DOMINION OF CANADA
DEPARTMENT OF AGRICULTURE
SEED BRANCH
GEO. H. CLARK, Seed Commissioner

WILD OATS
AND
FALSE WILD OATS

THEIR NATURE AND DISTINCTIVE CHARACTERS

BY
Mr. NORMAN CRIDDLE

BULLETIN No. S-7

Printed by direction of Honourable MARTIN BURRELL, Minister of Agriculture
OTTAWA, FEBRUARY, 1912

DOMINION OF CANADA

DEPARTMENT OF AGRICULTURE

SEED BRANCH

GEO. H. CLARK, Seed Commissioner

WILD OATS

AND

FALSE WILD OATS

THEIR NATURE AND DISTINCTIVE CHARACTERS

BY

Mr. NORMAN CRIDDLE

BULLETIN No. S-7

Printed by direction of Honourable MARTIN BURRELL, Minister of Agriculture

OTTAWA, FEBRUARY, 1912

18302—1

LETTER OF TRANSMITTAL.

OTTAWA, February 20, 1912.

The HON. MARTIN BURRELL,
Minister of Agriculture.

SIR,—I have the honour to submit the manuscript for a bulletin prepared by Mr. Norman Criddle describing field experiments with Wild Oats and False Wild Oats and the observations and conclusions connected therewith. Mr. Criddle's work throws much light on the heretofore vexed question of whether or not the peculiar forms known as False Wild Oats are dangerous weeds like Wild Oats. I recommend that the manuscript be printed for distribution as Bulletin No. S-7, entitled "Wild Oats and False Wild Oats, their Nature and Distinctive Characters."

Obediently yours,

GEO. H. CLARK,

Seed Commissioner.

PREFACE.

The material presented in this bulletin represents the results of careful investigations and observations covering a period of seven years. The writer, Mr. Norman Criddle, has been connected with the Seed Branch staff for several years in the capacity of Assistant Seed Analyst at the Ottawa or Calgary seed laboratory. He has also made a large number of colored and black and white drawings for "Farm Weeds" and other publications of this Branch. Mr. Criddle is a close student of nature and a very careful observer. During the past few years he has been devoting special attention to a study of Wild Oats and False Wild Oats. The experiments described by Mr. Criddle were conducted on his farm at Treesbank, Man., and his observations and conclusions constitute a very valuable contribution to the knowledge of the subject discussed.

From the knowledge acquired it does not seem probable that False Wild Oats will ever become a serious weed pest, and for the present at least it will not be considered as coming within the meaning of the term "noxious weeds" as applied to the Seed Control Act in official seed testing, but will be classed among the useless or harmful plants, or weeds of secondary importance.

GEO. H. CLARK.

18302—2

Plate I

Wild Oat
(Avena fatua)

18302

Plate II

False Wild Oat Banner Oat

Banner type

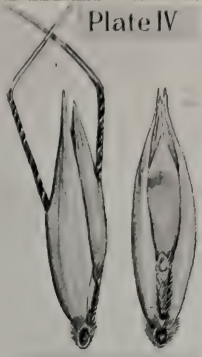
Plate III

False Wild Oat Storm King

Storm King type.

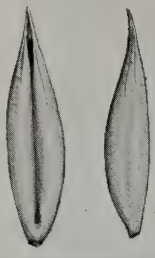
Plate IV

False Wild Oát
(Pin Oat)
Storm King Variety. 1.



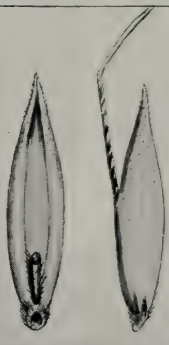
False Wild Oat
Storm King Variety. 2.

False Wild Oat
Newmarket Variety 3.



Storm King Oat
(Pin Oat.) 4.

False Wild Oat
Banner Type 5.



False Wild Oat
Banner Type 6.

Wild Oat
(Avena Fatua) 7.

Wild Oat
Hairs Removed 8.

Wild Oat
White Form 9.

WILD OATS AND FALSE WILD OATS.

THEIR NATURE AND DISTINCTIVE CHARACTERS.

By Mr. Norman Criddle.

There are few problems of greater importance to the grain grower of western Canada than that relating to Wild Oats belonging to the species *fatua*. The injury caused by this weed at the present time amounts to an annual loss of thousands, or perhaps millions, of dollars, and the loss is becoming greater yearly as the plant spreads further afield. The question of its control has been discussed frequently, and most practical agriculturists are now aware of the best means to keep the plants within reasonable bounds. I say reasonable bounds because to exterminate them is a task of years which few farmers care to undertake. It is unnecessary therefore, as well as rather out of place, to take up that part of the subject here. But within recent years a question has arisen as to the validity of classing certain forms of oats as Wild Oats and it is chiefly with this side of the problem that I propose to deal.

For several years past I have carried on a number of experiments with Wild Oats and what are termed False Wild Oats, also called Sports, White Wild Oats and Albino Wild Oats, with a view to discovering what their status should be in relation to agriculture, and, further, what relationship—if any—the latter has to the former. With the latter problem I have made no progress due, at least in part, to lack of time, but as I have otherwise brought my experiments to a fairly satisfactory termination, it seems well to relate what the conclusions are so that others may benefit from the knowledge acquired.

Different Types of True Wild Oats.

To the botanist who has followed, even casually, the trend of modern thought in relation to the origin of new forms of species and has read the leading works bearing upon plant breeding and the laws of Mendel, *Avena fatua* (Wild Oats) with its fixed varieties will prove an interesting species, and I have no doubt that accurate study over the wide range inhabited by this plant will reveal many forms, each breeding true within itself.

During the past three years I have grown three fixed varieties for observation and study as follows (see plates I and IV.):—

(1) *Avena fatua* proper. As known to me this is a tall, somewhat slender plant, with bending head and long pedicles bowed down with the weight of the seeds so that the whole head has a drooping appearance. The panicles mature unevenly; seeds borne on the upper part of the heads and at the tips of the branches ripening first and often shelling before those on the lower part are fully matured. Usually too *A. fatua* stands well above cultivated oats. The seed is dark brownish, almost black, turning to a lighter shade at the tip. In form it resembles a common black oat, but is not so plump, and differs from the ordinary cultivated varieties in having a much longer scar at its base, formed somewhat in the shape of a horseshoe, and also in having a long stiff awn and a densely hairy base. In fresh specimens these hairs, which are brown, cover approximately half the oat, and are particularly numerous upon the rachilla

(the small footstalk supporting the bosom grain in the spikelet) but the basal scar with its hairs, and the awn also, may be broken off by threshing or handling the grain.

(2) *A. fatua.*—White form. This form resembles exactly the typical *fatua* as described above, excepting in its seeds, which are creamy-white like ordinary white oats. It also seems rather less hairy, but this is partly due to the hairs being white and consequently less conspicious. This variety breeds true to seeds and on account of its color is difficult to detect in white oats. Beginners are also liable to confuse it with False Wild Oats of the same shade.

(3) *A. fatua.*—Hairy form. This is also very similar to the type described first but differs in the seeds which are densely hairy almost to the tip; the hull is also rather lighter in color. This form has grown true to type for three years.

Another type of *Avena fatua* similar to the foregoing ones but having slaty gray seeds has been grown for two years but proves less fixed. Some of the seeds remain gray while others turn either white or black; possibly some form of combination due to a cross between black and white varieties.

There are also a few other types showing variation from the normal, either in some character or growth, or in the seeds, which may vary in hairiness, some being rather free from hairs while others contain even more than the typical species. These however, have proved to be of a fluctuating nature and in consequence have been discarded.*

Appearance of False Wild Oats.

For a number of years past there has been some difficulty in judging oats at seed fairs due to there being found among the samples, kernels showing the outward appearance of Wild Oats; that is, having a long, twisting awn and characteristic horseshoe base. These at first were unhesitatingly classed as Wild Oats, but later doubts arose as to the correctness of this and eventually most of those who had had practical experience in the matter arrived at the conclusion that the forms involved were not Wild Oats, but represented some form of deviation from type which affected, apparently, the seed coat only and left the seed proper unaltered. I found by experiment that any type of oat showing these retrogressive characters when grown would produce a plant of typical appearance which, but for the long awn, could not be told from the cultivated variety from which it originated. It had also a seed of the same shape and plumpness but in addition to the long awn had a horseshoe shaped base, thus resembling a Wild Oat excepting in size. Apart from this, however, all the forms examined by me have been less hairy than a Wild Oat, especially round the base. (See plates II, III and IV.)

Experiments in Growing Different Types of False Wild Oats

These facts were arrived at after a few years study but as it seemed wise to make further tests, so as to leave less room for error, all the available material has been collected and grown with the following results:—

(1) Banner type. Three examples were tested, one for seven years and two for three. All have proved fixed.

(2) Newmarket of Abundance type. Three examples tested, one for five years, the others for two. They have shown no change in appearance.

(3) Old Island Black type. One example from eastern Canada grown for two years. No change.

---

* Editor's Note.—It may be stated in this connection that our best botanical authorities have failed, up to date, to adopt a uniform classification of the numerous known species, varieties and types of Wild Oats, several of which are considered as pure by some authors and as hybrids by others.

(4) A black oat, name unknown. This might easily be mistaken for a variety of *A. fatua* or true Wild Oats which it more closely resembles than any other False Wild Oats that I know of. It may be separated from the Wild Oats by the following features: Plant fully six inches shorter; stem stouter in proportion; pedicles not so long, giving the whole head a more compact and upright appearance; seeds dark as in *fatua* but less hairy especially round the scar, also stouter and more distinctly ribbed. This form has grown true to type for two years.

(5) Storm King type. Two examples grown for four and seven years respectively. No change.

The first four of the above mentioned varieties belong to the *sativa* (spreading panicle) form of growth, the last to the *Orientalis* (side oats) type.

In addition to these I received from Mr. A. Cooper of Treesbank, Man., some examples of Banner oats grown on land free from Wild Oats and supposedly from pure seed, showing a tendency in the direction of the wild type, having a rather more open basal scar and larger awn than is usual in the cultivated form. The first year these were grown about two per cent developed into fully formed False Wild Oats while a majority of the others remained as before. A certain number, however, developed stronger awns while others became entirely awnless. The more developed oats were again sown in 1911 and produced about 20% of False Wild Oats, some 40% of the long awned kinds and the remainder either with no awns or with the usual weak ones generally found on the primary oat on the upper grains in the head. Some of the original seed was also sown and showed less than one per cent of False Wild Oats but produced instead a dwarf type not above six inches in height which though developing sufficiently to reveal the usual long awns of False Wild Oat failed to produce germinable seeds. The proportion of plants of this kind amounted to nearly one per cent.

Distinguishing Characters of True and False Wild Oats.

The problem of distinguishing a true Wild Oat from a False Wild Oat is an important one from the farmer's standpoint. In the growing stage this is a comparatively simple matter as the False Wild Oat will have the manner of growth characteristic of a cultivated oat, in contrast to that of the Wild Oat previously described, but in the seed form the difficulty is much greater, and there seems to be no fixed character by which to distinguish between some of the smaller varieties of False Wild Oats and the true wild forms. With the larger sorts now grown so extensively the difficulty of distinguishing them is not so great, and an experienced eye will at once detect the False Wild Oat by its larger size and its usually close resemblance to the cultivated variety in which it is found. Generally speaking too the lemma or outer seed coat is more open in front with cultivated forms and False Wild Oats so that the palea or inner coat is broadly visible whereas in Wild Oats the edges of the lemma almost meet. There are, however, some exceptions to this rule. The seeds of False Wild Oats carefully picked will show the very characteristics of true Wild Oats, though somewhat less pronounced in most cases, but will mostly correspond with the cultivated variety in which they appear in size, plumpness, color and smoothness of the glumes.

Difference in Germinating Qualities.

Germination tests will also reveal the nature of an oat if recently ripened owing to the readiness with which False Wild Oats grow in comparison with true Wild Oats but unless at least one hundred seeds are tested the result will not be satisfactory. One of the worst traits in *Avena fatua*, true Wild Oats, is the

power of its seed to resist the ordinary factors of germination. Thus newly ripened seed usually fails to germinate under any conditions or at most does so to the extent of only about one per cent. On the other hand if kept for some three months or more approximately 50% will grow. Some seeds, however, may not germinate for several years and if buried deeply they are said to remain dormant for a very long time. Fortunately this is not a character of False Wild Oats.*

False Wild Oats not Dangerous.

From an agricultural point of view an interesting point is the lack of increase in False Wild Oats. This is extremely important because it is the power, or lack of it, to increase faster than cultivated varieties that would make them a dangerous or comparatively harmless plant. The fact that seeds of False Wild Oats germinate readily when fresh, as do ordinary cultivated oats, is sufficient reason for considering them as not being a noxious weed seed impurity and as they are large and contain as much nourishment as the cultivated varieties from which they are produced, so far as we know without chemical analysis and laboratory tests to determine the per cent hull, there can be little complaint against them on that account.* * Probably the chief objection to them is the long stiff awns— which, however, usually become broken off in threshing— and their tendency to shell out, due to the awns. As a matter of fact, it is this very characteristic of shelling that really keeps them down as owing to it they naturally drop to the ground before other oats and not having the power of Wild Oats to resist germinating they grow in the autumn and are killed by frost before they have time to ripen their seeds.

---

* Editor's Note.—Besides the numerous laboratory experiments showing that False Wild Oats germinate as readily as do the common cultivated oats, and the work done by Mr. Criddle, mention may be made here of a conclusive field experiment conducted at Guelph, Ont., by Mr. E. A. Howes, now Assistant Seed Analyst of the Seed Branch, Department of Agriculture, Ottawa. A mixture of False Wild Oats of different types and cultivated oats was sown in rows on a garden plot of sixteen square yards. Another plot similar in size and of the same character of soil was sown with common Wild Oats. Both crops were allowed to shell freely when ripe and after the straw was removed, the soil in both cases was given a surface cultivation sufficient to cover most of the seed scattered about. A fine fall growth of cultivated oats and False Wild Oats develope in a short time but not a single plant could be found in the Wild Oat plot throughout the autumn. This gro th was winter killed and in the spring the soil was stirred up with a rake. In the Wild Oat plot numerous plants appeared, though not so thickly nor so uniformly as in the case of the other plot during the previous autumn but not one plant appeared in the cultivated oats and False Wild Oats plot. In order to keep watch for plants from seed of retarded germination cabbages were set out on the whole strip. No oats came up in the plot where cultivated oats and False Wild Oats had been grown, but Wild Oats appeared in the other plot up to July 28th. In this case False Wild Oats and the cultivated oats from which they came acted alike, while the Wild Oats acted quite differently.

An experiment in spring germination was conducted in 1910. Wild Oats from Brandon, Man., cultivated oats from the Swedish Select, Ear'y Ripe and Irish Victor varieties and False Wild Oats from those three varieties, all the seeds taken from the harvest of 1909, were sown on May 10th, thirty seeds in each plot. The results showed a lower percentage, as well as a slower germination of the Wild Oats, but practically no difference between the final percentage germination of the False Wild Oats and the cultivated varieties, although the germination was somewhat slower with the False Wild Oats.

A summary of the results of all the experiments along this line indicate conclusively that False Wild Oats are quite distinct from true Wild Oats in their responsiveness to the ordinary factors of germination, but are very similar to the cultivated varieties in this regard.

* * Editor's Note—Tests at the Ottawa seed laboratory of two samples of False Wild Oats indicate that the per cent of hull is greater in these forms than in the ordinary grain of the variety in which they develop. A sample of False Wild Oats, originating from Banner oats grown in Manitoba tested 34·6 per cent hull, while the average for the Banner variety is about 28·5 per cent. The sample of False Wild Oats from the Storm King variety tested showed a strongly marked tendency toward inferior quality. Eighty-three per cent of the grains were double and in nearly all cases the primary grain was entirely kernelless or the kernel was very small. The sample tested 47·1 per cent hull, while the average for the Storm King variety is about 32 per cent. This apparent tendency toward an increase in per cent of hull in single grains and increase in the proportion of kernelless double grains, with some varieties at least, is very objectionable.

About the only practical means to prevent or restrict the occurrence of these undesirable forms is to refrain from growing such varieties as observation shows to be specially inclined to produced them and, where practicable, to remove them by hand from the growing crop or seed grain. Field experiments indicate that the seeds of False Wild Oats that shell out and fall to the ground could be destroyed by after-harvest cultivation to induce germination. On the other hand they tend to confirm the opinion that very little can be accomplished toward destroying Wild Oats by this method.

The Probable Origin of False Wild Oats.

The origin of these False Wild Oats still remains doubtful. It is possible that they may be the result of a cross between the wild and culvitated species, but in view of the seeming fact that they are no more numerous in oats which are known to have been brought into contact with Wild Oats than those kept free from them, and further as some varieties seem to contain far more False Wild Oats than others, it seems hardly likely that they are produced in this manner.*

Conclusions.

My chief object in presenting this material has been to show (1) that there is no longer any necessity for classifying False Wild Oats as Wild Oats, and (2) that their characteristic manner of growth, &c., gives little cause for apprehension or for supposing that they will ever become sufficiently numerous to be classed as anything but an impurity, just as a black oat in a white variety would be.

In conclusion I desire to express my indebtedness to Mr. G. H. Clark, the Seed Commissioner, and to Mr. G. Michaud, Botanist and Seed Analyst of the Seed Branch, for their kindness in placing the whole of their samples at my disposal.

*Editor's Note.—The problem of how to prevent the multiplication of False Wild Oats and destroy them is a most enigmatical one and it will remain so until more definite knowledge is acquired in regard to their relation to true Wild Oats and the cultivated varieties. First of all the problem of the origin of the cultivated oats should be defined and agreed upon by the cereal breeders and scientists. This problem solved, a few plausible explanations of the origin of False Wild Oats by atavism or retrogression could be accepted, also if it could be satisfactorily proven that some of our cultivated varieties of oats were originated from or have been improved by means of crossing with Wild Oats. These hypotheses are generally accepted on account of their plausibility, but as far as we know they have never been proved so as to furnish the basis of a reliable solution of this very important problem. Another hypotheses, the accidental or natural crossing of cultivated oats with Wild Oats, may seem logical and might be accepted were it not known that in sone countries, as in Sweden for instance, False Wild Oats also appear amongst cultivated varieties which, as far as human control can be relied upon, have never come in contact with Wild Oats. Dr. H. Nilsson-Ehle of the Swedish agricultural experiment station for plant breeding at Svalöf, one of the best authorities in that science, gives us a very logical scientific explanation of the occurrence of these False Wild Oats, as being apparent mutants occurring through disturbance in the arrangement of certain hereditary units of characters in the reproduction. According to Dr. Nilsson-Ehle, the idea that the False Wild Oat is the product of crossing is absolutely out of question; he contends that such hybrids would show different characters and that the similarity to both of the parents would extend itself over a larger number of characters, instead of being confined to anatomical changes in the hulls and rachilla only. This explanation, though not appealing very much to those not versed in the scientific study of the laws of heredity, is probably the most plausible one, and we very much incline to accept it for the present at least or until further research proves it to be incomplete or wrong.

DOMINION OF CANADA
DEPARTMENT OF AGRICULTURE
SEED BRANCH
GEO. H. CLARK, Seed Commissioner.

WEEDS AND WEED SEEDS

ILLUSTRATED AND DESCRIBED

BULLETIN No. S-8

Published by the direction of the
Hon. Martin Burrell, Minister of Agriculture
Ottawa, Canada.

December, 1914.

DOMINION OF CANADA
DEPARTMENT OF AGRICULTURE
SEED BRANCH
GEO. H. CLARK, Seed Commissioner.

WEEDS AND WEED SEEDS

ILLUSTRATED AND DESCRIBED

BULLETIN No. S-8

Published by the direction of the
Hon. Martin Burrell, Minister of Agriculture
Ottawa, Canada.

December, 1914.
71620—1

DEPARTMENT OF AGRICULTURE.

OFFICE OF SEED COMMISSIONER,
OTTAWA, CANADA, December 9, 1914.

To the Honourable MARTIN BURRELL,
Minister of Agriculture.

Sir,—I have the honour to submit herewith manuscript which has been prepared in accordance with your instructions for bulletin on weeds and weed seeds. It has been the aim to present in convenient form for reference the essential matter contained in the expensively illustrated book "Farm Weeds," the second edition of which is now exhausted. In addition, much new information pertaining to the problem of weeds and their dissemination, that has grown out of investigation and research work conducted by your officers of this Branch, has been included in summary form. I recommend that it be printed for general distribution.

I have the honour to be, Sir,

Your obedient servant,

GEO. H. CLARK,

Seed Commissioner.

71620—2

WEEDS AND WEED SEEDS.

Illustrated and Described.

The greatest difficulty in the way of producing a more abundant supply of clean clover and grass seed, as well as seed grain, is the prevalence of weeds. In order to produce high class clean seed, farmers must be constantly on the alert to keep the weeds on their farms in check and prevent the introduction and spread of new varieties. In various ways weeds lower the yield, depreciate the quality and value of crops, and add to the cost of production. They rob the soil of plant food and of moisture, thus increasing the effects of drought by taking up water from the soil and wasting it by evaporation; they crowd out more useful plants, being hardier, and, as a rule, more prolific; they increase the cost of every farm operation and cause depreciation in the market value of crops because of the presence of weeds in hay or of weed seeds in grain; the eradication of the worst weeds is costly in labour, time and machinery, and frequently prevents a farmer from following the best crop rotation or from growing the most advantageous crops; many weeds are conspicuous and all are unsightly on farms, and thus depreciate the value of land; some weeds are harmful to stock, while others are injurious to their products; weeds attract injurious insects and harbour fungus diseases.

New weeds are introduced on farms with grass, clover or other commercial seeds, and commercial feeding stuffs which often contain vital weed seeds. They are spread from district to district through various transportation facilities, such as railways, and become disseminated within a locality in stable manure from towns and cities, and through threshing machines and farm implements. The wind carries some weed seeds long distances, not only in summer but with drifting soil and over the surface of the snow in winter. Streams distribute them along their courses. They are also distributed by herbivrous animals, through the stomachs of which the seeds pass undigested; or they attach themselves by special contrivances, such as hooked and barbed hairs, spines, gummy excretions, &c., to passing animals.

Classification and Eradication.

Weeds are classified according to the length of time they live, as annuals or one year plants; biennials, or two-year plants; and perennials, or many-year plants. In eradicating weeds it is of the greatest importance to ascertain under which of these heads they come.

ANNUALS.

Annuals complete their growth in a year. As a rule, they have small fibrous roots and produce a large quantity of seed. Some weeds, called winter annuals, are true annuals when the seeds germinate in the spring, but they are also biennial in habit; that is, their seeds ripen in the summer, fall to the ground, germinate and produce a certain growth before winter sets in, and then complete their development next spring. Annuals may be eradicated from land, however badly infested it may be, through any method by which germination is hastened and the young plants destroyed before they produce seed.

BIENNIALS.

Biennials require two seasons to complete their growth, the first being spent in collecting and storing up a supply of nourishment, which is used the second season in producing flowers and seeds. Biennials must be either plowed or cut down before they flower. Mowing at short intervals in the second year, so as to prevent the development of new seeds, will clear the land of this class of plants; but a single mowing will only induce them to send out later branches, which, if not cut, will mature many seeds. Where plowing is impracticable, such plants should be cut off below the crown of the root.

PERENNIALS.

Perennials are those plants which continue to grow for many years. They are propagated in several ways, but all produce seeds. Perennials have two distinct modes of growth; some root deeply, while with others the root system is near the surface. The most troublesome are those which extend long underground stems or rootstocks beneath the surface of the ground, as Canada thistle, perennial or field sow thistle, field bindweed and bladder campion. Representatives of the second class or shallow-rooted perennials are pasture sage, yarrow and couch grass. Some perennials extend but slowly from the root by short stems or offsets, but produce a large quantity of seed. Of these, ox-eye daisy, dandelion, goldenrod and yarrow are examples.

Perennials are by far the most troublesome of all weeds and require thorough treatment, and in some instances the cultivation of special crops, to insure their eradication. Imperfect treatment, such as a single plowing, often does more harm than good, by breaking up the rootstocks and stimulating growth. For shallow-rooted perennials, infested land should be plowed so lightly that the roots are exposed to the sun to dry up. For deep-rooted perennials, on the other hand, plowing should be as deep as conveniently possible. The nature of the land must determine the depth of plowing. In light or gravelly soils shallow plowing may be preferable as deep plowing might interfere with the mechanical texture of the soil, which is so important in the storing of moisture.

The rootstocks of some perennial weeds are very persistent. Some sections or cuttings from them will quickly take root when they are distributed by plowing or cultivation. Where such persistent perennials have become well established, it is usually advisable to adopt the most convenient method of cultivation that will bring the rootstocks to the surface. They should then be gathered and burnt or otherwise destroyed. Most perennial weeds will, however, succumb to continued thorough cultivation that will prevent the growth of leaves.

Plants take in most of their food through their leaves. Perennial plants, which live for many years, have special reservoirs where some of this food, after elaboration, is stored in such receptacles as bulbs, tubers and fleshy rootstocks. The first growth in spring, particularly flowering stems, is produced mainly by drawing on their special store of nourishment. Plants are therefore in their weakest condition when they have largely exhausted their reserve supply of food and have not had time to replenish it. The stage of growth, then, when plowing will be most effective is when their flowering stems have made full growth but before the seeds, which would be a source of danger, have had time to mature.

Summer Fallowing.

The practice of summer-fallowing land, whatever may be said against it, affords the best opportunity to suppress noxious weeds. For lands foul with persistent growing perennials, a thorough summer-fallow will usually be the most effective and, in the end, the least expensive method of bringing the weeds under control.

The amount and nature of the cultivation of a summer-fallow will depend on the habits of the weeds, the kind of soil, and the climatic conditions. In some extreme cases of perennial weeds, it may be advisable to allow the plants to exhaust their reserve vigor by growth until the flowers are formed, then cut and remove the surface growth, plow to the depth of four or five inches, and bring the rootstocks to the surface before they have had time to renew growth. After cutting and removing the surface growth cultivators may, after several applications, be forced to the bottom of the furrow, thus unearthing the network of rootstocks. Perennial weeds having deep rootstocks may require a second and deep plowing before all the underground vegetation can be unearthed. If perennials alone are to be dealt with, they may be treated as above directly after an early hay crop.

When the destruction of annual weeds is the chief purpose of cultivation, deep plowing two or three times during the summer, with surface cultivation each week during June and July, and less frequently later in the season, should secure the germination and destruction of the maximum number of seeds. On account of the soil and climate, one plowing of summer-fallow is favoured in the Prairie Provinces.

Short Rotation of Crops.

To keep farms free from weeds, few methods give such good results as a systematic short rotation of crops, with regular seeding down to grass or clover at short intervals. Weeds are most in evidence in districts where the production of cereal grains predominates and where the systematic alternation of crops is not generally practised. Thorough cultivation with a systematic rotation of crops, combined with the maintenance of as many sheep as can be kept to advantage, is a certain and profitable means of keeping weeds under control.

Seeding to Grass.

Lands foul with some kinds of weeds, particularly annuals, may advantageously be seeded to grass for hay or pasture. The cultivation of hoed crops becomes too expensive for labour when the soil is polluted with weed seeds. Grain crops may also be unprofitable because of weeds, and they afford an opportunity for the weeds to increase. Seeding to grass and cutting the hay crops early will prevent most kinds of weeds from ripening more than a relatively small number of seeds, and the number of vital weed seeds in the sub-surface soil will rapidly decrease from year to year. If perennial weeds are also prevalent, it would be well to pasture with sheep and mow the roughage closely each year, before the spring growth has formed seeds.

Farm Implements to Destroy Weeds.

The best time to destroy weeds is within two or three days after the first pair of leaves has formed on the seedling plant. In friable soils the "weeder" is a useful implement for that purpose. The "tilting" harrow is also satisfactory for comparatively loose soils and is preferred as a weed destroyer on firm or clayey land. Weeds are irregular in time of germination; consequently it is necessary to apply the weeder or harrow frequently throughout the growing season. Potatoes, or fields of corn and cereal grains when sown with a drill, may advantageously be treated with such weed destroyers once or twice before the crop distinctly shows above the ground, and again, with corn and ordinary grain crops, when the plants are three to six inches high. Even relatively heavy harrows ordinarily in use will do little damage to the potatoes, corn or grain plants if the land is not wet, and the loosening of the surface soil benefits the crop in addition to the destruction of the weeds.

For perennial weeds or seedlings that have become well rooted, a cultivator having diamond shaped or other relatively broad shares is needed for hoed crops. The disc is a favoured implement for destroying weeds in a summer-fallow or in preparing a seed bed. When, however, it is desired to unearth and remove the rootstocks of perennial weeds such as couch grass, a narrow-toothed cultivator, that will loosen the soil and bring the underground vegetation to the surface, is preferred to an implement that will cut the rootstocks, the small cuttings of which may be exceedingly persistent in growth.

Weed Seeds in Seed Grain.

One of the principal reasons why weeds are not brought under better control on farm lands is because such large numbers of their seeds are put into the soil through lack of care in ordinary farm operations. The use of seed grain that has not been well cleaned is responsible for the introduction of many new weeds and the increase of those already in the land.

In the spring of 1913 an inquiry was conducted by the Seed Branch to ascertain the sources of supply and the quality of the flax and grain used for seed. Samples representing, as accurately as possible, the average seed being used in the districts visited were taken from over 2,000 farmers throughout Canada and forwarded to the Ottawa seed laboratory where they were tested.

According to this inquiry, about 75% of Canadian farmers grow their own seed grain. Most of the grain and flax purchased for seed is secured from neighboring farmers, but considerable quantities are obtained from grain dealers and seed merchants. The proportion of farmers who do not grow their own seed is largest in the newer parts of the Prairie Provinces and in Quebec, New Brunswick and Nova Scotia. Analysis of the samples collected shows that most of the grain and flax sold for seed contains large numbers of different kinds of weed seeds, and great care should be exercised in selecting and cleaning to prevent the introduction of new weeds. Weed seeds are also prevalent in home-grown seed.

Oats: The extent to which weeds are sown with seed grain is shown by a summary of the tests of the samples collected. Of the 978 samples of oats analyzed, 547, or 56% ,contained seeds of weeds classed as noxious under the Seed Control Act, the highest number being 4,838 per pound and the average 76. Weed seeds other than those classed as noxious were found in 860 or 88% of the samples, the largest number being 6,954 per pound and the average 239. With this weed seed content and the rate of seeding reported, weed seeds would be placed on the land sown with oats at an average rate of 44 noxious and 138 other sorts per square rod.

Barley: Of the 408 samples of barley tested, 234, or 57%, contained noxious weed seeds, the highest number being 2,539 per pound and the average 53. Other weed seeds were found in 352, or 86%, of the samples, the highest number being 9,968 per pound and the average 445. With this weed seed content and the rate of seeding reported, weed seeds would be placed on the land at an average rate of over 32 noxious and 270 other sorts per square rod.

Spring Wheat: Of the 506 samples of spring wheat tested, 271, or nearly 54%, contained noxious weed seeds, the highest number being 11,528 per pound and the average 79. Other weed seeds were found in 454, or nearly 90% of the samples, the largest number being 17,415 per pound and the average 343 per pound. With this weed seed content and the rate of seeding reported, the weed seeds placed on the land would average about 50 noxious and 220 other sorts per square rod.

Fall Wheat: With fall wheat the impurities were not nearly so high. Only 29 samples were collected, all from Ontario and mostly from the eastern part of the province. Thirty-seven per cent of these contained noxious weed seeds, the highest number being 176 per pound and the average nine; 76%

contained other weed seeds, the largest number being 187 and the average 68 per pound.

Flax: Weed seeds were especially prevalent in the flax samples. Out of 144 tested, 127, or 88%, contained noxious weed seeds, the largest number per pound being 15,424 and the average 662. Other weed seeds were present in all but seven samples, the highest number being 13,984 per pound and the average 4,087. With this weed seed content and the rate of seeding reported, the weeds placed on the land through sowing flax would average 136 noxious and 840 other sorts per square rod.

Some of these weed seeds are difficult to separate, but most of them could be removed by a fanning-mill properly equipped and well operated. The lack of cleaning is indicated by the fact that nearly 11% of the lots of wheat, oats, barley and flax were being sown direct from the thresher, with no cleaning whatever. Over 88% were reported as having been cleaned with a fanning mill, but the samples showed that either the mills were not equipped with the proper sieves or else that they were not well operated. In a few cases samples were taken from lots that were to be cleaned before sowing, so that the figures given above are inaccurate to the extent to which weed seeds were removed from these lots by cleaning. However, comparison of these uncleaned samples with those which had been passed through a fanning mill indicates that little improvement would be effected.

Weed Seeds in Grasses and Clover.

Except within limited areas, most farmers in Canada purchase grass and clover seeds. There is more danger of new weeds being introduced with these seeds than with seed grain, which is more generally home grown. In ordinary years Ontario produces all the alsike and red clover seed required for Canada and large quantities are exported, especially of the former. Timothy seed is grown to some extent in many parts of Canada but a large proportion is imported from the United States. Little alfalfa seed is grown in Canada. Most of our imported supply comes from the United States and Russian Turkestan. The following lists contain the names of the weed seeds most frequently present in alfalfa, clover and timothy.

Alfalfa Seed—*Noxious.* Ribgrass, ragweed, docks, chicory, wild mustard, dodder, wild carrot, campions, field bindweed. *Others.* Green foxtail, lamb's quarters, sweet clover, pale plantain, Russian knapweed, yellow foxtail, rocket, barnyard grass, black medick, Russian thistle, maple-leaved goosefoot, smartweed, lady's thumb.

Red Clover Seed—*Noxious.* Ribgrass, docks, ragweed campions, Canada thistle, stickseed, wild carrot, wild mustard, false flax. *Others.* Green foxtail, lamb's quarters, pale plantain, black medick, lady's thumb, sheep sorrel, yellow foxtail, sweet clover, plantain, mayweed, barnyard grass, knotweed, crabgrass, witchgrass, catnip, cut-leaved geranium, Russian thistle, heal-all, bedstraw, black bindweed, pigweed, blue vervain, smartweed, field pepper-grass.

Alsike—*Noxious.* Campions, docks, ribgrass, false flax, Canada thistle, ox-eye daisy, stinkweed, wild mustard, *Others.* Black medick, sheep sorrel, lamb's quarters, chickweed, plantain, green foxtail, mayweed, worm-seed mustard, pale plantain, cinquefoil, heal-all, shepherd's purse, catnip, old witch grass, common peppergrass.

Timothy Seed—*Noxious.* Canada thistle, campions, ox-eye daisy, ribgrass, docks, false flax, chicory, sow thistle, wild mustard. *Others.* Cinquefoil, sheep sorrel, plantain, lamb's quarters, chickweed, worm-seed mustard, pale plantain, peppergrass, green foxtail, mayweed, heal-all, witch grass, evening primrose, shepherd's purse, yarrow.

In buying grass and clover seed, it is well to remember that Extra No. 1, which contains no noxious weed seeds and not more than 30 other sorts per

ounce, when sown at the rate of 12 pounds per acre will place about 36 weed seeds on every square rod sown, whereas No. 3 seed, containing the maximum number of weed seeds (80 noxious and a total of 400 per ounce), sown at the same rate, will place about 480 weed seeds, nearly 100 of which may be noxious, on every square rod.

Samples of timothy and clover seed containing more than 10,000 weed seeds per ounce are sometimes received at the seed laboratory. In many cases proper sieves will remove most of the weed seeds and so prevent their return to the land at the rate of several thousand to every square rod.

Weed Seeds in Commercial Grain.

Ordinary commercial grades of grain that have passed through terminal elevators contain large numbers and many kinds of weed seeds. This is due to the fact that in handling grain at terminal elevators, cars containing many noxious and other weed seeds are mixed with clean grain of the same grade, thus contaminating the whole bin or bulk lot. On account of this, no grain coming out of the terminal elevators is fit for seeding; most of it is so foul with weed seeds as to constitute a dangerous source of noxious weeds unless carefully handled. Analysis of five samples of No. 2 Canada Western oats, taken from shipments from five terminal elevators at Fort William, showed the oats to average 313 noxious weed seeds per pound, including nine species, and a much larger variety and number of other weed seeds.

In transportation many seeds are scattered along the right of way of the railroad and thus introduce weeds into new localities.

The danger of spreading weeds through feeding dirty grain to horses and other stock is not sufficiently realized. A farmer who feeds his horses oats containing wild oats and mustards will later find these plants growing in patches all over his field, wherever the horses' droppings have fallen.

Large numbers of weed seeds are put on the land with manure. Many seeds pass uninjured through the digestive tract of farm animals, while others become mixed with the manure and offal from the stables through handling grain and other feeds. When manure is piled and allowed to "heat," the vitality of most of the weeds is destroyed; but when drawn to the field from the stable, or not left long enough in the pile to become well rotted, manure is one of the most important means of weed dispersal. It is especially dangerous when secured from town or city stables where dirty grain or hay is fed. Grain contaminated with weed seeds should not be brought on a farm even for feed until it has been crushed or ground so as to destroy the vitality of the weed seeds.

Weed Seeds in Screenings.

Most of the western wheat and flax and much of the oats and barley entering the terminal elevators at Fort William and Port Arthur passes through the cleaners before it is re-shipped eastward by lake or rail. The screenings thus obtained amount to over 50,000 tons annually. This material is made up of broken and shrunken kernels of wheat, oats, barley and flax as well as varying proportions of a large number of weed seeds.

A composite sample, representing over 6,000 tons of screenings from the 1912 crop, gave the following separations: 37% scalpings, 7% succotash flax, 18% buckwheat screenings, 38% black seeds. These separations were made by hand sieves but correspond quite closely with those made by screening separators in the elevators.

Scalpings consist of the larger grains and weed seeds in the screenings in the following proportions by weight: 65% wheat, 25% wild oats, oats, flax and barley, 3% weed seeds (wild buckwheat, lamb's quarters, stickseed, ball mustard, prairie rose, wolfberry, great ragweed, cow cockle), 7% straw, chaff, etc.

Succotash flax is made up of 30% flax, 40% broken wheat, 15% weed seeds (wild buckwheat, stickseed, lamb's quarters, wild oats, false flax, American dragonhead, lady's thumb, knotweed, sunflower, purple cockle, ball mustard, hare's-ear mustard, hemp nettle, roadside thistle, prairie rose), and 15% chaff, etc.

Buckwheat screenings consist of 50% wild buckwheat, 29% wheat, oats and flax, 9% weed seeds (ball mustard, stickseed, wild oats, cow cockle, purple cockle, ragweed, stinkweed, hare's-ear mustard, western false flax, Russian thistle, prairie rose), and 4% chaff, etc.

Black seeds are composed of the finer weed seeds separated from the screenings by the use of the 1-14 inch perforated zinc screen. This material contains about 45% lamb's quarters, 4% tumbling mustard, 2½% wild mustard, 6½% of other mustards (western false flax, hare's-ear mustard, stinkweed, worm-seed mustard, shepherd's purse, peppergrass), 8½% other weeds seeds (American dragonhead, hedge nettle, stickseed, green foxtail, Russian pigweed, sow thistle, catchfly, roadside thistle, Canada thistle, wormwood, cinquefoil, evening primrose, pale plantain, witch grass), and 33½% dust and chaff.

Most of the screenings which accumulate in the elevators at the head of the lakes is shipped to United States ports during the period of open navigation, but some of it is shipped in cars to Ontario and Quebec during the winter.

When the smaller weed seeds have been removed, it is not difficult to grind the rest of the screenings so as to destroy the vitality of nearly all the seeds remaining; but many of the small ones occurring in the portion called black seeds are so hard and so small that their complete reduction is difficult. An eighth of an ounce of elevator screenings which had been ground for chopped feed contained the following number and kinds of weed seeds:—

Noxious.—Tumbling mustard, 215; western false flax, 8; wild mustard, 2; hare's-ear mustard, 2; stinkweed, 2; small-seeded false flax, 1; stickseed, 1; campion, 1; perennial sow thistle, 1.

Other kinds.—Lamb's quarters, 460, cinquefoil, 7; green foxtail, 6; timothy, 3; wormwood, 3; plantain, 1; evening primrose, 1; yarrow, 1; tickseed, 1; western wall-flower, 1.

Weed Seeds in Feeding Stuffs.

The screenings which are separated from wheat in the large flour mills are usually ground or pulverized by special machinery and mixed with bran and shorts. Many of the mills do the grinding so carefully that their bran and shorts contain few, if any, vital weed seeds. But many weed seeds are to be found in the by-product feeds from some mills.

In the spring of 1913 the seed laboratory examined 396 samples of bran, shorts and chopped feed which had been collected throughout Canada by the inspectors of the Department of Inland Revenue. Analysis showed that 140 of these samples contained noxious weed seeds, the average number being 57 per pound. Twenty-four of the samples contained more than 100 noxious weed seeds per pound, and one sample of chopped feed held 1,104 seeds of wild oats, stickseed, catchfly and stinkweed per pound. Only 144 samples were free from vital weed seeds of any kind. The following seeds were most common:

Noxious.—Wild oats in 74 samples; wild mustard, 30; hare's-ear mustard 27; false flax, 25; stinkweed, 24; ball mustard, 23; catchfly, 21; docks, 8; ragweed, 6; Canada thistle, 5; stickseed, 5; western false flax, 5; tumbling mustard, 3.

Other Weed seeds.—Lamb's quarters, 180; wild buckwheat, 94; green foxtail, 11; lady's thumb, 9; chess, 9; American dragonhead, 7; worm-seed mustard, 7.

Weed Seeds in Farm Lands.

It is important to consider not only the large number of weed seeds sown with improperly cleaned grain but also those already in farm soils. Some of our worst weeds are so prolific in the production of seeds that relatively clean fields may be badly contaminated in two or three years if these weeds are allowed to go to seed. For instance, a single plant of wild mustard, stinkweed, foxtail, pigweed or campion produces from 10,000 to 20,000 seeds, wormseed mustard about 25,000, shepherd's purse about 50,000 and tumbling mustard about 1,-500,000. With such productiveness, soils become quickly infested with weed seeds, although on account of their inconspicuousness the presence of the seeds is not fully realized. Only a careful examination will reveal their kinds and numbers.

On account of the almost complete absence of data on the prevalence of weed seeds in farm lands, the Seed Branch at Ottawa in the spring of 1914 began an investigation to measure their extent in different soils under different climatic and cultural conditions. Although this investigation has only begun, it has already yielded significant results. Fields were selected in Alberta, Saskatchewan, Ontario and Quebec, records of their culture and cropping were obtained, and samples of soil at different depths and in different parts of each field were taken and examined at the Ottawa seed laboratory. In the four provinces 74 fields were selected from which 573 samples were taken, 191 from the surface, 191 from a depth of 2-3 inches and 191 at from 5-7 inches. From a definite weight of the air-dried soil of each sample, the weed seeds were separated out, identified and counted.

To convey some idea of the prevalence of weed seeds in these samples, four typical fields under different conditions have been chosen and the seeds found in them are tabulated below. At Lacombe, Alta., a field was examined which had grown oats and barley regularly without summer fallow from 1904 to 1912. It was nearly always fall ploughed but was harrowed before ploughing to sprout the weed seeds. In 1913 it was seeded to timothy and alsike. The following is a list of the numbers and kinds of weed seeds found in samples from this field.

Seeds found in 6 oz. of surface soil.		Seeds found in 6 oz. of soil taken 2 to 3 inches deep.		Seeds found in 6 oz. of soil taken 5 to 7 inches deep.	
Ball mustard	51	Ball mustard	59	Ball mustard	39
Lamb's quarters	78	Lamb's quarters	70	Lamb's quarters	69
Black bindweed	4	Black bindweed	2	Black bindweed	2
Grass	1	Sedge	1	Other sorts	2
		Other sorts	1		
Total	134	Total	133	Total	112

It is noticeable that the prevalence of weed seeds is nearly the same at all three depths.

Six ounces of air-dried soil has an approximate volume of 8·58 cubic inches, and from the above figures it may be calculated that a square yard of the surface inch of this field contains about 20,240 weed seeds.

Near Brantford, Ont., samples were taken from a field which had been in sod for six years, having either grown a crop of hay or been pastured each year during that time. The following weed seeds were found in these samples.

Seeds in 6 oz. of surface soil.		Seeds in 6 oz. of soil 2 to 3 inches deep.		Seeds in 6 oz. of soil 5 to 7 inches deep.	
Ragweed	9	Black bindweed	17	Black bindweed	11
Black bindweed	67	Green foxtail	1	Lady's thumb	5
Green foxtail	20	Lady's thumb	8	Crabgrass	4
Lady's thumb	14	Crabgrass	22	Lamb's quarters	7
Crabgrass	11	Lamb's quarters	9	Old witch grass	1
Sheep sorrel	2	Sleepy catchfly	1		
Yellow foxtail	3	Knotweed	1		
Lamb's quarters	1				
Total	127	Total	59	Total	28

In this field the number of weed seeds in the surface inch greatly exceeds the number at either of the two lower depths. A square yard of the surface inch of this field contains about 19,183 weed seeds.

Samples were taken from a field near Guelph, Ont., which for the last ten years has raised the following crops: 1905, meadow; 1906, corn (field was fall ploughed in 1905); 1907, oats; 1908, bare fallow; 1909, winter wheat seeded with timothy and clover; 1910, pasture; 1911, ploughed in early summer, seeded with millet and thoroughly cultivated after millet was removed (this treatment was owing to the prevalence of white cockle); 1912, barley seeded with alfalfa; 1913 and 1914, alfalfa. The following weed seeds were found in samples from this field.

Weed seeds in 6 oz. of surface soil.		Weed seeds in 6 oz. of soil 2 to 3 inches deep.		Weed seeds in 6 oz. of soil at 5 to 7 inches deep.	
White cockle	9	White cockle	6	White cockle	6
Black medick	10	Black medick	8	Black medick	6
Lamb's quarters	7	Lamb's quarters	5	Lamb's quarters	8
Black bindweed	4	Black bindweed	1		
Dandelion	2				
Canada thistle	1				
Total	33	Total	20	Total	20

The prevalence of weed seeds at the three depths in this field is practically constant, while a square yard of the surface inch contains about 4,984 weed seeds. It is significant that this field, which has been under a good system of cultivation, contains only about a quarter as many weed seeds as either of the two other fields mentioned.

Examination of samples taken from a spot along a road fence at Rouleau, Sask., shows how seeds may be spread by the wind. Weeds had been blown across a prairie field and lodged against the fence. The following seeds were found in the samples taken.

Weed seeds in 6 oz. of surface soil.		Weed seeds in 6 oz. of soil 2 to 3 inches deep.		Weed seeds in 6 oz. of soil 5 to 7 inches deep.	
Stickseed	330	Stickseed	3	Lamb's quarters	6
Wild mustard	267	Black bindweed	6		
Hare's-ear mustard	99	Chickweed	3		
Stinkweed	3				
Black bindweed	159				
Lamb's quarters	15				
Rye grass	12				
Pigweed	9				
Milk spurge	9				
Wall-flower	3				
Total	906	Total	12	Total	6

These results indicate that a large number of weed seeds of many kinds had been carried to this spot and show that the wind is an important factor in spreading weeds, especially on the prairie.

Germination of Weed Seeds.

The seeds of most annual weeds, when embedded in the soil, retain their vitality for several years. The seeds of the Mustard family and others, when ploughed down soon after ripening, seldom germinate the following year or until they are brought by further cultivation near the surface. Light surface cultivation during the early autumn usually serves to stimulate germination in freshly ripened weed seeds and a considerable proportion of them may thus be destroyed, whereas by deep ploughing the difficulty is simply deferred to succeeding years.

The germination of weed as well as other seeds is affected by heat. Many kinds of weed seeds, such as some of the grasses and mustards, will germinate in the late autumn or early spring when the soil is quite cold. Others, such as wild buckwheat and lamb's quarters, require a warmer soil, and the seeds of foxtail and purslane continue dormant until stimulated by the heat of summer. Late autumn or early spring cultivation is not effective in destroying the seeds of weeds that will not germinate unless the soil is quite warm.

Distribution from Weed Patches.

Patches of perennial weeds, such as field sow thistle, field bindweed, Canada thistle and couch grass, should receive prompt attention. The roots are commonly distributed by farm implements used for cultivating and new patches are established from broken roots that have been dragged along by the plow or other implement. Any method of cultivation that may be effectively employed to unearth and destroy the underground stems and fleshy roots of perennials should be used when patches of them are first observed. Patches of field bindweed and sow thistles may be smothered by covering them for a year with straw or farm yard manure.

Hand Weeding Seed Crops.

Even with the greatest care and the best cultivation some weeds are almost sure to appear in clover and grain intended for seed and the only practical means of handling them successfully is hand pulling or spudding. With clover seed crops especially it is essential that the fields be carefully gone over and the weeds removed or destroyed before they go to seed. Failure to do this often results in the production of clover seed that is badly contaminated with weed seeds and its market value is thereby greatly reduced or entirely destroyed.

REFERENCE COLLECTION OF ECONOMIC AND WEED SEEDS.

To assist seed merchants and farmers to become familiar with the seeds of economic plants and the most common weeds, reference collections containing authentic specimens of 100 species have been prepared. These collections are sold to seed merchants and agricultural organizations for $2.00 on application to the Seed Commissioner.

THE NOXIOUS WEEDS.

The Seed Control Act, 1911, empowers the Governor in Council to specify the weeds that are to be classed "noxious" within the meaning of the Act. This makes it possible to include any new weeds that may be introduced and become dangerous without amending the Act.

The following are the weeds classed noxious under the 1911 Order in Council. The arrangement is according to botanical order.

Wild Oats (*Avena fatua* L.) Introduced from Europe. Annual, 2 to 6 feet high. Plants closely resemble cultivated oats. Head spreading, usually nodding; seed-bearing stems very slender, bending with the weight of the seeds, giving the head a drooping appearance. The seeds vary somewhat in size and greatly in colour, from almost black to brown, gray and white. All forms are similar in shape to cultivated oats, but are slimmer and at once distinguished by the stiff twisted awn, the hairs which are particularly prominent at the base, the slanting horseshoe-shaped scar, and the minute stalk (rachilla) supporting the second or "bosom" grain. In Wild Oats this is stout, becoming wider and terminating at the top in a slanting surface, while in cultivated oats it is threadlike throughout its entire length. In threshed grain many of these distinguishing marks may be broken off but usually some remain.

False Wild Oats, often confused with the above, are a form of cultivated oats. The plants appear to be identical with those of the cultivated variety in which they occur but the seeds resemble those of Wild Oats in having both the long stiff awn and horseshoe-shaped base. They are, however, generally less hairy and stouter and do not differ in size from those of the cultvated variety in which they originate. False Wild Oats germinate readily the fall they ripen while the germination of true Wild Oats is deferred.

Eradication.—It is impossible to clean land of Wild Oats in one or even two seasons, but the following measures will greatly reduce their numbers and if persisted in will clean the land: Fall or spring discing followed by (a) shallow ploughing in early June with deeper ploughing in late July, or (b) ordinary ploughing in June sown to green feed. There is reason to believe that Wild Oats will not retain their vitality in the soil for more than five years. Seeding to grass and leaving in seed for this period should therefore prove effective in destroying them.

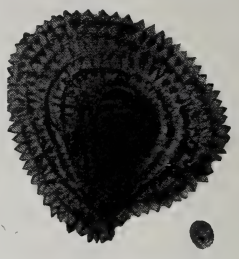
Common Darnel (*Lolium temulentum* L.)—Introduced from Europe. Annual, smooth, stems 2 to 4 feet high, simple. Leaves smooth beneath, rough above, the portion embracing the stem is purple when the plant is young. Spike 6 to 10 inches long; somewhat resembling that of Couch Grass, but having the edges of the spikelets resting against the stalk instead of the broadsides, as in Couch Grass. The seed, somewhat swollen, resembles small barley, with blunt ends and a shallow wide groove on the inner surface. The inner scale is minutely bristly on the edges but not coarsely bristly along the margins, as in Chess; the outer scale is hard and flinty, as in the chaff of wheat, and either with or without a long awn. The kernel, after the husks have been removed, is greenish-brown, often tinged with deep purple. The scales cover the seed very tightly, the inner one being adherent to it; in that condition it is nearly the same size and weight as small grains of wheat and is exceedingly difficult to separate from it by machinery. Darnel has become a pest in parts of the Red River Valley, and is found occasionally throughout the Prairie Provinces. Its seeds are found chiefly in wheat.

Eradication.—Similar to Wild Oats. Seed affected areas to grass.

Docks (*Rumex* species).—The most common member of this group is **Curled Dock** (*Rumex crispus* L.) shown in the illustration. It is a perennial with a deep tap-root. Stem 2 to 3 feet, smooth, erect, terminating in wandlike racemes. Root-leaves oblong-lance-shaped in outline with much crested or waved margins, 6 to 12 inches long, on long stalks; stem-leaves on short stalks and much smaller or absent towards the top of the stems. Curled Dock is a common weed in meadows, pastures and waste places throughout Canada, being very abundant in southern and western Ontario. The seeds of the Docks are commonly found in clover seed. They are very similar in appearance, but have the following points of differentiation: Curled Dock seeds, illustrated, $\frac{1}{12}$ of an inch long, shaped like a miniature beech-nut, nearly symmetrical, both ends pointed, widest near the centre, the edges very slightly margined, reddish brown and highly shiny; **Clustered Dock** (*Rumex conglomeratus* Murr.), apex of the seed pointed, base rounded, smaller, plumper, dark reddish brown; **Bitter Dock** (*Rumex obtusifolius* L.), seed unsymmetrical, widest below the centre, edges unmargined, the base with a rough scar, brownish yellow, dull.

Eradication.—Short rotation of crops. Hand pulling.

Purple Cockle (*Agrostemma Githago* L.)—Introduced from Europe. Annual and winter annual. Erect, 1 to 3 feet high; branches few; whole plant covered with soft, silky hairs; not viscuous. Leaves 2 to 5 inches long, narrow and pointed. Flowers purple, borne at the tips of the stems and branches, $1\frac{1}{2}$ inches across. Fruit capsule ovoid, with 5 teeth at the apex. It occurs in grain fields throughout Canada. The seed is pitchy black, from $\frac{1}{12}$ to $\frac{1}{8}$ of an inch in diameter, somewhat flattened, rounded triangular; the thin edge notched by the scar of attachment; rough, covered with rows of short teeth. It is difficult to separate the seeds from wheat without a heavy loss of grain. When ground with wheat, the seeds give the flour a dark colour and a bad flavour. They are a very common impurity in seed wheat and are found less frequently in seed oats.



Eradication.—Summer fallow. Hand pulling.

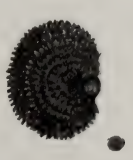
Campions, including **White Cockle** (*Lychnis alba* Mill.), **Night-flowering Catchfly** (*Silene noctiflora* L), and **Bladder Campion** (*Silene latifolia* (Mill.) Britten and Rendle). The most common weed of this group is Night-flowering Catchfly, which is very prevalent in the alsike growing districts of Ontario. It is an annual or winter annual, erect, 1 to 3 feet high, somewhat branching; the whole plant covered with soft, spreading glandular hairs. The flowers are few, erect in a branching cyme, nearly an inch across, pinkish inside, yellowish-white outside, opening at night. White Cockle is a biennial or short-lived perennial, sparingly distributed in Ontario, most abundant in the vicinity of Guelph, where it is very troublesome. The rootstocks are thick, sending up a few short barren shoots and long branching flowering stems, 1 to $2\frac{1}{2}$ feet high. The whole plant is viscuous hairy, but not so much so as Catchfly. It is wider branching, has many stems, the leaves are larger, the flowers more numerous and pure white. The male and female flowers are on separate plants.

Eradication.—These weeds are especially objectionable in fields intended for clover seed production as their seeds cannot be separated by sieves in ordinary cleaning mills. Fields at all infested should be ploughed up and worked under a short rotation of crops. Deep cultivation in spring is needed to suppress White Cockle and Bladder Campion. Avoid introducing these weeds by sowing only pure grass and clover seed. Hand-pull to prevent seeding and consequent rapid spread of the weeds.

Bladder Campion is perennial with deep running rootstocks and is the most dangerous weed of this group. It has become widely distributed in the eastern provinces during recent years, and has proven to be very difficult to suppress. The whole plant is pale green and in the common form perfectly smooth. Stems 1 foot to 18 inches high, forming large tufts. Leaves ovate-lance-shaped in pairs, meeting round the stems. Flowers white, nearly an inch across, drooping, the corolla divisions deeply divided. Calyx much inflated, pale green veined with bright purple, toothed at the contracted apex. Fruit capsule, included in the calyx, opening by five short backward curved teeth.

White Cockle.

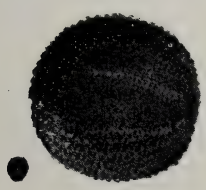
Catchfiy.



Bladder Campion.

The seeds of these species are very similar. They are round, kidney-shaped, about $\frac{1}{20}$ inch in diameter, grayish brown and covered with cone-shaped tubercles. With Catchfly the tubercles are not symmetrically arranged, while with Bladder Campion and White Cockle they are in concentric rows. With White Cockle the rows are slightly farther apart than with Bladder Campion, and the point of attachment is usually depressed. Catchfly seeds are the most common noxious impurity in alsike and occur less frequently in red clover seed. White Cockle and Bladder Campion seeds are less common, although the latter is becoming more prevalent, especially in red clover seed from central Ontario.

Cow Cockle (*Saponaria Vaccaria* L).—Introduced from southern Europe. Annual. Stem simple, branching above or much branched from the base, 1 to $2\frac{1}{2}$ feet. The whole plant is smooth, succulent and of a grayish-green appearance, like the leaves of a cabbage. Leaves ovate-lance-shaped, clasping the stem. Flowers pale rose-pink, $\frac{1}{2}$ inch across, in loose corymb-like cymes. Calyx ovate, 5-ribbed and much inflated, winged and angled in fruit. The smooth roundish fruit capsules contain about 20 seeds each. A troublesome weed only in the Prairie Provinces. The seed is round, hard, dull black, about $\frac{1}{12}$ inch in diameter, and is often confounded with the seeds of wild vetches. It can be distinguished from vetch seeds of a similar size by its minutely roughened surface, or by cutting it open after soaking, when the germ, which lies in a circle around the seed just beneath the seed-coat, will be seen. It in no way resembles the inside of a vetch or pea, which, when the seed-coat is removed after soaking, can be easily separated into similar halves. The seeds are a common impurity in commercial wheat and are almost as objectionable to the miller and baker as are those of Purple Cockle. *Eradication.*—Summer fallow. Hand pull to prevent seeding.



Stinkweed (*Thlaspi arvense* L).—Introduced from Europe. Annual and winter annual. Whole plant bright green and quite smooth. Root leaves borne on foot stalks; stem leaves clasping the stem with the arrow-shaped base. Flowers clear white, $\frac{1}{8}$ of an inch across. Pods flat, $\frac{3}{4}$ inch across, pale green and winged, notched at the top. Just before the seeds ripen the pods turn a characteristic greenish-orange shade, easily noticed when this weed is growing among crops. Stinkweed is now found in every province in Canada, but nowhere is it such a terrible pest as in the Prairie Provinces where it was introduced with the first settlers. The seed is about $\frac{1}{12}$ of an inch across, a little longer than broad, deep purplish-brown, unsymmetrically oval in outline, flattened, with rounded edges. The flattened surface has 5 or 6 loop-like lines, which start at the basal scar or notch and run concentrically around a central groove. The seeds are frequently found in western grain and grass seeds. *Eradication.*—Summer fallow. Disc as soon as the grain crop is removed. Late fall and early spring cultivation. Harrow once or twice when grain is two or three inches high.

False Flax (*Camelina* species). We have three species in Canada, two of which are widely distributed while the third is rapidly becoming so. They are **Small-seeded False Flax** (*Camelina microcarpa* Andrz), common from Ontario westward but becoming less plentiful toward the Pacific Coast, with small seeds, $\frac{1}{20}$ of an inch long, inclined to be egg-shaped, orange-red; **Western False Flax** (*Camelina sativa* (L.) Crantz), occurring in western Ontario and throughout the Prairie Provinces, with seeds considerably larger than the last named, cylindrical in shape and much lighter in colour; and **Flat-seeded False Flax** (*Camelina dentata* Pers.) with still larger seeds which are often flat and round in outline though very variable. The plant may be easily separated from the first two by its early leaves, which are broadly dentate. Small-seeded False Flax is a common impurity in all field crops and the seeds occur in alsike, timothy and small grains. The two latter species are most frequently found in western flax seed from which they are almost impossible to separate. All are small, yellow-flowered plants with flattish pods and strong-smelling leaves.

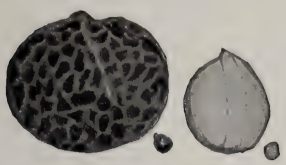
False Flax.

Small-seeded False Flax.

Flat-seeded False Flax.

Eradication.—Same as for Stinkweed. Seed to grass for period of years.

Ball Mustard (*Neslia paniculata* (L.) Desv.).—Introduced from Europe into the West about the same time as Tumbling Mustard, Hare's-ear Mustard and Cow Cockle. A tall annual or winter annual. Stems erect, very slender; strong plants throwing out a few long branches. Whole plant yellowish-green and covered with small, appressed, star-shaped hairs. Lower leaves lance-shaped, narrowed at the base; stem leaves arrow-shaped clasping the stem at the base, blunt-pointed. Flowers small, $\frac{1}{8}$ of an inch across, orange-yellow. Ball Mustard is very prevalent in the Prairie Provinces. The seed is enclosed in small, round, one-seeded, shot-like pods, commonly called "seed," which are borne on slender foot-stalks, about $\frac{1}{2}$ inch in diameter, roundish, greenish-brown, roughly net-veined, somewhat like a small piece of dry earth. The contained seed is yellow, with the miniature root of the germ prominent. The whole pods are generally found in grain, as they do not open to discharge the seed.

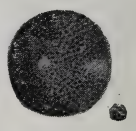


Eradication.—Similar to Stinkweed and False Flax.

Wild Radish (*Raphanus Raphanistrum* L.).—Introduced from Europe. Abundant in the Maritime Provinces. Annual and winter annual, 1 to 2 feet high, with a few long branches starting low down. The root is slender, not swollen as in the garden radish. The plant resembles Wild Mustard but the flowers are fewer and larger, noticeably paler yellow and conspicuously veined. The constricted seed pods are the most distinctive characteristic; with these no mistake can be made in identifying the two plants. In Wild Radish the seed pods have no valves, but are composed of two joints, the lower one small, $\frac{1}{10}$ of an inch, and seedless, which remains attached to the footstalk; the upper cylindrical, $1\frac{1}{2}$ inches long, with several one-seeded cells formed by transverse partitions. This seed-bearing portion separates from the first joint, leaving it attached to the footstalk; in threshing, it is often broken up into single-seeded sections. The seed itself varies much in size and shape, being about $\frac{1}{8}$ of an inch long, oval, irregular, slightly flattened, reddish brown, the surface very finely netted. The seed pods are frequently found in grain, especially oats. Wild Radish is a coarse, vigorous weed, not less objectionable than Wild Mustard though less difficult to suppress. Grain crops polluted with it are troublesome to harvest as the bulky nature of the plants prevents the elevation of the grain in self-binders and greatly increases the amount of binder twine required.

Eradication.—Summer fallow. Hoed crops with thorough cultivation. Rotation of crops.

Wild Mustard (*Brassica arvensis* (L.) Ktze)., and other wild Brassica species.—Wild Mustard is the commonest and one of the most injurious weeds belonging to the Mustard family. It is general throughout Canada in farm crops and waste places, being especially abundant along river valleys. It is an annual. Stems erect, branching, 1 to 3 feet high, rough, with stiff somewhat downward directed hairs. The purple at the junction of the branches with the stem is a striking characteristic. Flowers bright yellow, fragrant, $\frac{2}{3}$ inch across. Seed pods 1 to 2 inches long, knotty or slightly constricted between the seeds, ribbed and rising obliquely on short, thick footstalks, tipped with a long empty or one-seeded, two-edged beak, which breaks away whole from the ripe pod. Each pod contains about 15 to 17 seeds. When ripe the pods split and much of the seed is left on the land at harvest time; thus the plant rapidly increases on land devoted to cereal grains, particularly oats. The seeds vary somewhat in size, but are generally about $\frac{1}{16}$ of an inch in diameter, quite round, dark brown or reddish black, almost smooth to the naked eye but slightly pitted under a glass and have a decidedly pungent taste. They are frequently found in great numbers in grain and occasionally they occur in small seeds. Among the other wild Brassicas, not so common, the seeds of which closely resemble those of Wild Mustard, are **Indian Mustard** (*Brassica juncea* (L.) Cosson), **Black Mustard** (*B. nigra* (L.) Koch) and **Bird Rape** (*B. campestris* L).

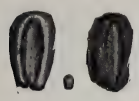


Eradication.—Similar to Stinkweed. Avoid cereal crops where practicable.

Hares-ear Mustard (*Conringia orientalis* (L.) Dumort). Introduced from Europe, probably with flax seed, about 1892. Annual and winter annual Stems erect, with few branches, 1 to 4 feet high. Whole plant perfectly smooth, and, when young, covered with a fine bloom like that of cabbage. Leaves fleshy, without teeth, the root-leaves obovate, gradually narrowed to the base; those on the stiff stems, which become wire-like when ripe, oblong oval, shaped like a hare's or a rabbit's ear, clasping the stem by two rounded, ear-like lobes. Flowers creamy-white, $\frac{1}{4}$ inch across. Pods square, 3 to 4 inches long. Hare's-ear Mustard is quite general throughout the Prairie Provinces, especially in southern Alberta, in grain fields, on stubble and by roadsides; spreading rapidly. The seed is dark brown, rounded oblong, pointed at the scar end, $\frac{1}{12}$ of an inch long, granular roughened; when soaked in water, covered with short, erect, white mucilaginous hairs. In shape it resembles the seed of common False Flax. The seeds are commonly found in western grain.

Eradication.—Similar to Stinkweed. A few years in meadow will greatly reduce this pest.

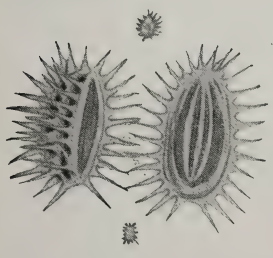
Tumbling Mustard (*Sisymbrium altissimum* L).—Introduced into the Prairie Provinces from central and southern Europe about 1887. Annual and sometimes winter annual; 2 to 4 feet high, stem branching, the lower part and the root leaves downy and glandular, with a musky odour; upper part of the stem and the much divided leaves smooth. The young plants form a rosette of soft, pale green, downy leaves, shaped much like those of the dandelion. On the flowering plants the leaves change very much in shape from the root up, no two being alike. Flowers pale yellow, $\frac{1}{8}$ inch in diameter. Seed pods 2 to 4 inches long, very slender and produced abundantly along the branches. Each pod contains about 120 seeds, and a single plant has borne as many as 1,500,000 seeds. When the seeds are ripe the whole head of the plant breaks off and is blown across the prairie, scattering the seeds far and wide.



The seeds, as in many "tumbling weeds," are not easily shed from the tough pods; consequently a head of this weed may blow about the prairie for a whole winter, dropping a few seeds at intervals for many miles. It occurs in grain fields and along roadsides. The seed is small, $\frac{1}{25}$ of an inch long, olive brown or greenish yellow, minutely roughened with mucilaginous glands, oblong, angular, cut off transversely at the scar end, sometimes almost square from compression in the pod, grooves conspicuously darkened. The miniature root of the germ is prominent and plainly visible through the thin skin.

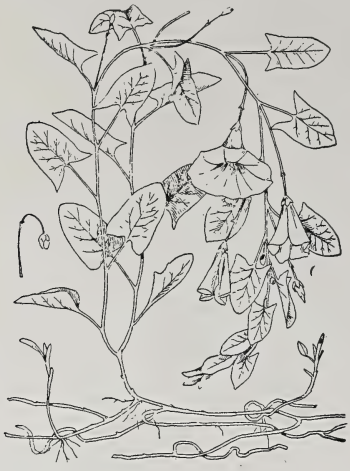
Eradication.—Similar to that given for other mustards.

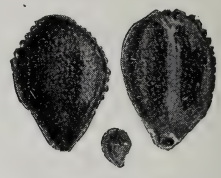
Wild Carrot (*Daucus Carota* L).—Introduced from Europe and now spreading rapidly in the clover seed producing districts of Ontario. It is an objectionable weed along roadsides, waste places and old meadows and occasionally gives trouble in cultivated fields. Biennial, with a large succulent root. Stems, flowers and leaves as in cultivated carrot. The fruit when ripe separates into two seed-like halves, commonly called seeds, each having 5 inconspicuous ribs running lengthwise and 4 winged secondary ribs bearing a row of barbed prickles which are easily rubbed off. The true seed is inside the fruit. The seed in the fruit is becoming quite a common impurity in Canadian grown red clover seed, but is more frequently found in imported stock. It seldom occurs in alsike.



Eradication.—Wild Carrot can best be kept in check in cultivated fields by a regular rotation of crops with thorough cultivation of hoed crops. Old meadows infested with it should be broken up and cultivated for a few years. Sheep will help to suppress it in pasture lands.

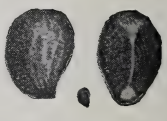
Field Bindweed (*Convolvulus arvensis* L).—Introduced from Europe. Perennial, deep-rooting, with extensive, creeping, cord-like fleshy rootstocks; these throw up numerous slender branching and twining smooth stems, which form thick mats on the surface of the land and twist around any plants growing within reach, using them as supports and choking them out. Leaves about 1 to $1\frac{1}{2}$ inches long on slender stalks, ovate or heart-shaped, arrow-shaped at the base. Flower-stalks slender, about the same length as the leaves, provided with miniature leaves at some distance below the large, open, funnel-shaped pink flowers, which are over an inch across. Fruit a round, cartilaginous, 2-celled capsule containing 3 to 4 seeds. The seed is rather large, $\frac{1}{6}$ of an inch long, dark brown, pear-shaped; one face convex, the other bluntly angled with flat sides. Surface roughened with small tubercles; the basal scar is a roughly lined, reddish depression at the lower pointed end. Field Bindweed is exceedingly hard to eradicate because of the almost incredible persistence of the fleshy rootstocks. Although widespread throughout the Dominion and in restricted localitites very troublesome, it is not yet a very common weed of Canada. The seeds are not often found in grain or clover seed. The plant propagates mostly by rootstocks and in many localities produces few seeds.





Eradication.—Persistent cultivation to prevent leaves forming. Smother small patches with straw or manure.

Clover Dodder (*Cuscuta* species).—Introduced from Europe. An annual parasite with slender yellowish and reddish stems, which twine about the host plant and become attached to the clover stems by suckers through which it obtains nourishment from the host. Flowers whitish or pinkish, in clusters along the thread-like, twining stems. There is probably no weed legislated against so much as Dodder. It is a serious pest in southern Europe, parts of the United States, Chili, and other temperate to warm climates having long summer seasons without frost. During years of shortage in clover seed crop of Canada, it has frequently been introduced and widely distributed in imported seed; but its ravages have been noted on red clover in only a few instances, and those in southern Ontario and the Pacific coast in years following an exceptionally late fall without frost until October. The seed is small, from $\frac{1}{30}$ to $\frac{1}{20}$ of an inch in diameter, yellow or brown, irregularly spherical, and more or less angled on the inner scar-bearing side; the surface granular roughened. Alfalfa Dodder has given trouble in southwestern Ontario and in the Prairie Provinces, where it is known to have continued in alfalfa for three years.

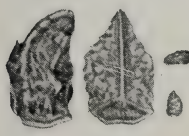


Eradication.—Badly infested fields should be ploughed under before seed forms. Small patches may be cut out and destroyed.

Blue Bur or **Stickseed** (*Lappula echinata* Gilibert).—Introduced from Europe. Annual and winter annual. Erect, branching, whole plant covered with short white hairs, which give it a grayish appearance. Leaves linear-oblong; root-leaves about 3 inches long, narrowed at base; stem-leaves stalkless. Flowers small, about $\frac{1}{8}$ inch across, pale blue, erect, in leafy, more or less one-sided racemes, and with minute bracts. It occurs by roadsides, in waste places, and in some sections in cultivated fields in eastern Canada and is a pernicious weed in fields of grain sown on stubble lands in the Prairie Provinces. The seed is about $\frac{1}{8}$ inch long, dark brown, pear-shaped, with a rough surface, inner face sharply angled, outer face rounded, without spines in the centre, but having on the sides a double series of long stiff spines, each of which has at its apex a star of 3 or 4 sharp hooks. This nutlet is often found in clover and other commercial seeds, when many of the long barbed bristles may be rubbed off; but it may be recognized by the angled inner face, with the small basal scar at the bottom of the central ridge and the unarmed area on the outer face. The seeds adhere to passing animals, bags and clothing, and are spread in this way.

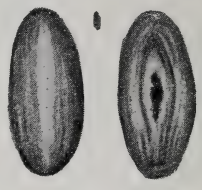
Eradication.—Fields badly infested with Blue Bur should be summer-fallowed. Thorough spring cultivation with the disc or broad-shared cultivator, or shallow ploughing, is necessary to prevent its abundant occurrence in crops sown on stubble land. Hand-pull from clover and grass crops.

Blueweed (*Echium vulgare* L.)—Introduced from Europe. Biennial, with a deep, black taproot. Whole plant bristly hairy, red at the base of the stiff bristles on the stem. Flowering stems erect and wand-like, forming compound spikes of reddish buds and bright blue flowers, 1 to 2 feet high; the spikelets curved at the tips, as is usual in the Borage family. Root-leaves linear-oblong or linear-lance-shaped, narrowed at base, without teeth or divisions, bristly hairy above and below, 6 to 8 inches long, the first year forming dense rosettes of long leaves lying flat on the ground; leaves of the flowering stems stalkless. Common by roadsides and in waste places and fields throughout Ontario and the eastern provinces. Chiefly on limestone and gravelly or poor soil. The seeds from each flower are $\frac{1}{8}$ inch long, dark brown, hard and rough, irregularly angular and cone-shaped, sharply angled on the inner face and rounded on the outer, with a keel running from the sharp apex half way down the outer convex face; basal scar a large, flat, triangular surface, acutely margined, marked with two little cone-like projections and a small deep depression close to the inner angle. They occur quite frequently in clover seed.



Eradication.—Keep closely cut and thus prevent seeding. Short rotation of crops with fall plowing and thorough spring cultivation.

Ribgrass (*Plantago lanceolata* L.)—Introduced from Europe. Perennial or biennial. Rootstock short. Leaves numerous, 2 to 12 inches long, narrowly lance-shaped and distinctly 3 to 5 ribbed, hairy, with tufts of brownish hair at the base. In the first year the leaves lie close to the ground, forming a dense rosette; on old plants they are erect. Flower stalks stiff, slender and grooved, 1 to 2 feet, much taller than the leaves. Flower heads at first ovoid and rather showy by reason of their numerous yellow stamens, elongating with age and forming dense, cylindrical, black spikes of seed, from 1 to 4 inches long. It occurs throughout Canada; most abundant in clover crops. The seed is about $\frac{1}{10}$ inch long, chestnut brown, minutely granular-roughened but highly polished, boat-shaped with rounded ends, the outer face rounded with the edges folded inward around a deep, longitudinal groove, in the centre of which lies the dark-coloured scar which sometimes has a pale ring of dried mucilage around it. Ribgrass seeds are one of the most common impurities in red clover seed and are found less frequently in alsike and alfalfa seed.



Eradication.—Use clean seed. Short rotation of crops.

Ragweeds (*Ambrosia* species). **Great Ragweed** (*Ambrosia trifida* L.), is a native annual which occurs occasionally in the eastern provinces and is abundant in the Red River Valley in Manitoba, extending westward mostly along the railways. It is a tall, coarse, branching plant, 4 to 8 feet high with rough stems and leaves. Leaves variable in shape; on young plants they are deeply indented but scarcely lobed, but as the stems grow, 3 or even 5 lobed leaves are produced, but on many plants leaves may be found without lobes. The male and female flowers are borne in different heads on the same plant; the male in long slender spikes at the ends of the branches, and the female two to three together, stalkless, in the axils of the leaves at the base of the spikes. Male flowers $\frac{1}{4}$ inch across, cup-shaped, nodding; stamens yellow and conspicuous. Female flowers inconspicuous; pistils slender and purplish. The seed is about $\frac{1}{4}$ of an inch long, brown, urn-shaped, tipped with a tapering beak and bearing around the base of this, about one-third from the top, 6 or 8 blunt spines, like the points of a crown, which are the ends of more or less distinct ribs. Wheat from some districts in the Prairie Provinces often contains considerable quantities of Great Ragweed seed.

Eradication.—Summer-fallow, followed by spring cultivation. Mow edges fields and roadways.

Common Ragweed (*Ambrosia artemisiifolia* L.) is the most widely distributed member of this group, being especially abundant in southwestern Ontario. It is a native annual, a coarse, branching plant with hairy stems 2 to 4 feet high. Leaves thin, smooth above, grayish white beneath from short, downy hairs, much cut up, pinnatifid, twice divided. The flowers closely resemble those of Great Ragweed but are smaller. The seed is from $\frac{1}{12}$ to $\frac{1}{6}$ of an inch long, dull light straw to dark brown, somewhat pear-shaped, the apex long and tapering to a sharp point. The surface is veined and slightly ridged lengthwise. This ridge usually terminates in sharp teeth, which form a circle around and point toward the apex. These teeth vary in number, size and regularity and are sometimes entirely absent. The outer covering of the seed is brittle and may be more or less broken away, thus revealing a smooth, brown, inner cover. The breaking off of this second coat shows the inside seed, which is greenish white, nearly round and slightly pointed at the base. Ragweed is a common impurity in red clover.

Eradication.—Avoid impure seed. Plow or disc stubble land immediately after harvest or mow to prevent seeding. Short rotation of crops.

Perennial Ragweed (*Ambrosia psilostachya* DC) resembles common Ragweed in the shape of the leaves and flowers, but has running rootstocks which throw up weak stems. It occurs on the prairies occasionally.

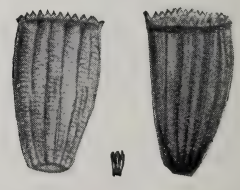
Ox-eye Daisy (*Chrysanthemum Leucanthemum* L. var. *pinnatifidum* Lecoq and Lamotte).—Introduced from Europe. Perennial, shallow-rooted. Stems numerous, simple or little branched, 1 to 3 feet high. Basal leaves are more or less pinnatifid or coarsely and irregularly toothed; middle and upper stem-leaves narrowly oblong or somewhat lance-shaped, conspicuously pinnatifid at the base. Flower heads solitary on long, naked footstalks, very handsome, $1\frac{1}{2}$ to 2 inches across; rays 20 to 30, pure white, spreading, two to three-toothed at the apex; centre flowers yellow. A single plant produces from 5,000 to 8,000 seeds. Abundant in old pastures, in meadows and by roadsides from the Atlantic coast to the borders of Manitoba and occasionally along the railways to the Pacific coast. The seed is $\frac{1}{12}$ of an inch long, club-shaped or elongate-ovate, usually curved, almost stright on one side and convex on the other, the knob-like scar at the top prominent; 10 well-defined white ridges run the whole length of the seed, meeting at both ends; between these ridges the surface of the seed is black, minutely dotted with white; no pappus. Often found in large quantities in Canadian grown timothy seed.

Eradication.—Shallow ploughing followed by cultivation. Short rotation of crops.

Canada Thistle (*Cirsium arvense* (L.) Scop.)—Introduced from Europe. Perennial with deep running rootstocks. Stems erect, 2 to 4 feet high. Leaves variable in shape, waved and crested, very prickly, in some plants much less so than in others. Flower heads numerous, in a large loose corymb at the top of the stems. Flowers variable in colour, ranging from pale purple through shades of pink to white. Some plants bear male flowers only, which form no seeds, other plants female flowers only, which produce many seeds; the flower heads of male plants are nearly globe-shaped, 1 inch across, those of the female plant only about half as large, oblong, with short florets. Large patches may be found bearing only male flowers, showing that all the plants originated from a single seed. It is abundant in eastern Canada, Manitoba and British Columbia and is spreading rapidly in Saskatchewan and Alberta. The seed is $\frac{1}{8}$ of an inch long, light brown, elongated oblong, smooth, somewhat flattened and curved, more or less less bluntly angled, marked with faint longitudinal lines; the top is nearly round, flat, and has a narrow rim with a small cone-shaped point in the centre. The seeds are frequently found in grass and clover seeds and sometimes in seed grain.

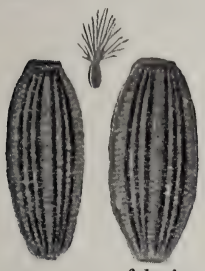
Eradication.—Frequent cultivation to prevent the formation of leaves. Plough in late June or early July and follow by almost weekly cultivation throughout the season. Root crops may be advantageously grown on infested land if kept clean. Small patches should be hoed or dug whenever the plants show above the ground.

Chicory (*Cichorium Intybus* L.)—Introduced from Europe. Perennial from a deep, long, thick root. Stems 2 to 3 feet high, branched, hairy below. Root-leaves closely resembling those of Common Dandelion, 6 to 8 inches long, spreading on the ground. Flower heads bright blue, sometimes purple or nearly white, about two inches across composed entirely of strap-shaped flowers, usually closing by noon, in stalkless clusters of three or four together along the almost leafless stems. It occurs in eastern Canada, most abundant in Quebec. A common roadside weed and occasionally found in cultivated fields. The seed is $\frac{1}{8}$ inch long, dark brown or straw-coloured, mottled with brown, wedge-shaped, obtusely 3 to 5-angled, sometimes much curved; the surface grooved and ridged from top to bottom and roughened crosswise with minute, close, raised and waved lines; at the top, surrounding the apical scar, is a fringe of short, flat, white bristles. The seeds are often found among crop seeds, particularly in clover and grasses.



Eradication.—Chicory is not often seen in good farming districts except as a wayside weed. A short rotation of crops will soon suppress it.

Sow Thistles (*Sonchus* species).—The most dangerous and widespread weed in this group is **Perennial** or **Field Sow Thistle** (*Sonchus arvensis* L.) Abundant in cultivated fields and along roadsides, rapidly spreading from the Atlantic coast westward and already a serious pest in Manitoba. It is a deep-rooted perennial, with large and vigorous running root-stocks. Stems 1 to 5 feet high, hollow, simple, with few leaves, and branching at the top. Whole plant filled with a bitter, milky juice. Leaves 6 to 12 inches long, pointed, deeply cut, the lower divisions directed backward, clasping the stem by their heart-shaped base, and edged with soft spines. Flowers bright yellow, $1\frac{1}{2}$ in. across, in corymbs, closing in strong sunlight. The seed is about $\frac{1}{8}$ of an inch long, dark, reddish brown, oblong, closely and deeply ridged lengthwise, the ribs wrinkled transversely, giving the seed the appearance of being ridged both ways, bearing at the top a tuft of white, silky and persistent hairs which spread in drying and enable the seed to be carried long distances by the wind. *Eradication.*—See Canada Thistle. Dig out or smother small patches as soon as discovered.



Annual or **Common Sow Thistle** (*Sonchus oleraceus* L.) has about the same distribution as the Perennial Sow Thistle. Stem, 1 to 4 feet high. Leaves deeply cut and toothed with soft spiny teeth; the basal ones pinnatifid, terminated by a large lobe, clasping the stem by their heart-shaped base, ending in sharp points. The flower is pale yellow, about $\frac{1}{2}$ to 1 inch in diameter. The seed is somewhat similar to that of Perennial Sow Thistle but a little shorter, flattened, pointed at the basal end. The longitudinal ridges are wider apart, much finer, and the whole surface of the seed, the ridges as well as the interspaces, is finely wrinkled transversely. Pappus falls off easily. **Spiny-leaved** or **Prickly Sow Thistle** (*Sonchus asper* (L.) Hill.) is an annual of the same habit as Common Sow Thistle. It may be easily identified by its more prickly nature and less deeply cut leaves, the base appendages of which, instead of spreading, are appressed to the stem and rounded. The seed is similar to that of the preceding species in size and shape; distinctly 3-nerved on each side but with nerves and interspaces quite smooth. Both of these annuals are comparatively harmless weeds and easily controlled.

Spiny-leaved.

Annual.

OTHER WEEDS.

Many species of farm weeds give trouble in meadows, pastures, grain crops, hoed crops, lawns and roadsides that are not here classed as noxious. It is believed to be impracticable and undesirable to legislate against more than 20 or 25 of the most troublesome kinds commonly disseminated in commercial seeds. Noxious weeds that might very well be included in a provincial law having for its object the suppression of weeds growing on farm lands would naturally differ materially from those embodied in a law to restrict their distribution in commercial seeds. Many kinds of weeds become dessiminated by wind, water and other natural agencies, the seeds of which seldom occur in grass or clover seed or in seed grain. Couch Grass, Wild Morning Glory and Paint-brush are more harmful weeds than Ribgrass which is a useful fodder plant in sheep pastures.

The ability of weed seeds to retain their vitality when embedded in the soil is one of the principal reasons why plants producing them are classed as noxious weeds. The length of time that mustard and other weed seeds will retain their vitality in the soil has not been very well understood. It is commonly stated that they will retain their vitality for an indefinite period and, when brought to the surface by plowing, will germinate and produce a fresh crop of weeds. There is, however, a good deal of evidence from careful experiments to prove that such weed seeds will not retain their vitality longer than about 15 years.

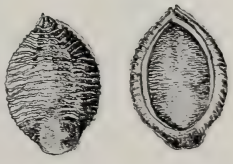
Some weeds, while noxious from an agricultural standpoint, are not classed noxious under the Seed Control Act because their seeds seldom if ever occur in commercial samples. Others are objectionable weeds but their seeds are very fine and are easily separated from grain and other coarse seed. There are a great many weeds, other than those classed noxious under the Act, the seeds of which occur in commercial samples. Over one hundred and fifty different species of weed seeds were found in the samples analyzed for seed merchants and farmers during the past year. Many of these are seeds of useless or harmful plants that are of only secondary importance as weeds and occur very seldom. Others are common impurities but are not sufficiently dangerous to be classed noxious. The following are among the most prevalent or important species.

Large Crab Grass or **Finger Grass** (*Digitaria sanguinalis* (L.) Scop.)—Introduced from Europe. Annual. Found as a weed in clover and timothy fields. Culms erect or ascending from a creeping base, 1 to 3 feet long. Leaves thin, flat, 2 to 6 inches long, $\frac{1}{8}$ to $\frac{1}{4}$ inch wide, usually smooth, sometimes a little hairy. Spikes very narrow, 3 to 8, growing from one point at the end of the culm (name from digitus, a finger), greyish green, often tinged with rich purple. Spikelets $\frac{1}{16}$ to $\frac{1}{8}$ inch long, in pairs. The seed is about $\frac{1}{8}$ inch long, $\frac{1}{24}$ inch wide, one side rounded, green, slightly shining, with a pointed hairy scale nearly half its length, the other side flat, purplish, distinctly 3-ridged, hairy at the edges with a very short smooth scale at the base. Seeds occur in timothy and clover samples; found more in timothy.

Old Witch Grass (*Panicum capillare* L.), a stout annual with hairy leaves and a large loosely spreading panicle about half the length of the whole plant, is one of our most common grass weeds. It is sometimes very abundant in grain crops and meadows when the crop stand is not strong, but it is not a serious weed on well cultivated land. After ripening the plants break off and are blown about by the wind. They are often seen in large quantities along fences. The seed is about $\frac{1}{16}$ of an inch long, spindle-shaped in outline, highly shiny, olive green, with white parellel nerves, more yellowish when unripe. It occurs often in large quantities in the seeds of timothy and other grasses and less frequently in clover seed. A number of other species of the **Panic Grasses** are quite widely distributed but none are so common as Old Witch Grass. The Panic grasses are closely related to the Foxtails but differ essentially by the absence of the persistent bristles below the florets.

Green Foxtail (*Setaria viridis* (L.) Beauv). An introduced annual found commonly in eastern Canada and becoming a serious pest in the Prairie Provinces, where it is taking heavy toll. As an annual this weed is very troublesome because of its extreme prevalence throughout Canada. Seed colour very variable according to the degree of ripeness; yellow, grey, brown or purplish, the darker seeds mottled with darker spots. The kernel is greenish-white, convex on the outer face, which bears the germ, and flattened on the inner face. Green Foxtail seeds are the most prevalent impurity in clover seed. They are contained in about 90 per cent of the red clover samples analyzed at the Ottawa seed laboratory and about 50 per cent of the alsike samples. Green Foxtail seeds profusely from harvest to late autumn. The presence of the seeds as an impurity materially reduces the value of red clover or alsike seed for commerce.

Yellow Foxtail (*Setaria glauca* (L.) Beauv.) is very similar to Green Foxtail. The branches, however, are more spreading, the whole plant is rather larger and more succulent, the spikes less compound and slenderer, with larger seeds. The bristles of the spikes are distinctly yellow. The young plant has a broad pale-green leaf and the base of the stem shows a characteristic yellow colour. The seeds are similar to those of Green Foxtail but larger. They are a common impurity in red clover and alfalfa seed, seed grain and feeding stuffs, but are seldom found in recleaned alsike and timothy. On account of their relatively large size they are easily cleaned from the smaller seeds. Thick seeding with clover and grasses will help to suppress the Foxtails in the autumn stubble and subsequent clover crop. In clover seed crops the patches that have been winter-killed should be mown while the Foxtail is quite green.



Eradication.—Disc stubble immediately after harvest. Hoed crops with clean cultivation late in summer.

Sweet Grass (*Hierochloë odorata* (L.) Wahlenb.) is a native perennial, rare in the eastern provinces, growing mostly in damp places by streams and rivers, but widely distributed in the Prairie Provinces where it seems to thrive on all kinds of soils. It is difficult to suppress because of its deep-rooting wide-spreading white rootstocks, which produce in summer many barren shoots with long, flat, deep green, shining leaves, over a foot in length. Flowering stems are thrown up early in spring, the first flowers opening when the stems are only a few inches out of the ground. When handled the plant produces a scent very similar to that of Sweet Clover. The naked seed closely resembles timothy, but is thinner, more cylindrical, and sometimes bears at its apex the remainder of the dried-off style (the elongated part of the pistil.) The miniature root of the germ is more prominent. The seeds are occasionally found in grass seed.

Eradication.—Plough in May. Choose a season when the soil is dry. Do not drag about the field with harrows as this starts new patches. After ploughing sow to some fast growing crop, such as oats or barley.

Chess (*Bromus secalinus* L.), is a winter annual widely distributed wherever winter wheat or other fall or winter crops are grown. The stems are erect and simple. The portion of the leaf that embraces the stem is smooth, strongly nerved. Panicle loose, its branches somewhat drooping, with many flowered, hairless spikelets, which are so distinct as to show openings between them along the stalk, when viewed from the side. The seed is about $\frac{1}{3}$ inch long, inclosed in scales of the same length. The outer scale is convex, thick and unrolled at the margin when ripe, provided with a short bristly awn. The inner scale is bordered with stiff hairs and adherent to the kernel. The footstalk of the grain above is strongly curved and club-shaped. The seeds are a common impurity in winter wheat, and, to a less extent, in winter rye and other grains and seeds of commerce, and in feeding stuffs. Chess is objectionable in wheat for milling as it gives the flour a dark colour and a disagreeable flavour. Removing it by cleaning causes considerable loss of the smaller grains of wheat.

Eradication.—Avoid winter wheat. Short rotation of crops. Hoed crops.

Couch or **Quack Grass** (*Agropyron repens* (L.) Beauv.) is widely distributed throughout Canada and a most injurious weed in all kinds of soil. It is perennial by wide-spreading but shallow fleshy rootstocks, forming large matted beds. Flowering stems rather freely produced, smooth above, downy below. Flowers in 3 to 7-flowered spikelets, forming a narrow spike with the spikelets lying flat against the stalk. Leaves dark green, rather distinctly ribbed, and more or less hairy below. The seeds are seldom found in cereals, timothy or clover seed but occasionally in the coarser grasses, and in litter from hay or straw containing mature Couch Grass.

Eradication.—To destroy this persistent weed let it exhaust its substance in the production of a hay crop, which should be cut and removed as soon as the head is formed and before it is in blossom. Plow shallow and cultivate until the rootstocks have been brought to the surface when they should be gathered and removed or burned. This may be followed by a cleaning crop of rape, buckwheat or millet and a hoed crop the next spring.

In the Prairie Provinces shallow ploughing late in June when land is dry, followed by back-setting as soon as possible in the fall and a thorough cultivation the following spring, has given good results. Plow shallow after hay crop and unearth rootstocks with successive cultivation before growth is renewed.

Skunk-tail Grass or **Wild Barley** (*Hordeum jubatum* L.) is a native perennial occurring from Lake Superior westward, particularly in alkaline soil where better grasses can not thrive and occasionally in eastern Canada. This grass is a serious enemy to western stockmen, being a source of much injury to horses, cattle and sheep. The barbed seeds and awns penetrate the soft tissues of the mouth, causing irritation and inflamed ulcers, and work down beside the teeth, producing inflammation and swelling. It does not flower the first year, forming tufts 8 to 12 inches high. Leaves grayish-green. Flowers in beautiful, silky, bristly heads, 3 to 4 inches long, pale yellowish-green often tinged with red. The seed produced by the female flower is slender, sharp pointed, somewhat resembling a miniature seed of barley, and provided with a long, upwardly barbed awn. The heads adhere to passing animals and are carried long distances by the wind.

Eradication.—There is no difficulty in eradicating this grass from land that can be plowed, but it gives considerable trouble in waste places where it ripens its seed which is widely scattered by wind and water.

Devil Grass (*Agrostis hyemalis* (Walt.) B.S.P.). A common weed in grain land in western Canada where it gradually starves out the cultivated grasses. It is useless as hay on account of the minute barbs on its stems which produce sores and ulcers in the mouths of the animals eating it. The plant is a very fine silky perennial growing from six inches to a foot in height and having a pinkish colour. The seeds are about half the size of Red Top and somewhat similar in appearance. Late in the season the heads break off and on account of their lightness fly long distances with a strong wind, dropping their seed in all directions.

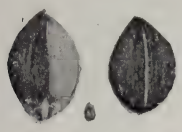
Eradication.—Plough deeply.

Sedges (*Cyperaceae*).—The sedges are similar to grasses in general appearance, with fibrous roots and mostly solid stems. Some species are troublesome weeds on wet lands. **Yellow Nut-grass** (*Cyperus esculentus* L.) is a troublesome weed in hoed crop or timothy grown on wet land. It spreads underground by small nut-like tubers and is difficult to eradicate. The stems are triangular, stout, 1 to 3 feet high, leafy at the base, with two or three leaves at the summit. Leaves light green, $\frac{1}{8}$ to $\frac{1}{4}$ inch wide, about the same height as the stem. These deep yellow or light chestnut coloured heads are easily seen in a field of timothy. The seeds, about $\frac{1}{32}$ inch in length, 3-angled, light brown, are occasionally found in samples of timothy, but very seldom if ever in clover seed. Sedges are chiefly wet land plants and their presence is usually a sign that the land needs draining. Thorough underdrainage will tend to eradicate sedges by making conditions less suited to their growth as well as by making the crop more vigorous and choking them out.

Ovoid Spike-rush (*Eleocharis ovata* (Roth) R. & S.), is a species of sedge widely distributed in wet places, the seeds of which are often found in timothy and occasionally in red clover samples. The seed is top-shaped, pale to rich chestnut brown, smooth and shining, about $\frac{1}{16}$ inch long and $\frac{1}{32}$ inch wide, with a lighter coloured triangular tubercle at the apex, $\frac{1}{4}$ its length, and 6 to 8 pale barbed bristles attached to the base of the seed and extending slightly beyond the tubercle. Usually found in timothy samples with one or more of the bristles broken off. Owing to their small size these seeds can readily be cleaned from most kinds of commercial seeds. Lands infested with this, or other species of sedges, should be thoroughly drained if possible and given clean autumn cultivation followed by hoed crop.

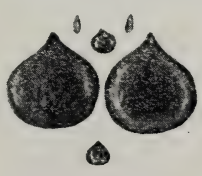
Fox Sedge (*Carex vulpinoidea Michx*) is another species troublesome on low lands. This seed is sometimes found in timothy in great abundance, being more prevalent than the two former species.

Sheep Sorrel (*Rumex Acetosella* L.) is naturalized from Europe and is now common in all parts of the country. It is perennial and very persistent by extensively spreading, yellow, fleshy rootstocks. Stems slender, 6 to 18 inches, erect or nearly so, branched above. Leaves with silvery ear-like appendages, spreading outward from the base, narrowly arrow-head-shaped, toothless, 1 to 4 inches long, quite smooth and rather fleshy, on long stalks. Flowers numerous in panicle-like racemes, of two kinds on separate plants; the male flowers have conspicuous stamens; the female are much less showy and are tipped with three tiny, crimson, feather-like organs (the stigmas). The seeds, as they occur among clover and grass seeds, are generally covered by the three larger conspicuously veined calyx divisions which fit closely over the seed. The naked seed, when the calyx divisions are removed, is $\frac{1}{20}$ of an inch long and nearly as broad, triangular-ovate, pale brown, shining. The seeds are of one the most abundant impurities in clover and grass seeds, being especially common in alsike. *Eradication.*—Application of lime. Good cultivation with hoed crops. Pasture with sheep.



Lady's Thumb (*Polygonum Persicaria* L.) is an annual common all over the country, especially in low fields and meadows. Although Lady's Thumb and others of the Knotweeds and Smartweeds are widely distributed, they are not seriously noxious in most field and garden crops. The stems are erect, fleshy, nearly smooth, hairless. Leaves lance-shaped, pointed, nearly stalkless, the surface roughish, often dotted and marked with a dark triangular or round spot near the centre. The mode of flowering is an ovoid or short cylindrical spike, dense, erect, composed of pink or dark purple flowers. The seeds are about $\frac{1}{12}$ of an inch in diameter, ovate, heart-shaped, hollowed out on one side or roundly triangular, jet black, shining. They are a common impurity in red clover and and less frequently found in alsike, alfalfa and grass seed. **Pale** or **Dock-leaved Persicary** (*Polygonum lapathifolium* L.) very closely resembles Lady's Thumb. It is a common, tall-growing and rather aggressive weed among grain and clover on rich low land in all parts of eastern Canada. The seed is $\frac{1}{10}$ of an inch long, more roundly heart-shaped, chocolate brown, hollowed on both sides and never triangular. *Eradication.*—Drainage, Late cultivation with hoed crops.

Lady's Thumb

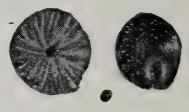


Pale Persicary.

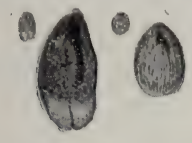
Wild Buckwheat (*Polygonum Convolvulus* L.) is general in cereal crops throughout Canada, but most prevalent in the Prairie Provinces. It is an annual introduced from Europe; a twining vine with rather rough branching stems and thin smooth, arrow-shaped leaves. Flowers greenish, drooping on short slender stalks, in small clusters, arising from the axils of the leaves, and in loosely flowered terminal racemes. Calyx 5-parted, persistent. The seed is dull, black, triangular, about $\frac{1}{8}$ inch long, bluntly pointed at the apex and almost twice as long as broad, widest just above the middle; the germ is club-shaped, small, curved and lies along one angle of the seed in a groove. When found in commercial grain, the seeds are often without the black coat and appear naked, white, wax-like, with slightly rounded angles. They are the most common impurity in cereals, being especially abundant in western grain, and constitute a very large percentage of the weed seeds occurring in elevator screenings. They are considered good feed, especially for poultry.

Eradication.—Summer fallow. Most of the early plants can be destroyed in grain crops by harrowing when the grain is about three inches high.

Lamb's Quarters (*Chenopodium album* L.) occurs throughout Canada in rich land. It is one of our most common garden weeds and commonly appears in cultivated fields. An annual, introduced from Europe and native. Extremely variable in every character. Mostly tall, succulent and herbaceous, with a slender, erect, grooved, much-branched stem, 2 to 6 feet high, with angular-ovate, pale green, coarsely toothed leaves, narrowed at the base and borne on slender footstalks. Flowers in compound spikes from the axils of the leaves. The seed is about $\frac{1}{20}$ of an inch in diameter, circular in outline, more or less flattened on one side, strongly convex on the other, edges bluntly rounded, the lower convex face grooved from the margin to the central scar, minutely wrinkled; colour shining black. The seeds, as found among crop seeds, have a thin envelope closely adhering to them, as a brown or gray mealy deposit, which gives them a granular-roughened appearance; they also often have the dried 5-angled calyx closed tightly over them. They are a common impurity in alfalfa and timothy, especially in the west. The seed is so nearly the same size as that of timothy that its separation is difficult, so that this weed should be hand-pulled from fields intended for seed. Next to wild buckwheat these seeds are the most prevalent impurity in grain. Its hard flinty seed-coat makes it difficult to grind, so that it commonly occurs unground in feeding stuffs made from poorly cleaned grain. *Eradication.*—As for Wild Buckwheat.

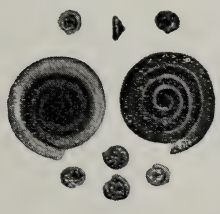


Russian Pigweed (*Axyris amarantoides* L.) was first noticed in Canada in 1886, by the roadside at Headingly, Man., 14 miles west of Winnipeg, where it is said to have been brought direct from Russia. It is now found along the railways throughout the West, and has been even detected on a railway bank as far east as St. John, N.B. It is an annual, tall, coarse plant, from 2 to 4 feet high, erect and widely branching, very leafy. When young much like Lamb's Quarters, but paler green with a more wand-like habit of growth, and instead of being mealy in appearance it has soft, short, star-shaped hairs. When full-grown the whole plant forms a large pyramidal compound raceme; the stems, bracts and the papery calyx segments turn white and make it very conspicuous. The seed is oval, flattened, $\frac{1}{12}$ of an inch long, gray or brown with a silky lustre, surface minutely lined and wrinkled lengthwise, basal scar a short thin groove across the lower end; many seeds have a close-fitting papery envelope, projecting above the top as a 2-lobed wing. The seeds are occasionally found in commercial samples.



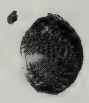
Eradication.—Fields badly infested should be thoroughly summer-fallowed and the succeeding grain crop treated with the harrow when the plants are a few inches high.

Russian Thistle (*Salsola Kali* L., var. *tenuifolia* G.F.W. Mey.) is an annual introduced from Asia. It is abundant in several localities in the dryer parts of Alberta and Saskatchewan, chiefly along roadsides, fire-guards and in neglected fields and is frequently found, though not seriously troublesome, in the eastern provinces. Russian Thistle is a large, succulent weed and thrives where the land is too dry for other plants. It is bushy, of a prickly appearance, due to the thin, thread-like, prickle-tipped leaves which characterize the young plant, and the short, triple, spiny bracts on the flowering branches of the older plants. It varies in appearance at different stages of growth. The young plant is dark green, the slender leaves, about two inches long, drop off soon after the seed is formed. The somewhat spherical branched top of the mature plant, when broken away from the root, is blown about by the wind and scatters its seeds widely. It is not a thistle and could be more appropriately called a tumbleweed. Flowers solitary, borne in the axils of the leaves. The seed is about $\frac{1}{16}$ of an inch in diameter, cone-shaped, the large end concave with a well marked protuberance in the centre of the cavity. The coat is thin and transparent, showing the grayish-brown, coiled germ. The seeds are generally enclosed in a papery envelope, the divisions of which are winglike. They occur quite frequently in imported alfalfa seed.



Eradication.—Badly infested fields should be seeded to grass. Avoid spring cereal crops.

Red-root Pigweed (*Amaranthus retroflexus* L.) is an annual introduced from tropical America and now established in all settled parts of the Dominion. It has a rosy pink tap-root. Stems erect, simple or branched, rough-hairy. Leaves on long stalks, ovate, bristle-pointed. Flowers inconspicuous, numerous, crowded into thick compound spikes at the ends of the branches and in the axils of the leaves. The seed is highly polished, reddish black to jet black, about the same size as that of Lamb's Quarters, circular or egg-shaped in outline, much flattened and equally convex on both sides. An immature or shrunken seed has a narrow, slightly flattened marginal band, which marks the location of the ring-like germ. Pigweed seeds are quite commonly found in clover and grass seeds, especially alsike and timothy. Red-root is especially troublesome in gardens and in potato and field root crops.



Eradication.—When embedded in the soil, the seeds retain their vitality for several years and produce seedling plants only when brought within about two inches of the surface by cultivation. Late cultivation of hoed crops should be made as shallow as practicable.

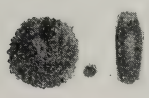
Tumble Weed (*Amaranthus graecizans* L.). A large bushy annual forming under favourable conditions a compact mass from one to two feet in diameter. Leaves small oval, narrower at base. Flowers very small, borne in clusters in the axils of the leaves. When ripe the plants break off at their base and, taking advantage of each wind, travel long distances, scattering their seeds as they go. Seeds black, very shiny, closely resemble Red-root but smaller and rounder in outline. They are often in western timothy and among the seeds of other fodder plants. This weed occurs chiefly on newly broken land in the Prairie Provinces where it is often abundant and a factor of no small importance in robbing the soil of moisture. It is, however, seldom injurious on old well-tilled soil.

Eradication.—Early discing of breaking. Summer-fallow followed by late spring harrowing of grain crop.

Spreading Amaranth (*Amaranthus blitoides* Wats.). Resembles common Tumble Weed but has rather large leaves and a prostrate manner of growth, forming mats upon the ground. The seeds which occur in alfalfa may be told from other Amaranths by their larger size.

Spurrey (*Spergula arvensis* L.) is an annual, now found and quite commonly in grain fields in the eastern provinces and in parts of British Columbia. Stems branching from the base, 6 to 18 inches high, almost smooth, sparingly hairy above. Leaves narrowly linear, apparently in a circle around the joints of the stem but really in two opposite sets of 6 to 8 together, with scale-like, modified leaves between them. Flowers white, the fruit hanging abruptly downward. The seed is dull black, lens-shaped or round and compressed, with the margin extended into a narrow pale wing. The surface is more or less roughened with small, pale-coloured, elongated protuberances, like gland-tipped hairs. Both the protuberances and the wing are sometimes absent when the seeds occur among commercial seeds. They are a common impurity in grain grown in the Maritime Provinces and Quebec and are occasionally found in timothy and alsike seed.

Common Chickweed (*Stellaria media* (L.) Cyrill.) is an introduced annual occurring in all parts of Canada where the soil is moist and rich; Stems diffusely branching, curving upward with a tendency to lie down. Roots hair-like and exceedingly tough. Leaves ovate. Stems bearing a conspicuous stripe of articulated hairs down one side. Flowers $\frac{1}{4}$ inch in diameter, numerous, solitary from the axils of the leaves, in old plants in terminal leafy cymes; corolla white. Fruit capsules cone-shaped, spreading or hanging down, longer than the calyx. The seed is small, $\frac{1}{24}$ of an inch in diameter, yellowish brown to dark brown, wedge-kidney-shaped, flattened and covered with coarse tubercles arranged in regular curved rows, about 5 on each side and 4 on the edge. It is frequently found in clover and timothy seed. Two or three species of **Mouse-ear Chickweeds** (*Cerastium*) also occur in Canada and are somewhat similar to Common Chickweed but are covered all over with downy hairs which in some species are glandular, giving a dirty appearance to the plants by reason of the dust which adheres to them. The seeds are also found in clover samples.



Common Chickweed.

Mouse-ear Chickweed.

Tarry Cockle or **Sleepy Catchfly** (*Silene antirrhina* L.). A somewhat slender annual with small pinkish white flowers and greenish stem bearing at intervals on the upper branches long purplish sticky patches. The seeds are similar to Catchfly but about half the size and rather darker.

Eradication.—Spurrey, Chickweed and Cockle may be kept in check by discing of stubble land after harvest to prevent seeding. Short rotation of crops and clean cultivation of hoed crops.

Purslane (*Portulaca oleracea* L.) is an annual introduced from Europe, now common in rich land, particularly in gardens; most abundant in the eastern provinces. It is a fleshy, prostrate, perfectly smooth plant, freely branching from a single central root, with fleshy reddish stems and dark green, alternate, obovate or wedge-shaped leaves mainly clustered at the ends of the branches. Flowers stalkless, solitary, about $\frac{1}{4}$ of an inch across, yellow, opening only on sunny mornings. Fruit capsule, membranous, many-seeded, the top coming off as the lid of a box. The seed is black, roughened but shiny, about $\frac{1}{40}$ of an inch in diameter, narrowly kidney-shaped, much as in the Pink family, and, like the seeds of most of the members of that family, with a curved germ running around the outside of the seed.

Eradication.—The seeds retain their vitality for several years. They do not germinate until the soil has become quite warm and they have been brought near the surface by cultivation. Several years of careful cultivation are required to eradicate Purslane. Seeds that have formed will develop and mature on the fleshy stems of the plant after it has been cut which makes it necessary to remove and destroy the plants after cutting. The seeds are seldom found in commercial samples.

Tall Buttercup (*Ranunculus acris* L.) occurs throughout Canada, especially in moist lands. It is a noxious weed with a poisonous, acrid, blistering juice; common in pastures and meadows. Perennial, with fibrous roots. Stems erect, generally hairy. The leaves in 3 divisions, each division stalkless, 3-cleft or parted, with deeply lobed segments. Flowers yellow. The dry seed-like fruits are in heads. The seed is about $\frac{1}{8}$ of an inch in diameter, flat, nearly round in outline but unsymmetrical with a somewhat wing-like margin; both the tip and the scar ends are pointed and very prominent, the former generally hooked. The colour varies from greenish-brown to nearly black; dull from the roughened surface. The seeds are occasionally found in commercial samples. Several allied species are prevalent in many districts as weeds of secondary importance. **Cursed Buttercup** or **Ditch Crowfoot** (*Ranunculus sceleratus* L.) is abundant along ditches, creeks and ponds and is occasionally found in wet pastures. **Small-flowered Buttercup** (*Ranunculus abortivus* L.) is common in old pastures and woods, less frequent in meadows and cultivated fields.

Eradication.—Drainage. Thorough cultivation with short rotation of crops. Avoid seeding to grass until suppressed.

Wood Whitlow Grass (*Draba nemorosa* L.) is a native annual and winter annual. Stem low, branching below. Leaves stalkless, oblong-ovate or lance-shaped, somewhat toothed, roughish. Flowers small, yellowish. Pods elliptical-oblong, half the length of the foot-stalks which are almost horizontal at maturity. The seeds are very small oval or egg-shaped and orange in colour. The flowers appear in May or late April and most of the injury is done during the former month. Troublesome only on summer-fallow or in gardens; easily destroyed by spring cultvation.

Peppergrass (*Lepidium apetalum* Willd.) is a native annual and winter annual, widely distributed but most abundant in light sandy soils. Stems erect, profusely branching above, 6 inches to 2 feet high, somewhat hoary with short appressed hairs. Autumn plants produce a rosette of dark-green, deeply indented leaves, much like some specimens of Shepherd's Purse but more succulent. Stem-leaves with a few coarse teeth, narrowed at the base. The many nearly erect and spreading branches give this plant, when in seed, the appearance of a miniature tree, the numerous small, nearly round, flat pods taking the place of leaves; the real leaves fall away when the seeds begin to ripen. The flowers are minute. The seed pods are about $\frac{1}{10}$ of an inch wide, heart-shaped, slightly longer than wide, notched at the top and at maturity separate into halves. The seed is about $\frac{1}{16}$ of an inch in length, bright reddish-yellow, egg-shaped in outline, much flattened, blunt on the straight side and very thin or slightly winged on the rounded side; both sides show a rather deep groove in the middle. When moistened the seeds develop a large amount of mucilage. Although there are only two seeds in a pod, each plant produces thousands of seeds. They are a common impurity in clover and grass seed, being especially abundant in timothy.

Eradication.—Thorough spring cultivation. Badly infested fields should be disced or ploughed directly after harvest, cultivated from time to time until winter and again until late June when they may be planted or sown to a late fodder crop.

Field Peppergrass or **Cow Cress** (*Lepidium campestre* (L.) R. Br.) is a biennial yet rare in Canada but occurring in the clover-growing districts of Ontario where it is increasing. The plant grows with two or three stems from the same root. The lower leaves are oblong and toothless; those of the stem are spear-shaped with blunt ends. The thick pods are broadly ovate, boat-shaped, being rounded below and hollowed out above. Each pod contains two seeds. The seed is $\frac{1}{12}$ of an inch long, egg-shaped, but pointed at the scar end. The surface is finely roughened and dull, with a mealy appearance. Two grooves, often filled with mucilage, extend from the sharp basal end almost to the other end of the seed. These seeds are now much more common than those of Peppergrass in red clover and alfalfa and are found to a less extent in alsike seed.

Shepherd's Purse (*Capsella Bursa-pastoris* L.) is an annual and winter annual occurring throughout Canada. The plants vary greatly. A seed-bearing plant may be a dwarf, little more than an inch or two high, or a vigorous, branching plant, three feet high, with many pods. There may be at the base a vigorous rosette of leaves, or none at all. The leaves may be deeply cut, pinnatifid, or without any teeth or division. The stem leaves are for the most part arrow-shaped, with two sharp, ear-like projections, one on each side of the stem. The flowers are small and white. The seed-pod is flat, triangular in shape, $\frac{1}{4}$ of an inch long, wedge-shaped at the base, notched at the top, with the outer angles rounded. Each pod contains about 20 seeds. The seed is small, $\frac{1}{24}$ of an inch long, oblong, reddish brown, the surface dull and punctured. When put in water it develops a large amount of mucilage and a covering of long but very fine transparent hairs. The seeds occur quite frequently in alsike and grass seed and occasionally in red clover. Shepherd's Purse has an enormous power of propagation; a single plant will ripen 50,000 seeds. In meadows which have been thinned by winter killing the vigorous rosettes of autumn-started plants will crowd out grass and clover.

The seed is a common impurity of alsike and timothy seed but is so small that it may be easily removed by a fine woven wire sieve.

Eradication.—Summer-fallow. Spring cultivation. Hoed crops.

Rocket or **Rocket Salad** (*Eruca sativa* Lam.) has recently been introduced into Ontario, probably with European alfalfa seed, and is now frequently reported. It is a hairy annual, somewhat resembling Wild Mustard. The leaves are pinnatifid, with a large terminal lobe. The flowers are yellowish-white, characteristically netted with dark purple veins, aromatic. The pods are shorter than those of Wild Mustard, upright, the beak broad and flat. The seed is a little larger than that of Wild Mustard, flattened, olive-brown, the miniature root of the germ generally lighter in colour. It is pungent and bitter, with a flavour characteristic of radish. The seed is occasionally present in European alfalfa seed. The plant is seldom referred to as a noxious weed in Europe but it should not be allowed to mature its seeds in cultivated crops. Many of our worst weeds have been introduced through imported seed and have become widely distributed through lack of care in preventing the first plants from seeding. Prevention is easier than cure in dealing with any weed and as Rocket belongs to one of our most dangerous plant families it should be carefully hand-pulled wherever it makes its appearance so that it can not get a chance to ripen seed and become established.

Green Tansy Mustard (*Sisymbrium incisum* Engelm., var. *filipes* Gray) is a native biennial occurring in grain crops in the Prairie Provinces and British Columbia and as a wayside weed in eastern Canada, where it is common along railways and where western grain or mill feeds have been distributed. In the first season it appears as a rosette of finely divided leaves lying on the ground. Stems 3 to 4 feet, erect, widely branching at the top and bearing an enormous number of narrow, smooth, slightly curved pods, from $\frac{1}{2}$ to $\frac{3}{4}$ of an inch long, on slender, spreading footstalks. Whole plant bright green and somewhat glandular. Leaves pinnatifid, each division sub-divided into 2 or 3 linear-oblong segments, with or without teeth. Flowers yellow, $\frac{1}{8}$ of an inch across in an elongated raceme. The seed is small, $\frac{1}{25}$ of an inch long, oblong, sometimes compressed at the scar end, reddish-brown, minutely roughened with mucilaginous hairs. The seeds occur in poorly cleaned western grain and occasionally in grass seed.

Gray Tansy Mustard (*Sisymbrium incisum* Engelm., var. *Hartwegianum* (Fourn) Watson) is similar to the above but grayer due to its being covered with short, gray, downy hairs. It has a more erect habit of growth, with pods much more crowded together. The seeds are similar to those of Green Tansy Mustard but ripen a month later.

These two coarse biennials grow only from seed but they throw out long branches from their white tap roots and draw nourishment from a wide area. As they stand considerably above the crop, they are a conspicuous advertisement of negligent farming.

Eradication.—The prevalence of these biennial mustards in grain fields of the Prairie Provinces is largely due to the practice of raising cereal grains on stubble land, with only surface cultivation in the fall or spring sufficient to produce a suitable tilth for a seed bed without first destroying the weed growth by plowing, thorough discing or the use of the broad-shared cultivator. Summer-fallows should receive clean cultivation until late in the fall. Waste places where it thrives should be sown to permanent grass and the weed growth kept cut until the grass has possession of the soil.

Hedge Mustard (*Sisymbrium officinale* (L.) Scop.) is a common weed along roadways and waste places. It seldom gives serious trouble in fields. The plant is from 2 to 3 feet high and of a ragged appearance. Flowers small, pale yellow. Pods slender, hard and brittle; when mature, closely pressed to the few-branched stem. Seeds sometimes found in timothy seed. They resemble somewhat the seeds of Tumbling Mustard but are larger.

Eradication.—This weed is easily destroyed along roads and waste places by cutting to prevent it from seeding.

Worm-seed Mustard (*Erysimum cheiranthoides* L.) is a native annual and winter annual, frequently found in waste places and on cultivated land throughout Canada. Stems erect, simple or branching, 6 inches to 2 feet high. Whole plant sometimes slightly hoary with short, star-like hairs. Leaves dark green, lance-shaped, sparsely toothed Flowers bright yellow, $\frac{1}{5}$ of an inch across, in terminal clusters about 1 inch across, on gradually elongating racemes. Seed-pods slightly curved, from $\frac{1}{2}$ to 1 inch long, obtusely 4-angled, erect on spreading footstalks. Each pod contains about 25 seeds. An average plant will ripen about 25,000 seeds. The seed varies somewhat in size and shape, generally pointed at one end, rounded at the other, about $\frac{1}{24}$ of an inch long, reddish yellow, with a dull surface but almost destitute of mucilage. Scar end darkened. The miniature root of the germ is conspicuous. The seeds are very bitter, and on account of their very disagreeable taste some kinds of stock, especially hogs, will refuse to eat chop made from grain containing any appreciable quantity of it. This seed is sometimes prevalent in considerable quantities in elevator screenings. It is also a very common impurity in alsike and timothy, especially from western Canada.

Eradication.—The seeds are short-lived, and so this mustard is kept under control on land worked under a short crop rotation with clean cultivation. Fall cultivation of stubble land, followed by discing in spring before seeding, will keep this pest in check.

Small Wall-flower (*Erysimum parviflorum* Nutt.). Biennial or winter annual. A stoutish sparingly branched plant with yellow flowers and upright or spreading pods which are thicker but shorter than those of Worm-seed Mustard. Height from 10 to 20 inches. This is a late seeder and the pods retain many of the seeds throughout the winter. The seeds themselves are about the same length as those of Worm-seed Mustard but average much wider and are squarer at the ends, practically never pointed. They are common impurities in western timothy. The plant sometimes causes injury to grain on poorly prepared fallow.

Eradication.—Spring cultivation. When grass lands are badly infested they should be ploughed up.

Western Wall-flower (*Erysimum asperum* DC.). Has habits like the former but the flowers are much larger and the pods very long and widely spreading; often becoming horizontal when ripe. The seeds are very similar but far less frequently met with.

Tower Mustard (*Arabis glabra* (L.) Bernh.). A tall plant, lower leaves stalked, rough; upper leaves smooth, stalkless, somewhat arrow-shaped; flowers small and white; pods long, clustered closely around the stem. The seeds which are met with in timothy are flat, brownish and somewhat winged. Several closely allied species occur in Canada.

Upright or **Rough Cinquefoil** (*Potentilla monspeliensis* L.) is a native annual common in old meadows and worn-out sandy soils throughout Canada. It is erect, branching, rough-hairy. The three leaflets of each leaf are obovate; those of the top leaves, which are stalkless, are toothed nearly the whole length. The mode of flowering is a leafy, rather close, cyme of yellow flowers. The seeds are grouped together on the receptacle, which is long, thin and downy. The seed when ripe is leather-brown, dull, about $\frac{1}{30}$ of an inch long, bluntly comma-shaped, with curved branching veins running longitudinally. Commonly found in timothy and alsike and occasionally in red clover seed.

The genus Potentilla is widely distributed, comprising many species closely related to the Upright Cinquefoil, as *Potentilla monspeliensis* L., var. *norvegica* (L.) Rydb., also commonly called **Upright** or **Rough Cinquefoil.** It is distinguished by less hairiness and by somewhat more narrowly oblong leaves. Both occur in similar situations and have about the same distributive range. The seeds of the cinquefoils are very similar and their identification is sometimes difficult. They vary only slightly in size and in the roughness of the net-like veins covering the surface, which sometimes are not apparent, especially when the seeds are not ripe. Another species of this genus which is sometimes found in moist land is **Silverweed** (*Potentilla Anserina* L.), occasionally mis-named Buttercup. It is a perennial with slender, jointed runners, which root and form new plants at each joint, like the strawberry. The leaves, silvery hairy beneath, are composed of from 3 to 10 large, oval, sharply-toothed leaflets on each side of the stalk, with very small ones between them. The long-stalked, golden-yellow flowers, nearly an inch across, are followed by a cluster of dry, smooth seeds. Silverweed roots on the surface of the ground and is best controlled by draining the land and ploughing down the plants.

White Cinquefoil (*Potentilla arguta* Pursh). Perennial, upright; very hairy; flowers much clustered, white; not unlike those of strawberry. Seeds very small; smooth, pinkish brown and pointed at one end. It may at once be separated from our other Cinquefoils by its white flowers and the seeds by their smallness. A rather common impurity in western timothy but is seldom troublesome unless the land has been sown down several years.

Eradication.—Ploughing at any time of the year. Proper drainage and short rotation of crops.

Prairie Roses (*Rosa pratincola* Greene or *Rosa arkansana* of Canadian writers, which includes *Rosa acicularis*, var. *Bourgeauiana* Crépin) are sometimes troublesome in parts of the Prairie Provinces. In southern Manitoba this dwarf, large-flowered rose is very persistent. Its deep perennial rootstocks send up many flowering shoots from the axils of the scales. The seeds vary greatly in size and shape, averaging about $\frac{1}{6}$ of an inch long, generally irregular-angular, with hard, yellowish shells. They are often found in the screenings of western grain and quite frequently in seed wheat. To destroy roses the land should be ploughed with a sharp plough in hot weather and then double disced at intervals of a week or ten days.

Sweet Clovers (*Melilotus officinalis* (L.) Lam.) and (*Melilotus alba* Desr.) are common biennial wayside weeds, the latter, or **White Sweet Clover,** being much more prevalent than the yellow species. Sweet Clover is quite common in cultivated fields in parts of Quebec, and is being introduced into many other parts of Canada. It is naturalized from Europe, a tall ascending plant 3 to 8 feet high, fragrant in drying, branching, smooth, sometimes with fine hairs on the younger branches. Leaves rather far apart with 3 narrow leaflets, $\frac{1}{2}$ to $\frac{3}{4}$ inch, saw-edged, leaf-stalks about as long as the leaflets. Flowers numerous, small, white, arranged in slender spike-like racemes, $1\frac{1}{2}$ to 4 inches in length, becoming longer in fruit. The pod is thin, small, $\frac{1}{8}$ inch, egg-shaped, light to dark brown, covered with a network of ridges, and having a short, stiff point at the top. There are from 30 to 50 pods on a stalk; each pod contains one seed. The seed is hard, small, $\frac{1}{8}$ of an inch in length, smooth, dull yellow, evenly egg-shaped. with a V-shaped light mark running from the scar. The seeds are common in commercial samples of red clover and alfalfa and are sometimes found in alsike. The seed is occasionally found in the pod, with the sharp point broken off.

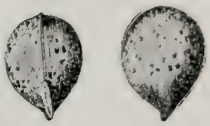
Eradication.—Hoed crops. Three year rotation of crops.

Black Medick (*Medicago lupulina* L.), introduced from Europe, annual, is a common weed in clover fields and lawns, thriving in moist soils. It grows from 6 to 18 inches in height, hardly erect, much branched, sometimes hairy, leaves bright green, small, of 3 leaflets. Flowers small, bright yellow in short close spikes, $\frac{1}{8}$ to $\frac{1}{4}$ of an inch long, becoming longer in fruit. Usually the bright flower heads and black cluster of fruit may be seen on the same plant as the seeds ripen quickly. The pod is thin, small, not more than $\frac{1}{8}$ inch long, kidney-shaped with one end coiled, dark brown or black, rough-ridged, the main ridges following the outline of the pod. There are sometimes 30 pods in one cluster, but each pod contains only one seed. The seed is little more than $\frac{1}{16}$ of an inch long, hard, smooth and somewhat shining, egg-shaped rather than kidney-shaped, yellow to pale olive green. It has a sharp projection near the scar from which a light line runs towards the larger end of the seed. It is found frequently in commercial samples of red clover, alsike and alfalfa. In alfalfa and red clover it is usually found in the pod. It is sometimes used as an adulterant in clover. The seeds of Sweet Clover and Black Medick are sometimes confused with each other and with alfalfa seed. They are both thicker and shorter, being egg-shaped, while alfalfa seed is kidney-shaped or sometimes irregularly angled. Sweet Clover seed may be distinguished from Black Medick by its larger size and the V-shaped light mark running from the scar. With Black Medick there is a sharp projection near the scar from which a light single line runs towards the larger end of the seed.

Eradication.—Of value for sheep pasture. Hoed crops.

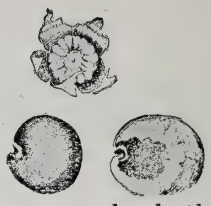
Wild Tare or **Wild Pea** (*Vicia angustifolia* (L.) Reichard) is an introduced annual, widely distributed in cereal crops and as a wayside weed in eastern Canada. The plant is hairless or downy. Stem slender, simple or branched at the base. Leaves are composed of 2-5, rarely 6, pairs of linear or lance-shaped leaflets. Flowers $\frac{1}{2}$ to $\frac{3}{4}$ inch long, purple, 1 or 2 in the upper axils of the leaves. Pods black and linear with the tips sharp and turned upwards, 2 inches long, 4 to 12-seeded. The seed is round, ranging from $\frac{1}{10}$ to $\frac{1}{6}$ of an inch in diameter, velvety black or olive brown, mottled with white and dotted with fine, black spots; the whitish scar about $\frac{1}{5}$ the circumference of the seed in length, thin, threadlike. The seeds are a common impurity in grain grown in the Maritime Provinces, Quebec and parts of Ontario They are especially objectionable in oats required for milling. A short rotation of crops designed to prevent Wild Tare from seeding will suppress it.

Wax-ball or **Three-seeded Mercury** (*Acalypha virginica* L.) is a native annual common in river flats and low fields in Ontario and eastward. It is a leafy plant, 1 to 2 feet high, with long-stalked, ovate leaves. It gives trouble in pastures, meadows and fields. On account of its acrid juice it is avoided by live stock and entails considerable waste wherever it occurs. The seed is about $\frac{1}{16}$ of an inch long, comparatively soft, with a thin coat finely striated, gray to yellow brown spotted with dark brown, sometimes reddish brown free from spots. It is ovoid, pointed at one end, rounded at the other. There is a dark slightly raised line running from the round end to the scar on the same side of the seed. The scar is one-third the length of the seed, oblong, raised and white. The seeds are quite frequently found in clover seed.



Sun Spurge (*Euphorbia Helioscopia* L.) introduced, is an erect, annual abundant in eastern Canada. Mode of flowering, nearly flat-topped, umbrella-like, surrounded at the base with a whorl of stalkless, obovate, finely and thickly dentate leaves. Pod or capsule smooth and even, 3-lobed. The seed at first sight somewhat resembles the pods of Ball Mustard in miniature. When examined closely, however, it is easily recognized. It is rounded-oval in outline, rolling freely on a smooth surface, a little flattened on one face, with a sharp central ridge running to the apex. The sides of the seed are not angled, the whole surface coarsely matted; scar kidney-shaped, white and very conspicuous. The seeds are seldom found in commercial samples. Sun Spurge is a common weed in gardens and waste places, being most troublesome on light, sandy soils. *Eradication.*—Special care is required to prevent the ripening of seed late in the summer. It will not long trouble lands worked under a short rotation with clean cultivation.

Round-leaved Mallow, Low Mallow or **Cheeses** (*Malva rotundifolia* L.)—Naturalized from Europe. Biennial. Low and spreading from a deep root branched from the base, stems 6 to 18 inches long. Leaves round-heart-shaped on long and slender stalks, margin scalloped and toothed. Flowers in threes or fours in the angles of the leaves, on slender flower-stalks, $\frac{1}{2}$ to $1\frac{1}{4}$ inches long. Flowers about $\frac{1}{2}$ inch wide, white, sometimes tinged with blue or pink. The fruit is made up of about 15 seed vessels. arranged in a ring, $\frac{1}{4}$ of an inch in diameter and called the cheese (see illustration). The seed with its light-coloured outer coat on is a little more than $\frac{1}{16}$ of an inch and a little less with the coat off. The seed itself is hard, smooth, almost round, with a small piece out of one side of it; it is gray to dark brown in colour with a white line around the scar. It is found in clover samples both with and without its outer coat. **Spiny Sida** (*Sida spinosa* L.), a profusely branched herb, about 1 foot high, covered with soft hairs, is another weed of secondary importance belonging to the Mallow family. The leaves are oblong or egg-shaped on long footstalks, dentate, with sharp teeth pointing forward. The flowers are greenish-yellow, small and shaped like those of the Hollyhock.



Eradication.—Good drainage. Hoed crops. Pasture with sheep.

Common St. John's-wort (*Hypericum perforatum* L.) introduced from Europe, is common in pastures, old meadows and roadways from Nova Scotia to Ontario. Perennial by runners at the woody base of the erect, much-branched, somewhat 2-edged stem Leaves opposite without teeth or divisions, elliptic or linear oblong, black-dotted along the margin like the corolla divisions. Flowers deep yellow, grouped into terminal, loose cymes. The seeds are borne in three-celled, ovoid pods. They are about $\frac{1}{25}$ of an inch long, cylindrical, rounded at the ends, with a minute point. The surface is rough, pitted, a little shiny, dark brown to black in colour. The seeds occur very rarely in grass seeds. Some allied species are quite common in different parts of the country. **Great St John's-wort** (*Hypericum Ascyron* L.) is a common, coarse-growing weed in low rich soils and about swamps in Quebec and Ontario, occasionally occurring in old meadows and pastures along river flats. **Spotted** or **Corymbed St. John's-wort** (*Hypericum punctatum* Lam.) about 2 feet high, is abundant in the Bruce peninsula of Lake Huron and quite general throughout Ontario, Quebec, and eastward to Nova Scotia. **Pale St. John's-wort** (*Hypericum ellipticum* Hook), with its bright yellow flowers, is common in Quebec, northern Ontario, and westward to Lake Winnipeg.

Eradication.—Avoid grass crops. Repeated close cutting in waste places.

Common Evening Primrose (*Oenothera biennis* L.) is a tall, coarse biennial which occurs throughout the country and is easily recognized by its tall, branching habit (4 ft. by 3 ft.), its soft, downy, lance-shaped leaves, and its large showy, yellow flowers which open in the evening. This species makes only a rosette of leaves the first year. For this reason it appears only in crops sown in autumn or on stubble. In thin clover fields it sometimes occurs conspicuously and should be either spudded out or cut off below the crown in the first season; or the tall flowering plants should be cut off below the surface and pulled out before the seeds ripen. The seeds are produced in large numbers in long, tapering, 4-celled capsules, 2 rows of seed in each cell, which are clustered all along the stems. They are about $\frac{1}{16}$ of an inch long, dark reddish-brown, and with a roughened surface much angled by compression in the pods. They are a very common impurity in clover and grass seed, being especially abundant in timothy. As the pods do not easily shed their seeds and the plants are at all times conspicuous, much contamination of seed crops may be prevented by a little care at harvest time.

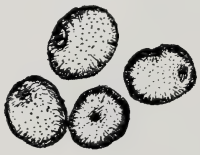
Eradication.—Prevent seeding.

White Evening Primrose (*Oenothera pallida* Lindl.) is a native perennial occurring in Manitoba and westward to British Columbia. It is deep-rooted and very persistent in sandy land. The roots are white and fleshy, wide-spreading and throwing up flowering stems at intervals, thus forming large patches. Stems mostly simple, shining white, sparsely downy above, erect or nearly so, about 3 feet high. Leaves from 1 to 4 inches long, narrow and waved, sometimes pinnatifid but usually without teeth or divisions in plants found in the West. Flowers axillary, large and handsome, $1\frac{1}{2}$ inches across, waxy-white, turning pinkish as they fade, open in day time, odour unpleasant. Tips of the calyx divisions at the ends of the buds free, as 4 little points. Capsules narrow and curved, 4-angled, about 1 inch long with the seeds in single rows in each of the four cells. The seed is about $\frac{1}{16}$ of an inch long, normally spindle-shaped but angular and somewhat twisted by compression in the pod, smooth and mucilaginous when soaked, yellowish-brown; under microscope minutely dotted with black and faintly striate lengthwise; not found in commercial samples.

Eradication.—Plow and summer-fallow after hay crop,

Spotted Cowbane or **Water Hemlock** (*Cicuta maculata* L.) is a native perennial occurring in low land along waterways. Stems stout, erect, hollow and jointed, widely branching, 3 to 6 feet high, quite smooth, pale green, dotted and streaked with purple. Root, a bundle of a few fleshy, spindle-shaped tubers, like small parsnips. Leaves compound, in 2 or 3 divisions, clasping, by an expanded base, the lower on long footstalks, the upper stalkless. The leaflets lance-shaped, deeply toothed. Flowers small, white, in compound, umbrella-like clusters 1 to 4 inches across; the little footstalks of the many flowered secondary clusters unequal, from 1 to 2 inches long. The seed is $\frac{1}{12}$ of an inch long, smooth, ovate, compressed on the sides, separating into boat-shaped, ribbed halves. When cut across, the seeds show four oil tubes between the ribs and two on the flat side. They do not occur in commercial samples. The roots are intensely poisonous to stock, particularly cattle, which pull them out and eat them freely when grazing in spring. The roots look like small parsnips and, like them, have a strong aromatic odour, apparently attractive to stock. It is claimed that the flowering plants, when cut with hay, may be eaten by animals without any ill effects, but that the seed-bearing plants are dangerous. Hand pulling is the most effective remedy.

Small Gentian (*Gentiana Amarella* L. var. *acuta* (Michx) Herder). A native annual, one-half to two feet high. Lower leaves obovate, upper lanceolate or narrowly oblong, stalkless, clasping. Flowers numerous, tubular, blue; seed less than $\frac{1}{25}$ inch in diameter, light brown, spherical with a small depression in one side. A common impurity in western timothy. This seed may be easily cleaned out of timothy by the use of a fine wire mesh sieve.



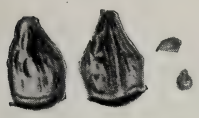
Hedge Bindweed or **Convolvulus** (*Convolvulus Sepium* L.). Perennial spreading by thick underground rootstocks which break into lengths by cultivation and readily grow when covered. Plants twining, flowers large and showy, pinkish or white. Leaves triangular in outline, hastate or somewhat spear-shaped. The seeds are not unlike those of Field Bindweed but average nearly twice as large. This is a very persistent weed in lowlands, particularly in parts of Manitoba. *Eradication.*—Thorough cultivation. Hoed crops.

False Phlox (*Gilia linearis* (Nutt) Gray). Annual or winter annual, six inches high with pointed leaves and small pinkish flowers clustered in a terminal head. The seeds which occur in western timothy slightly resemble those of Ribgrass but are darker and roughened, while instead of the opening on one side there is only an elongated narrow groove. They are larger than timothy and should not be difficult to clean out. This seed and that of Small Gentian are characteristic of timothy seed from western Canada. Neither persist in cultivated fields.

June Weed (*Ellisia Nyctelea* L.). A low spreading annual with pinnately divided leaves and small bell-shaped bluish white flowers. The seeds are very like Cow Cockle but when viewed through a lens show a fine net-like surface instead of the granulated one found in Cow Cockle. The plant takes less than two months to reach maturity and does all its injury in June; hence the name June Weed. In ripening it turns a characteristic black colour and is thus readily recognized even when dead.

Eradication.—Late spring ploughing and cultivation when the plants are small.

Pigeon Weed or **Corn Gromwell** (*Lithospermum arvense* L.) is abundant in western Ontario and troublesome in fields of fall wheat. It is a widely branching biennial or winter annual with white flowers and produces a large number of early-ripening seeds. The plants should be hand-pulled when practicable. The seed is similar in size and general shape to that of Blue Weed, but rather less angular and with a much smoother surface. Instead of having rough projections, it is deeply and irregularly grooved, with prominent ridges between the grooves. It may be easily recognized by the basal scar, which is oval or obtusely 3 to 5-angled; instead of the pit at the inner angle and the two cone-shaped projections on an excavated surface, it has a convex surface with two light-coloured distinct cones. These seeds are common in poorly-cleaned fall wheat and rye and are occasionally found in clover seed.



Eradication.—Land is best cleaned of Pigeon Weed by a short rotation, including grain sown in the spring instead of autumn, and well cultivated hoed crops. Plants which start growth in autumn can be destroyed by fall or spring ploughing or discing.

Blue Vervain (*Verbena hastata* L.). A tall perennial from 4 to 6 feet high; leaves stalked, lance-shaped, taper-pointed, with sharp, forward-pointing teeth. Flowers violet-blue, small, borne in cluster of spikes at the summit. The seed is brown except the large, whitish basal scar at the bottom of the inner face. The outer face is convex, irregularly ridged lengthwise and sharply angled at the sides. The inner face slopes to the margin from a sharply-angled central ridge. The seed is found in timothy and other grass seeds. Blue Vervain grows in rich soil in moist situations. It seldom gives trouble except in low grounds and may be eradicated by draining the land and cultivating it thoroughly.

American Dragonhead (*Dracocephalum parviflorum* Nutt.) is a native annual or biennial quite widely distributed in the Prairie Provinces. The seeds are much like those of Hedge Nettle, but longer ($\frac{1}{8}$ inch) and narrower, being twice as long as wide, more angular and somewhat winged and wrinkled along the angles near the apex. The basal scar is large and curved, with a slit in the middle, giving it the appearance of a mouth; colour dark brown; the outer convex face distinctly ridged lengthwise and granular roughened. The seeds are frequently found in western grain, being very common in wheat screenings; they occur occasionally in grass and clover seed. American Dragonhead will not long give trouble on well cultivated land.

Heal-all or **Self-heal** (*Prunella vulgaris* L.) is a native perennial which reproduces by running rootstocks. It is widely distributed over the continent in woods and fields but is not a very dangerous weed. The seed is about $\frac{1}{16}$ of an inch long, brown, slightly glazed, longitudinally striped, egg-shaped, sharp pointed at the base, which bears a white, heart-shaped scar with a deep depression in the centre. The seeds are quite a common impurity in red clover and grass seed and are occasionally found in alsike seed and alfalfa. Heal-all, like most other members of the Mint family, is not of great importance in agriculture as a weed and will not remain long or give serious trouble in land that is well cultivated under a short rotation including hoed crops.

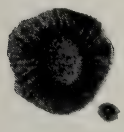
Hemp Nettle (*Galeopsis Tetrahit* L.), an introduced annual, is a common weed around barns and in rich damp soil in grain fields in all settled parts of Canada. It is very prevalent in the grain fields of Prince Edward Island. The stems are erect, tall, swollen below the joints, rough hairy, Leaves ovate, with strong, forward-pointing teeth, tapering at the end, on slender footstalks. Flowers purplish, white or variegated, grouped into nearly stalkless clusters at the axis of the leaves; corolla dilated at the throat, about twice as long as the calyx; the teeth of the latter needle-pointed, bristly. The seed closely resembles that of cultivated hemp, though smaller, about $\frac{1}{8}$ of an inch long. It is broadly egg-shaped in outline, one surface rounded, the other bluntly keeled from the round, flat, depressed scar up to the middle. The whole seed is grayish-brown, wrinkled from unevenly scattered, whitish tubercles. The seeds are quite common in grain grown in the Maritime Provinces and are occasionally found in alfalfa and red clover seed.

Eradication.—Drainage followed by thorough cultivation; keep closely cut or hand pull in waste places.

Hedge Nettle (*Stachys palustris* L.) is native, occurring in moist lands throughout Canada. A secondary weed in eastern Canada and northern Alberta, giving trouble only in moist, low lands in grain fields and meadows. It is perennial by a tuber-like rootstock producing many runners. Stem erect, leafy, its edges with coarse, downward turned hairs. Leaves stalkless, lance-shaped, oblong, tapering at the apex, rounded at the base with rounded teeth, hairy. Flowers pale red or spotted, formed into a long, interrupted spike of 6 to 10-flowered whorls at the axils of leaves; calyx half the length of the corolla, bristly hairy, with spiny teeth. The seed is a dark brown or black nutlet, about $\frac{1}{12}$ of an inch long, egg-shaped, pointed at the base, which bears a small, shrunken scar. The one side is sharply keeled from the scar up to two-thirds the length of the seed; surface dull, finely wrinkled. The seeds are found abundantly among screenings of western wheat, quite frequently in seed grain and occasionally in clover and grass seed.

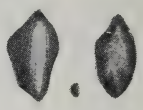
Eradication.—Good drainage, clean cultivation with short rotation of crops, will check this weed and enable cultivated crops to smother it out.

Toad Flax (*Linaria vulgaris* Hill.), introduced from Europe, is quite common in eastern Canada and spreading rapidly, especially in light and shallow soils. It is a persistent weed in waste places, roadsides, meadows and crops, being perennial and deep-rooted. The stems are erect, slender, becoming wiry. Whole plant hairless, slightly waxy. Leaves stalkless, extremely numerous, mostly alternate, linear, without teeth or divisions, acute at both ends. Flowers nearly an inch long, showy pale yellow with orange lips, borne in erect dense racemes; the two-lobed corolla closed and mouth-like, but, by a gentle pressure at the sides, it opens and closes like the muzzle of an animal. The seed is about $\frac{1}{12}$ of an inch in diameter, including the wing, dark brown to black, flat, round or oval, disc-like, roughened with tubercles and surrounded with a circular wing, as broad as the seed itself, finely radiate. The seeds seldom occur among crop seeds.



Eradication.—Short rotation of crops, with deep, thorough cultivation in spring and fall, will suppress Toad Flax. Badly infested meadows or pasture lands should be brought under cultivation by ploughing in July, summer-fallowing until autumn and planting with hoed crop the following spring.

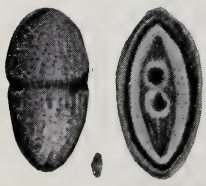
Common Plantain (*Plantago major* L.) is a native perennial which occurs throughout the Dominion, generally in rich, moist soil, often in lawns and dooryards. Rootstock short and thick, bearing many thick-spreading roots and a large tuft of dark green, oval, long-stalked, coarsely-toothed, spreading or upward curving leaves, strongly nerved underneath, and several dense spikes, 3 to 12 inches long, of inconspicuous flowers with purple stamens. Seed capsules oval, dividing about the middle. The seed is about $\frac{1}{20}$ of an inch long, greenish-brown, variable in size and shape according to the number in the capsule (which varies from 8 to 16), rounded on the outer face, angular on the inner scar-bearing face; scar pale and conspicuous. The surface of the seed is finely netted with dark brown broken waved lines, which radiate from the scar. The seeds are a common impurity in timothy and clover seed.



Common Plantain occurs in various forms, some of which may be distinct species, as indicated by the difference in habit of growth and degree of hairiness. It is found throughout the Dominion, generally in rich moist soils.

Pale Plantain (*Plantago Rugelii* Dcne.) often occurs with Common Plantain. It is a rather larger plant with more erect, smooth leaves, of a paler or yellowish green, the leaf-stalks purple at the base. The spikes are longer and the flowers less crowded, the capsules more pointed, 4 to 9-seeded, opening below the middle. The seed is of the same angular shape as that of the Common Plantain but about twice as large and nearly black, with the surface merely roughened, not lined and netted. It is very common in timothy and alsike seed, even more so than Common Plantain seed.

Bracted Plantain (*Plantago aristata* Michx.) is a western annual which is rather rare in Canada, although its seeds are occasionally found in grass and clover seeds. The whole plant is downy; leaves narrow, linear, grass-like; flower-stalks erect, bearing thick, cylindrical spikes 1 to 4 inches long with conspicuous, pointed bracts. Capsules two-seeded. The seed is boat-shaped, of the same size and form as that of Ribgrass but slightly wider, with sharper edges to the margin of the inner face. The elongated scar consists of two small, shallow pits lying close together in the centre of the inner excavated face, the whole of which is whitened by a coat of dried mucilage. The rounded outer face has a distinct shallow groove crossing it just below the middle. This groove and the two pits of the scar are the best characteristics for distinguishing this seed.



Eradication.—All the Plantains are difficult to eradicate from lawns when they become established. They may be weeded out when the soil is firm by forcing a small implement like a chisel, with a half-round blade having a point like a spoon, between the soil and the fleshy crown of the weed to a sufficient depth to break the plant away from its fibrous roots without disfiguring the turf.

Narrow-leaved Goldenrod (*Solidago graminifolia* (L.) Salisb.), is a native perennial with running rootstocks which occurs in low land throughout the Dominion. The stems are erect, branching above into cymes, 2 to 3 feet high, almost smooth. Leaves numerous, linear-lance-shaped, 1 to 5 inches long, the edges rough-hairy. Separate heads of flowers about $\frac{1}{4}$ inch across, bright golden-yellow, in dense, flat-topped clusters. The seed is small, white, about $\frac{1}{12}$ of an inch long, ovate-oblong, nearly cylindrical, slightly tapering, many-ribbed, downy. The pappus is white, consisting of a single row of rough bristles, about twice the length of the seed. Goldenrod seeds are seldom found in commercial samples, but are blown long distances by the wind. The plant spreads locally by running rootstocks and if left undisturbed soon forms large patches. Several other goldenrods are rather troublesome free-growing perennials; among them are **Tall Hairy Goldenrod** (*Solidago rugosa* Mill.) with long hairs, crowded leaves and a broad pyramidal panicle; **Tall** or **Canada Goldenrod** (*Solidago canadensis* L.) and varieties, with a slender stem, hairless at the base, and thin, narrow-lance-shaped leaves; and **Smooth Goldenrod** (*Solidago serotina* Ait.) with stout, smooth stems, leaves smooth on both sides. These showy autumn-flowering plants are wayside and grass-land weeds and do not give trouble on fields under regular cultivation.

Fleabanes (*Erigeron* species). A number of Fleabanes are widely spread, occurring as weeds in meadows and waste places. They are annuals and not particularly dangerous. Any method of cultivation which prevents them from going to seed will eradicate them. Their seeds are occasionally found in grass and clover seed, but as a rule they ripen and are blown away before the seed crop is harvested. The seeds of the different species are very much alike and closely resemble the seeds of the Goldenrods. **Daisy Fleabane** (*Erigeron annuus* (L.) Pers.), illustrated, occurs very frequently in meadows. It has a tall, stout, much-branched stem. Leaves coarsely toothed, the lower ones ovate. Heads in corymbs with flowers white, tinged with purple. **Rough Daisy Fleabane** (*Erigeron ramosus* (Walt.) B.S.P.) is also found in clover fields in all parts of eastern Canada. The stems are smaller and not so branched as with the preceding species, while the heads are smaller and the rays longer. Leaves without teeth or divisions. **Common Fleabane, Horse-weed** or **Fireweed** (*Erigeron canadensis* L.) is general in fields and waste places. It is most abundant in moist grounds and pastures, but is found in meadow land and even cultivated fields. It is sometimes tall and much branched, with wand-like stems; generally bristly hairy. Leaves without teeth or divisions, linear, the basal ones dentate. The numerous small white flower heads form a panicle. Fleabanes will not become troublesome under a short rotation of crops with clover and a hoed crop or bare fallow. Waste places should be watched and the weeds cut before they develop seed.

Poverty Weed (*Iva axillaris* Pursh.) is a native perennial occurring in grain fields and pastures from Manitoba to the interior of British Columbia, thriving in all soils but generally found on land where there is some alkali. The whole plant has a rank odour. Stems herbaceous, branching, nearly erect, from tough, woody extensive rootstocks 6 to 12 inches high, very leafy. Leaves thick, rough-hairy; the lower ones opposite, the upper alternate. Flower heads drooping, solitary, on short footstalks, from the axils of the upper leaves, $\frac{1}{6}$ of an inch across, inconspicuous. The seed is $\frac{1}{8}$ of an inch long; colour variable, olive green, yellowish brown to almost black, surface mealy and dull; pear-shaped, slightly flattened, There are seldom more than one or two seeds in each flower head and many heads have none.

Eradication.—Poverty Weed propagates mainly by its underground stems, which send up many flowering leafy shoots, and is difficult to eradicate when it becomes well established in the rich soils of western Canada. Ploughing for summer-fallow should be clean and deep, followed by frequent cultivation with a broad-shared cultivator.

False Ragweed (*Iva xanthifolia* Nutt). A coarse annual growing from 1 to 6 feet in height. It resembles a Giant Ragweed but has the leaves less divided while the seeds are small and pear-shaped, slightly flattened and black, clustered together in small heads. The weed is most frequently met with around barnyards.

Cockleburs or **Clotburs** (*Xanthium* species) are tall, much-branched annuals, differing mostly in the character of their fruits or seeds. The leaves are heart-shaped or ovate, except in the **Spring Clotbur** (*Xanthium spinosum* L.) which has lance-shaped or ovate-lance-shaped leaves, tapering at both ends. Some species are abundant as weeds in river bottoms and moist soils throughout the Prairie Provinces and are particularly troublesome to stockmen in parts of Alberta. Other species are plentiful in the eastern provinces, and are frequently reported as a nuisance in sheep pastures. The burs are from 1 to $1\frac{1}{2}$ inches long, hard and leathery, armed with beaks (except in Spring Clotbur) and covered with more or less long, thick, hairy, recurved and crowded prickles. Each bur contains two oblong, flat seeds which retain their vitality for several years. Owing to their large size, the fruits do not occur in crop seeds, but they are distributed to quite a large extent by animals.

Eradication.—These coarse, annual weeds should be watched and, where practicable, hand-pulled from year to year to prevent seeding. Follow immediately behind binder while cutting grain, with disc to destroy plants and prevent seeding.

Cone Flower or **Black-eyed Susan** (*Rudbeckia hirta* L.) is a native biennial occurring in prairie and pasture lands, old meadows and occasionally in cultivated fields. Abundant in Quebec, where it has doubtless been introduced from western Canada. The plant is coarse, rough-hairy throughout. Stem simple, sometimes branched below. Leaves thick, without teeth or divisions, the upper ones oblong-lance-shaped, stalkless, the lower ones broader at the top, tapering towards the base, on footstalks. The mode of flowering is by showy, terminal, usually solitary heads, glaring golden orange, about the size of those of Ox-eye Daisy. Rays 10 to 20, much longer than the hairy scaly bracts around the flower head. The dark brown centre, with its chaffy scales hairy at the top, is high, cone-shaped, and often becomes column-shaped in fruit. The seed is about $\frac{1}{12}$ of an inch long, black, 4-angled, narrow, with parallel sides; each side with fine, parallel longitudinal lines. The top of the seed is flat and bears no pappus. The seeds seldom occur in commercial samples. Cone Flower is objectionable in pastures to all kinds of live stock except sheep, which eat it and will do considerable to keep it in check when their pasture is short. When prevalent in meadows it materially reduces the yield and lowers the quality of the hay. Continued cutting for a few years, to prevent the plant from seeding, will suppress it.

Black-headed Sunflower (*Helianthus scaberrimus* Ell.) and **Many-flowered Prairie Sunflower** (*Helianthus Maximiliani* Schrad.) are common though not very serious weeds in the Prairie Provinces. Their bright yellow flowers are conspicuous in grain fields. The stems are stout, simple or sparingly branched, rough or hairy; leaves thick, ridged and rough. In the former species the heads are nearly solitary and the disc inside the bright rays is dark. With the latter the disc is yellow. The seeds are about one-sixth of an inch long, brown, variable in shape but mostly narrowly oblong, egg-shaped in outline, flattened and rather angular, grooved lengthwise, cross-mottled with irregular, zigzag, white lines; both scars, at the top and the base, are conspicuous, the latter rather oblique. They are often abundant in screenings of western grain and frequently occur in seed grain, especially wheat.

Eradication.—Wild Sunflowers are best dealt with by a summer-fallow ploughed early and thoroughly worked throughout the season. **Wild Artichoke** (*Helianthus doronicoides* Lam.), closely allied to the two preceding species, is not so abundant but more difficult to eradicate.

Stinking Mayweed (*Anthemis Cotula* L.) is an annual or winter annual, introduced from Europe. A common weed in old settlements, around buildings, along roads and in waste places, from the Atlantic coast to Manitoba, where it is rare as yet and found only along railways, but is rapidly appearing in new districts. It is an objectionable pest in fields and gardens; most abundant where crops have killed out in wet places. The plant is dull green, slightly hairy or hairless, with an acrid taste and a strong, fetid odour. Stems 12 to 18 inches high, much branched from the root up. Leaves finely dissected, twice or thrice pinnatifid. Flower heads numerous, white, yellow-eyed, daisy-like, only about one inch in diameter. The seed is small, about $\frac{1}{16}$ of an inch long, ovate-oblong, or oblong, cut off straight at the upper end, with a small knob in the centre, the smaller end abruptly pointed. The surface roughened with tubercles arranged more or less symmetrically in about 10 longitudinal rows; sometimes, however, the surface is nearly smooth. The seeds are a common impurity in grass and clover seeds. The dust from Mayweed, Ragweed and some other species of this family, produced in threshing, is irritating if not poisonous and the pollen often produces hay fever when the plants are in flower.

Eradication.—Good drainage. Repeated close cutting in waste places.

Yarrow (*Achillea millefolium* L.). Perennial with finely dissected fern-like leaves and flat-topped clusters of white or pinkish flowers.

The seeds are flat, chaff-like; about $\frac{1}{16}$ of an inch long; whitish with a darker centre. They are not uncommon impurities in timothy, particularly in western Canada.

Eradication.—Hoed crops. Pasture with sheep.

Common Ragwort (*Senecio Jacobaea* L.), introduced from Europe, is perennial from a few shallow, short, thick rootstocks. It is abundant in Pictou and Antigonish counties in Nova Scotia and in parts of Prince Edward Island; also reported from Quebec and some parts of Ontario. Ragwort is the cause of a curious and fatal disease of the liver in cattle. Stem stiff, erect, grooved, 2 to 3 feet high, much branched above. Root-leaves 6 to 8 inches long, stalked; stem-leaves stalkless, embracing the stem; all leaves dark green, deeply twice pinnatifid. Flower heads golden-yellow and very showy; $\frac{3}{4}$ of an inch across; numerous, erect, arranged in flat topped, dense, compound corymbs. The seeds are about $\frac{1}{12}$ of an inch long, creamy white, oblong, excavated at the top, with a small central point, deeply grooved along the sides; those of the centre almost straight, more or less angled, with short bristles; those of the ray-flowers smooth, much curved and broader; pappus white. They are seldom found in commercial samples.

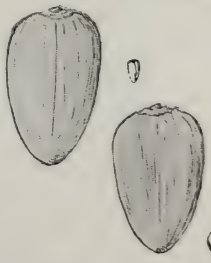
Eradication.—Rotation of crops. Close cutting in pastures.

Lesser or **Common Burdock** (*Arctium minus* Bernh.), introduced from Europe, is a biennial from a deep, thick tap-root. It occurs in rich land in the older settled provinces; common by roadsides, in waste places and orchards in sod. Root-leaves large, heart-shaped, downy beneath, somewhat resembling those of rhubarb, footstalks hollow. Flowering stems much branched, from 3 to 6 feet high. Flowers purple. The seed is about $\frac{1}{4}$ of an inch long, pale brown with dark, transverse, zigzag, depressed marks, oblong-ovoid, cut off abruptly at each end, flattened, with about 5 longitudinal ridges generally somewhat curved; apical scar circular with a central point; pappus, when present, consisting of several rows of short bristles, upwardly barbed. The seeds are not spread through commercial seeds to any extent.

Eradication.—Pull young plants. Cut with spade below crown. Cut and burn mature plants.

Bull or **Spear Thistle** (*Cirsium lanceolatum* (L.) Hill.) is a large, coarse biennial, introduced from Europe, 2 to 4 feet high, widely branching, with many large, deep purple flower heads, $1\frac{1}{4}$ inches high by as much across. The seed is similar to that of Canada Thistle, but larger, about one-sixth of an inch long, plumper in proportion to the length, generally darker at the broader end, grayish brown in colour, marked with faint longitudinal lines. It occurs sometimes in seed grain, but very seldom if ever in clover or grass seed. Bull Thistle does not give trouble in well cultivated fields. It can be eradicated from waste places by cutting below the crown either the first year or before the seeds are ripe the second year. The application of a handful of salt to the root after cutting is effective.

Russian Knapweed (*Acroptilon Picris*, DC.) is a species of Star Thistle the seeds of which occur frequently in samples of European alfalfa. They are very easily seen among the alfalfa seeds as they are larger and bright white, rarely tinged with yellow at the ends. The seeds are hard, smooth and somewhat shining, with fine vertical lines or ridges which may be distinguished with an ordinary magnifying glasss. The notch at the end of the seed, which is so characteristic of most of the Star Thistles, is wanting in this species. The seed is about $\frac{1}{8}$ of an inch long and half as wide, very nearly the same size and shape as that of Bull Thistle but curved evenly on both sides, while the Bull Thistle seed is a little longer and straighter in outline on one side with a deeper curve on the other. This Star Thistle seed is very white in appearance, whereas the Bull Thistle seed is gray or yellowish brown with darker lines and a yellow band around the top, forming a little well from the centre of which projects a short rounded knob. The *Acroptilon Picris* is the only pure white weed seed found in commercial samples. This annual weed readily succumbs to ordinary cultivation with rotation of crops.



Fall Dandelion or **August Flower** (*Leontodon autumnalis* L.) is a perennial introduced from Europe. Abundant in the Maritime Provinces and parts of Quebec and recently reported from several places in Ontario as occurring in hayfields. It spreads rapidly from seeds, which are spread widely by the wind, and overruns meadows, pastures and lawns, where it chokes out the grass. Rootstock short and thick, frequently divided into several heads, each of which bears a thick tuft of toothed leaves, somewhat resembling those of Common Dandelion, and several few-flowered, branched, leafless, scaly stems. Flower heads over 1 in. across, bright yellow. The seed is $\frac{1}{4}$ in. long, brown, linear, not beaked, ribbed lengthwise, marked with fine lines crosswise; pappus dirty white, in one row of feathery bristles, about the length of the seed itself. The seeds are mostly scattered by the wind before the crops are harvested and seldom occur in commercial seeds.

Eradication.—Fields infested with this weed should be brought under cultivation with a short rotation, such as cereal grain, clover and grass for two years and hoed crops or peas for the fourth year, followed again by cereals.

Common Dandelion (*Taraxacum officinale* Weber) is a well-known pest of all long-settled districts. It is very common in lawns and almost impossible to eradicate when thoroughly established. It differs from Fall Dandelion in having long, deep, tapering roots, every part of which, if broken off, will throw out leaves and form new plants, as well as in having hollow, single-headed flower stalks. The seed is about $\frac{1}{8}$ of an inch long, spindle-shaped, ridged lengthwise, the ridges roughened with upwardly directed, rigid spines decreasing in size from the top to the base of the seed, where they appear as minute tubercles. The top end of the seed runs into a beak, about one-third of an inch long, crowned with a white, thin pappus, half the length of the beak. This beak breaks off easily and is not present on seeds found in commercial samples. **Red-seeded Dandelion** (*Taraxacum erythrospermum* Andrz.) occurs with the preceding and differs from it merely by having more deeply divided leaves, sulphur-yellow, smaller heads of flowers, and reddish-purple seeds.

Eradication.—It is important to prevent dandelions from seeding in lands adjacent to lawns. Though entailing much labour the most satisfactory way to deal with them, when deeply rooted in lawns, is to loosen the soil with a digging fork and pull them up. Thorough and repeated spraying with sulphate of iron is recommended for lawns where this pest is prevalent.

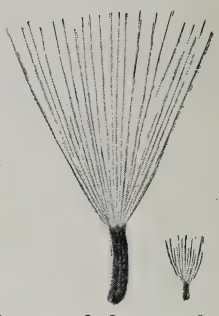
Prickly Lettuce or **Compass Plant** (*Lactuca scariola* L., var. *integrata* Gren. & Godr.), introduced from Europe, is annual or occasionally winter annual. It is widely distributed in waste places from Nova Scotia to the Prairie Provinces and reported from parts of British Columbia; sometimes giving trouble in fields. A coarse, tall-stemmed plant, averaging 3 to 5 feet in height. The leaves are oblong-lance-shaped margined with spines and prickly on the midrib beneath, only the lower ones more or less pinnatifid, stalkless, with ear-like lobes at the base. The leaves of the stem are twisted at the clasping base so as to stand vertically with the edge to the sun, instead of horizontally, as in the case of the leaves of most plants. This peculiarity has given rise to a common name of this lettuce, the Compass Plant. The flower heads are pale yellow, less than half an inch across, on a large, wide-spreading panicle, only a few open at a time. The seed is about $\frac{1}{8}$ of an inch long, dark greenish-gray, similar to that of the black-seeded varieties of the garden lettuce, usually a little smaller, and, like them, broadly lance-shaped and somewhat curved, flattened, margined and bearing five to seven narrow ridges down each face; whole surface roughened with fine wrinkles, and short, white bristles on the ridges near the apex.

Eradication.—Clean and seed waste places to grass followed by close cutting of this weed.

Blue Lettuce (*Lactuca pulchella* (Pursh.) DC.), is a native deep-rooted perennial, occurring throughout the Prairie Provinces and British Columbia in moist or sandy soil. It is a troublesome weed, having all the bad characteristics of Prickly Lettuce and much more difficult to suppress. Stems 2 to 3 feet, leafy below. Whole plant smooth and covered with a fine bloom, filled with milky juice. Leaves variable, linear-shaped or oblong; without teeth or divisions, or sometimes dentate or pinnatifid, the divisions directed backward; stem leaves less divided and stalkless. The flower heads are nearly one inch across, pale blue, not very numerous, on scaly footstalks, in a narrow panicle. The seed is about $\frac{1}{4}$ inch long, including the short, thick beak, the tip of which is whitish expanded into a short, cup-shaped disc, red when immature, slaty-gray to purplish when ripe; club-shaped, flattened with thick ridges down each face; whole surface dull and rough; pappus longer than the seed, pure white and silky. The distribution of the seeds should be prevented as far as possible by keeping the plants cut in waste places.

Eradication.—Ploughing in late June, followed by cultivation, thus preventing leaves forming.

Orange Hawkweed or **Devil's Paint-brush** (*Hieracium aurantiacum*, L.), introduced from Europe, is abundant and troublesome in the upland pastures of the Eastern Townships of Quebec and in some places in New Brunswick and Prince Edward Island; reported occasionally from Ontario and all the eastern provinces. It is a vigorous grower which spreads rapidly by its runners and seeds and soon overruns land that cannot be ploughed, the abundant and useless foliage displacing grass and ruining meadows and pastures. Perennial, low-growing, throwing out many creeping branches close to the ground. Filled with bitter milky sap. Whole plant very hairy. Flowering stems 1 to 2 feet, erect and simple, almost leafless. The fiery orange red of the flowers is very striking. Leaves long, rounded at the top, gradually narrowing towards the base.



The seed is from $\frac{1}{16}$ to $\frac{1}{12}$ of an inch long; purplish-black, unripe seed deep red; strongly 10-ribbed lengthwise. The seeds are spread by the wind and are seldom if ever found in crop seeds.

Eradication.—Plough shallow after hay crop, and summer-fallow for balance of year. Avoid grass crop until completely exterminated. Rocky pastures may be improved by sowing seed of more vigorous grasses as brome grass.

King Devil (*Hieracium praealtum*, Gochnat var. *decipiens* Koch.), introduced from Europe, is another Hawkweed which occurs in the eastern provinces and is abundant in southwestern New Brunswick, where it is a pest in pasture lands and old meadows. It is a pernicious weed in pastures, being perennial, with the general characteristics of the hawkweeds. It bears a few leaves, nearly all at the base, and numerous slender leafy branches running on the surface of the ground. The whole plant is sparsely hairy and lightly covered with a fine bloom. Basal leaves narrow, the long flower stalk bristly hairy, supporting a spreading corymb of yellow flowers. The seed is similar to that of the other varieties of hawkweed, a little smaller, black.

Most of our hawkweeds are of relatively recent introduction and many varieties have not yet been exactly located and described. Their identity may occasionally prove difficult, as there seem to be variations in the characters of some varieties.

Eradication.—The method of eradication is the same for all and consists mainly of a short rotation, with seeding down to clover and grass at short intervals. The seeds of the different varieties are practically indistinguisable. They sometimes occur in grass seeds and are a dangerous impurity.

Ergot on **Couch, Rye** and **Timothy** (*Claviceps purpurea* (Fr.) Tul.). There are often found among grains of rye, rarely among those of wheat, and abundantly among the seeds of some grasses, blackish or purplish solid bodies, commonly called ergot. Fresh specimens are of a waxy or oily consistency, purplish white inside. They are the storage organs or resting stage of a parasitic fungus belonging to the genus Claviceps. Ergot grains vary in size and form, according to the species of grain or other grasses on which they develop. Each of these solid bodies is called a sclerotium (plural sclerotia), derived from a Greek word skleros, hard or dry, in allusion to their nature. They are a part of the vegetative system, the "spawn" of the fungus, in a resting condition, but capable of growth in the spring under such favourable conditions of warmth and moisture as they get when sown with crop seed, or when lying on the ground at the bases of the stems on which they were formed the previous summer. In the spring small toadstool-like bodies, on violet stalks, with round orange-coloured heads, about the size of mustard seed, are produced from the sclerotia lying on the ground. These develop enormous numbers of microscopically small spores (organs analogous to the seeds of higher plants), at the time when grasses and grains are in flower. The minute spores, carried by currents of air or by insects, lodge in the flowers of the grasses and grow; in a short time they completely destroy the seed and form from them the horn-like sclerotia. During the summer spores are formed on these horns; at the same time appears a sugary secretion very attractive to insects, which carry off on their bodies many of the summer spores to the flowering heads of other grasses and thus spread the infection. Late in the summer the production of spores stops, and the sclerotia or storage organs begin to lay up a kind of starch found only in fungi and known as fungus starch, as well as oils, to serve as food for the growth of the fruiting organs to be sent out the following spring. They then harden up, turn dark purple, and fall to the ground or are carried away with the grain or hay. The sclerotia occur on rye, wheat, barley and wild rice, being especially common on rye, and are also found on timothy and other cultivated and wild grasses. They all contain an alkaloid and other violent poisons. Those produced on cereals are usually broken when found in the grain. Some are used in medicine under the name of ergot of rye. Bread made from flour containing ergot may cause a disease known as ergotism; and animals which feed on grain or hay containing ergot may also be severely poisoned, as is sometimes the case on our western plains. Abortion is one well known result of cows feeding on ergotized grain. Hay containing much ergot should not be fed. Ergotized grain should be thoroughly screened and the sclerotia destroyed. Seed from an ergotized crop should not be used if any other can be procured.

ENGLISH INDEX.

DOMINION OF CANADA
DEPARTMENT OF AGRICULTURE
SEED BRANCH
GEO. H. CLARK, Seed Commissioner

AN INQUIRY

REGARDING THE

WHEAT, OATS, BARLEY, FLAX, AND ENSILAGE CORN USED FOR SEED IN CANADA

BY

Edgar D. EDDY, B.S.A.

Chief Seed Inspector.

BULLETIN No. S9

Published by authority of Hon. MARTIN BURRELL, Minister of Agriculture, Ottawa, Ont
JANUARY, 1915

DOMINION OF CANADA
DEPARTMENT OF AGRICULTURE

SEED BRANCH
GEO. H. CLARK, Seed Commissioner

AN INQUIRY

REGARDING THE

WHEAT, OATS, BARLEY, FLAX, AND ENSILAGE CORN USED FOR SEED IN CANADA

BY

Edgar D. EDDY, B.S.A.

Chief Seed Inspector.

BULLETIN No. S9

Published by authority of Hon. MARTIN BURRELL, Minister of Agriculture, Ottawa, Ont.
JANUARY, 1915

72909—1

DEPARTMENT OF AGRICULTURE.
OFFICE OF SEED COMMISSIONER.
OTTAWA, January 7, 1915.

To the Honourable MARTIN BURRELL,
Minister of Agriculture,
Ottawa.

SIR,—I have the honour to submit for your approval a report of an inquiry into the quality of the seed wheat, oats, barley, flax and ensilage corn used by farmers. The main object of this inquiry was to ascertain the common practices of farmers in representative localities in each of the provinces. The data obtained is interesting and even surprising. It serves to measure the progress made as the result of education and legislation and shows the necessity for further aggressive activities with a view to make it easy and attractive for farmers to do the wise thing and difficult for them to do the thing which is opposed to the best interests of themselves and the community.

There is no warrant for general condemnation of so-called "indifferent farmers" because of unfortunate conditions revealed by this inquiry. There is much need for serious consideration why the best practices are not more attractive.

It is believed that the information contained herein will make more clear the dangers and losses accruing from the use of inferior seed. I recommend that it be printed for general distribution.

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

GEO. H. CLARK,
Seed Commissioner.

72909—1½

AN INQUIRY

REGARDING THE

WHEAT, OATS, BARLEY, FLAX, AND ENSILAGE CORN USED FOR SEED IN CANADA

On its grain crops depend to a great extent the wealth and general prosperity of an agricultural country. Each year the yield and quality of the principal crops are not only of special interest to the farmers but are matters of national concern. It is therefore of the utmost importance that methods be followed that will produce maximum yields of the highest quality.

One of the principal factors toward this end is the use of good seed. In order that land may give the best returns for the cultivation received, it is essential that the seed be clean, strong in vitality, and of a variety or strain suitable to the conditions under which it is to be grown.

With the object of securing definite information in regard to the quality of the seed used on Canadian farms, an inquiry was instituted in the spring of 1913 with wheat, oats, barley and flax, and continued in 1914 with ensilage corn. Seed inspectors were instructed to visit farmers in their respective districts and procure samples of seed actually being put into the ground, together with information in regard to variety, source of supply, treatment for smut prevention, rate of seeding, cleaning and selection. Over 3,700 samples were forwarded to the seed laboratory at Ottawa where they were tested for purity and germination. The aim was to get samples representing the average seed used by farmers. This was done so far as possible but the results are not presented as an accurate record of conditions in detail in the different provinces or districts visited. It is recognized that the number of samples from some provinces is smaller proportionately than from others and that unintentionally inspectors may have occasionally secured extreme rather than representative samples. In some cases, as will be noted in detail later, samples were taken from lots that were yet to be cleaned before seeding, so that the summary of the purity test reports is incorrect to this extent as indicating the impurities that were in the seed when sown.

However, after making full allowance for all inaccuracies, it is clear that the value of the grain crops produced in Canada is enormously lowered each year through the use of poor seed. Surprisingly little attention is paid to choosing the most suitable varieties. The seed is seldom selected or graded, except to pass it through a fanning-mill once or twice, and often not even this is done; in many cases the mills are not equipped with proper sieves and little improvement is effected. Much preventable loss is sustained through failure to treat seed for smut prevention. The number and variety of weed seed and other impurities in a large proportion of the grain and flax insures the introduction of numerous weeds and precludes the possibility of growing even reasonably clean crops which is essential for maximum yields and highest quality.

VARIETIES.

Experiments have repeatedly shown that certain varieties of grain give the largest yields in particular districts. In order to obtain the best results, it is important to study varieties and select those best adapted to the soil and climatic conditions under which they are to be grown. The lack of attention given to selection is indicated by the fact that over forty per cent of the farmers from whom samples of

wheat, oats and barley were collected did not know the variety name of the grain they were growing. In the following tables a list is given of the varieties of different kinds of grain reported from all Canada and by provinces, with an indication of their popularity as shown by the numbers. At the foot of each table is given the number of samples for which the variety name was not known.

VARIETIES OF OATS.

Varieties.	Canada.	P.E.I.	N.S.	N.B.	Que.	Ont.	Man.	Sask.	Alta.	B.C.
Total number of samples	978	51	60	8	158	164	146	224	132	35
Banner	264	23	32	3	29	33	65	52	26	1
Abundance	101	2			7	7	7	54	24	
Sensation	27		3		6	4		1	12	1
Ligowo	14	1			2	1	5	1	4	
Old Island Black	13	11	2							
Twentieth Century	11		1		1	7			2	
Newmarket	10	2				2		5	1	
Canadian	7				7					
Garton's No. 22	6						2	4		
Mammoth Cluster	5					5				
Sheffield Standard	5					2		1	2	
Storm King	5		4			1				
Waverly	5				1	2			2	
Irish White	4				2	2				
Prince Royal	4					4				
Silver Mine	4					2			2	
Black Norway	3	3								
Black Tartarian	3	1				1	1			
Russian	3						3			
Siberian	3					3				
Stirling	3					3				
White Jewel	3	2				1				
White Cluster	3					3				
Dodd's White	3					2		1		
Big Four	2		2							
Egyptian	2	1				1				
Mammoth	2				2					
Early Cluster	2					1			1	
Swedish Giant	2					2				
White Wave	2	1				1				
Wideawake	2	1						1		
White Giant	2					2				
Victory	2					1		1		
White Marble	2							2		
Early Blossom	1			1						
Danish	1				1					
Gold Rain	1	1								
Great Dane	1		1							
Gloucester	1				1					
Joanette	1			1						
Irish Victor	1					1				
Lincoln	1					1				
Minnesota No 4	1					1				
Improved Swedish	1							1		
Prospect	1								1	
Swedish Select	1								1	
Brazilian	1						1			
Early English	1								1	
Bonanza	1								1	
Surprise	1					1				
Rosedale	1					1				
Thousand Dollar	1					1				
Prize Cluster	1				1					
White Snow Drop	1					1				
Blanche D'Ecisse	1				1					
Danish Island	1	1								
Mixed	10				4	6				
Variety not known	417	1	15	3	93	58	62	100	52	33

Several samples of oats were reported under names which may indicate the source of the seed but have no meaning so far as variety is concerned, such as Western, Alberta White, New Manitoba, White Western. These or similar so-called variety names are often applied to ordinary commercial grain when purchased by dealers and sold as seed. Eighteen samples were reported only as white, eight as black and a number of others under such names as Regenerated, with no indication of the variety. For the table all of these are included in the number for which no variety name is given.

VARIETIES OF BARLEY.

Varieties.	Canada.	P.E.I.	N.S.	N.B.	Que.	Ont.	Man.	Sask.	Alta.	B.C
Total number of samples	408	25	12	2	56	84	60	104	59	6
O.A.C. No. 21	47	3	2	.....	2	38	1	.....	1	.....
Mandscheuri	33	1	1	.....	3	22	.....	6	.....	.....
Duckbill	9	2	3	1	3	.....	.....	.....	.....	.....
Mensury	7	1	.....	.....	2	.....	4	.....	.....	.....
Beaver	4	.....	.....	.....	.....	.....	.....	3	1	.....
Hulless	3	.....	.....	.....	.....	.....	.....	.....	3	.....
Garton's 68	2	.....	.....	.....	.....	.....	.....	2	.....	.....
Beardless	1	.....	.....	.....	.....	.....	.....	1	.....	.....
Chevalier	1	1	.....	.....	.....	.....	.....	.....	.....	.....
English Malting	1	.....	.....	.....	.....	.....	.....	1	.....	.....
Invincible	1	1	.....	.....	.....	.....	.....	.....	.....	.....
Odessa	1	.....	.....	.....	.....	.....	.....	1	.....	.....
O.A.C. No. 1	1	.....	.....	.....	1	.....	.....	.....	.....	.....
Triumph	1	.....	.....	.....	.....	1	.....	.....	.....	.....
Mixed	1	.....	.....	.....	1	.....	.....	.....	.....	.....
Variety not known	295	16	6	1	44	23	55	90	54	6

Included among the samples for which no variety name is given are 105 reported as 6-rowed, 21 as 2-rowed and 2 as 4-rowed.

VARIETIES OF SPRING WHEAT.

Varieties.	Canada.	P.E.I.	N.S.	N.B.	Que.	Ont.	Man.	Sask.	Alta.	B.C.
Total number of samples	506	24	18	6	61	22	100	202	66	7
Red Fife	252	2	4	1	17	1	84	110	32	1
White Fife	39	12	4	2	4	16	.....	.....	1	.....
Marquis	38	1	.....	.....	.....	.....	5	22	10	.....
White Russian	19	6	9	3	1	.....	.....	.....	.....	.....
Stanley	17	.....	.....	.....	.....	.....	.....	6	11	.....
Preston	13	.....	.....	.....	1	.....	.....	10	2	.....
Bluestem	4	.....	.....	.....	.....	.....	4	.....	.....	.....
Laurel	3	.....	.....	.....	.....	.....	.....	3	.....	.....
Champlain	2	.....	.....	.....	.....	.....	.....	.....	2	.....
Alberta Red	1	.....	.....	.....	.....	.....	.....	.....	1	.....
Black Sea	1	.....	.....	.....	1	.....	.....	.....	.....	.....
Club	1	.....	.....	.....	.....	.....	.....	.....	1	.....
Burril	1	.....	.....	.....	1	.....	.....	.....	.....	.....
Lost Nation	1	.....	.....	.....	1	.....	.....	.....	.....	.....
St. Lawrence	1	.....	.....	.....	1	.....	.....	.....	.....	.....
Unity	1	.....	.....	.....	.....	.....	.....	1	.....	.....
White Chaff	1	1	.....	.....	.....	.....	.....	.....	.....	.....
Mixed	5	.....	.....	.....	3	1	.....	1	.....	.....
Variety not known	106	2	1	.....	31	4	7	49	6	6

Several samples of spring wheat included in the above table among those for which no variety is given were reported under such names as Manitoba Hard or Western.

VARIETIES OF FALL WHEAT.

Ontario was the only province from which samples of fall wheat were collected. Of the 29 samples, only one was without a variety name. Dawson's Golden Chaff was reported 18 times; Early Clawson, 3; Early Windsor, 3; Mogul, 2; Abundance, 1; Winter King, 1.

TREATMENT FOR THE PREVENTION OF SMUT.

The treatment of seed grain for the prevention of smut is quite generally practised throughout the Prairie Provinces. Experience has shown that if it is neglected serious losses will follow. In the eastern provinces there is considerable smut in the grain crops each year, but it has not been sufficiently prevalent to make treatment for its prevention general. The losses are much greater in Eastern Canada than is realized and the value of the crops would be considerably increased if treatment for smut prevention were more generally practised. Over half the samples of fall wheat collected in Ontario contained smut and it is also very common in the spring crops, especially oats. The following table gives the number of samples representing the lots that were treated. It will be noted from the samples for which the method of treatment was reported that formalin is much more popular than bluestone.

Kind of Grain.	Canada.	P.E.I.	N.S.	N.B.	Que.	Ont.	Man.	Sask.	Alta.	B.C.
Oats—										
Number of lots reported	978	51	60	8	158	164	146	224	132	35
Treated	392	9	7	....	.....	6	67	211	74	18
With formalin	291	.....	..	.....	.....	1	57	170	48	15
With bluestone	19	.....	.....	.....	.....	.....	9	5	3	2
Method not specified	82	9	7	.....	.....	5	1	36	23	1
Not treated	586	42	53	8	158	158	79	13	58	17
Spring wheat—										
Number of lots reported	506	24	18	6	61	22	100	202	66	7
Treated	361	14	3	1	.....	.....	93	193	53	4
With formalin	228	.....	.....	.....	.....	.....	57	120	48	3
With bluestone	50	.....	.....	.....	.....	.....	36	10	3	1
Method not specified	83	14	3	1	.....	.....	.....	63	2	....
Not treated	145	10	15	5	61	22	7	9	13	3
Fall wheat—										
Number of lots reported	29	.....	.....	.....	.....	29	.....	.....	.....	.....
Not treated	29	.....	.....	.....	.....	29	.....	.....	.....	.....
Barley—										
Number of lots reported	408	25	12	2	56	84	60	104	59	6
Treated	167	9	.....	.....	.....	5	25	76	49	3
With formalin	123	.....	.....	.....	.....	2	17	73	28	3
With bluestone	9	.....	.....	.....	.....	.....	8	1	.....	.....
Method not specified	35	9	.....	.....	.....	3	.....	2	21	.....
Not treated	241	16	12	2	56	79	35	28	10	3

SOURCES OF SEED SUPPLY.

Slightly over seventy five per cent of the farmers from whom samples of wheat, oats, barley and flax were collected grew their own seed. About twelve per cent secured it from other farmers and five per cent from dealers. From the table below it

will be seen that the proportion of farmers who secured their seed from dealers was largest in Quebec, Nova Scotia and New Brunswick. In Quebec the amount of seed wheat from dealers was especially large. It is significant that the wheat sampled in Quebec contained on the average five times as many noxious weed seeds per pound as that from any other province.

Nearly all the grain purchased from dealers and used as seed in the eastern provinces comes from Western Canada; as a rule it is ordinary commercial grain that has had no special selection or cleaning. It almost invariably contains large numbers of weed seeds and the vitality of the oats is often injured by frost. Until a few years ago this grain was openly sold as seed, but this practice has been largely checked by the enforcement of the Seed Control Act. It is still offered under the Canada Grain Act grades without being definitely represented as seed. When a farmer asks for seed he is shown this grain with the explanation that it is not sold specially for seed but that it is often used for that purpose and is quite suitable. In this way the dealer protects himself against legal responsibility and the farmer who uses the grain for seed does so at his own risk and usually with disappointing results.

Dealers who handle grain for seed in this way are not to be confused with reliable seed merchants who usually supply well-cleaned grain of good quality.

Most of the home grown seed and that secured from other farmers might have been much improved by a more thorough cleaning to remove weed seeds and inferior kernels.

The following table indicates, so far as information could be secured, the sources of supply of the lots which were sampled.

Kind of Grain.	Canada.	P.E.I.	N.S.	N.B.	Que.	Ont.	Man.	Sask.	Alta.	B.C.
Oats—										
Number of lots reported	978	51	60	8	158	164	146	224	132	35
Home grown	737	49	42	8	63	126	138	202	86	23
From other farmers	110	.....	6	.....	18	28	.....	13	36	9
From dealers	57	1	11	.....	30	3	4	1	7	.....
Sources not given	74	1	1	.....	47	7	4	8	3	3
Spring wheat—										
Number of lots reported	506	24	18	6	61	22	100	202	66	7
Home grown	371	24	15	5	15	5	93	165	43	6
From other farmers	52	.....	1	.....	6	14	.....	12	19	.....
From dealers	28	.....	2	1	17	3	.....	1	3	1
Sources not given	55	.....	.....	.....	23	.....	7	24	1	.....
Fall wheat—										
Number of lots reported	29	.....	.....	.....	.....	29	.....	.....	.....	.....
Home grown	13	.....	.....	.....	.....	13	.....	.....	.....	.....
From other farmers	14	.....	.....	.....	.....	14	.....	.....	.....	.....
From dealers	2	.....	.....	.....	.....	2	.....	.....	.....	.....
Barley—										
Number of lots reported	408	25	12	2	56	84	60	104	59	6
Home grown	289	23	7	2	18	61	55	80	37	6
From other farmers	62	.....	.....	.....	7	19	2	13	21	.....
From dealers	27	.....	5	.....	15	3	1	3	.....	.....
Sources not given	30	2	.....	.....	16	1	2	8	1	.....
Flax—										
Number of lots reported	144	.....	.....	.....	.....	.....	48	90	6	.....
Home grown	122	.....	.....	.....	.....	.....	47	73	2	.....
From other farmers	14	.....	.....	.....	.....	.....	1	9	4	.....
Sources not given	8	.....	.....	.....	.....	.....	.....	8	.....	.....

RATES OF SEEDING.

The following table shows the highest, lowest and average rates of seeding in bushels per acre reported in the different provinces. In some cases the low rates were used when only a light nurse crop for clover was desired.

Kind of Grain.	Canada.	P.E.I.	N.S.	N.B.	Que.	Ont.	Man.	Sask.	Alta.	B.C.
Oats—										
Highest	4·5	4	4	3·5	4	3·5	4	4	4	4·5
Lowest	1·5	2·5	2	2	2	1·5	2	2	2	2·75
Average	2·72	3·3	3·37	2·58	2·69	2·34	2·61	2·6	2·83	3·39
Spring wheat—										
Highest	3·5	2	2·5	1·5	3·5	2·25	1·5	2·75	2·25	2
Lowest	0·5	1·75	1·5	1·5	0·5	1·5	1·25	1	1·25	1·66
Average	1·71	1·95	2·25	1·5	1·76	1·84	1·47	1·76	1·62	1·95
Fall wheat—										
Highest	2	.....	.....	.....	.....	2	.....	.....	.....	.....
Lowest	1	.....	.....	.....	.....	1	.....	.....	.....	.....
Average	1·83	.....	.....	.....	.....	1·83	.....	.....	.....	.....
Barley—										
Highest	3·5	2·5	3	1·5	3	3	3	3·5	3·5	3
Lowest	0·5	1·5	1·5	1·5	1	1	0·5	1·5	1	2
Average	2·02	1·89	2·06	1·5	2·04	1·75	1·93	2·29	1·98	2·75
Flax—										
Highest	0·75	.....	.....	.....	.....	.....	0·75	0·75	0·5	.....
Lowest	0·5	.....	.....	.....	.....	.....	0·5	0·5	0·5	.....
Average	0·59	.....	.....	.....	.....	.....	0·51	0·63	0·5	.....

CLEANING AND SELECTION.

The most significant feature of the inquiry is the information brought out in regard to the impurities sown with the seed as a result of the lack of proper cleaning. Nearly eleven per cent of the wheat, oats, barley and flax sampled were being sown direct from the thresher with no cleaning whatever. Over eighty-eight per cent were reported as having been cleaned with a fanning-mill, some being put through twice, while less than one per cent received special attention by hand in the field.

Among the lots reported as having been cleaned with a fanning-mill are a number which were sampled before the cleaning was done, as indicated in the table below. In some cases the farmers did not have all their seed prepared when the inspectors called, as the visits were made in time to secure samples of the seed sown first. The analysis given below covers all the samples collected and is therefore inaccurate, as indicating the impurities put into the ground with the seed, to the extent to which they were removed from the lots which were cleaned after being sampled. But comparison of the uncleaned samples with those that had been passed through a fanning-mill would indicate that the general result was not greatly affected by this, as in most cases the cleaning was ineffectual.

Most of the so-called cleaned grain contained large numbers of very small weed seeds as well as small, light kernels and inert matter, clearly indicating poor results from the attempt at cleaning. With flax this is shown by the presence of such small seeds as tumbling mustard, cinquefoil, wormwood, lamb's quarters, wormseed mustard, and also grain, black bindweed and other large seeds in samples that had been through fanning-mills. One sample reported as cleaned with a common fanning-mill contained 17 species of weed seeds, including over 2,500 tumbling mustard, over 1,000 lamb's quarters, 803 black bindweed and 140 wild oats per pound, beside wheat, oats, and barley. Some of the grain samples furnish equally striking examples of failure

to remove even small weed seeds by the fanning mill. In a few instances excellent work was done, but the high average weed seed content shows that in most cases the attempt accomplished very little.

Apparently there is a general lack of appreciation of the importance of cleaning seed and also of equipment for doing it. Some of the most successful farmers reduce the bulk of their grain, when preparing it for seed, from one-third to one-half by cleaning and grading. This is a practical recognition of the principle that like produces like and that for best results nothing but pure seed and only the best kernels should be put into the ground. But most farmers appear to be content with putting the seed through a fanning-mill once or twice, and often the mills are not properly equipped. Many of those in use have only a few sieves and riddles designed for cleaning grain for market and are entirely inadequate for properly cleaning it for seed. For small seeds the equipment is even worse. Nearly all the samples of flax would have been much improved by the use of a woven wire riddle 3 x 16-inch size (three spaces to the inch one way and 16 the other), to carry the large foreign seeds over the back of the mill, and a zinc sieve below, with ½-inch perforations, to let through the small seeds with practically no loss of flax.

The more general use of first-class fanning-mills, fully equipped with the sieves and riddles necessary properly to clean seed, is greatly needed.

The following table indicates the cleaning and selection received by the lots of seed sampled.

	Total.	P.E.I.	N.S.	N.B.	Que.	Ont.	Man.	Sask.	Alta.	B.C.
Oats—										
Number of lots reported	978	51	60	8	158	164	146	224	132	35
Fanning-mill only	857	40	43	.....	133	150	142	211	121	17
*To be cleaned before sowing	67	.....	.....	.....	1	4	4	53	5	.....
Hand selection	8	3	.....	3	2	.....	.....	.....	.....	.....
No cleaning	113	8	17	5	23	14	4	13	11	18
Spring Wheat—										
Number of lots reported	506	24	18	6	61	22	100	202	66	7
Fanning-mill only	457	19	10	2	54	22	99	187	59	5
*To be cleaned before sowing	9	.....	.....	.....	.....	.....	.....	9	.....	.....
Hand selection	7	2	.....	1	4	.....	.....	.....	.....	.....
No cleaning	42	3	8	3	3	.....	1	15	7	2
Fall Wheat—										
Number of lots reported	29	.....	.....	.....	.....	29	.....	.....	.....	.....
Fanning-mill only	28	.....	.....	.....	.....	28	.....	.....	.....	.....
No cleaning	1	.....	.....	.....	.....	1	.....	.....	.....	.....
Barley—										
Number of lots reported	408	25	12	2	56	84	60	104	59	6
Fanning-mill only	353	22	4	.....	49	75	58	87	56	2
*To be cleaned before sowing	40	.....	.....	.....	1	.....	5	29	5	.....
Hand selection	3	2	.....	1	.....	.....	.....	.....	.....	.....
No cleaning	52	1	8	1	7	9	2	17	3	4
Flax—										
Number of lots reported	144	.....	.....	.....	.....	.....	48	90	6	.....
Fanning-mill only	128	.....	.....	.....	.....	.....	47	76	5	.....
*To be cleaned before sowing	47	.....	.....	.....	.....	.....	21	25	1	.....
No cleaning	16	.....	.....	.....	.....	.....	1	14	1	.....

* These lots are included in the number reported as being cleaned with a fanning mill. They were sampled before being cleaned.

SUMMARY OF IMPURITIES IN THE SAMPLES COLLECTED.

Al the samples were analysed in the Ottawa laboratory and the results furnish striking evidence of the exteent to which weeds are introduced through dirty seed. The impurities, apart from inert matter such as chaff, pieces of straw, etc., are divided into three classes: (*a*) weed seed classed as noxious under the Seed Control Act; (*b*) weed seeds other than those included in the noxious list; and (*c*) seeds of other cultivated plants. In the first class are included the seeds of those weeds which are particularly harmful and especially legislated against by the law governing the sale of seed in Canada. Class (*b*) includes all weed seeds not classed as noxious; most of these are of a less harmful character although some have become dangerous in certain districts. A notable example is Russian thistle which is rapidly becoming one of the most widespread and troublesome weeds in the dryer parts of the Prairie Provinces. Class (*c*) includes the seeds of all cultivated plants other than the kind represented by the sample. In a few cases the grain was deliberately mixed for growing feed. This has made the average number of seeds of other cultivated plants given in the tables below somewhat higher than it would otherwise have been.

The weed seeds in grain often give an indication of where it was grown. It will be noted below that wild oats are the most prevalent noxious weed. They are quite common in some parts of Ontario but are especially prevalent in the older parts of the Prairie Provinces. The large number found in some of the samples secured in Quebec and the Maritime Provinces is fairly reliable evidence that this grain was grown in Western Canada. The seeds of ball mustard are common in grain from northern Alberta. Sinkweed is frequently found in grain from the Red River valley and parts of Saskatchewan.

In the folowing tables is presented a summary of the noxious weeds seeds, other weed seeds and seeds of cultivated plants which were found in the samples analysed.

SUMMARY OF IMPURITIES IN OATS.

Impurities.	Canada.	P.E.I.	N.S.	N.B.	Que.	Ont.	Man.	Sask.	Alta.	B.C.
Number of samples tested.....	978	51	60	8	158	164	146	224	132	35
Noxious weed seeds—										
Samples free.. number	431	43	44	6	50	70	40	85	75	18
Samples free.. per cent.....	44	84	73	75	32	43	27	39	57	51
Largest number per pound in any sample.....	4,838	8	691	64	3,600	4,838	2,153	2,164	1,216	287
Average number per pound of all samples.....	76	1	27	8	115	65	140	69	42	53
Other weed seeds—										
Samples free.. number	118	15	13	3	12	32	15	10	15	3
Samples free.. per cent.....	12	29	24	38	8	20	10	4	11	9
Largest number per pound in any sample.....	6,954	2,216	3,872	1,952	6,954	1,010	5,993	6,429	2,405	2,336
Average number per pound of all samples	239	181	294	396	232	75	229	412	139	308
Seeds of other cultivated plants—										
Samples free.. number	44	9	6	2	8	4	8	1	2	4
Samples free.. per cent.....	4½	8	10	25	5	2	5	½	1½	11
Average number per pound of all samples.....	405	140	236	441	405	58	456	454	279	356

The sample of oats containing the largest number of noxious weed seeds was secured from a farmer in Leeds county, Ontario. These oats were home-grown, the seed having been secured from a neighbour the previous year. They had been run through a fanning-mill to clean for sowing. The effectiveness of the cleaning may be judged from the fact that they contained 4,800 wild mustard seeds and 38 Canada

thistle seed per pound, beside 174 seeds of weeds not classed as noxious, including five species. These oats were sown at the rate of two bushels per acre, which would put over 2,000 noxious weed seeds on each square rod.

The sample containing the largest number of weed seeds other than those classed as noxious was secured from a farmer in Montmagny county, Quebec. The origin was not given. These oats were reported as having been cleaned with a fanning-mill. They contained nine species of weed seeds, the most prevalent being spurrey. The noxious weed seeds consisted of 139 ox-eye daisy and 43 Canada thistle per pound, making a total of 7,136 weed seeds per pound. They were seeded at the rate of 2½ bushels per acre, which would put about 3,600 weed seeds on a square rod.

With the average weed seed content and rate of seeding shown in the preceding tables, weed seeds would be placed on the land seeded to oats at the average rate of about 44 noxious and 138 other sorts per square rod.

SUMMARY OF IMPURITIES IN BARLEY.

Impurities.	Canada.	P.E.I.	N.S.	N.B.	Que.	Ont.	Man.	Sask.	Alta.	B.C.
Number of samples tested.....	408	25	12	2	56	84	60	104	59	6
Noxious weed seeds—										
Samples free.. number	174	24	11	2	17	54	8	25	32	1
Samples free.. per cent.....	43	96	92	100	30	64	13	24	54	17
Largest number per pound in any sample.....	2,539	7	5	.....	946	159	854	1,234	2,539	176
Average number per pound in all samples.....	53	¼	½	. ...	90	11	71	1	24	45
Other weed seeds—										
Samples free.. number	56	7	3	1	8	23	8	1	50	.....
Samples free.. per cent.....	14	28	25	50	14	27	13	1	8	.....
Largest number per pound in any sample.....	9,968	2,768	208	80	6,440	1,300	9,968	7,989	2,752	9,632
Average number per pound in all samples.....	445	111	17	40	510	35	551	824	278	2,241
Seeds of other cultivated plants—										
Samples free.. number	13	7	1	1	1	1	.....	1	1	.....
Samples free.. per cent... ...	3	28	8	50	2	1	.....	1	1½	.....
Average number per pound in all samples.....	649	215	517	212	1,261	34	424	44	398	730

It will be noted that the average number of noxious weed seeds in the barley was considerably lower than in the oats though the number of other weed seeds was nearly twice as high.

The sample containing the largest number of noxious weed seeds was from near Edmonton, Alta. With the exception of 16 wild oats, the 2,539 noxious weed seeds were all ball mustard. This sample also contained 2,283 other weed seeds per pound, making a total of 4,822. At the rate at which the barley was seeded, about 3,000 noxious weed seeds would be placed on each square rod. It was represented as yet to be cleaned with a fanning-mill, but unless the attempt was more successful than in most cases it probably went into the ground with little improvement.

The sample containing the largest number of weed seeds other than those classed as noxious was secured from a farmer in southern Manitoba. It also contained 44 noxious weed seeds, making over 10,000 of all kinds per pound. About four-fifths of these were lamb's quarters. This barley was sown at the rate of two bushel per acre which would put over 6,000 weed seeds on each square rod.

With the average weed seed content and rate of seeding shown above, weed seeds would be placed on the land seeded to barley at the average rate of 32 noxious and 270 other sorts per square rod.

SUMMARY OF IMPURITIES IN SPRING WHEAT.

Impurities.	Canada.	P.E.I.	N.S.	N.B.	Que.	Ont.	Man.	Sask.	Alta.	B.C.
Number of samples tested....	506	24	18	6	61	22	100	202	66	7
Noxious weed seeds—										
Samples free.. Nnmber.....	235	17	11	3	8	3	32	108	50	3
Samples free.. per cent.....	46	71	71	50	13	14	32	53	76	43
Largest number per pound in any sample.....	11,528	42	19	153	11,528	300	967	624	689	105
Average number per pound in all samples.....	79	7	4	35	391	43	78	23	33	23
Other weed seeds—										
Samples free.. Number.....	52	10	2	2	6	1	5	11	14	1
Samples free.. per cent.....	10	42	11	33	98	5	5	5	21	43
Largest number per pound in any sample.....	17,415	1,103	1,517	17,415	3,080	2,818	1,264	9,095	1,379	11,686
Average number per pound of all samples.....	343	142	280	3,317	507	288	248	319	90	1,827
Seeds of other cultivated plants—										
Samples free.. number	121	13	1	1	1	1	40	40	23	1
Samples free.. per cent.....	24	54	6	17	1½	5	40	20	35	14
Average number per pound of all samples	156	35	168	1,147	380	70	28	97	32	2,732

Noxious weed seeds were more prevalent in the spring wheat samples than in either oats or barley. The sample containing 11,528 noxious weeds per pound was taken from a farmer in one of the southern border counties of Quebec. It represented home-grown seed that was being sown without cleaning. With the exception of a few seeds of wild oats and purple cockle, the noxious seeds were all wild mustard. This seed was sown at the rate of two bushels per acre, which would put noxious weeds on the land at the rate of about 8,600 per square rod.

The sample containing 17,415 weed seeds per pound other than those classed as noxious was taken in New Brunswick and was represented as home-grown seed that was being sown without cleaning. This seed also contained 153 noxious weed seeds per pound. It was sown at the rate of a bushel and a half per acre, which would put about 9,800 weed seeds of all kinds on each square rod.

With the average weed seed content and rate of seeding shown above, weed seeds would be placed on the land sown to spring wheat at the average rate of 50 noxious and 220 other sorts per square rod.

SUMMARY OF IMPURITIES IN FALL WHEAT.

Impurities.	Ontario.
Number of samples tested.....	29
Noxious weed seeds—	
Samples free { Number.....	18
Samples free { Per cent.....	63
Largest number per pound in any sample.....	176
Average number per pound of all samples.....	9
Other weed seeds—	
Samples free { Number.....	7
Samples free { Per cent	24
Largest number per pound in any sample..	187
Average number per pound of all samples.....	68
Seeds of other cultivated plants—	
Samples free { Number.....	5
Samples free { Per cent	17
Average number per pound in all samples.....	18

The number of weed seeds in the Fall wheat samples was much smaller than in the other grains. The average number of noxious weed seeds per pound was about one-ninth of the number in Spring wheat, while the number of other weed seeds was only about one-twentieth as high. Fall wheat samples were collected only in Ontario and mostly form the easter part of the province.

SUMMARY OF IMPURITIES IN FLAX.

Impurities.	Total.	Man.	Sask.	Alta.
Number of samples tested	144	48	90	6
Noxious weed seeds—				
Samples free { Number	17	1	13	3
Samples free { Per cent	12	2	14	50
Largest number per pound in any sample	15,424	6,224	15,424	32
Average number per pound of all samples	662	660	706	10
Other weed seeds—				
Samples free { Number	7	2	2	3
Samples free { Per cent	5	4	2	50
Largest number per pound in any sample	13,984	12,784	13,984	656
Average number per pound of all samples	4,087	10,058	1,161	211
Seeds of other cultivated plants—				
Samples free { Number	36	12	20	4
Samples free { Per cent	25	25	22	67
Largest number per pound in any sample	3,134	2,960	3,134	400
Average number per pound of all samples	264	353	229	75

The noxious weed seeds in the sample containing 15,424 per pound were made up as follows: Wild mustard 11,936, false flax 1,792, wild oats 1,280, hare's-ear mustard 288, and stickseed 128. It also contained 11,616 other weed seeds per pound, mostly lamb's quarters. This sample was taken in central Saskatchewan and represented seed that had been in the stack over winter and threshed the following May. It was sown at the rate of one-half bushel per acre, which would put approximately 2,700 noxious and 2,000 other weed seeds on each square rod.

The sample containing the largest number of weed seeds other than those classed as noxious contained none of the noxious species. The most prevalent weed seeds were black bindweed and lamb's quarters. This flax was to be put through the fanning-mill once more before being seeded.

With the average weed seed content and rate of seeding above shown, weed seeds would be placed on the land sown to flax at the average rate of about 136 noxious and 840 other sorts per square rod. As previously stated, some of the lots were to be passed through a fanning mill after the samples were taken; but making liberal allowance for the improvement which might be made in this way, the facts furnish sufficient explanation of the weed infection which so often appears on new land after being seeded with flax.

DETAILS OF IMPURITIES IN SAMPLES COLLECTED.

Details of the impurities as they occured in the samples collected and analysed are presented in the following tables:—

DETAILS OF IMPURITIES IN OATS.

COLUMNS "A"—Number of samples containing the impurities named in the column to the left.
COLUMNS "B"—Average number of impurities per pound in samples, counting only those in which the impurities occurred.

Impurities in order of prevalence.	Canada.		P. E. Island.		Nova Scotia.		New Brunswick.		Quebec.		Ontario.		Manitoba.		Saskatchewan.		Alberta.		British Columbia.	
	A.	B.	A.	B.	A.	B.	A.	B.	A.	B.	A.	B.	A.	B.	A.	B.	A.	B.	A.	B.
Number samples tested	978		51		60		8		158		164		146		224		132		35	
Noxious Weed Seeds—																				
Wild oats	347	83			10	97	1	32	38	70	50	27	90	155	100	69	34	47	24	57
Ball mustard	120	53	1	8	2	52			11	30	5	110	30	34	39	21	30	118	2	15
Wild mustard	93	209			1	154			47	188	16	465	12	58	16	144			1	11
Stickseed	64	49			1	96			6	27	9	22	13	102	29	45	6	12		
Purple cockle	48	14	1	16					5	15	16	9	17	13	9	22				
Canada thistle	44	16	1	8					12	19	19	16	8	13	4	31				
False flax	43	22			1	12			6	66	4	12	9	13	22	16	1	27		
Ragweed	43	96			2	11			26	147	5	11	10	20						
Campions	41	36			1	7			13	31	14	5	13	76						
Hare's-ear mustard	32	23			2	58			5	47	1	12	5	37	15	9	3	16	1	6
Stinkweed	28	50			1	26			5	29	3	14	14	68	5	47				
Sow thistle	24	26							7	23	5	64	6	20	3	4			3	8
Cow cockle	19	60							2	11	2	5	7	78	8	70				
Tumbling mustard	18	140			1	6					1	67			16	153				
Docks	17	15			1	8			3	14	5	8	2	5	5	5			1	128
Ox-eye daisy	10	57			2	35	1	32	7	67										
Field bindweed	9	38									1	4			6	18	2	113		
Darnel	6	51							1	8	3	2	1	5					1	287
Chicory	4	34							3	41	1	12								
Wild carrot	1	64			1	64														
Ribgrass	1	4									1	4								
Other Weed Seeds—																				
Black bindweed	678	116	22	28	23	94	1	13	97	77	96	39	117	93	188	189	106	99	28	274
Lamb's quarters	354	100	1	9	11	151			37	165	23	85	72	247	141	358	58	123	11	23
Lady's thumb	141	43	6	92	20	53	2	40	61	29	35	45	1	5	2	23			14	77
Spurrey	86	317	19	371	21	500	3	361	36	225			1	32	1	83			5	78
Hemp nettle	72	27	11	25	17	36			30	23	7	24	5	17	1	6			1	85
Yellow foxtail	64	64							45	58	16	89	3	9						
Prairie sunflower	51	38			2	5			5	14	3	8	11	10	27	62	3	19		
Sun spurge	33	52							33	52										
Ergot	29	6			1	15			2	8	2	4			23	5			1	5

Barnyard grass	22	18			2	10			10	28	9	9	1	16								
Prairie rose	21	13			1	5			1	8			7	30	11	5	1	5				
Green foxtail	18	208	1	74	1	6			5	100	6	78	5	539								
Buttercup	18	19			1	32			16	19	1	3										
Smartweed	17	34	1	96	2	12	2	22	8	39	1	4	1	5							2	52
Knotweed	16	42	2	52	1	1	1	8	10	42	1	4	1	132								
Couch grass	15	121	5	49	5	293			3	33	2	5										
Cinquefoil	14	46			3	17			1	32	2	148	1	70	6	27					1	28
Wolfberry	14	10			1	2							1	7	12	11						
Sheep sorrel	12	228	2	10	3	85	3	562	1	93	2	27									1	629
Hedge nettle	12	67	1	32	1	32			1	6	1	4	2	645	6	14						
Bull thistle	12	67							1	21	1	12	1	16	7	105	1	4	1	14		
Worm-seed mustard	11	66									2	38	3	165	4	33	2	10				
Russian pigweed	11	18									1	8	2	15	5	8	3	42				
Peppergrass	10	16							1	64			4	6	5	13						
Plantain	9	53			2	76			2	44	1	32	2	46							2	58
Evening primrose	9	43											6	28	3	72						
Wall-flower	8	19							1	4			1	6	6	24						
American dragonhead	7	4											5	2	2	9						
Red-root pigweed	6	11			1	13					1	3			2	9	1	13	1	21		
Wormwood	5	193											1	32	4	233						
Black medick	5	78							1	25	4	92										
Pale plantain	5	114							1	384	1	5	1	27	1	4			1	148		
Chickweed	5	102							1	64	2	198			1	5			1	44		
Shepherd's purse	5	11									1	4			4	21						
Beggar-ticks	4	5							3	5	1	5										
Russian thistle	4	151													4	151						
Yarrow	4	52							4	52												
Chess	3	28									3	28										
Healing herb	3	7	1	11					1	6			1	4								
Gilia	3	3													3	3						
Tick trefoil	3	5													3	5						
Sedges	2	7													1	4			1	9		
Old witch grass	2	36							1	11	1	60										
Burdock	2	5									2	5										
Bugleweed	2	99					1	192	1	6												
Bristly ox-tongue	2	5			1	5									1	5						
Bedstraw	2	18							1	5	1	30										
Fragrant giant hyssop	2	4									1	4			1	3						
Fowl meadow grass	2	19							1	5			1	32								
Gum-plant	2	15							1	24					1	5						
Heal-all	2	14							2	14												
Low mallow	2	3							2	3												
Mayweed	2	13									1	15									1	11
Gaura	2	11															2	11				
Three-seeded mercury	2	56							2	56												
Tansy mustard	2	16													2	16						
Tower mustard	2	8													2	8						
Scentless chamomile	1	16									1	16										
Fleabane	1	5													1	5						

DETAILS OF IMPURITIES IN OATS—*Continued.*

COLUMNS "A"—Number of samples containing the impurities named in the column to the left.
COLUMNS "B"—Average number of impurities per pound in samples, counting only those in which the impurities occurred.

Impurities in order of prevalence.	Canada.		P. E. Island.		Nova Scotia.		New Brunswick.		Quebec.		Ontario.		Manitoba.		Saskatchewan.		Alberta.		British Columbia.	
	A.	B.	A.	B.	A.	B.	A.	B.	A.	B.	A.	B.	A.	B.	A.	B.	A.	B.	A.	B.
Other Weed Seeds—Con.																				
Hound's tongue	1	6									1	6								
Marsh elder	1	38															1	38		
Sweet clover	1	6							1	6										
Stitchwort	1	51							1	51										
Wild barley	1	3													1	3				
Toadflax	1	6			1	6														
Yellow daisy	1	5											1	5						
Wild aster	1	384			1	384														
Field peppergrass	1	37													1	37				
Other sorts	12	607			2	126			3	365					4	62	1	13	2	41
Seeds of Other Cultivated Plants—																				
Barley	593	220	21	78	37	83	2	51	105	227	150	242	51	559	110	152	106	179	11	96
Wheat	562	269	17	36	32	70	2	23	96	170	112	238	47	642	145	442	97	108	14	54
Black oats (in white oats)	535	109	21	65	35	123			72	90	80	277	48	122	155	65	112	60	12	103
Buckwheat	110	70	5	42	17	49	3	21	51	90	27	59							7	55
Flax	88	130			3	136			28	69	7	13	9	144	36	104	4	27	1	11
Vetch	192	25	10	25	12	17	1	56	91	27	62	22	7	4	4	5	1	13	4	112
Western rye grass	63	24	1	8	4	41	1	26	5	21	9	11	5	8	26	29	11	12	1	200
Timothy	58	128	2	22	8	56			13	81	9	457	7	21	8	185	5	13	6	15
Peas	43	29	1	8	3	13			19	37	19	16							1	160
White oats (in black oats)	29	617	8	389	2	1132	2	1617			2	345	7	55			3	45	5	1612
Alsike	27	112			1	11			5	54	8	270	4	16	5	100	3	8	1	5
Red clover	17	93			1	74			4	14	4	240	2	19	2	213	1	7	3	8
Rye	12	560							9	677					1	11	2	6		
White clover	4	11									2	8							2	14
Alfalfa	4	217									2	358			1	5	1	146		
Millet	4	22									3	8			1	64				
Blue grass	2	34			1	51													1	16
Beans	2	5									2	5								
Red top	2	19			1	32													1	5
Awnless brome grass	2	10													1	13	1	7		
Orchard grass	1	5							1	5										

Number of samples tested	408		25		12		2		56		84		60		104		59		6	
Noxious Weed Seeds—																				
Wild oats	156	59							10	9	18	33	44	62	67	83	12	12	5	27
Ball mustard	60	31	1	18					2	32			17	19	24	14	16	72		
Wild mustard	46	69							14	130	4	30	19	9	7	151	2	4		
Stickseed	38	33									2	6	10	10	20	53	5	13	1	4
Ragweed	13	202			1	5			9	251			2	178	1	5				
False flax	12	11									1	23	2	4	8	9	1	32		
Stinkweed	12	33							7	32	1	6	3	55	1	9				
Canada thistle	11	18							3	6	5	5	3	50						
Campions	9	45							4	91	1	4	2	13	2	8				
Hare's-ear mustard	9	13											2	26	6	8	1	18		
Docks	7	20							3	6	2	47			1	3			1	26
Purple cockle	7	20							3	7			4	31						
Ox-eye daisy	6	26							5	31	1	4								
Cow cockle	6	8									2	4	2	6	2	13				
Tumbling mustard	6	202									1	50			5	232				
Sow thistle	5	32							1	8	1	4	1	15	1	4			1	128
Field bindweed	2	154													1	290	1	17		
Ribgrass	1	11							1	11										
Chicory	1	1							1	1										
Other Weed Seeds—																				
Black bindweed	296	228	7	91	5	27	1	16	33	129	45	29	50	165	96	405	53	202	6	557
Lamb's quarters	157	490	1	99	2	20	1	2	22	194	8	9	27	866	69	614	26	232	1	611
Lady's thumb	50	142	7	114	3	50	1	48	26	193	7	28	1	7	2	2			3	292
Wild vetch	31	19	1	11					10	34	16	12	1	13	2	7	1	9		
Hemp nettle	25	72	4	31	1	9			14	115	3	4	2	20			1	11		
Spurrey	24	325	9	432	2	136			10	164	1	5							2	997
Prairie sunflower	17	32											1	4	15	36	1	4		
Barnyard grass	14	120	1	96					8	164	3	66	2	38						
Yellow foxtail	14	77					1	8	8	123	5	17								
Ergot	13	56							2	5	2	4			3	5	4	21	2	308
Sun spurge	13	160	1	27					12	171										
Green foxtail	10	310					1	8	5	495	2	65	1	477	1	8				
Buttercup	10	48							10	48										
Chickweed	9	440	1	16					4	873			1	27	1	5	1	5	1	416
Prairie rose	9	5											3	4	5	5	1	3		
Black medick	8	17							2	4	5	24	1	11						
Wolfberry	8	6											1	4	7	7				
Cinquefoil	6	73	1	6					1	58			1	208	2	81	1	5		
Knotweed	6	11							2	24	2	2	1	5					1	9
Smartweed	6	65	2	144					4	26										
Sheep sorrel	5	291	1	6					2	19									2	707
American dragonhead	5	19											4	9	1	60				
Couch grass	5	18							3	18	1	5			1	32				
Evening primrose	5	20											2	16	3	23				
Russian pigweed	5	16											2	28	3	8				
Peppergrass	4	9							1	4					3	11				
Shepherd's purse	4	34							1	12			1	5	2	59				

DETAILS OF IMPURITIES IN BARLEY—*Continued.*

COLUMNS "A."—Number of samples containing the impurities named in the column to the left.
COLUMNS "B."—Average number of the impurities per pound in samples, counting only those in which the imputities occurred.

Impurities in order prevalence.	Canada.		P. E. Island.		Nova Scotia.		New Brunswick.		Quebec.		Ontario.		Manitoba.		Saskatchewan.		Alberta.		British Columbia.	
	A.	B.	A.	B.	A.	B.	A.	B.	A.	B.	A.	B.	A.	B.	A.	B.	A.	B.	A.	B.
Other Weed Seeds—Con.																				
Chess	4	71									3	90					1	16		
Bedstraw	4	4							3	3	1	5								
Roadside thistle	3	8											2	9			1	6		
Bull thistle	3	207											1	4	1	5			1	611
Hedge nettle	3	6							1	6					2	6				
Maple-leaved goosefoot	3	349							2	18					1	1010				
Red-root pigweed	3	7											2	8	1	4				
Gilia	3	9													3	9				
Plantain	2	998											1	91					1	1904
Worm-seed mustard	2	25											1	16	1	34				
Sedges	2	34							1	20					1	48				
Yarrow	2	5											1	5	1	4				
Wormwood	2	22											1	40	1	3				
Hound's tongue	2	3									2	3								
Mayweed	2	6									2	6								
Wall-flower	2	10									1	5			1	14				
Fragrant giant hyssop	1	1203													1	1203				
Wild aster	1	4											1	4						
Atripex	1	52											1	52						
Old witch grass	1	7							1	7										
Healing herb	1	108							1	108										
Low mallow	1	4									1	4								
Meadow rue	1	30													1	30				
Meadow soft grass	1	611																	1	611
Pale plantain	1	160													1	160				
Burdock	1	4							1	4										
Other sorts	15	22							4	6	1	63	3	11	6	34	1	4		
Seeds of Other Cultivated plants—																				
White oats	382	443	16	840	11	322	1	192	52	553	80	322	60	267	99	606	57	305	6	679
Wheat	244	157	11	74	8	40			28	46	40	44	52	159	63	326	39	128	3	79
Black oats	68	115	3	53	2	2299			11	33	9	11	4	51	26	33	12	52	1	48
Buckwheat	53	104	4	12	4	9	1	232	30	163	13	20							1	16
Flax	41	50	1	6					5	21			9	71	25	52	1	5		

Timothy	31	54	1	220					13	62	7	39	3	26	6	48	1	11		
Western rye grass	23	37	1	32					5	22	2	24			12	52	3	13		
Alsike	13	20							6	34	4	11	1	4	2	3				
Vetch	13	13			2	7			6	10	4	21					1	6		
Peas	12	10			2	8			4	18	5	5			1	12				
Red clover	8	6							4	5	3	7	1	8						
Blue grass	7	71									2	172	4	36	1	8				
Black barley (in white)	7	152							1	11	1	18			3	176	2	253		
Millet	6	15							2	14	3	7	1	39						
Rye	5	22							3	32	2	8								
White clover	2	66			1	128			1	4										
White barley (in black)	2	103							1	170			1	36						
Alfalfa	2	6									1	3					1	8		
Awnless brome grass	2	8											1	10					1	
Beans	1	4									1	4								

DETAILS OF IMPURITIES IN SPRING WHEAT.

Number of samples tested	506		24		18		6		61		22		100		202		66		7			
Noxious Weed Seeds—																						
Purple cockle	127	27	7	17	6	5	3	19	30	508	18	16	34	30	29	12						
Wild oats	118	25			1	6			17	27	1	5	43	34	44	20	8	20	4	13		
Ball mustard	57	55							2	12			33	34	16	52	6	197				
Wild mustard	52	358							21	844	2	105	13	42	13	9	2	8	1	5		
Stickseed	46	27							2	7	5	7	20	50	18	11	1	25				
Cow cockle	31	12	1	6	1	8			3	5	1	3	11	17	14	11						
Great ragweed	28	116							11	250	1	13	15	31	1	11						
Campions	26	43							12	52	4	7	9	47	1	28						
Stinkweed	21	54							5	11			14	76	2	7						
Sow thistle	20	24	2	14	1	7			9	32	2	19	4	3	1	3			1	105		
Hare's-ear mustard	17	36							1	120			5	80	11	9						
False flax	13	30							1	33			1	6	9	35	2	22				
Canada thistle	12	7			1	13			7	7	1	8	2	2	1	4						
Darnel	10	83					1	16	1	13	1	25	6	14			1	689				
Tumbling mustard	9	198							1	84					8	212						
Docks	6	20							3	6	1	68			1	4	1	29				
Ox-eye daisy	4	103					1	135	1	64	2	105										
Field bindweed	3	131													2	183	1	24				
Chicory	2	101							2	101												
Wild carrot	1	3													1	3						
Ribgrass	1	16											1	16								
Other Weed Seeds—																						
Black bindweed	406	127	13	47	14	41	4	14	48	143	19	83	87	180	174	125	41	85	6	178		
Lamb's quarters	221	300	2	11	4	173	1	12996	20	161	3	31	54	121	112	364	22	83	3	29		
Lady's thumb	57	83	2	119	10	151	2	278	27	86	4	14	7	7			1	6	4	2		
Wild vetch	55	50	7	57	3	30	2	12	16	65	14	76	7	12	4	4	1	6	1	5		
Hemp nettle	52	94	7	34	9	82	1	439	21	128	2	17	1	746	1	3						

DETAILS OF IMPURITIES IN SPRING WHEAT—*Continued.*

COLUMNS "A"—Number of samples containing the impurities named in the column to the left.
COLUMNS "B"—Average number of impurities per pound in samples, counting only those in which the impurities occurred.

Impurities in order of prevalence.	Canada.		P. E. Island.		Nova Scotia.		New Brunswick.		Quebec.		Ontario.		Manitoba.		Saskatchewan.		Alberta.		British Columbia.	
	A.	B.	A.	B.	A.	B.	A.	B.	A.	B.	A.	B.	A.	B.	A.	B.	A.	B.	A.	B.
Other Weed Seeds—Con.																				
Wolfberry	42	9							1	16	1	3	9	6	26	11	5	6		
Ergot	36	7			3	6	3	19	3	5	1	3	2	2	22	6	2	7		
Spurrey	34	512	8	201	4	267	3	1,703	17	301									2	2,257
Prairie rose	30	6							1	9			18	5	9	6	2	3		
Knotweed	19	275			1	38			5	36	5	8	3	2	2	24			3	1,639
Green foxtail	18	101							8	172	4	49	6	41						
Yellow foxtail	18	77							14	97	3	9			1	5				
Sun spurge	13	163							13	163										
Sheep sorrel	12	89	2	15	1	6	1	135	1	16	2	5							5	413
Barnyard grass	9	17							4	28	4	8	1	11						
Smartweed	9	22	1	7	2	18	2	57	1	4	2	5							1	21
Prairie sunflower	9	15							1	15			2	5	6	18				
Peppergrass	8	9							1	3			4	9	3	11				
Hedge nettle	8	13			1	13							2	4	4	19	1	6		
Wall-flower	7	21							1	15			1	3	4	30	1	6		
Worm-seed mustard	7	11			1	6							3	8	3	16				
Chickweed	6	52	1	6	1	45			2	94			1	4					1	67
Couch grass	6	101	1	106	1	64	1	288	2	72					1	6				
Buttercup	6	5							5	4	1	8								
Russian pigweed	6	35											3	18	3	51				
Roadside thistle	5	9													3	8	2	12		
Beggar-ticks	5	3	1	9					3	2			1	1						
Bull thistle	5	6							1	3					3	4			1	16
Shepherd's purse	4	4							1	1			2	5	1	4				
Black medick	4	47							2	4	1	3			1	176				
Cinquefoil	4	17							1	4			1	18	2	23				
American dragonhead	3	4											3	4						
Catnip	3	7							1	9	1	8	1	4						
Bedstraw	3	14							3	14										
Healing herb	3	11							1	3	2	15								
Chess	3	920									1	2,754	1	4	1	3				
Red-root pigweed	3	102							1	3			1	3			1	301		
Gilia	3	23													3	23				
Yarrow	3	45					1	126	1	5					1	4				

Wormwood	2	3													1	3			1	3
Plantain	2	90									1	69	1	111						
Purslane	2	8			1	13											1	3		
Sweet clover	2	4							2	4										
Maple-leaved goosefoot	2	30			1	13							1	48						
Meadow rue	2	4													2	4				
Avens	2	11									1	15			1	7				
Wild aster	1	4													1	4				
Blue vervain	1	265									1	265								
Burdock	1	5							1	5										
Crabgrass	1	4							1	4										
Evening primrose	1	9													1	9				
Fragrant giant hyssop	1	4													1	4				
Yellow daisy	1	5													1	5				
Mayweed	1	2									1	2								
Russian thistle	1	14															1	14		
Three-seeded mercury	1	2									1	2								
Gaura	1	11															1	11		
Spurge	1	9	1	9																
Pale plantain	1	5									1	5								
Sedges	1	4													1	4				
Other sorts	29	127	1	11	4	28			8	296	2	7	2	374	3	98	9	15		
Seeds of Other Cultivated Plants																				
White oats	311	154	6	39	15	92	2	401	50	327	20	44	49	33	128	56	34	36	7	2,626
Barley	249	44	9	51	11	102	4	332	51	64	18	61	43	23	90	22	19	22	4	57
Flax	75	130			1	5			9	41	1	5	13	9	46	201	4	6	1	4
Western rye grass	69	23	1	32			2	212	5	33	1	9	2	4	51	17	6	5	1	22
Timothy	40	46	1	29	1	6	2	151	10	30	3	57	9	2	9	28	3	110	2	220
Vetch	35	37	2	25	1	5			18	55	12	22	1	4	1	4				
Buckwheat	34	78	1	9	9	37	3	322	18	74	2	2							1	10
Black oats	33	100	2	14	5	19	4	835	4	4			2	4	14	7	2	9		
Alsike	12	13			1	21			4	17	1	3			5	11			1	10
Red clover	12	7							6	8			2	2	4	6				
Blue grass	9	21			2	25	1	9			3	34	1	8	1	3			1	14
Peas	5	8					1	8	3	9	1	4								
White clover	3	13									1	12					1	19	1	9
Rye	3	77							3	77										
Red top	1	6			1	6														
Alfalfa	1	10							1	10										
Crimson clover	1	3							1	3										
Perennial rye grass	1	6															1	6		

DETAILS OF IMPURITIES IN FALL WHEAT.

COLUMNS "A"—Number of samples containing the impurities named in the column to the left.
COLUMNS "B"—Average number of impurities per pound in samples, counting only those in which the impurities occurred.

Impurities in order of prevalence.	Ontario.		Impurities in order of prevalence.	Ontario.		Impurities in order of prevalence.	Ontario.	
	A.	B.		A.	B.		A.	B.
Number of samples tested	29		*Other Weed Seeds—*			*Seeds of Other Cultivated Plants—*		
Noxious Weed Seeds—			Black bindweed	8	9	Barley	11	10
Stickseed	4	44	Chess	7	68	Oats	9	27
Wild oats	4	5	Lamb's quarters	2	8	Vetch	6	12
Campions	3	6	Green foxtail	2	6	Rye	4	13
Purple cockle	2	18	Red-root pigweed	1	16	Alsike	3	7
Canada thistle	1	3	Black medick	1	2	Buckwheat	2	5
Wild mustard	1	3	Couch grass	1	15	Peas	1	4
Sow thistle	1	3	Knotweed	1	3	White clover	1	6
			Other sorts	13	105			

DETAILS OF IMPURITIES IN FLAX.

COLUMNS "A"—Number of samples containing the impurities named in the column to the left.
COLUMNS "B"—Average number of impurities per pound in samples, counting only those in which the impurities occurred.

Impurities in order of prevalence.	Canada.		Manitoba.		Saskatchewan.		Alberta.		Impurities in order of prevalence.	Canada.		Manitoba.		Saskatchewan.		Alberta.	
	A.	B.	A.	B.	A.	B.	A.	B.		A.	B.	A.	B.	A.	B.	A.	B.
Number samples tested	144		48		90		6		*Other Weed Seeds—Con.*								
Noxious Weed Seeds—									Russian thistle	3	277	1	112	2	360		
False flax	91	162	32	119	56	195	3	14	Lady's thumb	3	32	3	32				
Wild mustard	60	496	26	152	33	842	1	19	Chickweed	3	16	1	32	2	8		
Stickseed	57	145	23	297	34	41			Old witch grass	3	15	1	32	2	7		
Wild oats	51	167	31	146	20	201			Bull thistle	2	190	1	317	1	64		
Hare's-ear mustard	42	100	2	648	40	72			Toadflax	2	35			2	35		
Ball mustard	25	34	15	24	10	47			Pale plantain	2	29	2	29				
Tumbling mustard	20	1,186	2	34	18	937			Wild vetch	2	13	1	9	1	16		
									Sheep sorrel	2	11			2	11		

Cow cockle	14	66	9	89	5	24	.....	.....
Campions	12	35	9	46	3	5	.....	.....
Canada thistle	11	32	8	37	3	18	.....	.....
Stinkweed	10	273	2	891	8	118	.....	.....
Docks	9	17	5	21	4	12	.....	.....
Purple cockle	8	20	5	29	3	6	.....	.....
Ragweed	4	29	3	37	1	3	.....	.....
Ox-eye daisy	1	364	1	364	.....	.....	.....	.....
Wild radish	1	16	1	16	.....	.....	.....	.....
Ribgrass	1	11	.....	.....	1	11	.....	.....
Sow thistle	1	4	1	4	.....	.....	.....	.....
Field bindweed	1	3	.....	.....	1	3	.....	.....
Other Weed Seeds—								
Lamb's quarters	127	1,463	48	2,548	76	821	3	384
Black bindweed	122	421	47	340	73	484	2	26
Prairie rose	26	15	8	28	18	9	.....	.....
Prairie sunflower	23	111	10	80	13	135	.....	.....
Russian pigweed	22	65	6	29	16	78	.....	.....
Wormwood	19	1,024	15	1,268	4	108	.....	.....
Cinquefoil	19	78	10	120	8	34	1	4
Ergot	17	22	1	16	15	23	1	19
Evening primrose	14	158	12	179	2	24	.....	.....
Tumble weed	13	847	12	915	1	34	.....	.....
Worm-seed mustard	13	35	6	44	7	28	.....	.....
Red-root pigweed	11	374	11	374	.....	.....	.....	.....
Wolfberry	10	23	5	32	5	14	.....	.....
Green foxtail	9	74	8	81	1	17	.....	.....
Plantain	8	57	7	64	1	6	.....	.....
Peppergrass	8	22	2	56	6	10	.....	.....
Hedge nettle	8	4	6	3	2	9	.....	.....
Bugleweed	7	123	6	142	1	11	.....	.....
Wild aster	7	42	3	89	4	17	.....	.....
American dragonhead	7	12	5	5	2	29	.....	.....
Shepherd's purse	6	16	4	20	2	8	.....	.....
Roadside thistle	5	50	1	7	4	60	.....	.....
Wall-flower	5	47	1	4	4	58	.....	.....
Sedges	5	7	3	8	2	5	.....	.....
Knotweed	2	9	1	5	1	12	.....	.....
Golden-rod	1	194	1	194	.....	.....	.....	.....
Yellow foxtail	1	121	1	121	.....	.....	.....	.....
Tickseed	1	83	.....	.....	1	83	.....	.....
Maple-leaved goosefoot	1	72	.....	.....	1	72	.....	.....
Crabgrass	1	32	1	32	.....	.....	.....	.....
Fragrant giant hyssop	1	32	.....	.....	1	32	.....	.....
Hedge mustard	1	32	.....	.....	1	32	.....	.....
Loosestrife	1	32	.....	.....	1	32	.....	.....
Hemp nettle	1	26	.....	.....	1	26	.....	.....
Yarrow	1	21	1	21	.....	.....	.....	.....
Tick trefoil	1	16	.....	.....	1	16	.....	.....
Catnip	1	16	1	16	.....	.....	.....	.....
Dodder	1	16	1	16	.....	.....	.....	.....
Gum-plant	1	16	1	16	.....	.....	.....	.....
Heal-all	1	16	1	16	.....	.....	.....	.....
Panicled willow-herb	1	16	.....	.....	1	16	.....	.....
Smartweed	1	9	1	9	.....	.....	.....	.....
Spurrey	1	8	.....	.....	1	8	.....	.....
Stitchwort	1	4	.....	.....	1	4	.....	.....
Yellow daisy	1	4	1	4	.....	.....	.....	.....
Other sorts	18	111	11	159	6	21	1	38
Seeds of Other Cultivated Plants—								
Wheat	83	203	30	291	53	153	.....	.....
White oats	71	177	31	113	39	231	1	19
Barley	37	177	18	220	18	143	1	8
Western rye grass	32	24	7	20	24	25	1	1
Timothy	10	30	6	34	4	25	.....	.....
Alsike	6	29	4	41	1	4	1	3
Red clover	5	34	3	48	2	12	.....	.....
Alfalfa	2	216	1	32	.....	.....	1	100
Blue grass	2	24	.....	.....	2	24	.....	.....
Black oats	1	80	.....	.....	1	80	.....	.....
Rye	1	32	.....	.....	1	32	.....	.....
Perennial rye grass	1	24	.....	.....	1	24	.....	.....
Awnless brome grass	1	16	1	16	.....	.....	.....	.....

GERMINATION OF OATS, BARLEY, WHEAT AND FLAX.

Germination tests of the samples collected indicate that on the whole the vitality of the seed was fairly good, although a considerable proportion of the lots must have given disappointing returns through failure to produce a full stand

The vitality of seed is liable to be impaired by a variety of causes. Among the most common are frost before ripening, immaturity, weathering, heating, improper curing, mould and must. The germinating strength of grain is often greatly lowered by the presence of small, immature or shrunken kernels, which produce weak plants or none at all if conditions are unfavourable. Such kernels are especially prevalent in oats. All grain intended for seed should be thoroughly cleaned and graded to retain only the strong plump kernels.

As shown by the table below, the average germination of the oats was 87 per cent, which is lower than with any of the other grains. Apart from the presence of weak kernels through lack of proper cleaning, the most common cause of low vitality in oats is frost. A very light frost when oats are in the milk stage is sufficient to ruin them for seed. When they are more matured the injury is not so great, but in any case its extent is difficult to detect. Oats quite normal in appearance and weight may be so badly damaged by frost that their value for seed is completely destroyed. It is therefore very important that a germination test be made when there is any possibility of the seed having been frosted before harvesting. Injury to vitality from other causes is usually more noticeable.

The standard percentage germination for good seed recognized under the Seed Control Act for grain and flax is 95 per cent. The Act requires that all grain sold for seed must germinate up to at least two-thirds of the standard or be marked to show the percentage germination. It will be seen from the results of the tests that 8 per cent of the oats sampled germinated below 63 per cent or two-thirds of the standard for good seed, the largest proportion being from the Prairie Provinces and Quebec.

The barley samples averaged 91 per cent germination. About 5 per cent of the samples were below two-thirds of the standard for good seed, the largest proportion being from Quebec, Manitoba and Saskatchewan. Wet weather during harvest and insufficient drying frequently cause low germination in barley. The vitality is also susceptible to frost injury and often the extent of the damage is not shown. Usually the hull is more or less loosened and has a shrunken appearance.

With wheat the frost injury is apparent from the kernels. Damage from weathering or heat is not always so evident, although as a rule wheat that looks strong will germinate well. The spring wheat samples averaged 96 per cent germination, about 1 per cent being below two-thirds of the standard. The average germination in the fall wheat was 98 per cent with 79 per cent as the lowest.

The vitality of flax may be impaired by severe weathering or frost, but usually healthy looking seed will grow readily. The average germination of the samples collected was 86 per cent with less than 1 per cent below two-thirds of the standard for good seed.

In the following table is presented a summary of the germination tests on the oats, barley, wheat and flax, showing the average and lowest percentage germination of seed from each province and the number of samples germinating from 90 per cent to 100 per cent. from 75 per cent to 89 per cent, from 63 per cent to 74 per cent, and below 63 per cent.

GERMINATION OF OATS, BARLEY, WHEAT AND FLAX.

—	Canada.	P.E.I.	N.S.	N.B.	Que.	Ont.	Man.	Sask.	Alta.	B.C.
Oats—										
Number of samples tested	978	51	60	8	158	164	146	224	132	35
Number germinating :										
From 90 to 100 %	637	49	37	6	83	135	114	140	49	24
From 75 to 89 %	202	1	16	1	36	22	19	54	48	5
From 63 to 74 %	64	1	4	1	17	5	2	11	20	3
Below 63 %	75	0	3	0	22	2	11	19	15	3
Average % germination	87	96	88	89	82	94	90	88	74	88
Lowest % germination	2	72	50	65	2	59	18	15	37	39
Barley—										
Number of samples tested	408	25	12	2	56	84	60	104	59	6
Number germinating :										
From 90 to 100%	295	19	10	1	34	71	36	81	40	3
From 75 to 89 %	72	6	1	1	15	10	11	11	16	1
From 63 to 74 %	21	0	1	0	3	1	7	5	2	2
Below 63 %	20	0	0	0	4	2	6	7	1	0
Average % germination	91	94	93	87	88	94	86	90	92	85
Lowest % germination	0	79	65	82	34	0	33	27	60	66
Spring wheat—										
Number of samples tested	506	24	18	6	61	22	100	202	66	7
Number germinating :										
From 90 to 100%	443	20	14	6	43	22	96	176	60	6
From 75 to 89 %	46	4	4	0	10	0	2	20	6	0
From 63 to 74 %	12	0	0	0	5	0	2	4	0	1
Below 63 %	5	0	0	0	3	0	0	2	0	0
Average % germination	96	95	93	99½	90	97	97	95	96	97
Lowest % germination	42	76	75	99	42	91	74	43	83	65
Fall wheat—										
Number of samples tested						29				
Number germinating :										
From 90 to 100%						28				
From 75 to 89 %						1				
From 63 to 74 %						0				
Below 63 %						0				
Average % germination						98				
Lowest % germination						79				
Flax—										
Number of samples tested	144						48	90	6	
Number germinating :										
From 90 to 100%	83						18	62	3	
From 75 to 89 %	39						20	17	2	
From 63 to 74 %	11						5	5	1	
Below 63 %	11						5	6	0	
Average % germination	86						82	88	88	
Lowest % germination	11						11	16	69	

ENSILAGE CORN.

According to the Census returns, 243,491 acres were planted to corn for ensilage in the province of Ontario in the spring of 1911. About 40,000 acres are annually devoted to the crop in Quebec, mostly in the Eastern Townships, and it is being grown to a limited extent in some of the other provinces. The amount and quality of the ensilage produced is largely dependent on the variety or strain of corn planted and the vitality of the seed. In most districts early maturing varieties and strains are required in order that the corn may mature sufficiently to make sweet ensilage of high feeding

value. Failure to secure suitable varieties is the most frequent cause of sour, poor quality ensilage. In many cases, though the use of seed weak in vitality, disappointing yields are obtained, or replanting, resulting in a late and uneven crop, is necessary. It is therefore important that only the most suitable varieties be used and that all seed be of strong vitality.

For this inquiry the seed inspectors were instructed to procure from farmers samples of corn being planted for ensilage, and to secure information in regard to the variety; where the seed was procured, whether from dealers, direct from the grower, or home grown; if purchased, whether on the ear or shelled; the area planted and whether in hills or drills. About 1,900 lots of seed were reported and nearly 1,700 samples collected. The reports cover about 11,000 acres planted in the spring of 1914. In many cases reports were not accompanied by samples or were not made out in all the details. This accounts for the number of lots reported under different headings not being uniform. Several samples were lost through the bags being broken in the mail.

For the purpose of comparing conditions in different localities with approximately similar climates, Ontario has been divided into four districts as follows:—

District No. 1.—Counties south of Huron, Perth, Waterloo, Wellington and Halton.

District No. 2.—Counties of Huron, Perth, Waterloo, Wellington and Halton, and north and east to and including the counties of Simcoe, Ontario, Durham, Northumberland and Prince Edward.

District No. 3.—Countries north and east of Simcoe, Ontario, Durham, Northumberland and Prince Edward, except New Ontario.

District No. 4.—Rainy River District in New Ontario.

SOURCES OF SUPPLY.

The reports indicate whether the seed was secured from local or wholesale dealers, direct from the grower, or homegrown. As may be noted from the table below, except in District 1 of Ontario very few farmers grow their own seed corn. A large proportion of the seed is secured through dealers. Only a very small percentage of this is Ontario grown corn shipped on the ear. It is nearly all shelled and much of it is imported from the central and western states. A great deal of the imported seed is of late varieties and strains not suitable to Canadian conditions. During recent years the practice of purchasing seed corn of known varieties direct from growers in southwestern Ontario has been adopted by some of the best ensilage growers. This method is now being followed by quite a number of agricultural societies and farmers' clubs. Most of the growers ship their seed corn on the ear and as a rule it is much better, both in suitability for local conditions and germination, than the shelled corn handled by local dealers.

The following table indicates the number and proportion of lots in each district secured from the different sources.

	Total.	Ontario.				Quebec.
		District 1.	District 2.	District 3.	District 4	
Number lots reported	1,900	190	675	838	10	187
Dealers { number	1,543	97	573	708	6	159
Dealers { per cent	81	51	85	84½	60	85
Growers { number	285	35	92	127	3	28
Growers { per cent	15	18	14	15⅛	30	15
Home grown { number	72	58	10	3	1	.....
Home grown { per cent	4	31	1	⅓	10	.....

SEED ON THE EAR AND SHELLED.

Although purchasing seed corn on the ear has many advantages, only one-quarter of the lots reported were procured in this way. The quality can be much more accurately determined. Before shelling, the poor ears can be discarded and the butts and tips removed, thus making it possible to secure a more uniform and much better sample. When corn of poor quality is sold for seed it is nearly always shelled, as its inferiority can be less easily detected. Shelled corn may include the butts and tips as well as the off-type ears and nubbins, and it is impossible to remove all of the inferior kernels even by severe grading. Unless corn has been thoroughly dried before shelling it is more liable to heat and lose its vitality than when on the ear. But all seed corn sold shelled is not of poor quality. Some first class seed is put on the market in this way. It may be produced by using only good varieties and well selected ears that have been thoroughly cured and the butts and tips removed before shelling.

It will be seen from the table below under germination that the corn shipped on the ear germinated on an average nearly six per cent more than that which was shelled. The proportion germinating 90 per cent and over was 26 per cent higher. Some of the shelled corn was quite dead. A number of the samples on the ear were also low in germination but in nearly all cases this corn was not planted. The poor quality was apparent from the appearance of the ears and purchasers procured other seed. Had this corn been shelled, the poor quality would not have been so easily detected. Corn on the ear costs more on account of the extra work in handling and the transportation charges, but as a rule the increased cost is many times repaid with the larger yield and superior quality of crop.

The following table indicates the proportions of the lots reported that were purchased on the ear and shelled.

	Total.	Ontario.				Quebec.
		District 1.	District 2.	District 3.	District 4.	
Number lots reported..	1,736	114	627	803	10	182
On Ear { number	441	20	175	214	6	26
On Ear { per cent.....	25	17½	28	27	60	14
Shelled { number	1,295	94	452	589	4	156
Shelled { per cent..	75	82½	72	73	40	86

GERMINATION.

The vitality of corn is liable to be impaired by a great variety of causes. It is very susceptible to frost injury before maturity and requires to be thoroughly dried and stored with good ventilation. Sometimes it is possible to detect injury to vitality from outward appearance but usually this is unreliable. The vitality of seed corn should be determined by a germination test before planting.

Germination tests were made with all the samples collected. In the summary presented below a separation is made of the corn purchased on the ear and that shelled. It will be noted that the total number of samples tested is considerably higher than the total of the lots shelled and on the ear. This is accounted for by the fact that

with a considerable number of the samples no information was given in regard to whether the seed was shelled or on the ear and also that the homegrown seed was not considered except in the total.

	Total.	Shelled.	On Ear.
Number of samples tested	1,694	1,164	339
Average per cent germination	86·8	85·6	91·1
Lowest per cent germination	0	0	10·0
Samples germinating from 90% to 100% — number	892	539	245
Samples germinating from 90% to 100% — per cent	52·7	46·3	72·3
From 80% to 89% — number	485	379	58
From 80% to 89% — per cent	28·6	32·6	17·1
From 60% to 79% — number	251	202	24
From 60% to 79% — per cent	14·8	17·4	7·1
Below 60% — number	66	44	12
Below 60% — per cent	3·9	3·8	3·5

PLANTING IN HILLS AND DRILLS.

Many of the best corn growers prefer to plant in hills. They claim that this method produces a larger yield of grain in proportion to stalk and leaf and facilitates thorough cultivation and the suppression of weeds. The following table indicates the extent to which each method was followed with the lots reported. It will be noted that about three-fourths of the farmers visited follow the drill method.

	Total.	Ontario.				Quebec.
		District 1.	District 2.	District 3.	District 4.	
Number lots reported	1,458	148	470	715	11	114
Drills — number	1,085	94	314	561	8	108
Drills — per cent	74	64	67	79	73	95
Hills — number	373	54	156	154	3	6
Hills — per cent	26	36	33	21	27	5

VARIETIES.

Many unsatisfactory crops of ensilage corn are the result of using late or otherwise unsuitable varieties. For conditions in Canada the varieties recommended are limited to four or five Dents and not more than this number of Flints, but the lots reported by the inspectors represent about sixty so-called varieties, many of them decidedly inferior. The best standard varieties are widely grown, including the most promising Dents which have been recently introduced, but some of those which appear to be quite popular would better be replaced. Not only are many growers using named varieties unsuited to their conditions, but a great deal of corn is planted the variety of which is not known. Some ordinary feed corn imported from the southern and central states is used for seed. This corn is almost always of a large late variety, entirely unsuitable to Canadian conditions, and often the vitality is weakened through heating.

The following table contains a list of the varieties which were reported more than five times. It will be noted that the total is considerably higher than the number of lots reported under other headings. This is because in many cases two and sometimes more varieties were being used by one farmer.

Varieties.	Total.	Ontario.				Quebec.
		Dist. 1.	Dist. 2.	Dist. 3.	Dist. 4.	
Number varieties reported	2,336	219	866	1,090	13	198
White Cap Yellow Dent	560	77	212	254	.....	17
Leaming	487	43	186	226	.....	32
Longfellow	288	8	64	155	4	57
Compton's Early	217	5	93	107	.....	12
Wisconsin No. 7	204	27	113	53	1	10
Mammoth Southern Sweet	156	14	39	96	.....	7
Salzer's North Dakota	121	3	32	80	5	1
Red Cob	59	.....	2	30	.....	27
King Philip	43	.....	15	27	.....	1
Bailey	32	4	28	.....	.....	.....
White Sanford	18	.....	1	.....	.....	17
Eight-rowed Yellow	17	.....	2	15	.....	.....
Stowell's Evergreen	17	4	9	3	.....	1
Cloud's Early Yellow	15	4	8	2	.....	1
Sweet Ensilage	13	.....	13	.....	.....	.....
Golden Glow	10	.....	3	4	2	1
Huron Dent	9	5	3	.....	.....	1
Smut Nose	7	.....	3	4	.....	.....
Iowa Gold Mine	6	.....	5	1	.....	.....
Pride of North	6	1	4	.....	.....	1
Angel of Midnight	6	.....	1	5	.....	.....
Mammoth Cuban	6	.....	2	4	.....	.....
Miscellaneous and mixed	89	24	28	24	1	12

SUMMARY AND CONCLUSIONS.

The quality of the grain grown and used for seed on the average farm in all the provinces is rather inferior to the ideals expressed in resolutions sometimes adopted by farmers' organizations and addressed to Ministers of Agriculture, praying for legislation to prevent the sale of impure seed.

Although the average quality of seed grain in all the provinces is much inferior to that used by the most successful farmers, there is evidence of improvement in the last ten years.

Field crop competitions, seed fairs and provincial seed exhibitions have been influential in improving the quality of seed grain used in all the provinces. Twenty-five per cent of the farmers visited purchased their seed from their neighbours or from dealers. The seed so purchased may commonly be traced back to a prize-winning field in a field crop competition, the seed grain from which had been sold at a local seed fair. Competitors in these field crop competitions obtain pure seed from growers of registered seed whose foundation stock, as a rule, is the result of careful breeding and selection at an experiment station. The Marquis wheat and O. A. C. No. 21 barley are notable illustrations of improved varieties now widely disseminated.

Forty per cent of the farmers visited did not know the variety of their wheat, oats or barley. The best variety for any locality is second in importance only to the best seed of that variety. A suitable variety is important in any crop but particularly so with ensilage corn. Unfortunately there are too many varieties, particularly of oats.

The conditions in respect to the poor cleaning which seed grain receives and the numbers of weed seeds which are returned to the land are most unfortunate and must result in enormously reducing the yield and in lowering the quality of the crops. In many cases the equipment which farmers have at their disposal is not efficient for cleaning seed grain. Few fanning-mills are properly equipped with riddles and screens for seed cleaning and often the sieves and other equipment in farmers' barns are badly in need of repair. There is also room for the exercise of greater skill in the use of the cleaning equipment now available.

Crop failure due to the unwitting use of seed of low vitality is comparatively rare. It was quite common ten years ago, especially with ensilage corn in eastern Canada and with oats and barley in the Prairie Provinces and Quebec. Although more precautions are taken than formerly, the vitality was low in a considerable proportion of the sample collected. With oats, barley and corn it is impossible accurately to estimate by appearance the extent to which the vitality may have been injured through frost and other causes. Many poor crops could be prevented by submitting the seed to a germination test.

The control of smut in cereal crops, particularly in wheat, is well understood and widely practised in Prairie Provinces. In the eastern provinces very little seed grain is treated and smut causes serious preventable loss, especially in the oat crop.

The Seed Control Act has prevented misrepresentation in the sale of seed grain. It has not created and can not create a reasonably clean supply suitable for seed. Some good seed is made available by seedsmen, but the great bulk of the grain purchased in commerce and used for seed is of the standard commercial grades, the cleanest of which may contain up to 150 noxious weed seeds per pound. In grading and handling Western grain no provision is made for keeping that which is clean separate from that which is badly contaminated with weed seeds with the result that practically none of the grain which passes through the terminal elevators is fit for seed.

It is impossible effectively to remedy by legislation the conditions shown to exist by this inquiry. Making and enforcing laws respecting the sale of seed and control of weeds may contribute materially toward the desired end, but success by these agencies will be only partial and always dependent upon educational work and the extent to which the means for securing and preparing good seed are available to and made use of by farmers.