality, as denoted by juice, crispness, and freedom from pungency; and 3. The length of time it retains this pleasant crispness.

Forty-four varieties were tested last season, particular attention being given to the points above noted.

The presence in great numbers of what is known as the radish maggot, was no doubt due in a large measure to a heavy coat of manure with which the soil was treated, and which was ploughed under previous to sowing.

Early Varieties.

Sutton's Rosy Gem (Pearce & Co.)—As noted by Mr. Hilborn in the report of last year, this was again the best early turnip shaped radish of its class, and remained in eating condition longer than any of the early varieties. Owing to the unfavourable weather for rapid growth in spring, vegetables of all kinds were much slower in maturing than is the case generally. This radish was ready for the table 38 days after sowing the seed and 4 days ahead of any other variety.

Early Fireball (Livingston).—A little later than the above, round; firm, crisp and tender.

Long Scarlet Short Top (Vaughan).—Proved to be one of the most satisfactory varieties of this class; ready for table in 43 days from sowing seed.

French Breakfast (Henderson).—One of the oldest, and still one of the best for forcing or early gardens; oblong scarlet; meduim in size, with white tips; flesh mild, white and firm.

Red Rocket (Henderson).—Olive-shaped, scarlet; with small root; firm and mild, but soon becomes spongy. One of the best for forcing.

Late Varieties.

Long White Winter (Vaughan).—Large, crisp, juicy; one of the best white.

Long White Vienna, or Lady Finger (Pearce).—A summer radish, vigorous grower; roots long; flesh pure white; crisp; firm, but is liable soon to become tough and pungent.

Rose China (Pearce).—Skin pinkish; flesh white; is probably the best winter variety.

Long Black Spanish.—An old and well tried sort; still gives good satisfaction.

Among other varieties which appear to possess desirable qualities, the following may be mentioned: *Wood's Early Frame, Olive-shape Scarlet, Early White Turnip* and *Long Purple.*

TOMATOES.

There is a common impression existing in the minds of many truck gardeners that to get the best results tomatoes should be planted in poor soil. This may be partially true where earliness alone is desired. Numerous carefully conducted experiments, notably those on the Experimental grounds of Cornell University, clearly disprove the fallacy of the above as a general statement. In summing up conclusions at the close of the season, Prof. Bailey says: "Liberal and even heavy manuring during the present season gave great increase in yield over no fertilizing, although the common notion is to the contrary. Heavy manuring does not appear, therefore, to produce vine at the expense of fruit."

Among the important points to be remembered in successful tomato culture, the following are noted: 1. Select seed from the best fruits of the most vigorous plants; 2. Sow early, eight to ten weeks before planting; 3. "Handle" frequently—transplant two or three times before setting out—by which means strong, stocky plants are obtained; 4. Transplant to the open as early as possible, into warm, rich well drained soil.

A test of forty varieties has been made here during the past season, and it is intended that the work shall be carried on each year, especially those lines bearing on the selection and production of new varieties. Notes on varieties on trial this year have been made on the date of blossoming; first ripe fruit; quality and character of fruit; and average yield per plant in pounds.

The following varieties, from experience of the past season, appear to be the most profitable for general cultivation, given in order of ripening:—

Chemin Market.—A new variety, introduced by Vaughan, of Chicago. Medium sized; round; somewhat cornered and elongated; deep red; cells well filled; and walls thick; a good shipper; one of the best early sorts

Ingnotum.—Originated with Prof. Bailey at the Michigan Experimental Station. Large; round; regular; bright red, with a large solid core; one of the best table varieties, though it has not kept as well after picking as some other kinds.

Favorite (Livingston).—One of the oldest, most generally cultivated and one of the best. Coming in early, it continues fruiting for a long season; a good market variety.

Potato Leaf.—Of the same type as Mikado and Table Queen. Large; smooth; somewhat irregular; dull pink in colour; very solid, consequently a good shipper; very productive.

Mikado.—Introduced by Henderson, of New York, in 1886. Has rapidly come to the front as a market variety. Large to very large; smooth and almost regular; purplish pink; the color somewhat detracts from its appearance; very desirable.

Optimus (Henderson).—Medium in size; smooth; regular; dark red; productive; a good late variety.

Golden Queen (Livingston).—This, as its name indicates, is yellow, and very attractive. Large, even, and regular in form; very productive. This gave the best results among the yellow varieties tested.

Many of the newer varieties give evidence of possessing points of merit which will place them on a par with most of those named above, but in advance of further tests, and considering that the present list is a very satisfactory one, descriptions are in the meantime withheld.

IV.—FORESTRY—FREE DISTRIBUTION.

The importance of this branch of horticulture is becoming more appreciated each year by the settlers of Manitoba and the North-West. This is being emphasized in a striking manner in those localities in which fruit-growing has been attempted, no matter on how limited a scale the beginning may be. The first requirement in the prairie region of the North-West is a shelter belt, whether a small fruit or vegetable garden is desired. It is the settler only, who can fully appreciate the benefit of wind-breaks for the protection of his home and his stock yards.

With a view to encourage tree planting on the plains, and gain information in regard to the adaptability of different varieties of forest trees to the requirements of the North-West, under direction of the Honourable Minister of Agriculture a distribution of 100,000 seedling forest trees from 10 to 15 inches in height, was made through the mails. During April of last year 1,000 packages, containing 100 seedlings each, made up in varying numbers of 17 varieties, were sent to applicants who had received notification of the intended distribution through their local journals. About 1,600 applications were received in excess of the number provided for, showing that to this line of experiment was accorded the hearty approval of the settlers of Manitoba and the North-West.

In sending out these trees due care has been taken to distribute them over as wide an area as possible, so that no part of the North-West might be overlooked.

In Manitoba 98 post offices received 591 packages of trees; North-West Territories, 92 post offices received 389 packages of trees. Total—190 post offices; 980 packages sent out.

A few varieties running out towards the end of the distribution, the remaining parcels were completed with small fruits, and are noted in that connection.

The following list gives the names of varieties and the number of each sent out, and was adhered to as closely as practicable, but in a few cases changes were necessarily made:—

10 White ash.	5 Russian mulberry.
10 Green ash.	5 Cottonwood.
25 Box elder.	3 Linden.
5 Soft maple.	1 Black wild cherry.
2 Hard maple.	1 Ky. coffee tree.
20 White elm.	1 Red cedar.
2 Honey locust.	1 Russian olive.
5 Black walnut.	2 Butternut.
2 Black locust.	

To each variety was attached a wooden label, with the name plainly printed upon it. The packing was done in a careful and expeditious manner, using sphagnum moss to preserve the necessary moisture, and covering with two sheets of paper—one oiled and the other the common manilla wrapping material. The trees arrived in good condition, though many were on the road from ten to fourteen days. Two parcels were returned after an absence of seven weeks, the parties to whom they were addressed having removed. These trees were then placed in the most favourable condition for growth, with the object of finding out how many still lived after such hard usage. In one instance 53 per cent. recovered and made some growth; in the other 58 per cent. gave evidence of life, by throwing out new shoots and rootlets.

With each consignment the following circular of instructions was mailed:

DOMINION OF CANADA,
DEPARTMENT OF AGRICULTURE,
CENTRAL EXPERIMENTAL FARM,
OTTAWA, April, 1890.

DEAR SIR,—A package containing one hundred *forest tree seedlings* has been mailed to you this day, and your attention is specially called to the following instructions:—

When the trees are received, unpack at once and wet the roots. If unable to plant immediately, store them in a cool cellar, or heel them in out of doors, covering them completely with moist earth. *Situation.*—When selecting a site for planting, if possible choose a loamy and friable soil on a northern slope. A piece that has been summer-fallowed is preferable. Avoid southern exposures, as trees in such situations are liable to be injured by alternate freezing and thawing in the spring and by the hot winds in summer. *Preparation of soil.*—Work the ground from 12 to 15 inches deep and pulverise thoroughly; mark out rows 4 feet apart, running north and south. *Planting.*—Cut back to the living wood any tops that may be withered or otherwise injured. Do not expose the roots to the sun or wind for a minute, as the tender seedlings are quickly injured by such exposure. A good plan is to carry the seedlings to the field in a pail of water, from which they are planted. Set deep, 4 feet apart each way, putting the *box elders* and *cottonwoods* in the. outside rows. If the soil is dry, pour water in the holes when half filled. Press the earth firmly about the roots in all cases, and leave the tree in a slight basin, with the top soil loosely laid on; it shoul d be kept in this loosecondition by frequent stirrings during the growing season. Where practicable plant corn in the interspaces of the north and south rows, and leave the stalks standing over winter. The corn will serve as a summer shade and assist in collecting snow through the winter. Cultivate at least once a week during the growing season; afterwards, sufficiently often to keep the weeds down. This treatment should be continued annually until the trees are large enough to shade the ground. Mulch heavily each year in the fall with straw, manure or prairie hay, which is removed in spring when cultivation begins.

You will be expected to take such notes during the growing period as will unable you to make a report at the close of the season on the behaviour of each variety, giving soil and exposure. Reports will be expected, whether favourable or unfavourable.

Yours truly,
JOHN CRAIG,
Horticulturist.

WM. SAUNDERS, *Director.*

This line of experimental work has been so well received and has met with such hearty support from those most concerned, that instructions have been given by the Minister of Agriculture to make another distribution next spring, sending out double the number distributed last year, and making such changes in regard to varieties as experience may warrant.

The work of testing larger sized forest trees on the North-Western plains was also continued. There was sent to twenty-five of the experimental gardens belonging to Canadian Pacific Railway a bundle of 125 trees of the hardiest sorts from 4 to 6 feet in height. These were distributed along the line from Moose Jaw to the Rocky Mountains. Among the Indian agencies there were also distributed about 3,000 trees of the same sizes and varieties. The following are the agencies to which trees were sent:—

Assiniboine,	Battleford,
Battle River,	Birtle,
Blackfoot,	Blood Reservation,
Piegan,	Crooked Lakes,
Edmonton,	Fort Pelly,
File Hills,	Moose Mountain,
Muscowpetung Reservation,	Onion Lake,
Touchwood Hills,	Sarcee Reservation,
Stony Reservation,	Saddle Lake,
Duck Lake,	Carlton.

By request of Fred. White, Esq., Comptroller of the North-West Mounted Police, about 3,500 trees of the same size as those sent to the Indian agencies and Canadian Pacific Railway gardens were distributed to the officers commanding at the following posts: Regina, Maple Creek, Medicine Hat, Lethbridge, Macleod, Calgary, Fort Saskatchewan, Battleford and Prince Albert. The results, showing the relative success of these trees as compared with seedlings raised *in the districts surrounding the above named places*, and those planted as yearlings cannot fail to prove instructive and useful. The subjoined list gives the varieties used in this distribution.

Deciduous Trees.

White ash.	Fraxinus viridis.
Green ash.	Fraxinus Americana.
European white ash.	Fraxinus excelsior.
American elm.	Ulmus Americana.
White birch.	Betula alba.
Canoe birch.	Betula papyracea.
American mountain ash.	Pyrus Americana.
European mountain ash.	Pyrus aucuparia.
Norway maple.	Acer platanoides.
Soft maple.	Acer dasycarpum.
Butternut.	Juglans cinerea.
Wild black cherry.	Prunus serotina.
European alder.	Alnus glutinosa.
European linden.	Tilia Europea.
Russian mulberry.	Morus hybrida.
European larch.	Larix Europea.

Shrubs.

Barberry.	Berbris vulgaris.
Artemesia.	Artemesia abrotans var?
Spiræa.	Spiraæ opulifolia.

Evergreen Trees.

Norway spruce.	Abies excelsa.
White spruce.	Abies alba.
Scotch pine.	Pinus sylvestris.
Austrian pine.	Pinus austriaca.
White pine.	Pinus strobus.
Arbor vitæ.	Thuja occidentalis.

DISTRIBUTION OF TREE SEEDS.

Considerable quantities of native tree seeds have been collected by the superintendents of the Brandon and Indian Head Farms, Messrs. Bedford and MacKay.

These seeds were forwarded to the Central Experimental Farm as early as practicable last fall, to be distributed from there in small sacks to Manitoba and North-West farmers, as a means of arriving at the relative advantages of growing trees from seed where wanted, and planting seedlings grown elsewhere. Experimental work in forestry at the above Branch Farms has already demonstrated the advisability of beginning with the hardiest native trees, and when with these shelter has been obtained the work will progress more satisfactorily.

The greater propotion of the seed arrived too late fo. the report of the distribution to be given this year. A part of the seed was sent out through the mails in small cotton bags. The Burr oak, and Black cherry were put up in packets containing about 400 seeds of each. The ash were sent out in sacks holding about 5,000 seeds. The seeds of the cherry being small were enclosed with those of the ash.

The distribution up to 1st January, 1891, was as follows:—

Species.	No. of Packages. Man.	N. W. T.
Manitoba burr oak (Quercus macrocarpa).................	60	85
do Green ash (Fraxinus viridis)..........................	219	201
do Black cherry (Prunus demissa)?.	219	201

The subjoined circulars of instructions were mailed to each recipient of the tree seeds:—

DOMINION OF CANADA,
CENTRAL EXPERIMENTAL FARM,
OTTAWA, December, 1890.

DEAR SIR,—A small sack, containing seeds of Manitoba burr oak (*Quercus macrocarpa*) has been mailed to your address this day.

Mix the acorns with damp sand and store in a cool cellar during the winter, being careful to guard from mice and rats. Sow after danger of heavy spring frosts is over, in well-drained mellow loam, sheltered if possible from strong sunshine and prevalent winds. Sow 2 inches apart, in drills which may be run 15 to 20 inches from each other. Cover to a depth of 2 inches, firmly pressing the soil over the seed. Keep the surface loose and free from weeds during the growing season. Protect the seedlings the first winter with a mulch of straw or hay. They may be allowed to remain in the seed bed 2 years, or they may be transplanted as yearlings to premanent positions.

Yours truly,
JOHN CRAIG,
Horticulturist.

WILLIAM SAUNDERS, *Director.*

DOMINION OF CANADA,
CENTRAL EXPERIMENTAL FARM,
OTTAWA, December, 1890.

DEAR SIR,—A small sack containing seeds of *Manitoba black cherry* and *ash* has been mailed to your address this day.

Mix the the seeds of each with damp sand or soil, and store in a cool cellar during winter, being careful to guard from mice and rats. Sow after danger of heavy spring frosts is over, in well-drained, mellow loam; shelter if possible from strong sunshine and prevalent winds. Sow 1 to 2 inches apart in drills, which may be run from 15 to 20 inches apart. Cover the cherry-pits to a depth of 1½ inches. The ash seed should have a covering of from ¾ to 1 inch. Press the soil firmly over the seed in both cases. Keep the surface loose and free from weeds during the growing season. Protect the seedlings the first winter with a mulch of straw or hay. They may be allowed to remain in the seed-bed two years, or they may be transplanted as yearlings to permanent positions.

Yours truly,

JOHN CRAIG,
Horticulturist.

WILLIAM SAUNDERS, *Director.*

A quantity of the seed of each variety received, was either planted last fall or is in course of preparation for planting next spring on the Central Farm. The seedlings raised will be available for future tests here and elsewhere.

EVERGREEN SEEDLINGS.

The year has been a very favourable one for transplanting these plants--so sensitive when young to change of position and strong sunshine. About 130,000 two year seedling Rigà pines were removed from the shaded seed beds and re-set in nursery rows, also several thousands each of Scotch pine, Norway spruce and a smaller number of Austrian pine, White pine, Arbor vitæ, Blue spruce and Douglas spruce. By setting in rows 15 inches apart and stirring the soil frequently with a Planet Junior cultivator very slight losses were sustained. These seedlings will be of suitable size, and available for distributing after another year.

The beds from which these seedlings were removed, were immediately re-sown with the following varieties, the seed having been obtained from the north-western Rocky Mountain region, with the exception of Pinus cembra, received from B. E. Fernow, Esq., Chief of the Forestry Division, Department of Agriculture, Washington, D.C.

Douglas fir.	Pseudotsuga Douglasii.
White fir.	Abies concolor.
Colorado blue spruce.	Picea pungens.
Bull or yellow pine.	Pinus ponderosa.
Stone pine.	Pinus cembra.

Douglas fir, White fir, and Colorado blue spruce germinated rapidly and well. Bull pine germinated more slowly and irregularly, but on the whole made satisfactory growth. The seeds of Stone pine have not yet germinated, probably due to the fact that they were not planted the same year as collected. Some difficulty was experienced and loss sustained from what is known to nursery men and florists as the "damping off" of the young plants. No specific remedy has yet been discovered against this malady. It seems to be encouraged by excessive moisture or by sudden dryness. The best results in growing evergreen seedlings are generally attained by keeping a partial shade and preserving a moderate but *even* degree of moisture

DISTRIBUTION OF FRUITS.

In reponse to a large number of requests by farmers in districts remote from fruit-growers, a number of packages were put up, containing as a rule, the following varieties—though in some cases it was found necessary to substitute other sorts, and sometimes vary the number of plants sent:

1 Apple tree, either Duchess or Whitney crab.
1 Cherry tree, either Vladimir or Bessarabian.
2 White grape currants.
2 Red Dutch currants.
2 Houghton gooseberry.
2 Shaffer raspberry.

2 Mammoth Cluster	raspberry.	Black.
2 Gregg	do	
2 Hansell	do	Red.
2 Turner	do	
2 Cathbert	do	

This selection was sent to 250 applicants. Many reports which have come in give very satisfactory accounts of the relative success of the different varieties Those coming from Manitoba and the North-West—which sections received the larger share of the distribution—are of special interest. Nearly all the varieties started well, except the black cap raspberries, of which "tip" plants only, were available at the time of sending them out. It is much safer and surer in shipping these varieties long distances to use yearling plants well rooted.

The following circular of instructions accompanied each parcel :—

DOMINION OF CANADA,
DEPARTMENT OF AGRICULTURE,
CENTRAL EXPERIMENTAL FARM,
OTTAWA, April, 1890.

DEAR SIR,—A package containing plants of small and large *fruits* has been mailed you this day, and your attention is specially called to the following instructions:—

When plants are received unpack at once and wet the roots. If unable to plant immediately, store them in a cool cellar or heel them out of doors, covering them completely with moist earth. *Situation.*—When selecting a site for planting, if possible choose a loamy and friable soil on a northern slope. A piece that that has been summer fallowed is preferable; avoid southern exposures, as trees and plants in such situations are liable to be injured by alternate freezing aud thawing in the spring, and hot winds in summer. Work the ground twelve to fifteen inches deep and pulverize thoroughly. *Planting—Raspberries.*—Set in rows six feet apart and four feet in the row; care should be taken not to plant the tip varieties deeper than three inches; the piece of old cane on these serves only the purpose of a handle and is of no use after setting out. Examples of this class are Mammoth Cluster, Shaffer and Gregg. The upright varieties, Turner, Cuthbert and Hansell, may be planted deeper. Manure freely and cultivate well. Pinch off the canes when three feet high, and prune back lateral branches the following spring to within twelve or eighteen inches of the main cane. It is necessary to bend down the canes in the fall and cover them with earth sufficient to hold them in this position. The apple and cherry trees we send out are cut back, and should be grown with low bushy heads. Bind the trunks and main limbs in the fall with straw or hay to protect from winter cold and spring sunshine. *Currants and Gooseberries* need liberal manuring and mulching in the fall. As two-year old wood bears most fruit it is best to remove annually all canes three years and over.

You will be expected to take such notes during the growing period as will enable you to make a report at the close of the season on the behavior of each variety, giving soil and exposure. Reports will be expected whether favorable or unfavorable.

Yours truly,

WM. SAUNDERS,
Director.

JOHN CRAIG.
Horticulturist

In addition to the above, there were distributsd 110 packages, containing a selection of strawberry, raspberry plants and forest tree seedlings, the latter being a number of incomplete bundles left over at the close of the tree distribution.

Arrangements have been made whereby this work can be continued during the coming season.

PROPAGATION OF TREES AND SHRUBS.

In view of the comparatively limited information we have in regard to the best and most expeditious methods of increasing many of the rarer and hardier forms of trees and shrubs, experiments in this direction were inaugurated during the past summer. The work thus far has been confined to testing different methods of propagating from cuttings, using green wood tips under glass and in the open air; also spring and fall planting in the open of hardwood cuttings.

Interesting results are being developed, but the work is not sufficiently advanced to report upon at this date.

V.—EXPERIMENTS WITH FUNGICIDES.

The annual losses to orchards during the past eight or ten years from the disease known as apple-scab (*Fusicladium dentriticum* FCKL.) has been so heavy as to cause some hitherto profitable varieties to be discarded in certain localities, and to raise the question of their usefulness in future planting. These failures among old and well-tried varieties have also brought about enquiry and experiment as to the best means of combating the disease.

A series of experiments along this line were conducted at Abbotsford, Que., during the past season, on the farm of Wm. Craig & Son. I am indebted to Mr. Wm. Craig, jr., for his labour in superintending the work, and furnishing me with some of the facts upon which the following deductions are based.

I am also indebted to Mr. F. T. Shutt, Chemist to the Experimental Farms, for valuable assistance in planning the lines of experiments, and for the preparation of the copper carbonate and other necessary materials.

The trees selected were of the Fameuse variety, planted fourteen years ago on a loose, gravelly soil. During the past four years this orchard has not yielded more than 25 per cent. of first-class apples.

Five rows in the centre of this orchard were selected, each row, which contained fourteen trees, being treated with a different mixture. A row of trees untreated was allowed to remain on either side of those operated upon. Four applications were made, one on each of the following dates: 14th and 26th June, and 17th and 29th July. At the time of the first application the fruit was about the size of garden peas.

When the fruit was picked it was divided into three grades, numbered 1, 2, and 3. The results are given in this way:—

Row 1.—Treated with

Copper carbonate	1½ oz.
Ammonia	1 qt.
Water	22 gals.

Result:

	Per cent.
No. 1	33
No. 2	25
No. 3	42

Row 2.—Treated with

Copper carbonate	3 oz.
Water	22 gals.

Result:

	Per cent.
No. 1	50
No. 2	25
No. 3	25

Row 3.—Treated with

Copper sulphate	1 lb.
Ammonia	1½ pts.
Water	22 gals.

This solution was too strong, injuring the leaves to such an extent as to cause half of them to drop within ten days from time of application. A second and weaker application had the same effect.

Row 4.—Treated with

Copper sulphate	1 lb.
Water	22 gals.

This had practically the same effect as the above, and was discontinued atter a second application. It would seem in this result before us that the ammonia did not increase the injurious effect of the copper sulphate.

Row 5.—Treated with

Hyposulphite of soda	1 lb.
Water	22 gals.

No beneficial effect was noted, though the experiments on this row were rendered useless by severe inroads of the leaf-crumpler.

Row 6.—Untreated.

	Per cent.
No. 1	24
No. 2	26
No. 3	50

The time occupied in making each application, covering the 70 trees, was about 3½ hours with one man and boy and a horse. Of course, if the same mixture were used on the whole lot without any change, the time taken in making the application would be greatly reduced. As the cost of the application is much increased by the addition of ammonia in the copper carbonate mixture—while the results in the experiments cited above do not seem to warrant its use—it would appear that the copper carbonate and water mixture, in the strength as applied above could be used to advantage, and at a cost of about 1 cent per tree each application, or 5 cents for the season. This is an outside estimate even for large trees. It is noteworthy to mention a fact which has attracted the attention of other investigators, viz., that the older leaves seem to be more sensitive to injury from most fungicides and insecticides, than the young and growing leaves. The later applications emphasized this observation.

OTHER FUNGICIDES.

Bordeaux Mixture.—This remedy for downy mildew and black-rot of the grape, though only of recent introduction, has, by reason of its efficacy, become one of our most important fungicides. It is prepared as follows:—

"Dissolve 6 lbs. of sulphate of copper in 16 gallons of water. In another vessel slake 4 lbs. fresh lime in 6 gallons of water. When the latter mixture has cooled it is slowly poured into the copper solution, care being taken to mix the fluids thoroughly by constant stirring. Prepare some days before needed for use. Stir before applying. Stronger mixtures were at first recommended, but they are not now used. For downy mildew and black-rot of the grape, blight, and rot of the tomato and potato." [Bailey, Horticulturist's Rule Book].

Eau Celeste.—"Dissolve 1 lb. of sulphate of copper in 2 gallons of water. In another vessel disolve 1 lb. of carbonate of soda (washing soda); mix the two solutions. When chemical reaction has ceased, add 1½ pints of ammonia; then dilute to 22 gallons." [Bailey, Horticulturist's Rule Rook]. Use for treatment of the same diseases as Bordeaux mixture.

I herewith append some conclusions arrived at by Prof. C. P. Gillette of the Iowa Agricultural Experiment Station, who conducted last season an extended series of experiments on this subject:—

"The oldest leaves are most susceptible to injury from arsenical applications; they often turn yellow and drop, without showing the burnt spotted appearance." * * * "London purple, (Paris green and white arsenic have not yet been tried) can be used at least eight or ten times as strong without injury to foliage. if applied in common Bordeaux mixture instead of water." * * * "The arsenites mix readily in carbonate of copper solutions, and do not seem to do more harm than when applied in water only." * * * "London purple in sulphate of copper solution, does vastly more harm than when applied in water only."

In the Journal of Mycology, Vol. VI, No. 3, published by Prof. Galloway and assistants, Department of Agriculture, Washington, an account is given of results of spraying grape vines to prevent black-rot with "Bordeaux mixture; ammoniacal copper carbonate solution; copper carbonate in suspension; and a mixed treatment, consisting of three applications of the Bordeaux mixture, followed by five of the ammoniacal solution." The following conclusions were reached :—

I. "That while the amount of fruit saved by the Bordeaux mixture was greater than that by the ammoniacal solution, the latter preparation is, after all, the cheapest. In other words, there was more profit in using the ammoniacal solution than the Bordeaux mixture."

II. "A mixed treatment consisting of Bordeaux mixture and ammoniacal solution, is more profitable than a treatment of Bordeaux mixture alone, but not as profitable as the ammoniacal solution alone."

EFFECT OF FUNGICIDES ON APPLE LEAVES.

(Frank T. Shutt and John Craig.)

The experiments, as set forth in the accompanying table, were instituted with the following objects in view:—

1. To ascertain the greatest strength in which the different fungicides can be applied without injury to the leaves of apple trees;
2. To ascertain the effect on the leaves of the copper salts, with or without the addition of ammonia;
3. To ascertain the effect on the leaves of apple trees, of a combined fungicide and insecticide, using Paris green as the latter.

The trees chosen for the experiment were of the Wealthy variety—a row set out three years ago, in which all the trees selected were in an equally vigorous condition. As shown in the table, a series comprising 14 combinations of fungicides in different strengths was prepared. Each application was prepared on the basis of a 22-gallon mixture, though the quantity used—the trees being small—was in each case about 1 gallon. A tree was set aside for each preparation, and numbered in accordance with the number of the mixture used.

Series I, received three applications, notes being taken at short intervals after each application. At the close of this series a new lot of trees was selected; these received two applications, and were used as checks on the results of the first experiments.

TABLE showing effects of Fungicides of different strengths on Apple Leaves.

Number.	Fungicides.	Quantity.	1st. Series.—Dates of Making and Effect of Application. July 12.	July 17.	July 23.	2nd Series. Dates of Making and Effect of Application. July 21.	July 30.
1	Copper carbonate	3 ozs.	Rain 3 hrs. after application.	Rain 2 days later.		Slight injury	Injury increased, but slight.
	Ammonia	1 qt.	Injury scarcely perceptible	Injury scarcely perceptible	Injury not increased		
	Water	22 galls.					
2	Copper carbonate	6 ozs.	Injury scarcely perceptible	Injury scarcely perceptible	Injury slightly increased, a few leaves turning brown.	Very slight injury.	No increase of injury.
	Ammonia	2 qts.	Considerable blue deposit on leaves.	Large blue deposit in patches.			
	Water	22 galls.					
3	Copper carbonate	3 ozs.	No injury; no deposit	No injury; slight deposit	No injury; slight deposit	No injury	No injury.
	Water	1 gall.					
4	Copper carbonate	6 ozs.	No injury; no deposit	No injury; slight deposit	No injury; slightly increased deposit	Slight injury	Injury slightly increased.
	Water	22 galls.					
5	Copper sulphate	8 ozs.	Injury scarcely perceptible	Injury somewhat increased; leaves brown.	Lost ¼ of leaves; much injured.	Considerable injury.	Injury somewhat increased.
	Water	22 galls.					
6	Copper sulphate	16 ozs.	Distinctly injured	Considerably injured	Badly injured, ⅔ of the leaves falling.	Badly injured	⅓ leaves falling
	Water	22 galls.					
7	Copper sulphate	8 ozs.	Slight injury on older leaves	Injury somewhat increased	Older leaves badly injured, ⅓ falling.	Slight injury	Injury increasing.
	Ammonia	1½ pts.					
	Water	22 galls.					

8	Copper sulphate	16 ozs	Slight injury; slight deposit.	Injury increasing	Badly injured, ¼ leaves falling	Considerable injury.	Badly injured; leaves falling.
	Ammonia	1½ pts		Considerable deposit			
	Water	22 galls.					
9	Copper carbonate.	1½ ozs	No injury; slight deposit	No injury; slight deposit.	Slight injury to older leaves	No injury.	No injury.
	Paris green	1¾ ozs					
	Ammonia	1 qt			Considerable deposit		
	Water	22 galls.					
10	Copper carbonate.	3 ozs	No injury; slight deposit	No injury; slight deposit	Injury scarcely perceptible.	Injury scarcely perceptible.	No increase of injury.
	Paris green.	1¾ ozs					
	Ammonia	1 qt					
	Water	22 galls					
11	Copper carbonate.	1½ ozs					No injury.
	Paris green.	1¾ ozs	No injury	No injury.	No injury.	No injury.	
	Water	22 galls					
12	Copper carbonate.	3 ozs					No injury; very slight deposit.
	Paris green	1¾ ozs	No injury	No injury.	Traces of injury barely perceptible.	No injury.	
	Water	22 galls.					
13	Copper carbonate.	8 ozs					Badly injured
	Paris green	1¾ ozs	Injury barely perceptible	Injury increasing.		Considerable injury.	
	Water	22 galls.			Badly injured, leaves dropping		
14	Copper sulphate	8 ozs	Injury barely perceptible	Injury increasing.	Considerably scorched and injured.	Older leaves turning brown; younger curling.	Injury increasing.
	Paris green	1 oz.					
	Water	22 galls.					

SUMMARY.

Quantities given below are all on the basis of 22 gals. of water, with ammonia as the solvent:—

1. Copper carbonate—3 oz. in solution, caused slight injury.

2. Copper carbonate—3 oz. in suspension caused no injury; 6 oz. in suspension caused slight injury, which did not increase with repeated applications.

3. Copper carbonate—3 oz. in solution, Paris green $1\frac{3}{4}$ oz. (proportion of 1 lb. to 200 gals. of water), caused slight injury in the later applications.

4. Copper carbonate—$1\frac{1}{2}$ oz. in solution, Paris green $1\frac{3}{4}$ oz., caused very slight injury after the third application.

5. Copper carbonate—$1\frac{1}{2}$ oz., in suspension, Paris green $1\frac{3}{4}$ oz., caused no injury.

6. Copper carbonate—3 oz. in suspension, Paris green $1\frac{3}{4}$ oz., caused slight injury after later applications.

7. Copper sulphate—8 oz. dissolved caused much injury, and proportionately as the quantity of sulphate was increased.

8. Copper sulphate—8 oz., with $1\frac{1}{2}$ pints of ammonia, caused much injury.

9. Copper sulphate—8 oz.; Paris green ·93 oz., and $1\frac{3}{4}$ oz. caused much injury.

The more promising lines, as indicated in the above summary, will receive careful attention another season, and on such a scale as to enable the submitting of a more complete summary of conclusions.

VI.—REPORT ON SEEDLING SMALL FRUITS.

To Wm. Saunders, Esq.,
Director Experimental Farms,
Ottawa.

Sir,—The members of the joint committee from the Fruit Growers' Association of Ontario, and the Montreal Horticultural Society, invited to inspect the fruits of the Ottawa Experimental Farm, beg to submit the following report:—

We met at the farm on the 22nd of July, and in company with yourself and Mr. John Craig, the Horticulturist, proceeded to examine the various fruits in cultivation. The results of our observations were very gratifying, indeed, having found success and improvement far beyond our most sanguine expectations.

The raspberry being the principal fruit in bearing at the time, our attention was more particularly drawn to it. We found some twenty-five or more varieties of the well-known sorts in bearing—most of them doing well and carrying a fair crop of fruit. But the chief attraction to your committee was a patch of two or three hundred seedlings and hybrids which were originated by the Director, some of which, in our estimation, bid fair to supersede the best of the standard varieties. These were carefully compared as to apparent hardiness of plant, quality, and productiveness with the standard sorts grown under the same culture and surroundings, and we found, not only in those of the red type, but also in the black and yellow sorts, marked improvements over the leading varieties in general cultivation, from which these were produced—Some as to time of ripening, others as to flavor, and still others as to size, hardiness, productiveness, &c., and it is the opinion of the committee that if these varieties are propagated and disseminated through the country that they alone will more than pay the country, the expense already incurred in connection with the Horticultural Department of the Experimental Farm. These varieties have been grown under numbers, and we herewith append our observations in regard to the most promising of them, and would suggest that they should all be named and further tested, and propagated as fast as possible, and disseminated as you may think best.

We also inspected several new seedling black currants and gooseberries, some of which we consider improvements on our present varieties, and shall expect good results from these when further tested.

The strawberry season was over, and we had no opportunity of seeing them in fruit, but a part of your committee saw several seedlings which were brought to the meeting of the Ontario Fruit Growers' Association at Niagara on the 9th of July, by Mr. Craig; and from the fruit inspected there and the growth and foliage of the plants seen on the farm we should pronounce them very promising.

In regard to the other and larger fruits being tested on the farm, they are not yet far enough advanced to form much of an opinion; yet, we have no hesitation in saying that we believe the experiments being conducted in the Horticultural Department will result in producing varieties that will be of great value, particularly in the colder parts of our Dominion; and in conclusion, we would express our regret that the climate at Ottawa will not permit of experiments with some of the more tender and most valuable fruits, such as the peach, and with many varieties of apples, pears, plums, cherries, apricots, grapes, &c. In view of the great advantage it would be to the country to have these fruits tested by disinterested parties not engaged in the sale of trees or plants, we would express a hope that at no distant day the Government will see fit to establish somewhere in western Ontario—where the climate is suitable—a branch Horticultural station for this purpose, similar to those established in some of the neighbouring States.

Fruit Growers' Association of the Province of Ont. — P. C. DEMPSEY, A. M. SMITH, P. E. BUCKE.

Fruit Growers' Association of the Province of Que. — W. W. DUNLOP, R. BRODIE.

SEEDLING RASPBERRIES.

RED VARIETIES

No. of Row.	No. of Plant in Row.	
3	11	A seedling of Biggar's Seedling. Berry above medium size; fair quality; early; firm; productive promising for market.
3	13	Seedling of Biggar's Seedling. Berry large; attractive; good quality; early; promising for market.
3	21	Probably from Biggar's Seedling. Berry as large as Cuthbert; bright red; fine quality; medium early; hardy and very productive.
3	24	Origin unknown. Large, dark red; good quality; firm; very productive; should be a good market berry.
3	36	Origin unknown. Very large; light red; good quality; firm; productive; hardy and vigorous. (I have noted this as one of the most promising for market.—J.C.)
3	39	Origin unknown. A duplicate of the last, but a few days earlier.
3	52	Seedling of Philadelphia. Medium to large; purple; early; good quality; very productive, of the same type as Philadelphia, but earlier.
4	48	Origin doubtful. Medium size; dark red; good quality; enormously productive, valuable on account of its great productiveness.
5	12	Seedling origin unknown Medium size; dark red; good quality; early. This is too nearly like the last to propagate both. (Either of these should supersede some of our present early sorts.—J.C.)
6	46	Seedling of Biggar's Seedling. Very large; bright red; first quality; firm; somewhat earlier than Cuthbert; prolific; hardy and vigorous; very promising.
6	47	Seedling of Biggar's Seedling. A little earlier, otherwise similar to last.

SEEDLING RASPBERRIES.

No. of Row.	No. of Plant in Row.	BLACK CAPS.
3	45	Seedling of Hopkins. Large; good quality; as late or later than Gregg.
3	47	Seedling of Hopkins. Size of Gregg; good quality; firm; medium early; productive. Try for market.
3	76	Seedling of Ohio. Above medium size; attractive; good quality; firm; very early; productive. (Valuable on account of its early season.—J.C.)
4	57	Doubtful origin. Large; purple; fair quality; later than Shaffer; exceedingly productive.
5	23	Seedling of Tyler. Medium to large; fine quality; fairly firm; early; season of Tyler; hardy; productive; very promising.
5	33	Seedling of Tyler. Large and equal to Gregg; good quality; medium early; very productive; hardy; very promising.
5	41	Hybrid; Gregg with Cuthbert. Shaffer type; large; dark purple; good quality; early; a typical cross; plant vigorous. (Very promising, on account of its size and earliness.—J.C.)
7	79	Chance seedling. Medium size; fine quality; very sweet; medium early; promising for home use; hardy; prolific.
7	80	Chance seedling. Largest size; fine quality; firm; productive; season just ahead of Hilborn; hardy; prolific. Promising for market.

[NOTE.—All varieties described above have been favourably mentioned for three seasons in notes taken by Mr. Hilborn, Prof. Saunders or myself. Hardiness and productiveness taken as points of primary importance. —JOHN CRAIG, *Horticulturist*.]

REPORT OF THE CHEMIST.

(Frank T. Shutt, M.A., F. Inst. Chem., F.C.S.)

Ottawa, 20th January, 1891.

Wm. Saunders, Esq.,
Director, Dominion Experimental Farms,
Ottawa.

Sir,—I have the honour to submit herewith the fourth annual report on the work of the Chemical Department of the Dominion Experimental Farms.

During the past year much has been accomplished, and the laboratory work, ever increasing as the Experimental Farm system becomes better known and appreciated, has been of a very varied character. Farmers in all parts of the Dominion are more and more taking advantage of the aid afforded them by the Government in these institutions, and as a result a larger number of samples have been received for examination and report. The correspondence of the Department has also greatly increased, and much time is now necessarily expended in answering the enquiries of agriculturists. This portion of my work, while forming no part of the annual report, has been found very useful to the individual farmer.

The samples sent in for analysis comprise principally soils, natural and artificial fertilizers, waste products of an agricultural value, well waters and feeding materials of all kinds.

Only such specimens are examined, the knowledge of which is considered to be of importance and benefit to the farming community of Canada, or at least to a large portion thereof. Exceptions to this rule are made, as in the case of well waters, but even here the printed reports will prove of great service to all who study them. No work is done of such a private nature that the report on it would benefit only the individual. Much of the work has a national interest, as for instance, the analysis of sugar-beets grown in different sections of the country, the examination of soils representing large areas, and the like.

That intelligent interest that has been awakened in the value of such knowledge is practically demonstrated by the fact that many samples of soils, fodders, fertilizers, etc., have now accumulated, and for want of time, are still awaiting analysis.

Besides this class of work, and, probably of greater importance to the Dominion at large, is that which has for its object the solution of chemical questions in connection with experiments planned and carried out on the Experimental Farms. These investigations usually entail a large expenditure of time and work, consisting often of a long series of analyses. Many of the experiments just referred to may be said to be wholly chemical, while others require many analyses to make them complete, and, consequently, more valuable. The chemical examination of different varieties of fodder corn, native and foreign grasses, roots and cereals, of animal products, such as milk of the various breeds, finds its rightful place here.

On account of this large amount of work and the consequent need of skilled assistance in the laboratory, the services of an Assistant Chemist have been secured. Mr. Adolph Lehmann, B.S.A., late of Guelph Agricultural College, was chosen for the work. By the technical skill and ability he has displayed in chemical analysis, by his untiring industry and by the warm and intelligent interest he has evinced in the work, Mr. Lehmann has shown himself well fitted for the position. It is due largely to his valuable aid that I am enabled to insert many of the analytical results which appear in the present report.

For convenience of reference, the following classification of the contents of this report will be found useful.

PART I, contains the analyses of soils from the North-West Territories and New Brunswick, with explanatory remarks thereon. Some notes on the general composition and character of soils are also added, which it is thought may be of interest and use to our readers.

PART II, includes natural and artificial fertilizers. Among these are to be found marsh muds, mucks and peats, marl, gypsum, gas lime, wool waste from a woollen mill and a report on the value of "lamb's quarter" (*Chenopodium album*), as a fertilizer.

PART III, treats of the products of farm plants and animals, and comprises analyses and reports on various food stuffs, including fodder corn, ensilage, grasses and concentrated foods such as oil cake and cotton seed meal. The relative values of certain varieties of potatoes as grown on the Central Experimental Farm during the past season are here given. The composition of the sugar-beet is set forth in a long series of analyses. These roots were grown in different parts of Ontario, and the results no doubt represent a very fair average of what has been done during 1890 towards bringing this valuable crop to perfection. In view of the probable development of the beet-sugar industry in the near future, the present results will be deemed valuable. The composition of the milk of the cows at the Central Experimental Farm appears in tabular form. These analyses are accompanied by such other information and deductions as will render them of service to the farmer and dairyman.

PART IV, comprises miscellaneous analyses of substances under experiment or otherwise connected with the farm. The subjects treated of form separate articles under the following titles: "The composition of apple tree leaves," being the first of a series of analyses on the apple, with a view to ascertain a rational mode of fertilizing orchards; "A report on the effect of solution of copper and iron sulphates, alone and togther, on the vitality of the wheat germ;" "Well waters," being a useful chapter on a very important matter, and containing analyses of water examined during the past year; "Foundation comb," giving the composition of three adulterated samples received for examination, to which are added simple methods for detecting the presence of paraffin.

As in former reports, explanatory remarks accompany the analytical data. These remarks have been made as concise and as free from technical terms as possible, but are, however, stated in sufficient detail to make the purely scientific results of value and service to the ordinary reader

In addition to the work set forth in the following pages, there has already been completed a series of analyses of several varieties of Indian corn as grown for fodder —only the averages of which appear in this report—(See Fodders). The objects in view when this task was undertaken were to ascertain the best varieties of corn as regards composition and yield, and to find out the proper time at which to cut the fodder for the silo. The details of this work and the deductions made from them have been put into bulletin form, now shortly to be issued.

The analyses of fifty-two samples of native grasses have also been completed. These grasses were grown on the experimental plots of the Central Farm under the direction of Mr. James Fletcher, the Botanist. The analyses show their composition, and hence their value, at different stages of their growth.

The native grasses of Manitoba and the North-West Territories are now undergoing examination. These have long been favourably known for their nutritious properties by stock-raisers. Their true and comparative values, as determined by chemistry, will be brought out by this work. When the analyses are finishe the whole will be published together as a bulletin.

There are also in progress the analyses of a number of barleys, including samples of the original importation of Carter's Prize Prolific, and of this barley as grown in the various provinces of Canada. Other 2-rowed, as well as specimens of 6-rowed, barleys, are also being examined. It is expected that the results, when completed, will throw additional light on the important question of barley for malting and export purposes.

I have the honour to be, Sir,

Your obedient servant,

FRANK T. SHUTT,

Chemist, Dominion Experimental Farms.

PART I.

SOILS.

The fertility of a soil is dependent upon its chemical composition and its mechanical texture. Soils to be fertile must contain the elements of plant food in such forms that they can be readily used for the nutrition of vegetation. At the same time its condition must not be too loose, else a firm hold will not be afforded the roots of plants, and there will be too much drainage and evaporation, nor must it be too heavy and plastic, for then air and water could not freely permeate it nor the roots extend themselves beyond a very limited area. Generally speaking, light, loose soils are not as rich in plant food as those in which clay predominates; yet, on account of their excellent condition of tilth, they often yield in favourable seasons heavier crops than the latter. Stiff, heavy clays, though rich in inorganic plant food (potash and phosphoric acid) are often poor in nitrogen, while their condition is such as to prevent thorough aeration and the penetration of the roots. It is these soils especially that are benefited by drainage. By a system of drainage the water which saturates the surface soil is carried off, air allowed to permeate, the whole rendered more friable and easily worked, and much plant food is converted into assimilable forms.

Where sand largely preponderates the soil is not retentive of moisture and fertilizing material, especially if the subsoil be light, and though easily worked is not so desirable in dry seasons as a heavier soil.

A proper proportion of sand and clay, therefore, for many reasons, makes the best soil.

With the clay and sand, varying amounts of peaty matter or humus (derived from the decomposition of vegetable matter), and of calcareous matter (principally carbonate of lime) are usually associated, and a right proportion of the two latter exerts a beneficial influence upon the tilth of a soil. From the presence of these predominating materials soils are known respectively as clay, sandy, peaty and calcareous, according as one or the other is in excess.

By the slow decomposition of the clay and the peaty and calcareous matter, plant nutrients are liberated in a soluble form, and therefore the function of these soil fundamentals is not only mechanical but chemical.

The constituents of soils may be divided into two classes: *inorganic* and *organic*.

In the first of these is the material formed by the disintegration of the rocks at the earth's surface by atmospheric agencies. This mineral matter consists principally of lime, magnesia, oxide of iron, alumina, potash and soda, combined with silica, phosphoric, sulphuric and carbonic acids.

The actual and relative amounts of these constituents in soils vary according to the nature and composition of the rocks from which they are derived.

The organic portion of a soil consists largely of semi-decomposed vegetable matter (roots, underground stems, leaves &c.), otherwise known as humus, peaty matter, &c. The elements which enter into its composition are carbon, hydrogen, oxygen and nitrogen, but it is the latter only that has an agricultural value.

INORGANIC CONSTITUENTS.

The most important inorganic constituents of a soil are potash and phosphoric acid. These together with nitrogen, are known as the essential elements of plant food.

Potash—derived principally from the decomposition of feldspathic rocks, *e. g.*, granite—exists chiefly in combination with silica in a more or less soluble condition. The limits of potash in a soil lie between a mere trace and about 2 per cent. A good agricultural soil contains between .25 per cent. and 1 per cent. Clay soils, usually, are the richest in potash.

Potash, as a fertilizer, is of special value to clover, peas and other leguminous crops; potatoes, beets, cabbage, grasses and leafy plants in general are also benefited by it.

Phosphoric acid, combined principally with lime, is found in all fertile soils. Like potash, it has been derived from the rock that originated the soil, and consequently is not constant in quantity. It seldom exceeds 1 per cent., even in the richest soils, and the average in good soils would probably be somewhat under ·5 per cent.

It benefits chiefly root crops, *e. g.*, turnips and beets, and in conjunction with nitrogenous manures is very effective for the cereals, promoting an early maturity and an increased yield.

Lime.—Of the inorganic elements of minor importance, lime is the principal. By its solution it affords food directly to the plant and liberates in the soil potash and nitrogen pre-existant in insoluble forms. Many consider that less than 1 per cent. shows a soil to be deficient in lime.

No special mention need here be made of the other mineral constituents, as most soils contain sufficient for all the requirements of farm crops.

ORGANIC CONSTITUENT.

Nitrogen is the element of value in the organic portion of a soil. It there exists, for the most part, in forms from which it can be but slowly absorbed by plants. By a process of fermentation, known as nitrification, it is rendered assimilable. The presence of lime (carbonate of lime) appears to assist in this useful operation, especially when the ground is sufficiently open for air to permeate it. Moisture and warmth are also necessary to encourage the growth of this microscopic ferment.

Very rich soils contain from ·5 per cent. to 1 per cent. of nitrogen; good, fertile soils possess on an average from ·1 per cent. to ·2 per cent.

Nitrogen is essentially the fertilizer for cereals, especially when associated with potash. An excess of nitrogen, however, promotes a rank growth of straw

Successive croppings, without a concomitant return of plant food, deplete a soil of these three important substances, and though, as we have seen, a fertile soil requires but minute quantities of them, they must be replaced in order to obtain lucrative harvests.

The examination of eight samples of soil has been undertaken since the issue of my last report. Six of these represent areas in the North-West Territories, and were analysed at the instance of L. A. Hamilton, Esq., Land Commissioner, C. P. R., Winnipeg; the remaining two soils, from the Sackville Marsh, New Brunswick, were forwarded by Josiah Wood, Esq., M.P.

ANALYSES OF SOILS.

Number.	Locality.	Water.	Organic Matter.	Clay and Sand.	Oxide of Iron and Alumina.	Lime.	Magnesia.	Potash.	Soluble Silica	Phosphoric Acid.	Carbonic Acid, &c. (undetermined.)	Total.	Nitrogen.	Clay.	Sand.
1	Walsh Flats, Tp. 11, R. 1, W. 4th	5·50	4·95	77·13	9·80	·53	·18	·39	·19	·17	1·16	100·00	·140	58·20	18·93
2	do Tp. 11, R. 2, W. 4th	3·50	5·28	80·13	8·85	·29	·63	·52	·12	·16	·52	100·00	·135	49·12	31·01
3	Tilley, Tp. 17, R. 13, W. 4th	1·31	4·66	87·15	5·94	·14	·33	·25	·10	·13	......	100·01	·179	22·57	64·58
4	Tilley, Tp. 16, R. 13, W. 4th	2·31	10·87	78·56	6·91	·36	·41	·26	·16	·17	.....	100·01	·389	12·17	66·39
5	Vermillion Hills, Tp. 21, R. 5., W. 3rd	2·21	10·20	77·31	8·13	·49	·67	·16	·07	·16	·60	100·00	·346	16·38	60·93
6	do Tp. 21, R. 7, W. 3rd	1·49	4·42	87·88	5·32	·16	·44	·11	·07	·18	......	100·07	·159	11·85	76·03
7	Sackville Marsh, N.B.	8·51	5·34	74·34	10·13	·12	·33	·15	·30	·15	·63	100·00	·120	63·30	11·04
	do do	14·08	4·73	69·60	9·82	·14	·70	·05	·15	·17	·56	100·00	·140	65·46	4·14

SOILS FROM THE NORTH-WEST TERRITORIES.

The districts from which these soils were taken enjoy but a very limited rainfall, and hence have yielded poor crops. It was thought desirous that the composition of these soils should be ascertained to find out if the diminished growth in these areas was due in part to the lack of any important fertilizing constituent or to the excess of alkali or other matter deleterious to plant growth. From these analyses it is conclusively proven that the soils contain a sufficient quantity of plant food for good crops, while there is in every case a total absence of free alkali.

Numbers 1 and 2 are clay loams; in numbers 3, 4, 5 and 6 sand predominates, which in 5 and 6 consists largely of undecomposed rock matter.

The mechanical condition was not of the best, especially in samples 1 and 2. This may be due to lack of working, and would doubtless improve by thorough cultivation.

The analyses were made on the air-dried samples.

Water.

The percentage of water is rather low throughout, but especially so in the sandy specimens, showing that they are apt to "dry out." The small amount of water may, however, be partly due to the fact that the samples had had a long exposure to the air before analysing.

Organic matter and Nitrogen.

In organic matter, Nos. 1, 2, 3 and 6 are comparatively close, ranging from 4·42 to 5·28 per cent. We accordingly find the nitrogen in these samples correspondingly close, the percentages lying between ·135 and ·179. Nos. 4 and 5 possess about twice as much organic matter as the foregoing, and their nitrogen is found to have increased in the same ratio. All these soils may be regarded as comparatively rich in nitrogen—the amounts being quite sufficient for paying yields of farm crops.

Potash.

In the clay loams there is a very fair percentage of this element, but, as might be expected, in some of the more sandy soils it drops below the average quantity. Nos. 5 and 6 would certainly be benefited by an application of wood ashes or potash in some form.

Phosphoric Acid.

The percentage of phosphoric acid is very constant throughout all the samples, being somewhat lower than what we might expect to find in rich soils.

Lime.

The small quantity of lime in all these soils is particularly noticeable. I am of the opinion that a liberal dressing of lime in some form would materially improve them both mechanically and chemically. The amount of available potash would certainly be increased and the nitrogen be converted into more assimilable compounds.

SOILS FROM NEW BRUNSWICK.

Samples Nos. 7 and 8 are from the Sackville Marsh. They are both clay loams. They differ chiefly from Nos. 1 and 2 in containing more water and less sand. In lime they are equally low with the specimens from the North-West Territories—a plentiful application of lime or marl would benefit them. The potash in No. 8 is low—wood ashes are to be recommended for it as a lucrative fertilizer. The amounts of phosphoric acid are similar to those found in the North-West samples. In nitrogen they are moderately rich, though only equalling in this respect the poorest of the North-West soils examined. The soils are friable and porous, and though they would not be considered as rich, they contain sufficient plant food to make them productive of good crops.

PART II.

MUDS, MUCKS AND PEATS.

Nine samples in all of these natural fertilizers have been chemically examined during the past year. They comprise two specimens of swamp muck, two of pond mud, one of mussel mud, two from under mussel beds and one of peat. Four were from Prince Edward Island, two from Nova Scotia, two from New Brunswick and one from Ontario.

ANALYSES OF MUDS, MUCKS AND PEATS.

Number.	Nature of Mud.	Sender.	Locality.	Nitrogen.	Water.	Clay and Sand.	Organic Matter.	Oxide of Iron and Alumina.	Lime.	Magnesia.	Potash.	Phosphoric Acid.	Soluble Silica.
1	Swamp	Hunt, W. T.	Summerside, P.E.I.	·920	6·75	41·01	42·37	3·84	3·13	·45	·18	·01	·42
2	From under oyster bed	Compton, Geo.	St. Eleanors, P.E.I.	·237	33·38	49·99	6·99	6·27	·28	·59	·19	·05	·08
3	Mussel	Frier, James.	Shediac, N.B.	·124	7·73	12·89	2·94	2·68	37·81	·81	·10	traces	·62
4	From under mussel bed	do	do	·357	27·00	48·78	10·18	9·61	·65	·21	·53	·11	·16
5	Marsh	do	Gaspareau River, N.S.	·081	11·11	74·28	3·35	8·08	·54	·95	·40	·12	12
6	Pond	Ramsay, James.	Lot 18, P.E.I.	1·640	7·54	28·31	48·12	7·90	1·04	·40	·39	·26	·48
7	do	do	do	·740	4·25	58·80	23·61	10·09	·33	·10	·64	·28	·22
8	Swamp	Hickey, J.	Point Wolfe, N.S.	1·000	7·94	1·00	88·17	2·47	·09	·06	·04	·20	·04
9	Peat	Meldrum, A.	Bellerica, Ont.	1·080	4·75	4·05	89·26	64	·30	·21	traces	·15	·06

The value of these materials as fertilizers depends largely upon the amount of nitrogen in their organic matter. In very few instances do we find either the phosporic acid or the potash exceeding the quantities present in good soils.

From the table of analyses it will be seen that those examined contained varying quantities of water. If we calculate the percentage of nitrogen upon the water-free substance we obtain the following figures, which show the relative values of these samples in the dry condition, with respect to this important element of plant nutrition. They are arranged according to order of merit.

TABLE showing percentage of Nitrogen in dry matter of Mucks, Muds and Peats.

Letter.	No. in previous table.	Nature of Mud, &c.	Sender.	Locality.	Percentage of Nitrogen in dry matter.
A	6	Pond	Ramsay, Jas.	Lot 18, P.E.I.	1·774
B	9	Peat	Meldrum, A	Bellerica, Ont.	1·134
C	8	Swamp	Hickey, J.	Point Wolfe, N.S.	1·086
D	1	do	Hunt, W. J.	Summerside, P.E.I.	·986
E	7	Pond	Ramsay, Jas.	Lot 18, P.E.I.	·773
F	4	From under mussel beds	Frier, Jas	Shediac, N.B.	·490
G	2	do oyster beds	Compton, Geo	St. Eleanors, P.E.I.	·356
H	3	Mussel	Frier, Jas.	Shediac, N.B.	·133
I	5	Marsh	do	Gaspareau River, N.S.	·095

The nitrogen in semi-decomposed vegetable matter is not in such a condition that it can at once be absorbed by plants. The process of rendering such assimilable is one akin to that of fermentation. This beneficial action goes on—though slowly—when the muck or peat is mixed with the soil, provided the degree of temperature and moisture be favourable. If, however, before application to the soil, the material be composted, its value as a fertilizer will be greatly enhanced, and a quicker return in increased crop yield made to the farmer. Composting favours fermentation, which sets free much valuable plant food. For this purpose, barn-yard manure may be used ; lime and wood-ashes are also strongly recommended. The first is an excellent composting material. The heat developed in its own fermentation starts a similar action in the colder peat or muck, converting into more soluble forms this locked-up store of nitrogen. These materials, being excellent absorbents, will retain the ammonia—valuable plant food containing nitrogen—formed in this fermentation, and which would be likely to escape, due to overheating and lack of moisture in the heap. The compost may be made by alternating layers of barn-yard manure with those of the peat or muck—the layers being about 8 inches in thickness.

Fish waste or refuse, liquid manure and all organic matter, whether animal or vegetable, if easily decomposable, may also be used to advantage in composting.

As has been stated, lime, ashes and similar substances will bring about the fermentation of peat and kindred materials, when accompanied by moisture and warmth. Besides acting directly towards "breaking down" the organic matter, the presence of an alkali appears to encourage the development of the ferment of nitrification.

When the peat or muck is dug in a very wet condition it should be allowed to dry somewhat before composting, fermentation will then proceed more rapidly and thoroughly.

The increased manurial value of these substances after treatment in the compost heap has been testified to by many of my correspondents during the past year.

The absorbent character of peat and allied materials has already been mentioned It is owing to this quality that they are of special value in the stable, the cow house and the pig-pen, and indeed, wherever there may be liquid manure to absorb. When sprinkled in such places, not only do they prevent bad smells, but they also preserve for future crops much plant food that would otherwise go to waste. Much ammonia escapes into the atmosphere in stables where absorbents are not used. Should there not be a very good system in cow-houses and pig-pens for conducting the liquid portion of the manure to tanks, a loss of fertilizing elements will be sure to ensue through soakage, unless some material is scattered that will take it up and retain it. For this purpose, the use of dry peat and muck can be with confidence advised. In this connection, it must not be forgotten that while the plant food in manure is thus rendered permanent by such treatment, the fertilizing ingredients of the absorbent are at the same time made more valuable for immediate use.

MARL.

One sample of this natural fertilizer was analysed quantitatively during the past year. It was forwarded by H. Glendinning, Esq., of Manilla, Ont., and upon analysis was found to have the following composition:—

Moisture	8·57
Organic and volatile matter	3·24
Clay and sand (insoluble in acid)	2·50
Oxide of iron and alumina	·62
*Lime	47·22
Magnesia	·74
Potash, (slight traces)	......
*Carbonic acid	37·11
Phosphoric acid, (traces)	......
	100·00
*Carbonate of lime	84.33

Marl owes its fertilizing properties essentially to the carbonate of lime it possesses. This specimen contains 84·33 per cent., showing it to be somewhat above the average. In other plant food—nitrogen, phosphoric acid and potash—as is usually the case, it is not rich, these elements not being present in notable quantities.

The application of marl is especially to be recommended for heavy clay and for very light soils in which sand and peat predominate. Besides supplying lime—an ingredient of plant food—it renders the tilth of the former mellower, allowing air to permeate the soil and the roots to spread more easily; its addition improves sandy soils, by making them heavier and more retentive of moisture and fertilizing materials. By the slow oxidation of the organic matter of peaty soils it converts their nitrogen into forms which can be taken up as food by plants. This beneficial process is chiefly brought about by a microscopic plant in the soil, known as the ferment of nitrification—to which allusion has been made in the preceding chapter—the development of which is greatly encouraged by an excess of carbonate of lime. To all soils deficient in lime it may advantageously be applied, furnishing thereby not only plant food, but also setting free in the soil the inactive store of materials, so that they may be assimilable by vegetation. Lime in all its forms has been proved of special value as a manure for the leguminosae—of which peas, beans, etc., are important members.

A good marl for agricultural purposes should be of a light colour, and not of a hard or flinty nature. Such will easily disintegrate or break down on exposure to the weather, allowing it to be easily mixed with the soil.

GYPSUM.

One of the most valuable of the fertilizers that occur in nature is gypsum, commonly known as land plaster. It is the result of the union of sulphuric acid and lime, both elements of plant food. Thus it is that plaster supplies nourishment directly to the growing crop. It, however, also acts beneficially—and perhaps principally—

upon the locked-up food ingredients in the soil, setting free potash, and adding to the store of readily assimilable plant nutrients. In the third place, it is especially valuable for its property of "fixing" ammonia in the presence of moisture. The strong smell of stables, cow-houses and manure heaps is chiefly owing to an escape of ammonia—a volatile compound, the essential constituent of which is nitrogen, one of the three principal elements of plant food.

Its use, therefore, for sprinkling in stables and cow-stalls is to be strongly recommended, for thereby the ammonia is retained, the manure consequently becoming more valuable.

On rich soils the application of plaster is wont to give an immediate return; on poor soils better results are obtained by the addition of other and more complete fertilizers.

As a fertilizer for peas, beans, clover and other leguminous plants it has proved of special value. It has also been advised, owing to its property of liberating potash in the soil, as a manure for Indian corn and turnips.

A sample of gypsum was received from Col. Chas. N. Snow, of Pictou, N.S., of which the following is an analysis:

Analysis of Gypsum.

	Per cent.
Insoluble rock matter	·48
Lime (CaO)	31·75
Magnesia (MgO)	1·11
Sulphuric acid (SO_3)	45·73
Oxide of iron and alumina	Very slight traces
Carbonic acid	Small quantity

From the above data I deduce the following percentage composition:—

Sulphate of lime (gypsum)	97·53
do magnesia	·92
Carbonate of magnesia	·98
Insoluble rock matter	·48
Moisture, etc. (undetermined)	·09
	100·00

As this sample contains but 2·5 per cent. of foreign matter, it must be considered a very pure specimen of commercial gypsum, and one that is well adapted for all the purposes for which this substance is used.

GAS-LIME.

The results of my analysis of a sample of gas-lime, forwarded by W. S. Turner, Esq., Cornwall, Ont., are as follows:—

	Per cent.
Water	22·31
Volatile and organic matter	12·93
Insoluble rock matter	1·69
Oxide of iron and alumina	2·53
Calcium sulphate (gypsum or plaster)	2·09
Calcium sulphide and sulphite	1·86
Magnesium carbonate	1·55
Calcium carbonate (chalk)	53·60
Lime, slaked	1·44
	100·00

Gas-lime is a bye-product in the purification of illuminating gas. The gas in passing through or over beds of slaked lime loses the greater quantity of its sulphur, converting the lime into sulphide of lime. This sulphide, although a good insecticide and destroyer of fungi, is, in quantities, deleterious to vegetation. If, however, fresh gas-lime is exposed to the air this sulphide becomes oxidized into sulphite, and finally into sulphate of lime, or gypsum, the properties of which have already been described. After a lengthy exposure, which brings about the conversion of the sulphur compounds into the valuable form of sulphate, the use of gas-lime is attended with profit. It will be found of particular value to those crops that have been mentioned as being specially benefited by gypsum, and to soils naturally deficient in lime. To this end, therefore, it is advised that it be spread upon the fields in the autumn to the amount of two or more tons per acre and ploughed in the following spring, when it will have lost the greater portion of its water and the sulphur compounds will be converted into sulphate. The exact amount to be applied per acre must vary according to circumstances. To land naturally deficient in lime five tons is not considered too much, but on ordinary soils a dressing of two tons per acre may be used, as above recommended, with perfect safety. Owing to the variation in the composition of different samples of this material, as produced at the gas-works, more definite instructions as to the quantity to be applied cannot be given.

Recent experiments in Germany have gone to show that gas-lime when composted with garden refuse or with barn-yard manure is beneficial in helping to retain the nitrogen of these substances. For composting purposes, it is desirous that the gas-lime be first well exposed, as fresh or caustic lime has a tendency to destroy the nitrogenous matter. For ameliorating the condition of stiff clays and liberating as plant food their inorganic constituents, for rendering more compact the texture of sandy loams and for rendering available the nitrogen of peaty soils, gas-lime does good service, both chemically and mechanically.

WOOL WASTE OR REFUSE FROM A WOLLEN MILL.

At the request of the Hon. Charles Péloquin, of St. Hyacinthe, Que., an analysis has been made of a sample of the above meterial, to ascertain its value as a fertilizer. My results are as follows :—

Analysis of Wool Waste.

	Per cent.
Water	7·86
Organic and volatile matters	32·24
Clay and sand (insoluble in acids)	42·84
Oxide of iron and alumina	8·17
Lime	1.58
Magnesia	·83
Potash	3·56
Phosphoric acid	·21
Soluble silica	1·64
Carbonic acid &c. (undetermined)	1·07
	100·00
Nitrogen, in organic matter	1·31

The fertilizing elements would therefore be, per ton of 2,000 lbs.

	Lbs.
Phosphoric acid	4·2
Potash	71·2
Nitrogen	26·2

If we assign the following values—

	Per lb.
Phosphoric acid	6 cents.
Potash	$4\frac{1}{2}$ do
Nitrogen	8 do

the value of one ton of this wool waste is, $5.55.

This "wool waste," evidently, is chiefly valuable for the potash and nitrogen it contains. The former ingredient may be at once used by plants, but the latter (nitrogen) is not present in a form that can be directly taken up by vegetable growth. It is, however, rendered assimilable in the ground, or, still better, by composting. If the "waste" is applied at once to the soil its value will not be received for some time, and consequently the best period for such application would be before the autumn ploughing. If, however, it were first thoroughly composted and rotted with barn-yard manure or wood ashes its action in the soil would be more immediate. The extra work entailed by this treatment would in most instances be amply repaid.

"Wool wastes" are very apt to vary in their composition; hence, from this single analysis it would be impossible to state the value of such in general. That we have in all of them, however, much fertilizing material, there can be no doubt, and their judicious use must be attended with profit.

LAMB'S QUARTER (*Chenopodium Album*).

The probable value of this weed, as a cattle food, in places where it is abundant, is discussed in this report in the chapter on fodders. In the analysis there given the ash is stated as 17·74 per cent. of the dry matter. To ascertain to what extent the land was exhausted of its mineral ingredients by this plant, its ash has been analysed. The results obtained are here stated:—

Percentage Composition of Ash.

	Per cent.
Insoluble residue	·55
Soluble silica	·17
Alumina, with traces of oxide of iron	8·40
Lime	7·52
Magnesia	4·34
Potash	43·28
Phosphoric acid	4·16

The percentage of ash and essential fertilizing constituents in the original substance, before drying, are as follows:—

	Per cent
Ash	3·27
Phosphoric acid	·14
Potash	1·41
Nitrogen	·45

If we assign the following values—

	Per lb.
Phosphoric acid	5 cents.
Potash	$4\frac{1}{2}$ do
Nitrogen	15 do

the value per ton of 2,000 lbs. in its green state as a manure is $2.74.

The ash of this plant is seen to consist largely (nearly 50 per cent.) of potash, and consequently this weed must be considred as one that would readily exhaust the soil of this valuable element of plant food. If the crop is not used as a fodder the plan of ploughing it under should be resorted to, in order that this potash—together with the other constituents—be returned to the soil.

PART III.

FODDERS.

By a knowledge of the composition of cattle foods and of the functions and relative values of their constituents, the economic and profitable feeding of farm stock is made an intelligent operation.

The term "fodder" may be used to include all plants or parts of plants, *e. g.*, seeds roots, &c., and all vegetable bye-products, *e. g.* oil and cotton-seed cake, that are used as foods for the animals of the farm.

Fodders consist of varying proportions of *Water* and *Dry matter.*

Water.

The percentage of water present depends upon the nature of the fodder. In root crops there is almost 90 per cent.; in green fodders, *e. g.*, corn and grass, there is between 70 per cent. and 80 per cent. according to variety, time of year, &c.; in hay we find about 14 per cent., and in corn meal, oil cake and similar materials, between 7 per cent. and 10 per cent.

Although water is as necessary to the animal as it is to the plant, yet on account of its abundance in nature no value can be assigned to it in fodders. It is, however, a most essential constituent for the well-being of the animal, acting in the body as a solvent and aid to the digestion of the solid matter of food, and forming a vehicle for conveying such dissolved and digested matter to the various organs and tissues of the animal.

During the maturing of many foliaceous plants, such as grass, Indian corn, etc., the withdrawal of water, accompanied by other changes, tends to lower somewhat the digestibility and hence the value of some of the constituents.

Hence, some plants may be more nutritious in their green and succulent state than they are when ripe and dry, in spite of the fact that in the latter condition the solid food materials may exceed in amount two or three times that found in the green and immature fodder.

The importance of a plentiful supply of pure water for cattle is spoken of in treating of well-waters— *Vide* page 148.

Dry Matter.

The dry substance of a fodder consists of an organic, and of an inorganic or mineral, part

Organic.—The valuable and nutritive constituents of fodders are of this nature. They fall into two classes, viz.: *Nitrogenous* and *Non-nitrogenous.*

The *Nitrogenous* compounds contain, in addition to carbon, hydrogen and oxygen, the valuable element nitrogen, often associated with sulphur and phosphorus. In the following table they are collated under the heading "Albuminoids." Though the albuminoids in plants and animals may differ in physical properties, they all closely approximate each other in chemical composition—containing in the neighbourhood of 16 per cent. nitrogen. Examples of albuminoids in the animal kingdom are: white of egg, casein (curd) of milk; in the vegetable kingdom: gluten of wheat—the tough elastic mass left after washing out the starch, etc., in flour, and vegetable casein found largely in the seeds of the leguminosæ—peas, beans, &c.

The nitrogenous matters or albuminoids are considered the most valuable of the nutritive ingredients of a fodder, and in the animal economy play the part of flesh-producers. They enter largely into the composition of muscle and cartilage, and are essential constituents of the vital fluids, blood and milk. They also assist in producing fat and developing heat and energy.

The *Non-nitrogenous* matter is made up of (1) fat, (2) fibre and (3) carbohydrates. These are all composed of carbon, hydrogen and oxygen, and their chief function in the animal is the generation of heat and muscular energy necessary for the continuance of life and the accomplishment of work.

Fat.—Of the non-nitrogenous constituents, fat has the highest nutritive value; and this because it contains a larger percentage of carbon than fibre, or the carbohydrates, in the burning of which in the blood much heat is evolved. Its increased value is largely due, also, to the fact that it can be converted into animal fat much more readily than the other organic ingredients.

Fibre is the least valuable of the food ingredients. It is the part of plants that corresponds in function to that of the bones of animals, viz., the supporting and strengthening of the other tissues. By chemical means it can be separated from the other parts of a fodder as a fibrous or woody material. As plants mature, the fibre, as a rule, becomes less digestible, chiefly owing to the deposition of ligneous or woody matter.

Carbo-hydrates.—These include starch, sugars and gums, and consist of carbon united with oxygen and hydrogen in the proportions in which they exist in water. They serve, by their oxidation to carbonic acid and water in the animal, to produce heat and energy.

The *Inorganic* or mineral part is recorded in the column "Ash." It is that part left when a fodder is burned, an operation that destroys and dissipates the organic matter. It is composed chiefly of lime, magnesia, potash and soda, combined with phosphoric and hydrochloric and silicic acids. The functions of these materials in the animal are to assist in forming bone (largely composed of phosphate of lime) and to furnish that small quantity of mineral matter found in all animal tissues.

Co-efficient of Digestion.

The portion of food digested is assimilated and utilized by the animal either in the formation of muscle or fat or in the production of heat; the portion undigested passes out of the animal as solid excreta. The amounts or percentages, of albuminoids, fat and fibre digested are known as the co-efficients of digestion. Thus, if 75 per cent. of the total amount of the albuminoids in a grass is digested, the co-efficient of digestion of the albuminoids in this fodder is 75.

The digestion co-efficients of the constituents of a fodder may be all different. We also find that the co-efficient for the same ingredient varies according to the nature of the fodder. The two following examples will illustrate these statements.

Digestion Co-efficients.

Name of Fodder.	Albuminoids.	Fat.	Fibre.	Carbo-hydrates.
Peas	88	58	74	97
Wheat straw	26	27	52	40

From the analysis of a fodder and a knowledge of the digestion co-efficients of its ingredients, the digestible matter in a ton can be easily calculated. The following is worked out for peas:

	Percentage Composition.		Digestion Co-efficient divided by 100 × by 20.				Digestible Matter in ton of 2,000 lbs.
Albuminoids	22·4	×	·88	×	20	=	394·24
Fat	3·0	×	·58	×	20	=	34·80
Fibre	6·4	×	·74	×	20	=	94·72
Carbo-hydrates	52·6	×	·97	×	20	=	1020·44
Total							1544·20

Nutritive Ratio.

The nutritive ratio of a fodder is the ratio existing between the amount of digestible albuminoids (nitrogenous matter) on the one hand, and the amounts of the digestible fat, fibre and carbo-hydrates (non-nitrogenous matter) taken together, on the other hand.

Since, as has already been pointed out, the fat is considered 2½ times more valuable than the other non-nitrogenous ingredients, the per cent. of fat found by analysis is first multiplied by 2½ before adding it to the sum of the fibre and carbo-hydrates.

The nutritive ratio serves as a ready means of comparing the relative values of the dry matter of fodders.

A properly balanced food, *i. e.* one in which the several ingredients are present in right proportion, is necessary if economy in feeding and the health of the animal are to be considered.

According to the function of the animal fed—whether it be the production of milk, flesh, wool or work, so there will be the requirement in the animal for different proportions of digestible nitrogenous and non-nitrogenous ingredients in the food. Thus by experiment it has been shown that a milking cow requires daily for every 1,000 lbs. of her live weight, 15½ lbs. of digestible matter in which the nutritive ratio is 1: 5·4. In the case of oxen at rest, there is required daily, for 1,000 lbs. of live weight, 8¾ lbs. of digestible matter, in which the amount of albuminoids is to the amount of the non-nitrogenous matter is as 1: 11·9, or, in other words, in which the nutritive ratio is 1: 11·9.

During the past year many analyses of food-stuffs have been made. These fodders comprise samples of oil cake, cotton-seed meal, "germ" (Indian corn) meal, corn ensilage, various grasses and other materials. The results of these analyses are set down in tabular form, together with the amounts of the digestible ingredients per ton and the nutritive ratio.

Analyses of Fodders.

Material.	Name of Manufacturer or Sender.	Water.	Dry Matter.	Composition of Dry Matter. Albuminoids.	Fat.	Fibre.	Carbo-hydrates.	Ash.	Pounds of digestible matter in a ton (2,000 lbs.) Albuminoids.	Fat.	Fibre.	Carbo-hydrates.	Total.	Nutritive Ratio.
Oil-cake	Livingstone J., Baden	7·49	92·51	32·12	6·17	10·49	43·09	8·13	517·03	103·88	50·46	725·50	1396·87	1:2
do	Mann & Co., Buffalo.	8·64	91·36	38·19	5·70	10·01	40·33	5·77	607·09	94·78	47·55	670·58	1420·00	1:1·55
do O.P.	W. & L., Chicago	10·06	89·94	36·90	6·21	9·35	41·16	6·38	577·47	101·65	43·73	673·75	1396·60	1:1·68
Cotton-seed meal	P. D. M. Co., Memphis	9·42	90·58	43·70	9·17	15·00	23·48	8·65	673·54	146·26	529·87		1349·67	1:1·3
Germ meal	A. Gunn & Co., Halfax	8·64	91·36	11·22	9·18	8·51	68·19	2·90	161·96	142·57	96·40	1133·82	1534·75	1:9·8
Golden Tankard mangel.	Hon. Chas. Peloquin, St. Hyacinthe	91·90	8·10	9·66	3·58	7·83	69·45	10·42	15·64	5·80	12·68	112·51	146·63	1:8·93
"Lambs Quarter" (Chen. Album)		81·56	18·44	16·12	·69	23·63	40·18	17·74	....	....	....	....	....	
Corn ensilage (taken 4th Dec.)	C. E. Farm	78·09	21·91	9·00	3·31	22·99	59·01	5·69	28·78	10·87	72·50	173·17	285·32	1:9·5
do (taken 5th March)	"	78·00	22·00	9·43	4·37	28·37	51·85	5·98	30·29	14·42	89·88	152·85	287·44	1:9·2
Wheat and thistles ensilage (21st Nov.)	Holland Bros	77·33	22·67	8·93	2·04	36·76	39·21	13·03	....	....	....	....	....	
Corn and Grasses.	*Stage of Growth.*													
Indian Corn, average of 7 samples	Ears appearing	80·76	19·21	9·17	1·08	26·98	55·60	7·17	25·58	3·10	77·16	143·91	256·31	1:9
" do 7 do	About glazing	77·25	22·75	8·28	1·45	27·36	57·58	5·33	27·41	5·00	89·68	175·77	297·72	1:10·4
Red top (Agrostis vulgaris)	In flower	66·88	33·12	8·06	2·88	37·10	45·97	5·99	40·04	12·59	179·40	240·56	472·59	1:11·2
June grass (Poa pratensis	Just before flowering	74·34	25·66	18·19	4·82	29·78	40·68	6·53	70·01	16·33	111·57	164·93	362·81	1:4·5
do do	Seed formed	72·37	27·63	9·87	3·06	32·72	49·41	4·94	38·18	10·99	124·76	215·70	389·63	1:9·6
Timothy (Phleum pratense)	Just speared	83·58	16·42	17·06	4·02	29·01	42·20	7·71	42·01	7·39	69·55	109·48	228·43	1:4·7
do do	Seed formed	73·55	26·45	8·19	1·50	31·17	55·30	3·84	30·32	5·13	113·77	231·09	380·31	1:11·7
Tall fescue (Festuca elatior)	Just before flowering	80·97	19·03	16·43	3·50	30·47	42·70	6·90	46·90	8·79	84·66	128·39	268·74	1:5·0
do do	In flower	71·77	28·23	11·41	1·79	39·40	40·64	6·73	48·44	6·67	162·39	181·27	398·77	1:7·4

OIL CAKE AND COTTON-SEED MEAL.

These fodders are particularly rich in albuminoids—the nutritive ratio approaching in some samples to 1:1. They also contain large amounts of fat and mineral matter, in which latter phosphates are abundant.

For these reasons, they are particularly valuable to the stock-raiser and dairyman as cattle foods for the production of flesh and milk.

The manure from animals fed with these highly nitrogenous foods is of great value—a value enhanced in the materials under discussion by the presence of a large amount of phosphates. Such manure returns to the soil the most important of the fertilizing elements for future crops.

As these are concentrated and expensive foods, their use in small quantities, and mixed with fodders low in albuminoids and fat (such as straw, roots, corn fodder, &c.,) must be practised, if profit is to be expected. The amount that can be economically fed, will depend upon the composition and quantity of the other food ingredients and the age and function of the animal fed.

"GERM MEAL.

This is manufactured from Indian corn. It differs from the fodder just discussed in containing less albuminoids and more carbo-hydrates. While therefore, compared with them, it is wanting in muscle or flesh-forming ingredients, it is richer in those nutrients that develop heat.

Corn-meal has high digestive co-efficients. It contains a large percentage of fat, and is well and widely known for its fattening qualities when fed to stock.

ROOTS.

Roots in general have a low feeding value, being very rich in water and very poor in albuminoids. Roots, however, are very easily digested, and therefore are valuable for their non-nitrogenous constituents. Owing to their large percentage of water they furnish a succulent food; and as they are also palatable, they are relished by cattle.

The sample of Golden Tankard mangel analysed contained somewhat less than 150 lbs. of digestible matter per ton, with a nutritive ratio of nearly 1:9; whereas, oil-cake meal contains about 1,400 lbs. of digestible matter, with a nutritive ratio of 1:1·5. From these figures and the explanations already given, the comparative values of roots and oil-cake meal as food may be easily ascertained.

LAMB'S QUARTER (*Chenopodium album*).

Throughout Manitoba and the North-West Territories, this well known weed is abundantly prevalent, large tracts of lands often being entirely covered with it. The high winds, so common in these districts, serve to scatter the seed over very wide areas, and, being a vigorous grower, the plant when left alone soon crowds out other vegetation.

Several enquiries have been received from farmers residing in such parts concerning the probable value of the weed as a fodder plant, and whether it would be useful as a crop for ensilage. To answer these questions, the plant has been analysed and a determination of its food constituents made. These are found in the table of fodder analyses. In another place will be found the results of the analysis of the plant's ash, which show its value as a fertilizer.

The specimen was taken at Ottawa late in autumn, after the first frost. It was quite green, and had evidently flowered but recently. From its analysis it compares very favourably with good pasture grass. The true albuminoids are probably somewhat lower than what is represented in the table, as in plants of this nature a part of the nitrogen is present in less nutritive compounds. The percentage of fat is low, that of the ash high, while the amount of fibre is about equal to that in corn ensilage. This weed belongs to the same botanical order as the beet, mangel and spinach, and in its young condition is often used as as a pot-herb. Whether the continued use of it would affect the digestion remains to be seen; but judging from its composition and relationship to other edible plants there seems no reason why it should not make a nutritive fodder if cut young and in a succulent condition. As the plant matures there appears to be a considerable deposition of woody fibre or lignin, which would lower the digestibility of the plant considerably. Its preservation in the silo could be accomplished with the same care as that given to any fodder crop.

The fertilizing elements which this weed extracts from the ground are discussed in another part of this report.

CORN FODDER AND ENSILAGE.

Experiments with fodder corn have been carried on during the past two seasons, both in the field and in the laboratory. The results of these experiments will shortly be published in detail in bulletin form. For the purpose of comparing the composition of corn fodder and ensilage with the food-stuffs just discussed, several of the analyses are here given.

Corn Fodder.—The averages representing the composition at two stages of growth of the corn plant are given. The average in each case is from the same seven varieties of Indian corn.

On account of the large yield per acre, and the succulency and easy digestibility, of the corn plant, it is one of the most valuable of all fodder crops. It is low in albuminoids, having a nutritive ratio of about 1:9·5, and consequently requires the judicious addition of nitrogenous food to make it a nutritious and well balanced fodder. According to our analyses, corn fodder at the "glazing" condition contains about twice as much digestible matter as mangels, and about two-thirds as much as timothy and red-top grass cut at their best. Corn fodder is chiefly valued for its milk-producing properties, and on this account is used by many dairymen as the staple green fodder during those summer months when the grass is short and withered.

Corn ensilage is also a fodder very widely known and used. The analyses of two samples taken 4th December and 5th March respectively, are given in the table. These prove the ensilage to be fairly similar in composition to the corn fodder from which it was made. Good corn ensilage should contain from 250 lbs. to 300 lbs. of digestible matter per ton; and its nutritive ratio should lie between 1:9 and 1:10.5.

Further information regarding the composition of the Indian corn and the ensilage will be found in the bulletin referred to.

A sample of ensilage made from thistles and wheat (about $\frac{2}{3}$ of the latter to $\frac{1}{3}$ of the former) was sent in for analysis by Messrs. Holland Bros., Ottawa, who reported it as readily eaten by their cattle. The specimen was very dark in colour and more distinctly acid than the corn ensilage. It will be observed that the fibre and ash are very high compared with corn ensilage, and that the carbo-hydrates are correspondingly low. Its feeding value would therefore be less than that of corn ensilage.

GRASSES.

Fifty-two samples of grasses, comprising forty-one varieties, have been analysed during the past year. These were all grown on experimental plots at the Central Experimental Farm. Most of the grasses were analyzed at two stages of their growth. From the results so obtained the analyses of several have been selected and inserted in the present table. The work in detail will be published separately, when the character of the grasses of the North-West will be discussed.

It is to be noticed that the percentage of albuminoids is higher in a grass before flowering or when in flower than when the seed is fully formed. As the seed matures there is a migration of the albuminoids of the leaf and stalk into the seed. As the grass ripens the seed is liable to be shed—when there will be also an additional loss in harvesting—and thus it becomes the most economical plan to cut for hay before the seed is fully formed. The best time for harvesting will vary for different grasses; but as far as general advice can be given, they should be cut while in flower rather than when more mature. The nutritive ratio in the early and late cut grasses point to this conclusion most emphatically. Although there is a general increase in the total dry matter of the grass as maturity is reached, yet this is more than counterbalanced in most instances by the decreased albuminoids.

RED-TOP (*Agrostis vulgaris*), is a valuable grass, and contains a large amount of digestible matter to the ton. It is useful for moist land, and as a pasture grass is thought highly of. In albuminoids it is about equal to early cut timothy, but in this constituent it is exceeded by June grass and tall fescue.

JUNE GRASS (*Poa pratensis*) is an exceptionally good grass. It is also known as Kentucky blue grass. It is held to be one of the most nutritive of the pasture grasses, doing best on moist, rich soils. From the luxuriance of its growth and the excellence of its composition (18 per cent. albuminoids, before flowering) it is esteemed as a specially valuable grass. If intended for hay, the analysis shows that it should be cut before the seed is fully mature.

TIMOTHY (*Phleum pratense*).—The analyses in the table give the composition of this well-known grass at two stages of its growth. They emphatically point to the advisability of cutting while in blossom. It then forms a very valuable hay crop. If allowed to thoroughly mature, not only do the albuminoids decrease, but the digestibility of the grass is lessened by it becoming hard and fibrous. On good soils and with favourable seasons the crop of timothy is very heavy.

TALL FESCUE (*Festuca elatior*).—Tall fescue grass. Two analyses of this grass were made—one just before it flowered, the other whilst the grass was flowering. The increased albuminoids and total digestible matter in the latter show that the grass between these two stages of growth had laid up a store of nutrients, and that if intended for hay it should be cut not earlier than the blossoming stage.

The conclusion to be drawn from the grass analyses with regard to the time at which to cut for hay is, that while the grass is in bloom or directly after, the mowing should be done. Then it is that the albuminoids are in the greatest proportion to the other nutrients; that the water has considerably decreased, augmenting the percentage of dry matter and that the fibre is still soft and digestible. Although, when more mature, the grass contains a greater amount of dry matter, yet because many of the seeds have dropped, the albuminoids are proportionately less. The fibre has then increased, both in amount and in indigestibility, and the grass has generally become less nutritious.

When studying the foregoing table of fodder analyses it will be well to first inspect the column headed "Total pounds of digestible matter in a ton," then the "nutritive ratio," and thirdly the "The amount of digestible albuminoids per ton." By following this order, and then consulting the other columns, the comparison of the feeding value of any two or more fodders can easily be made.

POTATOES.

The value of this important crop depends chiefly upon the yield per acre, the size of the tuber, with its freedom from scab, and its eveness of contour. These are largely the factors that determine the market price and the profitableness of any variety to the grower.

As a vegetable, however, the value of the potato depends upon its composition. The larger the percentage of "dry matter" the better the potato. This "dry matter"—varying from 15 per cent. to 25 per cent.—consists largely of starch. Numerous experiments in Germany and the United States have gone to show that the quality improves as the percentage of starch increases. The "mealy" potatoes are those richest in starch.

Upon this basis the many varieties of potatoes grown during 1890 at the Central Experimental Farm have been tested, and an estimation of their contained dry matter and starch made. These have been calculated from the specific gravity, using the table prepared by Holdefleiss. The results by this method, while not pretending to scientific exactness, show undoubtedly the approximate and relative proportions of starch possessed by the potatoes examined.

On an average, seven fair specimens of each variety were taken, from which to determine the "average weight of tuber," and the "specific gravity."

The results of this investigation are given in the following table, in which the varieties are arranged in the order of decreasing merit:—

No.	Name.	Average Weight of Tuber.	Specific Gravity.	Percentage of Starch.	Percentage of Dry Matter.
		ozs.			
1	Rural Blush	4¼	1099	18·56	23·25
2	Carter's Magnum Bonum	3	1097	18·17	22·81
3	Early Onion	7¼	1095	17·78	22·37
4	Fidelia	3¾	1095	17·78	22·37
5	Richter's Schnee Rose	4¾	1095	17·78	22·37
6	Alexander Prolific	6½	1093	17·41	21·95
7	White Star	4½	1091	17·05	21·53
8	"Large" from British Columbia	5¼	1091	17·05	21·53
9	"Blue"	4	1090	16·88	21·32
10	Richter's Improved	5½	1090	16·88	21·32
11	Clark's No. 1	6	1089	16·71	21·12
12	Sharpe's Seedling	6½	1088	16·54	20·92
13	Gleason's Late	2¾	1088	16·54	20·92
14	St. Patrick	2½	1088	16·54	20·92
15	Early Maine	7½	1088	16·54	20·92
16	Carter's Sukreta	4	1087	16·38	20·73
17	Wonder of the World	5½	1086	16·22	20·54
18	Burpee's Superior	5¼	1086	16·22	20·54
19	Early Eating	8	1086	16·22	20·54
20	White Sprout	5¾	1086	16·22	20·54
21	Beauty of Hebron	7¾	1086	16·22	20·54
22	Empire State	5¾	1086	16·22	20·54
23	Six Weeks Round White	2½	1086	16·22	20·54
24	Early Ohio	6¼	1085	16·07	20·25
25	Snow Flake	3¾	1085	16·07	20.25
26	Early Albino	6½	1085	16·07	20·25
27	Ruby	5¾	1085	16·07	20·25
28	Sugar	4	1085	16·07	20·25
29	Burpee's Seedling	6¼	1085	16·07	20·25
30	Dumfries Early White	4¼	1085	16·07	20·25
31	May Queen, Early	6	1085	16·07	20·25
32	Late Goodrich	4½	1085	16·07	20·25
33	Thorburn's Paragon	3½	1084	15·92	20·17
34	Carter's Holborn Abundance	5½	1084	15·92	20·17
35	Early Callao	3¾	1084	15·92	20·17
36	Rosy Morn	7¼	1083	15·77	19·99
37	Prairie Seedling	5	1083	15·77	19·99
38	Flower of Eden	6	1082	15·63	19·81
39	Compton's Surprise	5	1082	15·63	19·81
40	White Star	5	1081	15·50	19·63
41	Sukreta	3¼	1081	15·50	19·63
42	Ohio Gunner	6¼	1081	15·50	19·63
43	King of the Russets	6½	1081	15·50	19·63
44	"International Seed Co."	8	1081	15·50	19·63
45	Holton Seedling	5¾	1081	15·50	19·63
46	May Queen, Early	9	1080	15·37	19·46
47	Vanguard	7½	1080	15·37	19·46
48	Member of Parliament	5½	1079	15·24	19·30
49	Pride of America	3¼	1079	15·24	19·30
50	Crown Jewel	7¾	1079	15·24	19·30
51	Lee's Favourite	6¼	1079	15·24	19·30
52	Schoolmaster	3	1079	15·24	19·30

No.	Name.	Average Weight of Tuber.	Specific Gravity.	Percentage of Starch.	Percentage of Dry Matter.
		ozs.			
53	Pearl of Savoy	6½	1079	15·24	19·30
54	Emperor William	3½	1078	15·12	19·14
55	Great Eastern	6½	1078	15·12	19·14
56	Burpee's Early Crane	6¼	1078	15·12	19·14
57	English Kidney	2	1078	15·12	19·14
58	Kidney August	2¾	1077	15·00	18·98
59	Adirondack	4¾	1077	15·00	18·98
60	Chicago Market	7½	1077	15·00	18·98
61	Vermont	5¾	1076	14·89	18·83
62	Eye Carpenter	5¼	1076	14·89	18·83
63	Rose's New Giant	6¼	1075	14·79	18·69
64	New Badger State	9¾	1075	14·79	18·69
65	Alpha	3	1075	14·79	18·69
66	Manhattan	5¾	1075	14·79	18·69
67	Frame Early	2¼	1074	14·69	18·54
68	Carter's Surprise	2¾	1073	14·60	18·40
69	Early Household	2¾	1072	14·51	18·27
70	Mammoth Prolific	5½	1072	14·51	18·27
71	Scotch Champion	5½	1070	14·36	18·02
72	Carter's Cosmopolitan	3	1070	14·36	18·02
73	Rennie's Stray Beauty	5	1069	14·29	17·80
74	Rennie's Dakota Red	6¼	1069	14·29	17·80
75	First Crop Ash Leaf	2¼	1069	14·29	17·80
76	King of the Earlies	4¼	1069	14·29	17·80
77	Conqueror	4½	1068	14·22	17·69
78	Prime Minister	3¾	1067	14·15	17·58
79	Bliss' Triumph	6½	1067	14·15	17·58
80	Telephone	3¾	1059	13·59	46·87

SUGAR BEETS.

The results of the analyses of sugar beets examined in the Farm Laboratory during the past year will be found in the subjoined table. The beets were grown from seed imported from Germany by Wilfred Skaife, Esq., President and Manager of the Berthier Beet sugar factory, Montreal. The work of distributing the seed among the farmers of Ontario and of collecting and forwarding the roots for analysis was undertaken by Mr. Robt. H. Lawder of Toronto.

The chemical data include the percentage of sugar in the juice and the co-efficient of purity—the latter representing the percentage of sugar in the total solids of the juice. Besides these analytical results there will be found the average weight of one root in lbs. and ozs., the nature of the soil in which the beets were grown, the dates of sowing and pulling, and such general remarks as to the manuring, drainage and method and thoroughness of culture as were thought justifiable from the information afforded by the growers.

The last fourteen of the series are from beets grown on the Central Experimental Farm, Ottawa; the other localities—widely representative of different portions of Ontario—are indicated in the column provided for that purpose.

The method of analysis was the same as that adopted in 1889, viz., the determination of the specific gravity of the expressed juice by the Westphal balance, calculating therefrom the co-efficient of purity, and the estimation of the percentage of sugar in the clarified juice by a Schmidt and Haensch polariscope.

The averages of the first 68 samples, as shown by the following table, are:—

Sugar in juice	12·47 per cent.
Co-efficient of purity	76·70 do
Weight of one root	1 lb. 14 ozs.

According to the percentage of sugar they contain, the roots fall into the following classes:—

			No. of Samples.
Over	17 per cent. sugar		2
Between	16 and 17 per cent. sugar		1
do	15 and 16	do	0
do	14 and 15	do	10
do	13 and 14	do	12
do	12 and 13	do	15
do	11 and 12	do	13
do	10 and 11	do	12
Under	10 per cent. sugar		3

In other words:

60 per cent. of the samples yielded over .... 12 per cent. sugar,
and 38 do do .... 13 do

The average percentage of sugar this year is somewhat lower than that obtained in 1889—when, however, only 25 samples were examined. This falling off may in part be due to the difference in the seasons, though it is quite possible that badly prepared ground and careless cultivation may, in many instances, have been the cause of the lower sugar-yield.

The averages, however, as they stand, indicate a very fair factory beet, and all things being considered, compare well and favourably with those of other countries in which beet-sugar is manufactured. Sufficient work has been done to indicate that both as regards yield per acre and richness in sugar, with a more careful cultivation, sugar-beets may be raised in many parts of Ontario fully equal to those of Europe and the United States.

ANALYSES OF

No.	Name of Grower.	Locality.	Percentage of Sugar in Juice.	Coefficient of Purity.	Average Weight of One Root. Lbs.	Ozs.
1	Billing, W. H.	Tp. Gosfield, Co. Essex	10·41	73·1	....	
2	Walters, John	Tp. Maidstone do	10·53	73·9	1	9
3	Hunt, John	London South, Co. Middlesex	13·06	79·1	....	11½
4	Hunt, C. B.	do do	11·90	77·9	1	1
5	Hill, James	Tp. Trafalgar, Co. Halton	13·08	77·7	1	3½
6	McConachie, S.	Tp. Pickering, Co. Ontario	14·77	85·0	....	15
7	Laing, Geo.	do do	12·53	80·8	2	1½
8	Willis, R.	Tp. Whitby do	14·15	82·1	....	15¼
9	Moody, Thos.	Tp. Pickering do	11·32	75·7	1	11¾
10	Wilson, John	Oakville, Co. Halton	10·78	74·5	2	11
11	Robson, E. H.	Waterdown, Co. Wentworth	10·83	74·1	1	6½
12	Fothergill, Chas	Appleby, Co. Halton	8·65	67·3	3	8½
13	Graham, Jas. H	Tp. Scugog, Co. Ontario	12·00	76·9	....	11
14	Pearson, Wm.	Tp. Reach do	11·92	75·6	1	8½
15	Dryden, Hon. John	Brooklin P.O. do	14·78	78·7	1	11
16	Kellett, C. C.	Port Perry do	10·38	71·7	1	12
17	McGill, Wm.	Tp. Reach do	11·06	73·1	1	7½
18	Whitfield, John	Port Perry do	1·73	76·0	1	8
19	Coates, Jas.	Tp. Cartwright, Co Durham	12.50	80·0	1	11
20	Heard, John	Tp. Reach, Co. Ontario	11·87	79·2	3	0
21	Steele, Geo.	Tp. Cartwright, Co. Durham	13·84	82·3	1	1½
22	Steele, Wm.	Tp. Reach, Co. Ontario	13·84	82·4	1	9
23	Grierson, G. H	Tp. Whitby do	14·23	77·9	2	4
24	Lick, Jas.	do do	10·49	73·2	2	5
25	Jeffrey, Wm.	do do	12·69	78·3	1	9½
26	Lynde, R.	do do	12·84	70·4	3	2½
27	Ballantyne, Thomas.	Stratford, Co. Perth	13·11	77·4	1	11
28	Bell, Alfred	Tp. Hamilton, Co. Northumberland	11·12	72·4	1	10½
29	Russell, Jas.	do do	11·64	77·4	1	14½
30	Weaver, Peter	Paisley Block, Co. Wellington	13·07	81·7	1	13½
31	Betzner, David	"Paisley German Tract"	14·22	86·0	1	5¼
32	Hoskins, Thomas	Tp. Haldimand, Co. Northumberland	10·72	75·2	1	15

SUGAR BEETS.

Nature of Soil.	Date of Sowing.	Date of Pulling.	Remarks.
Gravelly loam....	......	....	
Rich loam........	May 14..	Oct. 2..	Kept well cultivated and covered.
Rich garden soil..	......	....	Fairly well cultivated, allowed to grow above ground.
do ..	......	....	do do
Sandy loam.... ..	do 8..	do 10..	Manured in 1889, undrained, not kept clean nor covered.
Clay loam........	do 25..	do 11..	Manured, tile drained, kept partially clean and covered.
do	do 15..	do 11..	Tile drained, manured, kept clean and partly covered.
do	do 12..	do 11..	Natural drainage, kept covered and clean, manured.
Heavy clay......	do 26..	do 11..	Drained, not manured, kept clean and covered.
Sandy loam......	do 5..	do 10..	Manured, not carefully cultivated nor covered.
do	do 24..	do 11..	Manured, kept fairly covered, roots wide apart.
Clay loam........	do 24..	....	Manured, grown too far apart, kept covered.
do	do 15..	do 13..	Manured, undrained, kept clean and covered.
do	do 26..	do 11..	Manured, tile-drained, kept partially clean and covered.
Black loam.......	do 1..	do 12..	Unmanured, tile drained, kept clean and partially covered.
Loam	do 1..	do 13..	Manured do do covered.
Sandy loam.......	do 15..	do 13..	Manured, undrained do do
Clay loam........	April 28..	do 11..	Unmanured do do do
Sandy loam.	May 26..	do 13..	Manured do do do
Heavy clay loam..	do 15..	do 14..	do do do do
Sandy loam.......	do 20..	do 13..	do do do do
dc	do 15..	do 13..	do do kept partially clean and covered.
....	....	.... ..	
....	.		
Clay loam........	do 20..	do 15..	Plot tile-drained, manured, kept scuffled and clean, and covered.
do	do 31..	do 15..	Plot not drained, manured.
Clay....... ...	....	....	Manured, kept fairly well covered.
Clay loam........	do 22..	do 14..	Manured, undrained, kept fairly clean.
Rich black clay...	April 27..	do 8..	Tile-drained, manured, clean and partially covered.
Rich sandy loam..	May 22..	do 16..	Roots well cultivated, planted close together, well covered.
do ..	do 22..	do 16..	Lightly manured, roots kept covered.
Heavy clay.......	do 10..	do 17..	Manured in 1889, undrained, kept clean and covered.

ANALYSES OF

No.	Name of Grower.	Locality.	Percentage of Sugar in Juice.	Coefficient of Purity.	Average Weight of One Root. Lbs.	Ozs.
33	Riddell, Walter	Tp. Hamilton, Co. Northumberland	12·43	78·4	1	5¾
34	Mulholland, J. T	Tp. Haldimand do	12·33	77·9	2	......
35	Westington, J.	Tp. Hamilton do	14·18	82·0	2	2¼
36	Bowman, John	do do	13·45	79·0	2	6
37	Schumacher, B	"German Block"	12·57	70·6	1	9
38	Shantz, Aaron	Berlin, Co. Waterloo	12·25	77·7	1	15
39	Merner, Ab	......	12·01	79·0	1	14
40	Page, Seth	Tp. Pelham, Co. Welland	17·05	82·6	1	8
41	Hilton, H	Tp. Trafalgar, Co. Halton	14·50	84·5	1	5¼
42	Barrie, Geo	Tp. Dumfries, Co. Waterloo	13·39	82.1	1	10¼
43	Todd, Thos	Galt do	12·00	74·7	1	3½
44	Howland, Sir W. P	Toronto, Co. York	10·10	67·3	1	......
45	do	do do	10·83	68·5	1	9
46	do	do do	8·52	62·0	1	......
47	Leslie & Sons	do do	16·53	77·8	....	13
48	Richmond, Wm	Tp. South Dumfries, Co. Brant	11·61	74·5	2	5½
49	Scott, Alex. E	Tp. North do Co. Waterloo	14·05	81·6	1	14½
50	Goldie, D	Ayr do	11·20	74·6	2	7¼
51	Stewart, Erskine	Tp. N. Dumfries do	9·89	69·1	2	14¾
52	McEwan, A	do do	13·51	80·0	....	12¾
53	McDonald, A	Tp. Howard, Co. Elgin	10·63	73·5	6	3½
54	Brubacher, M. E	Tp. Woolwich, Co. Waterloo	11·83	76·9	2	14
55	Schmidt, G. B	do do	10·92	74·1	3	3½
56	Carlow, T. B	Tp. Percy, Co. Northumberland	13·55	83·8	1	13¾
57	Murray, B. W	Tp. Toronto, Co. Peel	12·56	76·4	2	¼
58	Hinch, Ogden	Napanee, Co. Lennox	12·70	79·5	2	14½
59	Wordsworth, T. K	Weston, Co. York	13·81	75·7	1	7¾
60	McAllister, T	Tp. King do	13.86	79·9	1	11
61	Mitchell, J. & J. W.	Tp. Vaughan, Co. York	17·42	83·0	....	11¾
62	Dempsey, W. R	Ameliasburgh, Co. Prince Edward	14·06	79·9	3	11
63	do	do do	10·74	69·4	3	7
64	do	do do	11·50	76·0	3	1

SUGAR BEETS.—*Continued.*

Nature of Soil.	Date of Sowing.	Date of Pulling.	Remarks.
Strong clay loam..	June 20..	Oct. 17..	Manured, undrained, kept clean and fairly covered.
Clay loam........	May 5..	do 14..	do kept fairly clean and partially covered.
do	do 5..	do 14..	Unmanured, undrained, kept clean and covered.
Rich clay.........	do 15..	do 14..	Manured, undrained, kept fairly clean and partially covered.
Rich sandy loam..	do 22..	do 6..	
do ..	do 22..	do 16..	
....	....	....	
Sandy loam......	do 1..	do 18..	
Clay loam........	do 1..	do 10..	Unmanured, kept clean and well covered.
do	....	do 23..	
Garden soil.......	do 9..	do 23..	
Clay soil.........	do 1..	do 3..	Heavily manured, shaded, some roots very small.
do	do 1..	do 15..	do do do
do	do 15..	do 15..	do do do
Clay loam........	do 15..	do 25..	Kept well covered.
Rich loam........	do 5..	do 29..	Manured, tile-drained, kept fairly clean and covered.
Light loam........	do 1..	do 25..	Manured, undrained, kept fairly clean and partially covered.
Rich garden soil...	do 1..	do 22..	Undrained, unmanured, kept clean and covered.
Old do ..	do 3..	do 22..	Tile-drained, unmanured, kept clean, but not covered.
Light soil.........	do 4..	do 25..	Manured, undrained, kept fairly clean and covered.
Gravel loam......	do 27..	do 25..	Manured, tile-drained, kept clean.

ANALYSES OF

No.	Name of Grower.	Locality.	Percentage of Sugar in Juice.	Coefficient of Purity.	Average Weight of One Root- Lbs	Ozs.
65	Groh, Anson............	Preston, Co. Waterloo..................	14·67	78·1	1	12¾
66	Goodfellow, W..........	Tp. Albion, Co. Peel........................	12·90	66·6	1	7¾
67	Berwick & Co..........	Shelburne, Co. Grey.....................	11·70	72·7	3	5½
68	Rathbun Co............	Tp. Richmond, Co. Lennox.............	12·38	77·9	1	10½
	Average................	....	12·47	76·7	1	14
A	C. E. Farm.............	"Musy".................................	12·41	81·0	1	9½
B	do	White Silesian "Steele".................	11·70	81·6	1	8¾
C	do	do "Rennie"................	11·18	77·5	1	9
D	do	Vilmorin's Improved....................	12·77	81·2	1	13¼
E	do	Red Top "Rennie"....................	7·99	63·0	1	14¼
F	do	Carter's "Prize Nursery"...............	6·76	65·4	2	9¾
G	do	Imperial................................	8·37	69·0	3	½
H	do	Silesian "Landreth".....................	9·97	72·7	1	11¼
I	do	Imperial do	10·21	73·5	1	13¼
K	do	White "Buist"........................	8·77	66·3	3	6
L	do	"Musy".................................	11·33	80·7	1	11½
M	do	do	12·12	79·7	2	1½
N	do	"C. P. 2."...........................	10·74	76·5	2	14¼
O	do	"Skaife".............................	13·59	83·2	1	11½

SUGAR BEETS.—*Concluded.*

Nature of Soil.	Date of Sowing.	Date of Pulling.	Remarks.
....	...	....	
....		. .	
....		... ..	
Clay loam........	June 25..	Oct. 17..	Unmanured, tile-drained, kept clean and covered.
... .	....	....	
Sandy loam.......	May 13..	do 21..	Manured, tile-drained, kept clean.
do	do 2..	do 18..	do do
do	do 2..	do 18..	do do
do	do 2..	do 18..	do do
do	do 2..	do 18..	do do
do	do 2..	do 18..	do do
do	do 2..	do 18..	do do
do	do 2..	do 18..	do do
do	do 2..	do 18..	do do
do	do 2..	do 18..	do do
do	do 13..	do 18..	do do
do	do 13..	do 21..	do do
do	do 13..	do 21..	do do
do	do 2..	do 18..	do do

Cultivation of the sugar-beet.

The sugar-beet is a variety of the ordinary beet that, by careful and scientific selection and propagation, has been improved, so that now examples are not wanting whose juice contains 20 per cent. sugar.

It is not intended to describe the many different kinds of sugar-beets developed of late years and now grown on the continent of Europe for the sugar factory, but it is necessary to say that the seed of such varieties as have been proved to be rich in sugar should only be sown.

The sugar-beet has been found to thrive throughout the greater part of Europe and the United States. As the northern or southern limit of this very extended area of growth is approached the sugar-beet increases in richness. What the sugar-cane is to the tropics, the sugar-beet is to the temperate zones. As it has already been said, there can be no doubt but what the climate of a large portion of Canada is suitable for the development of beets rich in sugar.

The value of beets for the manufacture of sugar depends upon their richness in sugar and the purity of their juice (co-efficient of purity), and these again in turn depend upon the kind of seed, the quality and condition of the soil, the extent and nature of the cultivation and the character of the season. Failure in the past has often resulted from not recognizing the fact that the sugar-beet requires a different and more thorough cultivation than beets grown for fodder purposes. A right preparation of the soil, correct planting, and the keeping of the root well below the surface of the ground, all exert their influence upon this crop, both as to quality and quantity.

In view of the probable extension of the beet-sugar industry in the near future and the consequent growth of these roots in large quantities in this country, it has been thought advisable to give some information—necessarily in a concise form—regarding those methods of culture which have been found advantageous by experienced sugar-beet growers.

Soil.—The sugar-beet will grow in almost any soil, but its profitable culture requires a good soil, properly prepared.

Heavy clay and wet soils, rocky and marshy lands, are not desirable. By judicious drainage the former may be vastly improved. Soils in which clay predominate are often too hard and impenetrable. In a ground full of stones the roots become forked and unsuited for the factory, and in a wet soil a watery root is produced.

Rich, loose, sandy soils, containing a fair proportion of lime, are the most favourable for the growth of beets rich in sugar.

Too much organic matter in the soil is apt to impair the purity of the juice, and for this reason the soil selected should be well manured the previous autumn, no application being made in the spring. The manure used should be in a thoroughly rotted condition.

The soil must not only be fertile, but its mechanical condition must be such that the roots may easily penetrate it. Soils in suitable condition for grain crops give excellent results, and a soil in which the in-turned sod is thoroughly rotted is also good. New soil is not considered the most desirable.

In seasons when it is hot and dry the stronger and heavier soil, if well drained, will be found more favourable than a loose sandy soil, but the latter, if well manured, will be the better if the summer is rainy or cold.

The ground should receive a thorough cultivation previous to seeding. If at all heavy it should not be worked while wet.

Sowing.—The proper time for seeding will depend upon the season and the soil, but during the latter part of April or the beginning of May the soil will in most localities be sufficiently dry, without having lost that degree of moisture necessary for the germination of the seed. The earlier the sowing the better, as the beets require to grow as long as possible. If found desirable, the seed may be soaked from five to ten hours before sowing.

The seed should be planted from $\frac{3}{4}$ to $1\frac{1}{4}$ inches deep, and in drills 12 to 20 inches apart. As it is not the purpose to raise a large beet—from 1 lb. to 2 lb. is a good size for sugar-content—the closer the plants in the row and the nearer together the drills the larger will be the yield to the acre, other things being equal.

Weeding.—When the weeds appear, if the beets are above ground, this operation should be commenced. A dry day should be selected for the work, which may be done by a hoe or suitable cultivator.

Thinning.—This may be done when the beets have attained a thickness of about ½ inch. A damp day should be chosen, the roots being be left from 6 to 9 inches apart, according to the richness of the soil. The richer the soil the closer the beets may be left. It is not desirable to raise a very large beet; small beets are the richer in sugar and have purer juice.

Cultivation.—It is of the utmost importance that the weeds be constantly destroyed and the soil kept loose. The number of times necessary to go over the ground will depend on the nature of the soil and the season.

Moreover, it is necessary that the beet should not be allowed to grow above ground; and consequently, as the summer advances, earthing up will have to be resorted to. In the part of the beet root developed above ground there is very little sugar. In the manufacture of the sugar this portion, if present, is always cut off and discarded—for not only is it poor in sugar, but it contains an excess of other substances, which makes difficult the extraction of the sugar. Care should be taken not to break off the leaves during the early growth of the plant, for it is by them that the sugar is developed.

Harvesting.—When the leaves turn yellow the beet is approaching maturity. Although it is desirable to leave the beets in the ground as long as possible, they should be pulled before the first heavy frost, as such would materially lower the percentage of sugar.

If not intended at once for the factory they may be kept in a pit.

Secondary Advantages of Sugar-beet Culture.

The indirect benefits to be derived from the sugar-beet culture are not few, and chief among them is the improvement of the soil.

The thorough state of cultivation necessary for the profitable growth of sugar-beets vastly increases the soil's fertility for succeeding crops. Land in a perfectly clean condition, with a proper mechanical texture, and rich in plant food, is the result.

The pulp from the sugar-beet factory has been largely used as a fodder. According to the richness of the beets and the process by which the sugar is extracted its composition and value varies. As part of a ration for milch cows it is highly spoken of, causing an increased flow of milk without lowering its quality. With straw, hay and a small quantity of oil cake an excellent ration may be prepared. Pulp has been successfully preserved as ensilage, in which condition it is much relished by cattle. In feeding beet pulp the mineral fertilizing elements withdrawn by the growing crop are for the most part returned to the soil.

MILK.

In order to obtain data that could be used as a basis for future reference in connection with milk experiments, a large number of analyses of the milk of the thoroughbred cows at the Central Experimental Farm has been made during the past year.

The analyses comprise 93 samples, and were all made in duplicate—the average of the closely concordant results being given. The milk was from 31 individuals, representing the following breeds: Jersey, Holstein, Ayrshire, Aberdeen, Angus and Shorthorn. Of the Jerseys, there were 5 cows; of the Holstein, 7 cows; of the

Ayrshire, 5 cows; of the Aberdeen Angus, 2 cows; and of the Shorthorns, 9 cows. In addition to these, the milk of 3 grade cows was examined.

The constituents of milk are water, fat, casein (or curd), milk-sugar and mineral matter or ash—the four latter being known together as the "total solids."

From a commercial standpoint, the element of chief value is the fat—the richer in percentage of fat, the more valuable the milk becomes. It is therefore of the first importance to ascertain by a separate determination the percentage of fat, which being substracted from that of the total solids (directly determined), leaves the percentage of "solids not fat." This latter includes the casein, milk-sugar and ash.

Although the fat is the principal constituent of milk that will command our attention here, it must be remembered that milk as a nutritive food is not valuable simply from its contained fat. The casein or curd, which separates on the milk becoming sour or on the addition of acid, is the nitrogenous part of milk, and therefore the most highly nutritious from a food standpoint. Milk is an exceptionally complete food, the nitrogenous part being well proportioned to the non-nitrogenous portion. This, together with the fact that it is very easily digested, makes milk the most nourishing of all foods for the young.

The fertilizing elements remain in milk after it has been skimmed, so that when the fat (as butter or cream) is alone sold, and the skimmed milk fed on the farm, the land is enriched rather than impoverished, for thereby is returned to the soil by the manure much plant food (especially nitrogen and phosphoric acid) in an easily available form.

The quantity and quality of milk of a cow at any given period depend upon numerous factors, chief among which are nature and quantity of food and water, breed, state of health, individual characteristics, age, length of time since calving, and date when bred.

In the following table, besides the analytical data—comprising specific gravity, total solids, fat and solids not fat—will be found information regarding many of the points above mentioned as affecting the quality and flow of milk.

The rations fed during the periods in which the samples analysed were taken are as follows:—

Ration 1.

Fed 7 per cent. of live weight daily, from 1st December, 1889, till 2nd March, 1890.	Corn ensilage	25 lbs.
	Roots	20 "
	Oat straw	7 "
	Provender ($\frac{4}{5}$ oats, $\frac{1}{5}$ barley)	4 "
	Bran	4 "

Ration 2.

Fed 7 per cent. of live weight from 3rd March to 31st March, 1890.	Corn ensilage	25 lbs.
	Roots	20 "
	Oat straw	10 "
	Provender (as in Ration I)	2 "
	Bran	3 "

After 12th January, the milking cows, except Countess of Darlington, and the grades, were fed in addition to above 2 lbs. of oil cake daily.

After 31st March, Ration 1 was fed until the cows went out to pasture.

The times of milking were 4 p.m. and 6 a.m., making the interval between the evening and morning milking 14 hours, and that between the morning and evening milkings 10 hours.

ANALYSES OF MILK.

Breed.	Name.	Date.	Milking.	Weight of Milk in lbs.	Age.	Calved.	Bred.	Specific Gravity.	Total Solids.	Fat.	Solids not fat.	Milk produced during Month of Analysis. Lbs.	Oz.
		1890.										Lbs.	Oz.
Jersey	Oriondo's Girl	Jan. 31	Morning	10¼	4 years	June 14, 1889.		1032·1	15·31	6·01	9·30	452	8
do	do	Mar. 2	Evening	6½				1031·8	17·26	8·12	9·14	436	15
do	do	May 3	Morning	7⅜				1031·1	14·33	4·82	9·51	455	2
do	do	do 6	Evening	6				1031·7	15·35	6·46	8·89		
do	Clenna Rex, 2nd	Jan. 31	Morning	11¾	4 years	Nov. 15, 1889.		1033·4	13·71	4·36	9·35	629	..
do	do	Mar. 2	Evening	5			Feb. 4, 1890.	1032·5	15·15	6·09	9·06	471	10
do	do	May 3	Morning	8				1032·9	13.63	4.56	9·07	430	14
do	do	do 6	Evening	5½				1031·8	16·25	7·13	9·12		
do	Barberry of Dorval	Apr. 22	Morning	6	3 years		Feb. 20, 1890.	1033·9	14·56	5·26	9·30	256	10
do	do	do 24	Evening	4½				1033·6	15·27	5·91	9·36		
do	Flora's Oriondo	May 10	Morning	10¼		June, 1889.	May 8, 1890.	1034·2	14·06	4·68	9·38		
do	do	do 13	Evening	7				1031·9	14·47	5·23	9·24		
do	Clenna Rex, of Glen Duart	Oct. 16	Morning	10¾	2 years	Sept., 1890.	Jan. 29, 1890.	1035·3	13·65	4·17	9·48	500	12
do	do do	do 17	Evening	8¼				1032·8	14·26	5·33	8·93		
Holstein	Netherlands Dorinda, 2nd	Jan. 28	do	12½	5 years	Aug. 20, 1889.	Nov. 23, 1889.	1032·5	12·84	3·81	9·03	888	8
do	do do	Feb. 14	Morning	18¼				1033·3	12·63	3·45	9·18	809	12
do	do do	May 10	do	12				1034·0	12·42	3·17	9·25	702	4
do	do do	do 13	Evening	8				1033·9	13·16	3·88	9·28		

ANALYSES OF MILK.—*Continued.*

Breed.	Name.	Date.	Milking.	Weight of Milk in lbs.	Age.	Calved.	Bred.	Specific Gravity.	Total Solids.	Fat.	Solids not fat.	Milk produced during Month of Analisis. Lbs.	Oz.
Holstein	Netherlands Dorinda, 2nd	Sept. 11	Morning	25½		Aug. 24, 1890.		1032·3	11·82	3·05	8·77	1280	12
do	do do	do 11	Evening	21½				1031·2	12·52	3·68	8.84		
do	do Dorinda, 3rd	Jan. 28	do	10¼	4 years	Jan. 13, 1890		1033·7	14·35	4·64	9·71	504	..
do	do do	Feb. 14	Morning	16			May 4, 1890.	1033·4	11·63	2.56	9·07	799	12
do	do do	May 10	do	11¼				1032·3	11·43	2·79	8·64	619	2
do	do do	do 13	Evening	9½				1032·7	12·14	3·31	8·83		
do	Abi	Mar. 2	do	16	3 years	Feb. 21, 1890		1031·0	12·26	4·04	8·22	1160	13
do	do	Apr. 22	Morning	18¼				1031·5	10·25	2·22	8·03	1012	8
do	do	do 24	Evening	14			May 4, 1890	1031·2	11·41	3·26	8·15		
do	Bonnie Ethel's Mercedes	Mar. 2	do	8	2 years	Feb. 14, 1890.		1033·3	12·69	3·85	8·84	685	5
do	do	Apr. 22	Morning	10				1031·9	12·15	3·59	8·56	574	12
do	do	do 24	Evening	8½			June 22, 1890.	1031·7	11·65	3·25	8·40		
do	Inchfawn	May 20	Morning	10¾	3 years	About 1 year.		1031·0	11·07	2·80	8·27	612	2
do	do	do 22	Evening	7½			June 29, 1890.	1031·0	11·93	3·57	8·36		
do	Siepkje 3rd, Queen	Aug. 5	Morning	10	2 years	July 4, 1890		1032·6	12·53	3·61	8·92	597	..
do	do	do 6	Evening	8				1030·9	12·30	3·86	8·44		
do	Aggie Cornelia, 2nd	Sept. 11	Morning	15½	2 years	Aug. 31, 1890		1033·5	12·92	3·61	9·31	863	14
do	do	do 11	Evening	15½				1032·7	13·25	4·03	9·22		

Ayrshire	Eva	Jan. 31	Morning	10	6 years	Oct. 2, 1889		1032·5	11·98	3·47	8·51	622	4
do	do	Feb. 25	Evening	8				1032·0	13.18	4·42	8·76	511	4
do	do	May 10	Morning	9¼			Mar. 12, 1890	1032·2	12·25	3·64	8·61	506	6
do	do	do 13	Evening	7¼				1032·0	12·44	3·81	8·63		
do	Countess	Jan. 31	Morning	9¾	5 years	Dec. 23, 1889		1033·2	13·03	3·95	9·08	1039	4
do	do	Feb. 25	Evening	9½			Feb. 13, 1890	1033·3	13·43	4·31	9·12	741	4
do	do	May 3	Morning	10				1032·4	12·98	4·12	8·86	475	12
do	do	do 6	Evening	6¼				1032·6	13·52	4·50	9·02		
do	Gipsy	Feb. 6	Morning	14¼	5 years	Sept. 15, 1889	Nov. 13, 1889	1032·9	12·11	3·11	9·00	643	4
do	do	do 25	Evening	8¾				1032·5	12·68	3·80	8·80		
do	do	May 10	Morning	10½				1033·2	12·67	3·69	8·98	586	2
do	do	do 13	Evening	8½				1031·9	12·55	3·77	8·78		
do	do	Aug. 5	Morning	18		July 11, 1890		1033·8	12·92	3·56	9·39	966	8
do	do	do 6	Evening	14				1032·5	13·07	4·22	8·85		
do	Clara	Feb. 6	Morning	13	6 years	Aug. 3, 1889	Oct., 1889	1031·0	12·20	3·58	8·62	575	4
do	do	do 25	Evening	7½				1031·8	13·13	4·35	8·78		
do	do	May 3	Morning	2				1031·4	13·02	3·93	9·09	53	8
do	do	do 6	Evening	¾				1030·8	13·82	4·97	8·85		
do	May	Feb. 6	Morning	12¾	7 years	Aug. 18, 1889	Jan. 27, 1890	1033·2	13·16	3·81	9·35	567	..
do	do	do 25	Evening	7½				1033·5	13·56	4·21	9·35		
do	do	May 10	Morning	10				1033·8	13·43	4·17	9·26	529	8
do	do	do 13	Evening	8				1032·6	13·62	4·49	9·13		
Aberdeen Angus	Daisy of Eaton, 4th	Oct. 16	Morning	11¼	2 years	Oct. 5, 1890	Jan. 2, 1890	1038·8	14·30	4·17	10·13	484	10
do	do	do 17	Evening	7¾				1034·8	13·30	3·93	9·37		

ANALYSES OF MILK.—*Concluded.*

Breed.	Mame.	Date.	Milking.	Weight of Milk in lbs.	Age.	Calved.	Bred.	Specific Gravity.	Total Solids.	Fat.	Solids not sat.	Milk produced during Month of Analysis. Lbs.	Oz.
Aberdeen Angus	Stella of Eastview	Oct. 16	Morning	6	3 years	Oct. 5, 1890	Jan. 1, 1890	1036·0	14·73	4·87	9·86		
do	do	do 17	Evening	7½				1034·6	14·34	4·84	9·50		
Shorthorn	Countess of Darlington	Jan. 28	do	5¼	5 years	July 16, 1889	Oct. 1, 1889	1033·0	15·21	5·40	9·81	459	12
do	do	Feb. 14	Morning	8				1035·0	13·84	4·09	9·75	370	..
do	do	May 3	do	5				1034·0	15·54	5·09	9·45	211	8
do	do	do 6	Evening	3½				1033·0	16·18	6·73	9·45		
do	do	Aug. 5	Morning	18		July 24, 1890		1033·1	11·64	2·73	8·91	882	4
do	do	do 6	Evening	14½				1032·4	12·30	3·67	8·63		
do	Miss Elgins, 5th	Jan. 28	do	14	4 years	Dec. 30, 1889		1032·1	12·77	3·90	8·87	1056	12
do	do	Feb. 14	Morning	18¾			Apr. 20, 1890	1033·9	12·47	3·34	9·13	897	4
do	do	May 3	do	10½				1034·5	13·07	3·86	10·21	574	10
do	do	do 6	Evening	7½				1035·4	13·78	4·25	9·53		
do	Wildame	Apr. 22	Morning	6¼	3 years	Feb. 20, 1890		1035·9	12·96	3·54	9·42	341	10
do	do	do 24	Evening	5				1034·4	13·07	3·65	9·42		
do	Cowslip, 3rd	do 22	Morning	12¼	3 years	Mar. 7, 1890		1033·7	12·13	3·12	9·01	684	..
do	do	do 24	Evening	3½				1033·8	12·61	3·60	9·01		
do	Elmwood Garland, 3rd	do 22	Morning	6	4 years	July 30, 1889	Nov. 22, 1889	1034·8	12·32	3·05	9·27	276	12
do	do	do 24	Evening	4				1035·0	13·02	3·57	9·45		

Shorthorn	Guelder Duchess	May 20	Morning	11¼	2 years	Apr. 18, 1890	....	1033·5	12·40	3·45	8·95	663	2
do	do	do 22	Evening	10¼	....	....	....	1033·0	13·29	4·25	9·04		
do	Wild-flower	Aug. 5	Morning	12	4 years	June 16, 1890	....	1032·7	11·24	2·60	8·64	715	8
do	do	do 6	Evening	10¼	....	....	....	1030·1	11·98	3·66	8·32		
do	Flower of Berkeley	do 5	Morning	8	4 years	July 10, 1890	....	1030·6	12·63	4·13	8·50	498	14
do	do	do 6	Evening	6½	....	....	....	1031·2	12·35	3·91	8·44		
do	Constance, 3rd	do 5	Morning	12	3 years	June 5, 1890	....	1033·6	12·18	3·16	9·02	622	12
do	do	do 6	Evening	9¼	....	....	....	1032·5	13·01	4·06	8·98		
Grade	Ruth	Feb. 6	Morning	10¾	8 years	May 23, 1889	Nov. 10, 1889	1033·8	13·89	4·38	9·51	500	..
do	do	Mar. 2	Evening	6½	....	....	....	1034·3	14·08	4·59	9·49	479	9
do	do	May 20	Morning	6½	....	....	....	1035·7	11·90	4·66	10·24	347	2
do	do	do 23	Evening	4	....	....	....	1035·7	15·50	5·15	10·35		
do	Mollie	Feb. 6	Morning	7½	8 years	Mar., 1889	Aug. 28, 1889	1032·6	13·50	4·31	9·19	......	....
do	Sussie	May 20	do	18½	....	Apr. 5, 1890	....	1033·5	12·32	3·39	8·93	1003	..
do	do	do 22	Evening	14	....	....	....	1031·6	13·49	4·73	8·76		

A careful study of the foregoing data will reveal: 1st, how individuals of the same breed differ in the quantity and quality of their milk—a difference no doubt partly due to the varying ages and lengths of time since calving of the individuals tested; 2nd, how the same cow will vary in the richness of her milk within a comparatively short period of time; 3rd, how—except in the case of the Aberdeen Angus, of whom only 4 samples were analysed—the evening milk was invariably the richer, though less in quantity, of the two. Further experiments are required to prove if this difference remains when the intervals between the milkings are more equal.

From the results of these analyses, the following instructive table of averages has been prepared in which will be found: First, the average composition of the total number of milks; next the averages for the whole number of the morning and evening milks respectively; next follow the average composition of the milk of the different breeds—morning and evening milk taken together; and finally, the averages of the morning and evening milks separately of the different breeds. The order of the first table has been preserved.

TABLE OF MILK AVERAGES.

—	Specific Gravity.	Total Solids.	Fat.	Solids not Fat.
Average composition of 93 samples	1033·0	13·20	4·13	9·07
do morning samples	1033·4	12·91	3·78	9·13
do evening samples	1032·7	13·49	4·47	9·02
do Jersey	1033·2	14·80	5·58	9·22
do Holsteins	1032·4	12·24	3·46	8·74
do Ayrshire	1032·5	12·94	3·99	8·95
do Aberdeen Angus	1036·0	14·17	4·45	9·72
do Shorthorn	1033·4	13·00	3·87	9·13
do Grades	1033·9	13·95	4·46	9·49
do Jersey (morning)	1033·7	14·18	4·84	9·34
do do (evening)	1032·7	15·43	6·32	9·11
do Holstein (morning)	1032·6	11·88	3·08	8·80
do do (evening)	1032·1	12·54	3·42	9·12
do Ayrshire (morning)	1032·7	13·61	3·73	9·88
do do (evening)	1032·3	13·18	4·26	8·92
do Ab. Angus (morning)	1037·4	14·51	4·52	9·49
do do (evening)	1034·7	13·82	4·38	9·44
do Shorthorn (morning)	1033·8	12·70	3·51	9·19
do do (evening)	1033·0	13·30	4·22	9·08
do Grade (morning)	1033·9	13·65	4·19	9·46
do do (evening)	1033·9	14·36	4·82	9·54

What has already been said with regard to the richness of the evening milk is here very apparent. The averages of the total morning and evening milk show that the percentage of fat in the latter exceeds that of the former by ·69 per cent. At the same time it is to be noticed that the increase in total solids in the evening over the morning milk is ·58 per cent. From this it would seem that the "solids not fat" decrease somewhat as the percentage of fat increases. *i. e.*; that fat is developed at the expense of one or more of the other constituents.

The averages of the morning and evening milk of the Shorthorns, Ayrshires and Jerseys are all in accord with this deduction.

PART IV.

THE COMPOSITION OF APPLE TREE LEAVES.

At the Dominion Fruit Growers' Convention held in Ottawa, February, 1890, I had the honour of reading the following paper, which is the first of a series on the chemistry of the apple. As time allows, the fruit and the old and young wood of the tree will be analysed. From the data thus amassed it is confidently hoped that we shall be able to ascertain with more or less accuracy the nature and amount of those fertilizing elements withdrawn from the soil by the apple tree in bearing. This will be the first step towards a more rational mode of applying fertilizers to orchards.

"THE COMPOSITION OF APPLE TREE LEAVES.

"Agricultural chemists throughout the world are, and have been for some years, directing their attention towards the solution of questions concerning the growth and bringing to perfection of plants and animals which serve for the use of man. With regard to plants—and by that term I include all farm crops—analyses have been made of all their parts, so that their composition is, to-day, pretty well known.

"Field experiments and experiments in water culture—in which the various salts required by the plants are dissolved in water—have also been made, enabling us, at the present time, to state definitely what special fertilizing constituents are valuable for the growth of certain crops, what classes of soil are most suited to cereals, the leguminous plants, and so on.

"But as yet it appears that little has been done in this direction for the fruit-growers, and the reason for this is not difficult to find. In all experiments of this nature it is necessary to weigh and analyse an aliquot part of the final product of vegetable growth in order to arrive at the amount of plant food absorbed from the soil and other sources, and in this way ascertain the extent to which the soil has been exhausted and the special inorganic and organic elements which enter into the composition of plants tissues. In the case of farm crops, which are reaped annually, this is comparatively an easy task, but it is obvious that in the case of fruit trees—both small and large—this of necessity cannot easily be done. As, however, it is as highly important to the fruit-growers to know what kind of food and what class of soils are best suited to produce the largest amount of fruit as it is to the farmer to be in possession of such information respecting his crop, it is but the duty of those engaged in working out these problems to direct their study, as far as in their power lies, towards the solution of such difficult questions.

"It was with a view of throwing some light upon this abstruse subject, of proposing some rational mode in the application of fertilizers to orchards, that the work included in this paper was undertaken.

"Now, it must not be thought that even if we knew the exact composition of all the parts of the tree (and as long as the fruit is hanging it remains part of the tree), and the total weight of those component parts, and had also a knowledge of the composition of the soil in which the tree was growing, that the whole question would be settled. Until a few years ago it was thought that such data were sufficient to guide the agriculturist in manuring certain fields for certain crops, but later facts, evolved by patient experiments, conducted most carefully over many years, have now proved this theory fallacious. I might illustrate this by reference to the cereals and leguminosæ. The former contain but half the nitrogen of the latter, yet notwithstanding this fact, and all that it seems to imply, it is found that the application of nitrogen is specially beneficial to the cereals, but of little or no value to the leguminosæ, especially after a certain stage of their growth. Without going into the reasons, or rather theories, which have been advanced to account for this state of affairs, I will ask you to bear these facts in mind, and at the same time to remember that *ex nihilo nihil fit*, that we have to draw upon the soil, the air and water for the constituents of plant food, and that the soil, generally speaking, is the only one of the three we can modify or alter in composition by mechanical or chemical agents. The climate, including degree of frost, amount of rainfall, snow, sunshine, &c., all these are important factors in agriculture. But as we have no control over the elements the line of experiment seems rather in making choice of and breeding from such varieties, whose qualities, dependent upon heredity and environment, make them seem especially adapted to the climate immediately under consideration, and then finding out, by all the means at our command, and applying those elements of plant food best suited to their growth and development.

"In this series of experiments five well-known and hardy varieties of apple trees were selected and the leaves gathered at two stages of their growth, viz., 25th May and 20th September. The leaves in all cases were taken from two or more trees, so that their analysis should reveal the fair average composition of the leaf of that variety at that particular stage of the tree's growth. Upon the first date some difficulty was experienced in a few instances in getting sufficient leaves for analysis without seriously denuding the tree of foliage, so that these first specimens represent leaves in a very early stage of development. On 20th September all the leaves were still quite green, and their life apparently unimpaired and vigorous.

"Mr. John Craig, Horticulturist to the Central Experimental Farm, has kindly furnished me with the following descriptions of the apple trees under discussion :—

"*Duchess of Oldenburgh.*—Tree is vigorous and hardy, forming a roundish, upright head. Bears young, and abundantly. Young shoots, smooth, reddish. Leaves medium-sized, firm and glossy. September.

"*Tetofsky.*—Tree upright, very hardy, vigorous. A young and annual bearer. Young shoots, stout, reddish-brown. Leaves very large. August.

"*Wealthy.*—Hardy, vigorous and healthy. Spreading, open head. Bears young; is an abundant and annual bearer. Shoots, dark, medium. Leaves medium. October.

"*Fameuse.*—Tree moderately vigorous and hardy, round-topped, spreading. Young shoots, reddish-brown. Fairly young annual bearer.

"*Northern Spy.*—Rapid, upright growth. Tardy and moderate bearer. Young shoots, large, dark reddish-brown. Winter.

"The following table shows the composition of the leaves, together with such other data as may help to elucidate the question under consideration. After the column containing the name of the apple tree and the date when the leaves were gathered are three columns, representing in percentages the composition of the leaf—the water, organic matter and mineral constituents. Then follow six columns, showing the percentages of the chief inorganic components of the ash. The percentages of nitrogen in the dry organic matter are then given, followed by columns depicting the amounts of nitrogen, phosphoric acid and potash contained in 1,000 lbs. of the green leaf, which serve to illustrate the absolute and relative values of the leaves as a fertilizer, as well as to show the quantities of these materials taken from the soil for the growth of the leaves.

ANALYSES OF APPLE TREE LEAVES.

Composition of the Leaf, Percentage Composition of Important Constituents in Ash.

Name.	Composition of Leaf.				Percentage Composition of Important Constituents in Ash.						Nitrogen.	Weight of Fertilizing Constituents in 1,000 Lbs. of Leaves.		
	When Gathered.	Moisture.	Organic Matter.	Ash.	Phos. Acid.	Potash.	Lime.	Magnesia.	Oxide of Iron.	Silica.	Nitrogen in Organic Matter.	Lbs. of Nitrogen in 1,000 lbs. Leaves.	Lbs. of Phos. Acid in 1,000 lbs. Leaves.	Lbs. of Potash in 1,000 lbs. Leaves.
	1889.													
Duch. of Oldenburg.	May 25..	70·94	26·67	2·39	9·67	9·25	21·50	9·56	1·63	·92	2·87	7·65	2·31	2·21
Tetofsky ...	do 25..	72·11	25·40	2·49	8·82	14·33	18·20	7·52	·81	1·16	2·84	7·21	2·20	3·56
Wealthy	do 25..	71·25	26·84	1·91	8·95	10·19	16·02	8·49	1·44	·93	2·98	7·99	1·71	1·94
Fameuse	do 25..	75·45	22·01	2·54	11·61	9·54	16·26	10·84	1·64	1·04	3·01	6·62	2·94	2·42
Northern Spy	do 25..	72·04	25·62	2·34	13·33	....	14·00	12·43	1·92	1·30	2·99	7·66	3·11	....
Average	....	72·36	25·31	2·33	10·47	10·82	17·40	9·77	1·49	1·07	2·94	7·42	2·45	2·52
	1889.													
Duch. of Oldenburg .	Sept. 20..	57·30	38·75	3·95	3·00	6·35	34·80	5·62	1·43	1·00	2·48	9·61	1·18	2·50
Tetofsky	do 20..	60·49	35·87	3·64	5·93	11·02	33·59	5·55	1·19	1·28	2·20	7·80	2·15	4·01
Wealthy	do 20..	60·02	36·53	3·45	5·23	13·09	22·40	5·22	1·08	·80	2·38	8·70	1·80	4·51
Fameuse	do 20..	63·45	33·15	3·40	5·61	13·65	26·35	4·16	1·56	1·05	2·50	8·28	1·91	4·63
Northern Spy........	do 20..	62·30	34·85	2·85	9·31	14·04	22·40	3·50	1·80	1·57	2·84	9·89	2·65	3·99
Average ...	....	60·71	35·83	3·46	5·82	11·63	27·91	4·81	1·41	1·14	2·48	8·87	1·94	3·92

"*Moisture.*—With the exception of the Fameuse, the percentage of water in all the specimens taken 25th May lies between 70·94 and 72·11—practically, between 71 and 72. The Fameuse is more succulent, and contains 75·45 per cent. water. In the leaves gathered 20th September we find a general diminution in the percentage of water, the loss being in the neighbourhood of 12 per cent. It is interesting, and perhaps instructive, to note that with regard to the amount of water, the leaves of 25th May fall into the same order with those of 20th September, the Duchess of Oldenburgh containing least and the Fameuse most water, showing clearly that while all have followed the general law in loss of moisture, each has retained its own characteristic individuality.

Average percentage of water in young leaf.................			72·36
do	do	maturer leaf................	60·71

"*Organic Matter.*—This includes all the combustible material of the leaf, and is composed of carbon, oxygen, hydrogen and nitrogen. In the leaves of 25th May, those of the Duchess of Oldenburgh and of the Wealthy, the percentages of organic matter are almost the same, and head the list. The Tetofsky and Northern Spy also contain almost identical amounts, or somewhat less than the two first mentioned, while the Fameuse contains the smallest quantity of organic matter. This order is preserved in the leaves plucked 20th September. From an inspection of these two columns it will be observed that there is a general diminution of water and increase of organic matter as the season advances, and that any special variety preserves its relative position to other varieties in this respect throughout the season,

Average percentage of organic matter in young leaf......			25·31
do	do	maturer leaf...	35·83

"*Ash.*—The percentage of all the inorganic or mineral constituents of the leaf are found in this column. With the exception of the Wealthy we find the amounts of ash of the leaves of 25th May closely approximating one another. The leaves of the Wealthy fall about ·5 per cent. below the others in ash constituents. In those of the 20th September we find a general increase in the percentage of ash, amounting from ·5 to 1·5 per cent. over those of 25th May.

Average percentage of ash in young leaf......................			2·33
do	do	maturer leaf.................	3·46

"*Phosphoric Acid.*—With regard to the composition of the ash as detailed in the columns following, it is difficult to discover in many cases what principle, if any, underlies the distribution of the mineral constituents throughout the tissues of the leaf during its growth. Without reading too much, however, into the results of a single analysis, an inspection of this column shows most clearly that the young leaf contains in its ash a much larger percentage of phosphoric acid than the maturer one—in some instances the phosphoric acid in the latter is but one-half, or even less, than that of the younger leaf. This would lead us to suppose that, as the season advanced, there was a retrograde movement of the phosphoric acid of the leaf to other parts of the tree. As the seed is well known to contain a relatively large quantity of this acid we may legitimately be allowed to think that the food elaborated in the leaf found its way finally, in part, at all events, to the fruit and other portions of the tree. And this undoubtedly expresses a truth (though probably not the whole truth), for we observe that the average number of pounds of phosphoric acid per 1,000 pounds of the younger leaf is higher than the corresponding number for the maturer leaf, viz.: as 2·45, 1·94, and this in spite of the fact that the percentage of ash in the latter is considerably higher than the former.

Average percentage of phosphoric acid in the young leaf...			10·47
do	do	maturer leaf	5·82

"*Potash.*—It would not be safe from the results tabulated to advance strongly any theories regarding the disposition of this important element in the leaf. The percentage of potash in the young leaf is somewhat lower than that in the maturer leaf. When we, however, consider the increased amount of ash in the latter, we find that per 1,000 lbs. the older leaves contain 1·5 lbs. more potash than the younger leaves. On comparing the amounts of potash obtained in these analyses with the quantity as found in leaves of other trees it is at once apparent that the leaves of the apple tree are exceptionally rich in this material.

"*Lime.*—The average percentage of lime in the ash of the young leaf is 17·40, while that of the maturer leaf is 27·91, an increase of 10 per cent. This increase would appear also to be regular throughout the varieties examined. Thus, the Duchess stands first in percentage of lime in both lists, followed closely by the Tetofsky, and so on.

"*Magnesia.*—While the percentage of lime increased during the growth of the leaf, the analytical data show that the percentage of magnesia decreases during that period. Thus, in the young leaf we have magnesia 9·77 as the average percentage, and in the maturer leaf this number is reduced to 4·81. This fact is the more remarkable and interesting when we remember that the percentage of phosphoric acid diminished in the same ratio during the same period. It seems quite possible that these two elements of plant food are intimately related in the economy of the plant, and that in the elaboration of the plant food within the tissues and the distribution of this food to the different parts of the tree these two play a very important role.

"*Oxide of Iron and Silica.*—Throughout the whole series the amounts of these constituents are seen to be very similar, and the average in the young and the mature leaf closely approximate each other. The iron after it has performed its functions in the chlorophyll of the leaf appears to remain in the leaf, and from the figures in the table it is seen that there is no extra deposition of silica in the cells of the leaf as it grows older.

"*Nitrogen.*—The only constitutent of great importance that remains to be discussed is nitrogen. The differences in the amounts of nitrogen contained in the organic matter of the leaves of the different varieties examined are so small that one would not be warranted in drawing any conclusion therefrom as to differences in this constituent between the varieties. On taking the averages, however, of nitrogen of the leaves in the two stages of their growth, a considerable difference is at once apparent—a difference that corresponds to 3 per cent. of albuminoids. The figures are:—

Nitrogen in young leaf	2·94	corresponding to	18·61	per cent albuminoids.
do maturer leaf	2·48	do	15·50	do

"The amount of nitrogen per 1,000 pounds of the maturer leaf is 8·87 pounds, as against 7·42 pounds in the young leaf. This is due to the increased percentage of organic matter in the older leaf. It is evident from these results that changes which affect the relative percentage of nitrogen in the organic matter take place in the leaf during its development—but what these changes may be is beyond the scope of the present paper to discuss.

"Phosphoric acid, potash and nitrogen are the three constituents which above all others must be put back into the soil if we are to preserve its fertility. Plants of certain orders require more of one or other of these than plants of other orders. Some soils are specially rich or poor in one or more of the materials—and consequently in the rational mode of application of fertilizers much intelligence and patience must be exercised.

"That the leaves of the apple trees draw a large amount of food from the soil annually has been shown. This must be replaced in excess for the vigorous growth of the tree. The leaves of the tree play no unimportant part—respiration and digestion are their two chief functions—which, if they do not perform well, the tree cannot live and bring to perfection its fruit. Therefore when we feed the leaves we are indirectly feeding the fruit.

"The results of this work seem to point in the direction of mineral fertilizers, and specially of potash, as being more particularly equired for the growth of the leaves, and, therefore, for the vigorous development of the tree, including an abundant crop of fruit.

"A heavy dressing of wood ashes (which may be procured in many parts of Canada at a very low price), or of kainit or other form of potash, is, therefore, to be recommended for orchards.

"The value of the leaves composted—a process to be advised as more economical than burning—is also well established by the data afforded by this work."

REPORT ON THE EFFECT OF SOLUTIONS OF COPPER SULPHATE (BLUE VITRIOL), IRON SULPHATE (GREEN VITRIOL), AND OF "AGRICULTURAL BLUE STONE," ON THE VITALITY OF SEED WHEAT.

A communication was received in March last from Messrs. Tees and Persse, of Winnipeg, Man., accompanied by a sample of "agricultural blue stone"—a substance now in the market for destroying the germs of smut. The following extract is from their letter:—

"As you are no doubt aware, it has long been the custom of farmers to soak their seed grain in a solution of blue vitriol to destroy the 'smut' before sowing. The sample sent you is cheaper than the regular blue vitriol, but it is claimed that it is better for destroying smut; while some hold that the sulphate of iron in sample sent you will destroy the germ in the wheat. As this is a matter of such great importance to this country, we have taken the liberty of bringing it under your notice, and would be glad if you would give us your opinion upon the merits of this new article at as early a date as possible."

An analysis of this sample of "agricultural blue stone" gave the following results:—

Sulphate of iron (green vitriol)	69·30
do copper (blue vitriol)	30·70
	100·00

A series of experiments was then inaugurated to ascertain the effect of solutions of iron sulphate, copper sulphate and of the "agricultural blue stone" on the vitality of the wheat germ. The sample of wheat selected to be experimented with was Red Fife and yielded 97·5 per cent. of germinating seed.

The first experiment consisted in soaking the grain for 36 hours—the seed being totally submerged—in (*a*) a solution of "agricultural blue stone," and (*b*) a solution of sulphate of iron. The strength of the solutions was 1 lb. of the material to 8 gallons of water. The seed, at the expiration of the 36 hours, was taken out of the solutions and allowed to dry in the air at ordinary temperatures. It was then sown in earth in the conservatory.

The following table gives the number of plants from the grain on the dates which appear at the head of the columns. Two hundred grains were sown in each experiment.

Red Fife Wheat. — Sown 15th March.	27th Mar.	28th Mar.	31st Mar.	7th April.	22nd Apr.	Percentage of Vitality.
Untreated	191	193	194	195	195	97·5
Treated with sulphate of iron	166	170	171	173	173	86·5
Treated with "agricultural blue stone"	103	103	116	126	128	64·0

From the figures in this table it will be seen that the effect of this method of treatment with sulphate of iron was a reduction of 11 per cent. in the vitality of the seed, while the solution of "agricultural blue stone" diminished the vitality by 33·5 per cent. It may fairly be concluded from these results that the sulphate of copper present in the "blue stone" acted more injuriously than did the sulphate of iron. The following experiment was then made, in order to arrive at the action of the sulphate of copper *per se* upon the grain. The mode of treatment was the same as in the previous experiment (submergence for 36 hours, etc.), and the strength of the solution in the proportion of 1 lb. of the material to 8 gallons of water, as before. The seed treated with sulphate of iron and "agricultural blue stone" was part of the quantity tested on 15th March, and consequently had been dry after treatment 13 days.

Red Fife, 200 Grains. Sown 28th March.	2nd Apr.	5th Apr.	7th April.	10th Apr.	12th Apr.	17th Apr.	22nd Apr.	Percentage of Vitality.
Treated with Suphate of Iron	112	154	177	....	183	....	193	96·5
Treated with "Agricultural Blue Stone................	22	43	72	83	98	100	111	55·5
Treated with Sulphate of Copper.....................	30	43	61	67	72	74	80	40·0

It is thus apparent that the sulphate of copper in the "agricultural blue stone" during the 13 days had had the effect of still further lowering the percentage of vital seeds; while the sulphate of iron had not impaired the vitality of the wheat. The seed treated with sulphate of copper gave but 40 per cent. of growing plants. We may thus conclude that while sulphate of iron had but little action on the vitality of the wheat germ, sulphate of copper by the same treatment has a most deleterious effect.

As the method of treatment received in the foregoing experiments may be considered an extreme one, I determined to ascertain what the effect on the wheat germ would be by simply sprinkling the seed with solutions, allowing them to dry, and sowing at once. The following table shows the results obtained by this means, the solution being of the same strength as before:—

Red Fife, 200 Grains. Sown 28th March.	2nd Apr.	5th Apr.	7th Apr.	10th Apr.	12th Apr.	17th Apr.	22nd Apr.	Percentage of Vitality.
Treated with sulphate of iron...............	115	170	181	184	192	198	......	99·0
do "agricultural blue stone".....	47	93	130	138	144	151	159	79.5
do Sulphate of copper............	40	69	99	113	126	130	145	72·5

A marked difference, due to the mode of treatment, is at once seen. The seed thus subjected to sulphate of iron had its vitality uninjured; that with the "agricultural blue stone" lost 19·5 per cent. of its vitality, while that with sulphate of copper was destroyed to the extent of 26·5 per cent.

Throughout these experiments it was noticed that the seed treated with the different solutions had the growth of their plants retarded and weak as compared with those of the untreated grain, and this was much more marked in the case of seeds subjected to solutions of copper sulphate and "agricultural blue stone" than when sulphate of iron was used. As soon as roots had begun to absorb nourishment from the soil this lack of luxuriousness of growth was less noticeable.

The following conclusions from these experiments may, I think, be safely drawn:—

1. That a solution of sulphate of copper of the strength of 1 lb. to 8 gallons of water has the effect of destroying a number of wheat germs, and that even when the sulphate of copper is present only to one-third of this amount (as it is in the "agricultural blue stone") the injurious action is still strongly marked.

2. That a solution of sulphate of iron of the same strength has eventually but little destroying action on the wheat seed, though at first the plants from seed so treated have their growth somewhat retarded.

3. That the length of time that the sulphate of copper is in contact with the seed determines, to a large extent, the amount of damage done to the vitality of the germ. If sprinkling be sufficient to destroy the smut spores the grain should not be left in contact with the solution longer than necessary, but dried and sown at once.

In order to supplement this work and to ascertain, if possible, the effect of these solutions on bunt or hard smut, further experiments were undertaken during the past season at the Central Experimental Farm, Ottawa.

These experiments consisted of two series, in one of which the grain was Ladoga, in the other Red Fife. Each series comprised four plots. In the first plot of each series the grain sown was untreated, in the second it had been previously treated with sulphate of iron, in the third with solution of "agricultural blue stone," and in the fourth sulphate of copper had been used.

The strength of the three solutions was 1 lb. to 8 gallons of water. The grain in each experiment with treated wheat was thoroughly sprinkled, allowed to dry by spreading in a thin layer exposed to the atmosphere, and at once sown.

The results of these experiments are as follows:—

There was no smut of either kind upon any of the Red Fife plots.

In the case of the Ladoga, loose smut appeared on all of the four plots, the percentages of diseased ears from the treated and untreated grain being very close—between 3 and 5 per cent. There was no hard smut on any of the Ladoga wheat.

The results of these experiments seem to indicate that none of the solutions tried are efficacious in preventing the development of loose smut.

In view of the fact that it is the "hard," "stinking smut" or bunt that is chiefly deleterious in Manitoba and the North-West Territories, and that such rarely occurs when the wheat is grown here, it seems highly desirable that these experiments should be repeated in the districts above named, and to this end it is proposed to conduct the investigation during the coming year upon the Experimental Farms at Brandon and Indian Head.

WELL WATERS.

Attention was drawn in my last report to the great importance to farmers of a pure and abundant water supply, for use in their own families and for watering stock. At the same time, an offer was made of a free analysis to those farmers who suspected the quality of their water, if they were willing to prepay the freight on the sample. In response to this inducement several have asked for the examination of their drinking waters. To these, instructions were sent as to the manner of taking the sample The right collection of the water is a very important matter, and it is particularly desired that those in the future wishing an analysis should write for the necessary instructions beforehand.

It is especially to the dairymen that this question of pure water is of interest and importance. Pure and wholesome milk can only be obtained from cows supplied liberally with pure, fresh water. The general health of the animal must be impaired by drinking polluted water, and many germ diseases in man have had their origin traced to the milk from cows having access to impure and contaminated water.

From the following table it will be seen that out of ten drinking waters submitted to analysis only three were returned safe to drink. In many instances gross contamination had taken place by drainage from stables, barn yard or other source of pollution, thereby rendering the water poisonous and extremely dangerous for use.

ANALYSES OF WELL WATERS.

Results Stated in Parts Per Million.

Name.	Locality.	Free Ammonia.	Albuminoid Ammonia.	Chlorine.	Solids before Ignition.	Loss on ignition of solids.	Oxygen absorbed in 15 min. at 80° F.	Oxygen absorbed in 4 hrs. at 80° F.	Particulars of Source.	Report.
Thompson, C. J.	Virden, Man.	1·651	2·6700	48·00	2564·0	310·0	1·20	2·64	Well, 33 ft. deep, 120 ft. from stable	Unfit for use; contaminated by drainage.
do	Bonaly, Man.	·1942	·0728	25·00	802·0	130·0	.64	1·44	Well, 28 ft. deep, 90 ft. from privy	Suspicious; use attended with danger.
Mackay, Angus.	Indian Head, N.W.T.	1·626	·6798	35·00	5032·0	1006·0	3·896	9·00	Well, 65 ft. deep, close to outbuildings	Exceedingly bad water; quite unfit for use.
Bedford, S. A.	Brandon, Man.	·0728	·1821	18·00	468·0	90·0	2·316	4·508	Spring creek	Fairly good water; wholesome, free from injurious contamination.
do	do	·2428	·0849	30·00	604·0	180·0	·293	.712	House well, 21 ft. deep, 60 ft. from privy	Unfit for use; polluted with sewage matter.
do	do	1·1654	0546	110·00	896·0	174·0	·212	·632	Stable well, 23 ft. deep, 10 ft. from stable	Unfit for use; very bad; polluted with sewage matter.
Carling Bros.	London, Ont.	·2063	·0485	32·00	2032·0	302·0	5·60	8·000	Artesian well	Of the nature of a mineral water.
Smith, David	Brandon, Man	·1335	·2003	1·00	550·0	116·0	·860	1·672	Well, 40 ft. from house, 200 yds. from stable	Water highly suspicious.
Cowan, William.	Galt, Ont.	1·460	9200	40·00	520·0	212·0	3·008	5·856	Water from creek at Berlin, Ont.	Unfit for drinking purposes; very bad.
do	do	·280	·3950	40·00	388·0	132·0	2·144	3·408	Water from creek one mile below Berlin, Ont.	do do do do
Pollock, W. C.	Almonte, Ont.	·040	1400	46·00	730·0	355·0	.....	.....	Well, 55 ft. deep, unused for some time	A suspicious water.

The chief impurities found in drinking waters, as detected by chemical analysis, are of an organic nature, and arise from the presence of decomposing animal or vegetable matter, or both. The former is to be regarded as the more deleterious of the two, and comprises the solid and fluid excreta of animals, decaying animal matter and the like; vegetable pollution consists of peaty matter—the more or less decomposed remains of plants. Although vegetable matter is not as injurious as that of animal origin, an excessive quantity is very apt to cause diarrhœa and kindred complaints.

Whether the organic matter itself always acts in the water as a poison or not is yet a question open for discussion, though there seems to be ample evidence that in many instances active organic poisons are developed by the decomposing matter.

It has, however, been well established that it is the organic matter of a water that forms the food for the growth of bacteria—microscopic plants, among which are the disease germs—and cases of typhoid (a germ disease) have been repeatedly traced to drinking water surcharged with organic matter.

For these reasons we may safely conclude that a water containing much organic matter must be more dangerous to health than water comparatively organically pure.

It is of the first importance, therefore, to discover the degree to which any water may be contaminated by organic matter and to endeavour to establish whether such be vegetable or animal.

The amounts of free and albuminoid ammonia, of the oxygen absorbed in fifteen minutes and four hours, and of chlorine, are a measure of the organic impurities of a water.

Large quantities of free ammonia associated with a considerable amount of chlorine prove contamination with sewage.

Small quantities of free ammonia and chlorine and high amounts of albuminoid ammonia and "oxygen absorbed" indicate vegetable pollution.

When the ratio of oxygen absorbed in 15 minutes to that absorbed in 4 hours is as 1:2 dissolved vegetable matter is indicated; when this ratio approaches 1:1·5 the presence of animal organic matter is shown. A water contaminated with vegetable matter will absorb or use up more oxygen than one polluted with animal matter.

As every water must be judged according to its source and surroundings, it is impossible to lay down rules that could be applied rigidly in every case, though it has been abundantly shown that a good water, wholesome for use, should not contain more than ·08 parts per million of free ammonia, nor more than ·10 parts per million of albuminoid ammonia, and the amounts of chlorine and total solids should not exceed 70 and 570 parts respectively.

Those who are about to dig wells are cautioned against locating them in barn yards and stables or near any source of pollution—and this is especially urged where the soil is sandy or gravelly. It has been proved beyond dispute that the soakage from such contaminating sources will travel comparatively long distances in light soil, and it is in such that it will act as a cesspool.

The surroundings of the well should at all times be kept clean, and the well itself examined from time to time as to its freedom from refuse material. Vegetable *debris* and dead animals are often the cause of impure water.

FOUNDATION COMB.

In June last we were requested by the D. A. Jones Company Limited, of Beeton, to analyse and report on several samples of "foundation comb," which they suspected to be adulterated. As the matter was deemed of great importance to bee-keepers throughout the country, this request was complied with. Three samples of suspected comb were received, which, upon analysis, were found to have the following composition :—

ANALYSIS OF FOUNDATION COMB.

——	No. 1.	No. 2.	No. 3.
Beeswax	31·24	43·60	70·06
Paraffin	68·76	56·40	29·04
	100·00	100·00	100·00

The parties who sent these samples to Messrs. Jones & Co. all claim to have procured them from R. E. Smith, Tilbury Centre. The above analyses, with remarks on the fraud in selling, and the danger in using such adulterated comb, have been published by the editors of the *Canadian Bee Journal.*

In the opinion of bee-keepers, pure beeswax is the only material that can be satisfactorily used for foundation comb. Paraffin melts at a much lower temperature than beeswax, and this fact alone militates against its use in bee-hives. It has been proved by experience that manufactured comb containing paraffin melts in hot weather, a total collapse of the comb, often full of brood or honey, resulting. Besides this loss of honey or brood, the bees are smeared by the melted mixture. Messrs. Jones write me as follows, regarding their experience with foundation comb containing paraffin :—

"Paraffin was tested as a base for comb years ago, and, owing to the temperature at which it melts, was found totally useless as a substitute for beeswax. In all cases which we have had this summer, where adulterated comb had been sent out, great loss has been sustained through the comb breaking down when partly built out, and this will always be the case with foundation containing any great amount of paraffin."

In addition to this, it must be noted that the difference in price per pound of beeswax and paraffin is from 25c. to 30c. To sell adulterated comb at the same price as the pure article is therefore a dishonest practice.

When the foundation comb contains a comparatively large percentage of paraffin, the adulteration may be detected by one or more of the following means :—

1. By its smell, colour and consistency. Adulterated wax has not the strong characteristic odour of beeswax, developed especially by friction, neither has it the tough and pliable nature of genuine wax. On being kept, the wax containing paraffin becomes white and brittle.

2. If a small lump of this impure article be placed in cold water, together with a similar quantity of comb known to be pure, and the temperature of the water gradually raised, the comb containing paraffin will melt first and form a fluid layer on the top of the water, while the pure beeswax is but just beginning to melt.

4. Make a mixture of alcohol and water, in such proportions that a piece of pure beeswax will stay suspended in the middle of the fluid. This is most easily done by placing a piece of pure wax on the top of some spirit in a glass, and then adding carefully, and with constant stirring, sufficient water to make the wax sink slowly. If the mark is at first overstepped the addition of a little more spirit will cause the beeswax again to rise.

As paraffin is much lighter than beeswax, the adulterated sample will be found to float on this liquid, and a considerable quantity of alcohol will have to be added to cause the impure wax to sink.

SPONTANEOUS COMBUSTION.

The following article on the causes and prevention of cases of spontaneous combustion in barns and stables written by me in response to the enquiries of a correspondent, was published in the pages of the *Canadian Live Stock and Farm Journal.* The importance of the subject to the farmers throughout the Dominion is such that no apology will be needed for its insertion here.

"SPONTANEOUS COMBUSTION."

"Combustion, as it is ordinarily known and recognized, is the chemical combination of combustible matter with the oxygen of the air, the union of the two being accompanied by the giving out of heat and light. When the union takes place rapidly the heat evolved is intense, but when slowly, the heat produced may be almost imperceptible—though the sum total of the heat produced may be the same in both cases. Combustion may therefore occur without the phenomenon of flame—as flame is really burning gas, which, for its generation from ordinary combustible material and ignition, requires a somewhat intense heat. The heat of our bodies is maintained by a process of slow combution, *i.e.*, evolution of heat unaccompanied by flame, through the union of the organic matter of our food with the oxygen of the air we breathe.

"Spontaneous combustion (or ignition of inflammable material without contact with flame) occurs when the union of the oxygen (oxidation) is sufficiently rapid to raise the temperature to the ignition or burning point of the inflammable substance. The first great requisite of combustion is air—or rather the oxygen of the air. Woollen and cotton rags saturated with oil are capable of absorbing oxygen rapidly, and in consequence of which have their temperature raised to the ignition point—a comparatively low temperature for such material. Very many well-known and authenticated instances are on record of this character as causing fire in the holds of vessels and in manufactories. Dust, formed by the deposition of organic matter in an exceedingly fine state of division, often causes, in like manner, fires in woollen and grist mills.

"The spontaneous fires which break out in hay-stacks, barns, manure piles, etc., are all due to this same process of oxidation, and are caused by the inflammable material being damp—moisture greatly assisting slow combustion. Fermentation may be considered as one of the many forms of combustion. It is a process in which the decomposition of the material is brought about by bacteria—microscopic plants always present in the air—whose development requires moisture and warmth. By their growth more heat is generated, until that point is reached at which the material upon which they feed takes fire. Fermentation is the principal agent in causing spontaneous ignition in barns, outhouses, etc.

"There are other causes besides those given above for spontaneous combustion. A not infrequent one is the slaking of lime. Two instances have come under my notice in which barrels of quicklime, left uncovered in a leaky building, have become slaked by the rain, the heat generated by the operation of slaking—really a chemical combination of the lime with the water—being sufficient to ignite the surrounding woodwork. The prevention in such cases as these it is not necessary to enlarge upon. As to those instances in barns, etc., in which the fire is caused by damp hay or clover, I would say, if possible, do not store it damp, and see that the roof is water-tight or the stack well thatched. If, however, circumstances necessitate the putting away of the hay moist, salt it well. Salt is a preventative of fermentation, and consequently of heat. If, in spite of these precautionary measures, heat begins to generate in the mow, ventilation should be resorted to, so that the heat as it is developed may be carried off, and not allowed to accumulate or become so intense as to raise the hay to its burning temperature. In the case of manure piles, it is a wise practice to mix together in the heap the horse and cow dung. Horse manure ferments and heats more readily and rapidly than cow dung. The mixing of the two prevents the former from becoming fire-fanged, which means, to a large extent, depreciation in value, and at the same time a fermentation is set up in the colder cow dung which renders its fertilizing constituents more available for plants.

"With regard to your question respecting the frequent fires 'commonly credited to unknown causes,' it is quite possible that many of these are true cases of spontaneous combustion; yet, undoubtedly some are occasioned by the smouldering embers from the pipe of the farmer, his hired man, or the tramp, or are due to the carelessness in the use of unprotected lights, or caused by the viciousness of incendiaries. Without data, it is impossible to state what percentage of fires is due to these respective causes."

REPORT OF THE ENTOMOLOGIST AND BOTANIST.

(JAMES FLETCHER, F.R.S.C., F.L.S.)

W. SAUNDERS, Esq.,

Director, Dominion Experimental Farms.

SIR,—I have the honour to hand you herewith a report upon the work carried on in my Department during the past year. It is of course impossible to report in full upon the multiplicity of subjects which are brought officially under my notice during the year. I have treated at some length certain of the more important subjects, so that information as to the nature of the objects discussed, and remedies when known, might be disseminated as widely as possible.

DIVISION OF ENTOMOLOGY.

There has been much correspondence to attend to as well as field work to prosecute. I have reported fully upon the American Frit Fly, which has been a serious pest of wheat, barley and grasses for the last three or four years; the Mediterranean Flour Moth, a dangerous imported insect; the Pea Weevil, which is beginning to increase in numbers; the Diamond-back Cabbage Moth, and the Cabbage Maggot, dire enemies of that wholesome vegetable; the Strawberry Weevil, and an injurious caterpillar which periodically strips the oak trees on Vancouver Island of every vestige of foliage.

DIVISION OF BOTANY.

The work in this division has consisted chiefly in looking after the experimental grass plots, which are reported on in full herewith, and the arboretum; in naming botanical specimens and weeds sent in for identification; and in giving instructions in the use of the various remedies which have lately been used with such good effect against fungous diseases of plants. I regret that the space at my disposal precludes the possibility of treating of these in this report; but I hope at no very distant date to issue in bulletin form an account of the successful work which has been accomplished, particularly in the United States, in fighting these troublesome diseases.

In the meantime, I wish to announce that I shall be glad to send instructions for the treatment of fungous diseases, where remedies are known, to all who may wish for them.

These studies are very recent, dating only from about 1885. The good work which has been done is due largely to the energy and ability of Mr. B. T. Galloway, the chief of the Division of Vegetable Pathology at Washington, who, in writing on this subject in the *American Garden* for October, 1890, says as follows: "Let us now see what have been some of the practical results of this work. In the first place, grape-growers everywhere have been made acquainted with the causes of such diseases as black-rot, downy-mildew and anthracnose. Moreover, it has been proved to their entire satisfaction that these diseases can be prevented by proper treatment. Between two and three thousand grape-growers in all parts of the country used the remedies in 1889, and from estimates based on reports received from about thirty, we know that the actual saving in money to these, above all expenses, was something over $10,000. Our agents last year, in treating potatoes for blight and rot, succeeded in saving 75 per cent. of the crop. On this basis, the amount saved to the entire country, if all the infected districts had been treated, would have been something over a million dollars."

A memorandum is submitted herewith by Mr. Galloway, concerning a curious bacterial disease of oats, which, although not very injurious in Canada, has been very prevalent in some districts.

In the Arboretum and Botanic Garden the work begun last year has continued. The collection of trees and shrubs has been considerably augmented, and next spring several herbaceous perennials, which have been grown from seed, or have been collected from the woods in this and other parts of Canada, will be planted out in their proper places. Particular efforts will be put forth to render the collection of native Canadian plants as complete as possible. At present, nearly 400 different kinds of shrubs and trees have been set out, in most cases two specimens of each kind, which are made up as follows:—

Anacardiaceæ	7	Juglandaceæ	3
Araliaceæ	1	Leguminosæ	23
Berberidaceæ	12	Oleaceæ	30
Betulaceæ	5	Rhamnaceæ	4
Bignoniaceæ	4	Rosaceæ	92
Caprifoliaceæ	30	Rutaceæ	1
Celastraceæ	5	Salicaceæ	33
Compositæ	1	Sapindaceæ	17
Coniferæ	65	Saxifragaceæ	19
Cornaceæ	10	Simarubaceæ	1
Cupuliferæ	16	Tiliaceæ	4
Elæagnaceæ	7	Urticacæ	7

Several low spots which needed draining were attended to last autumn, and locations were decided upon for groups to illustrate some natural orders of plants not as yet represented in the Botanic Garden.

MEETINGS ATTENDED.

By permission of the Hon. Minister of Agriculture I was allowed to attend the Second Annual Meeting of the Association of Official Economic Entomologists, held at Champaign, Ill. The meeting was one of much importance to all concerned, and this association cannot but be a great influence in helping on the cause of agricultural entomology, by binding together all the students, over the whole globe, who are engaged in that study. The undersigned was highly honoured by being elected President for the ensuing year.

In February last I attended the Dominion Convention of Fruit Growers held at Ottawa and read a paper on "Insects Injurious to Fruits," which was listened to and discussed with interest.

I have also, by intruction of the Hon. Minister, attended several Farmers' Institute meetings. These opportunities of meeting the farmers have been gladly embraced, as I find them a most effective means of apprising farmers of the fact that such work as I am engaged in, is being carried on, and also of showing that it is of great importance to them. Not only this, but I have assured them that my services are entirely at their disposal, and that I shall be pleased at all times to advise them with regard te injurious insects and fungous diseases, if they will correspond with me. In this way, I believe the work will yearly become more useful and popular.

In January, 1890, I attended a very successful meeting of the County of Frontenac Farmers' Institute at Inverary, Ont., and delivered addresses upon "Farm and Orchard Insects" and "Weeds of the Farm." After this meeting I proceeded to the County of Peterboro' Institute at Norwood and Keene. At each of these places an afternoon and evening meeting was held. At the former I spoke upon "Injurious and Beneficial Insects" and "Window-gardening for Farmers' Wives," at the latter upon "Injurious Insects a direct tax of 10 per cent. upon all Farm Products" and "Farmers' vegetable and Fruit Gardens."

In June I was invited to attend a summer meeting at Picton of the Prince Edward County Institute, and through the kindness of Mr. W. Boulter, of Picton, I was enabled to visit many of the farms, hop-gardens and orchards in the vicinity of Picton. Mr. Boulter's own orchard was most instructive from an entomological point of view It would be impossible to find better trimmed and cleaner trees than were there. The smoothness and cleanness of the trunks of some trees which had been planted twelve years was remarkable, and was due entirely, he assured me, to watching them at the periods of insect occurrence and then attending to them promptly. A part of his regular annual treatment has been, for some years, washing them in June, with ordinary home-made lye. He says: "This is made by filling a large barrel, 'leach' as it is called, with hard-wood ashes, pounding them in tight, and then pouring water on as it soaks up. If the ashes are pounded in thoroughly it will take two days before it starts to run. This lye is very strong. If the ashes are not pounded down well it soon soaks through and the lye is weak. The proper strength is found out by experience, as farmers' wives know in soap-making. We put this lye on all our trees every year. For trees from four to six years old, we dilute the lye about one-half with water; after that we use it nearly full strength, applying it with a corn broom, rubbing the trunks and limbs thoroughly. We also let a good deal run down the trunk to kill any insects that may be at the ground. Many have told me that the lye is too strong. I think not, and you can judge from what you saw when here. We think the lye kills many insects which harbour in the bark; at any rate, we know that since we have tried washing we have been very little troubled with borers. We also draw all our ashes from the canning factory and spread them around (away from) the trees. These I consider one of the best fertilizers in an orchard."

The black-spot of the apple (*Fusicladium dendriticum*) was found to be very prevalent upon both apples and pears. I therefore made "Fungous Diseases and their Remedies" the subject of one of my addresses at Picton. Another was "Insects Injurious to the Pea Crop."

From Picton I went to Leamington, in the County of Essex, where I addressed a meeting in the afternoon upon "Fungous Diseases of Fruits" and "Fruit Insects," and in the evening spoke on "Window Gardening." The next day was spent with Mr. W. W. Hilborn, the President of the local Fruit Growers' Association, who kindly drove me to several of the large peach orchards and farms in the district.

CORRESPONDENCE.

The interest in the work under my charge is indicated by the large number of letters which have been received. These numbered 1,547 during the last year, and about the same number were dispatched. By far the larger proportion of these were from farmers and others in Canada, but many were from co-workers in other countries. During the past summer an important step has been taken in Great Britain by the introduction, by Miss Eleanor A. Ormerod, the distinguished Entomologist of the Royal Agricultural Society of England, of the arsenites as insecticides. It is somewhat remarkable that notwithstanding the fact that these materials are now so much used in America as to be considered indispensable in the cultivation of certain crops, it is only within the last year that they have been used in England. Owing to my position as Government Entomologist, I was honoured by being consulted, at the suggestion of Miss Ormerod, as to the best treatment for certain leaf-eating caterpillars which had been committing grievous depredations to fruit trees in the south of England. In response, an account was given of the American method of treating such insects, and under Miss Ormerod's able direction most satisfactory results were secured. On 23rd December, 1890, in reply to my inquiry, "Has the Paris Green treatment for leaf-eating orchard insects, which you have introduced into England this season, proved as satisfactory as you were led to expect?" Miss Ormerod writes, after expressions of thanks for assistance, which is very highly over-estimated, as follows:—

"With regard to results of our work, so far as is to be gathered from the reports which I have received from February up to date, I consider I am justified in saying that the Paris green treatment was quite a success wherever we know that it was applied in the proportion recommended, and with tolerable sprayers." Mr. C. D. Wise, Superintendent of the Toddington Fruit Farms, says: Paris green is the only thing which we have found really efficaceous; the foliage was not injured and the caterpillars were killed. In autumn, when the operation of sticky-banding the trees was carried on as usual, the lesser quantity of wingless moths captured was very remarkable. Up to date of report nine moths on one tree was the largest number captured, against 500 previously." On the whole, this treatment was most successful, and there is little doubt that it will soon be universally used in England.

ACKNOWLEDGMENTS.

My thanks are due to many of my correspondents who have assisted by making observations and giving information concerning injuries by insects and fungi. These cannot all be treated of in this report; but the data are all carefully recorded and will be made use of as occasion permits.

I wish particularly to acknowledge my indebtedness to Prof. Riley, the United States Entomologist, and Dr. George Vasey, the United States Botanist, for the identification of specimens and for their kindness in lending me most of the excellent figures in this report; to Miss Eleanor A. Ormerod, the Entomologist of the Royal Agricultural Society of England, for Figs. 3 and 4, and to Prof. H. Garman, of the Kentucky Agricultural Experiment Station, for Figs. 1 and 2. My thanks are also due to all the above for their valuable opinions concerning many matters which I was allowed to discuss with them. Mr. B. T. Galloway, Chief of the Department of Vegetable Pathology at Washington. Prof. W. G. Farlow, of Cambridge, Mass.; Prof. B. D. Halsted, of New Brunswick, N. J.; and Prof. T. J. Burrill, of Champaign, Ill., have also rendered me invaluable service in identifying difficult species of fungi which I have no facilities in the way of library or instruments to determine.

Donations have been received from the following:—

Dr. George M. Dawson.—Several remittances of seeds and cuttings from the Rocky Mountains.

Prof. J. Macoun.—Several packets of seeds of rare native plants, as well as a large collection of herbarium specimens.

Prof. S. M. Tracy, Agricultural College, Mississippi.—A large collection of grass seeds.

Prof. W. J. Beal, Agricultural College, Michigan.—A collection of grass seeds.

Messrs. J. S. Pearce & Co., London.—Samples of European grass seeds.

Government Botanical Garden, Bangalore, India.—Two remittances of seeds of ornamental plants for the green-house.

Mr. John Mather, Ottawa.—Collection of samples of weed seeds from various points in the North-West Territories, also seeds of *Ammophila arundinacea* and *Elymus arenaria*, two grasses used to keep sand from blowing and washing along sea-shores.

Mr. J. M. Macoun.—Bulbs of *Camassia esculenta* from British Columbia.

Mr. John Tolmie.—Bulbs of *Camassia Leichtlinii* from Vancouver Island.

Mr. J. W. Mackay, Kamloops, B.C.—Seeds of native grasses.

Mr. W. Scott, Ottawa, and Messrs. J. Dearness, W. E. Saunders and J. A. Balkwill, of London, for specimens of dried plants for the herbarium.

Miss Alice Williams, Victoria, Vancouver Island.—Insects and seed.

I have the honour to be, Sir,

Your obedient servant,

JAMES FLETCHER,

Entomologist and Botanist.

DIVISION OF ENTOMOLOGY.

Fig. 1.

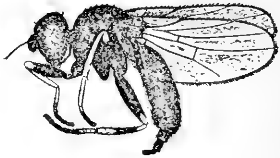


Fig. 2.

The American Frit Fly (*Oscinis variabilis*, Loew.)

Attack.—1. A small yellowish-white, legless maggot, which may be found in autumn, destroying the bases of the stems of several kinds of grasses and fall-wheat.

2. Also occurring in spring-wheat and grasses in June, attacking the young root-shoots close to the ground, and either destroying or seriously weakening them.

For the last three years a small Oscinid fly has been bred from the roots of various grasses, to some species of which the injuries had been considerable. *Agropyrum caninum*, *A. tenerum* and *A. repens* (Couch grass) suffered severely. Two forms of *Poa pratensis*, from the North-West Territories, and *Elymus Canadensis*, were also badly attacked.

During the past summer spring-wheat has been seriously injured in several places in the neighbourhood of Ottawa, and specimens of infested spring wheat, sown on 19th April, were sent to me in June, containing not only the pupæ or chrysalis cases of this fly, but also those of the Hessian Fly (*Cecidomyia destructor*, Say), and the Wheat-stem Maggot (*Meromyza Americana*, Fitch).

These specimens, which were forwarded by Mr. Freeman Britton, of Gananoque, Ont., were of particular interest. From them were reared the Hessian Fly and American Frit Fly at the end of June, and a few weeks later the fly of the Wheat-stem Maggot appeared. Thus it was proved that all of these insects attack spring-wheat in the stools or root-shoots in the same way as they are known to attack autumn-sown grain. In my last report I drew attention to the fact that the Wheat-stem Maggot attacked certain grasses in this manner; but it is now shown by the above that there is in this district a brood of each of the three above-mentioned pests, which appears in the beginning of May, and that the eggs are laid on the root-shoots of young growing grain. I am not aware that this fact has been previously noted. Later in the season abundant evidence was found as to the extent of this injury. At Eastman's Springs a field of spring-wheat was observed, the yield of which had certainly been reduced 75 per cent. In hardly any part of the field could a plant be found with more than one stem, and this was weak and spindly, with the ear frequently only half filled with grain. Upon examining the roots it could plainly be seen that the stools had formed, but had been subsequently destroyed by hosts of larvæ of the above insects. The dead plants in the drills also showed that many more plants had been killed than there were growing in the field. Of the insects occurring in the injured plants, the American Frit Fly was by far the most abundant.

The three insects are easily distinguishable in all their stages. In the larval or maggot stage, in which they do all their injury to crops, they may be known by the following characters.

1. *The American Frit Fly.*—The maggot is long and slender, of a yellowish-white colour, and has two small but distinct black hook-like jaws. The last division of the body bears two little knob-like processes. Length when full-grown, about $\frac{1}{12}$ of an inch.

Prof. H. Garman, of the State College of Kentucky, who has studied this insect and published his observations (Bulletin 30, Kentucky Agricultural Experiment Station), gives also the following differences: "Under the microscope another difference is apparent. The first two divisions and the under-side of those following are roughened with very fine raised lines, directed crosswise of the body in the wheat Bulb-worm*, while in the Frit Fly grub the first divisions and the under side of those following in the region of the joints are roughened instead, with numerous scale-like thickenings of the cuticle, with the hind edge of each thickening finely toothed."

2. *The Wheat-stem Maggot.*—This resembles the last in shape and structure, but is conspicuously different by reason of its colour, which is clear, glassy green, and also by its much larger size, which is $\frac{1}{4}$ inch when full-grown.
3. *The Hessian Fly.*—This is proportionately much broader than the other two, of a clearer white than the American Frit Fly maggot, and nearly always shows a green stripe down the centre. Instead of the two hook-like black jaws, which are present in the two previously mentioned maggots, the Hessian Fly larva has a horny, forked organ, sometimes called the "breast-bone." Length of maggot when full grown, $\frac{1}{8}$ inch.

In the chrysalis stage the differences are equally marked:

1. *The American Frit Fly.*—The pupa-case is shaped as shown above (Fig. 1), and is of a pale chestnut-brown.
2. *The Wheat-stem Maggot* changes to a pale translucent green pupa.
3. *The Hessian Fly.*—The pupæ of this insect are of a deep, rich brown, like small flax-seeds, Fig. 4, and it is in this stage that farmers will most easily and surely recognize the Hessian Fly when present.

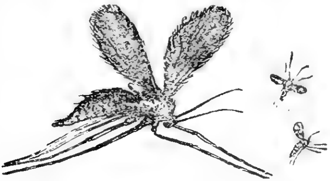


Fig. 3.

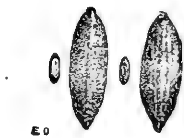


Fig. 4.

The attacks of these three insects also differ somewhat, although the effect upon the crop is of course similar. The only known method of attack upon our grain and grass crops by the Frit Fly is by the larvæ attacking the young shoots at the ground. The egg is probably laid near the base, on the upper side of the leaf, and when it hatches the young maggot works its way down and destroys the centre of the young stem. There are, however, sometimes as many as four or five puparia found in a single dead shoot. These do not appear to always lie in the centre of the stem, but between the bases of the sheathing leaves; but when there is only one larva it is generally in the middle of the shoot. This attack is very similar to an injury to grain by an insect of the same family *Oscinis*, which has been known for many years in Europe, and which is sometimes very injurious to oats and barley.

The Hessian Fly (Fig. 3) lays its eggs in the crease on the upper side of the leaves, and the young maggots work their way down to the heart of the plant just inside the leaf whereon they hatched. They lie there until full grown, and turn to "flax seeds," two or three being frequently found round one stem. They have not the

* = *Wheat-stem Maggot.*—I have used this name heretofore because the stem attack, which I have styled "Silver-top," is the more conspicuous of the two injuries committed by this insect.

power to tear up the tissues of the plant, as is done by the Frit Fly and Wheat-stem Maggot, because they have not the hooked jaws; but they do effect a certain amount of penetration, for they are frequently found partially embedded in hollows in the stem of the plant they are infesting. The Wheat-stem Maggot is hatched from beautiful white grooved and elongated eggs, which are laid upon the upper surface of the leaf, sometimes at a considerable distance from the axil. When the young maggot hatches, it like the others referred to above, works its way down into the shoot and destroys the central leaf. It tears the tissues apart and eats a gallery up the centre of the shoot. In the summer brood the maggot occurs at the base of the top, or ear-bearing joint, and by consuming the lower portion causes the ear to die and turn conspicuously white ("Silver-top") before the uninjured plants have shown any sign of ripening.

The perfect forms of these insects are extremely unlike. The Frit Fly is shown at Fig. 1 very much enlarged. The colours are black and yellowish-white. It is a very small insect, large specimens being only about $\frac{1}{15}$ of an inch in length. They are extremely active and hard to observe.

The fly of the Wheat-stem Maggot is a slender yellowish-green fly, $\frac{1}{5}$ of an inch in length, with three dark lines extending down the back. Eyes golden-green, when the fly is alive.

The Hessian Fly is a delicate dusky gnat, well shown in Miss Ormerod's excellent figure (No. 3,) where it is represented magnified and enlarged.

The somewhat remarkable popular name of the Frit Fly is explained by Miss Ormerod and Prof. Garman as follows:—

"Besides the attack to the young growing plant, great damage was recorded formerly in Sweden from the second or summer brood, the maggots of which fed on the soft grains in the ears of barley, and thereby caused the light worthless development of the corn, known in Swedish as 'frits,' whence the name of the fly. (Ormerod, E. A. Manual, 1890, p. 74.)

"The fly was long ago named *Oscinis frit* by the illustrious Linnæus, who also made record of its injurious habit, stating that in 1750 the annual loss from its depredations in Sweden alone reached 100,000 gold ducats." "From the accounts of the Frit Fly given by Curtis and Miss Ormerod it is evident that the insect works on grain much like a small fly which I find in the grub state infesting wheat in Fayette County, Kentucky. In structure and habit, as far as I have observed the latter, it proves so like the Eurepean species, that it might perhaps be appropriately named the American Frit Fly." (Garman, H., Kentucky Ag. Ex. Station. Bul. 30 August, 1890.)

Of all the insects attacking grain crops in the Ottawa district last summer, the American Frit Fly was by far the most destructive. In all cases observed the Hessian Fly and Wheat-stem Maggot were found associated with it. The injury to the plants was almost exclusively in the stools or root-shoots, and the usual summer attacks of the two last named insects on the stems of grain were conspicuously absent. On the other hand, the attacks upon the stools by the summer brood, in the same manner as fall wheat is attacked in the autumn, were this year for the first time observed.

That the American Frit Fly was abundant in the locality previous to this season was shown by its presence in injurious numbers upon the grass patches at the Experimental Farm during the seasons of 1888 and 1889. Indeed, it was so abundant that in these years, as well as during last season, the extermination of some species of grasses was threatened.

There were peculiarities about the attacks of all these insects during last season which would indicate that they may have been influenced by some meteorological conditions, and it is possible that these may have affected the growth and maturing of grasses and grain in the early spring. A remarkable fact was the enormous abundance of the perfect insects of the Wheat-stem Maggot in the month of May. This was so great as to have caused fear of a serious destruction of the wheat and barley crops. As a matter of fact, however, there was less injury both to small grains and grasses, by this insect, than for many years previously. This diminution I can only account for by the supposition that the eggs must have been destroyed by some predaceous insect. The eggs were certainly laid in large numbers, but there was very little evidence of the presence of the larvæ, either in the growing wheat or barley.

Remedies.—The life-history of the American Frit Fly, in all its phases, is not yet completely worked out, and much careful work is yet required, of which accurate notes must be taken at the time of observation, before any definite statement can be made as to the best remedies to apply.

From what is known of its habits, which seem to be very similar to those of its associates the Hessian Fly and Wheat-stem Maggot, some of the remedies which have been suggested for those insects may be applied for this.

The insect passes the winter in the form shown at Fig. 1, either in fall-wheat or grasses. When fall-wheat is attacked a liberal top-dressing of some quick-acting artificial fertilizer, sowed broad-cast over the fields in springtime, when growth re-commences, would help injured plants to overcome part of the injury by production of supplementary stools.

A knowledge of the exact time of the occurrence and the number of the broods would be of great use towards an intelligent treatment of stubbles and volunteer crops, by burning over or deep-ploughing, after a field had been found to be attacked.

I shall be obliged if any one who finds his crop attacked by this insect will correspond with me promptly upon its first appearance.

So far it can only be stated that two species of parasites were bred from this insect during the past summer. The specimens were accidentally destroyed so nothing more can be said at present concerning them.

The two figures used to illustrate the pupa and perfect fly of the American Frit Fly are by Prof. Garman, who has been good enough to lend me the blocks. They show the stages fifteen times larger than in life, and will be a great assistance in identifying the insect wherever it may be observed.

The Cabbage Maggot. (*Anthomyia brassicæ*, Bouché.)

Attack.—From one to many white, legless, maggots, which attack the roots of young cabbage plants soon after they are pricked out, frequently destroying all the roots and burrowing in the stems.

In most parts of Canada the insect which gives the greatest trouble to the cabbage-grower is the Cabbage Maggot. This is the larval form of a small gray, two-winged fly, somewhat resembling the common house-fly, but smaller, and with a slenderer body. The wings, too, shut one over the other, and are conspicuously longer than the body. The thorax, or portion to which the wings are attached, in the male bears three dark stripes, and there is also one down the centre and on the edge of each ring of the abdomen or hind-body. The female resembles the male, but is more ashy in general colour, and has not the stripes on the thorax nor the bands on the abdomen.

It is the usual custom to force cabbage in frames, which are kept covered during the first part of the season. but are left open for some time before the young plants are pricked out in the field or garden. Although in years of bad attack plants are sometimes injured in the frames, this is the exception. As a rule, they are not infested until some time after they are transplanted. It is probable that the handling, and the partially faded condition of the plants consequent to their transplantation, bring out the characteristic odour of the cabbage, and that this attracts the female flies, which lay their eggs close to the stem and as much below the surface as possible. The females will spend a good deal of time running over the earth and trying to find some crevice by which they can creep beneath the surface of the soil and lay their eggs close to the stem, or they will creep close up to it and push the eggs down below the surface by means of their extensile ovipositors. These eggs in a few days hatch, and the young maggots at once attack the outside surface of the root. As they grow larger they penetrate the stem and when there is only one it appears to remain inside the stem; when, however, as is frequently the case, there are a dozen or more, most of them lie outside in the soil, which is kept wet by the juices of the injured plant.

The maggots when full grown are white, about $\frac{1}{4}$ inch in length, with the front end pointed and furnished with two hard black hook-like jaws. The hind end is cut off obliquely and flattened with an irregular rosette of fleshy points round the margin, and on the flattened surface two conspicuous dark-brown points, which are breathing pores. These maggots are a great pest to the cabbage-grower, destroying large numbers of his plants when he thinks he has saved them from the omnivorous cut-worms.

Unless very numerous at the root of a cabbage it takes some time before the injury becomes apparent. There is a common saying that "the maggot takes them after the first thunderstorm in July." In the Ottawa district there is frequently a thunderstorm early in July, followed by hot, muggy weather. This is the time that cabbages which have been badly injured at their roots by the maggots succumb. The injury has been going on for some time, but the June rains have enabled the plant to preserve a healthy appearance; immediately the hot weather comes it turns pale and the leaves droop. If one of these plants be taken up it will be frequently found that the roots and all the lower part of the stem have been utterly destroyed, and many of the maggots are full grown.

The past season was marked by the great abundance of this insect. In a large patch of various kinds of cabbages, containing about 1,200 plants, which I examined 22nd June upon the Central Experimental Farm, I could find very few plants which did not show the work of the maggot upon the roots or on the underground stem, and in many gardens from one-half to three-quarters of the crop was destroyed. During the first part of July several letters were received, complaining of its ravages, from various parts of the Dominion. However, during the last week of June I visited the County of Essex, and was much surprised and pleased to learn from farmers and gardeners that this insect was practically unknown in the district round Leamington.

Remedies.—A satisfactory remedy for this insect has long been a desideratum. From some experiments tried during the past season I have received such success that although they are not yet complete and will require further verification, I consider it well to relate the details, so that, should the remedy prove satisfactory, others may have the advantage of the knowledge as soon as possible.

Some three years ago I was told of some experiments, made by Mr. S. Greenfield, of Ottawa East, to destroy the onion maggot by the use of white hellebore. This was made into a decoction, and watered along the rows of half a bed, with the result that the onions upon that portion of the bed were far superior to those on the part untreated. In fact, the onions were almost all sound, whilst the others were nearly all destroyed. This led me to try the same remedy for the cabbage maggot, and the result this year has been successful beyond all my expectations.

About 1st July the whole of the bed of 1,200 cabbages mentioned above was gone over by myself and one assistant. One person carried a 3-gallon pail full of water in which 2 oz. of white hellbore had been steeped, and an ordinary green-house syringe, the other placing the left hand beneath the cabbage, palm downwards, with two fingers on each side of stem, drew away the surface soil from the root of the cabbage, and at the same time, with the right hand, pulled the head a little over, so as to expose the roots. About half a tea-cup-full of the liquid was then syringed forcibly round the roots, and the earth was quickly pushed up again round the stem. The result of this treatment was that only about 1 per cent. of the cabbages was lost.

There is no doubt that the forcible syringing of the liquid removed the maggots to some distance from the roots; but by actual experiment it was found that the white hellebore killed them also. Furthermore, the moisture was of great assistance to the cabbage in recovering from the injury. The power of the cabbage plant to survive and out-grow injury is very remarkable. Several plants of which the roots and nearly all the underground stem had been destroyed, were washed and trimmed, and then planted and watered, and the earth kept well hoed up round them. Every one of these grew and produced a head. In years of only light attack it is not at all uncommon to find, when cabbages are pulled up, that they had been supported by roots which were produced some distance above the original root-mass, which had been destroyed early in the season by the cabbage maggot.

Frequent cultivation or light hoeing is of great benefit to cabbages in dry weather. By this means the thin layer of surface soil is loosened, aërated and thoroughly dried, so as to become a non-conducting medium, which prevents the evaporation of moisture from the soil below. Hoeing the soil well up to the stems of cabbages which have been injured gives them a chance to make fresh roots, and also prevents the flies from getting at the stems to lay fresh eggs.

In the third week of July, I visited the garden of Mr. S. A. Fisher, M.P., at Brome, P.Q., and was shown by his gardener, Mr. Louis Graindorge, a bed of cabbages which was in some parts badly infested with the Cabbage Maggot. I suggested that he should try the Hellebore application, and the whole bed was treated. One particular plant was taken as a test and marked. This was so badly injured that the root was almost severed from the head by the attacks of the maggots on the underground stem. There were more than a dozen of the larvæ lying close to the stem in the earth, which was quite wet from the juices of the cabbage. The earth was carefully removed sufficiently to pour in the decoction around the injured stem and then was replaced, the larvæ being disturbed as little as possible and left where they were at the root. In the end of September Mr. Graindorge writes me: "All the cabbage plants are doing well. Your test plant, the one which was nearly dead when you treated it now weighs about three pounds. I am very much satisfied with this experiment, and shall certainly try it another year and begin earlier in the season, when I believe I shall be able to save all my plants."

In the above mentioned experiment it would appear that the Hellebore killed by contact, for where a dozen cabbages were treated with Paris Green and water, 1 lb. to 100 gallons, not only did it fail by noticeably checking the growth of the cabbage, but the maggots were not killed. In applying this hellebore remedy, care must be taken not to dig down too deep or disturb the root too much. The chief seat of injury is the underground portion of the stem above the mass of roots. If about two inches of the soil be removed that part of the stem most attacked is laid bare, but the roots need not be disturbed. An important thing is not to put off treatment too long. In this district injury is made manifest in the first week of July, examination should therefore be made, and the remedy, if necessary, applied about the third week in June.

Late planting has been rather extensively practiced by some growers, but is not always a satisfactory remedy. With early cabbage the most paying market is over before they are ready, and with winter varieties there is the risk of their not heading well before winter sets in. The actual success of the practice however as a preventive of attack is sometimes most marked.

The greatest amount of injury is caused by a brood of flies which appears in the middle of June and up to about the first week of July. Cabbages planted out in the middle of July were not at all troubled by the Maggot. This was in low moist ground where the plants did not suffer from drought. They were kept well cultivated and produced a large crop of fine cabbage.

It is not, of course, wise to grow cabbage upon land where there has been an infested crop the previous year. The usual method of hibernation is in the puparium form; but the attack continues throughout the whole growing season, and where, as is frequently the case, the ground is not cleared up in the autumn and stems of cabbages that have been cut, or "blind" plants which have not headed, are left in the fields all the winter, many larvæ hibernate as such, in the stems and roots. This shows the importance of cleaning up and ploughing the fields in autumn. In this way many larvæ and pupæ will be destroyed, both by exposure to the weather under unnatural conditions and in other cases by being buried so deeply that the flies cannot emerge.

Nitrate of soda is also recommended by some growers. This is applied as a surface dressing in June and is washed in by the spring rains.

In my Report for 1887, I related the success attending the use of this fertilizer by Mr. R. Brodie, of Montreal. His method of using it was to place about a tablespoonful of nitrate of soda around each plant. One row of plants not treated with nitrate of soda was destroyed whilst the others were untouched.

In Miss Ormerod's New Manual of Injurious Insects the following appears at p. 27 :—

"When attack is present, heavy showers of rain, on land previously dressed with nitrate of soda round the plants, and superphosphate, stopped the spread of the maggots. Also, the application of lime-water has been found very serviceable. The plan adopted was soaking hot-lime for twenty-four hours in water, and watering with this, when clear, in the afternoon. This was found to destroy the maggot.—(J. Mc K.)"

Another active remedy which has been used with good effect is a Kerosene Emulsion applied beneath the surface as recommended above for the Hellebore decoction. Sand saturated with coal oil, placed round the base of the stems immediately after the plants are set out is a good preventive; but must be repeated every week until the middle of July.

In addition to all that man can do to keep down the numbers of this troublesome insect, he has a most potent ally in the shape of a small beetle belonging to the Staphylinidæ or Rove Beetles. This little friend which is named *Aleochara Anthomyiæ*, Sprague, is a small black elongated beetle, which was found in considerable numbers running about amongst the cabbages and burrowing down beneath the soil in search of the maggots. Not only is it extremely active in preying upon the maggots, but it is also a true internal parasite feeding inside them and completing its transformations inside the pupa case. In the hope of rearing this beetle, 16 larvæ and pupæ were taken from the root of a cabbage, where the perfect beetle had been seen and were enclosed in a breeding jar. From these were reared 9 beetles and one fly, the remainder of the pupæ dried up without coming to maturity. In some of them, however, the immature beetles were found when the cases were broken. When the beetle eats its way out of the pupa-case it gnaws a ragged hole at one end quite different from that made by the emergence of the fly. A description of the habits of this little beetle is given with a figure in Prof. Lintner's first report on the Insects of New York, p. 188, and mention is made of it in Prof. Riley's 1884 Report. The full description by Mr. Philip S. Sprague is to be found in the American Entomologist, Vol. II, p. 370. It is a small, slender, black beetle, about $\frac{1}{6}$ of an inch in length, covered all over with short silky hairs. The most notable features, when it is examined under a magnifying glass, are that the whole body is covered with hairs and small punctures, these are less numerous on the head, thorax, and first four joints of the antennæ, which thereby look blacker than the rest of the insect. The wing cases in some specimens have a greenish-coppery sheen. The feet are brownish which colour gradually deepens into black on the shanks or tibiæ. The antennæ after the fourth joint are so densely covered with short hairs as to have a grey appearance. I have generally been able to find a few of these beetles in beds of cabbages infested by the Cabbage Maggot and upon one occasion bred a specimen from the Onion Maggot. It is probable that other species of the genus are also parasites, but nothing definite is known of their habits. Mr. W H. Harrington has shown me specimens of *A. lata*, which he found in a breeding jar containing the cocoons of saw-flies. It did not occur to him at that time that they might be parasites, and the fact was merely recorded in his notes without any special examination being made of the cocoons.

A new attack of a serious nature by an Anthomyian larva has come under my notice during the present winter.

I have found full-grown larvæ mining in the mid-ribs and also boring through the heads of winter cabbage. These have not so far been bred to maturity, but from the larvæ and pupæ, I am unable to distinguish them from the Cabbage Maggot and believe they are that species. The varieties of cabbage most attacked belong to the class known as Savoys, which have hard, close heads. A few other varieties, however, were also attacked. The eggs are apparently laid near the top of the head and the young maggots work their way down between the leaves, generally following the course of a mid-rib, frequently confining their operations to that alone, but also sometimes boring straight into the heart of the cabbage and thus rendering it unsaleable. There does not appear to be much decay of the tissues, but simply an irregular channel is eaten out, which is filled with the shredded tissues of the leaf and a mucilaginous exudation from the plant.

Some of the larvæ have turned to pupæ inside the cabbages; but others placed in breeding jars have buried themselves in the soil.

I have so far received no complaints of this injury from outside sources; but should it become widespread, it will be a matter demanding the earnest attention of entomologists, to discover a remedy as soon as possible. As many as twenty larvæ were taken from one head.

In Prof. Riley's report for 1884, mention is made of a summer attack upon the mid-ribs of the leaves, as follows: "Our first acquaintance with this insect was in June, 1867, when Prof. A. N. Prentiss, then at the State Agricultural College, Lansing, Mich., sent us specimens of the larvæ, with an account of their gnawing and excoriating both the stems and roots of cabbages, and thereby doing much damage. They transformed June 21-25, just below the surface of the ground, to puparia of a honey-yellow colour, some lighter, some darker, and the first flies issued June 29 onward. We have since (in 1878) found the species not only working in the normal way in the roots, but also burrowing in the stout mid-ribs of the leaves. From June 8-13, quite a number of the perfect flies were obtained." This summer attack I have also occasionally noticed at Ottawa; but it is of far less importance than the winter attack above-referred to, because when the individual leaf only is destroyed, the plant soon replaces it, and when, as is usually the case in this attack, the stem is also injured, the plant is destroyed early enough for it to be replaced by a healthy one. This summer attack also has been very rare in my experience; the winter attack, however, is more serious, because the maggots work in the solid heads after they are stored in the root-house. I am under the impression that in ordinary summers, here, there is not sufficient moisture in the atmosphere above the surface of the soil to allow the young maggots to live long enough to penetrate the epidermis of the leaf before they are dried up. In the case of the eggs of the Onion Maggot (*Phorbia ceparum*) out of several clusters of eggs laid in the axil of the first leaf, where the ground beneath had been sprinkled with sand saturated with coal oil, not a single maggot effected an entrance, and in only one instance have I ever found an individual of this insect in the stem of the onion above the surface of the ground.

The Diamond-back Moth (*Plutella cruciferarum*, Zell.)

Attack.—Small green, exceedingly active, caterpillars about $\frac{1}{4}$ of an inch in length, which attack the leaves of cabbages, eating numerous small holes through the younger leaves and irregular blotches from the under surface of the older leaves. When disturbed they run backwards, wriggling their bodies violently from side to side, and fall to the ground by means of a silken thread, where they lie quite still.

This little insect although very small is a serious pest to cabbages every year in some parts of British Columbia, the North-West Territories and Manitoba, and in 1889 was extremely troublesome upon the Experimental Farm here. The eggs are laid on the under sides of the outer leaves of cabbages and many other plants belonging to the same botanical order. I have found the caterpillars on turnips, cabbage, cauliflower, pepper-grass (*Lepidium*), shepherd's purse, and in 1889 it was an incessant and most troublesome pest upon garden stocks and wall-flowers from about July till the frosts set in in November. The caterpillar is pale green in colour, sometimes almost yellow, and bears some black dots and short bristles in regular series, as shown at Fig. 5—*b-c*. When full grown the larvæ spin pretty open net-work cocoons upon the lower surfaces of the leaves, through which the pupæ can be easily seen (Fig. 5—*e*). These cocoons are open at each end. The pupæ (Fig. 5—*d*) are very pretty objects, being white with conspicuous black lines down the back and sides. In some specimens, however, these lines are entirely wanting, while in others they are so wide as almost to cover the whole chrysalis. The sheaths of the legs, tongue and antennæ are also dark coloured.

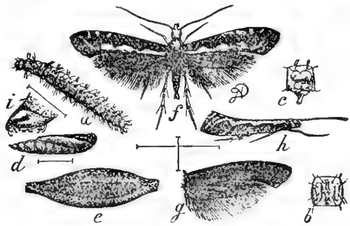


Fig. 5.

Fig. 5 is by Prof. C. V. Riley, who kindly lent me the figure.

The perfect moth is a beautiful, slender little creature, very variable in size and markings. A well marked example is shown in Prof. Riley's excellent enlarged figure above. The actual size of the moth is shown by the crossed hair-line beneath. The general colour is ashy-gray, with the light stripe of somewhat diamond-shaped marks on the back, more or less distinct, and in some specimens almost or quite wanting, as shown at *g*. The upper wings are freckled with black dots and small blotches of yellowish scales. The inner irregular margin of the light stripe is bordered with clear white, and is shaded outside with rich brown, which extends up the middle area of the wing to the end. The legs and body are silvery gray and the antennæ or feelers white, ringed with black.

There are two or three broods of this insect in the year. At Ottawa, Ont., the first moths were taken July 1, 1889, the only year I have ever found it here. Moths were also found through August and September, and the larvæ into November; the last brood passes the winter in the pupa state. Moths were first seen in Victoria, V. I., in 1885, in the month of May when I found it a most troublesome pest. Caterpillars taken at Regina, N. W. T., in the first week of August, did not emerge at Ottawa until the next spring; but a large number sent from Indian Head, N. W. T., at the end of last August, emerged during the next month.

This moth is said to have been imported into America from Europe; but is found in various parts of the world besides. A peculiarity of its occurrence is in the enormous numbers in which it sometimes appears and then as suddenly disappears entirely and is not seen again for several seasons. In 1885 it was most abundant at Victoria, but has not been reported since. In 1887 at Regina in Captain Deane's garden cabbages were almost destroyed. In Winnipeg, in 1885, it was a serious pest, but has not been complained of since. In 1889 it suddenly appeared in great numbers over a restricted area upon the Experimental Farm here. It was first observed upon a clump of Pepper grass (*Lepidium Virginicum*), from this it spread to almost every cruciferous plant near this patch, attacking various garden flowers as well as turnips slightly, and cabbages severely. Last season although sought for assiduously not a specimen could be found.

During 1889 also it was sent in by Mr. S. A. Bedford, the Superintendent of the Experimental Farm for Manitoba. He had found it a most troublesome pest amongst his cabbages at Brandon. It was also sent in from other parts of Manitoba; but did not occur last year. In August, 1890, Prof. Saunders sent me specimens from the Experimental Farm for the North-West Territories at Indian Head with the following letter :—"I send you herewith some small larvæ and chrysalids of a moth which has proved a very serious injury to the cabbages and cauliflower on the farm here. The outside leaves are all completely riddled with holes of various sizes and the larvæ also eat into the first two or three leaves on the head disfiguring the cabbages and making them worthless." Upon enquiry Mr. A. MacKay informed me that a few specimens were noticed last year; but that it had been abundant this year right through the season. The eggs are laid under the leaves where the caterpillar chiefly works. Although so abundant with him, it did not occur in other gardens near by.

Remedies.—I found that this insect was much more difficult to kill with Insect powder (*Pyrethrum*) than most of the other larvæ upon the cabbage. Hellebore was slightly more effective; but the most satisfactory remedy was a Kerosene Emulsion prepared after the usual manner (kerosene 2 parts, boiling soap-suds 1 part (1 gallon of water and ½ lb. soap), and the whole churned with a syringe until emulsified and then mixed with 9 times its quantity of cold water. To make the emulsion, boil the soap in the water till all is dissolved and then turn it into the kerosene and churn violently.

When the caterpillars appear early in the season, before the cabbage-head begins to form, Paris Green and flour, one part of the former to fifty of the latter, may be dusted on the plants. The Kerosene Emulsion will, however, probably be the best remedy, because owing to the readiness with which the caterpillars drop to the ground from beneath the leaves, they would be sure to be covered with the kerosene mixture which dripped from the cabbages, even if they were not touched by the spray when they were on the plants. The most convenient method of applying, the Kerosene Emulsion is by means of a force-pump and spray nozzle; but it may also be applied (although clumsily and wastefully) by means of a whisk or small broom.

This insect increases most rapidly in hot, dry summers, and Dr. Cyrus Thomas, in the Ninth Illinois Report, p. 56, suggests "that thoroughly showering the vegetation, which is attacked, with water will be found a most effectual remedy for the expulsion of the worms of this group."

Miss Ormerod also mentions: "In the South African observations, sent by Mr. J. deWitt Meulen, of the Witterhock, he noted 'heavy rains or frequent watering of the leaves destroys many grubs.'" (New Manual, p. 194). Dressings of soot and nitrate of soda and soot, are also recommended. Miss Ormerod says: "Almost the only method of lessening amount of damage from presence of these caterpillars appears to be from natural or artificial applications suited to drive on growth." In her manual it is treated of as a turnip insect. Upon that crop there need be no hesitation about treating it with Paris Green mixed with either flour or land plaster. These diluents must, however, always be perfectly dry, so as to be applied in the form of fine dust. If they are not they must be dried artificially or, I find, they will not adhere to the plants.

Natural Enemies.—This insect is remarkably subject to the attacks of parasites. In every one of the attacks recorded above more than 50 per cent. of the caterpillars collected were found to harbour internal parasites, which eventually destroyed them and emerged as small four-winged flies. Some of these have been sent to Prof. Riley, at Washington, who has kindly identified them for me as *Limneria parva*, Prov., bred from all localities, and *Phæogenes discus*, Cress, bred from Indian Head and Ottawa. Prof. Riley has also bred *Limneria annulipes*, Cress, from the same insect.

This little moth has been treated of by authors under various names. Asa Fitch, in Report II, p. 170, (1855) gives a very full account of it under the name of "The Cabbage Moth," *Cerostoma Brassicella*. Later, it was described by Dr. Clemens under the names *Plutella limbipenella* and *P. mollipedella*. Dr. Thomas, in Ill. Rep., IX, treats of it as the Cabbage Tinea, *Plutella cruciferarum*, Zell., and Prof. Riley, in his Second and Fourth Missouri Reports, refers to it under the same name. In his 1883 report as United States Entomologist, he gives some interesting information not found in the other accounts The popular name he uses in this article is the Cabbage Plutella. Miss Ormerod uses the name, "The Diamond-back Moth," that being the name by which I have always known and spoken of it, and by which it is known in England, at the Cape of Good Hope and in Australia.

John Curtis, in his "Farm Insects" (1860), treats of it as The Turnip Diamond-back Moth (*Cerostoma xylostella*, L.) and states that in Europe it lives principally upon the upright honey-suckle, *Lonicera xylosteum*, and attacks a great number of culinary plants; but seems to prefer the cabbage and turnip.

The Mediterranean Flour Moth (*Ephestia kühniella*, Zeller).

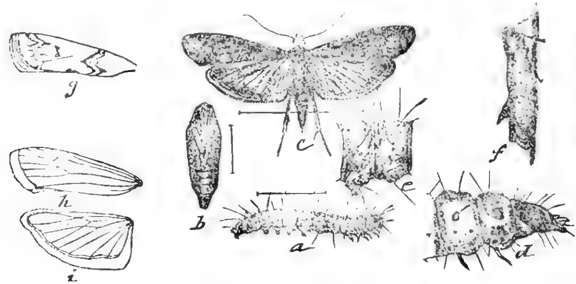


Fig. 6.—The Mediterranean Flour Moth (*Ephestia kühniella*,): *a*, larva; *b*, pupa; *c*, adult enlarged; *d*, head and thoracic joints of larva; *e*, abdominal joints of same—still more enlarged; *f*, moth from side-resting; *g*, front wing, showing more important marking; *h*, venation of fore-wing; *i*, venation of hind-wing—somewhat enlarged; (*a*, *b*, *c* and *e*, (Riley) *d*, *f*, *g*, *h*, *i*, (Snellen).

Attack.—Slender white or pinkish, cylindrical, caterpillars. When full grown from ½ to ¾ of an inch in length, with reddish brown heads, and having four conspicuous, and two smaller, dark bristle-bearing dots on each side of every segment. These caterpillars are found feeding in flour and manufactured foods prepared from wheat, rice and Indian corn, through which they burrow, spinning silken tunnels and threads wherever they go. They also infest the mills where these grains are ground, doing much harm by clogging the apparatus and by destroying the fine silk gauze of the machines.

In my last report I drew attention to the occurrence of the Mediterranean Flou Moth in Canada as an injurious insect, and in such numbers as to have already caused at the time of discovery considerable pecuniary loss to the firm into whose premises it had been introduced.

Mention was also made of the thorough investigation which was undertaken by the Ontario Government under the direction of Dr. P. H. Bryce, as Secretary of the Provincial Board of Health, and the vigorous measures which were adopted to ensure the eradication of a pest which it was justly surmised might materially affect one of the most important products of the whole North American Continent.

The gravity of the case demanded the full treatment which I gave it in my last annual report, and in order that the identification of the moth by millers and those most concerned might be facilitated, the above excellent figure, showing the moth in all its various stages, was lent to me by Prof. Riley, the United States Entomologist.

The official bulletin, prepared with great care by Dr. Bryce, illustrating the insect in all its stages and also giving full instructions as to the course to pursue should the insect appear in any mill, was widely distributed and noticed in the public press, "and was also sent to Boards of Health, members of the Ontario Millers' Association, and to such other persons as it was known would be interested in the matter." A particular request was made that the Board of Health might be notified of any occurrence of the pest, and promises were made of such practical assistance as the great interests at stake demanded.

It might naturally have been supposed that millers and produce dealers would have taken a little trouble to understand this matter and assist the Government in carrying out these measures which were being adopted for their special benefit; but such is by no means the case; and a most remarkable apathy and indifference prevails amongst millers in the very centre where one of their number has suffered so severely for unwittingly committing the same offence of "not thinking there was anything to fear," when the moths were found on his premises, which some of themselves are now guilty of, with the great difference that they, having been warned and shown the danger to themselves, their country, and the whole of North America, have no excuse for such unpardonable carelessness.

It is strange that no enquiries for information concerning this much-to-be-dreaded enemy have been sent either to the Ontario Board of Health or to this Department from millers of the city, where it first occurred and still exists. The enquiries have all been from millers of other Canadian or United States cities, where the moth had not appeared, or from consumers who have, upon several occasions, sent in larvæ for identification.

With regard to the steps taken by the Provincial Board of Health, and the Milling Company, on whose premises the caterpillars of the Mediterranean Flour Moth worked such havoc last year, it is very satisfactory to be able to report that they were entirely successful. The manager of the mill writes as follows: "I am thankful to say we are entirely free of them; but knowing the great danger if we ever allowed them to get a foothold in our premises, we have exercised the closest scrutiny the whole time, and every suspicious appearance has been at once attended to. A few straggling specimens were seen last spring. One hearty full-fledged fellow was found in the office in April. This must I think have come out of the books, which were not steamed. A few shrivelled up specimens were found in the packing room in June, and these we traced to an old trunk containing some clothes that a mill-wright had left, who had worked in an infested mill. This trunk had escaped our notice when the other things were steamed. We kept a sharp lookout all summer, and the only other discovery was under a hopper that had been put down without steaming. As soon as this was discovered we put the hopper and all material around it into the furnace. From the above facts you will see what a terrible pest this is to get rid of. We were not absolutely clear of the moth until mid-summer, even after all the steaming, burning and extra caution we had taken. Since August, however, we believe and claim that we have been absolutely free; but if we had not adopted all the measures referred to by Dr. Bryce in his report and followed up the stringent measures with a vigilance that many people considered altogether unnecessary, we should not have been clear of it now; but we feel sure that the pest would have come upon us with increased strength. We have great confidence in steam as a remedy, and we have so planned our mill that we can at any time fill it with steam and sulphur fumes should it ever be necessary. We keep it also cold—freezing cold—and have plenty of light. During this summer we have kept it thoroughly cleaned and dusted, and some places scalded, all ceilings and walls swept several times. Every bag, barrel, package and movable thing moved frequently, and in this way we have at last conquered this dire enemy. You enquire about possible infestation by means of bags returned to us. With regard to these, and sometimes goods from shops which may have been infested, I may say that we have had a room built which we heat up to 250° and into this we put everything we are the least doubtful of. This is not much trouble; at least, we do not consider it so, when we consider the possible danger it saves us from, and if some of the men who are now making light of this scourge, should get into the position we were in, they will wish they too had taken this precaution.

"In conclusion, sir, I do trust that you will not let this matter drop. I have been surprised all this summer to see the apathy, indifference and manifest carelessness about this moth on the part of those most interested. I have repeatedly telephoned and written about it. I also sent out and investigated certain stores, and found that in some places they were swarming; again, others came and told me that they were infested with the moth and did not know what to do about it. I am still afraid that unless more extreme measures yet are adopted, this awful pest will get such a foothold that it will be impossible to eradicate it. Now is the time to kill them out. They can't stand severe cold, plenty of light and cleanliness, but they do thrive in heated, dark and dirty places, such as many of our stores and feed shops provide them with. If they once get a hold there they will increase marvellously and spread rapidly. The winter is the best time to begin the war of extermination. In every place, mill or shop where there has been trouble, the frost should be allowed to enter several times during the winter. When zero weather comes the windows and doors should be thrown open and the places cleaned thoroughly from top to bottom and all the rubbish burnt. This would make a good beginning, to be followed up next spring with great vigilance, and upon the first appearance of moths a prompt application of the remedies recommended in Dr. Bryce's pamphlet and your reports."

There can be no doubt but that if millers and produce dealers would all recognize the danger of allowing this pest to increase, and would adopt the wise suggestions of my correspondent above quoted, a great deal might be done towards the extermination of this enemy; but this is a matter which, from its importance to the country at large, concerns everybody and I have not scrupled to request such consumers as have applied to me for information, to warn dealers from whom they have purchased infested foods of the nature of the infestation, and at the same time to remove their custom to such firms as would supply pure, clean food.

So little attention was paid to this important matter by the millers of Toronto, and the insect was found to have increased to such an extent, that the Provincial Board of Health found it necessary to issue, in October last, a printed circular letter addressed to millers and produce men, from which we learn that the insect has been found in several large establishments. The secretary of the Board (Dr. Bryce) goes on to say: "The Board, in view of the measures taken last year, not only to apprize millers and produce men of the nature of the pest which threatened them, but also of the offers of co-operation in the endeavours made to stamp it out, should it again appear, has to regret that its endeavours have not been seconded by the persons most immediately interested. In view, therefore, of the great loss which the reputation of the Province in the matter of pure grains and flours would sustain in its export trade, in addition to the health interests involved, should the pest become generally prevalent, the Board publishes herewith, not only the authority under which its inspections and those of local Boards are made, but also the penalties attached to any violation of the statute in the matter of selling unsound grain or flour."

A copy is here given of the Provincial Act (47 Vic., c. 38, s. 39 and s. 40), by which it is provided, that any medical officer or sanitary inspector may at any reasonable time inspect any mill and examine the goods being manufactured for sale as food, and may condemn and order to be destroyed any food-products which may be found to be unfit for use. In addition to this, the person exporting them for sale shall be liable to a penalty not exceeding \$100 for each parcel of grain, bread or flour.

An appeal is made to millers and others to co-operate in the important matter of maintaining the reputation of Canadian grain and flour. In conclusion, the steps to be taken to stamp out the pest are reprinted from the Bulletin issued last year, so as to give them the widest possible publicity.

Remedies.—The remedies for this most persistent enemy have been already referred to, and consist chiefly of great cleanliness and constant vigilance when the perfect insects appear; frequent fumigation should be made with sulphur, so as to destroy all the moths before they lay eggs for another brood. This should be done night after night, until not a moth is to be seen. Dr. Bryce gives the following instructions for making sulphur fumes; "Place a metallic dish containing hot ashes on some support in a pan of water, or place in an old pan or other vessel, a bed of ashes at least 6 inches deep and about 15 inches in diameter, and place the sulphur and saltpetre in a slight depression in the centre, and ignite. The proper proportions are 3 lbs. sulphur and 3 oz. saltpetre per 1,000 cubic feet of air space. All doors, windows and other openings should be tightly closed before the sulphur and saltpetre are ignited." If the fumigation with sulphur be persistently kept up, and the mill be frequently swept and kept clean, this pest can certainly be kept in check; but the treatment must be incessant. There are probably two normal broods of this insect, one emerging in the spring and another in autumn ; but in a jar kept constantly under observation, in my office (which was heated during the winter), there have been, I judge, three distinct broods; although from the fact that some retarded individuals have been emerging the whole time, and no special study was made of them, it has been very difficult to keep track of the separate broods. These insects are very retentive of life, and the following fact will indicate with what difficulty they will be eradiated if they are allowed to be introduced :

In the autumn of 1889, when studying the species, I placed a worn female in a small tight-fitting cardboard box, with about half a thimbleful of cornmeal, to obtain the eggs. The box was put on one side and forgotten until a week ago, when it was found to contain several half-grown larvæ, which, although much shrivelled, were still alive, and since, they have been supplied with food, have grown rapidly. From the appearance of the contents of the box this brood was hatched from the eggs laid by the female enclosed a year ago, and they have been for several months at any rate without any fresh food. All who have had experience with this insect notice its preference for dusty corners; these, therefore, should be carefully brushed out. When the caterpillars are full grown and ready to spin their cocoons, they have a tendency to climb up to an angle, such as is afforded by the meeting of a wall with the ceiling. Such places also should be frequently brushed. When possible, spraying the walls and floors with the ordinary kerosene emulsion would have a most beneficial effect. Anyone who sees this insect cannot fail to recognize it, if they will examine the figure given herewith. The moth differs from the ordinary flour moth found in mills (*Asopia farinalis*) in every way. The colour of the Mediterranean Flour Moth is slate-gray, with dark markings, and the outline is narrow and slender, the wings sometimes being slightly curled under the sides of the body when the insect is at rest. The ordinary flour moth (*Asopia farinalis*), which is produced from the meal worm, and which has been known in our mills for many years, is a pretty, triangular-shaped moth, in colour chocolate-brown and creamy-white.

The Pea Weevil. (*Bruchus pisi, L.*)

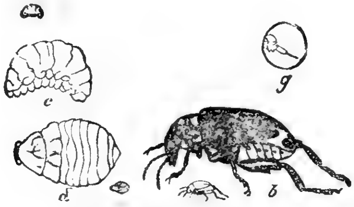


Fig. 7, *B. pisi* (after Curtis) kindly lent by Prof. Riley, the U. S. Entomologist.

Attack.—A small brownish-gray, very active beetle, about $\frac{1}{5}$ inch long, with two conspicuous black spots on the end of its body, which emerges from seed pease late in the autumn or in the spring, leaving a small round hole, through which it may be seen that the greater part of the inside of the pea has been eaten away. There is only one beetle in each pea.

During the last two years I have received abundant evidence of the rapid increase of this troublesome insect in the pea-growing districts of Ontario.

Mr. T. G. Raynor writes me from Rose Hall, Prince Edward County :—

"I have consulted the grain buyers and others about the Pea-Weevil and they say that the weevils are very bad this year, especially two or three miles back from the lake shore. With us here there were only a few."

Mr. J. H. Allan, a large seedsman and pea buyer of Picton, Ont., also writes to me: "The weevils are much worse this year than they have been for years."

Some years ago the pea weevil was a most serious enemy to the pea crop; but for the last eight or ten years it has been almost unknown in many districts where a few years before it destroyed from 50 to 75 per cent. of the crop. This exemption I attribute almost entirely to the care taken by farmers and seedsmen to treat the seed pease as soon as harvested. Owing to the small amount of injury for some years past, this extra labour and expense has been considered unnecessary, until now the insect has again increased in such numbers as to be a serious menace to this important industry. The high quality of Canadian-grown seed pease is acknowledged by all seedsmen in Europe and America, and it is important that every effort should be put forth to maintain the high standard of excellence to which they have attained. The cause which affects this most is the insect under discussion, and there really should be no difficulty, under the circumstances, of keeping this enemy in check, if all the pea-growers would act in unison.

There are very few native plants in Canada upon which it could live, and the seed for the next year's crop can be so easily treated to destroy the weevils, that it is merely a matter of close attention and the application of cheap and simple remedies.

The life-history of the Pea Weevil is well known. "The eggs which are spindle shaped, three times as long as wide, pointed in front, blunt behind, but larger anteriorly than posteriorly, are laid on the outside of the young pod, to which they are fastened by a viscid fluid, which dries white and glistens like silk."—(*Riley.*)

As soon as the larva hatches it eats its way through the pod and penetrates the nearest pea; the hole in the pod soon fills up, but that in the pea can always be seen as a minute black spot on the skin. The larva, which is a legless, yellow, maggot, soon attains full growth, and turns to the perfect beetle in autumn inside the pea. Frequently, the germ of the seed is left uninjured, and many of the injured pease will germinate and produce a weakened plant. Many of the perfect beetles leave the seed pease in the autumn and seek a suitable place for passing the winter; a large number however hibernate inside the pease until the following spring. The proportion of those which follow this course seems to depend upon the nature of the season, various observers estimating it from 25 to 75 per cent, according to the season. The following extracts from correspondence are of interest:—

"In reference to the percentage of weevils leaving the seed before spring, this depends on the weather. During a warm winter or early in the spring they eat their way out, and from 50 to 75 per cent. of the pease would be empty in this way. Where they are bad they cause the pease to heat; and a few years ago, in loading vessels, they would crawl out, and in some instances become 2 feet deep on the top of the pease."—(*T. G. Raynor.*)

"A considerable proportion of the beetles emerge from the pease in the autumn if the crop is left out until the bug is fully developed. In threshing them in this state the caps are removed and the bugs get out and conceal themselves in some dry place until the spring, when the heat revives them, and they will fly from field to field until they find the young crop of pease. They feed on the young leaves and flowers until the pods take form. The eggs are laid when the pease are quite small, about the size of a mustard seed. As soon as the beetles have laid their eggs they die. I advise early cutting and threshing so that the seed can be treated while the insect is in the larval stage."—(*J. H. Allan.*)

Remedies.—1. Bisulphide of carbon.—The distribution of the Pea Weevil is undoubtedly aided by means of infested seed pease. As stated above, many of the beetles do not leave the pease until the spring, and in this way many are carried to the field and sown with the seed, from which they soon emerge. Care should therefore be taken in the selection of sound pease. It is found that the beetles, even inside the pease, can be easily destroyed by the vapour of bisulphide of carbon, and this method, which is the best, is now adopted by most seed-dealers. In answer to the question:—"Is the treatment of seed pease with bisulphide of carbon much practised by seedmen?" Mr. J. H. Allan writes to me as follows:—"Yes; nearly every large grower has a building for the purpose. If properly made it works well. The whole building must be perfectly tight to be of any use. Some use tin, others cement and paint and paper lining, with a double floor with tarred paper between. The pan we use to put the bisulphide of carbon in, is about 3 feet across and only about 4 inches deep. The chemical is thus exposed to more air than it would be in a deep dish, from which it would not evaporate quickly enough to do good service. I put my pan up close to the ceiling above the pease, because the vapour being so much heavier than air it works down through the pease. We fill the building with bags as close as possible up to where the pan hangs, empty the carbon into the pan and get out as quickly as possible and close the door up tight and leave it for forty-eight hours. This must be done in warm weather, as it does not work well when colder than ten degrees above zero.

The bugs will live well into the second season if left in the pease in a bin or bags. This insect has, I know, been in this country for the last thirty-five years. A sharp, cold winter with a cold wet spring does a great deal of good in thinning out the bugs. They want hot and dry weather to do much harm.

Many of our farmers sow the late sorts of pease late in the season—say, the first part of June—with good results. I have seen a field of Golden Vine pease sown early in May. The crop was literally filled with bugs. The neighbour of this farmer planted his in June and his crop had none. I would say, plant as late as possible; but this will not answer for all kinds. The extra early varieties must be put in as early as possible to ensure a paying crop."

From the above, and what is known of the habits of the Pea Weevil, it is evident that steps should be taken to destroy the beetles infesting seed pease as soon as possible after they are ripe. In this way the insect will be destroyed in the larval stage, before it has consumed much of the substance of the pea in which it is passing through its transformations. This is an important matter, because by so much as the pea is reduced in volume, to that extent will the vigour of the plant grown from it be reduced, if even it be not destroyed altogether.

2. Warm Storage.—Another remedy which has been successfully practised by farmers who save their own seed, is to store the pease in strong, close bags, of either paper or close canvas, which the beetles cannot penetrate, and store them for the winter in a warm room. In this way the perfect insects are developed early and die long before the seeds are required for sowing.

3. Holding over Seed.—Pease can be held over until the second year after harvesting without injury, with the same result as above, but must of course be enclosed in bags or other receptacles to prevent the beetles from escaping.

4. Salt.—A plan, which, however, I have never tried myself, has been highly recommended by Mr. C. C. Bessey, of Ottawa. He informs me that when farming some years ago in Halton County, Ont., with his father, Mr. J. B. Bessey, it was their custom to thresh as soon as possible and then store the pease in bins with salt. After putting about 4 or 5 inches of pease in the bin a little salt was sprinkled over them; then more pease and more salt, until the bin was filled. This plan Mr. Bessey claims always killed the weevils when quite small, in the larval stage, without in any way injuring the pease.

The Strawberry Weevil (*Anthonomus musculus*, Say.)

Attack.—Just before the flowers of the strawberry expand they are sometimes found to be severed from their stems by a small reddish beetle, which pierces the buds and lays one white egg in each, which afterwards hatches into a white grub and passes all its stages inside the fallen bud, eating out the centre and forming a round cocoon or pupa-case of the frass, and then turns into a beetle within the same bud where the egg was laid.

For some years entomologists have been trying to discover whether the Strawberry Weevil actually passed through its stages inside the buds which the females sever from the plants, or whether this injury was mere wanton mischief, similar to that done by the Red-thighed Locust in biting off the flowers of oats. During the past season, with the assistance of Mr. W. A. Hale, of Sherbrooke, I have succeeded in breeding several of the beetles from the buds, and find that an egg is deposited in each at the time it is cut off from the flower-stem. In February, 1889, Mr. Hale wrote to me as follows, giving the true life-history : "For several years I have been suffering from the ravages of some sort of insect which attacks the buds of all the staminate varieties of strawberries ; a small puncture is made through an unopened sepal of the calyx, and an egg is deposited. The stalk is then partially or entirely cut through, and in about ten days the grub makes its appearance, and feeds upon the pollen in the still unopened bud. It soon assumes the chrysalid form. Though I was successful last summer in hatching out a number of the grubs, I never carried them beyond the chrysalis state. A remarkable thing about this depredator is its cleverness in selecting only those varieties which produce pollen. In a large field of strawberries, in which 80 per cent. of the rows were pistillate varieties, not a single bud was touched, while the remaining rows of strawberries were almost denuded of buds, the cutting process extending over a period of about ten days. This same trouble was noticed in Staten Island and in Hamilton, Ont., in 1886, but the insect was said to destroy the buds from mere wantonness, which was an error. I tried equal parts of air-slaked lime and sifted hardwood ashes; also ammonia in the form of fermenting hen manure, put on between the rows, powerful enough to wither the foliage, but with little or no effect * * * One of our most profitable and growing branches of horticulture is being threatened, unless some preventive can be suggested."

Mr. Hale again writes on 18th June, 1890 : "I am sending you a number of strawberry buds, cut off by some insect, in each of which you will doubtless find an egg. Whatever the depredator is, she is knowing enough to attack only the bisexual varieties, so that the larva is ensured pollen for its sustenance. So marked is this, that I have seen a single staminate plant in a bed of thousands of the Crescent (pistillate) entirely stripped of its buds, while not a single injured plant could be found amongst the Crescents. Last year, I was comparatively free from the pest, but in 1888 I suffered heavy loss."

On 31st December, 1890, Mr. Hale writes again : "I am sorry that I am not able to report any very marked success in coping with the strawberry weevil. Heavy dressings of air-slaked lime and wood ashes, twice applied while the dew was on, gave no appreciable results. 'Dissolved bone', possessing a very strong odour, checked to a certain extent the depredations, but left upon the hulls its pungent smell, even perceptible when the fruit was ripe, and this last fact has deterred me from making any experimental applications of Paris green or London purple."

Upon examining the buds sent by Mr. Hale, 18th June, I found that a hole had been bored through the calyx and closed corolla, and one small white egg pushed in to the base of the anthers. The buds were enclosed in a glass jar upon some slightly moistened earth. The beetles began to emerge about a month later. The larvæ had entirely consumed the contents of most of the buds, and had then made a thin cocoon of the agglutinated frass, inside the calyx which retained its shape. This cocoon is very similar to that of *Anthonomus rubidus*, which breeds inside the fruit of white currants, which ripen prematurely and generally drop from the bunches just before the main crop changes colour. I have never observed injury to strawberries at Ottawa, either upon wild or cultivated varieties, although the perfect beetle is frequently taken on bushes and low shrubbery during the month of June.

Remedies.—A practical remedy for this insect is difficult to devise. I had suggested spraying the vines with a weak mixture of Paris green and water (1 ℔. to 300 gallons), but Mr. Hale was unwilling to try it. Kerosene emulsion would probably kill all the beetles upon the vines at the time, and might deter others from coming for a short time. What is required is something which will keep the weevils away until the buds are open, but will not keep away the fruit-growers' friends, the bees and other flying insects, after the flowers are expanded. The beetle does not lay its eggs in the flowers after they have opened. I have suggested the plan, for next year, of covering the beds liable to attack with old newspapers, held down at the edges with a few handfuls of earth, and overlapping at the ends; or with strips of any fine cloth, as cheese cloth, muslin &c., &c. These would have to be put on at the first appearance of the beetles, and kept on until the flowers expanded, after which time they could be left off.

The little beetle which gives all this trouble is a minute species, only about $\frac{1}{16}$ of an inch in length, oblong-oval in shape, with a beak which folds down beneath its body. The colour and markings are very variable, but are modifications of the following. The beak is dark-coloured as well as the thorax; the wing-cases are reddish-brown, with a large, dark, irregular, sometimes double, blotch, bordered with white just behind the middle, and bear between them at their bases, where they join the thorax, a small white shoulder-plate or scutellum. They vary so much that Prof. Riley, in his 1885 report, has characterized no less than eight varieties.

The Vancouver Island Oak-looper (*Ellopia somniaria*, Hulst.)

Attack.—Slender caterpillars of a pale-brown colour, mottled with black—when full-grown about 1½ inches in length—which have only five instead of the usual eight pairs of legs—three pairs on the fore part of the body and two pairs behind—for which reason the middle part of the body is looped up, as the posterior part is drawn up to the front part in walking. On this account caterpillars of this structure are called "geometers" or "loopers." Feeding in large numbers upon oaks.

Every three or four years the oaks in some districts in the vicinity of Victoria, Vancouver Island, are seriously disfigured by being defoliated by the caterpillars of a geometric moth. I have frequently received descriptions of these depredations; but it was only during the past season that, through the kindness of Mr. W. H. Danby, of Victoria, I received specimens of the insect in all its stages, together with a note upon its ravages. In 1887 Rev. G. W. Taylor wrote to me: "This year has been pre-eminently a caterpillar year. The Clisiocampas stripped the forest trees, *Halisidota sobrina*, Stretch the firs and other conifers, and *Ellopia somniaria* the oaks. These last were very numerous, and were most disagreeable pests, dropping from their food-plant and hanging by threads, so that even in walking through the trees it was almost impossible to keep them out of ones eyes and mouth. The threads and larvæ were so numerous that it was most unpleasant to walk through the oak groves, and the sound of the falling excrement was suggestive of gentle rain. The moth is probably only a very slight variety of the well known *Therina fervidaria*, Hubn.; although Mr. Hulst, judging from a limited series, has thought it sufficiently distinct to deserve a new name."

Mr. W. H. Danby, who was good enough, at my request, to make careful notes on the spot, has sent me a long account of his observations, which I regret I cannot reproduce *in extenso*. The following is an abstract. He says: "On 17th August I was struck with the great numbers of the larvæ of a geometer from 10 to 12 lines in length, which were feeding on the oaks in the vicinity of Victoria. After a few days I saw that it was going to prove a very destructive pest. Upon trees which a week ago were beautifully green not a perfect leaf could be found, and the trees had the appearance of having been burned. Millions of larvæ were hanging in festoons from tree to tree, suspended by strong silken webs. They were everywhere—on trees, fences, and in vast numbers in the dusty roads, which they were attempting to cross in search of food, having devoured all behind them, and, finding none, were dying from starvation by thousands, their extenuated bodies hanging to fences, grass, &c.*

"They now averaged 15 lines in length (1¼ inches), and those in good condition seemed ready to pupate. About 20th August pupation began, the caterpillars generally descending to the trunk or to the ground and hiding amongst dead leaves, &c., at the base of the tree. They also pupate in crevices, under projections on

* NOTE.—I rather suspect that some of these may have been attacked by parasitic fungi.—J. F.

fences, in old spiders' webs, and occasionally lie exposed on the ground. On 24th August many pupæ were found under cattle manure, and on 3rd September, 113 were collected within the space of 18 inches square at the base of a large oak, some being under leaves and others exposed. They have a very slight, silken web, to which they are attached by the well-developed cremastral hooks. When the perfect insects emerged the full force of this invasion was most perceptible. On 20th September the moths were emerging in every direction and crawling up the trees to find a favourable spot to expand their wings. I had visited one tree the day before and found none. I now counted 127 and this was the beginning of one of the most wonderful entomological sights I have ever seen. By 5th October the moths were in myriads, the trees being literally covered, not only on the trunks but on every limb and branch, as far up as the eye could discern, so close together that the wings overlapped. On shaking a branch they would fly off in such numbers that you could positively hear them fly. When the moths first appeared the males averaged 90 per cent. of the whole, but on 24th October the females bore the same proportion to the whole. About this time heavy fogs set in, and the ground around was strewn with dead bodies. The districts which suffered most were the woods to the north, south and west. The east was affected somewhat but the north-east seemed to be exempt from their ravages, although oaks are abundant.

"About the 8th October the trees in districts which were first defoliated put forth a fresh covering of beautiful foliage; those trees which were injured later also put out new leaves, but did not make such good growth as the former.

"The egg is beautifully blue when first laid, oval in form, with one end slightly flattened, it adheres to the bark where it is deposited, generally scattered, though occasionally a dozen will be found side by side in an upright position. As a rule, however, they are deposited separately upon or in crevices of the bark.

"The moths vary from 14 lines to 24 lines in expanse, some males being very large and the females occasionally very small. They also differ greatly in the shade of colouring, ranging from a pale ochreous to a dark fuscous brown, antennæ of the male plumose; wings angulated, with a broad band transversely across. When disturbed during daylight they fly with a sluggish motion for a few yards and drop to the ground. Occasionally only do they fly up to the trees.

"It now remains for some means to be devised to stamp out, or at least reduce the numbers of this pest, and no doubt the Park Commissioners would be only too glad to have some plan suggested to them."

Amongst the moths Mr. Danby forwarded were well-marked examples, which agreed with Mr. Hulst's description (Ent. Am. I. 208), and all confirmed the differences between *somniaria* and the Eastern *fervidaria*.

Notwithstanding the fact that Mr. David Bruce identified the species as *fervidaria* and that Dr. Packard states in his monograph of the Geometridæ, p. 494, as below, I am inclined to consider *somniaria* a western representative of *fervidaria*, which should receive a distinctive name. Dr. Packard says: "The five males and one female from Vancouver Island are larger, but do not differ so much from eastern examples as the latter among themselves. They are more yellow, with coarser, dark speckles, and the lines are more broadly shaded with yellow." Now, it is on these very characters that Mr. Hulst has separated it, and I find them, with the exception of size, uniformly present in all the western specimens I have seen. The moth is pale brown, densely dotted with dark points, expands about $1\frac{3}{4}$ inches, wings acutely angled, crossed by two distinct dark lines, "the outer of which are broadly edged outwardly, and the inner ones inwardly with orange." The inner line on the primaries is situated $\frac{1}{3}$ of the way from the base, and is bowed out in the middle towards the apex, so as to form a segment of a circle. The outer line, which starts from the front edge or costa of the wing, $\frac{2}{3}$ of the way from the base, is zigzag, and runs a quarter across the wing, sloping slightly out to the outer margin, where it is sharply angled opposite the angle of the wing, and runs at an angle of 45 degrees to within a quarter of the distance to the inner margin. Here it is obtusely angled, and slopes outwards again at the same angle as the upper portion of the line. On the lower wings only the outer line is continued, and this is angled in the middle of the wing, opposite the hind angle of the wing. There is a distinct discal spot on each wing, sometimes faint on the lower wings.

Two caterpillars sent from Victoria were cream-coloured or pale brown, mottled very irregularly, with black, and could not be said in any way to resemble the description given by Dr. Packard from Abbott's MS. drawing. "Body yellowish-green above, pale purplish below. Two fine, blackish, lateral lines, with a pale line above." Although the two specimens received from Mr. Danby were comparatively fresh, and had only been in alcohol a week when received, they differed so extremely from each other that no good purpose would be served by giving a description, until a larger series was examined and described from living material. This opportunity I hope to secure next season from eggs sent by Mr. Danby.

These are for the most part of a reddish bronze colour, of a smooth and shining appearance; but when magnified are found to have the surface finely netted with pentagonal cells. Length 0·75—0·90 m m. ($\frac{1}{34}$—$\frac{1}{28}$ inch) of an ovate form slightly flattened on the sides and abruptly flattened at the upper end. In the centre of this apical area is a distinct conical protuberance. Most of the eggs were pushed beneath flakes of bark or into tufts of moss to which they adhered by their lower ends or sides. From these eggs I have several young caterpillars. They are slender, very elegant and active little creatures. The head black, general colour of body gray, with slender lateral and sub-stigmatal lines, and ringed with velvety black. The bands on segments 4 to 9 particularly the last four very conspicuous. Length at birth 3½ m m.

The chrysalis is a very pretty object. It is slender, clear white, lined on the wing and leg cases with black. The rest of the body is also dotted and blotched with black. The cremaster or hook at the end of the body by which it is attached to the slight cocoon consists of about six small and two large hooks. The abdominal rings bear several short stiff bristles pointing backwards.

Remedies.—The important points in the life-history of this insect, gleaned from the above, are that it passes the winter in the egg state; that young caterpillars are found on the trees in July, and that the chrysalids are usually in crevices of the bark or under leaves on the ground. As a remedy, if it be found that the eggs are chiefly laid on the trunks of the trees, spraying these in early spring before the buds burst, with a kerosene emulsion, would destroy large numbers. Pupation takes place from the middle of August until September, during which time many pupæ are on the ground or on the trunks of the trees. Of the former, many would doubtless be destroyed by pigs and chickens if they could be turned in at that time, and sweeping the trunks would dislodge many more. Probably the most successful remedy for the Park Commissioners to adopt, in future, will be a systematic spraying of the trees with a very weak mixture of one of the arsenical poisons, about the time the young larvæ are appearing. At that time a very weak mixture would suffice (1 lb. of Paris green to 300 gallons of water). The difficulty of throwing a spray over high trees has now been solved by attaching the spray nozzle to a thin tube and then fastening this to a light pole, by which, and with the help of a ladder, it can be carried to any reasonable height. The small cost of a suitable force-pump with the necessary labour is a small matter, compared with the pleasure secured for the frequenters of a public park by the banishment of such a grievous pest as this.

Parasites.—Mr. Danby sent me specimens of an Ichneumon fly which was taken in numbers amongst these geometers, and which he thought might be a parasite. This has been identified for me by Mr. W. H. Harrington as *I. cestus.* Upon one of the alcoholic specimens of larvæ sent I found the egg of a Tachina fly. I have also bred from a pupa sent by Mr. Danby, a *Pimpla* with a red abdomen which Mr. Harrington tells me is undescribed. This whole subject is one of great interest, and I hope the Victoria Natural History Society will work it up. Besides knowledge of the parasites, animal and vegetable, information is wanting as to how it passes the time from the opening of spring until August. Is it possible there are two broods?

DIVISION OF BOTANY.

RED LEAF OR BLIGHT OF OATS.

During the past season, as well as to a certain extent last year, a peculiar disease was noticed upon oat plants from about the 1st June until winter set in, and all volunteer or chance plants were destroyed by frost. This disease manifests itself by the tip of the leaf taking a purplish-red tint, and there are also semi-translucent blotches on the leaf. Although it has not been very virulent or destructive in Canada, it has been a serious tax in some parts of the United States. It has been carefully studied in the United States Department of Agriculture, and we have no doubt that before long some practical remedy will be suggested. The following memorandum upon this disease has been specially prepared by Mr. Galloway at my request.

" *The Blighting of Oats.*

"One of the diseases which has been under investigation the present year (1890) by the Division of Vegetable Pathology in the United States Department of Agriculture, is the so-called Blight of Oats. Complaints of this trouble began to arrive as early as the middle of May, and by the middle of June correspondents in nearly all the principal oatgrowing States had written us about it. Later it was reported as occurring destructively in various parts of Canada. So far as we are aware, it caused little or no damage in Michigan, Minnesota, Nebraska, Kansas and the States further west. East of Kansas, however, the loss from it, in several of the States, was from 50 to 80 per cent. Briefly summing up the results of our investigations, it may be stated that the disease is caused by a minute parasitic organism belonging to the group known as bacteria. The bacteria are extremely minute plants, and as is now well known, some of the most destructive diseases in the animal and vegetable world are caused by them. In the case of the oat disease, a bacillus swarms in the juices of the leaves, and by its action upon them produces the sickly yellow or reddish color of the foliage. As a result of this, the oats remain almost at a standstill, and in consequence the heads, if they appear at all, are small, while the grain is comparatively worthless.

"The germ has been repeatedly obtained from diseased oats and grown in various artificial culture media, such as nutritive gelatine, oat broth, hay infusion, etc. Inoculations with this material have produced the disease in every case. In shape, the organism is sometimes nearly round, although, as a rule, it is several times longer than broad. So very minute is it that when magnified a thousand times it is little larger than the head of a pin.

"Such problems as how this organism passes the winter, how it infects the young oats, together with questions as to treatment, are now being worked out. It is hoped that in the near future we shall be able to publish a full report on the subject, in the event of which we will gladly send it to anyone applying for it."

GRASSES.

Few agricultural products are of more importance to farmers than the various grasses which provide food for their live stock. Notwithstanding this, there are few branches of their business concerning which the generality know so little. In addition to over 300 different kinds of grasses* found wild or naturalised in Canada, there are many valuable foreign grasses from other countries suitable to our climate, which can be sown to great advantage in pastures in mixtures or alone. There is, however, amongst these a very large proportion of varieties which are useless or unsuited to most parts of Canada. Many of these are in the market, and are sold to farmers in high-priced mixtures by seedsmen, who sell them on their European reputation, without having ever tested them in this country. The following experiments have been undertaken to test the value of all available grasses for this locality, and

* Macoun, J. M. Check-list of Can. Plants, Ottawa 1889.

seed has been distributed to our branch Farms as well as to various other points in the Dominion, where they will be grown and the results recorded, so that before long we hope to be in a position to say definitely, the locality and circumstances being given, what are the best grasses to cultivate. Not only are there many different grasses varying in quality, but the price also differs widely, and it is not always the highest-priced varieties which are best to grow. Amongst the seeds examined, large numbers of injurious weed seeds have been found, and hardly a sample examined was free from seeds of other grasses than those for which they were sold. In addition to this a large percentage of some samples was found to be useless, owing to the fact that the seeds of many grasses lose very quickly their germinating power. In view of the above, the importance is evident of having grass seed examined and tested, both to see that it is true to name and up to the standard of vitality. We are now prepared to do this at the Experimental Farm, and farmers would do well to avail themselves of the opportunity. In the experiments recorded below, each promising variety has been grown separately on plots of one square rod each. To save time the seeds were sown in the forcing house, and as soon as large enough to handle were first pricked out in boxes and then planted out in the grass plots in rows 9 inches apart and the plants 8 inches apart in the rows. Weeds were kept down by hoeing. The soil is not very rich and no artificial protection has been given during the winter. Up to the present, 112 different kinds have been cultivated, besides 17 others of which the seed was sown last autumn A few packets of seed were distributed last spring, but none have yet been reported upon.

(All the plates of grasses used in this Report have been kindly lent by Dr George Vasey the U. S Botanist.)

I.—GRASSES GROWN IN PLOTS OF 1 SQUARE ROD.

A.—Native Grasses.

1. *Agropyrum caninum*, R. & S. (Bearded Wheat Grass). Seed from Brandon, Man., sown in house February, 1888. Pricked out May, 1888. Transplanted to present bed May, 1889. In 1890, speared June 24. Flowered, July 12. A tall grass, 4 feet high, growing in tufts, of a strong odour when bruised, but well liked by cattle. Cut for hay July 15; 80 lbs. green grass to the rod.

2. *Agropyrum divergens*, Nees. (Awned Blue stem). Seed from Dr. G. Vasey, the United States Botanist. Sown in the open in spring of 1888. Transplanted to present bed June, 1889. Speared, June 17, 1890. Flowered, June 30. Seed ripe, July 21. Height, 2 feet. This grass, spoken highly of in the West, made a poor showing at Ottawa. Both in 1889 and 1890 it was badly attacked by *Meromyza Americana*, the Wheat-stem Maggot, and *Oscinis variabilis*, the American Frit Fly. Leaves and stems slender and sparsely produced.

3. *Agropyrum glaucum*, R. & S. var. *occidentale*, V & S. (Colorado Blue-stem). (PLATE I.) Brandon, Man. Sown in house Feb., 1888. Pricked out May, 1888. Transplanted to present bed June, 1889. Speared, June 24, 1890. Flowered, July 12. Cut for hay, July 15; 72 lbs. grass to the square rod. Height, 2½ feet. Probably the most valuable grass on our western plains, where it is the chief grass of the cattle ranches. It produces an abundance of fine leaves from running root stocks and seeds freely. By the end of the first season plants pricked out 8 inches apart had made a solid mat of sod.

4. *Agropyrum repens*, L. (Quack Grass. Twitch. Scutch. Couch Grass). Transplanted from roadside May, 1890. Speared, June 20. Flowered, July 3. Ripe, Aug. 1. By some highly praised as a fodder plant; but undoubtedly a most pernicious weed. After the first year it fills the ground with underground stems and roots, and only produces a small quantity of feed. It is very subject to the attacks of rust and ergot.

5. *Agropyrum tenerum* (Western Bunch-Wheat-Grass). Seed from North-West Territories. Sown, February, 1889. Transplanted into present bed June, 1889. Speared, June 18. Flowered, July 3. Seed ripe, July 21. This is a true bunch grass and a

valuable hay and fodder grass from Manitoba west to the Pacific. Dr. Vasey says: "Like *A. glaucum*, it is one of the best grasses for hay." It has not succeeded well at Ottawa, having been nearly exterminated by the American Frit Fly and other insects. I have received magnificent specimens from Indian Head, N.W.T., 4 feet high.

6. *Agrostis vulgaris*, With. var *alba*, Vasey. (White Top. Creeping Bent Grass). Found at Ottawa, growing by the side of a spring. Transplanted to present bed June 10, 1890. Speared, June 24. Flowered June 28. Ripe, August 6. A fine-leaved, delicate green grass, starting early in spring and lasting green until late in autumn. Essentially a low-ground grass, frequently running out and forming floating mats on water. Valuable for swampy meadows and low lawns.

7. *Agrostis vulgaris*, With. (Red-top). Seed collected by Dr. G. M. Dawson along the Fraser River, B. C. Seed sown March 14, 1890. Pricked out May 24. Made a vigorous growth, forming a deep, soft, mat of foliage by August. This is a most valuable grass for sowing with timothy in low meadows. It occurs from Atlantic to Pacific.

8. *Beckmannia erucæformis*, Host, var *uniflorus*, Scrib. (Slough Grass). Seed from Brandon, Man. Sown March 13, 1890, in house. Transplanted June 9. Speared July 3. Flowered July 22. Ripe August 5. A tall, coarse grass, making remarkably soft hay. It grows naturally in wet sloughs or low ground. In many parts of Manitoba and the North-West Territories it is abundant, and forms valuable fodder, much relished by cattle.

9. *Bouteloua oligostachya*, Tor. (Gramma Grass). (PLATE II.) Seed from Brandon. Sown, 1888. Planted in present bed May, 1889. Speared June 20, 1890. Flowered, July 3. Ripe August 1. Plants cut July 15. Flowered second time August 6. This small but highly nutritious grass is much relished by cattle. Dr. Vasey says "On the arid plains of the West it is the principal grass, and is the main reliance for the vast herds of cattle which are raised there."

10. *Bromus ciliatus*, L. (Fringed Brome Grass). Seed from Rush Lake, Man. Sown April, 1889. Transplanted June, 1889. Speared, July 12. Flowered, July 29, Ripe, September 1. Of no value for agricultural purposes as it grows here. Specimens however grown at Brandon and Indian Head indicate that it is of value there. The stems are 4 feet in height, well clothed with leaves from the bottom to the top.

11. *Bromus Pumpellianus*. Scrib. (Western Brome Grass). Seed from Banff. N.-W. T. Sown March, 1889. Transplanted into present bed June, 1889. Speared June 10. Flowered, June 20. Ripe, August 5. Another bed of the same, cut for hay July 19, after the anthers had dropped, gave 82 lbs. grass to square rod. This is a very valuable grass, producing an abundance of leafy stems, continuing in flower for a long time and giving a heavy aftermath. It spreads rapidly from the root and closely resembles the European *Bromus inermis*.

12. *Cinna pendula*, Trin. (Wood Reed Grass). Seed from the Rocky Mountains Sown spring of 1889. Nearly all winter-killed during winter of 1889-90. Remainder speared July 4. Flowered July 20. Ripe August 23. Of no agricultural value.

13. *Deschampsia atropurpurea*. Scheele, var. *latifolia*, Scrib. Seed from Rocky Mountains. Sown March 14. Nearly all died during the summer.

14. *Deschampsia cæspitosa*, P. B. (Tufted Hair-grass.) Seed from Glacier, B.C. Sown spring of 1889. Transplanted into present bed June 1889. Speared 10th June. Flowered 28th June. Ripe 16th July. A most beautiful grass; but of no agricultural value.

15. *Deschampsia cæspitosa* var. ? (Rocky Mountain Hair-grass.) Seed from Harrison Hot Springs, B.C. Sown in house March, 1889. Transplanted to bed June, 1889. Speared 20th June. Flowered 30th June. Ripe 30th July. This is a very ornamental grass like the last, growing in tufts, but bears fewer flowering stems and many more and longer (18 inches) dark green leaves. After cutting on 5th August new leaves were thrown up so quickly that in one week the plot was green again. Very different in habit from the last.

16. *Deyeuxia Langsdorffii,* **Kunth.** Seed from Manitoba. Sown 14th March, 1890. Transplanted 15th July. Has not flowered yet, but has spread much by underground stems.

17. *Deyeuxia neglecta,* Kunth. (Neglected Blue Joint.) Seed from Brandon, Man. Sown March, 1889. Transplanted to bed June, 1889. Speared 18th June. Flowered 30th June. Ripe 27th July. This valuable grass has succeeded well under cultivation, producing great quantities of very long fine leaves and flowering freely. Height 3 feet. Mr. S. A. Bedford informs me that ponies will wander long distances over the prairies cropping the dry stems and leaves of this grass in preference to many others.

18. *Deyeuxia neglecta,* Kunth var. *robusta,* Vasey. Seed from Prof. Macoun, collected in the North-West Territories. Treated as the above and closely resembling it. Heads of flowers rather shorter and the stems rougher.

19. *Elymus Americanus,* V. & S. (American Lyme Grass.) Seed from Rocky Mountains. Sown March, 1889. Transplanted June, 1889. Has not flowered yet. Growth spindly and weak, only 7 plants living October, 1890.

20. *Elymus Canadensis,* L. (Canadian Lyme Grass.) Seed from Rocky Mountains. Sown in house March, 1889. Transplanted June, 1889. Nearly destroyed by the Wheat-stem Maggot. Speared 10th July. Flowered 24th July. Ripe 16th Sept. A coarse grass found amongst bushes in low ground. Not suitable for cultivation in the open.

21. *Elymus condensatus,* Presl. (Giant Rye Grass.) Seed from Dr. G. M. Dawson, collected in British Columbia. Sown 15th March, 1890. Transplanted 25th June. Has not flowered yet. This grass is useful for holding the sand on railway banks. When cut young it makes good hay and is also a valuable winter forage plant in the west.

22. *Elymus dasystachys,* Trin. (Downy Wheat Grass). Seed from N. W. Territories, near Banff. Sown spring of 1889. Roots divided and transplanted May, 1890. Speared 12th June. Flowered 20th June. Ripe 18th July. This grass has much the aspect of an *Agropyrum.* It produces long slender leaves and wheat-like heads of downy flowers. It promises well as a hay grass.

23. *Elymus Virginicus,* L. (Lyme Grass). Seed from Brandon, Man. Sown 14th March, 1890. Transplanted 9th June. Plants weak and hardly established when winter set in.

24. *Hierochloa borealis.* R. & S. (Holy Grass, Indian Hay). Seed from Brandon. Sown 1888. Transplanted to present bed June, 1889. Speared 12th May. Flowered 24th May. Ripe 20th June. Cut 5th July, after the leaves had grown to their full size. 55 lbs per square rod.

This is the earliest grass of spring, and is the scented hay made into baskets, &c., by the Indian women. Its very sweet odour makes it a valuable admixture in hay. Horses and cattle are very fond of it. When grown alone it is rather subject to rust.

25. *Kœleria cristata,* Pers. (Western June Grass). Seed from North-West Territories. Sown spring of 1888. Transplanted to present bed June 1889. Speared 15th June, 1890. Flowered 26th June. Cut for hay 1st July. 35 lbs. grass to the square rod. A poor bunch grass of the plains, not touched by cattle while there is anything else.

26. *Macoun No.* 8.—(*Panicum capillare,* variety). Seed collected by Prof. Macoun at Sprout Lake, Vancouver Island. Sown March, 1890. Pricked out 10th June. This turned out to be a useless grass, botanically it was interesting from the fact that it came true from seed. Although there were no good characters by which it could be separated from *P. capillare,* it presented a very different aspect from the Ottawa form of that species growing wild all round it. The whole plant is more glabrous, smaller, and has a contracted slender panicle.

27. *Macoun No.* 11.—Seed collected by Prof. Macoun on Mount Finlayson, Vancouver Island. Seed sown 15th November, 1890. Transplanted 25th June. This grass has not yet flowered but has a promising appearance.

28. *Muhlenbergia glomerata*, Trin. (Wild Timothy, Muhlenberg's Grass). Seed from Mr. Duncan Kennedy, of Bird's Hill, Man. Sown in open 15th May, 1890. Transplanted to bed 1st July. Speared 24th July. Flowered 6th August. Ripe 1st October. There has been more enquiry concerning this than any other native grass. I consider it and the following amongst the most promising in the collection. The plants mentioned above have not attained full growth and only grew about 1 foot in height; but I have specimens from Manitoba over 3 feet in height, branching and leafy to the top. In this part of Canada it grows in bogs and swampy meadows, but in the west it extends up on to the high lands. In Prof Beal's excellent work "The Grasses of North America" Dr. C. E. Bessey, of Lincoln, Neb., is quoted as follows: "Ten or twelve years ago I had my attention called to this wild grass as one possessing many valuable qualities, making it desirable for introduction and cultivation. I found that the liverymen of Central Iowa were in the habit of cutting those parts of the prairie which lie between the sloughs and the high land. The hay obtained from these places was of fine quality, being composed of leafy, branching stems of fine length and medium hardness. It was always cut late, but even then it was not often in seed." Chemical analysis shows it to be very nutritious, and cattle eat it greedily. It is very hardy, and although thriving best in low ground will grow almost anywhere. Mr. Duncan Kennedy says: "As to the Muhlenberg grass it will grow anywhere no matter how it is abused." Mr. Bedford says: "This grows on level prairie and meadow, is excellent feed, and is doing well under cultivation."

29. *Muhlenbergia Mexicana*, Trin. (Satin Grass) (PLATE III.) Roots collected in low pasture, Nov. 1889. These were divided and planted in present beds 2 days before continuous frost set in. Every one of these roots lived and flowered 20th July. Seed collected at same time was sown in the open in May, 1890. Transplanted 30th June. Speared 1st August. Flowered 20th August. Ripe 30th Sept. The plants grown from seed sown this spring gave almost as heavy a crop as the old plants. This species is more leafy and produces finer hay than the last. The stems branch at every joint. It seems to have every character of a good hay grass. The following extract will indicate that it may help to fill the great need for good hay grasses in the far west. In Prof. Beal's "Grasses of North America," p. 185, is the following: "Dr. Bessey also speaks well of this grass for Iowa and Nebraska. He writes: 'When I called Prof. Budd's attention to it he said that he grew a three-acre lot of it for four years, and that it yielded from 2½ to 3 tons per acre of hay of the highest quality. This agrees with other testimony.'" Mr. Bedford says: "This makes extra good feed." A special value of these Muhlenberg Grasses is that they will bear more shade than most species.

30. *Muhlenbergia sylvatica*, T. & G. (Bearded Satin Grass.) Plants collected in dry wood at Ottawa in autumn of 1889. Roots divided and planted in present bed 16th October, 1890. This species resembles the last closely; but has stouter stems and grows in drier localities. The flower panicle is looser and bears slender bristly awns.

31. *Panicum virgatum*, L. (Switch Grass.) Seed from Dr. Vasey. Sown spring of 1888. Transplanted to present bed June, 1889. Speared 10th July, 1890. Flowered 5th August. Cut for hay while in flower 11th August. 132 lbs to sq. rod. Height 5 feet. This is a late grass and must be cut young to make good hay, as it becomes very hard when the seeds are ripe. It thrives in low ground and comes in like the Muhlenbergias, when many other grasses have passed their prime. Dr. Vasey says: "It is a good and prolific grass if cut when young." One drawback is that it matures few good seeds, this however, Mr. John Craig informs me is not the case in the Western States.

32. *Phalaris arundinacea*, L. (Reed Canary Grass.) (PLATE IV.) Seed from Germany. Sown spring of 1887, did not flower until 1890. Transplanted to present bed June 1889. Speared 12th June. Flowered 24th June. Ripe 11th July. Height 4 feet. Although the actual plants mentioned here were grown from European seed, this valuable grass is found wild in low ground and along streams in all parts of Canada from

the Atlantic to the Pacific. It is very early and very prolific, having been cut three times in the season. On 4th June the bed was covered with a growth of delicate green succulent and very leafy shoots 3 feet 3 inches in height, which weighed 120 lbs. to sq. rod. On the same day fall rye was only 2 feet 6 inches in height.

On 5th August the same plot was cut again and gave 50 lbs. to the square rod. On 16th October it was cut again and gave 23 lbs. of grass. Another plot of the same grass left until the seed was ripe on 11th July was over 5 feet high and gave 160 lbs. of grass. This plot did not recover so soon after cutting, but was well covered with green shoots by September. This I believe will be found a valuable grass under cultivation and in low meadows. The root is perennial and extends by running root stocks.

33. *Phleum pratense*, L. (Timothy. Herd's grass.) Seed from Major Walker of Calgary, N.-W. T. Sown spring of 1889. Speared 16th June 1890. Flowered 1st July. Ripe 29th July. This well-known and valuable grass is familiar to all farmers. It is not indigenous in Canada; but is now well established wherever roads or railways have penetrated. It is hoped that the above form from the Rocky Mountains may prove hardier for the North-West than the ordinary form.

34. *Phleum alpinum*, L. (Alpine Timothy). Seed collected by Dr. G. M. Dawson on Mount Tod, B. C. (Alt. 5,500 feet). Sown April, 1889; transplanted May, 1889. Speared 12th June. Ripe, 3rd July. Nearly the whole of this bed flowered and then died off. Some few plants however threw up one or two weak shoots in September 1889, and flowered again in 1890 before dying. It is a smaller and less valuable grass than *P. pratense.*

35. *Poa compressa*, L. (Wire grass. Flat-stemmed meadow-grass). Plants collected on rocky pasture in 1889. Divided in autumn of 1890 and planted in present bed. This hardy and nutritious grass, although it starts early in the spring and keeps green longer than most native grasses in the autumn, does not produce enough fodder to make it worth cultivating except upon dry and rocky pastures where few grasses will grow. For such localities it is one of the best.

36. *Poa Nevadensis*, Vasey. (Nevada Bunch Grass). Seed from Whitewood, N.-W. T. Sown March, 1888, flowered freely in 1889. Young plants transplanted from old to present bed 15th June, 1890. Nearly all destroyed by Aphides, and did not flower. Plants began to recover about 1st September. This species seems to be peculiarly susceptible to attack by Aphides. When grown in the forcing house in 1888 it was the only grass attacked by them, and in the open air last year it was again the only plot injured by these insects. This is probably a grass of no agricultural value. Height of leaves 3 inches, stems 1 foot.

37. *Poa pratensis*, L. (June Grass. Kentucky Blue Grass) Form 1. (PLATE V.) Seed from Major Walker, of Calgary. Seed sown March, 1889; speared 2nd June, 1890. Flowered 12th June. Ripe 4th July. This is a tall form with wide leaves. The original plants from which the seed was taken measured 3 feet 5 inches in height.

38. *Poa pratensis*, L. Form 2. Seed from Glacier, B.C. Sown 15th March, 1890. Transplanted June, 1890. A leafy free-growing form, very dark green. By the end of the season the plot was a close sod which continued growing until winter.

39. *Poa pratensis*, L. Form 3. Seed from Forres, N.W.T. Sown spring of 1888. Flowered June, 1889. Roots divided and planted in present bed 1st June, 1890. Speared 12th June. Flowered 20th June. Ripe 4th July. Cut down 21st July. Did not spring up again till September. This is a wide-leaved coarse variety with dark leaves and very wide-spreading and few underground stems. It was severely attacked by the American Frit Fly and Wheat-Stem Maggot, and mildewed badly in October. I cannot separate this botanically from other forms of *Poa pratensis*, but agriculturally this is a poor grass of no value, while the others are all very good. This difference between varieties of the same species grown under the same conditions, may explain the various opinions so often expressed concerning Kentucky Blue Grass.

40. *Poa pratensis*, L. (White form.) Seed collected in North-West Territories. Sown spring of 1888. Flowered June, 1889. Transplanted into present bed May, 1890. Speared 14th June. Flowered 20th June. Ripe 4th July. This is a very handsome form with wide, slightly pale leaves and conspicuously glaucous panicles. It is almost a bunch grass producing very few and short runners. It is not unlike some forms of *Poa cæsia*; but has been pronounced *Poa pratensis* by most of the botanists to whom I have submitted specimens. Height 2 feet; leaves 1 foot. This variety was also badly attacked by the American Frit Fly.

41. *Poa serotina*, Ehrh. (Fowl Meadow Grass.) (PLATE VI.) Seed from Griswold, Man. Sown spring of 1889. Transplanted June, 1889. Flowered twice in 1889. Speared 12th June, 1890. Flowered 3rd July. Ripe 21st July.

Another bed grown from Rocky Mountain seed, but identical with above was cut for hay when in flower 8th July, and gave 44 lbs. grass to square rod. This shrunk in curing to 20 lbs. of excellent hay or 1⅗ tons to the acre. This excellent grass has been sparingly cultivated for 150 years. The fine branching stems are abundantly produced and remain green long after the seed is ripe. It grows well in low ground and bears almost as heavy an aftermath at the end of August as the first crop, flowering stems being thrown up from the lower joints. In Manitoba this grass sometimes covers large areas to the exclusion of nearly all other species. The Indians about Griswold prefer it to all other grasses and travel long distances to cut it.

42. *Sporobolus heterolepis*, Gray (Strong-scented Drop-seed Grass). Seed from Brandon, Man. Seed sown spring of 1888. Transplanted to present bed, June, 1889. Speared, 8th July, 1890. Flowered, 20th July. Ripe, 27th August. This is a bunch grass with long fine leaves. It will grow in almost pure sand or in stiff clay. Mr. Bedford credits it with being good feed. The quantity, however, is small.

Plots of the two following North American grasses have also been grown. *Bromus secalinum* is a Mexican species, but *Buchloe dactyloides* will probably be found along the southern border of our western prairies.

43. *Bromus segetum*. Seed from Dr. Vasey. An annual which bears twice cutting and will then seed itself for the next year. The yield of hay is not heavy enough to give it much agricultural value.

44. *Buchloe dactyloides*, Engelm. (Buffalo Grass). Seed from Dr. Vasey. Sown 1889. Transplanted to present bed, June, 1889. Began to flower, June, 24th, and continued till end of season. This is the true Buffalo Grass. It is of a remarkable habit. It starts very late in spring, not showing a sign of life until June, when it throws out vigorous shoots which branch at each joint and take root, so that it soon forms a thick mat about 3 inches in depth, of fine stems and hair-like leaves. It is said to be a most nutritious and attractive grass to all kinds of stock.

B.—*Foreign Grasses.*

A.—In addition to the above, the following foreign grasses have been grown in plots to test their value for this climate. The seed was in all cases received from English or German seedsmen, and almost every sample contained many seeds of weeds and other grasses.

45. *Agrostis capillaris*. Resembles *A. vulgaris*.

46. " *dispar*. The same as *A. vulgaris*, With. Cut for hay, July 23; 76 lbs. of grass to sq. rod.

47. " *vulgaris*, var. *alba*. This is not the same as No. 6 above, which seems to be identical with *A. stolonifera*, Sm. of English authors.

48. *Alopecurus agrestis* (Slender Foxtail). A slender annual grass of doubtful value, far inferior to the perennial Meadow Foxtail (*A. pratensis*).

49. *Anthoxanthum odoratum* (Sweet Vernal Grass). A very sweet grass with the same scent as Holy Grass. Sown, May, 1890. Has not flowered yet. Seed

sown in the spring of 1888 was all killed the next winter. It may, however, possibly have been the annual *A. Puelli* which is sometimes sold for this, which is a perennial.

50. *Avena elatior* (Tall Meadow Oat Grass).—Seed sown in open 1st July. Transplanted 5th August. Made good growth before winter; no flowers, but ground well covered.

51. *Avena flavescens* (Yellow Oat Grass).—Seed sown June, 1890. A few plants flowering 5th October. Highly spoken of for mixtures, but of small size and slow growth.

52. *Brachypodium sylvaticum* (Wood False-Brome-Grass).—Seed sown in open September, 1889. Transplanted 25th May, 1890. This grass is a free grower and produces an abundance of wide leaves 12 to 18 inches in length, which stand up well, giving the bed the appearance on 1st November of a heavy mat of green foliage. It has not flowered yet. If it endures our winter it should be a valuable grass. It grows naturally in woods and stands shading.

53. *Bromus giganteus* (Tall Brome-Grass).—This closely resembles the above and I suspect is not true to name.

54. *Bromus inermis* (Awnless Brome-Grass). Seed sown spring of 1888. Transplanted to present bed June, 1889. Speared 10th June, 1890. Flowered 26th June to 4th July. Cut for hay 5th July. 104 lbs. grass to the square rod. Cured hay 47 lbs. or 3¾ tons to the acre. This is an extremely hardy and very valuable Russian grass. It comes up early in spring and produces a heavy aftermath of succulent leafy shoots. It is one of the most valuable introduced grasses we have grown.

55. *Ceratochloa australis* (Southern Brome-Grass).—This is a coarse and succulent annual, which produces a large amount of fodder. It shoots up again quickly after cutting and continues growing until killed by winter.

56. *Cynosurus cristatus* (Crested Dog's Tail).—Seed sown 14th March. Transplanted 10th June. Has not yet flowered.

57. *Dactylis glomerata* (Orchard Grass).—This higly esteemed grass, which thrives well in many parts of Canada, has not succeeded well at Ottawa. Seed sown in 1889 produced by the autumn a bed of most vigorous plants. In the spring of 1890 only 17 plants were living, many of which were weak. Although included in all permanent pasture mixtures it is rarely found here two years after sowing. I have now plots in dry and in rich soil planted from seed sown last June.

58. *Festuca duriuscula* (Hard Fescue).—A hardy fine-leaved grass which has stood our winters well. Suitable for rocky pastures. It is taller than Sheep's Fescue. Seed sown 13th March, 1890. Transplanted 6th July.

59. *Festuca rubra.*—The plants I have growing are closely like the above and may prove to be that species. Seed sown 13th March. Transplanted 8th June. On 1st November these plants were cushions 6 to 10 inches across of fine hair-like leaves of an intense green.

60. *Festuca elatior* (Tall Fescue).—Seed sown spring of 1888. Transplanted to present bed 10th May 1890. Speared 15th June. Flowered 21st June. Ripe 24th July. This grass does not appear to be so hardy as the Meadow Fescue. It has wider leaves and a larger panicle of flowers. It is stated to be a valuable grass for a permanent pasture mixture.

61. *Festuca pratensis*, (Meadow Fescue). Seed sown spring 1888. This is undoubtedly the most valuable of all the European grasses for this district. It is perfectly hardy matures two crops of hay and produces a very heavy autumn growth of rich fodder. It should always be included in mixtures for permanent pastures. Flowered 21st June. Cut for hay 11th July. 70 lbs to the square rod.

62. *Festuca pratensis* var *loliacea*, (Slender-spiked Fescue). Seed sown spring of 1890. Transplanted 25th June. Flowered 6th August. This proved to be ordinary *F. pratensis*. It is doubtful whether the var *loliacea* would come true from seed, as it appears to be an accidental variety.

63. *Holcus lanatus*, L. (Velvet grass). Seed collected at Harrison Hot Springs,

B. C. Sown March 1889 in the house. Transplanted 22nd May. This is a handsome but useless perennial grass. It made a heavy growth and flowered sparingly in 1889; but every root was killed in the winter.

64. *Lolium Italicum*, (Italian Rye Grass). Seed sown spring of 1890. Transplanted May 20. Speared 30th June. Flowered 26th July. Ripe 20th Aug. This seed was much mixed with Perennial Rye Grass. The two species may be separated when not in flower, as pointed out to me by Mr. John Speir, of Glasgow, by the fact that the young shoots of Italian Rye Grass are round while those of Perennial Rye Grass are flat. This grass makes a heavy growth of green leaves the first year in rich land; but is not hardy enough for the Ottawa climate.

65. *Lolium perenne*, (Perennial Rye Grass). (PLATE VII.) Seed sown in open April, 1890. Transplanted 10th June. Did not flower, but produced an extremely heavy crop of long tender foliage which kept green till the snow came. This is hardier than Italian Rye grass and makes a valuable addition to permanent pasture mixtures for this district.

66. *Poa nemoralis*, (Wood Meadow Grass).

67. *Poa trivialis*, (Rough-stalked Meadow Grass.) I have experienced great difficulty in procuring these grasses true to name. Thanks to the kindness of Mr. H. de Vilmorin of Paris, I have now true seed of both, and hope to report on them next year. They are reputed to be valuable grasses suitable to this climate.

II. ASIATIC GRASSES.

A small collection of grasses was received from India. Most of the seed was mouldy and very few grains would germinate. This collection consisted of the following:

Andropogon pertusus and *A. annulatus*. (Mixed) *Panicum colonum*, and *P. ciliare*. None of these germinated. *Setaria glauca* (not sown, it being a common weed throughout the country).

68. *Eragrotis megastachya*.—This is a wild plant in western Canada. Sometimes grown as an ornamental grass.

69. *Apluda aristata*.—One plant germinated, but was killed by frost before the seed ripened.

70. *Cynodon dactylon*.—(Bermuda grass).

71. *Eleusine Indica*.—(Yard grass). Half a dozen plants of each of these grasses grew; but they were destroyed by frost before the seed was ripe.

72. *Eragrostis Abyssinica*, (Teff.) Seed received from the Government Botanic Gardens at Bangalore, India, and from Mr. Alfred Boyd, of Toronto, and grown on separate plots. Sown in house 15th March, 1890. Transplanted into beds 28th June. Speared 24th July. Flowered 5th September. Some seed ripe 12th October. One plot was cut for hay 10th September, and gave the remarkable crop of 170 lbs. to the square rod. It was eaten by the cattle, but was not apparently very palatable. The packets were labelled as Red and White Teff; but both produced similar plants.

73. *Panicum miliaceum*, (Common Millet) Annual. Seed from Prof. Beal. A valuable soiling crop, but not in any way equal to Indian corn. Seed ripe in September.

III. MISCELLANEOUS GRASSES.

The following are being tested in small quantities, either for want of more material, in which case all seed is being carefully saved; or because they are only of botanical interest and are not deemed worthy of more extensive cultivation than will serve for study or the distribution of herbarium specimens to botanists. In addition to those enumerated below, a few plants of several of the species mentioned in list I. are being grown for comparison, from seed collected in widely separated localities, or upon different soils. These names are not repeated here.

A.—NATIVE GRASSES.

Agropyrum caninum, R. & S. Glaucous variety.

Agropyrum tenerum ? From Ottawa.

Agropyrum unilaterale. From Michigan Ag. Col.

Agrostis perennans, Tuck. (Thin grass).

Agrostis perennans, Glaucous variety.

Agrostis scabra Willd. (Tickle grass).

Andropogon scoparius, Mx. (Little Blue Stem). This is a valuable grass in the West where it will grow in pure sand. It makes excellent feed for horses, (S. A. Bedford).

Andropogon provincialis, Lam. (Turkey foot). "Good feed. Cattle and horses very fond of it. Grows on high land." (S. A. Bedford).

Briza media, L (Quaking grass) from Vancouver Island. Of no agricultural value.

Bromus Kalmii, Gray. (Wild Chess).

Chrysopogon nutans, Benth. (Indian grass). Considered valuable in the West. A tall coarse grass. Very late in starting in spring. It will grow in pure sand.

Danthonia spicata, Beauv. (White Top. Old Fog.) This forms a large proportion of the herbage in dry upland and mountain pastures. It is a small grass, but improves much under cultivation.

Deyeuxia Canadensis, Hook. (Blue-joint Grass.) This common but valuable grass grows in all low meadows. It produces an abundance of leafy stems which are eaten greedily by stock. Height 3 to 5 feet.

Elymus americanus, V. & S. (Long-awned form.)

Elymus americanus, (Short-awned form.)

Eatonia obtusata, Gray. (Early Grass.) Seed from Brandon, where Mr. Bedford says it is the earliest grass to ripen its seed.

Eatonia Pennsylvanica, Gray. (From Ottawa.)

Festuca microstachya, Nutt. var. *divergens*, Thurb. A small annual grass from Vancouver Island, of no value.

Festuca ovina, L. (Sheep's Fescue, Plate VIII.) This is the type of a division of the Genus *Festuca* in which the root leaves are short and bristle-like. They are small but very valuable grasses for upland pastures. Reported to be doing well under cultivation at Indian Head, N.W.T.

Hordeum jubatum, L. (Squirrel-Tail Grass.) Seed from Manitoba. A pernicious weed in pastures. Mr. J. Craig tells me that in dry regions it makes a beautiful lawn grass, and bears cutting well. He has seen it used for this purpose in the State of Iowa, and it should be tried in the arid portions of our North-West.

Macoun No. 4. From Langford's Lake, B.C. This is possibly *Glyceria pauciflora*, Presl.

Macoun No. 6. From Qualicum, Van. Isd.

Macoun No. 10. From Barclay Sound.

Macoun No. 12. From Cameron Lake, B.C. Probably a Deyeuxia.

Orizopsis——? From Kananaskis, Rocky Mountains.

Pennisetum longistylum. Seed from Prof. W. J. Beal. A very ornamental grass.

Poa cæsia, Smith. Seed from Indian Head. A short-leaved, slender and weak grass.

Poa tenuifolia, Nutt. (Slender-leaved Meadow Grass.) A small but valuable species in mountain pastures. It grows in bunches with long fine glaucous leaves and loose panicles. Seed from Harrison Hot Springs, B.C. Sown spring of 1889. Flowered July, 1890.

Stipa spartea, Trin. (Northern Buffalo Grass. Porcupine Grass.) Seed from Indian Head. Sown 1889. Flowered and ripened seed 1890.

Trisetum subspicatum, P.B. From Ottawa.

Trisetum subspicatum, P.B. From Rocky Mountains. A small grass not likely to be of much value.

B.—EUROPEAN GRASSES.

Agrostis——? Interloper in other seed. A very fine Bent-grass, suitable for lawns.

Aira flexuosa, (Heath Hair-grass.) Very dissimilar from what I am growing as *Deschampsia flexuosa* from the Rocky Mountains.

Arrhenatherum avenaceum (Tall Oat Grass). Young plants doing well.

Bromus mollis, (Soft Brome Grass.)

Elymus arenarius, (Sea Lyme Grass.) Seed from Mr. John Mather, who imported it to grow to arrest drifting sand. It is used for this purpose in some parts of the United States and Holland, together with Beach Grass (*Ammophila arundinacea*).

Festuca heterophylla. (Various leaved Fescue.) A fine-leaved grass of the *ovina* type.

Festuca ovina var. *angustifolia*, (Sheep's Fescue.) Leaves very fine and of a delicate green.

Holcus mollis (Perennial Velvet Grass.) A beautiful but useless grass.

Poa sudetica.—A small species.

Stipa Lessengerianum.
Stipa Sareptana. } From Dr. Vasey.

Both of the above are fine-leaved grasses suitable for dry localities, but of little agricultural value.

IV.—Besides the above, a large collection of seed was sown last September including many of the above as well as the following not before mentioned.

A.—NATIVE GRASSES.

Ammophila longifolia, Vasey, from Manitoba.
Aristida purpurea, Nutt., from British Columbia.
Andropogon provincialis, Lam., from Manitoba.
Bedford No. 25, from Manitoba.
Danthonia Californica. Boland, from British Columbia.
Elymus Virginicus, L. var. *submuticus*, Hook, from Manitoba.
Ericoma cuspidata, Nutt., from British Columbia.
Festuca tenella, Willd., from British Columbia.
Glyceria grandis, Kunth, from Manitoba.
Glyceria Canadensis, Trin., from Ottawa.
Phleum pratense, var. *alpestre*, Vasey, from Idaho.
Stipa viridula, Trin., from Manitoba.
Zizania aquatica, L. Sown in the Lake.

B.—FOREIGN GRASSES.

Avena pubescens. (Downy Oat Grass).

Bromus pratensis. (Meadow Brome Grass).

Bromus secalinus. (Chess. Plate IX.) A useless grass concerning which some farmers hold the remarkable and utterly erroneous opinion that it is degenerated wheat, with which, however, it is in no way related.

Molinia cærulea. (Purple Melic Grass.)

In conclusion I would add that seed or plants of any grasses not included in the above lists will be thankfully received and their qualities examined and reported upon.

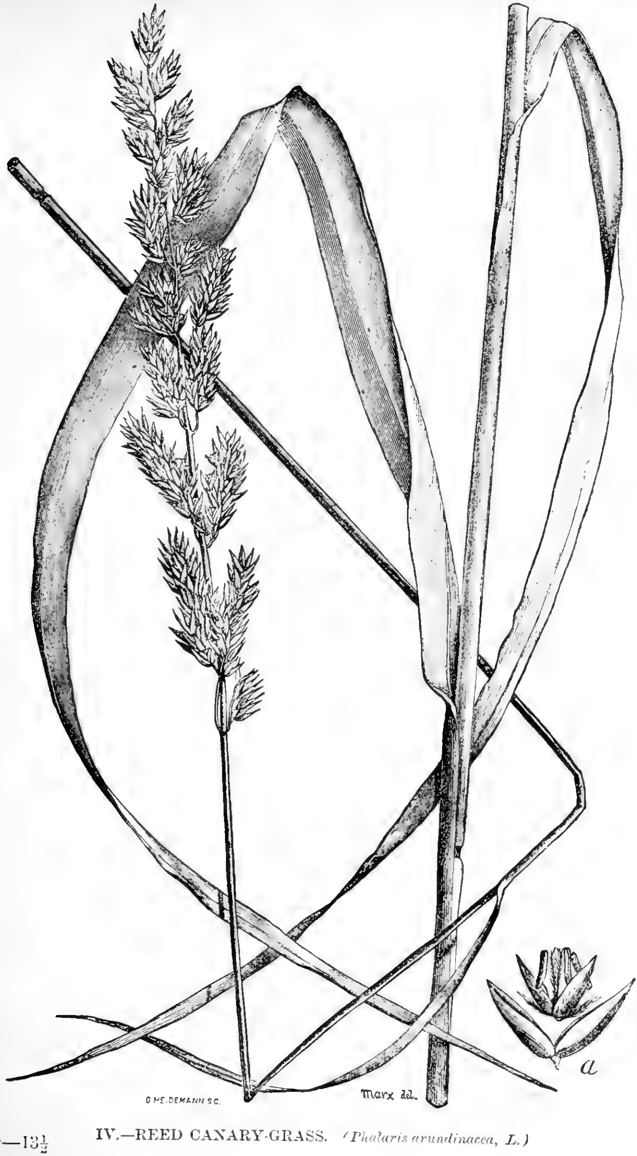
PLATE I.

I. COLORADO BLUE-STEM. *(Agropyrum glaucum, R & S. var. occidentale V. & S.)*

II.—GRAMMA GRASS. *(Boutcloua oligostachya, Tor.)*

6c—13

III.—SATIN GRASS. *(Muhlenbergia Mexicana, Trin.)*



6c—13½

IV.—REED CANARY-GRASS. (*Phalaris arundinacea, L.*)

Marx del.

V.—KENTUCKY BLUE-GRASS. *(Poa pratensis, L.)*

VI.—FOWL MEADOW-GRASS. *(Poa serotina, Ehrh.)*

VII.—PERENNIAL RYE-GRASS. *(Lolium perenne, L.)*

VIII.—SHEEP'S FESCUE. *(Festuca ovina, L.)*

MARX.DEL.

IX.—CHESS. *(Bromus secalinus, L.)*

REPORT OF THE POULTRY MANAGER.

(A. G. Gilbert.)

To William Saunders, Esq.,

Director Dominion Experimental Farms,

Ottawa.

Sir,—I have the honour to submit to you the third annual report of the working of the poultry department of the Central Experimental Farm, since 3rd January, 1890, the date of last report. During the winter season of 1889–90 careful notice was taken of the effect, on the various breeds, of the different sorts of ground meal composing the hot or stimulating food, given in the morning as an incentive to winter laying. These warm messes were made more or less stimulating by the addition or omission of ground meat and red pepper, the latter being entirely omitted when egg laying had fairly commenced. This experience, coupled with that of the previous winter, has shown,—

1. That the stimulating and fattening foods which go to eggs in the Spanish family, such as Leghorns, Minorcas, Andalusians, &c., make the Asiatics, viz.: Brahmas, Cochins, Langshans, &c., so fat as to lay soft shelled eggs or not to lay at all.

2. That Plymouth Rocks and Wyandottes—breeds of American origin and not to be properly classed with either of the foregoing—are to be treated as Asiatics in the matter of feed.

3. That it is best, when possible, to keep the pullets of late hatch from the two year old hens, for the reason that the latter are at their best for egg production and the fattening food that is suitable to pullets is likely to make the hens too fat to lay. The importance of having pullets hatched as early as possible will thus be apparent.

What is the proper treatment of the different breeds in winter?

WINTER TREATMENT OF DIFFERENT BREEDS.

1. Brahmas, Cochins, Langshans, Plymouth Rocks, &c., &c., require more oats, less wheat, little or no Indian corn, soft or stimulating food in moderation and a generous supply of vegetables. Lean meat twice or thrice a week and plenty of exercise.

2. Leghorns, Minorcas, Andalusians, Hamburgs, &c., &c., will take more soft or stimulating food, more wheat, Indian corn with meat and vegetables in liberal supply.

3. It is essential to success that lime, grit, gravel, &c., &c., should be before the layers at all times, and that the hens be kept in activity by throwing the grain fed to them in chaff, straw or dry leaves scattered on the floor.

Soft or stimulating food is generally fed in the morning and is composed as follows:—

HOT MORNING FEED.

A warm morning mess for the heavy breeds may be made of shorts, ground oats, bran, and lean meat scraps mixed with boiling water. This can be varied by giving cooked vegetables instead of the ground oats or bran. Clover hay cut in small pieces, steamed and mixed with the morning feed, is one of the best of green foods and cannot be given too often.

For the Spanish family a more stimulating morning mess may be made of shorts, cornmeal, ground oats or barley with ground meat or meat scraps in judicious quantity every morning, with a modicum of black or red pepper. Vary by mixing boiled potatoes or other vegetables in lieu of the ground oats or barley. Steamed clover hay at any time.

In cold weather Indian corn may be fed to the fowls for the last meal.

It is taken for granted that the fowls have comparatively comfortable quarters, with pure water to drink in regular supply; the chill taken off the water; the grain warmed in cold periods and the other directions, as given in detail in report of last year, carried out.

Should the foregoing treatment be found too forcing, the soft feed may be curtailed and more green stuff and oats fed. It is quite likely thin shelled eggs may be laid and it is a sign that the hens are getting too fat. As a preventative mix fine ground oyster shells, or sand, or both in the morning soft feed.

A QUESTION AS TO FEED ANSWERED.

A correspondent in the North-West Territories asks, "What kind of feed am I to use when I want to give my hens a rest after laying all winter and previous to breeding from them?" In reply it may be stated that a cessation of the stimulating soft feed and a gradual change from wheat to oats will, in most cases, have the effect of stopping production. Care must be taken that grit is regularly supplied, (as it should always be) to aid digestion, or else the change to oats may result in some of the hens becoming crop bound. The change from a generous to a non-stimulating diet, or *vice versa*, should be gradual. Should the hens have a run out, meanwhile, the latter is not likely to occur.

THE FARM LAYERS.

Owing to lack of room, some of the male birds remained with the laying stock during the winter. When the additional building, in course of erection, is completed it is intended to keep the laying and breeding stock apart. In cases where the hens had laid all winter, and were used as breeders in spring, they were allowed a rest and the eggs for hatching were saved, after laying recommenced.

BREEDING PENS MADE UP.

The breeding pens were made up as follows:—

Breed.	Number in Pen.	When Mated.
Wyandottes	1 cock, 2 hens	Feb. 26
Black Minorcas	1 cockerel, 7 hens	do 26
Plymouth Rocks	1 do 11 do	
Brahmas	1 do 9 do	
White Leghorns	1 cock, 11 do	
Houdans	1 do 11 do	
Buff Cochins	1 do 9 do	
Black Hamburgs	1 do 11 do	

Where no dates are given the male birds remained in the pens all winter.

CROSSES.

Plymouth Rock, with White Leghorns	1 cockerel, 5 hens		Mar. 27
Black Java, with mixed hens	1 cock, 11 do		April 7
B. B. R. G., with White Plymouth Rock	1 do 5 do		do 28

Later in the season the mixed pen was broken up, owing to the death of the Black Java cock.

The table below will show the number of eggs given to hens and the chickens hatched:—

NUMBER OF CHICKENS HATCHED.

When Eggs were set.	Number of Eggs set.	Description of Eggs.	Number of Chickens hatched.	When Chicks were hatched.
1890.				
Mar. 29	6	Plymouth Rocks	3	April 19
April 5	9	4 White Leghorns, 5 Houdans	6	do 26
do 5	9	4 do 5 do	6	do 26
do 16	9	4 White P. R., 5 B. Minorcas	3	May 7
do 22	13	Plymouth Rocks	8	do 13
do 23	11	do	10	do 14
do 25	13	Langshans, purchased in Ottawa	12	do 16
do 28	13	do do	10	do 18
May 1	15	8 Buffs, 7 Wyandottes	10	do 22
do 3	11	Plymouth Rocks	8	do 24
do 7	13	Black Minorcas (From London, Ont.)	10	do 28
do 7	13	7 do 6 Brahmas do	10	do 28
do 7	11	7 do 4 do do	9	do 28
do 7	11	Brahmas do	8	do 28
do 12	11	7 do 4 Wyandottes	7	June 2
do 16	11	8 White Leghorns, 3 Plymouth Rocks	8	do 6
do 30	13	Plymouth Rocks	11	do 20
June 13	13	B. B. R. Game	9	do 20
do 17	13	Buff Cochins (Imported. Eggs shaken)	5	July 4
July 9	13	Plymouth Rocks	12	do 30
do 19	13	7 White Leghorns, 6 Game Crosses	7	Aug. 9
			172	

HOW THE SITTING HENS WERE MANAGED.

As in previous years care was taken to rid the sitting hens of lice by dusting their bodies and the nests well with carbolic powder. China eggs were placed in the nests and the broody hen allowed to sit on them for two days. The imitation eggs were then taken away and the genuine placed in their stead. It is of the utmost importance that the sitting hen should be rid of all vermin before the eggs to hatch, often of great value, are given to her. When the sitter is not so rid of lice she is apt to leave the nest for long periods and frequently will not return to it. When a hen is noticed standing on the nest, as if in distress and loath to sit on the eggs, the trouble is caused by lice. The heat of the *embryo* in the shell and the high temperature of the hen's body, tend to make the parasites so active as to become unbearable. As before said, although against the natural instinct, some hens leave their nest and the hatch is lost. During last summer a visiting farmer said: "I have not got a chicken this year. What was the matter with my hens? They all left their nests." He was informed of the reason, and although surprised that the cause was so easy to find, remarked that it was worth the price of the journey to get the information. As a matter of fact, a great many of the so-called diseases of poultry may be traced to the presence of lice.

EARLY SITTERS.

There was a remarkable demand for sitters in the early hatching season, and it was noticed that the sitting varieties were unusually tardy in becoming broody. In the case of the farm fowls, the majority of the mixed breeds, kept for sitters, did not become broody at any period of the season, and the thoroughbred Buff Cochins had to be used as early sitters. The first hen to be put on eggs was a coloured Dorking, on the 29th of March, followed by two Buff hens, on the 5th of April, and four others on the 16th, 22nd, 25th and 28th of the same month, consecutively. In the next month, four Buff Cochins, with five Brahmas, six Plymouth Rocks, one Black Russian, two Wyandottes and three mixed breeds were used as sitters. It will be seen that of the total number of sitters, three only were not thoroughbreds. Apart from their fair laying qualities, the Buff Cochins, in two successive seasons, have proved invaluable as early and reliable sitters. Had their services not been required for hatching out chickens they would have been broken up and made to lay again. For an early sitter, when it can be had, a light hen is to be preferred, for at that time egg shells are apt to be thinner than at a later date.

BREAKING UP A HEN.

By breaking up a sitter, it is meant to get her rid of the incubating fever and laying again as quickly as possible. The best way to accomplish this is to put the broody hen in a coop, or compartment without a nest, where she cannot sit, feed her generously, and in a few days she will cease to be broody, and if the good feeding is kept on will soon be laying again. The practice of ducking the broody hens in water, tying them to a stake, swinging them by their legs, is simply cruel and unnecessary. Some hens, Wyandottes, for instance, are much more easily broken up than others. A broody member of the Spanish family should not be used as a sitter. Occasionally an exception may be found, but, as a general rule, although very fussy, they are not reliable.

EXPERIMENT 1.—HATCHING RESULTS FROM EGGS SET ON DRY BOARDS AND ON DAMP GROUND.

In conformity with the intention expressed in last year's report, an experiment was tried by setting a number of hens on eggs placed in nests on the dry boards of the attic floor of the central portion of the poultry building, and others placed in nests, directly on the damp earthen floor of the cellar. The eggs in all the nests were tested on the seventh day of incubation. The following will show that the eggs were fertile to a very satisfactory extent, and that there was very little difference in the result:—

UPSTAIRS ON BOARD FLOOR OF ATTIC.

Date when set.	Number of Eggs set.	Kind of Sitters.	Result of Test.	Number of Chickens hatched.
April 5..	22	2 Buff hens..........	7 unfertile, 2 addled, 1 broken	12
do 22..	13	1 Buff hen..........	1 unfertile egg, 2 did not hatch out, 2 broken by hen...	8
do 23..	11	1 P. Rock hen.......	1 egg did not hatch.........	10
do 25..	13	1 Buff hen..........	1 chicken died in hatching..................	12
May 1..	15	1 Brahma hen.......	2 eggs broken, 3 unfertile..................	10
do 7..	13	1 Buff hen..........	2 eggs broken, 1 did not hatch out..................	10
do 16..	11	1 Wyandotte hen....	3 eggs unfertile	8
	98			70

IN NESTS ON DAMP FLOOR OF CELLAR.

Date when set.	Number of Eggs set.	Kind of Sitters.	Result of Test.	Number of Chickens hatched.
April 28..	13	Buff hen............	3 eggs unfertile..................................	10
May 3..	11	Russian hen........	3 eggs unfertile..................................	8
do 7..	13	Buff hen....	2 unfertile eggs, 1 chick killed by hen..............	10
do 7..	11	P. Rock hen........	1 addled, 1 chick dead in shell.....................	9
do 7..	11	Brahma hen..........	1 chick died in hatching, 2 unfertile eggs....	8
do 12..	11	Wyandotte hen.	4 unfertile eggs...	7
do 30..	13	Brahma hen	1 chick died in shell, 1 unfertile egg...............	11
June 13...	13	P. Rock hen........	1 chick killed by hen in nest, 3 addled eggs........	9
	96			72

Both of the above methods have their earnest advocates. The contention, on one side, is that eggs to hatch out well should be placed on damp ground, or, on some substance calculated to retain moisture, and the opposite on the other side. It would appear from the above experiment that the fertility of the eggs had more to do with the result than the location of the sitter. As remarked in previous report it is quite possible that early in the spring season, when the weather is yet cold, the dry floor may be the best because it is likely to be warmer. In the hot season of July, or August, no eggs are hatched out that can possibly be placed under hens at an earlier date. Should there be no alternative, the cool damp cellar would be preferable.

Mr. A. W. Morton, of Deloraine, Manitoba, gives his experience in hatching on the ground in a letter dated 10th of April, 1890, from which the following is an extract. He says: "Last year ('89) I set four hens on the ground in the stable, having no proper hen house. The first hen hatched 14 chicks from 14 eggs; the second hen hatched 9 chicks from 14 eggs; the third 14 chicks from 14 eggs and the fourth 13 chicks from 14 eggs. Every time I found a sitter off her nest I sprinkled the eggs with water. I am going to try the experiment again. My experience in hatching eggs with the hens placed in comfortable boxes, in quiet places, was not nearly so good. I may say that it is my intention to construct and equip a suitable place for my poultry, following many suggestions given in the farm report, which seem to be excellent."

SHIPMENT OF EGGS AND STOCK.

The demand for eggs, during the hatching season of last year, was far greater than could be supplied. Numerous orders were received from Manitoba and the North-West Territories. Frequent enquiries were made as to the sort of fowls considered most suitable for those portions of the Dominion. Should poultry departments be established on the branch Experimental Farms, they would be valuable distributing centres for the districts in which they are situated. Eggs sent from them would have less distance to travel to surrounding country and be likely to give better hatching results. As an instance of the demand for eggs, it may be stated that in April, last, there were on the list for delivery in one week, 26 sittings of Plymonth Rock eggs and 21 of White Leghorns. As there was only one pen of Plymouth Rocks, composed of 1 male and 9 females, and one pen of White Leghorns with 1 male and 11 females, it was not possible to comply with all demands. Of the Plymouth Rocks, some would get broody and some time would elapse before they could be broken up and laying again. All the hens did not lay every day, so that the percentage of eggs obtained per diem was not large. The same remarks will apply to Brahmas, Cochins and others of the sitting varieties. It will be evident that to supply a demand such as that mentioned, several breeding pens of the popular sorts would be required and a large establishment necessary to contain them As long as there is a limited number of breeding pens, there will be a limited number of eggs to dispose of after those required for home experimental purposes are reserved. Stock was shipped to the branch experimental farms at Indian Head, North-West Territories, and Nappan, Nova Scotia.

HOW THE CHICKENS WERE CARED FOR.

While the chickens were hatching care was taken that the sitters were not disturbed. This is most important, for if the sitters are disturbed after the eggs are "pipped," the young chicks just coming into the world are apt to be chilled; if the hen is irritated or frightened she is likely to become restless and crush the young ones to death. After the chickens were hatched the broken egg shells were removed to make the nest more comfortable. But this should not be attempted by any but an old hand. It is best to leave the hen alone if she is a reliable sitter. Occasionally it happens that a hen will become so nervous or excited at the "peeping" of the chicks in their efforts to break out of the shell, that she will trample them to death. Such a hen should be marked and not set on eggs again, as she is not reliable. One case occurred, in which the hen was discovered eating the egg shells before the chicks were properly disengaged from them, the result being the loss of four chickens. A spare sitter was fortunately at hand and the remaining half-hatched eggs were at once placed under her and the lives of the chickens saved. After being hatched out the chicks were allowed to remain under the hens for 18 or 24 hours, until thoroughly dried. With the mothers they were then placed in coops outside in the sunshine. If hatched before the grass had grown they were kept indoors, the bottom of the coop being covered with sand. The dry board floor would soon have used the little ones up, literally put them off their legs. Previous to being put into the coop with her brood, the hen was fed and allowed to drink apart from the chicks, otherwise she would have greedily eaten up the dainty food intended for the tender youngsters. It must be remembered that for two or three days or nights the careful mother has not left her nest, for had she done so while the chickens were hatching (except in very warm weather) there would have been no chicks, as a result she is so hungry and thirsty that she will voraciously eat and drink what is placed near her.

HOW THE CHICKS WERE FED.

As in previous years the bread and milk system of feeding was adopted and proved highly satisfactory. The bread was soaked in milk, squeezed dry and so fed. Dry bread crumbs were also given. As the chickens progressed, their bread and milk diet was gradually changed to the less expensive one of shorts, cornmeal, bran, table scraps, ground meat, with all the wheat or crushed corn they could eat for their last ration. When very young the chicks were fed about once every hour, a little at a time, but often, so as not to allow them to get hungry. As they grew older, they were fed once every two hours, and as they increased in size the rations were gradually made more substantial, but reduced in number. It is important that the chickens should be sent to rest with their crops full. A critical part of the chicken's life is the first five weeks, while it is getting its feathers. At this period all the resources of the system are drawn upon to supply the growing feathers, besides flesh, bone, muscle, &c., &c., and it is necessary that the chickens should be generously fed on a variety of the most nourishing food. A chicken stinted of food, or allowed to hunt for its living, as is too frequently the case, at this period of its growth, will never make a large fowl, indeed, if allowed to become stunted from either of the causes named, no subsequent care will make amends for past neglect. To have poultry of large size for table use, it is imperative that they should be pushed from the earliest date of their existence. This is well understood in Great Britain and France, where raising choice poultry for market is made an important source of revenue to the farmers. If easily procured, milk, sweet, skimmed or sour, given as a drink, or mixed in their food, or left in open dishes to take as they please, is one of the best incentives to vigorous growth that can be given. If not milk, then pure water should be regularly furnished and put into shallow pans. The water should not be allowed to get hot from exposure to the sun. The first chickens to be placed in the coops outside were Plymouth Rocks, White Leghorns and Houdans. They were exposed for the first two or three weeks of their existence to the bitterly cold north-west winds which marked the last week of April and the first two weeks of May. Being well fed and cared for, they not only stood the trying ordeal well, but made good growth. Had they not been generously and frequently fed they would have been "dwarfed," or if they had been left to shift for themselves, as the majority of early chicks are, they would have quickly succumbed. Where effort of any kind has been made to secure a brood, or broods of chickens, it will pay well to see to their future growth.

The progress of the chickens, although satisfactory, was not equal to that of the year previous. Three reasons may be assigned for this, the absence of the large quantities of sour milk supplied the year before, limited quarters and ground used the year before. Some of the weights, as compared with those of the previous season, are given as follows:—

Plymouth Rocks.—Again led the other breeds in making weight. A cockerel five months and two weeks, after being hatched, attained a weight of 6 lbs. 2 ozs. as compared with 5 lbs. 2 oz. of a Houdan, hatched a week later but weighed on the same day. At the same age, as the one above, a Plymouth Rock cockerel, the season previous weighed 8 lbs. 4 ozs.

Brahmas.—Were hatched from imported eggs at the end of May. Rather late to give them a fair chance as they had to stand the brunt of midsummer heat before attaining any size. They showed an average development of 12 ozs. per month as compared with 15 ozs. per month of the season previous.

Houdans.—Hatched at the end of April weighed, on 1st of October, 5 lbs. 2 ozs. averaging a development of 1 lb. per month.

Wyandottes.—At first made slow and almost discouraging progress. This was no doubt owing to their being crowded. The pullets, however, picked up in the fall, turned out to be very fine ones and were laying by end of December.

Langshans. This breed was tried for the first time. Two settings of eggs were purchased in Ottawa and 22 chickens were hatched. Of this number 18 grew up to maturity. They proved hardy chickens, grew well and the pullets began to lay by middle of December. In their growth they displayed the characteristics of the Asiatic family as to large frame and slowness to put on flesh, until maturity.

Black Minorcas.—Two sittings of eggs were purchased, from which 18 chickens were hatched. Their progress was very satisfactory, the chickens proving hardy and vigorous growers.

Crosses.—Chickens of a cross between a B. B. R. Game cock and White Plymouth Rock hens were hatched on the 9th August, Their progress was not satisfactory, probably owing to their late hatching. Many of them succumbed to the cold of the first winter month.

A good deal of space has been given to the care and management of chickens, for the reason that a frequent cause of complaint is the great mortality among the young stock. In the majority of cases, want of care and proper food have undoubtedly been the cause of death. In the case of many farmers, inbreeding has resulted in weak chicks, and weaklings as a rule seldom last long. Perhaps it is as well they do not, for they would never, in the event of their maturing, make stock fit to breed from. It may be added to the general instructions given above, that as the chickens grow large, they should be removed from the smaller ones. If they are not, they will not allow the little chicks to have the proper quantity of food they require to make rapid progress. In chicken life the weak has to go to the wall. Where chickens are raised in large numbers and are placed in small coops, the latter must be frequently cleaned, or sickness will surely result.

WHEN THE PULLETS LAID.

The first pullet to lay was a Plymouth Rock, on the 24th November, hatched 19th April; the second a White Leghorn, on the 28th November, hatched 26th April; the third, a Black Minorca, on the 1st December, hatched 7th May; fourth, a Langshan, on the 12th December, hatched on the 16th May.

COMMENCEMENT OF WINTER LAYING.

The fowls were allowed full liberty to run in the fields, in rear of the poultry house, as soon as the grain was harvested. As the result of this freedom (which, owing to the fine open fall, they enjoyed until the 25th November) and nutritious feeding during moulting, they went into winter quarters in excellent health, and were in full lay for the winter season by the 10th December. The White Leghorns, Black Minorcas, Andalusians and Plymouth Rocks, were the first to lay, a few days after going into winter quarters, followed soon after by the Black Hamburgs, Mixed breeds, Brahmas, Buff Cochins, Houdans, Red Caps and Wyandottes, in the order named. Six days after being closed in, the winter commenced in earnest, the thermometer on the 1st December going down to zero, and the next day showing 14 degrees below that figure. The weather continued unusually cold during the month of December, the temperature in the poultry house several times going to 10 and 15 below freezing. Notwithstanding, the Leghorns, Andalusians and Minorcas laid steadily through the month, responding to the stimulating food with satisfactory results.

EGGS LAID BY DIFFERENT BREEDS.

Owing to the fowls running at large, promiscuously, for so many weeks in the fall, it is impossible to give a table of the eggs laid during the whole year; but the following figures will show what has been done by a certain number of the different breeds, since going into winter quarters. It is to be remembered that the laying and breeding stock were kept together, and that some old hens, though past their prime as layers, were kept for their superior points as breeders. Thus, in a pen of 20 Plymouth Rocks, several may be old hens for breeders, others may be late hatched pullets. It is only fair in such a case to give the number of actual layers. When there is room, the aim will be to keep a certain number of fowls of the same age for layers.

EGGS LAID IN DECEMBER AND JANUARY.

Date.	10 White Leghorns.	10 Plymouth Rocks.	5 Black Minorcas.	8 Langshans.	3 Andalusians.	5 Brahmas.	6 Black Hamburgs.	16 Mixed Hens.	5 Buff Cochins.	9 Houdans.	2 Redcaps.	4 Wyandottes.	Remarks.
1890.													
Dec. 1	....	2	2	....	1	....	....	....	....	....	....	....	
do 2	2	....	....	....	....	1	....	....	....	....	....	....	
do 3	1	1	1	....	1	....	....	1	....	....	....	....	
do 4	1	2	1	....	....	1	....	....	....	....	....	....	
do 5	1	1	2	....	....	....	....	2	....	....	....	....	
do 6	2	1	1	....	1	....	....	....	....	....	....	....	
do 7	....	2	2	....	....	....	....	2	....	....	....	....	
do 8	2	1	2	....	....	....	....	1	....	....	....	....	
do 9	2	....	1	....	....	....	....	1	....	....	....	....	
do 10	1	2	2	....	....	....	....	2	....	....	....	....	
do 11	3	2	2	....	....	1	....	....	....	....	....	....	
do 12	1	2	....	1	....	....	....	3	....	....	....	....	
do 13	3	1	2	1	....	....	1	1	....	....	....	....	
do 14	1	2	2	....	....	1	....	....	....	....	....	....	
do 15	4	2	1	1	....	1	....	2	....	....	....	....	
do 16	2	2	2	1	2	....	1	1	....	....	....	....	
do 17	4	1	1	....	....	....	....	....	....	....	....	....	
do 18	2	2	1	2	2	....	3	....	....	....	....	....	
do 19	5	3	2	1	....	1	1	1	....	....	....	....	
do 20	3	2	1	2	2	1	2	1	1	1	....	....	
do 21	4	3	2	2	1	2	....	....	....	....	....	....	
do 22	2	3	1	2	2	....	2	....	1	....	....	....	
do 23	5	3	2	1	....	2	....	....	1	....	....	....	
do 24	3	2	2	3	2	1	2	....	....	1	1	....	
do 25	3	5	2	2	1	1	1	....	1	....	1	....	
do 26	5	3	2	2	1	....	2	1	2	....	....	1	
do 27	5	2	2	2	1	1	....	3	....	1	1	1	
do 28	4	3	2	....	1	1	1	....	2	1	1	....	
do 29	4	3	2	2	1	1	2	1	1	....	....	1	
do 30	4	2	2	4	1	1	1	2	....	1	1	2	
do 31	4	3	2	1	1	2	1	3	1	....	....	1	
1891.													
Jan. 1	5	3	2	4	1	....	1	....	1	1	1	1	
do 2	2	1	2	....	....	1	1	3	....	....	....	1	
do 3	5	4	2	2	2	1	1	1	1	....	1	1	
do 4	5	2	2	3	....	1	1	1	1	....	....	2	One Andalusian sick.
do 5	4	2	....	....	2	1	....	1	2	....	....	....	
do 6	4	3	2	2	1	1	2	....	1	....	1	2	
do 7	7	3	2	2	....	1	1	1	1	....	....	1	
do 8	2	3	1	....	2	1	1	1	3	....	1	2	
do 9	7	3	1	1	....	1	1	....	3	....	1	2	
do 10	2	3	....	3	2	....	....	....	2	....	1	1	
do 11	6	4	2	1	2	1	1	....	2	....	1	3	
do 12	1	2	1	2	1	1	1	2	3	....	....	1	
do 13	9	5	2	4	2	....	1	....	2	1	1	1	
do 14	2	3	3	2	3	1	....	2	2	....	....	2	
do 15	8	2	3	4	3	....	1	1	4	....	....	2	
do 16	3	2	1	2	....	1	1	3	3	1	1	1	One Buff hen broody.
do 17	8	3	1	3	2	....	1	1	2	....	1	3	
do 18	4	1	2	2	....	1	....	2	4	2	1	1	One Buff hen died.
do 19	4	3	3	3	1	1	2	....	4	1	2	1	One Wyandotte broody.
do 20	2	1	3	1	....	....	2	1	2	1	....	2	
do 21	5	2	1	3	....	1	2	2	2	2	2	1	Two Langshans removed.
do 22	1	2	3	3	1	2	....	2	2	1	....	3	
do 23	1	2	1	2	....	1	....	2	2	1	2	3	
do 24	2	2	3	2	....	1	2	2	....	2	....	2	
do 25	....	3	4	1	1	1	....	2	....	....	2	1	
do 26	....	2	2	2	1	1	2	2	1	2	1	2	
do 27	....	5	4	1	....	2	3	3	1	1	2	3	
do 28	1	....	3	2	2	1	1	2	....	....	1	1	
do 29	....	5	3	2	....	1	1	5	1	2	2	2	
do 30	1	....	3	1	1	1	2	3	....	....	1	1	
do 31	2	4	3	1	1	2	3	2	1	....	2	1	
	186	143	114	91	52	47	55	74	63	23	33	56	

DISEASES OF POULTRY.

THE EPIDEMIC OF LAST YEAR EFFORTS TO FIND OUT WHAT IT WAS.

The description given in last report of the disease which was general in the district, with such fatal effect, attracted wide attention. Many letters were received giving various opinions as to its nature, and every effort was made to arrive at a correct conclusion. With this object in view, the remains of one of the farm fowls, which had died from the disease, was sent to Professor Wesley Mills, of the Physiological Laboratory of McGill University, Montreal, a gentleman well known not only as a skilled physician and lecturer, but as an authority on the diseases of animals and the philanthropic interest he takes in the same. Dr. Mills was given a full description of the disease, and was requested to give his opinion as to its nature. In the kindest manner possible he at once expressed his interest in the matter and expressed his intention, with Dr. Johnston, Demonstrator of Pathology of McGill, to have a *post mortem* made of the body of the fowl sent and to report on the same. At the same time he asked to have any live fowls which were suffering from the disease sent to him. Fortunately no other of the farm stock was sick at the time, nor did others become so afterwards from the same ailment. The following will show that the examination by Dr. Mills had a negative result :—

"PHYSOLOGICAL LABORATORY, MCGILL UNIVERSITY,

"MONTREAL, 19th Dec., 1890.

"Manager of the Poultry Department,

"Experimental Farm, Ottawa.

"DEAR SIR,—A *post mortem* examination of the P. Rock fowl you were good enough to forward, showed extreme emaciation, and pronounced pallor of parts generally. There were no evidences of any organic or zymotic disease. Dr. Johnston, Demonstrator of Pathology, inoculated some animals, including fowls, with the blood of this bird, but with negative results.

"Taking everything into account, I am inclined to think that the symptoms, &c., of the affected birds are indicative of a profound alteration in nutrition, to be explained by something in the conditions under which the bird lived.

"Truly yours,

"WESLEY MILLS, M.D."

In connection with the foregoing and as instance of the interest taken in the subject, the following extract from a letter received from Dr. J. Fitz Mathew, of Dauphin, Dauphin Co., Pa., author of the "British Colonist in America," is given. He says: "I am interested in your report of the chicken disease in the Ottawa district. I should suspect tuberculosis from the symptoms. Numbers of fowls die of it. In France, on one occasion, forty died (about) of tuberculosis from eating the *sputa* of a consumptive man, the attendant. I would advise an examination of the lungs and stomach." Dr. Mathew was informed of the result of the investigation by Professor Wesley Mills and in return wrote :—"I only made the suggestion of a diagnosis of the fowls, for the case is most interesting, especially at a time when tuberculous affections are occupying the attention of the medical faculty throughout the world. I enclose a few remarks on tuberculosis in fowls, which may be thought of service. I would suggest that the next case of this disease—which I believe to be tuberculous —you can get hold of, you submit to the McGill University experts for examination for the 'bacilli of tuberculosis,' slender bodies from $\frac{1}{17000}$ to $\frac{1}{7000}$ of an inch long.

"REMARKS ON 'TUBERCULOSIS' IN DOMESTIC FOWLS.

"'Johne'—Deutsche Zeitschrift fuer Thiermedizin, ('84), 155—describes the appearance of tuberculosis among fowls fed by a consumptive woman. Her sputum was thrown upon the manure pile, where the fowls had access to it. The symptoms were 'great emaciation' and debility.

"Nocard—Recueil de Méd. Vét (1885) annexe, 93—reports that ten fowls of a yard attended by a consumptive man died of tuberculosis of the abdominal organs. The fowls were seen eating the sputum.

"Nocard (Compt. Rend. Soc. Biologie (1885), 601), subsequently found the disease among the fowls of a slaughter-house, 'which were being fed on the diseased organs of cattle which could not be sold in the market.'

"Zürn, in an examination of six hundred hens found sixty-two affected with tuberculosis—turkeys, pheasants and partridges, &c. are subject to tuberculosis.

"The tubercular lesions are limited to the intestines and the liver; or they may involve the 'ganglia' and the ovary.

"In the case of the disease affecting the fowls in your district (in one case a dairyman losing 45,) assuming it to be tuberculosis—which can only be determined by microscopical examination for the 'bacilli' of tuberculosis the question is: 'In what way was it communicated?' Two ways may have already been noticed. Authorities are well agreed that the milk from an udder (tuberculous) is infectious. Sputum of tuberculous patients is so infectious, that even when diluted with 100,000 times its bulk of water, it is still infectious. Even although the disease may not be recognized, the symptoms being often very obscure, it may exist in animals slaughtered and sold for consumption. It is more prevalent among dairy cows subjected to unsanitary conditions and may exist also in the udder without being suspected. In France the percentage of meat found tuberculous at the various abattoirs varies from 1·43 to 14·5 per 1,000; observations extending over a period of 5 years. In England (Cope, Vet. Journal, 1889, 398) it varies from 1 to 26 per cent.

"Animals, such as dairy cows, subject to special feeding, brewery and distillery waste, &c., are specially liable to a tuberculous condition. Finally, it may be concluded that since the neglect of sanitary precautions, generally, undoubtedly gives rise to tuberculosis, it follows that fowls crowded together in roosting houses without 'proper ventilation,' &c., may generate tuberculosis. In cold winters in order to maintain heat it is a custom with many to 'exclude all air,' and no provision is made to permit foul odours to pass off."

ANOTHER DISEASE WHICH CAUSED GREAT LOSS TO FARMERS.

During the first week of September a letter was received from M. André Bertrand, a farmer of St. Esprit, P.Q., stating that a disease had broken out among his poultry and that a number of turkeys, chickens and fowls had died. The remaining birds he feared would be lost. A brief description of the disease was given.

A reply was sent asking him to forward a detailed description of the disease, and expressing the fear that cholera was the ailment. A statement of how his poultry was housed, extent of premises, &c., was also asked for, as it was intended to submit the correspondence to Prof. Wesley Mills, of McGill University, for his opinion.

In response the following letter was received from M. Bertrand:—

"SIR,—You ask me to give you a description of my place and of the disease which has broken out among my fowls. I live on my farm, which is a large one. My farm buildings are extensive and commodious, with the hen-house in the corner of the stable. The buildings are situated near the river. When I noticed that my fowls were getting sick I closed the hen-house and then the fowls went to roost in the trees, in the barn or under the gallery. They all died one after another, until, now, I have only nine chickens out of one hundred. Ten turkeys have died out of thirty-six. The symptoms of the disease are as follows: The fowls commence at once to fail and to appear broken down, although they eat until the last day. The head becomes of a blueish colour, but is not swollen, as in roup. The droppings are thin, of a white, yellow and greenish tinge. Some contain what looks like coagulated blood. The disease seems to be epidemic, as all my neighbours fowls are suffering from it. This is about all the explanation I can give you.

"Yours very truly,

"André Bertrand,

"St. Esprit, P.Q."

This letter was at once sent to Professor Wesley Mills, of McGill University, asking the favour of his opinion as to the nature of the disease. In reply the following opinion and advice was received :—

"Physiological Laboratory, McGill University,

"Montreal, 19th December, 1890.

"Dear Sir,—The symptoms and results described by Mons. Bertrand seem to point to chicken cholera or some closely allied disease as the one that has played such havoc among his birds. It would be well that every bird showing the first symptoms of the malady should be killed at once if it cannot be isolated, and the bodies of all the dead burned. The well birds should be isolated and the buildings in which the others have been, thoroughly disinfected, All excrement should at once be burned. The food must be carefully examined as well as the water. It might be well to boil the latter and feed the flock for a while on soft food, prepared by pouring boiling water over meal of various kinds. In medical treatment little, I fear, can be done. I should give at once a compound cathartic pill and follow it in a few hours by a good dose of castor oil. A gelatine capsule containing powdered charcoal and a little cayenne pepper might also be of use, if given every three or four hours. However, in such a disease it is better to kill the sick than try to cure them, it seems to me.

"Truly yours,

"Wesley Milis, M.D."

Immediately following this letter came the request from Dr. Mills, to have two birds suffering from the disease, but alive if possible, sent to him at the University.

Accordingly a note was sent to M. Bertrand, asking him to comply with Dr. Mills' request. A few days after, M. Bertrand wrote to say that he had sent two fowls, one dead from the disease and another alive, but sick from it. He had obtained the fowls from a neighbour as his own had all died. It was learned afterwards that the fowl, which was alive when shipped, was dead when it reached its destination.

A request was sent to Professor Mills to kindly forward the result of the examination to be published for the benefit of farmers and others who kept poultry. In answer Dr. Mills said, that "the investigation was in progress, but that it would be premature to make a diagnosis yet. He would like M. Bertrand to send one or two more fowls alive, and just as soon as they are decidedly ill." M. Bertrand was written to accordingly.

It may be remarked here that the importance of having such authorities as Professor Mills and Dr. Johnston to refer to, will be evident at first glance. The uniform promptness and willingness of Professor Mills to give his opinion, as to cause and advice as to remedy, cannot be too much appreciated.

OTHER AILMENTS REPORTED AND REMEDIES ASKED.

On the 25th April, Mr. Munro, of Almonte, Ont., wrote, "that he had a Leghorn hen which had a large lump growing on one side of her face below the eye. The lump came on the year before, disappeared but was again coming on." He was answered that the lump was probably of a scrofulous nature, and that the fowl was not fit to breed from.

Later in the year, Mr. J. Riach, of Hamilton, Ont., wrote that he had some valuable fowls which were so troubled with worms as to make them very sick. He was advised to soak Indian corn in turpentine and water, and feed to the fowls (if the worms were in the intestines) once or twice and follow with a compound rhubarb pill. If the worms were in the throat—as in gapes—to put a few drops of turpentine in the drink water. He subsequently wrote to say that as he had not the pills, he had given castor oil after the turpentine, and that the treatment had been successful.

Many other diseases were described and remedies asked for. In all cases information was at once given. It may be useful to others to know that in some instances a remedy for lice was asked, and dusting the hen with carbolic acid powder was recommended ; others stated their hens were sneezing and wheezing, and injection into the nostril of coal oil and a few drops of carbolic acid liquid was advised, with care that the hens were not exposed to draughts ; others had fowls with swelling at leg-joint, when painting with iodine was suggested. In some cases chickens were reported as having died in numbers, when enquiry discovered that feeding wheat at too early an age was cause of death.

EXPERIMENTS WITH EGGS AT DIFFERENT TEMPERATURES.

With the object of ascertaining how long newly laid eggs will keep fresh in different temperatures a number of experiments were made, the results of which are given below. The eggs were laid by the farm fowls and were supposed to be fertilized. They were assorted as follows: Twelve were placed in an incubator and kept at a temperature of 78 to 84; twelve others were placed in a basket kept on a shelf in the cellar, at a temperature of 46 to 48 ; twelve were kept in the incubator part of the day at 78 to 84 and the remaining portion were placed in a basket and kept in the cellar at a temperature of 46 to 48, the object being to submit them to alternate variations of temperature ; twelve were packed in bran in a basket and kept in the cellar and twelve others were greased with lard and packed in salt and also kept in the cellar. The notes were taken when examination of the eggs were made by yourself, with the exception of the first.

7TH NOVEMBER, 1890.

Examination No. 1.—An egg laid on the 29th October, and another laid on 31st of same month were placed in the incubator with others on the latter date. The incubator was kept at a temperature of 78 to 84 degrees. No. 1 egg was examined on November 7th as mentioned above, and showed a faint dark mark on one side, but when broken into a saucer was found quite sweet and fresh. No. 2. ditto

20TH NOVEMBER, 1890.

Examination No. 2.—Examined two Andalusian eggs which had been in drawer of table in office of poultry building since the first week in August. The eggs were placed on their sides on bran and when laid were supposed to be fertilized. No. 1 egg was found clear and bright; quite sweet and good ; entirely free from any odour or musty taste. No. 2 egg—ditto.

Examination No. 3.— Examined two eggs which had been kept in incubator since 31st October at a temperature of 78 to 84°. No. 1 egg—Yolk somewhat soft and easily broken up. Both yolk and white quite sweet to taste and free from everything objectionable. No. 2—In similar condition to No. 1. Both these when examined through egg tester looked as if some change was going on.

Examination No. 4.—Examined eggs stored in open basket in cellar, at temperature of 46 to 48, on 29th October. Eggs were found perfectly fresh and sweet ; yolk firm ; white, clear and bright.

Examination No. 5.—Examined an egg, which with others was packed in bran in a box in cellar at a temperature of 46 to 48 on 29th October. Found perfectly fresh and sweet; yolk firm; white, clear and bright.

5TH DECEMBER, 1890.

Examination No. 6.—Examined 2 eggs, which with others had been constantly kept in incubator at a temperature of 78 to 84, since 31st October. No. 1 egg, yolk easily disintegrated, breaking up when egg was opened; air space much enlarged; contents perfectly sweet. Egg laid on 30th October. No. 2 egg in similar condition to No. 1, but air space not so large.

Examination No. 7.—Eggs placed in basket and kept part of time in incubator and part in cellar. Yolk hangs well together; air space small; contents perfectly sweet.

Examination No. 8.—Eggs kept in plain basket in cellar, at temperature of 34 to 46 since 29th October. One egg opened; perfectly sweet; yolk hangs well together; has every appearance of fresh egg; air space small.

Examination No. 9.—From the number packed in bran, in a box and kept in cellar at temperature of 34 to 46 since 29th October. Result same as in plain basket, examination No. 8.

Examination No. 10.—From the lot greased with lard and packed in salt contained in a box and placed in cellar on 10th November. Yolk hangs well together; air space small; perfectly sweet; every appearance of a fresh egg.

Examination No. 11.—From the eggs placed in the drawer of the table in office in first week of August previous. (See No. 2.) Egg quite sweet; yolk rather tender; not so easily broken up as those from incubator.

DECEMBER 31ST, 1890.

Examination No. 12.—An egg from those kept in incubator since 31st October, at a temperature of 78 to 84. Egg quite sweet; air space very large, occupying one-fourth of shell; yolk partly thickened and partially adhering to side of shell. Egg laid on 31st October.

Examination No. 13.—Egg part of time in incubator and part of time in cellar. (See No. 7). Yolk of egg easily broken up; air space large, occupying about one-sixth of shell. Egg laid 5th November; quite sweet.

Examination No. 14.—From eggs kept in plain basket in cellar at temperature of 34 to 46 (see No. 8) since 29th October. Egg perfectly sweet; every appearance of fresh egg; yolk solid; white clear; air space small. Egg laid 27th October.

Examination No. 15.—From eggs packed in bran in a box in cellar. (See No. 9.) Same as in No. 14. Egg laid on 26th October.

Examination No. 16.—From eggs greased with lard and packed in salt and kept in cellar. (See. No. 10.) Egg perfectly sweet; every appearance of fresh egg; yolk firm and sound; white clear; air space small. Egg laid 2nd November.

Examination No. 17.—One egg from those placed in drawer of the table in office of poultry building in the first week of August. Yolk slightly adherent, and breaking up easily; air space large; contents perfectly sweet.

From the above experiments, it will be seen that fertilized eggs, if fresh when placed in the shippers hands, should reach the British or any other market, in good condition and flavour at the end of several weeks, even if exposed to the high temperature of midsummer weather.

EXPERIMENTS WITH NON-FERTILIZED EGGS.

On the 30th of October, 20 hens of different sorts were placed, without a male companion, in one of the compartments of the poultry house. They were so placed in order to secure non-fertilized eggs, with which to try a series of experiments similar to those described above. It was five weeks before any of these hens began to lay, so that there can hardly be any doubt as to the non-fertility of the eggs. On the

23rd December, 12 of these eggs, each one marked with the date of laying, were placed in the incubator to be kept at a temperature of 80 degrees, and to be examined from time to time and notes taken of their condition. These experiments are being continued.

[NOTE.—A further examination was made as the report was going through the press as follows :—]

24TH FEBRUARY, 1891.

Examination No. 18.—Two eggs were taken from those which had been in the incubator from the 31st October, 1890, till the 11th February, 1891, at which date the incubator tests ceased. In No. 1 egg, the white was found evaporated. The yolk was hard and granular, the two occupying about one-third of the space in the shell; contents quite sweet; no musty odour; no evidence of decay. No. 2 specimen had the yolk semi-solid, with about a teaspoonful of the white still fluid; contents quite sweet and free from all odour.

Examination No. 19.—One egg from those kept part of each day in incubator and part out. About one-third of egg occupied by large air space; yolk easily broken up; small proportion of white; contents quite sweet, both to smell and taste and free from all mustiness. Egg laid 2nd November.

Examination No. 20.—An egg from the lot packed in bran and kept in the cellar. Yolk round and firm; white fairly clear; contents perfectly sweet; has every appearance of a fresh egg; air space not very large. Egg laid 29th October.

Examination No. 21.—An egg from those greased and packed in salt. Yolk round and firm; white nearly transparent; contents perfectly sweet; has every appearance of fresh egg; air space small. Egg laid on the 2nd November last.

Examination No. 22.—An egg from those laid in first week of August last and kept in drawer of table in office. Air space occupied fully one-third of egg-shell; yolk fairly round and firm; white nearly transparent; contents perfectly sweet and free from mustiness.

UNFERTILIZED EGGS.

Examination No. 23.—An egg laid on the 11th December and placed with eleven others in the incubator (at a temperature of 78 to 84°) on the 28th December, and kept there until the 11th February, after which they were kept in the cellar at from 38 to 40°. Yolk nearly round and solid; white slightly opaque; air space large; contents perfectly sweet and free from mustiness.

Examination No. 24.—An egg from twelve unfertilized ones kept in an open basket in cellar at a temperature of 38 to 40. Egg was laid on 9th of January last. Yolk round and firm; white transparent; air space medium; contents perfectly fresh; has every appearance of fresh egg.

Examination No. 25.—An unfertilized egg from a dozen packed in a box in bran and kept in the cellar. Egg laid on the 30th December. Yolk round and firm; white transparent; air space medium; contents perfectly sweet; has every appearance of fresh egg.

Examination No. 26.—An unfertilized egg from a dozen others greased and packed in salt and kept in cellar. Egg laid on 21st January. Yolk round and firm; white transparent; egg perfectly sweet.

Owing to one of the tanks of the incubator starting to leak on the 8th of January it was stopped for repairs for a week and the incubator tests were finally discontinued on the 11th February.

FEEDING HENS FOR EGGS OF FINE FLAVOUR.

To have eggs of fine flavour the hens should be fed on clean food. Fowls fed on putrid meat, decayed or decaying animal substances, will lay eggs not fit to eat. Proof of how the food affects the egg may be had by feeding a number of hens on onions for a certain period. The eggs will become so strongly tainted with the onion flavour as to be unpalatable. Where the farmer allows his fowls unlimited range, it may be said that it is impossible to control their feed, but under no circumstances should the fowls be allowed access to filthy substances. Even the practice of allowing the hens to scratch in the dunghill, as some of the old school of farmers think is necessary for the production of eggs, is not to be recommended. Where fowls are kept for the purpose of money-making, they will be found systematically arranged in certain numbers in pens and their actions under control. Good care, clean food, and clean quarters will be found hand in hand. System and intelligence is as necessary in the management of poultry as in other lines of business.

WHITE OR DARK-COLOURED EGGS.

Should the production of dark or brown-coloured shells be desired for a particular market, either of the following breeds will be found to lay them, viz: Cochins, Brahmas, Wyandottes, Plymouth Rocks or Langshans. Where eggs with white shells are wished, they will be produced by Leghorns, Minorcas, Andalusians, Polands, Hamburghs, Games, Houdans or Dorkings. Where both are required, Plymouth Rocks or Wyandottes, with the Leghorn or Minorcas, will be found to fill the demand most satisfactorily.

RAPID FLESH FORMERS FOR EARLY MARKET.

Experience with twelve of the leading varieties so far has proved that the Plymouth Rock (see report of last year) is the most rapid flesh former, making a good market chicken between three and four months of age. All who try will find this result, provided, the young bird is properly cared for and pushed from time of hatching. (See care and management of chickens.) The Wyandotte matures rapidly, making a round plump market chicken at from four to five months of age. Brahmas do not take on flesh quickly while growing, but after seven or eight months make a fine large bird. Either of the two first named will be found to make early chickens for market.

WEIGHT OF EGGS.

The following figures will give the weights of eggs laid by pullets and hens singly and by the dozen:—

——	Single Egg.	Per Dozen.
	Ozs.	Lbs.
White Leghorn pullet	$1\frac{9}{10}$	1·09
do hen	$2\frac{1}{4}$	1·11
Black Minorca pullet	2	1·07
do hen	$2\frac{2}{3}$	1·11
Andalusian pullet	....	....
do hen	$2\frac{1}{7}$	
Plymouth Rock pullet	2	1·09
do hen	$2\frac{1}{4}$	1·11
Brahma pullet	....	....
do hen	$2\frac{1}{4}$	1·12
Buff Cochin pullet	....	1·08
do hen	....	1·11
Houdan pullet	2	1·08
do hen	$2\frac{1}{2}$	1·12
Wyandotte pullet	2	1·07
do hen	....	1·09

The following is the list of poultry at present :—

LIST OF POULTRY.

Breeds.	Males.	Females.
Langshans	10	11
Brahmas	6	15
Plymouth Rocks	10	24
Buff Cochins	2	12
White Leghorns	8	21
Black Minorcas	10	13
do Hamburgs	3	13
Houdans	2	12
Andalusians	6	6
Mixed	3	25
Wyandottes	3	9
Redcaps		2
Coloured Dorkings		1
Russians		2
Golden Polands		1
B. B. R. Games	1	4
	64	171
		64
		235
Wild geese from Gulf of St. Lawrence		4
Hitchins geese from Hudson Bay		2
		241

ANSWERS TO CORRESPONDENTS THAT MAY GIVE INFORMATION TO OTHERS.

The following letters from a few of the many received during the year, are published in condensed form with the hope that the replies may anticipate information desired by others :—

CALGARY, N.W.T., 17th March, 1890.—A correspondent states that he has taken up land 15 miles from the town and desires eggs from breeds suitable to that climate. He thought money could be made out of eggs and poultry, as the price in winter for the former was 50 to 60 cents per dozen, and the latter 22 to 25 cents per lb. In summer eggs did not sell below 30 cents.

REPLY.—Eggs from Plymouth Rocks, White Leghorns and Houdans were sent. Fear was expressed that the eggs would receive too much shaking *en route* to hatch well.

FORT MACLEOD, N.W.T., 21st March.—The correspondent desires a sitting each of Wyandottes, Silver Pencilled Hamburgs, Black Minorcas, White Leghorns, Black Hamburgs and Plymouth Rocks, as he is going extensively into breeding poultry. He thought the climate suitable, being dry and cool.

REPLY.—It was stated that it would be impossible to send all the eggs wanted. What could be spared would be sent. A request was made to report what success attended his efforts.

ASHCROFT, B. C., 31st March.—The correspondent asks how the Experimental Farm poultry house is built and how it is heated? He is going to erect a house for poultry, and although the climate is genial, it is sometimes necessary to have a stove going. Average price of eggs the year round in his district 25 cents per dozen.

Reply.—Full particulars as to construction of poultry house were sent as given in report of 1889.

Whitewood, N.W.T., 20th April.—The correspondent is about to erect a poultry house and sends his order for eggs a season ahead. The maximum price of eggs in his neighbourhood is 40 to 50 cents per dozen, and minimum 20 to 25 cents.

Reply.—It was stated that eggs would be sent if at all possible.

Toronto, Ont., 18th April.—The correspondent had bought a sitting hen and was afraid that a week or ten days would be too long to keep her waiting for eggs ordered.

Reply.—That if the hen is rid of lice and placed on imitation eggs, in comfortable nest, with feed and water near her (see Farm Report, 1890), that she will sit well when genuine eggs are given her.

Ottawa, 24th April.—The correspondent is about to put up a poultry house; would like it to cost as little as possible, and yet be modern and practical.

Reply.—Suggests battened boards, tar paper, four or six inches of dry sawdust, then boards to be whitewashed; false ceiling of boards, which could be removed in summer; space above ceiling in winter could hold chaff, straw, hay or dry leaves, to be let down as required, for hens to scratch in; board floor, platform and roost, dust bath, nest and box for gravel, grit, &c.; windows not too large.

Toronto, Ont., 14th April.—The writer desires a sitting of White Leghorns to be sent to his brother, who is a farmer. He thinks the breed suited to a farmer, as it is hardy and lays well.

Reply.—That eggs will be sent; that his conclusions are justified by the experience of the breed on the Experimental Farm.

Melita, Man., 12th May.—The correspondent would like to improve his fowls. Desires to know if he can have eggs sent by mail, as he is 25 miles from the nearest express office.

Reply.—The eggs cannot be sent by mail. If they could they would be too much shaken up to hatch.

Wapella, N.W.T., 27th May.—The writer has been informed that eggs are distributed from the farm, and would like a sitting or two of some variety.

Reply.—That a moderate charge per sitting is made for eggs sent to farmers.

Wentworth, N.S., 30th May.—The correspondent desires to know the proper temperature at which to keep his incubator; (2) should the thermometer be left in tray while eggs are being turned? (3) will it hurt the eggs to leave them out till temperature falls to 70? (4) is the incubator to be treated in the same manner for ducks as chickens?

Reply.—To No. 1 query, 102 to 103 degrees. (2.) Yes. (3.) No. (4.) Yes; but the ducks will take a week longer to hatch than chickens.

Langenburg, Assa., 15th May.—Asks how he is to know fertile eggs from others.

Reply.—By looking at egg held in front of tester placed before strong light on seventh day, when the dark outlines of the chick will be seen. The clear ones are unfertile.

Hillhurst, Que., 25th July.—The correspondent would like to exchange two cockerels of large size for a cockerel of the Brahma-Minorca cross, as she has seen by Farm Report that the females of this cross lay very large eggs. Her own fowls (crosses) laid eggs during winter $3\frac{1}{2}$ ozs. each.

REPLY.—That all the Brahma-Minorca crosses turned out hens.

NORTH LANCASTER, ONT., 26th July.—The writer asks if a Buff Cochin and Plymouth Rock would make a good cross. (2) Are the White Plymouth Rocks superior to the barred?

REPLY.—(1) Not much, if anything, to be gained by the cross. (2) Hardly any difference. The barred are to be preferred for farmers, as they do not show the dirt so easily.

NEWCASTLE, N.B., 6th August.—(1) Would like to purchase 6 Leghorn pullets and the same number of Plymouth Rocks.

REPLY.—That the pullets are not disposed of. They are kept for layers.

WALTER'S FALLS, ONT., 29th August.—Desires to know how to distinguish between the gander and goose in his wild geese.

REPLY.—Very hard to distinguish except by size, the female being smaller. They will likely pair in spring, and will breed only in pairs.

SASKATOON, N.W.T., W.T.C., 19th September.—Asks will the White Plymouth Rocks breed true to type and markings.

REPLY.—Yes.

ERINVIEW, P.O., MAN., 8th October.—(1) Desires to know if a log poultry house, well plastered, roofed, floored and well ventilated with windows of one thickness only would be sufficiently warm to keep fowls in, provided with plenty of short straw, hay or chaff, and fed as recommended in Farm Report, 1889. (2) Would like some suggestions, or plan, to keep eggs from freezing going a distance of 45 miles to market, with the thermometer 20, 30 and 40 below zero.

REPLY.—That house should be warm enough with double windows on; but hard to say until size and number of hens to be kept were given. (2) A plan (drawn by Prof. J. W. Robertson, Dairy Commissioner) of an outside case was sent.

CAMPBELLFORD, ONT., 27th November.—(1) Would like to know what kind of poultry was best for a farmer. (2) Which kind of Dorkings is the best?

REPLY.—(1.) Plymouth Rocks and White Leghorns for reasons given on page 108 of report of 1889. (2.) All are good, but the coloured is considered the hardiest.

CALGARY, N.W.T., 15th December.—The correspondent had an incubator made in accordance with instructions given in a poultry book. The eggs were placed on flannel spread over $\frac{1}{2}$ inch of sand on top of a tank, which was heated by a lamp underneath it. The eggs were turned once a day, and sprinkled, slightly, twice *per diem*, with lukewarm water. The day the chicks should have hatched, some of the eggs were broken. The chickens were alive, but did not seem ready to come out. The incubator was kept going as usual, and two days afterwards one chick came out of its own accord and two others with a little help. The next day the eggs were broken, and the great proportion of the chicks seemed to have come to the hatching point, their bodies being covered with down and the yolk taken up, but all were dead in the shell. The incubator was tried again with the same result, except that no chickens were found alive. Temperature first time 105, second time 103, evenly kept up. Would like to have some explanation as to cause of failure of the chicks to hatch out when they had lived so long.

REPLY.—That the incubator was open too often at the hatching period, and probably the chicks were chilled to death. (See management of sitting hens.) The hen sits closely from the 20th day till the chicks are ready to leave the nest. The bottom heat does not seem natural. The hen sits on the top of the eggs. She does not have them on her back. The temperature of 105 seems to be very high, if the thermometer is correct. The most modern incubators are run at a temperature of 102 to 103, and instructions are explicit not to exceed the latter figure. Top heat is used in the latest made incubators and brooders.

SOME GOOD RESULTS.

As showing what a small number of poultry will do, when well cared for and fed, the following from Mr. William Feeley, residing on the Gatineau Road near Hull, P.Q., will be read with interest.

NUMBER OF EGGS LAID BY 15 PLYMOUTH ROCK HENS.

January	214	
February	144	
March	283	
April	280	
May	240	
June	211	one hen killed.
July	197	
August	187	
September	130	
October	75	hens moulting.
November	4	
December	37	
	2,002	

Total cost of feed for the year $17.90.

Four of the hens raised 39 chickens. The cost of the chicken's feed is included in above amount.

One of the pullets began to lay when five months and three days old.

THE POULTRY SHOW AND POULTRY MEETING AT THE TORONTO INDUSTRIAL EXHIBITION.

During the third week of September a visit was paid to the poultry exhibit, one of the features of the Industrial Fair at Toronto. Advantage was taken of the opportunity to attend a special meeting of the Ontario Poultry Association. The exhibition of poultry was very fine and well arranged in a building erected for the purposes of the annual show of fowls. The building is constructed in the most modern style, embracing all latest improvements as to lighting and arrangement of coops. The fowls were exhibited in classes with large cards distinguishing each breed, a method instructive to visitors and highly to be commended. The arrangement by which food and water were always kept before the birds was a great improvement on previous methods, as it prevented the birds from over eating or drinking, as they are apt to do if neglected until very hungry or thirsty. By another ingenious device the entry card was kept in good view but beyond reach of the fowls to pick it to pieces. At the meeting of the Poultry Association, upon invitation, a few remarks were made explaining the methods in operation in the poultry department of the Central Experimental Farm, and the efforts made to instruct the farmers and enlist their interest in poultry, a department of their farms which could be made a paying one by intelligent and systematic management. A vote of thanks expressing the sympathy of the association in the good work being done at the farm, was unanimously carried.

A VALUABLE PRESENT.

During the month of October last, two large and handsome Langshan cockerels were presented to the poultry department of the farm by Mr. W. H. Doel, of Eglinton, North Toronto, a gentleman well known as a veteran fancier and breeder of poultry. The birds are a valuable acquisition to the farm stock, and a splendid instance of skill in mating and the benefit of early hatching.

THE INCUBATOR.

So great was the demand for eggs during the hatching season that it was impossible to save enough to fill the incubator at the early period it was desirable to have it in operation. An effort will be made to hatch out a number of chickens in it during the approaching spring.

THE WILD GEESE.

The wild geese mated in early spring, but did not breed, probably owing to limited quarters and water supply. When removed to a new and more extensive run and pond accommodation they may do better.

VISITORS.

During the year a large number of persons visited the poultry department. Many of them were farmers who sought information as to the best breeds for layers and market fowls, care of chickens, appliances, and the most suitable kinds of food.

RECAPITULATION OF INFORMATION GIVEN IN PREVIOUS REPORTS.

The following summary of information, previously given, may be found useful for reference:—

HOW TO SET A HEN.

Make a comfortable nest on floor or ground.
Place the sitter where other stock cannot annoy her.
Dust the sitter and nest with lice-destroying powder.
Put three or four imitation eggs in nest.
Allow hen to sit on these eggs for two days.
Then give her the valuable eggs.
Give a small hen nine eggs in spring.
A large hen may have eleven eggs, later in season thirteen.
If possible choose a light sitter to put on early eggs.

TREATMENT OF A SITTING HEN.

Have food, drink and dust bath convenient.

In cold weather see that sitter is not off nest more than seven to nine minutes.

In early spring Indian corn is the best food, as the crop can be quickly filled with it.

Do not disturb the sitter, particularly when the chicks are hatching out.

Choose hens that have proved reliable sitters and good mothers.

Should an egg be broken in nest, gently wash remaining ones in luke-warm water and return to nest.

TREATMENT OF CHICKENS.

After hatching leave them in the nest for 24 hours.

Take hen apart and feed her well and give water to drink, or she will eat all the chicken food.

On coming out of nest, feed chicks on bread soaked in milk and squeezed dry, or give dry bread crumbs.

After a few days give chicks all they can eat, as often as they will eat, of bread and milk, or bread-crumbs.

After second day give milk or water in shallow pans for drink.

Be careful bread is not fed too sloppy or looseness will follow.

If chicks appear sick or drooping look for lice. Dust with insect powder carefully.

After two weeks feed wheat sparingly at first, afterwards all they can eat, particularly at night. Vary with crushed corn.

Be careful the chicks are not stinted of food or they will become stunted.

Remember that a chick stunted in first five weeks of its life will never make a plump fowl.

If the hen and chicks are placed in small coops the latter should be cleaned every day, or second day. As the early chicks grow large they should be removed from the younger ones, or the latter will be crowded and make no progress.

HOW TO MATE THE DIFFERENT BREEDS.

Brahmas.—One male with seven females. A cockerel with two year old hens if possible.

Plymouth Rocks.—One male; nine females. A young bird with two year old hens preferred.

White Leghorns.—One cockerel with eleven two or three year old hens.

Houdans.—One male, nine or eleven females.

Black Minorcas.—Same as Leghorns.

Langshans.—Same as Brahmas.

Mixed Fowls.—One male with nine or eleven females.

Wyandottes.—One male with nine females.

The above embraces the best known breeds. Where only one sort is kept and the fowls have unlimited run, a greater number of females may be allowed. Eggs are fertile after fowls have been mated about ten days.

TREATMENT OF LAYING STOCK.

Keep hens warm enough so that their combs will not freeze.

Take chill off water and warm the grain in cold weather.

Keep hens active by throwing grain among straw on floor.

Give meat in regular supply, warm mess in morning and regular supply of grit, gravel, &c.

Supply what the hens can pick up for themselves when outside.

Send layers to roost with their crops full to carry them over night.

Do not give layers soft feed enough to gorge them, or make them lazy.

MISCELLANEOUS.

For layers choose White Leghorns; for general purposes, Plymouth Rocks; for both Wyandottes.

Do not continue to inbreed, or the stock will decrease in size, stamina and value.

Get rid of the three and four year old hens; keep the pullets; eat or sell the cockerels.

Give the poultry as fair a trial as would be given a new kind of seed, vegetable, breed of horses or cattle.

Utilize the grain, vegetable and meat waste of the farm by converting it into poultry and eggs.

REMARKS.

The information sought in the greatly increased correspondence of the past year, goes to show that the farmers are taking a greater interest in their poultry as a source of revenue and an article of food. As to the former, with intelligent and systematic management it will certainly prove satisfactory. As an article of diet it is well known to be both wholesome and delicious.

I have the honour to be, Sir,

Your obedient servant,

A. G. GILBERT,

Manager Poultry Department.

CENTRAL EXPERIMENTAL FARM,
OTTAWA, 31st January, 1891.

EXPERIMENTAL FARM FOR THE MARITIME PROVINCES.

REPORT OF W. M. BLAIR, SUPERINTENDENT.

To WILLIAM SAUNDERS, ESQ.,
Director Dominion Experimental Farms,
Ottawa.

SIR,—I have the honour to submit herewith the following report of the operations on the Experimental Farm for the Maritime Provinces at Nappan, N. S., during the year 1890:—

WEATHER.

The year has been beset with difficulties for farm work. The winter was mild with much rain and occasional short periods of extreme cold, and, as the ground was bare at those periods, the frost penetrated very deep, in many places four feet. The spring was wet, with cold east winds extending into June. Farm work commenced on 6th May, seeding on 17th May, and continued at intervals as the land could be got ready and the weather would permit, until 16th June, during which time there was a continuation of cold which lasted until 1st July. It was then fine with occasional showers until 9th August. Then followed an almost continuous rain for two weeks, which was succeeded by fair weather, with some rain, until 9th September. After this commenced what is called the warm rain, which continued nine days with very warm weather, and which terminated in a flood that destroyed large quantities of grain as well as the late Marsh hay. This was also destructive to potatoes, causing them to rot badly. From that time until October, there was fine weather, with wet again until the ground was frozen 1st December.

MANURE.

450 loads of marsh-mud was drawn from the marsh flats during the time there was sleighing. A dressing of this mud at the rate of 100 loads per acre, usually gives a strong growth of straw, free from rust, with the heads well filled and heavy. The manure from the cattle and horse stables was drawn to the fields during the winter, and eit er spread directly on the land, or, when the litter was long and coarse it was piled up to rot. Care was taken to have the horse and cattle manure well mixed when piled, so as to insure more rapid decomposition.

In addition to this, special fertilizers were used, manufactured by the Provincial Chemical Fertilizing Co., of St. John, N. B., "Ceres" Superphosphate, manufactured by Jack & Bell, Halifax, and bone-meal and phosphate manufactured by Samuel Archibald, Truro, N. S. There appears so far to be very little difference in the quality of these different kinds. In each case we found the grain more plump and heavy in the kernel where it was used, while there was little difference in the growth of straw, indicating that the profit for this expenditure is to be found mainly in the weight and quality of the grain, rather than in the stouter growth of the straw in the field, which is often taken as the chief indication of the value of special fertilizers.

MARSH LANDS.

The English hay in the marsh was heavy and of good quality, and was saved in good condition. The Broad-leaf hay was much winter-killed by the frequent freezing and thawing during the winter, more particularly on the lower portions of the marsh, thus suggesting the necessity of more thorough drainage. This hay is not usually far enough advanced to be cut before 1st September, and was in consequence much damaged by the long wet weather of September. When "Broad-leaf" hay is harvested in good weather, it is of excellent feeding quality, but it requires to stand ten days to make properly before it is ready for the barn or stack.

In order to protect the marsh from being worn away by the action of the tides, and freshets, it was found necessary to build two small break-waters. 40 loads of brush and 20 loads of stone were used for this purpose. The weak places in the dykes were also repaired. Six acres known as the Mines and Forest Marsh, were ploughed and partially levelled. We hope by another year to get these rough pieces in good shape for a seed bed for grass.

WHEAT.

Twenty-eight varieties of wheat were sown. A statement of the date of sowing time of harvesting, number of days from sowing to maturing, quantity per acre and weight per bushel is given below of the most promising kinds.

——	Date of Sowing.	Date of Harvesting.	Number of Days to Mature.	Yield per Acre.	Weight per Bushel.
				Bush.	Lbs.
Green Mountain....	May 20....	Sept. 11....	114	21	60
Hungarian Mountain....	do 20....	do 11....	114	20⅕	60¾
White Fife	do 20....	do 6....	109	29¾	59¾
Wellman's Fife....	do 20....	do 11....	114	40	60½
Indian Red Karachi....	do 20....	Aug. 27....	99	21	61
do Hard do	do 20....	do 27....	99	20	61¼
Judket....	do 20....	Sept. 5....	108	20	59½
Pringle's Champlain....	do 20....	do 4....	107	41	61
White Russian....	do 20....	do 4....	107	31	59¾
Magyar	do 20....	do 11....	114	20	60½
Campbell's Triumph....	do 20....	do 5....	108	30	60½
do White Chaff....	do 20....	do 3....	106	32	60
California White....	do 20....	do 4....	107	21	59⅕
Carter's Cross-bred, Selection I....	do 20....	do 19....	121	29¾	56¾
Indian Hard Calcutta	do 20....	Aug. 27....	99	24¼	62½
White Delhi	do 20....	do 30....	102	13	62
Ladoga....	do 20....	do 30....	102	19	62
Defiance	do 20....	Sept. 19....	121	22	60¼
Rio Grande....	do 20....	do 19....	121	28½	61⅕
Red Fife....	do 20....	do 19....	121	19	60¾
Red Fern....	do 20....	do 19....	121	12½	61¼

OATS.

Twenty-five varieties of oats were sown. A statement showing the best varieties, time of sowing, date of harvesting, yield per acre and weight per bushel is given below.

It must be borne in mind, however, that much of the grain suffered severely with the continuous rain storms which prevailed during harvest-time, causing it to shell badly which reduced the yield in many cases, but just how much cannot be determined.

—	Date of Sowing.	Date of Harvesting.	Number of Days to Mature.	Yield per Acre.	Weight per Bushel.
				Bush.	Lbs.
Victoria Prize	May 17	Aug. 19	94	31	42¾
Waterloo	do 19	Sept. 3	107	16	32
Early English White	do 19	do 21	125	28	42
American Triumph	do 21	do 10	112	37½	31½
Banner	do 21	do 3	105	47½	33
Bonanza	do 21	Aug. 28	99	28	43½
White Tartarian	do 21	Sept. 19	121	51	33
Early Blossom	do 21	do 4	106	45	35½
Prize Cluster	do 21	Aug. 27	98	22½	40
Imported Black Tartarian	do 21	Sept. 10	112	33¾	32¾
Cream Egyptian	do 21	do 4	106	39	37¾
Egyptian	do 22	do 4	107	39¾	38
Flying Scotchman	do 22	do 2	105	39¾	36¼
Welcome	do 24	Aug. 25	93	26¼	40¾
Early Racehorse	do 26	Sept. 1	98	26⅓	42¼
Poland White	do 26	do 1	98	21	42½
August do	do 26	do 1	98	23½	38¾

Thirty-four varieties of barley were grown. A table giving the names, date of sowing, date of harvesting, yield per acre and weight per bushel is given below of the more valuable varieties.

—	Date of Sowing.	Date of Harvesting.	Number of Days to Mature.	Yield per Acre.	Weight per Bushel.
				Bush.	Lbs.
Petschora	May 23	Aug. 19	88	35	45
Large Two-Rowed Naked	do 23	do 27	96	14½	60
English Malting	do 23	Sept. 3	103	21½	48½
Early Minting	do 23	do 3	103	19	48
Peerless White	do 23	do 3	103	32	48½
Selected Chevalier	do 23	do 3	103	44	46¾
Goldthorpe	do 23	do 3	103	29¾	49¼
Baxter's Six-Rowed	do 23	Aug 19	88	20	47¾
Rennie's do	do 23	do 19	88	40	49½
Odessa do	do 23	do 19	88	40½	48½
Bhagarmany Hills (India)	do 23	do 19	88	15½	57
Carter's Prize Prolific	do 23	do 30	99	25	49¼
Sharp's Improved Chevalier	do 23	do 30	99	31	48½

CORN.

Thirty-one varieties of corn were sown for ensilage.

These were all sown on the 6th of June and cut on the 28th and 29th September. The weight per acre and stage of growth when cut are given below. The size of the plots from which the yield has been calculated was one-twentieth of an acre.

The season was much against the growth of corn, being cold and damp, resulting in a light crop.

	Weight per Acre.		Condition when Cut.
	Tons.	Lbs.	
Golden Dent	23	......	In tassel; no ears.
Marblehead	9	500	Glazed.
Extra Early Adams	8	1,000	do
Pee and Kay	12	1,000	In milk.
Golden Beauty	16	1,400	In tassel.
King Phillip	13	1,600	In silking.
Leaming Yellow	17	1,500	Tasseling.
Mammoth Early	17	500	Commencing to silk.
Amber Cream	11	500	Silking.
Thoroughbred White Flint	19	500	Tasseled.
Cinquantine or Fifty-day Corn	12	200	Silking.
Blunt's Prolific	19	500	No tassels.
Hickory King	4	1,000	Tasseled.
Early Concord	11	500	Silked.
Minnesota	11	1,400	In milk.
Long White Flint	17	400	do
Narragansett	10	1,400	Ears glazed.
Extra Early Cory	7	1,000	Full grown ears.
Chester County Mammoth	14	500	Tasseled.
Virginia Horse-tooth	15	1,200	Tasseling.
Perry's Hybrid	11	500	Glazed.
Long Yellow Flint	17	200	In milk.
Mitchell's Extra Early White	7	500	Glazed.
Early Adams	11	1,400	Silked.
Longfellow	13	200	do
Crosby's	12	500	In milk.
Stowell's Evergreen	12	200	Silked.
Queen of the Prairie	13	1,500	Tasseled.
Nova Scotia Yellow	5	500	Well glazed.
Red Cob Ensilage	16	....	No ears; some tassels.

BEANS.

Twenty-five varieties of Beans were planted. Of these only eight varieties, as named below, matured, the others grew well but there was not enough sunshine to ripen them and they rotted.

Ne Plus Ultra	Ripened.
Schirmer's	do
Emperor William	do
Black Speckled	do
Negro Black Long-podded	do
Golden Butter, Wax Black	do
Sugar Pearl	do
Flageolet Purple-seeded	do

MANGELS, CARROTS.

Mangels were a poor crop, but stood in the following order:—

Mammoth Long Red	1st.
do Prize Yellow	2nd.
Warden Prize Yellow Globe	3rd.
Golden Intermediate	4th.

In carrots the Orange Giant gave the best return.

TURNIPS.

Four acres of turnips were grown of the varieties given below.

			Yield per Acre.
Queen of the Swedes,		June 13th	780 Bush.
Skirvings Purple Top Swede,		do	860 do
Bangholm,	do	do	850 do
Lord Derby,	do	do	920 do
Elephant,	do	do	910 do
Purple Top,	do	do	875 do

POTATOES.

Sixty-nine varieties of potatoes were planted, twenty-one of which were seedlings. The majority yielded a good crop, but many of them rotted badly. The dates of planting, character of the tubers and yield are given below.

——	Date of Planting.	Character of Tubers.	Yield.
Experimental Farm seedlings—			
Number 2	May 29	Large long white	Good.
do 10	do 29	do rough	Fair.
do 27	do 29	do do white	Small.
do 73	do 29	Small round	do
do 49	do 29	Long large white	Fair.
do 123	do 29	Small long blue	do
do 153	do 29	Long blue	Good.
do 231	do 29	Small long blue	Small.
do 5	do 29	Long rough white	Fair.
do 15	do 29	do white	Good.
do 53	do 29	do large blue	Fair.
do 80	do 29	Large blue and white	Large.
do 98	do 29	Small round white	Small.
do 120	do 29	Long white	Good.
do 136	do 29	Small round pink	Small.
do 170	do 29	Long blue, medium size	Large.
do 188	do 29	do white	Small.
do 209	do 29	Medium size, round white	Good.
do 116	do 29	Long blue	do
do 122	do 29	Medium long blue	Large.
do 141	do 29	Long blue	Fair.
Rural New Yorker	do 27	Large round white	Good.
Dakota Red	do 27	do pink	do
Rural Blush	do 27	Medium size round pink	Fair.
Stray Beauty	do 27	Small round pink	Small.
Rosy Morn	do 27	Large pink	Fair.
Crown Jewel	do 27	do with white eyes	do
Clark's No. 1	do 27	do	Good.
Late Goodrich	do 27	Round white, deep eyes	do
Rose's New Giant	do 27	Long flat white	do
Empire State	do 27	Round white	do
Thorburn	do 27	Pink and white	do
Rothrant	do 27	do	do
Conqueror	do 27	Round and light, pink eyes	do
Centennial	do 27	do do	do
Jackson's Improved	do 27	White flat	Medium good.
St. Patrick	do 27	Small white	do
Richter's Elegant	do 27	do pink	Small.
Early Callao	do 27	Round white	Fair.
White Star	do 29	Long do	do
Richter's Gem	do 29	Round small white	Small.
Sukreta	do 29	Small white	Fair.
Jumbo	do 29	Long round white	Large.
Richter's Schneerose	do 29	Small white	Good.
Silver Skin	do 29	Long do	Fair.
May Queen Early	do 29	do pink	do
Acadian	do 29	Round smooth purple	Good

	Date of Planting.	Character of Tubers.	Yield.
Early White	May 29	Round white	Good.
Burpee's Extra Early	do 29	Smooth round pink	Fair.
Snowflake	do 29	White	Good.
King of the Earlies	do 29	Large white	do
Six Weeks Round White	do 29	Small round white	Poor.
White Elephant	do 29	White	Good.
Black Montana	do 29	Large round black	Large.
Wonder of the World	June 2	Long white	Good.
Great Eastern	do 2	Round white	do
Sugar	do 2	Flat white, rough skin	Fair.
Early Rose	do 2	Long pink	Good.
Richter's Imperator	do 2	Large round	do
Manhattan	do 2	Dark blue	do
Chicago Market	do 2	Pink	do
Brownell's Superior	do 2	Red	do
Fidelia	do 2	Long blue and white	do
Thorburn's Late Rose	do 2	do pink	Fair.
Beauty of Hebron	do 2	White	Medium.
Burbank s Seedling	do 2	Long white	Fair.
Prolific	do 2	White	Good.
Compton's Surprise	do 2	Blue	do
Gleason's Late	do 2	Long late round blue	do
Early Ohio	do 2	Light pink	do

Among those in which no rot was observed were Rural New Yorker, Dakota Red, Rural Blush, Stray Beauty and Acadian, all the other varieties rotted more or less.

The following results were obtained by planting whole potatoes and different cuts in plots of 30 hills each.

	Yield.
Whole potatoes, smooth and even lots, fair size	54 Lbs.
Half split from seed-end, an average lot	51 "
Seed-end, smooth and even, medium size	52 "
But-end, rough and uneven, some large and some small	55 "
Three eyes, smooth and even, all small	40 "
Two " many small	37 "
One " rough and uneven, all small	29 "

PLOTS FOR TESTING FERTILIZERS $\frac{1}{10}$ OF AN ACRE EACH.

The testing of fertilizers was continued this year on the same plots as last year, of $\frac{1}{10}$ of an acre each—an explanation of which is given on page 118 of Report of 1889—with the addition that one bbl. of "Ceres" Superphosphate was applied to the whole eleven plots, being at the rate of 50c. worth per plot or $5.00 per acre, each of the plots receiving the same amount. The plots were then sown with oats on May 31st. A comparative statement of the yield of last year and this year is given below. The small dressing of special fertilizer this year was given to these plots because the land was poor and the spring was so late.

	Proceeds.		Lbs.
No. 1, Barn Yard Manure	100 lbs oats	—yield for 1889	88
2, Mussel Mud	92 "	— "	47
3, Bone Meal	117 "	— "	54½
4, Fine Ground Phosphate	72 "	— "	44
5, Guano	76 "	— "	49
6, Corn Fertilizer	115 "	— "	62
7, Sup. of Lime	98 "	— "	70
8, Nitrate of Soda	128 "	— "	61
9, Archibald Fertilizer	93 "	— "	69
10, "Ceres" Superphosphate	77 "	— "	68
11, No Fertilizer	79 "	— "	42

DRAINAGE.

About five acres have been drained this year, making in all 55 acres drained since possession was had of the farm in May, 1888.

The land drained has given entire satisfaction, and it is hoped that this much needed work will be pushed vigorously forward next year.

BUILDINGS.

The Superintendent's residence has been completed. A rain-water cistern and a wood furnace were built therein this summer, both of which are giving good satisfaction. The house has been occupied since Nov. 5th.

A silo was built this summer in the barn that will hold 40 tons of ensilage. Two of the old buildings which were much dilapidated have been taken down, the two which still remain are used for storing carts, waggons, implements, etc.

ROADS.

On account of the sticky nature of the soil, it was found necessary to make some permanent roadways to the barns and other buildings, and, as gravel cannot be had in this district, they were made of broken stone. This stone was drawn into an old barn and broken by the men in wet weather. In this way some 60 rods of good road have been made, and the work will be continued another year.

CATTLE.

The cattle bought last fall, were fed during the winter on hay, straw, turnips and meal, and were sold in April for the St John N. B., market, at a good price. By this means all the coarse food and a large proportion of the English hay was converted into beef, and a valuable lot of manure for this years crop secured. Another lot of two and three year old steers are now being fed and a record of the food consumed kept. This consists of English and Broadleaf hay, straw, ensilage, turnips and smashed oats, peas and barley.

During the month of November, ten thorough-bred cattle were brought to the Farm, some of which came from the Central Farm at Ottawa, and the others were purchased in Ontario. They consist of

Four Short Horns, one bull and three females.
Three Holsteins, one do and two do
Three Ayrshires, one do and two do

This selection was made with a view of laying the foundation here for a herd of the three breeds named. The following are the pedigrees of the different animals.

SHORTHORNS—FEMALES.

Countess of Darlington 12th.—Born 19th July, 1885; bought from Richard Gibson, Delaware, Ontario; dam, Countess of Darlington 8th, by Marquis of Kirklevington; 2nd dam, Countess of Darlington by Duke of Airdrie.

Wildame 2nd.—Born 8th Nov., 1886; bought from James Graham, Port Perry, Ontario; dam, Wildame by Prince Victor 5th; 2nd dam, Blossom by Royal Prince.

Columbine.—Born 24th Nov., 1888; bought from Richard Gibson, Delaware; dam, Wild Flower by Duke of Wellington; 2nd dam, Hermosa by Wild Eyes Laddie

Nappan's Fashion bull.—Born 14th May, 1890; bred by George Johnstone, Ashburn, Ontario; dam, Fashion 7th. by Warfare; 2nd dam, Fashion of Maple Hall, by Lancaster; 3rd dam, Fashion 2nd, by K.C.B.; 4th dam, Fashion by Duke of Airdrie.

AYRSHIRES—FEMALES.

Eva.—Born 15th Sept., 1884; bought from Jas. Drummond, Petit Côte, Quebec; dam, Bell by Promotion; 2nd dam, Juno by Lorne.

Count of Ottawa, bull.—Born 23rd Dec., 1889; bred on Experimental Farm, Ottawa; dam, Countess by Rob Roy; 2nd dam, Victoria by Promotion.

Ida.—Born 10th March, 1884; bought from Thos. Guy, Oshawa, Ontario; dam, Mary by Lord Lorne; 2nd dam, Martha by Carluke.

HOLSTEINS.

Nina Rooker.—Born 3rd April, 1884; imported by Smith Powell and Lamb; dam, Mina by "Pieter" by de Ruiter.

Netherland Dorinda of Ottawa.—Born 24th Aug., 1890; bred on Central Experimental Farm, Ottawa; dam, Netherland Dorinda 2nd, by Netherland Pythias; 2nd dam, Netherland Dorinda by Sir Henry 2nd, of Aaggie.

Abi's Netherland of Ottawa, bull.—Born 21st Feb., 1890; bred on Central Experimental Farm, Ottawa; dam, "Abi" by Netherlands Clothilde; 2nd dam, Snowie by Oatka 3rds Neptune jr.

WATER.

The water supply is not as good as it should be. That from the well at the barn is not uniform in quality, as the surface water sometimes fills it up during a heavy rain and makes it turbid. The supply at the house is obtained from the cisterns in the cellars. A better and more uniform supply is needed and some provision should be made for this during the coming summer.

FRUIT TREES.

An orchard was planted last spring, consisting of 144 apple trees of 54 varieties; 12 crab apple trees of 4 varieties; 5 cherry trees of 2 varieties; 30 plum trees of 14 varieties; 46 pear trees of 21 varieties.

Nearly all have made good growth. A few of the pear and apple trees have died; but on the whole the results so far are quite encouraging.

STRAWBERRIES.

The strawberries were badly winter killed. Some had a small quantity of fruit. We allowed them to run to vines and make plants for another year's setting

RASPBERRIES.

Raspberries wintered well and made good growth. Nearly all fruited well.

Blackberries appear to stand the climate well. The winter did not injure them, and they produced good fruit, but not in such abundance as the raspberries.

Gooseberries do well in this district, the Houghton being the most vigorous. The Downing did well; also Smith's Improved. The Red and White currants yielded but little, but Black currants did well

"EXHIBITIONS" AND "FARMER'S INSTITUTES."

Some of the products of the Farm were shown at the exhibition held at St. John, N.B., commencing 24th September, also at Yarmouth on 9th October, and at Sackville, N.B., on 15th October.

The exhibits consisted of the following varieties:—68 of grain in straw and glass; 84 of potatoes; 31 of corn; 13 of grasses. These were all distinct.

At Yarmouth and Sackville the exhibits consisted of the grains and grasses only.

I also attended the "Farmers' Institute" of N.B., held at Fredericton on 28th and 29th January, and was at the meeting of the "Dominion Dairymen's Association" and "Fruit Growers' Association," held at Ottawa on the 17th, 18th and 19th February.

In company with Prof. Robertson, Dairy Commissioner, the following meetings were attended:—The "Dairyman's Association" of N.S., held at Halifax on the 18th and 19th March; two meetings of farmers at Sackville, N.B., on the 20th March; two meetings of farmers at New Glasgow on the 21st, at Antigonish on the 22nd, Nappan on the 24th, and two at Fredericton, N.B., on the 26th.

Besides these named, I attended several meetings in Colchester and Cumberland County during the year. At these meetings, farming in all its branches was discussed, and much interest was manifested by those in attendance.

I have the honour to be, Sir,

Your obedient servant,

W. M. BLAIR,

Superintendent.

EXPERIMENTAL FARM FOR MANITOBA.

REPORT OF S. A. BEDFORD, SUPERINTENDENT.

BRANDON, MANITOBA, Dec. 31, 1890.

To WM. SAUNDERS, Esq.,
Director Dominion Experimental Farms,
Ottawa.

SIR,—I have the honour to submit herewith the following report of the operations on the Experimental Farm for Manitoba at Brandon, during the year 1890.

WEATHER.

Although there has been a deficiency of rain throughout the south-easterly portions of the province, the past season has generally been a favourable one for all farm products. Seasonable showers fell from the 20th to the 23rd of April. During May and June the rainfall was below the average, and for a short time, fears were entertained that the drought of 1889 would be repeated, but happily these fears, so far as this portion of the province was concerned, were dispelled by the abundant rains which fell from the 5th to the 25th of July, and from that date all vegetation made rapid growth. On the 20th of August the wind shifted to the north and continued from that direction until the evening of the 22nd, when the temperature on the lower lands fell below the frost line, slightly injuring the uncut wheat in some portions of the province. Considerable rain fell from the 23rd to the 25th of August, and the first half of September was very wet, greatly delaying harvesting, and in some cases sprouting badly the shocked grain.

The following is a review of the temperature and rainfall for the province during the growing season.

In April the Temperature was 0·7 above the normal. Rainfall, 1·13 or 0·31 inches below the average.

May.—The Temperature was 8·4 below the normal. Rainfall 1·75 inches, or 0·80 inches below the average.

June.—The Temperature was 3·9 above the normal. Rainfall 2·64 inches or 1·07 below the average.

July.—The Temperature was 2·0 above the normal. Rainfall 3·28 inches or 0·24 above the average.

August.—The Temperature was 3·9 below the normal. Rainfall 3·54 inches or 0·60 inches above the average.

September.—The Temperature was 1·7 below the normal. Rainfall 2·83 inches or 1·03 above the average.

WHEAT.

Sixty varieties were sown in large plots on the Experimental Farm this year, 30 varieties on the higher portion of the farm, and 30 acres in the valley. The stronger lands of the valley averaged the largest yields, but the uplands gave the best samples, very little, if any, of the grain from the higher land was injured by the frost of 22nd and 23rd August, but its effects were plainly seen on the late varieties in the valley. A very striking difference was shown in its effects on different varieties of wheat maturing at the same time, the close and heavy chaffed varieties appear the least liable to injury from this cause. White Fife and White Connel are striking examples of this, for although neither of these varieties were much earlier than the Red Fife, the samples were much better.

Tests were made of cutting wheat at different stages of ripeness, but owing to the exceptionally cloudy and wet weather prevailing during harvest, the tests were not reliable for average years.

TEST OF WHEAT ON BACKSETTING.

Deeming it important that all varieties of wheat tested should receive similar treatment, a block of nearly uniform new upland prairie was selected and sown with

37 varieties of wheat in half-acre plots. As it is almost impossible to find a block of land perfectly uniform, the plan of sowing every fourth plot with Red Fife was adopted, thus establishing for comparison a standard growing in close proximity to each variety, the varying yields of Red Fife as shown in the accompanying table will illustrate the necessity of this. The soil of this block was light loam. Seven pecks per acre of seed was sown with a broadcast seeder.

Among these wheats it will be noticed that in yield the Red Fife takes the lead, but it is several days later in maturing than some of the other varieties. In this field the following varieties of wheat are promising, White Connel, a bald, hard, white wheat and the next in yield to the Red Fife. Defiance, a bald, moderately hard, red wheat. Both of these ripened with the Red Fife. Eureka or Red Fern, a bearded, red wheat; Russian Hard Tag, a bearded, hard wheat, but rather ricy, both six days earlier than Fife: Red Connel, a bald wheat, five days earlier, but not as productive as Fife; Ladoga ripened six days in advance of Red Fife, but the yield was less.

In this field was sown ten varieties of wheat obtained from D. McArthur, Esq., of Winnipeg, five of them had the appearance of fall wheats, these were still living when winter set in, they were allowed to remain and some of them may possibly survive the winter and yield a crop next year. The five spring wheats received from Mr. McArthur were Soft Red Calcutta, Hard Red Calcutta, Russian Ghirka, No. 1 Club Bombay and Australian.

Below will be found a list of the wheats grown in this field with yields and other particulars.

Results of Tests with Wheat, sown on backsetting on Prairie:

—	Sown.	Came up.	Headed.	Ripened.	Yield per Acre.		Weight per Bushel.	Matured in.
					Bush.	Lbs.	Lbs.	Days.
Russian Ghirka	April 14	May 8	July 13	Aug. 25	16		64⅓	133
Soft Red Calcutta	do 14	do 8	June 28	do 17	12	7	63¾	125
Red Fife, No. 3	do 10	do 7	July 11	do 22	25	6	63	134
Red Fern	do 10	do 5	do 11	do 18	25	24	64	130
Eureka	do 10	do 5	do 10	do 16	27	16	64	128
White Fife	do 10	do 5	do 10	do 21	26	42	61⅓	133
Red Fife, No. 7	do 10	do 7	do 11	do 22	27	58	62⅓	134
White Connel	do 10	do 8	do 12	do 22	29	14	63¼	134
Red Connel	do 10	do 8	do 10	do 17	26		61⅓	129
Judket	do 10	do 8	do 10	do 20	25	42	61⅓	132
Red Fife, No. 10	do 10	do 8	do 10	do 22	26	6	60⅓	134
Club	do 10	do 8	do 7	do 16	24	16	61½	128
Onega	do 10	do 8	do 2	do 16	10	22	58	128
Defiance	do 10	do 8	do 11	do 22	28	22	60½	134
Red Fife, No. 14	do 10	do 8	do 11	do 16	25	38	60½	......
Golden Drop	do 10	do 6	do 7	do 16	24	16	61¾	128
Old Red River	do 10	do 6	do 10	do 18	23	56	61⅓	130
Rio Grande	do 10	do 7	do 10	do 25	28	12	63¼	137
Red Fife, No. 18	do 10	do 8	do 11	do 25	30		62¼	137
California White	do 11	do 8	June 29	do 25	25	26	62	126
White Delhi	do 11	do 8	do 25	do 14	17	52	61¾	125
Summer Cob	do 11	do 8	July 12	do 25	28	26	61¾	136
Red Fife, No. 22	do 11	do 8	do 11	do 22	30	16	62⅓	133
Campbell's White Chaff	do 11	do 8	do 8	do 19	24	36	61⅓	130
Saxonka	do 11	do 7	do 5	do 19	23	56	63¼	130
Ladoga	do 11	do 6	do 7	do 16	21	20	59⅓	127
Red Fife, No. 30	do 11	do 8	do 11	do 22	29	12	62¼	133
Russian Hard Tag	do 11	do 8	do 5	do 17	26	48	64	128
No. 1 Club Bombay	do 11	do 8	do 11	do 15	12	16	60⅓	126
Red Fife, No. 34	do 11	do 8	do 11	do 20	33		62¼	131
Hard Red Calcutta	do 11	do 8	do 11	do 16	24	40	64	127
Australian	do 11	do 8	do 11	do 18	30	50	60½	129

WHEATS IN THE VALLEY.

Besides the varieties sown on backsetting, 32 varieties were sown after fodder corn in the valley.

These plots were all under half an acre, and were sown from the 7th to the 23rd of April. In this case also one plot in each block was sown with Red Fife.

Some of the noticeable wheats among these are Hard Calcutta, one of the best Indian wheats, fairly productive, and 13 days earlier than Red Fife; Wellman's Fife, a good hard variety, four days earlier than Red Fife, and a heavy cropper; French Imperial, 10 days earlier than Fife, productive but rather soft.

Two of Carter's crossbred wheats were also tested in these plots, one of them ripened with the Red Fife, and the other 26 days later. In neither case was the sample equal to Red Fife.

RESULTS of Tests with Wheat sown in valley.

—	Sown.	Came up.	Headed.	Ripened.	Yield per Acre.		Weight per Bushel.	Matured in
					Bush.	Lbs.	Lbs.	Days.
Red Fife, No. 24	April 7..	May 5..	July 10..	Aug. 22..	30		61	137
Colorado	do 7..	do 5..	do 7..	do 14..	31	15	61	129
Blue Stem	do 7..	do 2..	do 10..	do 18..	33	20	59	133
Herison's Beardless	do 7..	do 2..	do 10..	do 22..	16	40	56¼	137
Wellman's Fife	do 7..	do 2..	do 10..	do 18..	30	25	60½	133
French Imperial	do 7..	do 1..	do 9..	do 12..	31	15	61½	127
Hard Calcutta	do 7..	do 4..	June 27..	do 9..	25	25	63	124
Lahoul, from India	do 7..	do 2..	July 2..	do 16..	22	30	53⅔	131
Hueston's	do 7..	do 3..	do 9..	do 18..	29	35	60	133
Talavera	do 7..	do 5..	do 20..	do 25..	19	10	57½	140
Club Calcutta	do 7..	do 5..	do 1..	do 16..	27	5	59	131
Red Fife, No. 37	do 7..	do 5..	do 10..	do 22..	25	11	59¾	137
Hungarian Mountain	do 7..	do 2..	do 9..	do 16..	30	37	60¼	131
Indian Karachi	do 7..	do 5..	June 24..	do 16..	15	37	59½	131
Wheat, No. 1,701	do 7..	do 3..	July 9..	do 18..	23	32	59½	133
Paine's Defiance	do 7..	do 5..	do 10..	do 18..	22	17	58½	133
Magyar	do 7..	do 5..	do 20..	do 25..	20	12	61	140
Greek Summer	do 7..	do 5..	do 2..	do 15..	19	47	58	130
Simla, from India	do 7..	do 6..	do 5..	do 16..	17	42	57½	131
Campbell's Triumph	do 7..	do 2..	do 9..	do 19..	23	57	60¼	134
Green Mountain	do 7..	do 2..	do 8..	do 19..	26	33	61	134
Pringle's Champlain	do 7..	do 2..	do 8..	do 19..	29	3	61	134
Soft Red Calcutta	do 7..	do 5..	June 28..	do 12..	8	45	63¾	127
Chilian White	do 9..	do 2..	July 8..	do 22..	23	37	58	135
Spiti Valley	do 9.	do 2..	do 2..	do 9..	9	2	46¾	122
Defiance, J. A. Bruce	do 9..	do 2..	do 1..	do 20..	20	12	59½	133
Red Fife, No. 49	do 17..	do 12..	do 15..	do 22..	25	20	60½	127
Carter's Selection, I	do 17..	do 12..	do 19..	do 22..	26		......	127
Carter's Selection, D	do 17..	do 13..	do 22..	Sep. 17..	21	37	56¼	153
Red Fife, No. 52	do 23..	do 12..	do 15..	Aug. 22..	34	17	60½	121
Assinaboia	do 23..	do 13..	do 14..	do 22..	31	6	60½	121
Newton Club, Fallow land	do 24..	do 10..	....	do 16..	15	35	58	114
Red Fife, do	do 24..	do 21..	do 21..	do 30..	24	40	60½	128

FROZEN WHEAT FOR SEED.

A quantity of frozen seed from the crop of 1888 was procured and sown in adjoining half acre plots of new land, at the rate of 2 bushels per acre, sown broadcast. The soil was apparently uniform and the test complete.

Although the loss from slightly frozen grain was small, the No. 3, or badly frozen seed, gave considerably less than the No. 1 hard, and in an unfavourable season the difference would no doubt be greater.

TEST WITH FROZEN SEED SOWN ON BACKSETTING.

———	Sown.	Came up.	Headed.	Ripened	Yield Per acre		Weight per Bushel.	Matured in
					Bush.	Lbs.	Lbs.	
Red Fife, No. 1 Hard	April 16	May 9	July 12.	Aug. 23.	33	4	61½	129 days.
do No. 1 Frozen	do 16	do 9	do 14.	do 25.	32	40	59½	129 do
do No. 2 do	do 16	do 9	do 14.	do 25.	32	20	62	129 do
do No. 3 do	do 16	do 9	do 14.	do 25.	28	56	62	129 do

TEST WITH FROZEN SEED SOWN ON FALLOW LAND IN VALLEY.

———	Sown.	Came up.	Headed.	Ripened	Yield Per acre		Weight per Bushel.	Matured in
					Bush.	Lbs.	Lbs.	
Red Fife, No. 1 Hard	April 7.	May 2	July 11.	Aug. 20.	24	49	61½	135 days.
do No. 1 Frozen	do 7.	do 2.	do 11.	do 25.	23	23	60¾	140 do

SMUT.

The aggregate loss sustained by the farmers of this province from smut is very large.

Although the majority of farmers consider that the treating of seed with preparations of bluestone, salt, &c., has a beneficial effect, reliable experiments conducted in the province to test the different methods were much needed.

During the past season a quantity of very badly smutted wheat was procured and sown in four adjoining plots, each one-tenth of an acre. Plot No. 1 was sown with wheat not treated. Plot No. 2 was sown with wheat treated with bluestone; 1 lb. of bluestone being dissolved in a pail of hot water, and applied to ten bushels of wheat, which was then left to soak for three hours. Plot No. 3 was treated with a salt brine sufficiently strong to float an egg, the seed being soaked in the brine three hours and then dried. Plot No. 4 was treated by the Jensen or hotwater method, the seed placed in a gunny sack, was immersed in water heated to a temperature of 130 degrees. Fah. then removed to another boiler of water heated to 132 deg. and soaked in the latter for 15 minutes.

All were in adjoining plots and received similar treatment during growth and harvesting; when ripe 200 heads were taken from each plot and examined. Plot No. 1 or untreated gave 6 per cent. of smutty heads. Plot No. 4 or scalded gave 1 per cent. of smutty heads while none of the 200 heads from plots No. 2 and 3, (the bluestoned and salted) were smutty.

After threshing, the grain was again examined, and the bluestoned gave two smut balls to the thousand grains of wheat, the salted gave three, and the scalded five, while the untreated gave 29.

These results would point to the conclusion that none of these methods can be depended upon to completely destroy the spores in badly smutted seed, but the bluestone treatment was one of the most successful, its application requires the least labor and leaves the seed in the best condition for sowing. Below will be found the yield and other particulars of this experiment.

—		Sown.	Came up.	Headed.	Ripened	Yield per Acre.		Smutty Head.	Smut Balls in Grain.	Matured in.
						Bush.	Lbs.			Days.
Red Fife,	Untreated	April 23	May 9	July 10.	Aug. 22.	23	18	6½ per c.	29 per 1,000	121
do	Bluestoned	do 23	do 9	do 10.	do 22.	25	11	None.	2 do	121
do	Salted	do 23	do 9	do 11.	do 22.	22	9	do	3 do	121
do	Scalded	do 23	do 9	do 9.	do 22.	23	44	1 per c.	5 do	121

FALL SOWN SPRING WHEAT.

The Red Fife mentioned in my last report as having been sown in November, 1889 was late in appearing above ground, and was very thin all summer, the past year apparently not being favourable for fall sown spring wheat.

The spring sown grain gave 30½ bushels and the fall sown 12¼ bushels per acre, the fall sown ripened two weeks later than the spring sown.

FALL WHEAT.

One variety of fall wheat was sown 26th of August, 1889, and two others on the 2nd of September, these germinated well and the plants covered the ground before winter set in, and were apparently uninjured when spring opened, but the changeable weather in early spring killed all, except a few plants of the Democrat variety growing in a depression, these escaped and yielded about 13 lbs of very fine wheat. This will be sown during the coming fall and may prove more hardy than the imported seed.

OATS.

Twenty varieties of oats were tested on the upland prairie, in adjoining half acre plots, soil a light loam, broken the previous year. All were sown with the Broadcast Seeder, at the rate of 2½ bushels per acre. The soil proved to be very uniform, the oats stood up well, and the test of varieties was apparently satisfactory in every respect. The varieties being all on adjoining plots, this field was a source of great interest to visitors during the season.

In addition to the above, 8 varieties were sown in the valley on fall ploughing after roots. This field being subject to injury from drifting soil, the seed at the rate of 2½ bushels per acre was sown with the Press Drill. Although the crop in this field was badly lodged, none of the grain was lost, and the experiment was in every respect satisfactory.

OATS SOWN ON BACKSETTING ON PRAIRIE.

—	Sown.	Came up.	Headed.	Ripened.	Yield per Acre. Bush.	Yield per Acre. Lbs.	Weight per Bushel. Lbs.	Matured in Days.
English White Oat	April 15..	May 12..	July 12..	Aug. 16..	83	12	36¼	123
Early Blossom	do 15..	do 13..	do 17..	do 22..	82	32	37½	129
Early Calder	do 15..	do 13..	do 14..	do 22..	81		36	129
Black Tartarian	do 16..	do 13..	do 20..	do 22..	78	22	33½	128
Glenrothern	do 15..	do 13..	do 18..	do 22..	77	4	35½	129
New Zealand	do 14..	do 12..	do 17..	Sept. 9..	76	2	37¼	148
Black Champion	do 16..	do 13..	do 20..	Aug. 25..	74	4	35¼	131
Banner	do 14..	do 8..	do 16..	do 18..	73	18	39	126
White Russian	do 15..	do 13..	do 14..	do 16..	73	4	40½	123
Australian	do 14..	do 12..	do 14..	do 18..	72	2	36¾	126
Welcome	do 15..	do 13..	do 10..	do 15..	72		37	122
Flying Scotchman	do 15..	do 13..	do 12..	do 22..	71	14	39¾	129
Winter Grey	do 15..	do 13..	do 10..	do 16..	69	25	41¾	123
Rennie's Prize White	do 16..	do 12..	do 10..	do 14..	68	16	41½	120
August White	do 15..	do 13..	do 17..	do 18..	63	18	42	125
English Potato	do 15..	do 13..	do 16..	do 21..	62	20	40¾	128
White Poland	do 15..	do 13..	do 12..	do 18..	59	24	41¼	125
Prize Cluster	do 15..	do 13..	do 11..	do 16..	54	14	42¼	123
Early Racehorse	do 14..	do 12..	do 12..	do 18..	51		42	126
Red Oats	do 16..	do 9..	do 20..	do 22..	48	30	36¼	128

OATS SOWN AFTER POTATOES IN VALLEY.

—	Sown.	Came up.	Headed.	Ripened.	Yield per Acre. Bush.	Yield per Acre. Lbs.	Weight per Bushel. Lbs.	Matured in. Days.
American Beauty	April 17..	May 10...	July 15..	Aug. 23..	85	19	37	128
Golden Side	do 17..	do 15..	do 14..	do 23..	80	27	37	128
Welcome	do 17..	do 15..	do 15..	do 15..	77	8	37	120
Holstein	do 17..	do 12..	do 15..	do 30..	72	24	35¾	135
American Triumph	do 17..	do 11..	do 16..	do 22..	69	10	35¾	127
Rosedale	do 17..	do 15..	do 15..	do 20..	63	13	37¾	125
Archangel	do 17..	do 12..	do 8..	do 15..	60	24	38	120
Swedish	do 17..	do 12..	do 15..	do 28..	56	24	35¼	133

To test the comparative values of newly imported seed oats, with oats sown for a succession of years in this Province, four plots of backsetting were sown with importations from Britain, made at different dates, the plots were side by side, soil a uniform light loam, 2½ bushels per acre of seed was sown with a Broadcast Seeder.

—	Sown.	Came up	Headed.	Ripened.	Yield per Acre. Bush.	Yield per Acre. Lbs.	Weight per Bushel. Lbs.	Matured in. Days.
Black Tartarian, imported prior to 1888	April 16..	May 13..	July 20..	Aug. 22..	76	2	35	128
do do in 1888	do 16..	do 13..	do 20..	do 22..	78	22	35	128
do do in 1889	do 16..	do 13..	do 20..	do 22..	69	14	34½	128
do do in 1890	do 16..	do 13..	do 20..	do 22..	77	14	34	128

A very interesting experiment, and one which may lead to good results, was undertaken in connection with our oat tests. Five pecks of Black Tartarian seed was selected, the kernels being all heavy, plump and black. This was sown alongside of unselected seed, and gave a yield of 88 bushels per acre, in comparison with 76 bushels from the unselected, or a gain of 12 bushels per acre from selection.

BARLEY.

Throughout the westerly portion of this province the season has been exceptionally favourable for the growth of barley, and the yield has been large. Owing, however, to the unfavourable weather at harvest time, the sample is not as bright as usual.

On the Experimental Farm 12 varieties of the two-rowed were sown in half acre plots on backsetting; 2 bushels of seed per acre was used; soil a light, gravelly loam; all stood up well, and the soil being apparently uniform, the test of varieties was a very fair one.

The Danish Chevalier was one of our best varieties last season, and has this year given slightly the best yield among the two-rowed, both on the high land and in the valley. This excellent variety is said to be in active demand on the English market, and appears well adapted to our climate.

BARLEYS SOWN ON BACKSETTING.

—	Sown.	Came up	Headed.	Ripened.	Yield per Acre.		Weight per Bushel.	Matured in
					Bush.	Lbs.	Lbs.	Days.
Danish Chevalier	April 25	May 13	July 15	Aug. 16	51	36	53	113
Peerless White	do 25	do 13	do 13	do 18	49	38	54½	115
Swedish	do 25	do 12	do 9	do 14	49	30	55	111
Beardless	do 25	do 15	do 15	do 15	48	20	52¼	112
Thanet	do 25	do 12	do 12	do 18	48	10	54	115
Two-rowed Duckbill	do 25	do 13	do 10	do 14	48	12	52¼	111
Golden Melon	do 25	do 13	do 14	do 16	47	36	53	113
Danish Printice Chevalier	do 25	do 13	do 15	do 16	46	40	52⅓	113
Prize Prolific Imported seed	do 25	do 13	do 16	do 16	43	42	53	113
do do Manitoba seed	do 25	do 13	do 16	do 16	42	26	53	113
English Malting	do 25	do 13	do 14	do 18	40	40	54⅓	115
New Zealand	do 25	do 13	do 18	do 14	40	8	54½	111

Eleven varieties of barley were also sown in the valley, on land planted with potatoes the previous year. All were more or less lodged, but were cut without waste.

Of the two-rowed varieties in this field, the Prize Prolific gave the largest yield, and the Goldthorpe had the stiffest straw. Of the six-rowed varieties, the Odessa gave the largest yield, 68½ bushels per acre, the largest yield of any variety of barley grown on the farm. Baxter's six-rowed gave great promise when growing, but was disappointing when threshed.

Barley Sown after Roots in valley.

—	Sown.	Came up.	Headed.	Ripened.	Yield per Acre.		Weight per Bushel.	Matured in.
					Bush.	Lbs.	Lbs.	Days.
Goldthorpe	May 5	May 23	July 21	Aug. 23	56	25	52½	111
Prize Prolific	do 5	do 22	do 21	do 24	59	43	52¾	111
Saale	do 5	do 22	do 21	do 20	40	14	51	107
Odessa Sixrowed	do 5	do 22	do 7	do 14	68	24	51¼	101
Rennie's do	do 5	do 23	do 8	do 10	54	26	52	97
Baxter's do	do 5	do 22	do 10	do 7	44	2	49½	94
Palampur, from India	do 5	do 22	June 28	do 11	60	29	43½	98
Kulu, from India	do 5	do 23	July 11	do 17	50		48	104
Seoraj do	do 5	do 22	June 30	do 19	47		45½	106
Spiti Valley, from India, Hulless	do 5	do 22	do 30	do 6	39	18	53¾	93
Bhagarmany Hills, from India, Hulless	do 5	do 22	July 10	do 7	39	14	55½	94

PEAS.

Seven varieties of field peas were grown on the farm. These were drilled in on a sandy loam soil at the rate of three bushels per acre of the smaller varieties and three and one-half bushels per acre of the larger ones.

Variety.	Sown.	Came up.	In pod.	Ripened.	Yield per Acre.
					Bush.
Multiplier	April 19	May 12	July 10	Aug. 19	24·20
Prince Albert	do 19	do 10	do 11	do 15	22
Prussian Blue	do 19	do 11	do 9	do 13	21·15
Early Field	do 19	do 10	do 10	do 14	18·35
Crown	do 19	do 11	do 9	do 13	18·30
Golden Vine	do 19	do 10	do 11	do 15	16·30
White-eyed Marrowfat	do 19	do 12	do 11	do 19	11·45

GRAIN SOWN ON STUBBLE LAND.

As a large proportion of the crop of this Province is sown on stubble land, it was thought advisable to test the different methods of sowing on stubble.

It will be seen by the accompanying table, that wheat plowed in on oat-stubble gave a smaller return than that drilled in, but oats on the other hand succeeded best when ploughed in, and oats following a crop of wheat yielded better than two successive crops of oats.

The plots were half an acre in area. Soil, a uniform stiff clay loam.

WHEAT ON OAT STUBBLE.

——	Sown.	Came up.	Headed.	Ripened.	Yield per Acre.	Weight per Bushel.	Matured in
					Bush.	Lbs.	Days.
Red Fife, ploughed in......	April 21..	May 10..	July 18..	Sept. 2..	20	62½	134
do drilled in	do 21..	do 16..	do 20..	do 2..	22	62¼	134
OATS ON WHEAT STUBBLE.							
Welcome, ploughed in	April 18..	May 17..	July 14..	Aug. 15..	56·27	44½	119
do drilled in	do 18..	do 10..	do 11..	do 15..	51·16	44½	119
OATS ON OAT STUBBLE.							
Welcome, ploughed in.	April 18..	May 17..	July 14..	Aug. 15..	49·30	42	119
do drilled in	do 18..	do 10..	do 10..	do 15..	41·10	42	119

DIFFERENT DATES OF SOWING.

To lessen chances of error and to gain information as to the best time of sowing, it was thought advisable to continue the experiment of sowing the different kinds of grain at varying dates.

It would appear, in a season similar to the past one, that both wheat and barley succeed best when sown about the middle of April, this is about the date at which the bulk of the wheat is usually sown in the Province, but it is much earlier than it is customary to sow barley.

Oats were also included in this experiment, but owing to wet weather the harvesting of this grain was delayed until the early sown was badly shed, and the returns being inaccurate are not given.

The plots were 1 acre for wheat, and ½ an acre for barley. Soil a clay loam.

WHEAT.

——	Sown.	Came up.	Headed.	Ripened.	Yield per Acre.	Weight per Bushel.	Matured in
					Bush.	Lbs.	Days.
Red Fife, sown early	April 7..	May 2..	July 18..	Aug. 20..	24·49	60¼	135
do do medium....	do 19..	do 9..	do 19..	do 25..	25·38	....	128
do do late........	do 24..	do 17..	do 21..	do 30..	24·40	60½	128
BARLEY.							
English Malting, sown early	April 16..	May 8..	July 16..	Sept. 3..	45·40	52½	140
do do medium	do 24..	do 10..	do 17..	do 3..	45·32	52½	132
do do late....	May 22..	June 5..	do 28..	do 6..	43·36	52½	107

THICK, MEDIUM AND THIN SOWING.

The experiments on this line began with oats in 1889, were continued during the past year, and included oats, wheat and barley. All were sown with the common drill, the soil a strong clay loam.

As will be seen from the accompanying tables, 7 pecks of wheat per acre, 2¼ bushels of oats and 2 bushels of barley gave the best returns.

WHEAT.

——	Sown.	Came up.	Headed.	Ripened.	Yield per Acre.	Weight per Bushel.	Matured in
					Bush.	Lbs.	Days.
Red Fife, 5 pecks per acre..	April 5..	April 30..	July 8..	Aug. 19..	28·28	....	136
do 6 do ..	do 5..	do 30..	do 8..	do 19..	29·35	....	136
do 7 do ..	do 5..	do 30..	do 8..	do 19..	30·55	....	136
do 8 do ..	do 5..	do 30..	do 8..	do 20..	30·5	....	137

OATS.

Blk Tartarian, 9 pks per acre	April 16..	May 10..	July 17..	Aug. 28..	61	34¾	134
do 10 do ..	do 16..	do 10..	do 17..	do 28..	54·3	34½	134
do 11 do ..	do 16..	do 10..	do 17..	do 28..	54·12	34½	134
do 12 do ..	do 16..	do 10..	do 17..	do 28..	51·14	36	134

BARLEY.

Prize Prolific, 6 pks per acre	April 24..	May 12..	July 17..	Aug. 30..	50·36	52½	128
do 8 do ..	do 24..	do 12..	do 17..	do 30..	58·04	52¾	128
do 10 do ..	do 24..	do 12..	do 17..	do 30..	47·12	53	128

TEST OF DRILLS.

Much attention has been directed to the question of common and press drill against broadcast sowing of grain, some very satisfactory tests with oats were made on the farm last year, proving conclusively that in a very dry season drilling of oats is preferable to broadcasting, these experiments have been continued and enlarged this year by testing the sowing of wheat, oats and barley on adjoining plots, with common drill, press drill and broadcast seeder, the plots on which these experiments were carried on were a great source of interest to visiting farmers.

Although in yield the drilled grain is but little in excess of broadcast, in the tests with wheat and oats the drilled crops matured in from four to nine days in advance of that sown with the broadcast seeder, an important consideration in a season like the past one, it was also noticed that the drilled grain germinated earlier and more evenly, and that fewer immature heads were seen at harvest time than with the broadcast.

To obtain reliable data these experiments should be extended over a number of years so as to include various seasons.

Below will be found full particulars referring to this experiment.

TEST OF DRILLS.

——	Sown.	Came up.	Headed.	Ripened.	Yield per Acre.	Weight per Bushel.	Matured in
Wheat, 1 *acre.*					Bush.	Lbs.	Days.
Red Fife, sown with common drill	April 5	April 30	July 8	Aug. 15	30·24	60¾	132
Red Fife, sown with press drill	do 5	do 28	do 6	do 15	29·31	60½	132
Red Fife, sown with broadcast seeder	do 5	May 2	8	do 19	28·20	61	136
Barley, ½ *acre.*							
Danish Chevalier, sown with press drill	April 24	May 10	July 17	Aug. 24	60·14	52	122
Danish Chevalier, sown with common drill	do 24	do 12	do 17	do 24	56·10	52	122
Danish Chevalier, sown with broadcast seeder	do 24	do 15	do 20	do 24	50·46	53	122
Oats, ½ *acre.*							
Black Tartarian, sown with press drill	April 16	May 9	July 17	Aug. 21	72·30	34	127
Black Tartarian, sown with common drill	do 16	do 10	do 17	do 21	72·22	34½	127
Black Tartarian, sown with broadcast seeder	do 16	do 14	do 19	do 30	56·32	35½	136

SPRING VERSUS FALL BREAKING.

Although not generally recommended there are a few advocates of fall breaking, principally among new arrivals from the East. To test this question, half an acre of upland prairie was broken two inches deep in May and back-set in September, the adjoining half-acre was broken in September six inches deep, but not back-set.

The result as seen below was decidedly in favour of spring breaking.

——	Sown.	Came up.	Headed.	Ripened.	Yield per Acre.	Weight per Bushel.	Matured in
					Bush.		Days.
Red Fife, sown on spring breaking	April 11	May 8	July 11	Aug. 22	28·38	....	133
Red Fife, sown on fall breaking	do 11	do 8	do 11	do 22	14·20	....	133

GRAINS GROWN AS SINGLE PLANTS.

During the year the following have been grown as single plants, viz., 123 varieties of wheat, 86 of oats and 67 of barley. Fifty kernels of each variety were planted one foot apart and kept free of weeds.

These plots were convenient to the buildings, and enabled the growth of the different varieties to be studied and compared with the expenditure of very little time.

The different varieties were harvested in good order, and will be separately threshed and weighed during the present winter.

TURNIPS.

During the past season, seventeen varieties of turnips have been grown. All were drilled in on the level in rows three feet apart; soil a sandy loam.

As a number of the varieties were badly injured by a cut-worm, while others escaped, the experiment as a comparison of varieties is not accurate.

Slacked lime placed near the plants was found to destroy a large number of the cut-worms.

Swedes.	Sown.	Harvested.	Yield per Acre.
			Bush.
Queen of the Swedes	June 3 and July 19	Oct. 20	1,048
Bangholm	do 3 do 19	do 20	953
Munster	do 3 do 19	do 20	792
Lord Derby	do 3 do 19	do 20	586
Purple Top	do 3 do 19	do 20	568
Skirvings	do 3 do 19	do 20	410
Elephant	do 3 do 19	do 20	344
White and Yellow-fleshed Turnips.			
White Stone	July 3	do 20	1,320
White Sixweeks	do 3	do 20	1,305
Early Milan	do 3	do 20	1,133
Flat White Dutch	do 3	do 20	861
Orange Jelly	do 3	do 20	836
Breadstone	do 3	do 20	781
Purple Top Strap-Leaf	do 19	do 20	605
Red Top Strap-Leaf	do 19	do 20	495
Large White Norfolk	do 19	do 20	322

MANGELS AND SUGAR BEETS.

Five varieties of mangels and three varieties of sugar-beets were sown; with the exception of one variety of mangel, all were destroyed by cut-worms

Selected long red mangel gave 825 bushels per acre.

CARROTS.

Carrots have suffered severely from the attacks of cut-worms. One of the varieties was completely destroyed, and the others badly injured. All the varieties were sown on the level in rows three feet apart.

—	Sown.	Harvested.	Yield per Acre.
			Bush.
White Field Carrots	April 21	Oct. 21	381
Danvers Orange Red	do 21	do 21	256
Early Scarlet Shorthorn	do 21	do 21	231
Chantenay	do 21	do 21	224
Mitchell's Early Perfection	do 21	do 21	165

POTATOES.

The past season has been exceptionally favourable for potatoes, and the yield large. A number of varieties of potatoes planted on this farm in 1889 proving either unproductive or inferior in quality were discarded and others added. Among the new varieties tested are 29 seedlings raised on the Central Experimental Farm, Ottawa. One of these, No. 80, heads the list for productiveness. All were ploughed in on the 24th of May; soil a clay loam; field was sown with roots in 1889. Twenty-three varieties have also been raised from seed on this farm, and will be tested next season; in all, 101 different sorts were grown this year. A number of varieties were tested during winter to ascertain their cooking qualities.

Name.	Colour.	Yield per 100 Sets.	Quality.
		Lbs.	
C. E. F. Seedling, No. 80	White	315	Only fair.
Thorburn's Late Rose	Red	255	Fair, late.
Genessee Seedling	White	251	Good flavor, dry.
Jumbo	do	248	Wet.
C. E. F. Seedling, No. 120.	do	243	Fair flavor, dry.
Beauty of Hebron	Red	241	Dry, good flavor.
Early Rose	do	240	do
Empire State	White	238	Fair, damp.
White Star	do	236	Medium, wet, bad.
Roses New Giant	do	234	Wet.
Richter's Imperator	do	233	Wet, yellow, poor.
Clark's No. 1	do	232	Good, dry.
Thorburn's Paragon	White, round	230	Fair flavor, damp.
Early Conqueror	White	228	Poor, soft and wet.
Wonder of the World	Light pink	228	Good, dry.
Alpha	White	223	Fair, good flavor.
Richter's Schneerose	White, long	212	Wet.
Jackson's Improved	White	210	Dry, good flavor.
St. Patrick	do	209	Damp, fair.
Sugar	do	206	Wet, good flavor.
C. E. F. Seedling No. 15	do	204	Very good, dry.
do do 225	do	205	Poor quality, wet.
Thorburn's	Pink	198	
C. E. F. Seedling No. 9	White	198	Good flavor, dry.
do do 209	do	198	Fair, dry.
Burbanks Seedling	do	197	Damp, poor.
Niagara	do	195	Very wet, yellow.
C. E. F. Seedling No. 188	do	195	Very good, dry.
Algiers	do	183	Poor, wet.
Snowflake	do	183	Dry, good, white.
Amon's Early		181	
C. E. F. Seedling No. 27	do	180	Good, dry
Brownell's Best	do	179	do
C. E. F. Seedling No. 118	do	177	Poor flavor, wet.
Giant Long Dutch	do	175	
Member of Parliament	do	173	Wet, poor flavor.
King of the Earlies	do	172	
Early Callao	do	171	Dark, poor, wet.
Brownell's Beauty	White and pink	171	Wet.
Centennial	White	170	Poor flavor, wet.
White Elephant	do	163	Fair.
Six-weeks Round White	do	162	Fair, damp.
Chicago Market	Pink	165	Very good, dry.
C. E. F. Seedling No. 122	Dark red	162	Good flavor, dry.
do do 94	Yellow	162	do
do do 21	White	162	Very good, dry.
Telephone	do	159	Good flavor, dry.
C. E. F. Seedling No. 5	do	156	Wet, poor flavor.
Patterson's Albert	do	154	Very wet, yellow.
C. E. F. Seedling No. 231	Dark red	153	Good flavor, dry.
May Queen, Early	Pink	152	Good, dry.

Name.	Colour.	Yield per 100 Sets.	Quality.
		Lbs.	
C. E. F. Seedling No. 46	Dark red	150	Fair, dry.
do do 53	do	147	Poor flavor, wet.
do do 54	White	145	Very good flavor, dry.
do do 10	do	144	Poor quality, wet.
do do 98		144	
do do 73	do	144	Fair, slightly wet.
Rosy Morn	Pink	144	Dry, very good.
Early Calico	White, red spots	142	Medium, poor.
C. E. F. Seedling No. 83	White	141	Good flavor, dry.
Eye Carpenter		140	Extra good, dry.
Pride of America	do	133	Dry, fair flavor.
C. E. F. Seedling No. 177	Dark red	126	Fair flavor, damp.
Sukreta	White	124	Good, dry.
C. E. F. Seedling No. 141	do	123	do
Bliss's Triumph	Red	120	do
Emperor William	White	119	Fair, dry.
Manhattan	Blue, white spots	117	Good, dry.
Early Short-topped		114	do
C. E. F. Seedling No. 2	White	111	do
American Magnum Bonum	do	109	Damp, yellow.
C. E. F. Seedling No. 170	Red	102	Fair, rather wet.
Early Frame	White and pink	100	Fair, damp.
Matchless	do	100	Good, dry.
C. E. F. Seedling No. 153	Red	99	Good flavor, dry.
do do 118*a*		78	
do do 136	Red spots	63	Fair, wet.
Large vs. Small Seed.			
Early Rose, medium sized seed		290	
do small		252	
do large		238	
do planted 6 inches apart		244	
do do 12 do		243	
do do 18 do		229	

GRASSES AND FODDER PLANTS.

The yield of native hay throughout the Province was larger during the past year than in 1889; still many of the meadows are either drying up or becoming exhausted, and the demand for substitutes is still increasing. Considerable attention has therefore been given to grasses and fodder plants.

CULTIVATED GRASSES.

Of the 12 varieties of cultivated grasses sown in 1889, only the following survived the winter:—Tall, Hard and Meadow Fescues, Timothy and Kentucky blue grass. The Fescues made very little growth, and were only fit for pasture. The Timothy yielded about 1½ tons per acre. The Kentucky Blue grass was very thin in spring, but thickened out during summer and remained quite green until late in November. This is a very promising pasture grass. Of the clovers sown in 1889, Common Red and Lucerne, being somewhat sheltered, survived the winter and gave two cuttings, but the plots were too small for accurate returns to be obtained.

In May of this year, 12 varieties of grass and 9 varieties of clover were sown with spring wheat; all germinated readily, and were looking thrifty when winter set in.

NATIVE GRASSES.

I have pleasure in reporting continued success with the cultivation of native grasses. The six varieties mentioned in my last report as having been grown successfully in 1889, survived the past winter, and have given a fair yield of fodder. All were permitted to ripen their seed. We were, therefore, unable to test their value for feed. A considerable quantity of seed of these varieties has been secured which will be sown next spring. During the past season, several additional varieties have been sown, some of which are promising.

Below will be found the names, height and estimated yield this year of the seven varieties of native grasses sown in 1889. One variety (Agropyrum tenerum) was omitted in my last report but is included in this.

NATIVE GRASSES.

——	Remarks.	Height. Ft.	Height. In.	Estimated Yield. Tons.
Muhlenbergia glomerata, Trin	Very promising; somewhat late		27	2
Elymus Americanus, V and S.	A coarse grass of fair quality	4		3
Elymus Virginicus, L.	Bunchy, with heavy wheat-like head	3		1½
Bromus ciliatus, L.	Bunchy; quality apparently good		30	1
Agropyrum tenerum, Vasey	Somewhat like English rye grass in appearance; early	4		1½
Agropyrum caninum, R and S.	Rather hard; early		33	1½
Poa serotina, Ehrh.	Very fine stalk, known here as red top or meadow grass	2		1

FODDER CORN.

Thirty-two varieties of fodder corn were grown on the farm during the past season. The seed was sown on May 31st with a common wheat drill, in rows three feet apart, and the plants thinned out to about 6 inches apart in the rows. Weeds were kept down with the horse cultivator. The season being favourable, growth was very rapid and the yield large. All the varieties were cut on August 29th. It was then cured in shocks of about 600 lbs. (green weight). The cured fodder was readily eaten by both horses and cattle.

Below will be found a list of the varieties sown and full particulars regarding growth, yield, &c.

[NOTE.—The weight of each variety as given is accurate, but it must be borne in mind that it is seldom that a large plot or field will give returns per acre equal to a small plot, where special care is given to the growth of the plants.]

TEST OF FODDER CORN.

	Sown.		Came up.		Yield per Acre, Green Weight.		Stage of growth when cut.
					Tons.	Lbs.	
Thoroughbred White Flint	May	31....	June	13....	46	400	In tassel.
Blunt's Prolific	do	31....	do	13....	38	1,000	Not in tassel.
Early Mammoth	do	31....	do	13....	37	1,200	do
Long Yellow Flint	do	31....	do	13....	36	1,700	In tassel.
Long Sweet	do	31....	do	13....	34	1,300	In the silk.
Golden Dent	do	31....	do	14 ...	33		In tassel.
Stowell's Evergreen	do	31....	do	12....	30	500	do
Hybrid from P. C. Dempsey	do	31....	do	13....	30	280	do
Leaming Yellow	do	31....	do	13....	29	1,400	do
Golden Beauty	do	31....	do	13....	29	300	Not in tassel.
Early Adams	do	31....	do	12....	28	1,200	In tassel.
Crosby's Early Sweet	do	31....	do	13....	28	100	In the silk.
Amber Cream	do	31....	do	13....	28	100	do
Minnesota Sweet	do	31....	do	13....	26	800	In milk.
King Philip	do	31....	do	13....	25	600	In silk.
Cinquantine or Fifty-day Corn	do	31....	do	12....	24	1,400	do
Longfellow	do	31....	do	12....	23	1,300	do
Mitchell's Early White Flint	do	31....	do	12....	23	640	In milk.
Chester County Mammoth	do	31....	do	14....	23	200	Not in tassel.
Pee and Kay	do	31....	do	13....	22		In milk.
Queen of the Prairie	do	31....	do	14....	21	900	In silk.
Early Concord Sweet	do	31....	do	13....	21	900	do
Narragansett Sugar	do	31....	do	14....	19	1,600	In milk.
Hickory King	do	31....	do	14....	19	500	Not in tassel.
Virginia Horsetooth	do	31....	do	13....	19	500	do
Marblehead Sugar	do	31....	do	13....	18	700	In milk.
Perry's Hybrid Sugar	do	31 ...	do	13....	18	300	do
Extra Early Adams	do	31....	do	13....	16	1,000	do
White Squaw or Native	do	31....	do	13....	16	1,000	do
Early Corey	do	31....	do	14....	15	800	do
Dark Squaw or Native	do	31....	do	13....	12	420	do
Giant Prolific Ensilage	June	20....	do	24....	24	400	Not in tassel, seed at first planting did not germinate.

MIXED GRAIN GROWN FOR FODDERS.

In many parts of the United States where it is difficult to grow cultivated grasses, resort is had to a mixed grain crop for fodder. As an evidence of its value for feeding purposes, I might add that hay made from oats and barley commands a higher figure in the San Francisco market than clover hay.

To ascertain what would be most suitable for this Province, eleven mixtures of grain were tested on the farm, a portion being sown on oat stubble, the balance after a root crop.

A mixture of oats and peas gave the largest yield, closely followed by barley and peas.

MIXED GRAINS GROWN FOR GREEN FODDER AND HAY ON OAT STUBBLE.

—	Sown.	Cut.	Yield per Acre, Green.		Yield per Acre, Dry.	
			Tons.	Lbs.	Tons.	Lbs.
Oats, tares and peas	April 22	July 29	5	698	3	712
do barley and peas	do 22	do 29	5	90	3	606
do wheat do	do 22	do 29	4	147	2	946
Barley, wheat do	do 22	do 29	3	1,610	2	769

MIXED GRAINS GROWN FOR GREEN FODDER AND HAY, AFTER ROOTS.

—	Sown.	Cut.	Yield per Acre, Green.		Yield per Acre, Dry.	
			Tons.	Lbs.	Tons.	Lbs.
Oats and peas	April 23	July 28	8	310	3	1,659
Barley and peas	do 23	do 26	9	1,081	3	1,206
Wheat do	do 23	do 26	7	91	3	299
Oats and tares	do 23	do 28	8	702	3	904
Rye and peas, 1st crop	May 23	do 17	4	1,573	2	186
do 2nd crop	do 23	Sept. 20	2	552	0	1,264
Rye, peas and tares, 1st crop	do 23	July 17	5	784	2	
do 2nd crop	do 23	Sept. 20	1	1,896	0	1,192
Rye and tares, 1st crop	do 23	July 17	4	1,540	1	1,953
do 2nd crop	do 23	Sept. 20	2	352	0	1,384
Rye	April 23	June 28	2	1,139	1	22
do	do 23	July 17	4	570	2	144
do and peas	do 23	June 28	2	1,288	0	1,939
do do	do 23	July 17	3	1,659	2	973

MILLETS.

Below will be found a list of the Millets tested on the farm during the past season, with the yield of fodder both green and cured. *Panicum Miliaceum*, introduced from India by Prof. Saunders, and known there as "the Inferior Millet," gave the largest yield, and is in every way promising. The seed was drilled in on fallow land, at the rate of 22 lbs. per acre.

—	Sown.	Harvested.	Yield per Acre, Green.		Yield per Acre, Dry.	
			Tons.	Lbs.	Tons.	Lbs.
Hungarian	June 7	Aug. 21	8	1,400	3	1,884
German Millet	do 7	do 28	10	1,600	4	1,786
Common do	do 7	do 6	7	1,816	3	618
Chena or Indian Millet	do 9	do 28	Not weighed		5	711

RAPE OR COLE.

One of our most promising green crops for late feeding is that of Rape or Cole. This has done remarkably well with us this year. Sown in rows 3 feet apart on June 3rd, it yielded in October 33 tons per acre (green weight). Cattle eat it greedily, and it seems particularly suitable for the feeding of sheep and cattle. To cattle it must be fed with care as in cold weather, it is apt to induce bloating.

BUCKWHEAT.

There is considerable enquiry among farmers for plants suitable for green manure. To determine the suitability of buckwheat for this purpose, three varieties were sown in adjoining plots of clay loam soil. The plants were weighed green just as they were in full blossom. Silver Hull gave 14 tons 168 lbs. per acre; Common, 12 tons 390 lbs., and Japanese, 9 tons and 816 lbs. The plots were planted with potatoes in 1889.

FRUIT AND FOREST TREES.

In submitting my report on the Horticultural and Forestry work on the farm, I beg to call attention to the fact that the extremely dry season of 1889, followed by a severe winter, was very trying to young trees newly transplanted, and this should be borne in mind when considering the report of trees planted in 1889.

Trees planted in the plots situated on the bluffs overlooking the valley and protected by a growth of scrub, have again proved the most vigorous. Of the 237 fruit trees planted during 1889 in the open prairie plot, 84 or about 36 per cent have died, while of the 158 trees planted in the protected plot, only 22 or about 14 per cent. have died.

Encouraged by the above results, four additional half-acre plots were cleared of scrub and ploughed. A belt of scrub 4 to 8 feet high has been left around each plot as a wind break. These plots have been planted as follows:—

No. 1, with apple trees set 20 by 20 feet apart, with raspberries planted in the intervening spaces; No. 2, with plum and cherry trees 20 by 20 feet apart, and gooseberries between; No. 3, with crab apple trees set 20 feet apart each way, and currant bushes intervening; No. 4, with grape vines planted 10 by 20 feet apart, and raspberries between.

In addition to the foregoing, a quarter acre plot has been cleared and broken up for strawberries. This we hope to fill with home-grown plants next spring.

APPLE TREES PLANTED IN 1889.

The winter of 1889 was very severe, and the trees in the exposed plot, already weakened by the hot winds of the previous summer suffered badly, while those planted among the scrub on the hillside were comparatively little injured. Of the 382 apple trees planted in different parts of the farm in 1889, 261 are still living, although some are considerably weakened and may succumb during the present winter. It is noticeable that the trees allowed to branch out near the ground have succeeded much better than those trained as tall standards, the latter, having a large amount of bare trunk, suffered severely from sunscald.

As these trees have now been planted nearly two years, it is thought advisable to give results in full as follows:—

	Total Planted.	Alive.	Present Condition.	Number Dead.	Probable Cause of Death.
Sandy Glass	2	1	Extra good	1	Winter killed; in exposed situation.
Romna	2	1	do	1	do do
Russian Green	2	1	do	1	do do
Cross	2	1	do	1	do do
Pineapple	2	1	do	1	do do
Ostrokoff	2	2	do	0	
Kursk Anis	2	1	do	1	do do
Krimskoe	2	2	do	0	
Crooked Spice	2	1	do	1	do do
Repolovka	2	2	do	0	
Red Repka	2	2	do	0	
Sugar Sweet	3	2	do	1	
Zusoff	2	2	do	0	
Karabovka	2	2	do	0	
Tashkin	2	2	do	0	
Simbirsk No. 2	2	2	do	0	
Orel No. 5	2	1	do	1	Winter killed.
Orel No. 11	2	1	do	1	do
Broad Green	2	2	do	0	
Vargulek	2	2	do	0	
Kruder	2	1	do	1	Winter killed; in exposed situation
Anisim	2	2	do	0	
Silken	2	2	do	0	
Yellow Sweet	2	1	do	1	Winter killed.
Osimoe	2	1	do	1	do
Kremer's Glass	2	1	do	1	do
Tiesenhausen	2	1	do	1	do
Blushed Calville	6	3	do	3	do
Anisim, 18m	2	2	Good	0	
Anis	2	1	Extra good	1	do
Borovinka	2	2	do	0	
Antonovka	2	1	do	1	do
No name attached	3	0		3	do
Ukraine	4	4	Extra good	0	
Kursk Reinette, 20m	1	1	do	0	
Herren, 87m	1	1	do	0	
Autumn Streaked	10	5	do	5	In exposed place; winter killed.
Yellow Anis	10	9	do	1	do do
Red Anis	20	14	do	6	do do
Lejanka (Liebig)	20	13	do	7	do do
Titovka	10	8	do	2	do do
Grandmother	10	7	do	3	do do
Duchess of Oldenburg	10	10	do	0	
Plikanoff	10	9	do	1	do do
TALL STANDARD TREES.					
Antonovka	6	5	Good	1	Transplanting, 1890.
Arabka, summer	5	2	Growing from roots	3	Winter.
do winter	5	2	Fair	3	do
Anis	3	2	do	1	do
do yellow	2	0		2	Transplanting.
do red	2	1	Good	1	do
do mottled	2	2	do	0	
Aport	4	4	Fair	0	
Alexander	7	6	do	1	Winter killed.
Pineapple	3	2	Poor	1	do
Blue Pearmain	2	1	Fair	1	do
White Borodovka	2	1	Good	1	do
Ben Davis	4	4	Fair	0	
Belle de Boskoop	4	0		4	do
Borovinka	5	2	Good	3	do

	Total Planted.	Alive.	Present Condition.	Number Dead.	Probable Cause of Death.
TALL STANDARD TREES.					
Grandmother.	4	2	Fair..	2	Winter killed.
Canada Baldwin....	5	4	do	1	do
Duchess of Oldenburg	7	4	do	3	do
Fameuse	5	3	Poor	2	do
Gipsey..	2	2	Good	0	
Gideon	4	0		4	do
Golden White.	2	2	Extra good..	0	
Grand Duke Constantine..	2	2	Fair..	0	
German Calville	2	1	do	1	do
Golden Russet	5	3	Growing from roots..	2	do
Grimes Golden	3	1	do	2	do
Hibernal.......	2	2	Good..	0	
Herren	2	2	Fair..............	0	
Haas	3	1	Growing from roots..	2	do
Enormous ..	2	2	Fair..	0	
Blushed Calville	2	2	Good.....	0	
Kellogg Russet	2	2	Growing from roots..	0	
Livland Raspberry	2	1	Fair..	1	do
Longfield ...	5	4	do	1	do
Mann ..	3	2	do	1	do
McIntosh Red.	5	4	Growing from roots..	1	do
Pointed Pipka.	2	2	Good	0	do
Peach	3	2	Growing from roots..	1	do
Red Bietigheimer	2	1	do	1	do
Christmas ...	2	2	Fair..	0	
Romna	5	4	Good	1	do
Red Astrachan	3	2	Growing from roots..	1	do
Sugar Miron .	3	0		3	do
Serinkia	2	1	Growing from roots..	1	do
Cross......	2	0		2	do
Scott's Winter.	3	2	Growing from roots..	1	do
Stêklianka .	2	2	Fair...	0	
Ostrokoff's Glass	2	2	do ...	0	
Bogdanoff's Glass	2	2	Growing from roots..	0	
Lead ..	2	2	Fair....	0	
Switzer.	2	2	do	0	
Stettin, red..	2	0		2	do
do yellow	2	1	Growing from roots..	1	do
Shaker Pippin.	2	2	Fair...	0	
Tetofsky...	5	3	do	2	do
Titovka..	3	2	do	1	do
Gipsey.	2	2	do	0	
Tolman's Sweet	3	1	Growing from roots..	2	do
Ukraine	2	1	Good	1	do
do	3	1	Fair	2	do
Vargul...	2	1	Good	1	do
Winter St. Lawrence	2	2	Fair.....	0	
Wallbridge......	3	2	Growing from roots..	1	do
Wealthy.	3	2	Good	1	do
Yellow Transparent..	5	5	Growing from roots..	0	

CRAB APPLES, 1889.

Of the 25 crab apple trees planted in 1889, 16 are still living. These have made good growth and some of the varieties appear quite hardy and promising.

	Number of Trees Planted.	Alive.	Present Condition.	Dead.	Probable Cause of Death.
Transcendent	5	4	Extra good	1	Transplanting, 1890.
Whitney's No. 20	5	3	do	2	do
Hyslop	3	2	do	1	Winter.
Orange	2	2		0	
Early Strawberry	2	2		0	
Queen's Choice	2	2		0	
Lou's Favourite	2	1		1	Transplanting, 1890.
Martha	4	0		4	Winter.

CHERRY TREES, 1889.—PLANTING.

The cherry trees planted in 1889 were nearly all winter killed, but a further supply of hardy Russian varieties was planted last spring, and it is hoped some of these may prove hardy.

	Number Planted.	Alive.	Present Condition.	Dead.	Probable Cause of Death.
Ostheim	5	2	Growing from roots	3	Winter killed.
Vladimir	3	0		3	do
Early Richmond	3	2	Growing from roots	1	do
12 m. from Russia	2	2	Good		

PEARS, TREES.—1889.

Nearly all the pear trees planted in 1889 were injured by the winter, either killed outright or to the snowline, a few of the trees of the hardy Russian varieties escaped with very little injury and have made fair growth during the past summer.

	Number Planted.	Alive.	Present Condition.	Dead.	Probable Cause of Death.
Bessemianka	2	1	Good	1	Winter killed.
Beurre Hardy	2	0		2	do
Clapp's Favourite	2	2	Growing from roots	0	
Flemish Beauty	4	2	do	2	do
Howell	2	1	do	1	do
Gakovsk	3	1	Good	2	do
Kurskaya	4	3	do	1	do
Pomeranovka	2	1	Growing from roots	1	do
Sapieganka	2	1	do	1	do
Seckel	2	2	do	0	
Thin Twig	2	1	Fair	1	do

PLUM TREES PLANTED IN 1889.

Plum trees were mostly planted in the exposed plot, and suffered severely by winter. Those surviving were transplanted to the hill plots last spring. This also gave them quite a check.

A number of native plum trees have been set out; these will prove useful for grafting purposes.

—	Number of Trees Planted.	Alive.	Present Condition.	Dead.	Probable Cause of Death.
Bradshaw	2	2	Growing from root	0	
Coe's Golden Drop	2	1	do	1	Winter.
De Soto	4	2	Good	2	Transplanting
Early Red	7	6	do	1	do
German Prune	2	0		2	Winter.
Lombard	4	0		4	do
Late Red	2	2	Fair		
Marianna	2	2	Growing very vigorously from roots.		
Moreman	2	0		2	do
Moore's Arctic	2	2	Growing from roots		
Nicholas	7	3	Good	4	do
Otschakoff	3	2	Fair	1	do
Trabische	2	1	Growing from roots	1	do
Yellow Gage	2	1	do	1	do

GRAPE VINES.

Although very thrifty in summer and well covered with earth in the fall, none of the grape vines planted in 1889 survived the winter. A further supply of 100 vines composed of 18 varieties were procured in 1890. According to instructions, these were planted in holes 3 feet below the surface, and as the vines grew, the soil was gradually filled in, by this method, placing the roots much deeper than by the ordinary mode of planting.

Before winter the vines were covered with a mound of earth, which will be allowed to remain until late in spring.

APPLE TREES, &c., PLANTED IN 1890.

The past season has been more favourable for tree-growing than 1889, and the 22 apple and 5 plum trees planted in May of this year were all living when winter set in; of 17 cherry trees planted, 10 were living.

Beside the above, 500 apple and 50 pear seedlings raised on the Central Experimental Farm, Ottawa, from imported Russian seed, were placed in nursery rows; of these, 340 are living. Those which survive will be grown as seedlings, and it is hoped that some may produce fruit worthy of cultivation.

On the approach of winter, fruit trees of all kinds were wrapped with straw and tar paper to protect them.

GOOSEBERRIES.

Of the 96 plants of cultivated varieties, and 12 natives planted on the open prairie in 1889, only 9 were killed by the drouth of that year, but the surviving plants of Industry and Woodward's Whitesmith succumbed to the winter of 1889-90. The remaining varieties were removed to one of the sheltered plots, in April, and have made a thrifty growth during the past summer. Houghton's Seedling bore a small quantity of fruit. During April, additional plants were procured and planted in the same plot. These have all done well.

	1889.		1890.		Total Living.
	Planted.	Alive.	Planted.	Alive.	
Houghton's Seedling	26	26	138	130	156
Downing	25	25	108	103	133
Smith's Improved	25	20	48	45	65
Woodward's Whitesmith	10	0			
Industry	10	0			
Native	12	11	20	20	31

CURRANTS.

All the varieties of currants tried have proved perfectly hardy and have made a good growth. During the past season, although the bushes were small, many of them were loaded with fruit. Black Champion and Lee's Prolific both bore well, their fruit being about equal in size and quality. Of the red varieties, Fay's Prolific and Raby Castle produced some fine berries.

	1889.		1890.		Total Living.
	Planted.	Alive.	Planted.	Alive.	
Black Currants, Lee's Prolific	427	426	......	......	426
do Black Champion	10	10	......	......	10
do do Naples	16	16	86	84	100
Red Currant, Fay's Prolific	26	24	......	......	24
do Raby Castle	265	202	......	......	202
do Red Cherry	10	10	133	130	140
do Victoria	25	13	......	......	13
do Red Grape	10	10	......	......	10
White Currant, White Grape	148	143	27	27	170
Native Black	20	20	19	19	39
do Red	11	11	......	......	11

RASPBERRIES.

A number of varieties of raspberries were received and planted late in May, 1889, but probably owing to the dry season, only one variety of the red (the Turner) and one of Blackcap (the Hilborn) survived the summer and following winter. These two varieties are very promising. The Turner has also produced some fruit.

About 20 varieties of raspberries and blackberries were planted in May, 1890, but owing to all the plants being too far advanced in growth when planted, only a few of each variety were alive at the commencement of winter. Some Philadelphias were procured, which were grown in Southern Manitoba. They were planted early, and all are alive and some have borne fruit.

As very few farmers will go to the trouble of protecting their bushes, it was thought advisable to test some of each variety without protection. The balance were protected by a mound of earth or manure placed over each plant

STRAWBERRIES.

Although none of the strawberries planted on the open prairie survived the summer of 1889 and following winter, I take pleasure in reporting a fair amount of success with those planted in the plot protected with scrub, this plot has a sandy loam soil naturally mulched with decayed leaves. When uncovered late in spring fully 90 per cent. of the plants in this plot were alive and quite fresh. During the summer they made rapid growth, the Crescent, Captain Jack and Wilson sending out a mass of runners. About the middle of July the Crescent produced a fair crop of very fine berries, Wilson and Captain Jack also bore a few. The varieties planted by us range for merit and hardiness in about the following order: Crescent Seedling, Wilson's Albany, Captain Jack and Manchester. Sharpless and Daniel Boone were planted but very few plants survived.

There are a large numbər of new plants of the three first named varieties, these will be available for planting and distribution next spring.

A variety of the native strawberry produced under cultivation an abundant crop of fruit of good quality. This will probably be worthy of a further trial, a few of them were planted on the open prairie in July and may prove sufficiently hardy to withstand the exposure.

FOREST TREES AND SHRUBS.

During 1889 nearly 12,000 forest trees and shrubs were planted on the farm, the greater portion of these were used in planting a windbreak on the west boundary. Owing to the drought of the summer of 1889, followed by a severe winter, 7,379 or over 60 per cent. of these have died. During the present year 21,721 trees, &c., were received from the Central Farm, Ottawa, and from Nebraska, of these 2,224 have died. The loss, however, of about 1,400 of these was no doubt attributable to heating in transit, leaving a loss of only 783 trees or less than 4 per cent. chargeable to the climate.

The trees planted in the shelter belt on the west boundary of the farm in 1889, were placed 9 feet apart, this year an additional tree has been placed between these making them 4 feet 6 inches apart, and 738 yards of additional belt 50 feet wide has been planted. A large proportion of the trees used in the belts this year were native varieties raised from seed on the farm and are likely to prove hardy. On this farm the following varieties of trees are found to succeed best: Native Ash-leaf Maple, Native Ash, American Elm (from native seed), Russian Poplars and Willows, Cottonwoods (northern grown), Alders, Birch and White Spruce.

Of shrubs the following have done well Asiatic Maple, (*Acer ginnala*), Caragana arborescens, Flowering Currant, Cytisus Capitatus, Lilac's, Spiraea opulifolia, billardi and nobleana. Climbers: Lycium Europeum and Clematis flammula. A Japanese rosebush, (*Rosa rugosa*), has also proved perfectly hardy.

FOREST TREES PLANTED IN 1889.

——	Number of Trees Planted.	Alive.	Present Condition.	Dead.	Probable Cause of Death.
Acacia or Honey Locust	340	3		340	Winter killed.
Ash, White (seedlings)	250	19		231	Summerdrouth, '89, and winter.
do Red (seedlings)	349	81		268	do do
do Green	285	160	Good	125	do do
do Black	50	0		50	Winter.
do European Mountain	51	26	Good	25	do
do American do	22	16	Extra good	6	do
Alder, European	52	50	do	2	do
do White	10	10	do	0	
Arbor Vitæ or Cedar	1,066	596	Green and healthy.	470	Drouth, 1889.
Beech (seedlings)	172	0		172	Received in bad order.
Birch, Yellow	105	89	Extra good	16	Drouth, 1889.
do White	50	48	do	2	do
do Canoe	40	28	do	12	do
do Sweet	10	6	do	4	do
Catalpa	1,066	0		1,066	Winter, 1889-90.
Coffee Tree Kentucky	18	0		18	do
Cherry, Black	153	15		138	do
Elm, American	1,082	623	Good	459	Drouth and winter.
do do from native seed	1,087	954	do	.133	do
do Rock	250	0		250	do
Hemlock	43	4		39	do
Oak, Macrocarpa (Burr Oak)	44	0		44	Received in bad order.
do American Red	2	0		2	Winter.
Larch, European	522	118	Fair	404	Drouth, 1889, and winter.
Maple, Ashleaved (Box-elder)	503	500	Extra good	3	do
do Norway	536	70	Poor	466	do d
do Soft (A dasycarpum)	76	62	Good	14	do
Pine, Scotch	258	45		213	do
do Austrian	439	41		398	do do
do Riga	67	29	Good	38	do do
Cottonwoods	308	300	Extra good	8	Drouth.
Populus Pyramidalis	1	1	do	0	
do Certinensis	5	4	do	1	Accidental.
do Beno	8	8	do		
do Virginiana	2	2	do		
do Aurea	1	1	do		
do Bolleana	2	2	do		
do Wobstii Riga	2	2	do		
do Sibirica	2	2	do		
do Petrovsky	36	36	do		
do Bereolensis	11	11	do		
do Alba Argentea	2	2	do		
Spruce, Norway	1,532	127		1,405	Drouth, 1889, and winter.
do White	65	62	Fair	3	do
Sycamore	51	0		51	do do
Walnuts, Black	100	0		100	do do
Willows White	7	7	Extra good		
do Yellow	7	7	do		
do Purple	4	4	do		
do Norway	4	4	do		
do Voronesh	5	5	do		
do Wisconsin Weeping	8	8	do		
do Basket	7	7	do		
do Acutifolia	3	3	do		
do Laurifolia	1	1	do		

ORNAMENTAL TREES AND SHRUBS PLANTED IN 1889.

	Number Planted.	Alive November 1, 1889.	Apparent Condition.	Dead.	Probable Cause of Death.
Birch, Cutleaf Weeping	3	2	Healthy	1	
Asiatic Maple (Acer ginnala)	2	2	do		
Caragana arborescens	44	25	Extra good	19	Received in bad order.
Tilia sylvestris	1	1	Good		
Cornus Sibirica	1	1	do		
Pyrus Baccata Auruntiacum	1	1	do		
Artemisia Abrotans (Southernwood)	4	4	Extra good		
Berberis vulgaris	150	128	Good	22	Drouth.
do elegans	12	0		12	Winter.
do purpurea	16	0		6	do
Flowering Currants, Ribes alpinum	1	1	Good		
do sanguineum	2	2	do		
Cytisus capitatus	10	10	do		
Robinia Bessoniana	88	0		88	Winter killed.
do monophylla	10	0		10	do
do viscosa	10	0		10	do
do Decaisneana	4	0		4	do
do pseudacacia	168	0		168	do
do tortuosa	19	0		19	do
Weigelia Sibirica	1	0		1	do
do Lavallei	1	0		1	do
do Vershafeldti	1	0		1	do
Hydrangea paniculata	2	0		2	do
Deutzia Fortunei	2	0		2	do
Colutea Halipica	21	0		21	do
Lilacs, Syringa vulgaris	4	4	Good		
do alba	77	65	Very healthy	12	Drouth, 1889.
do Josikea	1	0		1	
do De Marley	4	3	Good	1	
do purpurea	2	0		2	
do rothamagensis	2	2	Good		
Spiraea opulifolia	60	16	Extra good	44	Received in bad order
do Douglasii	6	1	Good	5	Drouth and do
do van Houtte	6	2	do	4	do do
do prunifolia	2	1	do	1	do do
do bullata	2	1	do	1	do do
do billardii	6	6	Extra good		
do callosa	3	1		2	
do rotundifolia	2	0		2	Winter.
do Californica	7	1		6	do
do nobleana	2	2	Good		
Climbers—					
Lycium Europeum	1	1	Extra good		
Clematis Flammula	7	3	do	4	Received in bad order.
do Vitalba	10	0		10	do
Rosebushes—					
Rosa rugosa	1	1	Good		

FOREST TREES PLANTED IN 1890.

	Trees Planted.	Alive November 1, 1890.	Apparent Condition.	Dead.	Probable Cause of Death.
Ash (Fraxinus) American White	2,286	2,569	Good	317	Transplanted late.
do Green	2,000	2,000	do	0	
do Black	134	108	Fair	26	Drouth in early summer.
do pubescens	500	439	Good	61	do
do acuminata	61	57	do	4	do
Mountain Ash, American	31	31	do	0	
do European	111	89	do	22	do
Soft Maple (A dasycarpum)	2,000	1,950	do	50	do
Box Elder or Native Maple	175	175	do	0	
Norway Maple	110	105	do	5	
Alder, European	100	68	do	32	do
do American	100	92	do	8	do
Butternut	900	824	do	76	do
Kentucky Coffee Tree	250	241	Fair	9	
Black Walnut	1,000	522	Injured by frost	478	Received in bad order.
Honey Locust	500	500	do	0	
Black do	500	500	do	0	
Elm, American White	5,000	4,765		235	Drought in early summer.
do	389	382		7	
Russian Mulberry	1,050	856	do	194	
Cottonwood	1,000	434		566	Received in bad order.
Spanish Chestnut	25	25		0	
Sweet do	25	25		0	
White Birch	42	40	Good	2	
Populus Bolleana	100	94	do	6	
Russian Olive	100	100	Extra good	0	
Linden seedlings	500	463		37	
Hickory	15	15		0	
Spruce, Norway	378	352	Good	26	Transplanting.
do White	75	69	do	6	
do Blue	10	6		4	
Pine, Austrian	120	86		34	
do Scotch	175	141		34	
do Riga seedlings	500	103	Poor	397	Received in bad order.
do Mountain seedlings	150	91	do	59	do
European Larch	138				Bare of foliage, cannot say how many are dead.
Arbor Vitæ	65	63		2	
Red Cedar	100	56		44	Drought in early summer.
SHRUBS PLANTED IN 1890.					
Artemisia abrotans	25	25	Good	0	
Ribes aureum	5	5	do	0	
do alpinum	2	2	do	0	
Berberis vulgaris	50	37	do	13	
do purpurea	30	9	do	21	Transplanting
Caragana	100	66	do	34	do
Symphoricarpus racemosus	3	3	do	0	do
Viburnum opulus	3	3	do	0	
do lantana	4	4	do	0	
Deutzia candidissima	7	7	do	0	
Wiegelia Lavallei	3	3	do	0	
Philadelphus nana	35	21	do	14	do
do inodorous	11	11	do	0	
do coronarius	13	13	do	0	
do cordifolius	13	12	do	1	
Syringa alba	8	8	do	0	
do vulgaris	10	10	do		
do de Marley	17	17	do		
Spirea, 9 varieties	67	61	do	6	

NATIVE TREE SEEDS AND SEEDLINGS.

A large quantity of native maple, ash, oak, cherry and other seeds has been collected during the past year. A portion of these have been sent to the Central Experimental Farm, Ottawa, for distribution. Sufficient for 7¼ acres were reserved and sown on this farm in the fall and the balance kept for distribution from here and for spring sowing.

As an experiment, a few native elm seedlings were transplanted from the banks of the Assinaboine River last spring. These are doing well. 33,000 of elm, 4,000 of spruce and 1,500 of Buffalo berry seedlings were collected during the fall and healed in ready for spring distribution and planting.

12,300 native maple and 6,500 ash trees were raised from seed during the past summer. These will be available for planting and distribution during the coming spring.

The total number of trees and shrubs growing on the farm at this date is as follows: 53,000 forest trees and shrubs, 600 trees of large fruits and 2,000 of small fruits, or a total of 55,600 trees and shrubs.

AVENUE TREES.

During May, 5 per cent. of the large avenue trees set out in 1889 died. This loss was traced in nearly every case to the presence of cold clay soil around the roots. The balance of the trees are thrifty and have made a large growth.

In May of this year, two additional avenues, each 550 yards long, leading from the public road to the farm buildings were planted with large native maple trees. Of the 340 trees planted, 339 were living when winter set in. The avenue leading from the main entrance has, in addition to the maples, a row on each side 120 in all of native spruce procured from the Sandhills, twenty miles east of Brandon. All were planted in June. A large ball of earth was brought with each tree, and every care was taken to preserve the roots from drying. So far only 5 have died, the balance look very promising, and their bright green appearance during our long winter is very refreshing.

VEGETABLE GARDEN.

Early in spring a suitable plot of rich sandy loam was prepared, and sown with hardy varieties of vegetables. The season was favourable and the yield of nearly every kind large, the cauliflowers being particularly fine. In point of excellence, the varieties tested rank about as follows:—

Beans.—Early Dwarf China, Early Mohawk, Champion Scarlet Runner.

Beans.—Windsor or English Broad.

Beets.—Early Blood-red Turnip, Long Smooth.

Cauliflower.—Early Erfurt, Early Snowball, Sutton's First Crop.

Corn, for Table Use.—Cory, Native, Early Adams, Early Minnesota.

Cucumbers.—Long Green, White Spine, Boston Pickling, Chicago Pickling.

Cabbage (for summer use).—Early Express, Early Dwarf York, Early Winningstadt.

Cabbage (for winter use).—Premium Flat Dutch.

Carrot.—Chantenay, Early Shorthorn, Danver's Orange Red.

Kohl Rabi.—Red and White.

Lettuce.—Toronto Gem, Paris Cos, Hanson.

Onions.—White Globe, Red Wethersfield, Mammoth Silver King.

Pumpkins.—Mammoth King, Sugar.

Parsnips.—Hollow Crown, Student.

Peas (Early).—Steeles Extra Early, Kentish Invicta, Little Gem.

Peas (Medium early).—Telephone, Champion of England, Stratagem.

Peas (Late).—Laxton's Omega.

Radish.—White Tip, Scarlet Olive.

Rhubarb.—Champion, Paragon, Linnaeus.

Salsify.—Mammoth Standard.
Spinach.—Large Viroflay, Round Summer.
Squash.—Vegetable Marrow, Scalloped, Summer Golden, White Bush.
Tomatoes.—Dwarf Champion, Perfection, Mikado.
Turnips.—White Stone, or Nimble Dick, Six Weeks, Breadstone.

FLOWERS.

The impression is general throughout the Province that the cultivation of garden flowers here must necessarily require much time and skill to produce satisfactory results, while the reverse is the case, for it is questionable whether the natural soil of any portion of the Dominion is better adapted to the growth of flowers than that of this Province, as is evidenced by the abundance of wild flowers growing everywhere.

A plot of sandy loam soil, 100 feet by 100 feet in size, and with a southern exposure, was selected for a flower garden. This was either sown or planted with the following varieties of flowers, of which the tender sorts only were started in a hotbed; these gave an abundant supply of bloom from the middle of July to the end of October:—

Asters—6 varieties were sown and produced an abundance of fine flowers.

Antirrhinum, or Snapdragon—A perennial; several varieties were sown and proved very hardy and attractive.

Balsams—3 varieties were sown; grew and bloomed well; very susceptible to frost.

Calliopsis—Were a showy mass of bloom all summer.

Chrysanthemums (Annuals)—3 varieties; grew very rank; bloomed freely.

Dianthus, or Pinks—8 varieties sown; some of the hardiest and best of flowering plants for this climate; some varieties will withstand our winters.

Dianthus Barbatus, or Sweet William—Has lived through the winter without protection.

Linum Perenne, or Flowering Flax—Perfectly hardy and flowered from May to October.

Linaria Safferina—Hardy, and bloomed profusely from June to October.

Pansies—10 varieties sown; hardy; all grew and bloomed well.

Phlox Drummondi—5 varieties sown; all bloomed freely until October.

Petunias—2 varieties; grew rapidly, and produced a mass of bloom.

Poppies—5 varieties; all grew well, and produced some very fine flowers.

Stocks—3 varieties; did not do well.

Salpiglossis—Grew well, and produced an abundance of very showy and effective bloom.

Verbenas—Grew well, and flowered abundantly until very late in fall.

Zinnias—Bloomed well and were very showy all summer, but very tender.

BEES.

Of the four hives of bees placed in the cellar in November, 1889, three came through the winter in good condition; the fourth, a late and weak swarm, lost its queen and perished in early spring. From a self-registering thermometer kept in the bee-cellar, the temperature was found to range between 30 and 32 all winter.

During the past season the three hives increased to ten, but owing to unfavourable weather and excessive swarming, only 20 lbs. of surplus honey per hive (spring count) was obtained. All were placed in the cellar early in November.

BUILDINGS.

Since my last report a comfortable bank barn, 111 feet by 50 feet, has been erected on the farm. The stone basement is 10 feet high, and has accommodation for forty head of cattle and 12 horses. The upper storey will be used for storing grain, hay, &c.

Two silos, 9x9, and 21 feet high, are built in the west end of the barn, extending from the floor of the basement to 11 feet above the floor of the upper storey. The silos are constructed of 3x12 inch studding and double boarded both inside and out; tar paper was also placed between each two layers of boards.

Two excellent springs have been found near the barn, one of these has been flowing all winter.

A house for the use of the Superintendent is also finished. This will allow of the one at present occupied by the Superintendent being used as a boarding-house, which is greatly needed on the farm.

Accommodation for swine, sheep and poultry is greatly needed, and the buildings at present in use as implement sheds are only temporary, and should be replaced by permanent ones.

NEW BREAKING AND FALLOW LAND.

The former occupant having broken up portions of the valley in irregular patches, the intervening spaces have been cleared of scrub, stones, etc., and broken up. This will add very much to the appearance of the farm, and largely increase the area for cultivation. Eight acres on the side of the bluff overlooking the valley have also been cleared and ploughed. Altogether, 140 acres of new land has been broken and backset during the year.

About 95 acres of fallow land has been prepared. For comparison, a small portion was ploughed once, and the balance twice. The weeds were kept down between ploughings by means of surface cultivation.

ROADS, GRADINGS, &C.

Two avenues, each 550 yards long, leading from the public road to the farm buildings, have been graded during the past year, and 230 yards gravelled. Nearly a mile of road has also been graded on the upland prairie, and another road through the valley a mile long laid out and partly graded. Considerable grading has also been done on approaches to the new barn, &c.

VISITORS TO THE FARM.

I take pleasure in reporting a rapidly-increasing interest in the work of the Experimental Farm, as evidenced by the large and increasing number of visitors during the summer months.

Since the completion of the different railroads centering in Brandon, the advantage of this location as a site for the Experimental Farm is very apparent. It is within easy reach of farmers living in all portions of the Province, and the system inaugurated last year by the different railroad companies, of granting reduced fares on special days, enables all to visit the farm at very little expense.

In July the County Council of the municipality of Cornwallis visited the farm in a body, and at their next meeting passed a resolution strongly endorsing the work of the farm, and advising all in their municipality to visit it.

The British Delegates, with their friends, paid a visit to the farm in September. As the harvest was about over, and there was no opportunity of examining the growing crops, samples of the produce of the farm were displayed in the new barn. All expressed a deep interest in the work of the farm generally, but particularly in those experiments connected with the culture of grasses, roots and fodder plants

CORRESPONDENCE, &C.

The correspondence between the farmers of the Province and the Experimental Farm is rapidly increasing. In 1889, 467 letters were received; in 1890, 842, or an increase of nearly 100 per cent. Many of these letters are of such a nature as to occupy considerable time in answering. The correspondence and the book-keeping connected with the farm has so far been carried on by the Superintendent.

SEED GRAIN DISTRIBUTION.

During the early spring of the past year a number of farmers throughout the province were supplied with promising varieties of seed grain grown on the Farm, the amounts sent to each applicant varying from 3 lbs. to 2 bushels, quantities of 1 bushel or more being charged for at market rates. The reports so far as received from these farmers are such as to lead us to hope that the Farm will prove very useful in distributing throughout the province new and improved varieties of seed grain.

The quantity available for distribution this year is much larger, but judging from the number of applications already received, all will be applied for.

EXHIBITS AT AGRICULTURAL FAIRS.

Some of the products of the Farm were exhibited at the following summer and fall fairs:—Brandon, Pilot Mound, Deloraine and Killarney.

Samples were also sent to the Manitoba Government and to the Canadian Pacific Railway Company, and were exhibited by them throughout the Eastern Provinces. The exhibit from the Farm shown at the International Exhibition, St. John's, N. B., by the Manitoba Government was awarded a diploma for the best collection of farm produce.

A small building on the Farm has also been fitted up as a museum, and samples of the produce of the Farm prepared and arranged. This is much appreciated by visiting farmers, especially during the winter months.

FARMERS' INSTITUTES.

During the present winter an excellent Farmers' Institute has been formed at Brandon, the meetings are well attended and much interest shown in the subjects under discussion. Other institutes are being organized throughout the province and will no doubt be productive of much good.

Papers on the following subjects were read by me at the Brandon Farmers' Institute:—"Notes on some of the varieties of wheat tested on the Experimental Farm," and "The selection, treatment and method of sowing grain."

I attended a very interesting meeting of the Manitoba Dairymen's Association held at Portage la Prairie on January 15th and 16th, at which the following papers were read:—"Canadian Dairying," by Senator Boulton; "Dairying in Manitoba," by Professor Barre; "Grasses and Forage Plants suitable for Manitoba," by S. A. Bedford, Superintendent of the Manitoba Experimental Farm.

Interest in dairying and mixed farming is increasing throughout the Province, and many inquiries are received regarding the work to be undertaken in this line by the Experimental Farm.

I have the honour to be, Sir,

Your obedient servant,

S. A. BEDFORD,

Superintendent.

BRANDON, MANITOBA, 29th January 1891.

EXPERIMENTAL FARM FOR THE NORTH-WEST TERRITORIES.

REPORT OF A. MACKAY, SUPERINTENDENT.

INDIAN HEAD, N. W. T., 31st December, 1890.

WM. SAUNDERS, Esq.,

Director Dominion Experimental Farms,

Ottawa.

DEAR SIR,—In submitting this, my third annual report of work done and returns from crops on the North-West Experimental Farm, allow me, before entering into farm work proper, to refer to a few points of great importance to the settlers in this country.

Never in the history of our country has such an abundant crop of grain and straw been granted, but in quality much of the wheat has been very inferior. Barley, oats, peas and vegetables are a good, I may say a great crop, but these, so far, do not count for much in summing up our prosperity.

To a man accustomed to farming in the North-West nothing is so agreeable as raising wheat, yet nothing is doing so much harm to the country.

Although our soil is unsurpassed, our climate healthy and agreeable, because a frost of a few degrees visited us in August the whole country has been greatly injured and all because we try to grow only No. 1 Hard wheat which requires to be entirely free from frost to bring a reasonable price. To a man depending entirely on wheat, a frost in August is almost ruinous; and the sooner a change is made the sooner will the North-West Territories attain their proper place in our great Dominion.

Many argue that because frost visited Ontario in early times, and gradually ceased as the country became opened up, that the same effect will be produced here, when cultivation is carried on over large areas and the surface exposed to the influence of the sun. I fear there is no similarity in the two provinces in this respect. From the very nature of things we are subject to frost at any time and our wisest course is to be prepared for it.

Many foretold no frost last season until September. Still it came shortly after the middle of August, and had it come a little earlier or a few degrees harder, I ask how would it have left those depending entirely on wheat?

I submit the returns of the various crops grown on this Farm as evidence that we need not and should not depend entirely on one crop.

Another point of great importance is early seeding. Every settler realizes this fact, but very few act up to it. As long as seed and land hold out seeding continues, whether it be in April, May or June. The result is that most of the late sown grain is frozen and the country, sometimes on this account, pronounced a failure.

Let a series of years be taken by any settler and if he examines the difference between the first and last half of his crop it will astonish him to find how little of the former has ever been frozen and how small a percentage of the latter has paid harvesting expenses.

On the Experimental Farm, nine days changed an acre of Red Fife, promising 40 bushels, to an actual yield of 23 bushels per acre. Fifteen days made the difference between a crop of 35 bushels per acre of No. 2 Hard and one of $19\frac{8}{60}$ bushels of chicken feed.

Let a settler compare the early, medium and late seeding as shown in wheat tests on this Farm and then compare them with his own returns and I doubt not they will be found much the same.

Early maturing grain is another point of very great importance. I need not remind you, Sir, how safe the field of Ladoga wheat on this farm looked on the morning of the 21st August last, nor how cold and green its neighbour, Red Fife, across a 12-foot road, looked on that eventful morning. By the dates given it will be seen that both were sown at the same time, and while one was waiting your inspection several days after being ripe, and still was cut some time before the frost came, the other on which our whole country depends was barely ready for the binder when frost overtook it.

The field of Carter's Prize Cluster Oats also had been seven days in stook on your arrival, while others were hardly fit to cut 10 days afterwards. Yet the Cluster variety was sown only one or two days earlier than these.

I respectfully submit the foregoing to the serious consideration of the settlers of the North-West Territories.

The returns from the various crops grown on the Experimental Farm the past year will, I trust, be regarded as satisfactory.

You saw them being harvested and can understand how bright the prospects may be one day and how clouded the next. How a promise of forty bushels per acre, to-day, may be materially reduced to-morrow. Although many of the varieties of wheat were injured by frost, the returns from other grains, the results of tests of fodder plants and the progress made in tree culture, will, I hope, be deemed favourable.

The winter of 1889-90 was considered a genuine one. The past summer may also be classed in the same category, inasmuch as it was totally different from any of its predecessors since 1882. Winter lingered long, but finally gave way about the middle of April. A favourable seeding season followed and crops on the Farm were hurried in as quickly as possible. In June, rain, long absent, came in abundance; in fact, the outpour was too boisterous by far and, when accompanied by hail, proved disastrous to many things. The root-crop, corn, young grass, &c., suffered considerably. The growth of straw after the rains came was very remarkable, but had the great drawback of causing the grain to be long in ripening and proved, in the end, to be a serious loss to the country.

On the Experimental Farm, sixteen varieties of wheat were in stook when frost came, and those uncut suffered in proportion to the state they were in when overtaken.

All the varieties of barley but one were harvested on the 21st August and may be taken as entirely free from loss, so far as frost is concerned.

Six kinds of oats were uncut on that day. These suffered in weight, although straw and quality did not appear to be at all affected.

Five degrees of frost was recorded on the Farm on the 21st August, which was sufficient to kill potato-tops, corn, cucumbers, beans, &c.

Harvest commenced on 9th August and was prolonged till the 25th September on account of frequent rains and a heavy snow storm, which unusual occurrence took place on 10th September.

All grain was got in in good condition and, when threshed, barley alone was found to be discoloured, but not to any great extent. Wheat was not hurt by rain, but the frost cut down the yield and greatly injured the grade.

It is worthy of notice the effect fallowed land had on the crop just harvested, it having prolonged the ripening process fully eight days over that which had been fall ploughed and several days over spring ploughing.

Hot winds in July caused the grain on fall and spring ploughing to be considerably shrunken but hastened the ripening and caused such to be out of danger of frost earlier than on fallow land. The summer fallow, however, has several great advantages—causing a better yield, it can be got ready when no other work is on hand, and at the same time is in the very best condition to hurry in the crop in the spring, which is one of the things absolutely necessary for success here.

A great deal of controversy has arisen over the best way of killing weeds by summer fallow. The course too commonly adopted is to allow them to attain their full growth, and then turn them under. This is, no doubt, a good plan if the work can be accomplished in a few days, or before the seeds form and ripen, but in the great majority of cases this cannot be done, and long before the field is ploughed there is a thousandfold added to the already innumerable weed seeds ready for growth in the spring. Two plans are being tried on the Experimental Farm to overcome these troublesome pests. One is to gang plough a weedy field in the fall, thereby causing weeds to start early in the following spring. The other to plough early in May and June and by repeated cultivation prevent the weeds from attaining more than a bare appearance above the ground. No definite conclusion can yet be given as to the success of the first mode except that it takes not more than one-half the work to keep down the weeds during the time the fallow is being made, in comparison with the labour necessary on spring ploughing to effect the same purpose. Whether weeds will appear more numerous in the grain from fall or spring ploughing can only be determined by next year's crop; but as to the success of the latter way, that is by ploughing early and repeated cultivation, there need not be the slightest doubt.

Land ploughed last year, before 1st July, bore abundant evidence this year of the wisdom of early work.

A Randall harrow was found to be the most effectual implement last summer to keep down the weeds, but it was necessary to use it often and allow nothing to appear very far above the surface.

WHEAT.

This, as in past years, was given the largest acreage, for the reason that it is the chief product of the country and important that some early and good varieties be obtained.

Nineteen new and 28 old varieties were tested. Red Fife was given 32 acres, Ladoga 16 acres, White Fife, Eureka, Saxonka, Red Fern and others, 1 to 2 acres each; 26 varieties had $\frac{1}{2}$ an acre and newer sorts from $\frac{1}{10}$ to $\frac{1}{5}$ of an acre each. The larger portion of the land was fallowed, but fall and spring ploughing were sown with Red Fife, to test the difference in earliness and yield.

Red Fife and Ladoga were sown at different dates and with different quantities per acre. These were also sown by drill and broadcast, and attempts were made to sow by press drill, but on account of the sticky nature of the soil these were not successful. Grain on fall ploughing is shrunken and as will be seen the yield is much less than that on fallow. That on spring ploughing was equally as good as on fallow in quality and nearly the same in yield.

The difference between early, medium and late sowing is very noticeable, but this may, to a large extent, be accounted for from the frost of 21st August which caught the various lots in different stages of ripening. The field sown on 16th April was barely ripe and could have stood several days without injury had no frost occurred.

The grain from this field grades No. 2 Hard and is plump but frozen. The medium, sown on 24th April, was equally heavy in straw as that sown on 16th, but the frost came when the grain was in the milk and the result is 23 instead of 35 bushels per acre. The late sown on 30th April, was about $\frac{1}{3}$ less in straw and the heads were much smaller than that first sown. The frost caught it just as the grain was well filled but quite soft, and hurt it badly, so badly in fact that it is useless for anything but feed, and although the return is $19\frac{8}{60}$ bushels per acre, this quantity may be put down at about 12 bushels of wheat for its feeding properties.

In the tests of different quantities per acre the results must not be taken as indicative of the relative advantages from the various quantities sown, as none of the plots reached maturity when overtaken by frost, unless it is considered that each plot was injured equally, which I think could not be the case, as plots sown with $1\frac{3}{4}$ bushels per acre would have, on a reasonable calculation, one-half more heads exposed to the frost than that sown with one bushel and consequently suffer more per acre. The test, however, is given as showing the results of these different methods of seeding when their growth is stopped by frost.

In comparing Ladoga as an early wheat with Red Fife, in the tests of sowing different quantities per acre, Ladoga comes out about the same as in all other trials, being a few bushels behind in yield, but the grain is better or at least not hurt so much by frost on account of its being a few days more advanced.

In testing by broadcast and drill, nothing on the farm was so apparent, during the whole summer, as the difference between the two ways of sowing, especially when the grain was put in late. That sown by drill in every case came up in a few days and very even; that sown broadcast, early, came up with the drilled grain, but not so even or thick; whereas that sown broadcast, late, was ten days behind in appearing above ground, and then, was not one-half as thick.

When rain came in June, the grain near the surface started and thickened up the crop, but frost coming before this portion was filled or even the heads wholly formed, the last growth did more harm than if it had never started. Perhaps nothing has caused so much poor grain in the country as broadcast seeding the past year. A few drying days, in seeding time, made the soil an ash-heap for one or one and one-half inches down, and unless the seed was below this, it must there remain until rains come. This year they did not come until June, with the result that that portion of seed above the moisture did not grow for several weeks after that where the moisture was, and when the frost came was sufficiently advanced to injure the early grain by mixing with it, but not far enough on to be of any use in itself.

On the advent of frost on the morning of the 21st August, four plots of Red Fife and four of Ladoga, which were sown on the 30th of April, were thought to be in suitable condition to test the effect of cutting a part immediately after frost, and allowing another part to remain standing until ripe and noting the difference in yield. This was done, and the result was that the grain left until ripe gave 4 bushels per acre more than that cut immediately after the frost. The average of the eight one-half acre plots cut on the 21st was 15 for Red Fife and 14 $\frac{40}{60}$ bushels per acre for Ladoga. The average of that cut when ripe, or on 29th August, was $19\frac{8}{60}$ for Red Fife, and $18\frac{50}{60}$ Ladoga, or an increase of a little more than 4 bushels per acre in both varieties.

As will be seen there were sixteen varieties of wheat cut when frost came. This number does not include Red Fife, which was harvested both before and after the 21st.

In earliness, Karachi Club Bombay and Hard Calcutta were first last year and are the same this.

Gehun, a variety tried this year, is early and has given the best yield of any kind tested.

Campbell's Triumph, the Red and White Connell, Green Mountain, Campbell's White Chaff, &c., are all fine wheats; while Defiance, Judket, Magyar, Russian Hard Tag and others are late and not suitable for a year like the past.

The different varieties of wheat, except a few sorts from India, were very heavy in the straw and had frost held off for 10 days more, the yield would have been increased several bushels per acre in those sorts not cut by 21st August. The returns from those cut before the 21st, may be regarded as a correct and full yield.

Frozen Red Fife seed was sown, which in quality would grade No. 3 frozen. This was put in by drill at the rate of 2 bushels per acre, and returned $21\frac{50}{60}$ bushels. It was sown at the same time as No. 1 Hard, Red Fife and beside it on land similarly prepared. No. 1 Hard gave 23 bushels per acre.

The following are the varieties of wheat tried, the date of seeding is given, the harvest, yield, and weight per bushel, also the different tests of early, medium and late sowing, different quantities per acre sown, and drill and broadcast seeding, &c.:—

Wheat, 1890.

Variety.	Seeding.	Harvest.	Yield.	Weight.
			Bush.	Lbs.
Red Fife	April 16	Aug. 23	35·16	59
Ladoga	do 16	do 13	28·10	58⅓
Saxonka	do 16	do 19	28·8	60¾
White Fife	do 17	do 23	33·7	59¼
Eureka	do 17	do 23	23·18	60
Red Fern	do 17	do 23	28·18	59½
White Connell	do 18	do 25	28·32	57¾
Red do	do 18	do 25	26·40	60
Golden Drop	do 21	do 19	21	59¾
Defiance	do 21	do 28	21	57
Magyar	do 21	do 28	19·35	55½
Chilian White	do 21	do 21	29·8	59
Russian Hard Tag	do 21	do 28	27	59½
White Delhi	do 22	do 19	23·40	64
Soft Calcutta	do 22	do 19	19·8	62
Improved Summer Cob	do 22	do 28	19·30	57½
Rio Grande	do 22	do 19	20·50	58
Karachi (India)	do 22	do 9	20·10	61¼
Assiniboia	do 22	do 19	30·30	59½
Campbell's Triumph	do 23	do 21	38·38	58¼
Blue Stem	do 23	do 25	27·30	56½
Hungarian Mountain	do 23	do 25	17·30	58½
French Imperial	do 23	do 25	24·25	59
Wellman's Fife	do 23	do 24	18·54	58
Herison's Beardless	do 23	do 24	27	58½
Carter's Cross Bred, I	do 23	do 28	16·28	53¾
do D	do 23	did not	fill.	
Club Bombay (India)	do 23	do 9	25·57	60½
Hard Red Calcutta (India)	do 23	do 15	36·10	62
Australian	do 23	do 21	27·7	57½
Azima (Russian)	do 23	do 21	19·4	56
Green Mountain	do 24	do 21	34	58¾
Campbell's White Chaff	do 24	do 19	32·4	59½
Greek Summer	do 24	do 19	25·4	61⅓
Simla (India)	do 24	do 25	20·37	58½
Gehun do.	do 24	do 15	46·34	64¼
Kangra do	do 24	do 15	25·32	64
Palampur do	do 24	do 25	15·32	55
Seoraj do.	do 24	do 15	20·43	63¼
Kulu do	do 24	do 28	22·30	54⅓
Judket	do 21	do 28	18·16	55
Polish Odessa	do 23	did not	head out.	
Sandomerica	do 23	do	do	
Baltic Red	do 23	do	do	
Hungarian	do 23	do	do	
Californian White	do 23	Aug. 28	21	55
Early, Medium and Late Seeding—Test.				
Red Fife	do 16	do 23	35·16	59
do	do 24	do 28	23	58¾
do	do 30	do 29	19·8	54
Ladoga	do 16	do 13	28·10	58⅓
do	do 24	do 18	30	59¼
do	do 30	do 29	18·50	56
Different Quantities of Seed per Acre.				
Red Fife, 1 bushel per acre	do 30	do 29	22·58	54
do 1¼ do	do 30	do 29	21·34	54
do 1½ do	do 30	do 29	19·8	54
do 1¾ do	do 30	do 29	14·20	54
Ladoga 1 do	do 30	do 29	23·40	56
do 1¼ do	do 30	do 29	18·45	56
do 1½ do	do 30	do 29	15·55	56
do 1¾ do	do 30	do 29	12·20	56

WHEAT, 1890.

Variety.	Seeding.	Harvestl	Yield.	Weight.
Drill vs. Broadcast—Test.			Bush.	Lbs.
Red Fife, drill	do 16	do 23	35·16	59
do broadcast	do 16	do 23	32·00	59
Ladoga drill	do 30	do 29	19·8	54
do broadcast	do 30	do 29	8·50	54
Test—Cutting Wheat immediately after Frost and Cutting when Matured.				
Red Fife	do 30	do 21	15·00	51
do	do 30	do 29	19·8	54
Ladoga	do 30	do 21	14·40	56
do	do 30	do 29	18·50	56
Result of Wheat Sown on Summer Fallow—Fall and Spring Ploughing.				
Red Fife, fallow	do 16	do 23	35·8	59
do spring ploughing	do 16	do 18	30·40	59
do fall do	do 14	do 15	23·00	58½

BARLEY.

Thirty-two varieties of this grain were sown last spring from 24th to 30th of April. Except the India sorts all were very heavy in straw and a good deal was laid down by rain storms before harvest. The only barley not lodged was Duck-bill and this although having more straw than any other was not in the least injured in this respect; it was, however, more discoloured than any other sort, from having fewer beards and the exposed position of the grain in the heads.

Seven varieties were sown in acre lots on 24th April. All were cut down by frost after coming up a few inches above the ground and were retarded a few days in their growth from this cause, but in the end suffered no loss from it. Each acre was very heavy in straw, taking from 5 to 6 pounds of twine to bind them. For earliness, yield, good straw, vigorous growth, and general appearance none equalled the Duck-bill.

Mensury, a six-rowed variety, approaches the Duck-bill in straw, but is not equal in yield and the straw crinkles down as it approaches maturity, which is not the case with the Duck-bill.

Goldthorpe is very like the Duck-bill in straw and formation of head and will, no doubt, be a very productive barley for the North-West.

Three of the seven varieties were sown again on the 29th or five days later than the first seeding. These were not quite so heavy in straw and a large proportion of each lot except Duck-bill was badly lodged.

Although the yield was not quite so large as from the early seeding, the berry was somewhat better on account of the straw not being so thick on the ground. Both were sown with the same quantity of seed per acre, but the spring frost had the effect of causing the early sown to stool out one-third more than the late.

Early seeding of barley on the Experimental Farm has invariably produced the best crop. Though on one occasion the early growth was cut back by frost three times; yet in the end the crop turned out the best, and in view of the probability of there being a large increase in the acreage sown next spring of this grain, it is recommended to sow as soon as possible after the spring opens.

One and one-half bushels is sufficient seed per acre where sown early, as it will almost certainly be cut back by frost and will then stool out more than if sown later; 1¾ to 2 bushels per acre is necessary if sown late.

None of the varieties have this year come up to last year in weight per bushel. Although the yield is far better, the grain is not so plump or rounded, which was probably caused by the large growth of straw.

The following table shows the varieties sown and returns, &c :—

BARLEY, 1890.

Variety.		Sown.	Matured.	Yield.	Weight.
				Bush.	Lbs.
Two-Rowed	Carter's Prize Prolific	April 24..	Aug. 19..	49·6	52¼
do	Duckbill	do 24..	do 12..	55·20	51¼
do	Saale	do 24..	do 19..	53·30	50
do	Thanet	do 24..	do 19..	49·4	48¾
do	Beardless	do 24..	do 19..	45	51⅓
do	Danish Chevalier	do 24..	do 16..	46·10	47¾
do	Chevalier	do 24..	do 18..	43·25	49¾
do	Golden Melon	do 28..	do 17..	50·30	50⅓
do	Swedish	do 28..	do 17..	53·9	51⅓
do	Peerless White	do 28..	do 17..	40·16	47¾
do	Peerless	do 28..	do 14..	39·10	47
do	Danish Printice Chevalier	do 28..	do 17..	37·8	49¼
do	English Malting	do 28..	do 17..	37·26	49⅓
do	Early Minting	do 28..	do 18..	34	49
do	Selected Chevalier	do 28..	do 17..	25	50½
do	Goldthorpe	do 29..	do 14..	45·24	48
do	New Zealand	do 29..	do 14..	36·32	51¾
do	Sharpe's Improved	do 30..	do 26..	46·42	49⅓
Six-Rowed	Mensury	do 29..	do 7..	47·17	49⅓
do	Baxter's	do 29..	do 6..	41·16	49¼
do	Odessa	do 30..	do 15..	38·5	47¾
do	Rennie's Improved	do 30..	do 7..	39·15	49½
do	Sialkot (India)	do 30..	July 31..	20	49⅓
do	Seoraj do	do 28..	Aug. 15..	25·24	48¼
do	Kulu do	do 28..	do 15..	38·7	48
do	Simla do	do 28..	do 15..	24	50½
do	Palampur (India)	do 28..	do 15..	30·30	55
do	Bhagarmany Hills (India)	do 30..	do 7..	31·42	53¼
	Feed Barleys.				
Lahoul (India)		do 30..	do 21..	28	60
Spiti Valley		do 29..	do 6..	37·10	60
Six Rowed Naked		do 30..	do 15..	39·25	57¾
Large Two-Rowed Naked		do 29..	do 13..	28·03	61½
	Test of Different Dates of Seeding.				
Prize Prolific		do 24..	do 19..	49·6	52¼
do		do 29..	do 17..	45	52¼
Duckbill		do 24..	do 12..	55·20	51¼
do		do 29..	do 11..	53·10	51¼
Beardless		do 24..	do 19..	45	51⅓
do		do 29..	do 15..	42·34	51½

OATS, 1890.

Oats were a good crop, but like the barley were very heavy in straw, and those on fallow were badly lodged. Oats were sown on fallow and on fall and spring ploughing. The returns from each are appended.

Prize Cluster, this year, maintained its reputation for earliness, although not so decidedly as last.

Flying Scotchman and Poland White were equal to it in this respect, but in this only; as neither in grain nor straw did either of these varieties equal the Prize Cluster.

The black oats have given the largest yield. This is somewhat remarkable from the fact that they were quite green when frost visited the Territories, and must have been injured to some extent.

The best crop of oats in point of yield was grown on land gang-ploughed three inches deep in the spring; the seed being sown before the land was ploughed.

The field having borne a wheat crop the preceding year, some volunteer grain came up with the oats. The united crop gave a return of 85 bushels per acre.

Oats like barley ripened in shorter time the later it was sown. This may have been caused by frost retarding the early sown and a few days of bad wind in May injuring them, or from being in a more exposed place than those later sown.

The following are the varieties sown, yield &c :—

OATS, 1890.

Variety.	Sown.	Harvest.	Yield.	Weight.
			Bush.	Lbs.
White Prize Cluster	April 22	Aug. 13	63	45
do Welcome	do 22	do 19	42·15	38
do Egyptian	do 22	do 20	61·30	36
English White	do 22	do 18	41·7	36
White Early Racehorse	do 22	do 20	47·20	40
do Banner	do 22	do 22	58·20	40
August White	do 25	do 14	48·16	35½
White English Potato	do 25	do 13	46·4	34½
do Flying Scotchman	do 26	do 11	53·20	42
Poland White	do 26	do 11	47·20	36
Black Longfellow	do 26	do 24	30	36
White Cream Egyptian	do 29	do 17	55·8	42
Rennie's Prize White	do 26	do 14	63·10	45
White American Triumph	do 26	do 22	58·16	40
Black Tartarian, Imp. 90	do 23	do 29	74·30	40
do	do 23	do 29	71·24	36
Black Champion	do 23	do 29	58·4	37
Summer fallow compared with fall and spring ploughing.				
Black Tartarian, fallow	do 23	do 29	71·24	37
do fall ploughing	do 23	do 18	52·5	36
do spring ploughing	do 23	do 16	67·24	37
do do	do 29	do 24	85·10	37
Results of sowing at different dates.				
Fallow, Prize Cluster ... Acre.	do 22	do 13	68·10	43½
do do ... Field.	do 25	do 11	65·2	43½
do Welcome ... Acre.	do 22	do 19	42·18	39
do do ... Field.	do 26	do 14	48·10	39
do Black Tartarian ... Acre.	do 23	do 29	71·24	36
do do ... Field.	do 26	do 25	67	37
do do ... spring ploughing.	do 29	do 25	85·5	37

PEAS.

Five varieties of Field peas were sown; fallow and fall ploughing being used for the test.

All the varieties were greatly damaged by a hail storm, which passed over the Farm on 12th June, cutting off the young leaves and battering the stocks. The Extra Early peas never recovered, and continued poor to the end. Black Eye, Crown and Multiplier gave a large crop in straw, but were late in ripening, and to the frost of August 21st may be attributed the loss of at least one-fourth of the yield.

Mummy peas were obtained late, and were far from being ripe when overtaken by frost, and hence are a light crop. The prospect for this variety was good up to the time of frost, and with early seeding, it is likely to be very suitable for the country.

Considerable difference will be observed in yield from fallowed land and from fall ploughing. This piece of fall ploughing was given great attention, it having had two ploughings and several harrowings; yet the crop was poor in everything but weeds and volunteer grain.

PEAS, 1890.

——	Sown.	Harvest.	Yield.	Weight.
Returns from Summer Fallow.			Bush.	Lbs.
Black Eye	April 24	Aug. 28	30·10	62
Crown	do 24	do 23	25·53	62½
Multiplier	do 24	do 28	27·58	61
Extra Early	do 28	do 3	10	63
Mummy	May 23	do 28	12	..
Returns from Fall Ploughing.				
Black Eye	do 24	do 26	14·5	..
Crown	do 24	do 20	10·14	..
Multiplier	do 24	do 26	13·30	..
Extra Early	do 28	do 3	4	..

FALL WHEAT.

Three varieties, viz., Manchester, Democrat and Tasmania were sown in the fall of 1889. On account of dry fall weather, and being a little late in sowing, a large growth did not take place before winter set in. During the winter, straw to the depth of two inches was put over one-half of each variety, but the only difference observed in the spring was that the portions covered were green a few days longer than those which were not; all died early in May. One variety, "Velvet Chaff," was sown this fall, also one variety of fall rye, viz., "Reading Giant," and two acres of spring wheat was sown just as winter set in.

FODDER PLANTS.

Rye, millet, Hungarian grass, tares, oats, peas and corn were sown for fodder. Of all the varieties tested, rye, this year, like last, proved to be the best and most reliable, and can, without doubt, be depended on every year for a crop of fodder or hay. Rye, sown on fall ploughing on 29th April, cut on 14th July, gave 1½ tons cured hay per acre.

That sown on 2nd May on spring ploughing, cut on 14th July, returned 2½ tons per acre of very fine cured hay. It was again sown on 17th May and on 7th July on fallow, and cut on 1st August and 1st September, the yield being 3 and 2 tons respectively. Rye was also sown for seed on 29th April and on 17th May; ripe on 1st and 15th August. They gave 18·20 and 30·45 bushels per acre respectively. Rye and tares, rye, tares and oats, and rye and oats were sown on 2nd May and gave a large quantity of green fodder, but were not entirely successful for hay on account of having to cut the crop before tares or oats were far enough advanced. Barley would be a more suitable grain to sow with rye, as both would come in nearly together. Oats, tares and peas were sown together in equal parts on 2nd May and cut on 24th July returning 1¾ tons per acre. The hay from this mixture is not equal to rye, but does very well for green fodder.

Golden and common millets were sown on spring ploughing on 7th May; injured by hail on 12th June, were cut on 4th August and gave 1¾ tons per acre each. The same varieties were sown on fall ploughing on 22nd May. Injured by hail and hot winds, gave only 1¼ tons per acre when cut. The same were again sown on fallow on 17th May, but overtaken by frost before ripe, and gave only 1¼ tons per acre.

Hungarian grass was sown each time the millets were, and gave the same quantity per acre, but was hardly so far advanced when cut. Tares, sown on 29th April and cut on 24th July gave $1\frac{3}{4}$ tons per acre; sown on 17th May and cut on 9th August returned 2 tons per acre. Hay very poor, only suitable for green fodder.

CORN.

Corn was sown and planted for fodder on 23rd and 26th May. That portion sown was put in with seed drill by closing up all but four spouts of the drill. The drills were 24 inches apart for the corn sown, and 30 inches where planted.

The most vigorous sorts had attained a height of 5 feet when overtaken by frost on 21st August and all growth stopped. As soon after the frost as possible two-thirds of all the corn was cut and shocked up and the remainder left for ten days. The portion uncut was considerably more withered or dried up than that cut on the morning of the frost. The corn was left in the field in shocks until the ground became frozen, then drawn into the barn and is now being cut with the cutting-box and fed to the cattle, which devour it very readily. In earliness Mitchell's Early, Early Cory and Early Adams are ahead of the rest. In quantity of fodder, Golden Dent, Golden Beauty, Blunt's Prolific, Thoroughbred White Flint, Chester County Mammoth, and Queen of the Prairie rank first. Cinquantine or fifty day corn, though not so high as these, was better suckered and further advanced and may prove a better corn for fodder than any.

The following are the varieties tested and the condition they were in when overtaken by frost:—

CORN, 1890.

Land.	Variety.	Height. Ft.	Height. In.	Condition on 21st August.
	Cinquantine	4	0	In tassel.
	Ex. Early Adams	4	0	Fully tasseled. In silk.
	Ex. Early Cory	3	6	Tasseled. In silk.
	Mitchell's Early	3	6	do do
	Perry's Hybrid	4	0	Commencing to tassel.
	Minnesota Sweet	3	6	do
	Early Concord	3	6	No sign of tassel.
	Narraganset	3	9	Tasseled. No silk.
	Crosby's Early	3	9	Commencing to tassel.
	Blunt's Prolific	4	0	Strong growth. No tassel.
	Virginia Horse Tooth	4	0	No tassel.
	Golden Dent	5	0	Strong growth. No tassel.
	do Beauty	5	0	do do
	Queen of the Prairie	4	9	do do
	Longfellow	4	6	Late. No tassel.
	Thoroughbred Wh. Flint	5	0	do Good growth. No tassel.
	Pee & Kay	4	6	Fully tasseled out.
	Chester Co. Mammoth	5	0	Late. No tassel.
	King Philip	4	0	do do
	Stowell's Evergreen	4	6	do do
	Amber Cream	4	0	Partially tasseled.
	Early Minnesota	3	0	Barely tasseled.
	Leaming Yellow	4	0	Late. Not tasseled.
	Sugar	3	6	Fully tasseled out.
	Long White Flint	4	0	Late. No sign of tassel.
	Fallow and Fall Ploughing Test.			
Fallow	Queen of Prairie	4	9	Strong growth. No tassel.
Fall ploughing	do	4	0	Weak do do
Fallow	Thoroughbred Wh. Flint	5	0	Strong do do
Fall ploughing	do	4	2	Weak do do
Fallow	Golden Beauty	5	0	Strong do do
Fall ploughing	do	4	6	Fair do do
Fallow	Virginia Horse Tooth	4	6	Late do
Fall ploughing	do	3	0	Very weak do

GRASSES.

Up to the present the testing of grasses has proven very disappointing on account of the difficulty of getting any of the varieties to start on this Farm. If the seed is put down out of reach of the winds, very little will germinate; if near the surface, the periodical winds of May or early June sweep them out of the ground. If not sown until after the winds are over, the young plants are not strong enough to stand the dry weather of August and September and generally perish.

The past season was an exception in this respect, and any grasses sown in the latter part of June or the first of July, made a vigorous growth during the rest of the season. Unfortunately the greater part of all our grasses and clovers had been sown at different times before this growing period came, and except for the lawn grasses sown about the house and barn, we had no seed left to sow over again. As evidence of the difficulty of getting a catch of grass seed, I may mention that the lawns were sown three times before success was attained. In my last report mention was made of 18 grasses and clovers having been sown in addition to some native and other sorts. These, except two native kinds were all destroyed by winds. The 18 varieties were resown as quickly as possible. Out of the 18 varieties Perennial Rye Grass, Italian Rye Grass, Orchard Grass, Meadow Fescue, Sheep Fescue, Crested Dog's Tail, Red, Alsike, Lucerne, Sanfoin and White Clovers grew. Perennial Rye Grass, Italian Rye Grass and Crested Dog's Tail were completely killed by the winter or spring. Orchard Grass was half killed, but gave ¾ tons per acre. Meadow and Sheep Fescue were hurt very little and the return from these was 1¼ tons each. The clovers all came through in good shape and returned, Alsike, 1 ton; Red, 1¼ tons; Lucerne, 1½ tons; Sanfoin, 1½ tons; White was a thick mat and of course could not be cut. In addition to those already mentioned, there appeared this spring from the second seeding, Hard Fescue, Red Top and timothy; the timothy producing ¾ tons per acre.

This year all those varieties that stood last winter were sown with grain and in plots on the bare fallow, and in addition 33 varieties were sown in small plots in the garden, 8 kinds are from India, 20 native, and the balance includes Texas Blue Grass, Bermuda Grass and Johnson Grass.

Winds and hail destroyed the various kinds sown on the bare fallow, and a thin catch was obtained among the grain. In the small plots Muhlenbergia sylvatica, Muhlenbergia glomerata, Poa serotina and Glyceria grandis grew well. The first two headed out and ripened their seed. Johnson grass had obtained a height of 30 inches when destroyed by frost. Very little of any of the other varieties grew.

FLAX.

Flax was sown on three different dates. First on 7th May, second on 17th May and third on 22nd May. Ripe on 15th, 20th and 22nd August, respectively. Gave 7·10, 12·5, 9·26 bushels per acre. The stalks grew about 30 inches high..

BUCKWHEAT.

Was sown on 22nd May and 2nd June. Both seedings made a good growth, but were overtaken by frost on 21st August and completely killed.

BEANS.

Twenty varieties of beans were planted on 21st May. They consisted of the following:—

Sugar Pearl, Sugar Grey; Chevrier; Emperor William; Schirmer's Purple Seeded; Golden Butter Wax; Large Podded; English Horse; Sugar Pearl Rose predome; Negro Black; Ne plus Ultra; Round Yellow 6 Weeks; Flageolet Purple Seeded; Zion House; Negro Extra Early; Empress Augusta; Black Speckled; Nettle-leaved White and Hundred to One.

Butter Wax and 6 Weeks were the earliest but not early enough to escape the first frost on 21st August. Except the English Horse beans, all were destroyed at this date, English Horse was not hurt then, but succumbed to a frost of 10° on 12th September. When overtaken the beans were hardening and a very few days more would have put them out of danger. All the beans were in pods, but Butter Wax and 6 Weeks were more advanced by a week than any other sort.

ROOT CROP.

On account of the root crop being on a heavy piece of land the past season, the crop was not a good one considering the year.

Shortly after the carrots, mangels, beets and turnips were above ground a hail storm passed over and almost destroyed them. Three varieties of mangels and all the beets were killed and the land was resown with turnips near the end of June. Those left partly injured never recovered from the hail and were often after this put back by heavy dashes of rain which several times flooded the pieces of land on which the roots were sown.

TURNIPS.

Bangholm, Queen of Swedes, Skirvings, Lord Derby Green Top, Highland Prize, Purple Top and Elephant were the varieties sown. Bangholm, Skirvings and Queen of the Swedes each gave 500 bushels per acre. Lord Derby, 300 bushels; Green Top, 420 bushels; Highland Prize, 320 bushels; Purple Top, 410 bushels; and Elephant, 480 bushels per acre.

MANGELS.

Mammoth Long Red, Mammoth Long Yellow, Giant Intermediate, Prize Yellow and Giant Yellow Intermediate were sown. The three latter were destroyed by hail. Mammoth Long Red returned 605 bushels and Mammoth Long Yellow, 502 bushels per acre.

CARROTS.

Orange Giant, White Belgian, Long Orange Nantez, White Vosges and Improved Short White were sown. Improved Short White was by far the best; in fact, the only one worth taking up and it only gave 200 bushels per acre.

SUGAR BEETS.

Three varieties were sown, but all were destroyed.

Chicory and Amber Sugar Cane were also sown. The chicory grew to a fair size, but was very rooty.

Amber Cane did not grow over six inches high.

POTATOES.

The following potatoes were planted last May: Early Rose, Beauty of Hebron, Morning Star, White Star, Stray Beauty, Early Bird, May Queen, Gleason, Matchless, Rosy Morn, Wonder of the World, Sharpe's Seedling, Bliss' Triumph, Early Ohio, Lees Ex. Early, Early Conqueror, Genessee Seedling, Empire State, Stonewall Beauty, Richters, Brownwell's Beauty, Clark's Beauty, Adirondack, Alpha, Richter's Gem, Jumbo, Boston Market, Member of Parliament, Great Eastern, Rose's New Giant, Harrison, Conqueror, Goodrich, St. Patrick, Thorburn, White Elephant, Snow Flake, Thorburn's Paragon, Vick's Pride, Sugar, Kidney August, Telephone, Pride of America, Richter's Elegant, Chicago Market, Empress Bell, Brownwell's Beauty, Early Puritan, Count Moltke, and 29 seedlings. Like the mangels and turnips the potatoes suffered from excess of rain on the heavy soil, and before the majority were matured the frost of 21st August came and stopped further progress.

On the whole the crop was only fair. Beauty of Hebron made the best show of tops. Morning Star, Stray Beauty, Sharpe's Seedling, Beauty of Hebron, Early Rose, Lee's Ex. Early, Rose's New Giant, White Elephant, Clark's Triumph, Empress Bell, Early Puritan, Late Rose, Boston Market, Harrison, Early Bird, Early Conqueror and Brownell's Beauty were the best croppers.

VEGETABLE GARDEN.

This necessary but often much neglected portion of farm work was again much injured by winds. Although not so destructive as last year, they were sufficiently so to require the resowing or replanting of several of the varieties tested and kept back all at least 4 weeks; which in our short season makes the difference between a good and a medium crop.

Vegetables, all over the North-West, were exceptionally good the past year; and anyone whose garden was sheltered either by natural or artificial means from the cold winds of May and hot winds of July, has, this fall, an abundant crop.

The following were the varieties tested in the vegetable garden on the Experimental Farm; the results are also given:—

Cabbage.—Early Epping, Early Summer, Winningstadt, Large Drum Head, and Green Curled Scotch Kale were set out. Early Epping was the earliest. Heads small, but firm. Early Summer was later, but cabbage good. Winningstadt did not come to head. Large Drum Head, late, with some fine heads. Kale did extra well.

Cauliflower.—Snowball, Ex. Early Erfurt and Mitchells were planted. The snowball and Ex. Early Erfurt were by far the best. Mitchells, although they were the best plants, made few heads, and those few were poor.

Celery.—London Red, Paine's Golden Yellow and Sandringham were planted on 12th June. All did well.

Onions.—Globe Danvers, Wethersfield, Barletta and White Globe were sown, and White and Yellow Dutch Sets were put out. All were so badly injured by winds that they had to be resown, but too late for any good results.

Carrots.—Chantenay, Ox Heart and Scarlet Nantes were sown. These were all blown out after coming above ground, and although sown over again, the crop was poor.

Turnips.—Early Milan, Nimble Dick, Orange Jelly and Large White Globe were sown. All were blown out. A fair crop was the result of a second seeding. Early Milan being the earliest.

Radish.—Rosy Gem, Long Scarlet and Scarlet Oliveshaped were sown. Rosy Gem and Scarlet Oliveshaped were the earliest and best.

Peas.—Maclean's Little Gem, Maclean's Advance, American Wonder, Early Dwarf Brittany, Pride of the Market, Yorkshire Hero and Champion of England. These were sown on 17th April, and almost entirely destroyed by winds when about six inches high; were resown on 19th May. Maclean's Advance was the earliest. All gave good crops, except Dwarf Brittany.

Beans.—Early Valentine, Early Mohawk and Golden Wax were planted on 9th May. Early Valentine gave green beans for table use on 28th July; the others a few days later. None were ripe when frost overtook them on 21st August.

Beets.—Half-long Blood and Early Eclipse were sown on 24th April; destroyed by wind and resown on 9th May with Early Egyptian and Lentz. Early Egyptian was earliest and best quality, but Lentz was the heaviest crop.

Tomatoes.—Conqueror, Smooth Red, Dwarf Champion, New Peach and Potato Vine were planted on 3rd June. Dwarf Champion and Conqueror had the largest and best crop of tomatoes. The others had a fair crop. None ripened except under glass.

Salsify—Good crop, but roots rough.

Spinach.—Entirely blown out.

Parsnips.—Two-thirds blown out. Balance, fair crop.

Parsley.—Sown 16th April and 6th May. Good crop.

Lettuce.—Toronto Gem, Prize Head and Early Hanson were sown at different times from 23rd April to end of May. The early sowing was destroyed by winds, the later sowing did well and gave lettuce until October.

Corn.—Early Cory, Fifty Day, Crosby's Early, Early Adams, Mitchell's Early, and Native Squaw corn were planted on 23rd May. The Squaw corn and Early Adams had a few ears fit to use when frost of 21st August came. Crosby's Early, Early Cory and Mitchell's Early were a few days later.

Watermelons, Citrons and Cucumbers were sown. The water melons formed no fruit. A few fair sized citrons were on the vines and the cucumbers were fit to use when frost came.

Asparagus.—First cut on 1st June and continued for a month.

Rhubarb.—Badly injured by hail on 12th June, but a good crop toward end of season.

FLOWER GARDEN.

I trust those who may read this annual report and have never seen the North-West will not imagine a flower garden to be an utter impossibility. Although we have not yet succeeded in making one equal to many seen in Ontario, nevertheless the attempt is being made to grow flowers as well as raise No. 1 Hard wheat. We do not boast much of the success in raising Zinnias, Marigolds, &c., but in Sweet Williams, Pansies, Mignonette, Sweet Peas, Phlox, &c.. visitors to the Farm during August, September and October testified by their button-holes that such ample success was obtained as to warrant every settler in having a flower garden.

Pansies, Dianthus, Phlox Drummondi, Asters, Stocks, Mignonette, Portulacca, Petunias, Sweet Peas, Verbenas, &c., were sown or transplanted from hot beds from 16th May to 11th June. Of these Pansies, Mignonette, Sweet Peas, Phlox Drummondi, Stocks, Dianthus, Verbenas, and Poppies proved the best and surest for the North-West climate.

APPLE TREES.

Apple trees suffered greatly last winter and this spring, so mnch so that I am compelled to report almost the entire failure of those set out in 1888-89. Numbers are living, but in such a crippled condition that I am almost afraid they may be classed with the lost. Last season was a very hard one on trees of all kinds and when succeeded by a severe winter and unfavourable spring the result could hardly be anything but disastrous. Only one tree of 1888 planting grew from the tips and that only ½ inch. Eight trees were cut down to the snow-line, or about 18 inches above ground and all but these were killed to the ground. Sprouts have come from above grafts, but whether they will stand any better than the parent trees remains to be seen.

Those planted in 1889 died by wholesale, but very few being found alive this spring. This year's planting consists of 500 Russian seedlings, which it is hoped and expected will stand better than any before put out. The following are apple trees planted in 1888, 1889 and 1890, showing state they are in at present:—

APPLE TREES, 1888.

——	Planted.	Killed to Snow Line.	Killed to Ground.	Growth from Tops.	Dead.
Alexander	8	....	4	....	4
Wealthy	3	2	1	..	0
Walbridge	3	....	....		3
McIntosh Red	3	....	1	..	2
Tolman's Sweet	3	....	2	..	1
Keswick Codling	3	.	3		0
Red Astrachan	3	..	1	..	2
Anis	3	1	2		0
Golden Russet	3	1	....	...	2
Mann	9	....	7	..	2
Duchess	5	....	3	1	1
Scott's Winter	3	..	1	....	2
Grimes' Golden	3	....	1	....	2
Tetofsky	3	....	2	....	1
Canada Baldwin	3	....	2	....	1
Fameuse	6	..	1	....	5
	64	4	31	1	28

One hundred and twenty-three of 43 Russian varieties (not named) were also planted in 1888. Twelve of these are growing from tops, 44 from ground, 14 were killed to snow line, the remainder are dead.

Planted, 1889.	Planted.	Killed to Snow Line.	Killed to Ground.	Growth from Tops.	Dead.
Arabka (Dept)	35	2		2	31
Longfield	10				10
Mottled Anis	11				11
Repka Malenka	9			4	5
Whitney, No. 20	19				19
Titovka	20				20
Barloff	5				5
English Borovinka	4				4
Red Anis	19	2			17
Grand Duke Constantine	4				4
Zolotareff	3				3
Bogdanoff	1				1
Ostrokoff	6				6
Enormous	8				8
Reinette	2				2
Cross	7			1	6
Antonovka	19				19
Switzer (Dept.)	9				9
Golden White	9				9
Grandmother	8				8
Herren	4				4
Red Repka	3				3
Label defaced	2				2
Hibernal	14		2	1	11
Yellow Anis	17	1	2		14
Vargul	3				3
Sandy Glass	13				13
Ukraine	3				3
Livland	7				7
Russian Apple	6				6
Plikanoff	10	2	1		7
Autumn Streaked	10	1	1		8
Lieby	10		1	9	0
Getman's Bean	4				4
White Borodovka	[illegible]				8
Titus	10		1		9
Grandmother	10	2		6	2
Red Duck	10	5		4	1
	352	15	8	27	302

CRAB APPLES.

Three each of Hyslop, Transcendent, Red Siberian and Whitney Crab were planted in 1888. Two Hyslop, 2 Transcendent, 1 Red Siberian and 3 Whitney are living, all growing from the tops; 1 Transcendent was cut down to ground, remainder are dead.

In 1889, 109 crab-apple trees of 8 varieties were planted. This year only 6 are living.

CRAB APPLES, 1889.

	Planted.	1890, Living.
Stanley	22	5
Minnesota	8	0
Brier's Sweet	10	1
Gibb	20	0
Orange	30	0
Late Winter	9	0
Welcome	10	0
	109	6

PEARS.

In 1888, 20 pear trees were set out. These consisted of Beurré Hardy, Clapp's Favourite, Howell, Flemish Beauty, Seckel and 2 Russian varieties. One Flemish Beauty lived through the first winter. None were alive in spring of 1890. Thirty Russian seedlings were planted in May last.

PLUMS.

Twenty-three plum trees of 9 varieties, viz:—Golden Drop, Moore's Arctic, Lombard, Marianna, German Prune, Wolf, Speer, Rollingston and Early Red were planted in 1888. Eleven of these were alive last year. This fall, 2 Speer, 3 Wolf, 1 Rollingstone and 3 Early Red are alive. All are cut back and only side shoots are growing. This year, 3 trees of Early Red were planted and are all alive now.

CHERRIES.

Thirty-four cherry trees were planted in 1888. The varieties were Ostheim, Morello, Vladimir and Early Richmond. One Early Richmond and two Vladimir stood the first winter, but are dead now. This year three varieties, were planted consisting of 5 Koslov Morello Cherry, 3 Black Hill and 3 M. Cherry No. 6. All lived and made good growth the past summer.

SMALL FRUITS—CURRANTS.

We never had a better prospect for currants than last season up to 12th June. At that time all the fruit was formed and much of it well grown. The bushes were loaded down, and everything promised a most abundant crop. Unfortunately a shower of hail passed over on that day and left very few on the bushes. When ripe only two quarts of currants were gathered.

The following are varieties set out with number of bushes of each kind living at present from planting done in 1888 and 1889:—

CURRANTS, 1888–89.

	Planted.	Living.
Victoria	25	24
Lee's Prolific	349	266
Champion	12	10
Fay's Prolific	25	20
Raby Castle	255	246
White Grape	185	141
Red Dutch	20	16
Black Naples	44	42
Red Grape	7	6
	922	771

Almost all the losses occured with bushes set out in 1889 from the dry weather which prevailed that season.

RASPBERRIES.

These were uncovered on the 28th April. Golden Queen, Cuthbert and Caroline were all killed down to ground. The Turners and Philadelphias were in fair order, but the canes were very weak. All these varieties made good growth during the past summer and the canes are a good size and well ripened. Turner and Philadelphia had a great deal of bloom, but the hail of 12th June hurt them badly. There was, however, considerable fruit of good size and well formed gathered from these two kinds. The following varieties planted in 1889 were entirely killed by the dry summer or cold winter: Hilborn, Doolittle, Parnell, Clarke, Marlboro', Souhegan, Gregg, Ohio, Taylor and Snyder; while out of 139 Mammoth Cluster, Rancoccas, Reeder, Brandywine, Hornet and Hebner's Cluster, only 46 plants are living, and these made little or no growth during the past summer. Except a few hydrids, no raspberries were set out the past spring and the hail of 12th June killed them all. In 1888 a good many native raspberry bushes were obtained and this year they bore a fair quantity of fruit. Like the cultivated varieties they suffered from hail.

GOOSEBERRIES.

No new varieties have been planted or additions made to this fruit since 1889. Smith's Improved, Houghton Seedling and Downing were then planted. Smith's Improved and Houghton showed a good deal of bloom this spring but nearly all was knocked off by hail. A few berries ripened of the Smith's Improved and a considerable quantity of the Houghton. The Downing was mostly winter killed but all started again from the roots. The Houghton has stood the two winters best of any of the varieties set out.

STRAWBERRIES.

All the vines came through the winter and spring safely, but bore little or no fruit afterwards.

The hail was partially the cause of this and dry weather last summer, which prevented the runners from growing, was no doubt also partly to blame. This winter a good number of healthy young plants are covered up, and it is hoped better success will be had next season.

GRAPES.

Seventeen varieties of grapes were planted last spring. These consisted of Champion, Niagara, Moore's Early, Roger's, Woodruff Red, Hartford Prolific, Agawam, Worden, Telegraph, Brighton, Clinton, Elvira, Concord, Jessica, Early Victor, Delaware and one not named. They were planted 18 inches deep, and as the vines grew, soil was filled in until level with surface. When winter set in all were well mulched with earth and coarse manure.

FOREST TREES.

Thirty-eight thousand three hundred and seventeen forest trees were planted in May last. These consisted of 4 varieties of pine, 4 of spruce, 3 of maple, 4 of ash, 3 of elm, 2 of chestnut, 2 mountain ash, and 1 variety each of cedar, larch, juniper, basswood, birch, hickory, oak, butternut, walnut, Russian mulberry, honey locust, coffee tree, cottonwood, Russian olive, and red cedar. The pines, with the exception of Scotch, suffered greatly from hot winds in June and July, and as table will show a large proportion died. The spruce and larch suffered much loss, but not to the same extent as the pine. The maple, elm, ash and Russian olive nearly all grew. Honey locust, butternut and walnut were nipped by the first frost and by 20th December every tree seemed dead. It will be seen that very few trees, planted in 1889, came through last winter; those that did so, excepting ash-leaved maple and Manitoba elm made little or no growth the past year. White and Norway spruce never moved; in fact this fall they appear to be dying. Scotch and Riga pine show the most vitality. So far, the following may be said to be the result of tree testing on the farm: Scotch, Riga and European mountain pine and red cedar a fair success. The spruces, hemlock and American arbor vitæ have thus far failed. The birches, mountain ash, Norway maple, American elm and Cottonwood have in a measure succeeded, as a number of each have stood two winters and made a fair growth the third summer.

Butternut, walnut, ash, locust, beech, catalpa, sycamore, oak, hickory, &c., have failed. Our native maple, elm, ash, oak and cherry are, of course, successful wherever grown, and it seems quite safe to recommend that such as these be planted almost entirely by settlers.

Forest Trees planted, 1889–90, with number living in November, 1890.

Name.	Planted, 1889.	Living, 1890.	Planted, 1890.	Living, 1890.
Scotch Pine	421	70	175	164
Austrian Pine	400	0	200	21
Riga Pine	43	28	500	40
Mountain Pine	.....	.....	150	96
White Spruce	1,018	358	310	247
Norway Spruce	675	30	185	140
Hemlock	153	0	.....	.....
Cedar	650	0	70	63
Red Cedar	50	40	180	52
Ash-leaved Maple	500	440	225	221
Norway Maple	875	142	110	93
Soft Maple	75	0	2,010	1,946
Russian Olive	.....	.....	100	100
Black Walnut	53	5	1,000	800
Rock Elm	135	120	.....	.....
Manitoba Elm	982	955	.....	.....
American Elm	600	200	320	320
Yellow Birch	71	50	.....	.....
White Birch	.....	.....	42	28
European Birch	50	30	.....	.....
Canoe Birch	100	40	.....	.....
Green Ash	90	30	2,020	1,820
White Ash	140	0	2,970	2,680
Black Ash	105	42	834	782
Mountain Ash	75	50	.....	.....
Oak	54	0	200	0
Locust	374	0	530	436
Red Oak	2	0	.....	.....
American Beech	200	0	.....	.....
Black Cherry	114	50	.....	.....
White Elm	.....	.....	5,017	4,898
Juniper	.....	.....	5	3
Russian Mulberry	.....	.....	1,000	849
Linden	.....	.....	415	0
Chestnut, sweet	.....	.....	25	19
Spanish Chestnut	.....	.....	25	22
Native Maple	.....	.....	215	215
Catalpa	850	0	.....	.....
Cottonwood	2,000	160	1,000	897
European Alder	50	5	.....	.....
Sycamore	41	0	.....	.....
Coffee Tree	.....	.....	250	150
European Larch	500	0	135	42
Butternut	.....	.....	625	409
European White Ash	.....	.....	11	11
Blue Spruce	.....	.....	10	9
Hickory	.....	.....	15	10
American Mountain Ash	.....	.....	31	30
European Mountain Ash	.....	.....	11	11
Native Maple, Elm and Ash (transplanted)	.....	.....	17,676	16,980

WHERE TREES WERE OBTAINED.

Four thousand nine hundred and forty-seven were received from the Central Experimental Farm, Ottawa ; 15,450 from Nebraska ; 29 from Prof. Budd, Iowa; 215 from Rev. Mr. Fotheringham, Grenfell, 17,676 transplanted from seed sown on Farm, 1887 and 1888 ; also 3,450 shrubs and cuttings of willow and poplar from Central Experimental Farm, Ottawa, and 737 shrubs and cuttings from Prof. Budd. 500 cuttings of seven varieties of our native willow were obtained and planted ; a total of 42,998, and if to these were added 705 fruit trees, a grand total of 43,703 trees, shrubs, &c., were planted in May last.

WHERE PLANTED.

A large number were planted on wind-break on the west side of Farm. This wind-break is 100 feet wide and extends one mile the entire length of Farm. This had been two-thirds planted the year before with many varieties of trees, 10 feet apart each way. Last spring every tree, excepting native maple and a few elm, were found to be dead. This necessitated almost the entire replanting, which was done, and the unfinished portion was also planted, but instead of being planted 10 feet apart, the rows were made 5 feet, and the greater portion set out with trees 5 feet apart in the rows.

Our native maple and elm were the principal sorts put out in the plantation, but a number of pine, spruce, ash, elm, Russian olive, &c., were interspersed.

On the southern portion of farm on banks of the coulée, a block of 5 acres was planted with box elder or native maple, trees being put 5 feet apart each way, also two small blocks of 1 acre each on the northern part of Farm. In addition, large numbers were planted along roads, around dams, buildings, &c., and in nurseries. It is computed that at least 22 acres of land were set out in trees in May, last.

WILLOWS AND POPLARS.

The following varieties of willow and poplar were planted in 1889 .

—	Name.	Number Planted.	State, 1890.
Willows	Salix Acutifolia	3	3 growing from tips.
do	Wis. Weeping Willow	7	All dead.
do	Salix Voronesh (116)	5	All living to tips.
do	White Willow	7	do from roots.
do	Yellow do	7	All dead.
do	Purple do	4	4 growing from roots.
do	Norway do	4	All growing from tips.
do	Salix Laurifolia	2	do roots.
Poplars	Populus Wobstin, Riga (40)	2	do tips.
do	do Virginiana	4	All dead.
do	do Beno	8	5, poor growth from roots.
do	do Pyramidalis	2	All dead.
do	do Bolleana	2	do
do	do Aurea	2	2, growth from tips.
do	do Certinensis Sargent	6	All dead.
do	do Not named	7	do

Three varieties of willow, Salix Voronesh, Salix Acutifolia and Norway willow and 2 of poplar stood last winter well, and made a strong growth this past season. This year 2,910 cuttings of these willows and poplars were received from Ottawa and from Prof. Budd, Iowa, and set out, but only a small percentage grew. Five hundred cuttings of our native willow were also planted, with no very good results.

SHRUBS.

One thousand three hundred and twenty-seven shrubs of the following varieties were planted last spring: Alnus incana, Artemisia, Sorbus acuparia, Caragana arborescens, Alnus glutinosa, Spiraea Van Houtte, Spiraea Fortunei, Spiraea superba, Syringa De Marley, Spiraea callosa, Spiraea opulifolia, Weigelia Lavallei, Ribes aureum, Viburnum opulus, Syringa vulgaris, Syringa alba, Deutzia candidissima, Philadelphus nana, Philadelphus coronaria, Berberis purpurea, Spirea Bullata, Berberis vulgaris, Symphoricarpus racemosus. The following list shows the proportion which survived :—

PLANTED IN 1889.

Name.	Number.	Condition in 1890.
Ligustrum vulgare	46	All dead.
Robinia pseudacaia	155	do
do tortuosa	9	3 living.
Cytisus alpinus	16	All dead.
do capitata	54	19 living.
do laburnum	80	All dead.
Spartium scoparium	48	do
Robinia bessoniana	77	18 living.
Cytisus elongatus	20	All dead.
Clematis viticella	6	do
Genista Germanica	45	do
Spirea alba	1	do
Robinia monophylla	24	do
Berberis elegans	12	2 living.
Spirea opulifolia	71	55 do
do Billardii	7	6 do
Clematis flammula	10	All dead.
Ribes acuparia	17	8 living.
Cytisus Lab. sessifolius	7	All dead.
Berberis vulgaris	3	1 living.
Colutea halepica	22	All dead.
Genista tinctoria	5	do
Cytisus hirsutum	24	do
Cytisus Lab. quercifolia	7	do
Robinia viscosa	16	do
Ceanothus Americanus	16	do
Spiraea callosa	11	10 living.
Cytisus Lab. Parkii	24	All dead.
Spiraea rotundifolia	3	do
Ribes sangineum	24	do
Weigelia	1	do
Colutea frutescens	21	do
Acer Ginnala	2	2 living.
Philad. Zeyheri	5	All dead.
do coronaria	3	do
Syringa De Marley	7	5 living.
Weigelia Lavallei	7	All dead.
Cytisus	80	do
Philad. cordifolia	2	do
Syringa rothamagensis	2	do
Pyrus bacca aurantiacum	2	2 living.
Spiraea Californica	6	All dead.
do prunifolia	1	1 living.
Syringa Josikea	2	2 do
Weigelia Desboisi	2	All dead.
Lycium Europeum	1	1 livlng.
Spiraea Douglasi	6	1 do
Philad. inodorus	1	All dead.
do grandiflora	2	do
Caragana arborescens	1	1 living.
Deutzia Fortunei	2	All dead.
Berberis purpurea	6	do
Tilia sylvestris	2	2 living.
Syringa alba	70	45 do
do vulgaris	5	2 do

From the foregoing it will be seen that the Syringas, Caraganas and Spiraeas, came through fairly well. Out of the whole list Caragana, Syringa alba, and Acer Ginnala came through in perfect condition, and can safely be recommended for trial. To these may be added Eleagnus or Russian Olive which was planted in 1888, has stood two winters and during the past year made good growth.

TREE SEEDS.

Maple seeds were sown in the spring of 1889 and in the fall of the same year. Large numbers of the spring sowing were blown out, but many survived and made a growth of 6 to 8 inches, and this year are 20 to 24 inches high. Those sown in the fall came up in time to be completely destroyed by wind in May.

Two bushels of black walnuts were sown in 1889. From these 40 trees grew, but none lived through the winter.

A large quantity of elm seeds was also sown in the spring of 1889, but between winds and failure to germinate, only a few hundred grew.

This last season, large quantities of maple, ash and elm were sown in May, June and July. Those sown in June have done the best on account of not being troubled by winds after they appeared above ground. In October, 3 bushels hazel nuts, 12 bushels acorns, 2 bushels of wild cherry seeds, 2 bushels saskatoons. and 2 bushels hawthorns were sown in beds. Several bushels of Manitoba maple and ash seeds were sown in October. According to instructions, I had picked by half-breeds in the Qu'Appelle Valley the large quantity of 156 two bushel bags of maple, and 83 bags of ash seed. With a part of these it is intended to sow a large area of land in the spring, so as to have a plentiful supply of young trees for transplanting and distribution. The portion not required for the Indian Head Farm has been forwarded to Ottawa for general distribution.

HORSES.

Eleven horses constitute the force on hand. Nine of them are draught and two general purpose. Excepting a few attacks of colic, no sickness has taken place among the horses since my last report. All are well at present and in good condition. Since work stopped in the fall, no hay has been fed. Cut oat sheave , bran and straw constitute their food.

CATTLE.

During October a selection of cattle was made from those on the Central Farm at Ottawa, of the following breeds:—Shorthorns, Ayrshires, Holsteins and Polled Angus. Of the Shorthorns, 1 bull, 3 cows and 1 heifer were obtained; Ayrshires, 1 bull, 1 cow and 2 heifers; Holsteins, 1 bull and 3 cows, and Polled Angus, 1 bull and two cows. Since their arrival, one of the Polled Angus cows has increased the herd by the birth of a heifer calf. In the month of November, two cows and nine heifers were purchased from farmers. Ten of these are the ordinary Shorthorn grades of the country and one a Polled Angus grade. They were obtained for the purpose of crossing with the pure-bred bulls on the Farm. Since their purchase three births have taken place.

In the following list the particulars of their breeding are given, the animals having been selected from strains likely to be very useful in the North-West:—

Shorthorn Bull.

Rosy Prince 8th, No. 9,198, C. H. B.—Date of birth, 6th November, 1886; colour red, with a little white; bred by Richard Gibson, Delaware, Ontario; sire Wild Eyes Laddie, No. 67,992, E. H. B.; dam Rosy Princess 7th, by 7th Lord of Oxford.

Shorthorn Cows and Heifers.

Wild Flower, No. 14206.—Date of birth, 3rd April, 1886; colour red and white; bred by Richard Gibson, Delaware, Ontario; sire, Wild Eyes Laddie No. 9192 C.H.B.; dam, Hermosa by Prince 3344; 2nd dam, Rose by Viceroy of Richmond.

Cowslip 3rd, No. 16646.—Date of birth, 13th October, 1886; colour red; bred by James Graham, Port Perry, Ontario; sire Prince Victor 5th; dam, Cowslip 2nd by Royal Buck 2374; 2nd dam, Cowslip 797 by Senator 1058.

Red Rosebud 2nd, No. 16918.—Date of birth, 14th November, 1887; colour red and white; bred by John Miller & Sons, Brougham, Ontario; sire, Vice Consul (Imp.) 4132; dam, Rosebud (Imp.) 5205, by Gladstone 43286; 2nd dam, Rosebud 6th, by Sir Christopher 22895.

Nellie Elgins, No.—Date of birth, 31st December, 1889; colour red; bred at Central Experimental Farm, Ottawa, Ontario; sire, Mazurka Duke 5th; dam, Miss Elgins 5th, No. 16644 by Minna Duke No. 2108 C.H.B.; 2nd dam, Miss Elgins 2nd No. 4108.

Holstein Friesian Bull.

"Onetta's Edgely," No. 11308.—Date of birth, 8th October, 1888; colour black, with white markings; bred by Smith Bros, Churchville, Ontario; sire Duke of Edgely, H. F. 552; dam Onetta D.F. 1816.

Holstein Friesian Cows.

Abi, H.F.H.B. 9831.—Date of birth, 5th July, 1887; colour black, with white patches; bred by C. F. Sweezey, Marion, N.Y.; sire, Oatka 3rd Neptune, jr., H.H.B. 4531; dam, Snowie, H.F.H.B. 3114, by Empire Boy, H.H.B. 2615; 2nd dam, Rosalind, H.H.B. 577.

Bonnie Ethel's Mercedes, H.F.H.B. 11243.—Date of birth, 5th April, 1888; colour black, with white markings; bred by Thomas E. Wales, jr., Iowa City, Iowa; sire, Mercedes Prince, H.H.B. 2150; dam, Bonnie Ethel, H.H.B. 9510.

Siepkje 3rd Queen.—Date of birth, 11th September, 1888; colour black, with white markings; bred by W. A. Rowley, Mount Clemens, Mich.; sire Macomb Boy, H.F.H.B. 8734; dam, Siepkje 3rd, H.F.H.B. 2387.

Ayrshire Bull.

Pride of Carleton, No.—Date of birth, 3rd August, 1889; colour red, with white spots; bred at Central Experimental Farm, Ottawa, Ontario; sire, Rob Roy 3971; dam, Clara No. 3590 by Promotion; 2nd dam, Maud No. 2356.

Ayrshire Cows and Heifers.

Gipsy, No. 3979.—Date of birth, 15th August, 1886; colour red, with white spots; bred by James Drummond, Petite Côte, Quebec; sire, Promotion 3212, imported; dam Victoria 2931, by Lorne 2227; 2nd dam, Effie 579, by Gordie 26.

Viola, No. 943.—Date of birth, 1st November, 1888; colour white and red; bred by David Nicol, Cataraqui, Ontario; sire, Norseman 478; dam, Dido 942, by General 155; 2nd dam, Dora 244, by Douglas 148.

Eve, No.—Date of birth, 2nd October, 1889; colour red, with white markings; bred at Central Experimental Farm, Ottawa, Ontario; sire, Rob Roy 3971; dam, Eva No. 3828, by Promotion; 2nd dam, Bell 3131.

Polled Angus Bull Calf.

Date of birth, 3rd March, 1890; colour black, bred at Central Experimental Farm, Ottawa, Ontario; sire, King of Eastview, No. 8780; dam, Dolly Varden, of Eastview, No. 6792, by Knight of Canada, No. 5622; 2nd dam, Dolly Varden 3rd, No. 3458.

Polled Angus Cows.

Pride of Eastview, No. 6809.—Date of birth, 3rd October, 1886; colour black, bred by late Hon. J. H. Pope, Cookshire, Quebec; sire, Knight of Canada, 5622; dam, Pride of Montbletton 3rd, 3473.

Stella of Eastview, No. 7638.—Date of birth, 14th June, 1887; colour black; bred by late Hon. J. H. Pope, Cookshire, Quebec; sire, Knight of Canada, 5622; dam, Stella of Ardconnon, 4929.

POULTRY.

Three breeds of poultry were obtained from Central Experimental Farm, Ottawa, last October, namely:—Plymouth Rocks, Light Brahmas and Houdans. When a poultry house is built further breeds will be added to these.

BEES.

Two hives of bees were obtained last summer but were late in reaching here and made little or no honey afterwards. Before putting them into the cellar they were supplied with sugar to carry them over the winter.

LAND PREPARED FOR 1891.

Two hundred and fifteen acres have been summer fallowed during the past season. Of this 105 acres were ploughed twice and several times harrowed; 70 acres were ploughed once and cultivated from 2 to 3 inches deep and harrowed 3 times. 40 acres were gang-ploughed in the fall of 1889; ploughed once in 1890 and twice harrowed. Fifteen acres stubbleland was ploughed in October for testing purposes next year; 10 acres were also gang ploughed.

No weeds were allowed to grow over 2 inches high at any time on the fallow. One hundred acres were in crop in 1889, and 105 acres had not been cropped since Experimental Farm commenced, and was in consequence in a very bad state with wild buckwheat and pig weed.

OTHER WORK.

One new dam was built, before frost set in, across the coolée on the north part of the Farm, to collect water for the stock during the summer; additions were also made to the drains already built; some new roads were made and kept in order where crops were growing; and some grading done about the buildings.

WATER.

I am pleased to report the purchase of a wind-mill and the necessary piping to bring from one of the dams to the barn the supply of water required for stock and other purposes, and trust the further drawing of water from tanks will be avoided after the spring opens.

This fall, cisterns in the dwelling houses and a large tank in basement of barn were made and well filled with rain-water collected from the roofs, before winter set in. They are found to be of great use, especially that one in the barn for supplying water to the stock during cold weather.

BUILDINGS.

No new buildings or additions were made during the past year. An implement house is urgently needed, for, on account of the large crop, no room can be found in the barn, and a temporary erection provides poor shelter for costly implements. A good sized granary was put up in the barn during the summer, but part of the oat crop filled it. Wheat, barley and much of the oats had to be put in bins or sacks on the barn floor, or in the basement.

FAIRS.

During the month of October the Fall Fairs held in Whitewood, Broadview, Grenfell, Indian Head and Regina were attended with an exhibit of the products of the Farm. Samples of the various grains were shown in the straw and in bottles or bags; also a collection of 82 varieties of potatoes and 40 varieties of our native grasses, mostly gathered on the Experimental Farm. A collection of the grain in straw, grown on the Farm, was also sent to the Central Fair at Ottawa, and shown at the Toronto, London and Ottawa Exhibitions. A collection of the better sorts of barley, wheat and oats in straw was also sent to the Board of Trade, Regina, and from there forwarded with other exhibits of the North-West Territories, in a special car through Ontario, Quebec and the Maritime Provinces.

I have the honour to be, Sir,

Your obedient servant,

ANGUS McKAY,

Superintendent.

EXPERIMENTAL FARM FOR BRITISH COLUMBIA.

REPORT OF THOMAS A. SHARPE, SUPERINTENDENT.

AGASSIZ, B. C., Dec. 31, 1891

To WM. SAUNDERS, Esq.,
Director Dominion Experimental Farms,
Ottawa.

SIR,—I have the honour to submit the following report of the work done on the Experimental Farm at Agassiz, B. C., for the year 1890.

The winter of 1889 and 1890 was the severest known in this district for some years past, the ground was frozen to a considerable depth early in January. The spring was rather wet and cold, and although during the latter part of haying and through harvest we had rather unsettled weather, yet the summer has on the whole been a favourable one for the growth of grain, and root crops. Up to this date there has only been two slight frosts, pansies, daisies and other hardy flowers are unhurt.

During the winter we had plenty of work for the men employed, as there was a large quantity of birch, alder, and other roots to be hauled off the ploughed land, the weather being too wet to admit of burning them in piles on the ground. We took off during the winter, and in spring after the second ploughing, over six hundred wagon loads, which were burned when dry.

On the 10th of March we began clearing a piece of bench land at the base of the mountain, for grapes and other fruits, and cleared ground sufficient to plant a small orchard of peach, nectarine, apricot, cherry and fig trees, as well as grape vines, of which the following is a list

PEACHES.

1. Schumacher.	1. Hilborn.
1. Early Rivers.	1. Lord Palmerston.
1. Amsden.	1. Salway.
1. Mountain Rose.	2. Late Crawford.
2. Wager.	1. Stevens' Rare Ripe.
1. Old Mixon.	2. Foster.
1. Wheatland.	1. Waterloo.
1. Early Barnard.	1. Alexander.
1. Early Beatrice.	1. Lemon Cling.
1. Golden Cling.	1. Coolidges Favourite.
1. Early Canada.	1. Stump the World.
2. Early York.	1. Globe.
3. Early Crawford.	1. Hale's Early.
1. Aiken.	1. Smock.

Three of these trees have died, the rest have done well.

APRICOTS.

1. Nicholas.

NECTARINES.

1. Pitmaston's Orange.	1. Boston.

CHERRIES.

1. May Duke.
1. Windsor.
1. Mezel.
1. Early Richmond.
1. Yellow Spanish.
1. Lieb.
1. Black Eagle.
1. Black Tartarian.
1. Knight's Early Black.

FIGS.

2. Brown Turkey.
2. Early Violet.

ORANGE.

1. Satsuma Orange from Japan.

All of these trees made a good growth.

GRAPE VINES.

2. Rogers 34.
3. Worden.
2. Brighton.
2. Clinton.
2. Delaware.

These have all made a very fair growth.

The land on the bench being warm and dry and earlier than that on the level, this was done before the level land was sufficiently thawed to allow of its being worked.

As soon as the frost was out of the level land harrowing was begun with the disk and drag harrows, and after getting the ground well harrowed down, it was cross ploughed and again thoroughly barrowed when the fruit trees received and heeled in last fall were planted and plots sown with wheat, oats, barley and roots.

GRAIN.

The varieties of fall wheat, and rye, sown last fall have all done fairly well, considering that the land could not be got in good condition, in the short time we had to prepare it previous to planting.

Fall Wheat.	Date when Sown.	Date when Harvested.	Number of Pounds Sown.	Number of Pounds Harvested.
	1889.	1890.		
Manchester	Oct. 30	Aug. 1	6¼	133
Tasmania	do 31	July 30	5½	93
Democrat	Nov. 1	do 30	6	98
Carter's Hybrid A	Dec. 18	Aug. 19	1	29
do B	do 18	do 13	1	31
do C	do 20	do 19	1	20
do D	do 20	do 19	1	24
do F	do 20	do 19	1	28
do G	do 21	do 19	1	22
do H	do 21	do 19	1	24
do J	do 21	do 19	1	18
do K	do 21	do 19	1	28
Fall Rye.				
Giant Reading	Nov. 4	do 8	5½	92
Polar	do 4	do 8	5½	100

The varieties of spring grain were sown on land newly reclaimed and could not be expected to do much under such conditions. The general experience of the old settlers in British Columbia goes to show that it takes two or three years of cultivation to get this fern land into condition, to do itself justice, and the experience gained this year on the Experimental Farm confirms this view. I hope, however, to be able to shorten this time somewhat, as arrangements have been made with the

Canadian Pacific Railway to leave their stock cars here long enough to admit of the manure being taken out of them, and I hope in this way to get during the winter—together with what will be made on the farm—a sufficient quantity to dress most of the land that was broken last fall. In cleaning the land all the ashes from the burned wood and roots were saved and used to dress the land about the newly planted fruit trees, and where applied early in the season, produced most satisfactory results. The peaches especially showing more than double the growth and a healthier appearance, where the ashes were applied, than those not so treated.

Spring Wheat.	Date when Sown.	Date when Harvested.	Number of Pounds Sown.	Number of Pounds Harvested.
	1890.	1890.		
Carter's Hybrid I	April 3	Aug. 29	1	35
Campbell's Triumph	May 6	do 26	3	45
California White	do 6	do 27	3	44
Hungarian Mountain	do 6	do 27	3	43
Judket	do 6	do 26	3	45
Ladoga	do 6	do 26	3	35
Red Fife	do 6	do 28	3	31
White Fife	do 6	do 28	3	45
Red Fern	do 6	do 28	3	35
Rio Grande	do 6	do 28	3	47
Campbell's White Chaff	do 6	do 26	3	48
White Delhi	do 6	do 26	3	13
White Russian	do 6	do 28	3	61
Mountain Spring	do 6	Sept. 4	8¼	98
Barley.				
Large Two-rowed Naked	do 6	Aug. 25	6	54
English Malting	do 6	do 25	6	89
Saale	do 6	do 25	6	79
Rennie's Improved Six-rowed	do 6	do 5	6	79
Baxter's Six-rowed	do 6	do 5	6	64
Peerless White	do 6	do 25	6	61
Goldthorpe	do 6	do 29	6	85
Beardless	do 6	do 29	6	50
Prize Prolific	do 6	do 29	6	65
Odessa	do 6	do 18	6	76
Golden Melon	do 6	do 29	6	25
Danish Chevalier	do 6	do 29	6	47
do Printice Chevalier	do 6	do 29	6	56
Mensury	do 6	do 7	6	38
New Zealand	do 6	do 29	6	30
English Malting	do 6	do 29	6	39
Improved Chevalier	do 6	do 29	6	24
Six-rowed Wheat	do 6	do 18	6	47
Spiti Valley (Indian)	do 6	do 18	3	10
Oats.				
Prize Cluster	do 6	do 27	6	70
Victoria Prize	do 6	do 27	6	69
American Triumph	do 6	do 28	6	58
Bonanza	do 6	do 14	6	50
American Banner	do 6	Sept. 4	6	68
Early Racehorse	do 6	Aug. 27	6	66
Flying Scotchman	do 6	do 27	6	69
Rennie's Prize White	do 6	do 27	6	51
Cream Egyptian	do 6	do 27	6	50
Egyptian White	do 6	do 27	6	54
Welcome	do 6	do 26	6	55
Golden Grains	April 25	do 14	1	48
Rosedale	do 25	do 12	1	32

NOTE.—Golden Grains and Rosedale oats were sown on old land, which probably accounts for the great difference in their yield.

CORN.

There were 29 varieties of corn planted on 13th and 14th of May for fodder. It was sown with the grain-drill, in rows 36 inches apart, and cultivated to kill the ferns. Some of the varieties made a very fair growth, but only a few matured corn. There was considerable difficulty in getting it cured for fodder owing to the frequent rains and the yield on the newly broken land was small. Further tests will be needed to determine its relative value for fodder here.

The following is the weight of yield per acre:—

			Tons Per Acre.
No.	1	Moore's Early Concord, corn matured, one of the best..	10
"	2	Crosby's Early Sugar, corn matured, good..................	8
"	3	Early Mammoth, no corn, ears did not form................	12
"	4	Early Adams, corn matured to glazing stage..............	5
"	5	Extra Early Adams, corn matured to glazing stage......	5
"	6	Mitchell's Extra Early White Flint, produced some matured ears..	5
"	7	Long White Flint, ears did not form..................	8
"	8	Long Yellow Flint, ears did not form........................	8
"	9	Thoroughbred White Flint, ears did not form.............	8
"	10	Cory Sugar, matured corn, a small growing sort, not a good yield..	4
"	11	Marblehead Sugar, matured corn, ears very small.......	4
"	12	Narraganset, sweet, corn did not fill to tips of cob.......	8
"	13	Perry's Hybrid, did not produce corn........................	10
"	14	Chester Co. Mammoth, no corn formed......................	12
"	15	Minnesota Sweet, produced corn, ears small...............	6
"	16	Stowell's Evergeen, no ears formed..........................	12
"	17	King Philip, produced corn to roasting stage, ears did not fill to tip..	7
"	18	Hickory King, roasting ear corn, good........	8
"	19	Queen of the Prairie, no ears formed........................	10
"	20	Golden Beauty, no ears formed.......	8
"	21	Golden Dent, no ears formed....................................	8
"	22	Amber Queen, roasting ear corn, good.......	10
"	23	Long Yellow, no ears formed	10
"	24	Leaming Yellow, no ears formed	8
"	25	Blunt's Prolific, no ears formed................................	10
"	26	Virginia Horse-tooth, no ears formed.........................	10
"	27	Pee and Kay, no ears formed....................................	12
"	28	Fifty day corn, ears formed but very small.................	3
"	29	Tom Thumb, no ears formed, planted 9th June............	1

SOUTHERN COW PEA.

A small quantity was sown of the Southern Cow Pea so valuable for fodder in the Southern States. Evidently the summer is not hot enough here for them, they made a very poor growth and do not promise to be of much value in this province.

ENGLISH HORSE-BEANS.

Three pounds of these were planted and did fairly well, but not having barn room in which to dry them they sprouted in the pod and were spoiled.

BEANS.

Owing to wet weather and a press of other work, the beans were not harvested promptly when ripe, but pulled and put under cover as opportunity offered. The Black Wax was the first to ripen followed by Negro Extra Early. Others ripened in rapid succession.

Beans.	Date when Sown.	Number of Pounds Sown.	Number of Pounds Harvested.
	1890.		
Nettle-leaved White	May 9	3	47
Hundred to One	April 29	3	65
Schirmers	May 17	3	35
Emperor William	do 7	3	53
Black Speckled	do 8	3	55
Negro Extra Early	April 27	3	13
Chevrier	May 8	3	37
Sugar Pearl Rose Pedrome	do 13	3	36
Wax Date	do 13	3	27
Sion House	do 12	3	39
Schirmer's Purple-seeded	do 12	3	32
Round Yellow Six Weeks	do 7	3	51
Ne Plus Ultra	do 13	3	39
Negro Black, Long-podded	do 7	3	28
Flageolet, Purple-seeded	do 12	3	31
Sugar Pearl	April 25	3	53
Largest Podded	May 9	3	32
Golden Butter-wax, Black	April 28	3	36
Empress Augusta	do 25	1	8
Sugar, Grey White-podded	May 13	3	47

POTATOES.

There were 31 varieties of seedlings received from the Central Experimental Farm, these were planted in rows 3 feet apart and about 1 foot in the row.

They are being tested as to their table qualities, and those of merit will be planted next year. A few of them were so badly rotted as to be worthless.

The following are the weights from potatoes planted:

—	Date Planted.	Date Harvested.	Number of Pounds Planted.	Number of Pounds Yield.
Number 2*	May 10	Sept. 20	$\frac{3}{4}$	10
do 5	do 10	do 20	3	26
do 9	do 10	do 20	3	28
do 10	do 10	do 19	3	39
do 15	do 10	do 19	3	54
do 21*	do 10	do 19	3	26
do 27	do 10	do 20	3	19
do 53	do 10	do 20	3	63
do 54	do 10	do 20	3	62
do 73	do 10	do 20	3	55
do 80	do 10	do 19	3	75
do 83*	do 10	do 19	3	20
do 94	do 10	do 19	3	55
do 98	do 10	do 19	3	33
do 116	do 12	do 19	2	52
do 118	do 12	do 19	3	43
do 120	do 12	do 20	3	32
do 122	do 12	do 18	3	61
do 123	do 12	do 19	3	58
do 136*	do 12	do 19	2	24
do 141	do 12	do 20	2	33
do 153	do 12	do 22	3	33
do 170	do 12	do 22	3	42
do 177	do 12	do 22	3	34
do 178	do 12	do 22	3	65
do 188	do 12	do 19	3	30
do 155	do 12	do 20	3	39
do 196	do 12	do 20	3	34
do 209	do 12	do 20	3	75
do 225	do 12	do 20	3	75
do 231	do 12	do 19	3	34
Japanese	do 12	do 19	$2\frac{1}{2}$	57

* Rotted.

TURNIPS AND MANGELS.

There were five varieties of Swede turnips sown 20th June in drills, 3 feet apart, Elephant Swede, Skirvings Purple Top, Lord Derby, Queen of the Swedes, and Bangholm, all of which made a medium growth, some of each variety were sown in ridged and some in flat drills, but there was no apparent difference in growth from the time they appeared above ground until harvested.

Four varieties of mangels were sown 18th April, Mammoth Prize Long Red, Mammoth Long Yellow, Golden Intermediate, Warden Prize Yellow Globe.

The Long Red and Yellow Globe gave the best returns.

FIELD CARROTS.

Two varieties of field carrots were sown 22nd April, Orange Giant and Mitchell's Perfection. Both of these gave good returns.

FRUITS.

The old orchard has been carefully cultivated and kept clean. There was a fair crop of apples this year, but many of them were so badly damaged by scab as to be unfit for use. There were small exhibits sent to Brandon and Indian Head to be shown in the North-West, with the products from the Experimental Farms at those places, to the Central Experimental Farm in Ottawa, also to the exhibition at Calgary Alta.

Two hundred and seventy-seven apple trees comprising 78 varieties were received last fall, these were planted this spring, and all except two have made a good healthy growth. In addition we have received and planted this autumn 44 trees of 19 varieties, making altogether 321 trees and 97 varieties of which the following is a list:—

No. of Trees.	Variety.
7	Golden Russet,
2	Henry do
3	Anis,
3	American Pippin,
5	Alexander,
3	Bottle Greening (one dead),
7	Ben Davis,
7	Baldwin,
2	Blue Pearmain,
3	Blenheim Orange,
3	Belle de Boskoop,
2	Bombshell,
2	Bailey's Sweet,
2	Canada Red,
3	do Baldwin,
3	Carolina Red June,
3	Cooper's Market,
5	Colvert,
3	Chenango Strawberry,
12	Duchess of Oldenburg,
5	Fameuse,
5	Early Harvest,
2	Fallawater,
3	Fanny,
7	Gravenstein,
5	Grimes' Golden,
3	Fall Jennetting,
5	Haas,
3	Sweet Bough,
3	Sutton's Beauty,

No. of Trees.	Variety.
2	Lady,
2	Ontario,
2	Hyde's King of the West,
2	Wagener,
2	North-Western Greening,
2	White Pippin,
2	Rawles Janet,
2	Lawver,
2	Stark,
3	Hurlburt,
3	Hastings,
2	Jonathan,
2	Jersey Sweet,
5	King,
2	Keswick Codlin,
3	Longfield,
5	Maiden's Blush,
7	Mann,
4	McIntosh Red,
3	McMahon's White,
2	Mayne Island (one dead),
2	Magog Red Streak,
4	Northern Spy,
2	Oregon Red Cheek,
3	Peach of Montreal,
5	Peck's Pleasant,
2	Pewaukee,
3	Ribston Pippin,
5	Red Bietigheimer,
3	Rolfe,

No. of Trees. Variety.

3 Salome,
3 Shannon,
3 Smith's Cider,
2 Spitzenburgh,
7 Twenty Ounce,
2 Tolman's Sweet,
5 Tetofsky,
2 Waxen,
3 Wellington,
3 Winter St. Lawrence,
3 Wolf River,
7 Wealthy,
2 Walbridge,
5 Yellow Belleflower,
3 Warner's King,
5 Yellow Transparent,
2 Autumn Swaar,
2 Stump,
2 Shiawassa Beauty,
2 Western Beauty,
2 Delaware Winter,
2 Arnold's Beauty,

No. of Trees. Variety.

5 R. I. Greening,
2 Rambo,
9 Red Astrachan,
2 Swaar,
2 Seek No Further,
3 St. Lawrence,
3 Scott's Winter,
2 Cano,
2 Rome Beauty,
2 Bullock's Pippin,
2 Roxbury Russet,
2 Hubbardston's Nonesuch,
2 Autumn Strawberry,
2 L. S. Pearmain,
2 Fall Pippin.

Crab Apples.

2 Montreal Beauty,
2 Whitney,
2 Transcendent,
2 Yellow Siberian,
2 General Grant,
4 Hyslop.—In all 14 trees of 6 varieties.

PEARS.

Last fall 143 pear trees of 36 varieties were received; they were planted in the orchard this spring and have done well. This season there was sent from the Central Experimental Farm and other sources 36 std. pear trees, 16 varieties, making a total of 179 trees and 52 varieties of which the following is a list:—

No. of Trees. Variety.

2 Armond Morrell,
8 Bartlett,
7 Beurre Easter,
3 Beurre Diel,
3 Beurre Hardy,
5 Beurre Clairgeau,
7 Beurre d'Anjou,
3 Buffum,
7 Clapp's Favourite,
7 Duchess d'Angouleme,
3 Doyenne d'Ete,
2 Grey Doyenne,
2 White Doyenne,
3 Doyenne Boussock,
2 Early Madeline,
8 Flemish Beauty,
3 Goodale,
3 Howell,
2 Keiffer,
2 Dearborn's Seedling,
5 Louise Bon de Jersey,
2 Souvenir d'Esperin,
2 Belle Lucrative,
2 Madeline,
1 Wilder,
1 Salviata.

No. of Trees. Variety.

4 Lawrence,
2 La Conte,
3 Mount Vernon,
5 Margaret,
5 Osband's Summer,
2 Passe Colmar,
3 President,
3 Ritson,
5 Sheldon,
7 Seckel,
4 Souvenir de Congress,
3 Summer Belle,
5 Tyson,
2 Winter Nelis,
2 Dula Medovska,
2 Tonkovietka,
1 Dempsey,
2 Sapieganka,
2 Bessemianka,
5 Vicar of Winkfield,
6 Kurskaya,
2 Frederick Clapp,
2 Brandywine,
3 Idaho,
2 Onondaga,
2 Beurre Bosc.

All those planted last spring have made vigorous growth.
The following dwarf pear trees were also received:—

No. of Trees.	Variety.	No. of Trees.	Variety.
2	Beurre d'Anjou,	2	Josephine de Malines,
2	Doyenne Boussock,	2	Kieffer,
2	Bartlett,	2	Louise Bon de Jersey,
2	Beurre Easter,	2	Lawrence,
2	Duchess d'Angouleme,	2	Margaret,
2	Clapp's Favourite,	2	Seckel,
2	White Doyenne,	2	Urbaniste,
2	Beurre Hardy,	2	Tyson,
2	Howell,	4	Beurre Superfin.

A total of 38 trees of 18 varieties; all have made a good growth.

PLUMS.

The plums have all lived and made a fine growth, some of this year's shoots being over six feet long. The following is a list of the different varieties:—

No. of Trees.	Variety.	No. of Trees.	Variety.
3	Peters' Yellow Gage,	2	Lombard,
1	Sugar Plum,	5	Peach Plum,
2	Damson,	5	Coe's Golden Drop,
5	Reine Claude,	2	Prunus Simoni,
3	Fellenburg,	2	Bleekers Gage,
4	Weaver,	5	Pond's Seedling,
5	German Prune,	3	American Violet,
2	Victoria,	3	Hudson River Purple,
7	Bradshaw,	3	McGillivray,
5	Imperial Gage,	2	Prune d'Agen,
2	Italian Prune,	5	Red Egg,
2	Columbia,	7	Washington,
2	Jefferson,	2	Green Gage,
3	Smiths Orleans,	2	Quakenboss,
3	Saunders,	2	Richland,
3	Moore's Arctic,	2	Kelsey's Japan,
4	Yellow Egg,	2	Ogon,
3	Genii,	2	Lincoln,
3	Duane's Purple,	2	Spaulding,
3	General Hand,	2	Satsuma Blood,
3	Munroe,	2	Abundance,
3	Niagara,	2	McLaughlin,
4	Shippers' Pride,	2	Saratoga,
3	Moyer,	2	Botan,
3	Large Golden Prolific,	2	Shropshire Damson.
2	Beauty of Naples,		

Of these one Imperial Gage is dead, leaving a total of 152 trees of 50 varieties all in first-class condition.

PEACHES.

In addition to the peach trees noted in my report last year, a consignment was received in the spring; all were planted, and with the exception of five, are alive, and have made a thrifty growth. There is now in the orchard, or in nursery rows awaiting planting, the following varieties.

No of Trees.	Variety.
5	Foster,
5	Salway,
5	Late Crawford,
3	Lemon cling,
2	Amsden,
2	Hale's Early,
3	Hilborn,
2	Aiken,
2	Coes Golden Cling,
3	Early Canada,
4	Globe,
3	Early Beatrice,
3	Stump,
3	Old Mixon,
3	Mountain Rose,
5	Early York,
3	Early Barnard,
3	Wheatland,
3	Smock,
3	Alexander,
3	Stephens Rare-ripe,
2	Waterloo,
2	Malta,
2	Coolidges Favourite,
2	Alexander Noblesse,
2	Early Silven,
2	Princess of Wales,
2	Lord Palmerston,
2	Surpasse Melocoton,
2	Wheelers Late,
2	Jaques Rare-ripe,
2	Red-cheek Melocoton,
2	Amsden June,
2	Golden Drop,
2	Golden Rare-ripe,
2	Belyeas Late.
2	Fords Late,
2	Yellow St. John,
2	Burke,
1	John Haas,
2	Mary's Choice,
2	Barnards New Rare-ripe,
2	Early Rivers.

No of Trees.	Variety.
7	Early Crawford,
3	Schumacher,
5	Wager,
2	Scott's Nonpareil,
2	Marshall's Late,
2	George 4th,
2	Druid Hill,
3	Lovett's White,
2	Susquehanna,
2	Hill's Chili,
2	Stonewall Jackson,
2	Lemon Free,
2	Southern Early,
2	Moore's Favourite,
2	Ward's Late,
2	Fox's Seedling,
2	Hugh's I. X. L.,
2	Chair's Choice,
2	Kayport White,
2	Pratt,
2	Steadley,
2	Reeve's Favourite,
2	Elberta,
2	Hyne's Surprise,
2	Willet,
2	Indian Blood,
2	Heath Free,
2	Chinese Blood.
2	Shipley's Late,
2	Hyatt,
2	Heath's Cling,
2	Muir,
2	Normand's Choice,
2	Troth's Early,
3	Good,
2	Cooley's Mammoth.
2	Reeds Early Golden,
2	Kaloola,
2	Thurber,
2	Hances Golden,
3	Wonderful,
2	Gudgeon.

A total of 207 trees of 85 varieties.

CHERRIES.

The cherry trees received last fall, also those received from the Central Experimental Farm in spring were planted, some on the bench land, and the remainder in the orchard. Four trees have died, the others have made a very good, and in some cases, an exceptionally fine growth. The collection includes in all 137 trees of the following 41 varieties.

No. of Trees.	Variety.	No. of Trees.	Variety.
7	Knights Early Black,	7	Yellow Spanish,
7	May Duke,	7	Black Eagle,
3	Downer's Late Red,	2	Napoleon,
3	Ostheim,	2	Royal American,
3	Early Purple Guigne,	3	Lieb,
3	Great Bigarreau,	5	Windsor,
3	Parent,	2	Black Republic,
3	Black Heart,	7	Early Richmond,
3	Cumberland,	5	Elton,
3	Coe's Transparent,	3	Florence,
3	Vladimir,	3	Champagne,
3	Empress Eugenie,	3	Love Apple,
3	Lithau,	2	Willamette,
3	Louis Phillipe,	2	English Morello,
7	Black Tartarian,	5	Montmorency,
2	Mezel,	2	Reine Hortense,
2	Rockport,	2	Governor Wood,
2	Bessarabian,	2	Olivet,
2	Lutovka,	2	Carnation,
2	Dyehouse,	2	Wragg.
2	Late Duke,		

APRICOTS.

Of this fruit there has been received and planted the following, all of which have made vigorous growth, 43 trees of 18 varieties.

No. of Trees.	Variety.	No. of Trees.	Variety.
3	Alexander,	2	De Coulange,
3	Gibb,	2	Moorpark,
3	J. L. Budd,	2	Peach,
3	Catherine,	2	Royal,
3	Alexis,	2	St. Ambroise,
3	Nicholas,	2	Turkey,
2	Alberge de Montgamet,	4	Shense,
2	Breda,	2	Roman,
2	Carmine Gros,	1	Early Golden.

NECTARINES.

Of nectarines we have the following 12 varieties—25 trees, 21 of which are living and thrifty.

No. of Trees.	Variety.	No. of Trees.	Variety.
2	Downton, (1 dead)	2	Victoria,
2	Early Violet,	2	Pitmaston,
2	Lord Napier, (1 dead)	3	Boston, (1 dead)
2	Milton,	2	Stanwick,
2	Red Roman, (1 dead)	2	Hardwick,
2	Spencer,	2	Early Newington.

QUINCES.

Fourteen trees of six varieties of Quinces have been planted and thirteen have lived and made healthy growth.

4	Orange,	2	Rea's Mammoth,
2	Pear (1 dead),	2	Meech's Prolific,
2	Champion,	2	Fuller.

GRAPE VINES.

Of grape vines 202 have been planted, of which there are now living 188 vines of 78 varieties.

No. of Vines.	Variety.	No. of Vines.	Variety.
3	Amber Queen,	2	Barry, Rogers 21, (1 dead),
3	August Giant,	3	Rogers 28,
8	Brighton,	3	Rogers 39,
3	Jessica,	3	Lindley,
3	Delaware,	3	Catawba,
3	Early Victor,	2	Florence,
3	Niagara,	2	Secretary,
3	Lady,	2	Moyer, (1 dead),
3	Naomi,	2	Brant,
3	Wilder,	2	Autochon,
3	Moore's Early,	2	Eva, (1 dead),
3	Agawam,	2	Victoria,
13	Worden,	2	Champion,
3	Concord,	2	Woodruff Red,
3	Pocklington	2	Jefferson, (1 dead),
3	Salem,	2	Essex,
3	Herbert,	2	Merrimac,
3	Martha,	2	Rogers 34, (1 dead),
3	Massasoit,	2	Bacchus,
3	Gærtner,	2	Creveling,
2	Ives seedling,	2	Cynthiana, (1 dead),
2	Elvira, (1 dead),	2	Canada,
2	Moore's Diamond,	2	Rogers No. 1,
2	Triumph,	2	Goethe,
2	Eumelan, (1 dead),	2	Israella,
2	Lady Washington, (1 dead)	2	Duchess,
2	Berckmans,	2	Cottage,
2	Hayes,	2	Marion, (1 dead),
2	Prentiss, (1 dead),	2	Poughkeepsie Red,
2	Arnolds No. 1, (Othello,)	2	Eaton,
5	Clinton,	2	Oriental,
2	Eldorado,	2	Rogers No. 5,
2	Wyoming Red, (1 dead)	2	Noah, (1 dead),
2	Mo. Riessling,	2	Kensington,
2	Telegraph,	2	Emerald,
2	Mills,	2	Delta,
2	Centennial,	2	Cross between Delaware and Concord
2	Highland,	2	Cross between Chasselas & Concord,
2	Ulster Prolific,	1	Chance seedling.

SMALL FRUITS.

Of the small fruits planted, the currants, raspberries, blackberries and gooseberries all came through the winter in good condition, but the ground heaved so badly that the strawberries were almost destroyed, only 12 strawberry plants being left when growth began.

There are now planted in suitable plots the following varieties of small fruits.

Blackberries, planted in rows 8 feet apart and three feet apart in the rows over 900 of the following 17 varieties.

Agawam,
Snyder,
Taylors Prolific,
Gainor,
Crystal White,
Tecumseh,
Early Harvest,
Kittatinny,

Western Triumph,
Stones Hardy
Minnewaska,
Early Cluster,
Wilson Junior,
Wilson Early,
Lawton,
Erie.
Early King with 50 plants of Lucretia Dewberry.

Of red, yellow and black cap raspberries there are nearly 800 plants of the following 25 varieties.

Cuthbert,
Marlboro,
Turner,
Hansell,
Brandywine,
Heebner,
Shaffer,
H. R. Antwerp,
7 varieties of Saunders' seedlings.
Gregg,
Hilborn,
Caroline,
Brinckle's Orange,
Souhegan,
Mammoth Cluster,
Golden Queen,
Clarke,
Hornet,
Franconia.

RED AND WHITE CURRANTS.

Of these nearly 250 bushes have been planted in rows 8 feet apart and 6 feet apart in the rows of the following 10 varieties.

Cherry,
Fay's Prolific,
Versailles,
Moore's Ruby,
Knights large red.
White Grape,
White Dutch,
Victoria,
Red Dutch,
Long bunch Holland.

BLACK CURRANTS.

Nearly 150 bushes of these have been planted in rows 8 feet apart and 6 feet apart in the rows of the following 16 varieties.

Black Naples,
Champion.
Lee's Prolific,
Manitoba Wild.
nd 12 varieties of Saunders' seedlings.

GOOSEBERRIES.

About 100 bushes have been planted 8 feet apart and 6 feet in the rows of 9 varieties.

Houghton,
Smith's Improved,
Golden Prolific,
Industry,
Triumph.
Crown Bob,
White Smith,
Downing,
Transparent.

STRAWBERRIES.

From the Central Experimental Farm there was received in the autumn about 7,500 plants of the following 39 varieties:—

May King,
Hathaway,
Black Giant,
Bubach,
Seneca Queen,
Manchester,
James Vick,
Woodruff,
Jumbo,
Emerald,
Green Prolific,
Mary Fletcher,
Crescent,
Old Ironclad,
Prince of Berries,
Osceola,
Connecticut Queen,
Westfield's No. 2,
Haverland,
New Dominion,

Charles Downing,
Photo,
Cumberland Triumph,
Windsor Chief,
Atlantic,
Wonderful,
Maggie,
Mrs. Garfield,
Jersey Queen,
Belmont.
Jessie,
Itasca,
Norman,
Sharpless,
Wilson,
Captain Jack,
Gandy,
Pine Apple,
Bordelaise.

Some of these were planted on the bench land and the balance in plots which were prepared by manuring and thorough cultivation during the summer; it is hoped that they will come through the winter this time in good condition.

FOREST TREES, SHRUBS AND VINES.

As many of these were very small when planted they were more or less injured by the heaving of the ground in the spring, many of them had to be reset on that account. Those that lived have made a vigorous growth.

The following lists show the number which has been planted of each sort with the number now living. It is proposed to plant many of the hard wood timber trees on the bench lands and in the interspaces among the rocks on the face of the mountain at the back of the farm for the purpose of ascertaining whether these valuable woods of the east cannot be grown here to advantage. If such land, much of which is of no value other than for timber, can be utilized in this way it will no doubt result in much future benefit to the Province.

The trees in the following list have been raised from seed, either at the Central Experimental Farm or by some of the growers of forest trees and shrubs in the United States; the following list gives the number planted and living.

——	No. Planted, Fall, 1889.	No. Alive, Fall, 1890.
Ash, Black, *Fraxinus sambucifolia*	200	35
do Green, *Fraxinus viridis*	200	200
do White, *Fraxinus Americana*	1,000	762
Black Walnut, *Juglans nigra*	500	458
Butternut, *Juglans cinerea*	4	4
Black Cherry, *Prunus serotina*	200	195
Beech, American, *Fagus ferruginea*	100	61
do European, *Fagus sylvatica*	100	77
White Elm, *Ulmus Americana*	500	410
Rock do *Ulmus racemosa*	500	123
Red do *Ulmus fulva*	50	31
Hickory, *Carya alba*	500	33
Sugar Maple, *Acer saccharinum*	500	468
Red do *Acer rubrum*	200	148
Tulip Tree, *Liriodendron tulipifera*	15	6
Chestnut, American, *Castanea vesca Amer*	75	69
do Spanish, *Castanea vesca*	50	36
Kentucky Coffee Tree, *Gymnocladus Canadensis*	50	40
Sycamore, American, *Platanus occidentalis*	100	61
Basswood, *Tilia Americana*	200	147
Canoe Birch, *Betula papyracea*	100	44
Yellow do *Betula lutea*	200	140
Locust, Black, *Robinia pseudacacia*	100	100
Honey Locust, *Gleditschia triacanthos*	50	41
Catalpa, Hardy, *Catalpa speciosa*	100	66
do Japan, *Catalpa Kaempferi*	100	58
do Lee's Hybrid, *Catalpa hybrida*	100	67
Persimmon, American, *Diospyros Virginiana*	50	27
Russian Mulberry, *Morus hybrida*	101	101
Ailanthus, *Ailantus glandulosa*	100	6[illegible]

—	No. Planted, Fall, 1889.	No. Alive, Fall, 1890.
Larch, American, *Larix Americana*	50	35
do European, *Larix Europea*	100	82
Black Spruce, *Abies nigra*	50	25
Hemlock Spruce, *Abies Canadensis*	50	32
White Pine, *Pinus strobus*	200	151
Bull Pine, *Pinus ponderosa*	10	5
Scotch Pine, *Pinus sylvestris*	200	83
Riga Pine, *Pinus sylvestris Rigensis*	45	25
Austrian Pine, *Pinus Austriaca*	200	73
Jack Pine, *Pinus Banksiana*	100	85
English Yew, *Taxus baccata*	50	35
Mugho Pine, *Pinus mugho*	50	46
Dwarf Mountain Pine, *P. mugho v. rostrata*	150	144
Red Bud, *Cercis Canadensis*	50	30
American Wahoo, *Enonymus atropurpureus*	10	10
High Bush Cranberry, *Viburnum opulus*	10	10
Black Thorn, *Prunus spinosa*	100	88
English Oak, *Quercus robur*	50	45
Russian Apple Seedlings	100	97
Quercus monophylla	27	27
Tilia macrophylla	16	13
do grandiflora Europea	30	28
Sambucus glauca	7	6
Crataegus oxyacantha	12	10
Pyrus domestica	6	6
Colutea frutescens	12	11
Cephalanthus occidentalis	8	7
Populus Bolleana	50	44
Magnolia tripetala	12	1
Calycanthus Floridus	24	11
	7,824	5,338

A consignment of useful and ornamental trees and shrubs was also received from France, and although they were a long time in transit, and some were beginning to grow in the cases, yet a large percentage have made a healthy growth and look promising at this time.

The following list gives the number planted and living:—

—	No. Planted, Summer, 1890.	No. Alive, Fall, 1890.	—	No. Planted, Summer, 1890.	No. Alive, Fall, 1890.
Acacia julibrissin	50	18	Ampelopsis Veitchii	50	18
Acer campestris	100	89	Arbutus unedo	10	1
do platanoides	100	100	Acuba Japonica	10	7
do pseudo-platanus	100	100	do hymelaica	10	9
do negundo variegata	25	25	Azalea pontica	10	10
do pseudo-platanus purpurea	50	50	do mollis	10	10
do Tartaricum	25	25	Berberis Darwinii	50	25
do do ginnala	50	50	do dulcis	50	50
do platanus Reitenbachi	10	10	do stenophylla	25	18
do do Schweidleri	10	10	Betula alba	100	96
Æsculus hippocastaneum	100	98	do laciniata	10	3
do rubicunda	10	10	do pendula elegans	10	6
do flore albo pleno	10	10	do purpurea	10	9
Æsculus laciniata	10	10	do pyramidalis	10	5
Akebia quinata	10	9	Bignonia grandiflora	10	10
Alnus cordata	10	10	do radicans	25	16
do laciniata	10	2	Bocconia cordata	10	10

	No. Planted, Summer, 1890.	No. Alive, Fall, 1890.
Buxus arborescens	50	50
do aurea var	25	25
do Japonica aurea	25	20
do Balearica	50	44
do fol argentea	50	45
do microphylla glauca	50	50
do mac. rotundifolia	25	24
do pyramidalis var	25	20
do suffruticosa	500	435
Ceanothus Albert Pittet	10	0
do azureus	10	7
do gloire de Versailles	10	0
do intermedius	10	4
do Marie Simon	10	0
Cytisus hirsutum	25	14
do laburnum	100	96
Celtis Australis	25	25
Cercis Canadensis	25	23
do siliq. carneum	25	20
do do rubrum	25	17
Chionanthus Virginicus	10	1
Corchorus Japonicus	25	20
do do variegata	10	0
Cornus mascula	25	22
do sanguinea	25	25
do Sibirica	25	24
do do var	10	9
do var elegantissima	10	9
do mas variegata	10	10
do mas aurea elegant	10	0
Coronilla emerus	10	6
Corylus avellana	50	48
do laciniata	10	2
do purpurea	10	2
Castanea vesca (Spanish Chestnut)	100	96
Cotoneaster buxifolia	25	25
do Nepaulensis	25	25
do Simmonsii	25	2
Crataegus pyracantha	50	29
do Lalandii	25	24
Daphné laureola	25	25
do mezereum rubrum	10	1
Deutzia candididissima	25	9
do flore pleno rosea	25	1
do gracilis	25	25
Diervilla lutea	10	0
Diospyros lotus	50	41
Eleagnus angustifolia	10	10
do macrophylla	10	9
do pungens var	10	10
Eucalyptus globulus	10	0
Euonymus argentea	25	25
do latifolia aurea	10	7
do viridis Japonica	10	7
Fagus purpurea	50	50
do laciniata	10	10
do pendula	10	10
Forsythia Fortunei	25	18
Hedera Algeriensis	10	10
do variegata	10	0
Hibiscus Syriacus	25	25
Hortensia Japonica	25	11
Hydrangea paniculata grandiflora	25	16
Hypericum hircinum	25	0
Juglans Regia (English Walnut)	50	50
Laurus camelliafolia	25	25
Ilex aquifolium	500	395
Laurus angustifolia	25	9
Ligustrum ameurense	50	47
do Italicum	25	6
do Japonicum	25	20
Ligustrum longifolium	10	10
Lonicera aurea reticulata	10	3
do Belgica (monthly)	10	0
do Halleana	10	6
do Sinensis	10	1
do verna	10	1
Liriodendron tulipifera	25	25
Magnolia grandiflora	25	20
Mahonia aquifolium	25	21
do Japonica	25	21
Morus Italica moretti	10	10
Platanus orientalis	50	48
Pawlonia imperialis	10	0
Pavia macrostachya	10	10
Philadelphus Deutziaflorus	25	2
do grandiflorus	10	10
do foliis aureus	10	8
Prunus pissardi	10	10
Pyrus Japonica	20	20
Quercus cerris	25	25
do ilex	10	9
Rhus cotinus	25	25
Salisburia adiantifolia	25	24
Sambucus aurea nova	10	6
do laciniata	10	9
do pendula	10	10
do aurea var	10	9
Spiraea Californica	10	10
do Douglasi	25	25
do Fortunei alba	10	0
do Thunbergii	10	0
do Van Houttei	10	5
Staphylea colchica	10	2
Syringa Charles X	10	10
do rothamagensis	10	7
Tilia platyphylla	100	100
do sylvestris	50	50
Tamarix Africana	10	10
do Indica	10	10
do Japonica	10	10
Ulmus campestris	100	90
do latifolia	100	100
Ulex Europea	50	4
Viburnum lantana	10	9
do opulus flore pleno	10	10
do macrocephalum	10	
Virgilia lutea	10	10
Weigelia amabilis	10	3
do nana variegata	10	1
do rosea	10	0
Wistaria sinensis	25	23
do alba	10	9
Yucca filamentosa	10	10
Rhododendron arboreum	10	10
Abies amabilis	10	4
do apollonis	10	10
do Canadensis	50	20
do nobilis	10	7
do Orientalis	10	3
do Nordmaniana	10	10
do pectinata	25	25
Picea cephalonica	25	21
Araucaria imbricata	2	2
Cedrus Atlantica	10	5
do deodora	10	10
do Libani	10	3
Cephalotaxus Fortunei	10	10
Cryptomeria Japonica	10	9
do elegans	10	10
Cupressus Lawsoniana	10	6
do argentea	10	10

—	No. Planted, Summer, 1890.	No. Alive, Fall, 1890.	—	No. Planted, Summer, 1890.	No. Alive, Fall, 1890.
Cupressus elegantissima	10	9	Taxodium distichum	10	10
do lutea	10	7	Taxus baccata	510	319
Juniperus Hibernica	10	10	do do v. fastigiata	10	6
do Bermudiana	10	7	do variegata	10	10
do Japonica aurea	5	5	do do aurea	10	10
do sinensis var argentea	5	5	do var elegantissima	10	10
do Virginiana elegantissima	10	10	Thujopsis boreaus	10	10
Pinus cembra	10	2	Thuja aurea	10	6
do Laricis Corsica	50	19	do elegantissima	10	9
do Mugho	40	40	do conica	10	6
do ponderosa	10	9	do filiformis Japonica	10	10
Podocarpus Korayana	10	10	do vervaenana	10	9
Retinospora aurea gracilis	10	5	Wellingtonia gigantea	10	2
do argentea	10	1	Bengal China Roses	25	2
do ericoides	10	0	Roses Hyb. perpetual	50	3
do filifera	10	3	do climbing	25	0
do leptoclada	10	10	Willow	10	9
do pisifera aurea	10	6			
do plumosa	10	5		6,047	4,706
do squarrosa	10	10			

In addition to the foregoing, a further consignment of useful and ornamental trees, shrubs and vines was received this fall from the Central Experimental Farm, also a case of flowering bulbs, containing 1,700 bulbs; from the Experimental Farm at Indian Head a thousand asparagus plants, and from a nursery a hundred of another variety, all of which have been carefully planted. There are now altogether over 500 different varieties of fruit, and more than 400 varieties of useful and ornamental trees, shrubs and vines, making a total of nearly 1000 sorts.

Fifteen experimental plots of fall wheat were sown in the autumn, and two of rye, all of which at the present time are looking well.

There is now ready for crop, exclusive of what is sown with fall grain or in nursery, about 70 acres—making in all about 90 acres. 250 fir trees and stumps have been taken out besides the birch, alder and other brush with which much of the land was thickly covered. Ferns have given a considerable amount of trouble in the newly reclaimed land, but it is hoped they will be got rid of in a year or two by frequent hoeing during the season of growth.

The short-horn bull and cow are both in good thrifty condition, and during the year a very fine calf has been added to the stock.

FOWLS.

Most of eggs laid by the fowls during the spring and early summer were sold for hatching. There are a few chickens of the following breeds:—Wyandottes, Houdans and White Leghorns. The Houdans and the Wyandottes began laying earliest.

The following is an account of the number of eggs laid by each breed during the year:—

—	Three Houdans.	Two White Leghorns.	Three Wyandottes.	Two Black Spanish.
March	15	10	27	3
April	48	31	58	45
May	62	27	45	40
June	48	35	22	39
July	33	20	12	41
August	29	21	21	19
September	1	10	8	0
October	2	0	0	0
November	0	0	0	0
December	9	7	15	5
	247	161	208	192

The bushy-tailed rats were very troublesome in the poultry house, occasionally carrying off both eggs and chickens.

I have the honour to be, Sir,

Your obedient servant,

THOS. A. SHARPE.

Superintendent.

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