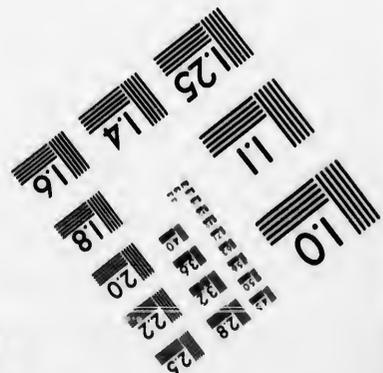
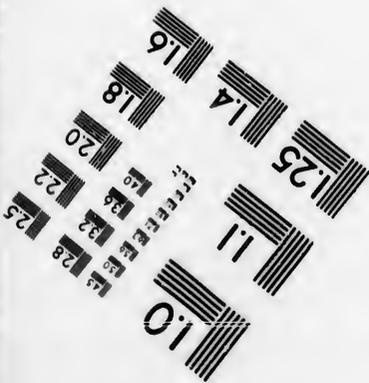
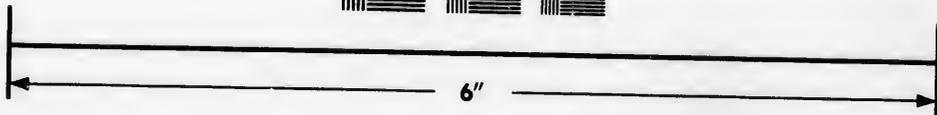
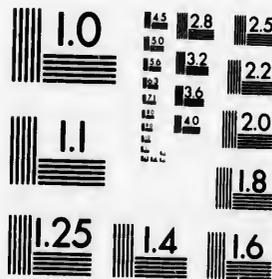


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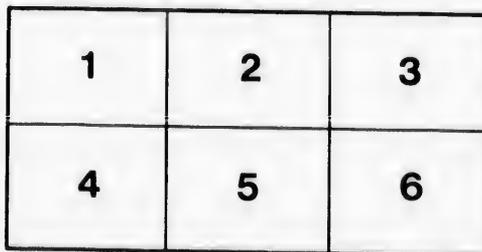
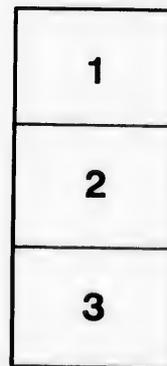
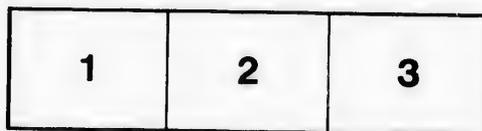
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James Fletcher.

EVIDENCE OF MR. JAMES FLETCHER
ENTOMOLOGIST AND BOTANIST
BEFORE THE
SELECT STANDING COMMITTEE OF THE HOUSE OF COMMONS
ON
AGRICULTURE AND COLONIZATION
Session of 1893

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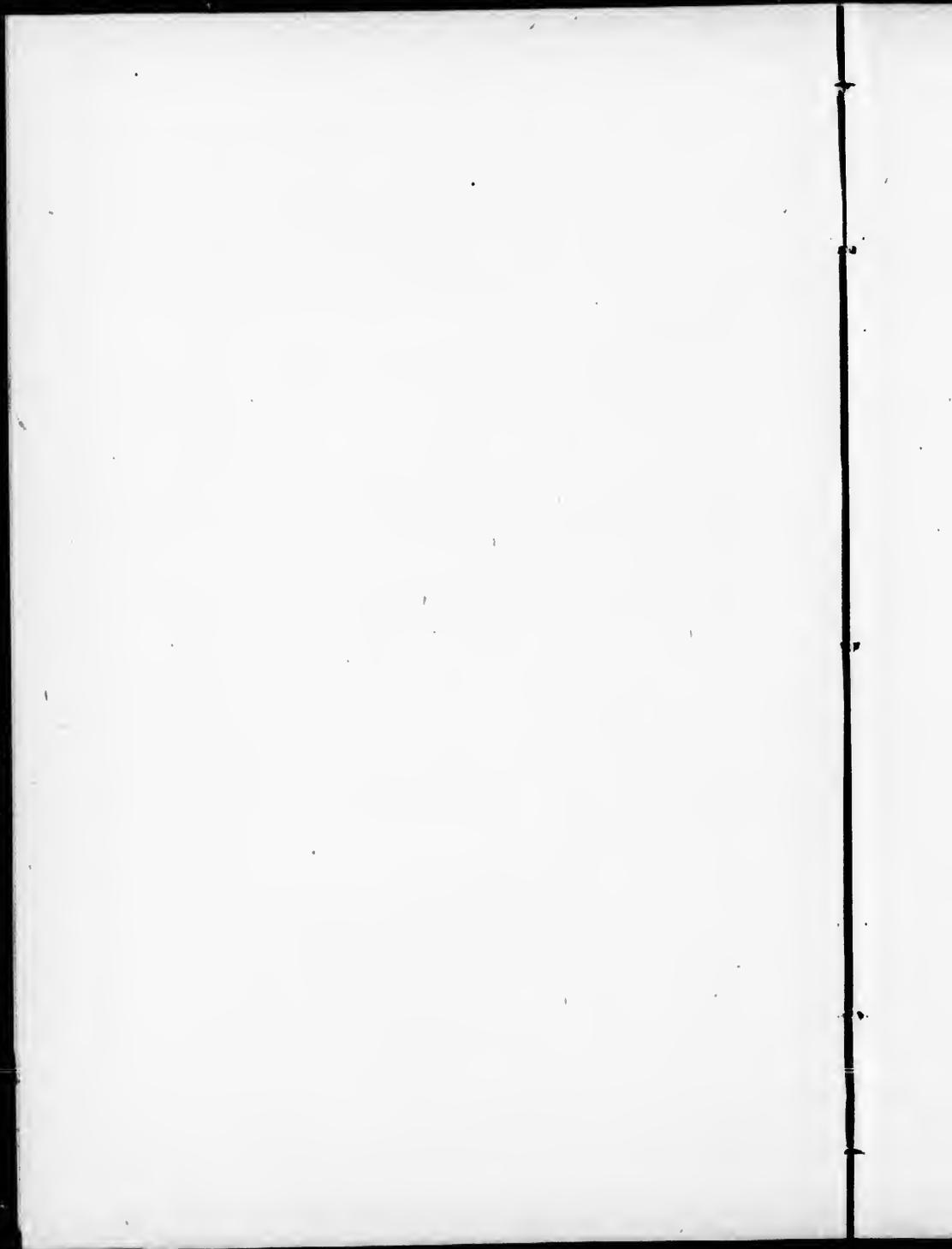
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The Select Standing Committee on Agriculture and Colonization met this day at 10.30 a.m., Dr. Sproule, chairman, presiding.

The CHAIRMAN:—Mr. Fletcher, the entomologist and botanist of the experimental farms is before us this morning to give us information as to what is being done in his department. The question was raised at the last meeting about grasses. Mr. Fletcher has some specimens with him here. Perhaps it will be well to dispose of that subject before he makes a statement.

Mr. FLETCHER:—Mr. Chairman and Gentlemen: I am very glad of this opportunity to again appear before the Committee on Agriculture, as I believe it affords me an excellent opportunity of getting into touch and into correspondence with farmers throughout the country, through their representatives in Parliament, who come to Ottawa annually, and then are able to advise their constituents where to apply to for help whenever outbreaks of agricultural pests occur, and also to let them know of the work which is being done here. In attending meetings of Farmers' Institutes in different parts of the country, we find that, although the Dominion experimental farms are being carried on at large expense, for the benefit of the farmers, many are entirely ignorant, and others know very little indeed, of the nature of the work we are doing.

When, however, we can get farmers to visit the experimental farms, as a rule, they are satisfied with what is being done, and that what we are doing is for their benefit. They then take an interest in the work, which helps it very much. We often get suggestions from practical men as to important and useful lines of work, and we are always glad to receive suggestions from them.

FODDER GRASSES.

Without further introduction, sir, I shall now go straight to my subject, and shall, first of all, direct your attention to the subject of grasses, as I understand some gentlemen who are anxious to leave to catch the train, are desirous of hearing something about these important plants. First, with regard to the fodder grasses which are being grown at the farm, I will make the bare statement, which may surprise some of the members of the committee, that we have here at our Central Experimental Farm at Ottawa, the best grass garden in North America. This is acknowledged to be the case by specialists who have taken up this work. I need not waste time, sir, in explaining to the committee how important a place grass crops hold among farm crops, nor to the fact that we should pay great attention to this subject in our experimental work. The dairy industry is now being developed to such an extent in all parts of Canada, and has become of such magnitude, that it is necessary for all scientific agriculturists to do what they can to help on so important an industry, an industry which, I think, has been developed more during the last ten years than ever before. This being the case, the discovery of the best and cheapest foods for cattle becomes a matter of great moment; therefore, the necessity is shown of finding out as soon as possible the most suitable varieties of grass to grow in different districts and the best way to cultivate them.

We know now the great advantage to farmers of growing corn and feeding it as ensilage. In many districts, however, corn cannot be grown to advantage, and it is therefore desirable to pay more attention to the growth of grasses. In prosecuting this part of the work at the experimental farm, I have endeavoured to test all the different kinds of grasses that were available. Seeds were procured of all the varieties mentioned in seedmen's catalogues on this continent and in Europe, besides a few from India. These have all been tested. Moreover, whenever possible, I have

collected or obtained from our own mountains, prairies and fields, the wild grasses of Canada. These have been grown carefully, and from them we have got some very satisfactory results. What led to this critical study of our native grasses was the conviction that many of the grasses imported from Europe and put into the expensive permanent pasture mixtures, which are offered for sale, are quite unsuited for cultivation in the Dominion. A very large percentage of these mixtures is made up of one particular kind of grass which in this part of Canada, at any rate, is utterly useless. That is the Perennial Rye grass. For this part of the Dominion the sooner we get rid of this grass the better, because it nearly always dies out the very first winter. It seems at first sight surprising that seedsmen here should supply and our farmers grow this grass; but it is the one chiefly supplied to them. Seedsmen would by far prefer to sell to their customers what would satisfy, but they cannot get anything better, because the demand for other grasses has not yet been sufficient to create the supply. Directly we can show that Perennial Rye and some other grasses are unsuited to our requirements, something else and something better will be found to take their place.

VALUABLE NATIVE GRASSES.

I think we shall find among our native grasses some kinds better suited to our requirements than many we now get from Europe, because they will be better suited to the climate, which is a very important matter. By this, I do not refer to the intensity of cold only, for few native plants are affected by the severity of the cold, if at all. In the majority of cases it is of little importance to plants covered with snow, whether the temperature in winter is 100 below or at zero. With introduced exotics, however, this is not the case, and the peach tree is a notable example. It is generally believed that, if the thermometer drops to 15° below zero in the peach-growing districts, the peach trees are seriously injured.

With regard to the grasses imported from Europe, we know now that our climate is far less suited to their cultivation than to that of the native grasses. We have, too, among our 300 kinds of native grasses some from which we have obtained very good results. I am sorry that I could not bring a better collection with me; than that which I have to-day. Most of my specimens have been sent to Chicago to the World's Fair Exhibit. I have here with me, however, a few which I think will be of interest to the members of the committee. Here is a grass which seems to me to possess all the requirements of a good hay grass. It is very leafy from the bottom to the top, and although the seed does not form a large portion of the grass, a large quantity of seed is produced, because it is exceedingly small. It is the Wood Drop-seed grass (*Muhlenbergia sylvatica*) [Fig. 1]. That grass sown in the early spring will produce hay the first year in August. The spring grasses are gone by that time, and the aftermath is not ready, so that an abundance of green food in August is a very valuable adjunct to the farmers' fodder supply. There are three of these grasses which are extremely hardy and indigenous to Canada, and will grow from the Atlantic to the Pacific. The seed of the first one, which I have shown to the committee, I got in the woods near Ottawa. I have also received seeds of the others from Brandon and Indian Head.



W. L. D. S. S. S.
FIG. 1.—WOOD DROP-SEED GRASS.

(*Muhlenbergia sylvatica*.)

By Mr. Carpenter:

Q. Have you tested its feeding qualities? Do the animals like it?—A. Yes, the animals like it very much. Here are specimens of two other grasses of the same family, which are probably of equal quality with the first one. This is called the Satin Grass (*Muhlenbergia Mexicana*.)

By Mr. Hughes:

Q. Will you give us the name of the first one?—A. It has not an English name. It is named *Muhlenbergia* after a German botanist. The species is called *sylvatica*, and it may be called Wood Drop-seed grass.

By Mr. Carpenter:

Q. How does it winter? Does it heave with the frost?—A. Not at all. It grows on the top of the ground and spreads out its roots like a bird's claws on the surface.

By Mr. McMillan (Huron):

Q. Does it form bunches or does it grow in a heavy mass?—A. It forms a solid mass of fodder.

Q. Where does it grow?—A. On rather low land or in woods in a state of nature; but I have it growing on well drained soil.

Q. I suppose where you tested it, the soil was pretty well manured?—A. Not particularly well; but it is good land.

By Mr. Semple:

Q. Is there any danger of not being able to remove it at all, if it is introduced?—A. No, sir. The peculiar habit of growth on the top of the soil allows of its easy removal when necessary.

By Mr. McDonald (Huron):

Q. Does it always grow as high as the sample we have here?—A. I have only grown it for two years and on both occasions it attained that height. The other two grasses of the same family do not grow so high, Satin Grass and Wild Timothy, both of which have been grown and the fodder is of great value. Wild Timothy (*M. glomerata*) was first brought to notice in Iowa about ten years ago. The botanist at the Government Experimental Farm in that state found that the livery stable keepers went out on the prairies and cut this grass in preference to any other. On analysing and examining it, he found it an exceedingly valuable grass. It does not produce such a heavy crop as Timothy but its nutritive qualities are very high, and I think it will be a very valuable grass for this country in districts where Timothy will not grow well.

By Mr. Hughes :

Q. When do these grasses ripen?—A. They flower in August, and are ready for cutting then, but of course they take a longer time to ripen their seeds. The next of the native grasses to which I will call the attention of the committee, are two common ones that grow all through Canada. These are the Canadian and the Northern Blue Joint which grow in wet land. [Figures 2 and 3.] They are often called Beaver Hay. I found last year that both in good and poor soil they did very well indeed. For one or two years they will succeed very well on dry land. In my last year's report I called attention to them at some length. During the past season they attracted the attention of many visitors. They make capital hay. But public opinion is not ripe yet to accept hay made of native grasses, at its proper value. It is called "wild hay," and such will not sell. If a load of "wild hay" goes on the market, the price offered for it is far less than that which can be readily obtained for hay made from old over-ripe Timothy which is really worth far less.



FIG. 2.—SPIKE, of *M. glomerata*.



FIG. 3.—CANADIAN BLUE-JOINT. (*Deyeuxia Canadensis*.)

STAGE AT WHICH TO CUT GRASS.

This is one of the points of ignorance on the part of our farmers upon which we hope to enlighten them, for they lose money in buying Timothy, when, perhaps wild hay can be more readily obtained, and it is far more valuable than Timothy left uncut, as is frequently the case, until the seed is almost ripe. The proper time to cut all grasses for hay is soon after the flowering stage. As soon as the seed is formed, the nutritious principles are transferred from the stems to the seed, and if Timothy or other hay is left standing too long, when cut and dried the seed drops out and the good constituents are gone, leaving nothing but dry weedy stems. The excellent qualities of well made Timothy hay are well known, and this gives a special value to all Timothy; it pays farmers to grow it because they can always get a ready market for it. They can sell almost a worthless over-ripe Timothy when other good hay will not sell at all. Timothy is popular and is convenient to handle. The hay is easily handled. You know always pretty well what the weight of the crop will be, and what it will sell for; again, the seed is easily handled, and always meets with a ready sale; for this reason it will always be a paying grass for farmers to grow, but at the same time some of those other native grasses when better known are going to pay farmers well too. There is another grass that grows in wet land, the Reed Canary Grass (*Phalaris arundinacea*). [Fig. 4.] It belongs to the same family as the Canary seed (*Phalaris Canariensis*). This on the 3rd of June was nine inches higher than Spring Rye, and the crop was much heavier. It was also a much more succulent grass, and a better spring fodder grass for that season. The seed is not easily obtainable yet in the market, but it will be in time as the demand increases. We cut twice and got good crops both times.



FIG. 4.—REED CANARY GRASS. (*Phalaris arundinacea*.)

A VALUABLE EUROPEAN GRASS.



FIG. 5.—ARMLESS BROME GRASS,
(*Bromus inermis*.)

I will now draw your attention to a European grass. Of all the imported grasses this is undoubtedly the most valuable one we have ever imported. It is called the Armless Brome grass (*Bromus inermis*, Fig. 5). It was imported five or six years ago from Germany. We are now getting enough to distribute small quantities all over Canada. Some of our seedsmen are also now supplying it to customers. It grows a heavy crop, four feet high, is succulent very early in the spring and has a heavy aftermath. It is the one grass above all others reported upon favourably and uniformly, from the North-west Territories. I sent out last spring, by mail, over 2,000 small packets of seed grasses for testing and it was spoken of most highly by every person who sent in a report. These reports show that it is of value in the West and the experience of it in Ontario, Quebec and in the Maritime Provinces is no less favourable. It is an extremely heavy and uniform cropper. It is also succulent and palatable, as stock eat it readily; further, the chemical analysis shows that its ratio of useful constituents is well above the average. It has grown best on low rich land, but has done well in the West on dry land. It belongs to the same family as Chess grass, of which I have specimens here.

— FALL WHEAT AND CHESS, NOT-HOMOGENEOUS.—

I will first mention briefly that I have been carrying out during the last two years some experiments to try to convince farmers that chess has no connection whatever with fall wheat. It is a good grass and is now largely grown as fodder in Washington and Oregon States, it produces heavy rich hay and has a special value from the fact that it will grow in alkaline soil where timothy will not succeed. One of the peculiar ideas is that chess is a bastard grain, that it is a cross between wheat and some other grains and therefore will not produce seed at all. The fact that it is now grown so largely in Washington State shows that it will grow from seed. I have myself had it growing from the seed year after year for six years. There are however circumstances occasionally which make it difficult for farmers to understand that it has nothing to do with fall wheat. The circumstances are that it is most often found growing amongst fall wheat; but this only means that it is a grass of the same nature as fall wheat, and to flower the next spring it must be sown in the autumn, and moreover, fall rye and fall wheat are almost the only crops we treat in this manner. Again, there are one or two instances on record in which a head of chess has been alleged to have been found growing out of an ear of wheat. These are, however, all mistakes. There was one well known instance, of which a figure appeared some years ago in the *Farmers' Advocate* of London where the ear of wheat had a head of chess apparently growing from the base. It was found that the wheat head held a head of chess mechanically by means of the scales of chaff which had been broken off its own stem in picking it. This was submitted to Professor Saunders years ago and he would not touch it alone. He said: "I won't touch it because some one would say I have made a mistake about it." Having gathered together two or three witnesses, the wheat head was bent sideways a little and the chess head dropped out. There was no connection whatever between the two. It was plainly shown that it was a mistake. Very frequently the two plants are claimed to grow together from the same root. The fine roots of grasses

frequently grow so closely together, that it is difficult to separate them. I am frequently told by people that they have actually found the two growing together on the same root but I always say "I don't doubt your word at all; but bring along your specimens and we will examine them together." I have had three of these brought to me, and although to the botanist, of course, the idea is utterly absurd, that they can be joined together, to the ordinary observer that is not the case. By washing out the roots in water, in every instance the plants separated easily; with plants having a great many fibrous roots, such as grasses of all kinds, including both fall wheat and chess, they will undoubtedly grow together; and the roots will intertwine, but there is no closer relation whatever between the chess and fall wheat.

Now the only importance of this question is this; a great deal of time is frequently wasted at Farmers' Institute meetings discussing this question, and I will just mention this for the benefit of the gentlemen present, that if you ever find the interest in farmers meetings lagging and the people in attendance getting tired, you can pull them together in just about five seconds by standing up and saying fall wheat has nothing to do with chess—they will jump up immediately all over the meeting, and you will have no more lack of interest for that session at any rate: each will want to give his experiences. I have tried it and know the remarkable interest that is taken in the matter. This is the trouble. Many think that it is a very important question. I think it is one of no importance whatever, and they are wasting time over a thing they cannot settle by discussion, but can very easily by experiment. Let me tell you, Mr. Chairman, how I tried to settle it.

One of my correspondents, through a member of parliament, wrote to me and asked me to try to solve the problem. I said I would try any experiment he would suggest. We wrote several letters to each other on the subject and finally I said: "I will send you the seed of fall wheat and chess and you can do anything you like to them. I will do anything you suggest and we will see if we can either turn chess into fall wheat or fall wheat into chess. Finally we each took 100 grains of chess and 100 of fall wheat. I took a witness and planted them myself and put a picket in with each grain. They were all sown last autumn and came up before winter set in. They did not look much alike the first autumn, but the next spring they looked so much alike I could hardly tell them apart when they began to grow. The fall wheat as I have said was planted in the autumn and came up the same season, the next spring before the snow went off and when the thermometer was below zero, I uncovered half of the bed. After the snow melted, water lay for three weeks in the lower part of the bed. Some of the fall wheat was drowned out, but very little of the chess was injured. It is claimed by the advocates of the transmutation theory, that "freezing out" or "drowning out" will turn fall wheat to chess. Another contention is that "trampling" or "eating off" by stock will have the same result; therefore to give all the adverse circumstances possible, early in the spring I walked over the ground—I weigh more than 200 pounds, which I thought sufficient for the experiment, I threw all my weight on to the poor fall wheat seedlings and stamped them down into the ground as far as I could and left them so. Directly they began to grow I took a pair of scissors and cut off the tops of half the plants right to the ground. The result was that every seed of chess sown produced chess, and every grain of fall wheat which grew produced fall wheat. My friend said he could not quite understand it, and is going to try it again; but he will certainly get the same results. Now I think that this experiment was important for this reason. We had more than 3,000 farmers who came to the farm last year, and although some of them refused to acknowledge that they were convinced, many others were, and a few of the most positive have acknowledged they were wrong. If we can get only a few of these men believe it, it is going to do some good, for they will convince others, and there is more time wasted over this useless question than almost any other which comes before our farmers to-day.

NATIVE LAWN GRASSES—IMPOSITION BY DEALERS.

Another experiment that was tried with regard to grasses was in connection with the unnecessary waste which comes from importing seeds of grasses for lawns. All through our farming districts, farmers and others want a little piece of lawn

about their houses. A farmer generally goes to town and buys 50 cents' worth of some lawn mixture, gives it to his wife or daughters, and says to them: "Attend to it as you like." Now, as a rule, this lawn is a nuisance to them. Unless a lawn is properly cared for, a farmer might just as well, or better, do without it, for a badly kept lawn is not an ornament to a house. To one who knows what a good lawn is, and that our wild June grass, which grows wild by every roadside, is the very best variety for a lawn, the question naturally presents itself: Why should they spend 50 cents for a thing that they can get far better for themselves along the sides of the roads at the end of June? Why, as a man is coming from church, he could pick enough seed to enable him to sow a splendid lawn. Careful experiments were tried last year to see which were the best grasses for lawns, at Ottawa. We procured all the grasses advertised as lawn grasses, and several of the mixtures, for the purpose of testing them. Different grasses vary just as much in colour as they do in appearance.

A feature of much importance in a lawn is that it should be of a bright and uniform colour. In order to demonstrate the unadvisability of having several varieties mixed together in a lawn, I chose some varieties which differed most in colour, and sowed the seed so as to form a grass Mosaic, in the pattern of the Union

Jack. First the St. George's Cross was sown with the Hard Fescue, which is a deep blue green. Across this was now sown St. Andrew's cross of the yellowish green Sheep's Fescue. Both of these have hair-like leaves, and are very much in use on lawns. They are not very suitable, however, because in the hot weather they turn to a dull colour. Then there were left eight triangular patches between the limbs of those crosses, and I was able to separate eight grasses of distinct colours, which could be told easily by sight. The seeds took well and the figure was very conspicuous; it attracted much attention. When I asked visitors which grass had the best appearance for a lawn, in every instance they pointed to one grass, and that one is the one I have mentioned, our wild June grass (*Poa pratensis*, fig. 6), which sometimes we call Kentucky Blue Grass (when we want to pay a high price for it). The "Spear grass," or "June grass," of Canadians, and the "Kentucky blue grass," are identically the same thing. Lately I have learned that this seed is being shipped from western Ontario to Kentucky, whence we shall probably buy some of it back again at two or three times the price. Our June grass is not only one of the best pasture grasses of the country, but absolutely the best lawn grass nearly all over the world; it is certainly so in Great Britain and the north of Europe. It is indigenous to our country, and grows from



FIG. 6.—JUNE GRASS.
(*Poa pratensis*.)

the Arctic regions to Texas, so that any one who wants a good lawn can easily get the best seed for \$1.25 or \$1.50 a bushel.

It should be sown at the rate of three bushels or more to the acre, and with that quantity there should be put in two quarts of white clover seed. This will give about the best lawn mixture that can be made. When we go to the seedsmen and get one of their lawn mixtures, we get ten, twelve or fourteen kinds of grasses. These only swell the price, and are a great disadvantage. As soon as you get rid of all the varieties but June grass, you are going to have a good lawn, but not till then.

AN ECONOMIC MIXTURE OF GRASSES.



FIG. 7.—RED TOP.
(*Agrostis vulgaris*.)

Blue Grass for dry land, and would
Red, a little Alsike and White Clover
in mixtures.

Grasses are required for different aspects. Sometimes a man may have a moist farm and want the best grass for such a farm to mix with his timothy. The best that he can get is, I think, Red Top (*Agrostis vulgaris*, Fig. 7). If he has a dry farm he should mix June grass with his timothy. This gives him a good stocky bottom. Red Top is better for lowlands than uplands. It is a well-known perennial native grass, which grows in wet bottom lands and flowers about the same time as timothy. It gives from one to two tons of hay to the acre, soft and of good quality. Red Top will grow well on marsh land, too wet for some of the better varieties, and forms a thick matted sward, which prevents the feet of cattle from poaching. It is generally considered a good grass in this country, but in England is lightly esteemed. It is just possible that the grass they have there under the name of *Agrostis vulgaris* may have decidedly different characteristics from ours.

By Mr. Carpenter :

Q. I suppose you recommend Kentucky Blue Grass as the best for permanent pasture?—

A. I do for the basis of it. I think you might also grow with it Meadow Fescue, which is an exceedingly valuable grass. I would suggest Meadow Fescue, Orchard grass and Kentucky put in all the three clovers, that is, Mammoth Red, a little Alsike and White Clover and some Lucerne, which has succeeded well in mixtures.

By Mr. Roome:

Q. Would they mature so as to make good hay?—A. They matured sufficiently near enough to one another to make good hay.

By Mr. Carpenter:

Q. The clovers with us won't remain in the ground more than two years?—A. I suppose so. Most of the clovers are biennials. If you can grow Kentucky Blue Grass, I do not think there is a better grass in the world for pasture. It grows spontaneously all through Canada, but seems to be very little thought of. I think that this may be so for this reason. It flowers in June and gives a small crop of hay; but it is not hay that you want from it, it is pasture. After flowering it sends out runners all through the soil and makes a thick mat of tender leaves. On rock pastures the Canadian Blue grass or Wire grass (*Poa compressa*, fig. 8) makes an extremely rich, heavy hay, which is of high nutritive value. Very closely allied to the Arrowless Brome grass (fig. 5) which I passed around, is the Rocky Mountain Brome grass, which is finer, in the sense of being a thinner and more slender grass. It

is not such a heavy yielder nor so valuable. It is one of our native grasses and grows naturally over a wide area in the North-west. Here is another grass which is called White Top, White Bent or Water Grass; it is sometimes used for seeding down wet pastures. It is, however, too small for a pasture grass and even for lawns. It is of rather too thin a texture to be of great value; the leaves are all small and of a pale yellow, and it dries up very easily unless well supplied with water.

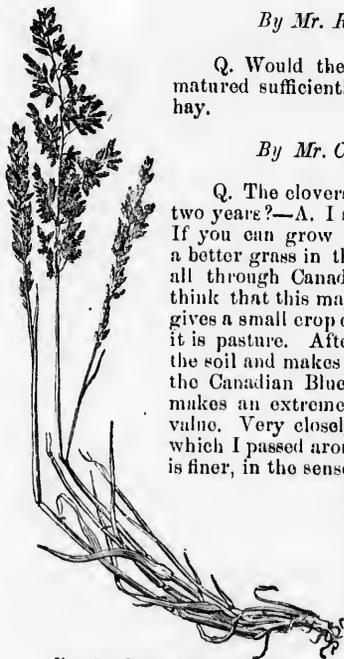


FIG. 8.—CANADA BLUE GRASS.
(*Poa compressa*.)

WESTERN QUACK GRASS AND RYE GRASS AS FODDERS.

The grass to which I will now call your attention is a western form of what farmers here know very well as Quack grass. It is claimed to be par excellence the very best grass which grows for hay. This opinion is also endorsed by Dr. George Vasey, the eminent botanist of the Department of Agriculture at Washington, and it is supported by the best of all evidence, chemical analysis. It is, however, a very close relative of Quack grass, and as such must be introduced into cultivation with the greatest caution. If you examine the specimen sent round you will observe how closely it resembles Quack grass in appearance. It is, however, a better fodder grass, having finer leaves and more of them. This is the grass that above all others of our native species has been the support of the western cattle ranches. It grows through Manitoba and the North-west, but is wonderfully improved by cultivation. I have, therefore, distributed seed to farmers, even in districts where it grows naturally.

Another valuable grass of the same family is the Western Rye-grass (*Agropyrum tenerum*). This has given excellent results but has not the same running habit of growth, as it forms tufts.

By Mr. Roome:

Q. Is the Western Quack grass doing well here?—A. Yes, upon the experimental farm. Such a grass, however, is not required in this part of Canada, as we have others which will give a heavier crop of hay and will not give so much trouble to eradicate. Some of the Blue-joints will grow on the same land and produce far

more hay. We must not, however, make the mistake about our Eastern Quack grass of supposing that it has no good qualities. It is a nutritious grass and if we find that a field which can be used for pasture, has become overrun by it, we need not take much trouble to eradicate the quack as it will form a useful addition to the pasture mixture; and when the field is broken up, it will not give more trouble than the other grasses.

HOW BEST TO ERADICATE QUACK GRASS.

There is not, as I say, much trouble in getting Quack grass out of land if its habit of growth is observed, for the reason that it does not root deep. As a general thing, when a farmer wants to clean land of Quack grass he ploughs as deeply as he can; but this is the worst thing he can do for it only plants it a little deeper and gives it a better chance. You must plough shallow to destroy Quack grass. Plough shallow in the autumn; harrow or cross-plough in the spring, keep ploughing shallow and the surface rough and you will get Quack grass out of the land without much trouble.

SUMMER PASTURE GRASSES.

By Mr. Hughes :

Q. Are there any grasses or combinations of grasses that would be good for ordinary rolling dry lands in summer months when as a rule our pastures are now very bare? In the July, August and September months there is usually very poor pasture on dry ground. It would be a great advantage could some combination or grass alone, be found giving good pasture results for any seasons.—A. Of course that is the greatest difficulty in the grass problem, and is the contingency which has called forth the use of ensilage. We have found that among the 300 different kinds of native grasses there are some which will grow in dry districts. There are some which grow actually in pure sand. Of these dry land grasses a few occur to me now, Sheep's Fescue is one. The Canada Blue grass, or Wire grass (*Poa compressa*) is a very rich grass; species of *Andropogon* and *Sporobolus* are others. None of these dry land grasses produce a heavy crop of hay; but Sheep's Fescue and Canada Blue grass with a much smaller amount of foliage will give the same amount of nourishment, and the cattle will get fat on them. On the western plains the true Buffalo grass (*Buchloe dactyloides*) does not grow more than two or three inches high, but it is so thick that you can sleep on it like a bed. It is so palatable to stock that drovers bringing their cattle up from the south, find if they strike a patch of this grass, they can hardly drive the cattle off it, till it has been eaten down to the ground. This grass is essentially a dry ground species, and grows in patches from about as big as this room to 30 or 40 feet in diameter. It spreads from a central point as though all had started from one seed originally. Some kinds of Drop seed grasses are also dry land grasses in the west. We have wild Timothy grass in the benches in the west, one of the *Mühlenbergias* already mentioned. By careful cultivation and study of these grasses we shall, I think, discover before long those most suitable for the different soils and districts. Some grasses may be of value for special characteristics, as has been ascertained with regard to the habits of Chess. I have a letter from the botanist of the Oregon station in which he says Chess is there worth \$8 a ton, while Timothy is worth \$10. The hay is thus of almost the same value. It is a rich and heavy grass, and has a special value, from the fact that it will grow on alkaline land where Timothy will not succeed.

By Mr. McMillan :

Q. Have you succeeded with any of these grown in large quantities?—A. This year we are going to have one-eighth of an acre plots. We have had so far plots of one square rod,

By Mr. McMillan (Huron) :

Q. I think it would be well if you went into fields and experiment as a farmer would experiment?—A. Results are checked in this way. We know that around the edges of a plot where you have cultivated you always get a better crop than in the centre. Allowance is made for this in taking our weights. We take that piece off and take the inside, and thus the luxuriance due to the effects of that outside cultivation does not interfere with our calculations. The figures are calculated from the square rod. In the United States, they have usually only a square yard of each kind, and it was in recognition of the fact that you could not get a true estimate from a yard that we adopted the size of a square rod. A rod would be about double the area of this table. I think it gives a large enough patch to test a species thoroughly and to arrive at a fair estimate of its value. The grasses have been kept growing on that same land now for five years. I have had no manure put on it until last spring, when it had a light top dressing of stable manure. Farmers do not, of course, as a rule, keep their land in pasture for that length of time.

DURATION OF HAY CROPPING.

I doubt if there is any part of Canada where hay should be cut more than two years running to obtain the most satisfactory results. Of course, it is done sometimes for convenience as in the case of a pasture near a homestead. In such pastures it is well to manure the land by top-dressing it, so as to keep up the yield.

Passing on from grasses, I will merely mention, *en passant*, that I have been making a special study of weeds and their eradication. There are one, two or three general rules for the eradication of weeds which I think every farmer in the country should know about. There is now, I am glad to see, considerable agitation for an agricultural education in the public schools of Ontario. There is a little book recently published, and although it sells for the small sum of 35 cents, it is worth far more than that to every one who reads it. This little book is the production of Professors Mills and Shaw of the Guelph College, and it is of such a useful character that any one who has any interest at all in agriculture will find it invaluable. This book is worth its weight in gold to farmers for the information they will find in it.

Q. What is it called?—A. The Principles of Agriculture.

THE CHAIRMAN.—It has been adopted by the Education Department for the Ontario public schools.

MR. FLETCHER.—It is a capital little book, and touches briefly many of the practical questions which come in working a farm. It merely touches the essential principles, but a man or boy who will read it, will have his interest awakened, and will wish to know more. It is a splendid little book for this purpose. I think this is a good opportunity of mentioning it, although it might seem to some to be a little out of place.

By Mr. Kaulbach :

Q. Where are they to be had?—A. Any bookseller will get them for you.

POTATO BLIGHT, PATHOLOGY AND REMEDY.

I will now refer to another subject of enormous interest to the whole country. I suppose it is not exaggerating to say that, year in year out, almost fifty per cent of the potatoes grown in the world are destroyed by the disease known as potato-rot, which has now spread to all countries where the potato is grown. It is the same disease which thirty or forty years ago was credited with being the sole cause of the frightful famine and fever in Ireland, which in one year carried off three millions out of eight millions of people. The life history of that disease has been worked out, for potato-rot is a disease, and a clue has been obtained to a remedy. Last year

I stated to the committee that experiments would be made in this direction, and during the last season those experiments were carried out. The results are such as to induce me to state to the committee that there is a remedy for potato-rot and that, if our farmers would try it, though I will not say they will save their whole crop, yet beneficial results, which will more than pay for the applications and the labour, will follow from the treatment which I suggest. Here is a stalk of an ordinary potato, of the variety Holborn's Abundance, a variety which has shown a great immunity from this disease. Of the two plants I hold in my hand, both grew together in the same row. One was treated and the other was not. The first was practically dead for six weeks while the other was well covered with green leaves, simply because it was treated with a solution which can be made without much trouble and at very little expense.

BORDEAUX MIXTURE—HOW TO MAKE AND APPLY IT.

This is known as the Bordeaux mixture and is a mixture of sulphate of copper and lime. I have found so far that the most inconvenient thing for the farmers to get is the fresh lime, and they actually write to me to ascertain where they can get lime. It did not occur to me that there would be a difficulty in this respect. They can get slaked lime without much trouble, but it is very difficult to get unslaked. We have found, however, that if one quarter more of slaked lime is added to the mixture it will do almost as good work as the fresh lime. The mixture is composed of 6 lbs. of sulphate of copper and 4 lbs. of lime added to 45 gallons of water. The sulphate of copper, of course, dissolves, but the lime is merely in suspension, when the whole is mixed together, it is sprayed over the foliage of the potatoes. The result is that the potato keeps the green leaves for six weeks longer when thus treated, than it does without treatment. It means that the potato plant is kept growing all the time, and that the leaves are preserved so much longer to perform their functions of laying up a supply of nourishment in the tubers.

By Mr. Carpenter :

Q. How much of slaked lime do you use?—A. One quarter more than of fresh lime.

Q. Is it mentioned in the committee's report?—A. I believe I referred to it last year. I tried eight different mixtures in all, and the one I have mentioned and which I suggested to the committee last year proved as satisfactory as any other. This is made as follows: Dissolve 6 lbs. of copper sulphate in 10 gallons of water; throw this into a barrel which will hold 45 gallons. In another tub slake 4 lbs. of perfectly fresh lime in 6 gallons of water. When all the lime is slaked, pour it slowly through a strainer into the copper solution; a coarse gunny sack tied over the head of the barrel answers well for this purpose. Afterwards fill the barrel up to the top with water, which will make 45 gallons; stir thoroughly, and all is ready for use. It is best to use powdered copper sulphate.

By Mr. McDonald (Huron) :

Q. How do you apply it?—A. It can be applied with an ordinary watering can supplied with a fine rose, but much more easily and with less expense by means of a spray pump.

By Mr. Dawson :

Q. How often should the plants be sprayed?—A. I think about twice will be, as a rule, sufficient. I tried it last year, beginning the first of August, but I think that was a week too late. I would say that the first spraying here should be done about the last week in July.

By Mr. Roome :

Q. You would recommend it whether the potatoes are affected or not?—A. I would.

By Mr. McDonald (Huron) :

Q. What length of time should elapse between the two sprayings?—A. About a fortnight.

By Mr. Kaulbach :

Q. What would you consider to be the correct time for applying in the Maritime Provinces?—A. In Nova Scotia you are later than we are. I think the rule followed in France is to spray when the potatoes are about a foot high, but I do not think it is safe to lay down a rule. The proper time must be discovered by careful observation in each district.

By Mr. Dawson :

Q. How would it do to spray near the blossoming?—A. It would not be safe to make that a rule, because some varieties may vary much in the time of blossoming, and some do not show any blossoms at all.

By Mr. Carpenter :

Q. Will you suggest any stage of growth for the application?—A. In every locality, farmers know only too well what the rot is, and when it shows itself as rust on the leaves. They can smell it in the fields. I think in Nova Scotia, Col. Blair, our superintendent at the Nappan Farm, told me that it usually appeared towards the end of August. Here at Ottawa it is at the beginning of that month. In Western Ontario, I should think it would probably be the first week in July. I do not think it would be well to delay the first spraying in western Ontario later than the middle of July.

By the Chairman :

Q. Two sprayings would be sufficient?—A. I think so.

Q. At what intervals?—A. At intervals of about two or three weeks.

By Mr. Roome :

Q. You claim the disease is a parasite?—A. Undoubtedly. It is a disease due to a parasitic fungus which lives inside the plant. We sow it ourselves. When we sow the potatoes in the spring, the disease is inside the seed potato as dry rot. The most approved method of planting potatoes now is considered to be to take medium-sized whole potatoes, and not cut them at all. I would recommend the old plan of cutting up larger tubers, and for this reason: when you cut them, you are able to see whether they are affected with the rot or not. If this course be adopted, it will give an opportunity for discarding all such seed potatoes as are found to be diseased. If you plant affected potatoes, it is obvious that you are planting the disease. The parasite grows up inside the stems, and in this locality it shows itself about the first week in August in the shape of little brown patches on the leaves. If you examine them under a microscope, you will see a little mouldy growth, which is none other than the "rust" or summer form of the potato rot. There are now produced little spores or seed-like bodies which are carried from the affected plants to the other plants, so that the disease spreads from plant to plant, and some of the spores are washed down into the ground where, coming in contact with the forming tubers, they germinate upon them and cause the well-known autumn form, the wet-rot.

By Mr. McDonald (King's, P.E.I.) :

Q. In Prince Edward Island we had no rust last year until after the potatoes were taken up; but some of them afterwards rotted badly?—A. Perhaps they were put in the root house or shipped away in a damp state. It is better to leave them out in the open air for a day to get thoroughly dried. The spores from the diseased plants which are washed down into the soil attack the tubers and penetrate their tissues. There they may remain dormant until the next spring and not develop till the potato begins to grow. On the other hand, under favourable conditions of moisture and warmth, rot may appear in the same autumn, either before the potatoes are dug or after they are housed.

By Mr. McLean :

Q. Your remedy would prevent that?—A. Sprayed on the leaves it destroys the spores. In that way, it checks the spread of the disease by preventing its attacking other leaves.

By Mr. McDonald (Huron) :

Q. Supposing the potatoes did not rot until after they were dug, would it prevent the rot if they were washed in that solution?—A. Probably it would, but I do not think it would be necessary if they were dried before they were put away. By leaving them out a day to dry, it would prevent the spores on the outside from growing as they must have moisture and warmth.

By Mr. Cochrane :

Q. If you are satisfied in your mind that you plant these spores and they are developed from the seed planted, did you ever test any operation on the seed?—A. Yes, experiments were tried and it was found that, the spores being inside the potato, they cannot be reached. A patch of dry rot will sometimes extend more than an eighth of an inch into the substance of the potato, but you can see on the outside only a little depression.

By Mr. Roome :

Q. Do you think that the disease will propagate in the potatoes after they are put away?—A. I do.

By Mr. McMillan (Huron) :

Q. What about scattering a little dry lime on them?—A. It is a good plan. It dries them up. If you see that the potatoes are attacked by rust—and you can tell it at once, for you can smell the characteristic odour, at least I can detect it directly, if I go near infested fields,—it is advisable to dry the potatoes at once, and if you cannot market or use them, sprinkle dry lime over them; this is a far better plan than to leave them in the ground where they will surely rot. I will cite an instance of the rapidity with which this disease can spread. About the 10th of August I left Ottawa, and there was a patch of potatoes I was watching in a garden in Stowarton. I intended to have sprayed them, before leaving, but I forgot to bring the pump. I had to go off, and I said to myself: "I suppose they will be all right for a week." I really knew, however, at the time that it was running a great risk. I cheated myself; I should say. I came back and the whole plot was ruined. The disease started just at one little corner. There were just about two infested plants in one corner and the pest had spread from them all over the patch. I told the gardener to dig them, and starting from the end where we had seen the rust in the first place we found there were more rotted tubers there, and the number became less and less till we reached the other end of the patch. In short, by one week's neglect a good crop of potatoes was virtually ruined.

By Mr. Semple :

Q. I don't think it is the seed at all. I think it is the season. Parties planted potatoes early in the spring and the drought was pretty well over before the dry weather set in, and they had far less rot than those who planted later. There were other places in my neighbourhood where the bugs had eaten the potatoes pretty well off and the potatoes were small, but there was not as much rot as where the tops were fully developed, and the potatoes reached their full size.—A. It is quite possible in some of the earlier varieties such as Lee's Favourite, to secure the crop before the disease develops.

THE SOURCE OF POTATO ROT DEMONSTRATED.

The fact that potato rot is due to the attacks of a parasitic fungus has been clearly demonstrated, and also the development of the parasitic plant has been

traced, inside the tissues of the potato plant, from the tuber up through the stems to the leaves where the spores are formed; the spores under favouring conditions, infest either the leaves of neighbouring plants, or, falling to the ground, infest the tubers. The presence of rot in a crop, it is true, is largely affected by the meteorological conditions of the season, and we find that this is the case with all fungous diseases, but the season does not produce the disease; it only gives the conditions necessary for its development, provided that the spores are present; and unless these are there, the rot cannot occur. This is the reason why I have been advocating the use of preventive treatments which shall protect fruit and other crops against their fungous enemies whatever the season may be. With regard to the greater development of the disease where there is a heavy growth of foliage, I am not prepared to say whether this is the case or not; but if it be so, it is probably due to the same reason as causes a more probable occurrence of epidemics in densely populated places, where hygienic conditions and the food supply are not properly regulated.

By Mr. Semple :

Q. In the very dry season in Ontario there was scarcely any rot.—A. That is frequently the case; but on heavy lands of restricted area it will often develop when there is none in adjacent fields. In fact, some people, having observed this, say, though it is not actually the case, that clay lands cause potato rot.

MR. COCHRANE.—The rot never develops on loamy land; it is on the clay land.

MR. MACDONALD (King's, P.E.I.)—I quite agree with what Mr. Fletcher said about the disease developing under conditions of warmth and moisture. There was not a sign of rot when our potatoes were taken out of the ground; but as soon as they went into vessels they commenced to rot at once.

MR. FLETCHER.—Now, I should like to tell you, gentlemen, of an experiment we tried on a large area at the farm. I had six plots of potatoes, 33 feet across the head and extending 60 rows into a field. They were in the middle of the field, and were sprayed with six different mixtures. From the distance of nearly a mile we could see that plot in the field as a distinct green patch, while all the other potatoes around it which had not been sprayed were ruined. The effects upon the crop were also marked. Where the leaves had been preserved by the application, the potatoes were better and almost entirely free from rot. The improvement was far greater than would pay for the application—sulphate of copper (blue-stone) costs only four cents a pound, and the value of the lime is, of course, according to the distance from the point at which it is produced, but that is not large. It took about 60 gallons of the mixture to treat the six plots; so you see it is not very expensive, and it certainly paid. The chief primary expense is that of a proper spraying pump, but it is going to pay any one to get one. In the Ottawa district, last season all the potatoes were much diseased, except within a few miles of the farm. I anticipated that we should have a bad season here; last June was extremely wet and July was extremely dry. Our experiments were interfered with by the drought, which actually killed some of the potato plants before the time for treating them. I should have had otherwise exact figures to lay before the committee of the yield of these plots to allow comparison with the untreated plots. We are not likely to have such another season next year.

By Mr. Bowers :

Q. Would excessive use of this experiment be hard on the plant?—A. No, sir; I tried more than double the strength I have recommended and it had no bad effects on the plants.

By Mr. McMillan (Huron) :

Q. How would it do to spray potatoes with Paris green to destroy the potato bug. How would it do to mix Paris green along with your solution?—A. Quite well—I did that, but you must use the Paris green which is far better than London purple. London purple is merely a subterfuge because it is a little cheaper. There

is no doubt that the colour green is now recognized as that of something poisonous or dangerous, and for this reason also the use of Paris green should be encouraged, by preference. It can be mixed with the Bordeaux mixture, and the lime in the Bordeaux mixture reduces the chances of injury from the Paris green. Probably one of the most important discoveries written, in the last two years, is the fact that where it is necessary to spray fruit trees with delicate foliage with Paris green, by mixing twice the amount of lime it materially reduces the caustic effects. We can now actually spray peach trees which we could not do before. Before we had to make the Paris green so weak that it had no effect on the insects. Now, by mixing twice the weight of lime with Paris green we can spray it on tender plum, cherry and peach trees without injury.

By Mr. Roome :

Q. Won't that destroy the poisonous effect of the Paris green on the insects?—
A. No, sir, we find that it does not. As a matter of fact, it does not affect the poisonous properties of arsenic putting lime in it, it only reduces its causticity. We found that the results of mixing Paris green in the Bordeaux mixture were most satisfactory.

By Mr. Roome :

Q. Generally you think the lime diminishes the disastrous caustic effects of the Paris green?—A. Yes. Experiments have shown that this is the case, and the result is that Paris green can be used of double the strength in mixtures which contain twice as much lime as Paris green. Paris green is an aceto-arsenite of copper.

Q. It makes an insoluble mixture?—A. Yes, practically, but still it has the effect of destroying fungi without injuring the plant.

By Mr. Macdonald (Huron) :

Q. Would it be sufficient to mix lime water with Paris Green. Would it be of sufficient strength?—A. I don't know about that. I have never tried it and it would take a very large quantity of lime to make the lime water strong enough, but I have found that it is troublesome to mix the milk of lime because it is hard to get the lime so completely slaked that it is all kept in suspension; but experiments with lime water with all the lime precipitated, were not carried out by me.

THE CATTLE HORN-FLY.

Now, there is just one more point I should like to bring before the committee. It is with regard to the cattle Horn-fly which has been introduced into Canada, during the past season. This is a fly, the origin of which has been traced back to Europe. It came to North America some five or six years ago and last summer during July, I received the first Canadian specimens, these were sent from Oshawa.

I have brought specimens with me this morning so that it may be known by sight to the members of the committee. It is a small insect but extremely injurious. From reliable data, I find the annoyance which the fly is capable of causing to cattle is such as to reduce the quantity of milk and flesh formed, in some instances, by 50 per cent. Cattle that were affected by it in one particular herd that I heard of, only put on the same amount of flesh in three months, that otherwise they should have put on in two. You will observe that it is a very small fly—about one-third the size of the house fly. Many false reports have been published about its boring into the horns of cattle. This is incorrect, it does not do so. This report, however, did a very good thing; it thoroughly frightened the farmers all through the country, and induced them to take some steps towards remedying the injury. Generally it takes farmers three or four years to get stirred up, to fight against a now insect pest, but in this particular case, actually before the thing had been in the country a month they were all awake and applying remedies. Generally of course they ap-

plied remedies which were unsuitable or unnecessarily expensive. One was smearing the animals with tar, which got them into a horrible mess and did not do much good.

A WARNING TO FARMERS.

I fear that the pest is going to be troublesome all through Canada next year. It has already spread from Sarnia to Boucheville in Quebec, and it would be well for our farmers to know how to treat it. I worked out its history in Virginia with the Assistant U. S. Entomologist four or five years ago; but it was only at the end of July, last, that I got from an Oshawa farmer specimens of this fly. As a remedy it may be remembered that any greasy substance whatever put on the animals will prevent the flies from biting them; but it is not a very easy or cheap thing to get a greasy substance put on a large herd of cattle. It means considerable expense to everybody who has to use it. Of course it is necessary to go to some expense sometimes to meet unexpected injuries.

MOST ECONOMICAL AND BEST REMEDY FOR HORN-FLY—HOW TO MAKE AND APPLY IT.

The great question, however, is, what is the cheapest remedy to give the best results. The cheapest that we can get in this case, in the shape of a greasy substance obnoxious to the fly and not obnoxious to the animals, is a mixture of coal oil and soap suds, which we call the kerosene emulsion. It is made by taking half a pound of soap and boiling it up in one gallon of soft water. If ordinary soap is not used, one quart of home-made soft soap will be the equivalent. The whole should boil until the soap is thoroughly dissolved, and then it should be turned into twice its quantity of coal oil. This should be done by putting it into a washing tub or some other receptacle away from the fire. When the boiling soap suds have been added to the coal oil, the whole should be heated together with a whisk, or what is better still, churned with a syringe until the whole takes the consistency of a thick cream. While it is still hot, you should dilute it with nine times its volume of soft water, which will give you thirty gallons in all. I mentioned this preparation to the committee last year. When the emulsion is warm, it mixes very easily with water. If not wanted for immediate use, it can be put on one side and the water added when it is required for use. When the emulsion has been diluted, it can be applied directly upon both animals and plants without injury: this is best done with a spray pump. It will also answer just as well as McDougall's and other dips for lice on cattle, and is cheaper. With a spray pump or syringe, one can cover an animal all over with a dew-like deposit which requires very little of the wash, but is sufficient. Then by turning up your sleeves and rubbing it into the hair with your fingers, all lice will be reached. The effects of the first application when used for the horn-fly will last four or five days, when it must be renewed at intervals of four or five days. After three or four applications the deterrent effects will last for a long time.

Q. It will not injure the animals?—A. Not at all.

By Senator Read:

Q. We do not find the fly interfering with our animals, only near the horns?—
A. When they settle on the horns they are not doing any harm at all. They only gather on the horns between the shoulders and above the tail in those places where the animals cannot dislodge them. (Fig. 10.) Serious injury is sometimes done by the animals licking themselves on the sides of the udder and inside the legs until large sores are made. The fly worries incessantly and causes, as stated, great loss both in milk and in flesh. A convenient time to spray is after milking. One man with a pump can spray the animals. Prof. Atwood, of Virginia, has devised an ingenious method. He makes the application with a knapsack pump, fitted with a cyclone nozzle, and the work is done just after milking time. His method is as follows:—The animals are driven into an inclosure, through a gate which will only admit one

at a time. A man with a knapsack pump on his back stands at the gate and sprays one side of each animal as it passes; they are then driven out again, and the other side is treated in the same manner. The quantity of liquid thus applied is very small, but has been found sufficient. Previously, Prof. Atwood employed two men at

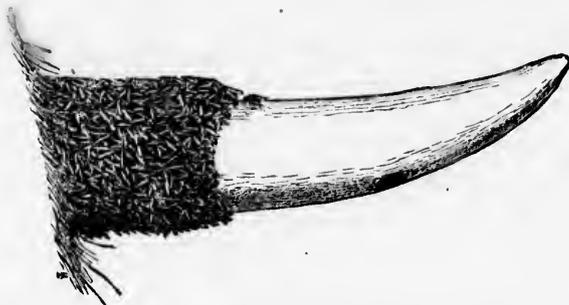


Fig 10—Cow-horn showing ring of resting horn-flies—reduced.

milking time, and used one or two pints for each animal. Care must be taken when milking that the teats are clean before beginning to milk; but ordinary precautions would prevent any trouble on this score. This remedy is the cheapest and most effective means of keeping these flies off the animals.

By Mr. Dawson :

Q. And other flies as well?—A. Yes, other flies as well. I have used it satisfactorily this winter in treating cattle lice. There is hardly a herd to be found in which there are not some lice. It is most important to keep cattle free of lice. Some farmers think lice do not do much harm; others will say that warbles are a sign of health, but both of these views are very erroneous. Warbles cause a large festering tumour inside, within which the large maggots, nearly an inch in length, with sharp bristles on their bodies, live, and every time they move they create great irritation, which produces pus upon which they live. There is in fact an angry inflamed sore, and the flesh underneath it is practically diseased from the irritation, and it is certainly a great injury to the animal, and in no way a sign of good health, but a disgrace to a farmer who allows his animals to be thus tormented, for he can get rid of them with comparatively little trouble and to his own great advantage.

By Mr. Carpenter :

Q. There is some little change in the details of that emulsion that you have suggested to-day. I suppose it will be in full in this year's report?—A. I will mention the exact formula. Take two parts of kerosene (or coal oil), to one of soap suds to make the stock emulsion; of this mix one part with nine of water when required for use.

By A. Roome :

Q. I suppose you are quoting it more fully in this year's report?—A. Last year I avoided giving figures when speaking because they could be got in print in Bulletin 11.

By Mr. Kautbach :

Q. The fly—is that not the ordinary black fly which is a pest in the spring of the year?—A. No, it is about the same size, but it is a different family altogether. The true Black fly is a water fly.

LIFE HISTORY OF THE CATTLE HORN-FLY.

I would like to give you in a few words the life history of this fly. The remedy of keeping the flies off the animals is very unscientific. If you merely drive it off your own cattle it will go on some one else's. The proper way is to prevent it breeding. It does not breed in the horns of the cattle, nor on the animal itself at all; but it breeds in the fresh dung. (Fig. 11.) Directly the dung is ejected the flies will fly down

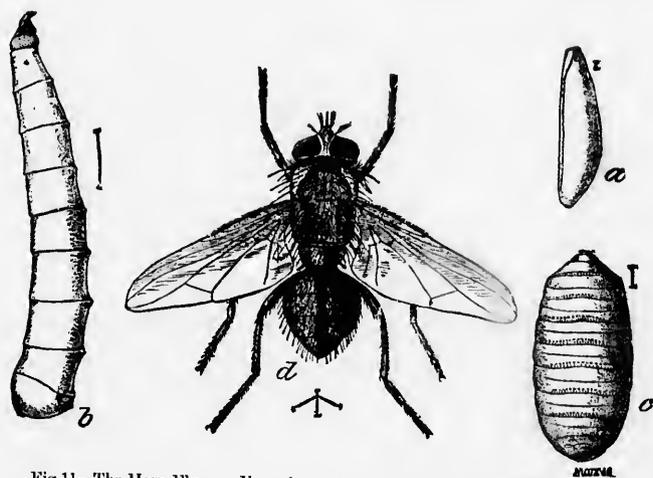


Fig 11—The Horn-Fly. a, Egg; b, maggot; c, puparium; d, adult fly in biting position—all enlarged.

and lay their eggs on the surface. From these eggs in 24 hours the maggots hatch, and in about a week they have gone through all their stages, and they are ready to leave the dung, which by that time is almost dry. They can live in it only while it is moist. By the end of a week they burrow into the ground to go through the other stages. They take altogether about a fortnight to pass through all the stages. Any means, therefore, by which we can reduce that manure to a dry state renders it unsuitable for the maggots to live in. This can be done by rolling or brush-harrowing the droppings. A brush harrow is not often seen in this country, but as its name implies, it is made of boughs of trees. In England, it is made of hawthorn from the hedges, and is dragged over the pastures to renovate them. In the same way such an implement would break manure pats, so that in hot weather they would soon dry up, or be washed away in wet weather by the rain. If this or a similar treatment were practised, the manure would not be long in a condition for these insects to live in it. One difficulty arises from the fact that the cattle are allowed to run on the roads, or are turned into large pastures where it would be difficult to treat the droppings; but we shall have to do as is done in the United States where cattle are infected with cattle ticks. It is now supposed that the cattle tick has some subtle connection with Texas fever, and it has been proposed to keep cattle out of large wooded pastures and in smaller closures until they have been cleared of those parasites. Similarly, we shall have to keep our cattle in small pastures, for a time, where we can treat them and the manure, for this fly is

going to spread and be a great pest for a few years. After that I hope from its history in the United States that it will reduce in number. In the meantime, it is well that all should find out as soon as possible the best way of treating it in the cheapest and most effective manner, and it was with this object that I prepared Bulletin 14 on the subject.

By Mr. Roome :

Q. Does that fly affect the sheep as well as the cattle?—A. No, it attacks only the horned cattle, not even horses.

By the Chairman :

Q. How would that emulsion do for treating horses troubled with the horse fly?—A. I have tried it on one or two occasions, but never systematically. I put it on the neck of a horse when riding through the forest and it certainly had the effect of keeping the flies from biting the animal. I dare say it would do very well. There is one thing about the kerosene emulsion, made as I have advised; it does not hurt the skin at all, nor the hair. Cattle that were treated for lice had a better appearance than the others. They had a far better appearance than when they were treated with the usual tobacco solution, for lice.

By Mr. Girouard (Two Mountains) :

Q. I would take the liberty of asking you to repeat that recipe. Half a pound of boiled soap; boil with one gallon of water, and then add to that a double quantity of coal oil?—A. It must be mixed away from the fire. The coal oil must not be brought near the fire.

Q. And then you must add nine times as much water?—A. Yes; when the emulsion is made, you take one part by measure and mix it with nine of rain water.

By Mr. Dawson :

Q. How often will it be necessary to spray the cattle with this mixture to keep off the horn fly?—A. It appeared at Ottawa last summer late in the season. I applied the emulsion three times, and I found that the flies were kept off for a long time. The first application kept them off for about four days, when I repeated it, and the effect of this application lasted longer. I put it on a third time, and that brought us to the end of the season; but I think three or four applications will probably last for a long time, even earlier in the season; but this has to be found out next year.

Q. If the cattle were out in the rain would it wash off?—A. Not so much as the tobacco dust and the tobacco solution, because it is an oily mixture.

Mr. FAIRBAIN.—I understood you to say that the cattle were not affected about the horns by these flies. My experience was that is where they annoyed our cattle. We lost several cattle in our neighbourhood from that fly altogether about the horn. My own experience was that cattle running in the bush where they could rub their heads on the brush were not harmed, but out in the open field they were affected, and had it not been for rubbing this mixture of tar and coal oil on them, I am satisfied we would have lost all our cows last year. Several died from the effect of that fly, and it was altogether about the head and horn.

ERRONEOUS REPORTS AND THEORIES ON THE HORN-FLY.

Mr. FLETCHER.—I should like to ask, sir, if you actually saw this or merely were told of it, for I received probably 15 or 20 letters from people saying that they

had lost cattle. I wrote immediately to them, asking: "Did you see the dead animals, and can you tell me exactly how they were affected?" and in every instance the answer came back—and I may say that this has been the experience of the United States entomologists as well for four or five years: "It was not I who saw it; I heard of it; it was Mr. So-and-so. Somebody else told me," &c. I have not been able to trace up a single instance in which I could find the man who had actually had an animal killed by the flies. We know this, that they do cluster on the horns and make them in a very dirty mess with their excrement—a condition which is very unsightly, and which has given rise to the idea that they were bored by the flies, but I have never found a single instance where there was even severe inflammation around the horns. One ingenious theory was advanced that the horns were eaten away and became corrugated; but as I pointed out to a visiting farmer who told me this at the experimental farm, about half of our cows had their horns similarly furrowed. My contention is that the flies will settle where there is least possibility of the animal dislodging them, and this is on the horns and at the base of the tail.

Mr. FAIRBAIRN:—Of course, what I say was only what I was told. I did not see it myself.

By Mr. Cochrane:

Q. Do the flies lay eggs all the time?—A. Some insects lay eggs from a few hours after the time they assume the perfect state. In this instance they certainly lay eggs within a day. These eggs hatch within 24 hours; the maggot stage lasts a week or a little more, the pupal stage as short a time as four days in hot weather, and the insects will attain maturity in about 15 to 17 days. I have already published a bulletin, as I have said, on this subject, which is issued both in French and English. I shall be glad to send copies to any one who may desire them. It is a very important thing that we should tackle this pest at once, on its first appearance in the spring, before they begin to propagate.

By Mr. Bowers:

Q. This fly has not got down to the Eastern Provinces yet?—A. Not yet. In conclusion, I may say that I am very much obliged to you, gentlemen, for affording me this opportunity of appearing before you. As I have stated on previous occasions, I am always glad to be of service to you or your constituents whenever an opportunity occurs. And with regard to injurious insects, I would mention that out of about 100 of the worst pests that attack farm products every year, we can suggest remedies or give some useful information about at least 85 of them, so as to enable farmers to ward off or alleviate their attacks.

By Mr. McMillan (Huron):

Q. There is a gentleman in my constituency who discovered in the milk given from one of his cows, two or three little, white, hair-like worms. Have you any idea what that would be? I never knew of anything of the kind before.—A. No, I am afraid I do not recognize the species from your description. I should have liked much to see the specimens. There are some maggots which might occasionally get into milk by accident, but I know of none having been found in milk freshly milked from the teats. Specimens were sent to me from New Brunswick last year of maggots taken from the flesh of sheep that had been blown, and the maggots had eaten into the flesh of the sheep, but I never heard of such a case as you mention.

Having read the preceding transcript of my evidence, I find it correct.

JAMES FLETCHER,

Entomologist and Botanist to Dominion Experimental Farms.

