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IMPROVEMENT OF SEEDS AND SEED-GRAINS

EVIDENCE

OF

JAMES W. ROBERTSON

COMMISSIONER OF AGRICULTURE AND DAIRYING

BEFORE THE

SELECT STANDING COMMITTEE

ON

AGRICULTURE AND COLONIZATION

1903

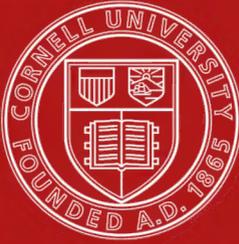
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are all right, but I claim that it will be just as warm if the floor was of wood or paved with stone.

A. If paved with stone, yes.

Q. I have my cattle stables paved with stone and see no difference in the result. When I had a cement floor put in I did not see that the cement makes any difference. If the stable is warm otherwise I cannot see that it makes much difference what material a floor is made of.

A. Let me make one more statement. In carrying on winter dairying it becomes necessary to have the stable kept clean and kept clean permanently. I have had stables with a wooden floor and I have found, like every one else, that one of the difficulties is to save the liquid manure and to keep the stable in a thoroughly sanitary condition. It is all right if you are only fattening the cattle; but if you are using them for dairy purposes the stable must be kept absolutely clean. When we made the discovery, it was to me a revelation, that in a climate like ours the temperature should never go below 40 degrees in these unoccupied big buildings without heating. I said to our live stock commissioner lately, 'I want you to look out for three cattle stables and arrange for a real investigation and object lesson along this line.' Next winter we hope to have these in different parts of the country, where a comparison can be made with thermographs running in the stables, one stable with an ordinary floor and one with a cement floor. This can be arranged without any expense to three farmers who want to improve their stables and who are willing to keep these thermographs in the stables under the different conditions, giving us a record of the results.

Mr. SPROULE.—Don't you find the cement floors are often detrimental to cattle owing to their slippery condition?

Mr. ERB.—That depends on how they are finished; you can get them rough finished.

By Mr. Sproule:

Q. You want to get them very rough finished.

A. The passages should be rough finished and the gutters quite smooth. Let me make one further observation before we leave this matter. There was an idea that cement floors conduced to rheumatism in cattle. I know it has been claimed that this has occurred in the case of pigs, but I do not think there is any ground for saying that anything of that character affects cattle owing to their stables having cement floors.

By Mr. Erb:

Q. All people who keep cement floors have put lumber on top after using them for some time without wood.

A. I know one stable used for pigs where they have the sleeping place floored with wood over the cement, but it is the sleeping place only; the other part of the floor is without wood, and by this means your pig pen is easily kept clean.

IMPROVEMENT OF SEEDS AND SEED GROWERS' ASSOCIATIONS.

Mr. Chairman, the matters I propose to bring before the Committee this morning, are on the improvement of seeds and the organization of seed growers' associations in Canada for the purpose of improving the grain crops of the country. In growing crops—if I put in a parenthesis here and there I shall not detain the Committee long by preliminary explanations—in growing crops two main matters are important; first, the ease or difficulty with which the plants can obtain their food from the soil and from the air—in other words, the environment of the plant, or its opportunities; the other main matter is the power of the individual plant to take in, absorb and assimilate food from the soil and the air—the power to overcome obstacles, the personal ability of the plant to do things in its own environment. I need not say that these two great principles condition our progress—opportunity and personal power. Even in human progress the principles are persistent; and governments are concerned with these, with

their preservation and their enlargement. Plants and animals are nourished by processes that may be considered in three different stages. In animals we speak of the processes as digestion, absorption, assimilation. Digestion is the process of making soluble, absorption is the process of taking into the juices or fluids of the body, assimilation is the process of change into the structure of the body or its fluids. Plants are nourished in a similar way. Plants take nothing in through their rootlets that has not been previously digested, that is, made soluble. Nothing enters a plant except in either a soluble condition through the roots or in a gaseous state by the leaves. So there is digestion of all crude plant food before it goes into the roots of the plants; after that it enters into the juices of the plants and is absorbed, then it is assimilated and moved about afterwards to different parts of the plant. As you know, plants take in food in a liquid form through their roots and in a gaseous form through their leaves. All the starch, the carbohydrates that form the bulk of their weight, comes in through the leaves. It is not taken out of the soil to any extent at all. Plants largely feed in and on the atmosphere; but they take things out of the soil in a partly digested state. It will be sufficient to make a few observations on some of the sources of food substances before I speak of the large bearing and sweep of this matter of organizing seed growers' associations.

THE RESULTS FROM BACTERIA IN SOIL.

The source of food materials: soils are composed of broken down rocks, some are clay, some sand, and some gravel, or mixtures of all three mixed with broken down organisms, such as leaves, stems, roots, bones and bits of leather. These two make the soil—broken down inorganic matter and broken down organic matter. As I very well know, many members of the Committee are not professional men and words, and the ideas they represent, are sometimes unfamiliar when used in a new connection. Organic matter is only matter that has once formed part of an organism that lived; it may have been a tiny so-called micro-organism, or it may have been a very large tree. Soil is made up of broken down matter; inorganic matter that has never lived in an organism; and organic matter, the remains of what has once lived. With these materials must be some water in order that they may be made soluble and in a fit state for the rootlets to take them in; and with these three—inorganic, organic and water—must be living organisms to carry on the work of preparing the organic and inorganic matter and water into food materials suitable for the sustenance and nutrition of plants. These organisms are not well understood by farmers. It is only of late years that anybody has understood their manifold functions and use; but crops never grow except as preceded by the labours of these organisms, in preparing, in practically digesting, food substances for them. We need to know more of these things. This is one of the new things that is dawning on agriculture and is bringing not merely pleasure and interest into the work, but an increased power of producing good crops and maintaining the fertility of the soil. If you take a portion of soil and heat it so as to destroy the life of these little organisms it will afterwards carry only a very few crops. The plant food that has been liberated by the organisms is there in only very small quantities; and as soon as that is exhausted the land is absolutely barren, until myriads of lowly forms of life come into it again to make the raw material which it contains fit for the use of the crops. That has been proven many times. It is not enough to have substances—ingredients of plant food—in the soil to nourish the plants, but to have them in a suitable condition, partly prepared for the plants to use. Now that plant food is being continually prepared in the soil by the action of bacteria or soil germs. There are series of changes going on, partly chemical and partly physical, as a result of their life and of their activity. They digest the crude plant food. They are the cooks of nature that prepare the food for the higher forms of living things, primarily, because the higher life lives on the things that they prepare. How can you make the conditions favourable for their multiplication and beneficial activity? Let me give you one instance—take an orchard that has been in sod for a great many years, and if you

have an examination made of that soil you will find less than one-twentieth as many soil bacteria in it as if that land had been ploughed up and cultivated for a couple of years. The reason is that the sod land does not afford favourable conditions for their multiplication; by actual examination, sod land like that contains less than one-twentieth as large a number of bacteria per cubic inch as is contained in the land after being cultivated the second year. Everybody knows that if you plough up the sod in an orchard the trees take on greater vital activity, they produce better crops and they make a better growth of wood, because nature's cooks are preparing, out of the materials found in the soil, food for their use. The value of those lowly forms of life in all the fields of this country is what I am trying to impress upon the Committee.

Again, they do not thrive very fast in wood land. If you have land that is what is called slightly sour, they do not thrive in land like that. But a very light dressing of quick lime will change that land, it will neutralize the acid in the soil to the extent of making the soil fit for these things to live in and to multiply; and they will multiply, multiply and make the land fertile, not by increasing the quantity of the substances of plant food, but by altering the conditions so as to make the food soluble, and ready for use.

It has been the practice in the old countries to put a compost dressing on the fields. Thirty years ago I remember helping to make them as a lad on my Saturdays out of school. How are they made? So many cart loads of dust or scrapings from a well travelled road, so many cart loads of sods, and so many bushels of lime all mixed up. The constituents are well mixed, left at rest for a time and mixed over again once a week, and then the compost is scattered thinly on the land.

Some years ago I had sent to me from England a formula for the making of compost that was said to be over 250 years old, and to come from Somersetshire, famous for its dairy products. The formula was to take so many cart loads of dust from the highroad, so many loads of turf, and so many bushels of lime, make them into a heap and turn them over twice or more. When such a compost was put on the land it was said that it made a tremendous difference in the crop. I showed the formula to an eminent chemist, who after examining it said it was worth nothing, that it was like the old superstition as to the virtue of killing pigs in certain phases of the moon. And yet there was the experience of 250 years, as shown by the traditions and records; but he said the formula did not add anything to the land but lime, and that did not count for much because the land might have it already. On the other hand, take a man who has studied the lower forms of life and wants to make a culture of soil bacteria; what does he do? He may take sod and dust—and there is nothing better than road dust—and put in some lime. He will make a culture—what the dairyman would call a 'starter.' This old Somersetshire compost was a culture, a starter, promoting the growth of low forms of life that would work like Trojans in preparing soil food for plants.

Moreover, there are other forms of bacteria which increase the productiveness of land in quite another way—which add to the nitrogen content of plants and soil by fixing nitrogen direct from the atmosphere.

I have seen men with a wagon take three bags of earth from one piece of ground to sow on another piece of ground that would not grow clover; and the following year the clover grew luxuriantly. In taking this earth from the one piece of land to the other the men were seeding the land to which the earth was taken with bacteria. Sometimes if clover will not thrive the first year it will do better the second year; the reason for its not doing so well the first year being that the low forms of life were not abundant enough, or perhaps that the particular germ which lives in clover roots was not present in the soil. If you pull up clover and examine the roots you will find little nodules or tubercles containing low forms of life. These low forms of life are an agency by which the land is made rich by taking in free nitrogen from the atmosphere. An eminent French chemist is reported to have made cultures of soil bacteria which have enriched the land in nitrogen content, apart from the growing of clover. What is the possibility of this thing?

I have seen the difference in the crops from soil treated that way in the case of soja beans—on the untreated soil giving crops 12 inches high, and on the soil after inoculation giving crops 32 inches high. The field that gave the poor crop, after being sown with three bags of soil from the good field, gave an excellent, heavy crop. The wonderful power of these soil bacteria is only beginning to be known, although the fact itself has been in existence since the world, as we now know it, began.

By Mr. Ross (Ontario):

Q. Can you see these bacteria?

A. Under the microscope only. On clover and beans, however, you can see the tubercles or small wart-like growths produced by the bacteria. The bacteria are believed to grow as little filaments into the rootlets, and then begin to make the nodula or tubercle—a little thing sometimes as big as a pin head and sometimes as big as a pea; you can split these open with a knife or your thumbnail; they contain soft matter almost like proud flesh, but that is not the bacteria.

Q. Have the bacteria any particular shape or form?

A. Sometimes they are round and some are in the form of rods. As I have just mentioned, an eminent French chemist, Bertholet, has found one that can take the nitrogen from the air into the soil without the interposition of the plant. He has been able to find as much as 980 pounds of nitrogen per acre fixed under laboratory conditions.

THE CHARACTER OF SEEDS.

I will now speak of the power of the individual plant to first of all take in, then to absorb and then to assimilate the food it gets prepared in that way. There are in plants again two processes of increase. I have spoken of the process of nutrition being by three stages. There are two processes of increase in plants, the increase that makes for the enlargement, the maturity of the parts of the plant that die—the root, the stem and the leaves, parts that die utterly at the end of the plant's life; and also the process that makes for the increase in the size and maturity of the seed part of the plant, that does not die at the end of the plant's life, but which carries the life over into the next generation. The seed that carries the life over is itself a tiny, an embryo, plant, and a store of food. In some seeds you can, by having them softened and swollen a little, almost see the beginning of the plant itself in the embryo and the store of food close by ready for the nourishment of the young plant when it starts to grow and before it is quite vigorous enough to get nourishment through its roots and leaves.

If the embryo is imperfectly formed or weak it cannot thrive well; therefore, any seed that is only partially ripe, not wholly matured, is a poor kind of seed to sow on land. You know that is the condition of frosted wheat and frosted oats and all that. If the seed is not completed by perfect maturing and ripening, you have a poor seed even if it is of a highly priced sort. If the seed be very small for the variety, there is apt to be only a partial store of food close to the young plant when it is beginning its life. That is why a very small potato set is a mistake. If you have a very small set there is not enough to nourish the potato until the roots and leaves increase enough to take in its own nourishment. A seed has to be considered both in regard to its maturity, and its size for the variety. The selection of seed does not receive anythink like the care that it should, or would if farmers knew the meaning of these things of which I have spoken—the preparation of the food within the soil and the ability of the individual plant to get hold of that food and make good use of it. A good many farmers buy whatever seed is cheapest and trust to luck. That is the straightest road to failure a man can follow.

ON THE BUYING OF GRASS AND CLOVER SEEDS.

May I say only a few words about other things to consider in buying or procuring seeds? First of all one has to see that the seeds are genuine and what they are represented to be. Then one has to see that the seeds are pure, because it is not an uncommon occurrence at this time or in Canada, for a farmer to buy grass or clover seeds and find that he has seeded down his farm to weeds of the most pernicious and persistent sort.

One has also to make sure that the seeds are vital, and have adequate germinative energy. It is not uncommon to have seeds of grasses mixed with old seeds that are dead and have even been slightly oiled to make them look fresh. Sometimes seeds are adulterated with sand, which, however, is harmless enough and is only costly in being sold under false pretences for the price of seeds.

Last year, as this question had been pressing on us for a good while, I directed Mr. Clark, who is now the head of the seed division, to make a collection of seeds of Red Clover, Alsike and Timothy as sold by retail all over Canada. We enlisted the assistance and interest of members of farmers' institutes and farmers' institute workers and many other leading agriculturists. We obtained altogether 513 samples by actual purchase in seed stores and other stores all over this Dominion. We had them come to our seed laboratory here with the name and address of the person they were bought from, the price per pound or per bushel, and all the rest of the information in the package with the seeds; and then we had them analysed for both purity and vitality. A very useful bulletin by Mr. Clark has been published on that subject, and I think it is one that should be read, especially by members of this Committee, because I think it is the intention of the Minister of Agriculture to bring a Bill before the House dealing with this matter as affecting the prosperity and conditions of agriculture in Canada.

DOMINION DEPARTMENT OF AGRICULTURE—SEED INVESTIGATION.

Place where sold.	Price per Bushel.	Per cent of Pure Vital Seed.	Cost of Pure Vital Seed per Bushel.	No. of Weed Seeds per Pound.
<i>Red Clover.</i>				
	\$ cts.		\$ cts.	
Ottawa.....	7 80	86	9 07	5,535
Kemptville.....	7 20	73	9 86	10,350
Caintown.....	7 20	93	7 75	9,180
Carleton Place.....	7 50	93	8 06	1,035
Pembroke.....	7 20	85	8 47	9,360
Renfrew.....	7 20	67	10 74	36,990
<i>Alsike.</i>				
Ottawa.....	9 60	81	11 85	2,265
Kemptville.....	10 20	82	12 43	3,715
Mallorytown.....	8 40	53	15 85	9,785
Carleton Place.....	7 20	65	11 07	8,879
Pembroke.....	10 80	72	15 00	14,528
Renfrew.....	10 20	80	12 75	3,533
<i>Red Clover.</i>				
Barrie.....	7 20	90	8 00	1,170
Hamilton.....	5 50	86	6 39	5,715
Brantford.....	5 25	72	7 29	13,005
Toronto.....	6 00	95	6 94
Galt.....	5 90	90	6 55	5,985
Galt.....	5 75	96	5 99	1,440
<i>Alsike.</i>				
Barrie.....	7 20	78	9 37	2,718
Galt.....	9 00	62	14 51	23,556
Bradford.....	11 00	94	11 70	272
Toronto.....	9 00	90	10 00	1,903
Brantford.....	8 00	48	16 66	49,830
Hamilton.....	8 50	65	13 07	1,993

Now if you observe that chart—one half of it applies to eastern Ontario and the other half to western Ontario—you will see that the sample of Red Clover bought at Ottawa at \$7.80 per bushel contained 86 per cent vital seed. Therefore the cost of the pure vital seed was \$9.07 per bushel; and the sample contained 5,535 weed seeds in every pound.

By Mr. Ross (Ontario):

Q. How many seeds are there to the bushel in Red Clover?

A. I think about 350,000 to a pound. I have not the exact figure in my mind.

Q. 14 per cent of that would be weeds and 86 per cent pure seed?

A. No, there would be some dead seeds you know and some seeds or other useful plants. The weeds would amount to 5,000 out of every 350,000, or one weed for every seventy clover seeds. We had the number of weed seeds put there to show this. If one sows 12 pounds to the acre of this Red Clover seed bought in Ottawa he would seed 66,000 weed seeds per acre. This is the appalling side of it. If you take the next sample it would be still worse; and worst of all if he were sowing seed like the last sample, from Renfrew—it was found to contain nearly 37,000 weed seeds per pound, to be exact 36,990 seeds of weeds per pound of what was sold as clover seed. The actual value of the pure vital seeds as shown in that other column would be for that Renfrew sample \$10.74 for each bushel; but with that seed, when the farmer sowed it, he would sow on his farm, even if he only used 10 pounds to the acre, 369,900 weed seeds to the acre. One year's seeding and seven years of weeding in very fact. There is a striking fact for the farmers to consider.

By Mr. McGowan:

Q. Is there no remedy under the existing law?

A. The Minister of Agriculture intends to bring down a Bill to parliament this year to remedy this.

By Mr. Ross (Ontario):

Q. Are these vital weeds?

A. Yes, we tested many of them.

Q. Some of them objectionable?

A. Yes, very.

Q. Any of them harmless?

A. I would not call any of them harmless.

By Mr. Robinson (Elgin):

Q. How many varieties did you notice?

A. I could not give you that, but I know that we found only five or six samples over the Dominion out of the 513 we bought that were free from weeds. In some distant parts of the Dominion, remote from the source of supply, we found seeds hardly anything better than screenings being sold to the farmers. Now it is exceedingly difficult for anybody by a simple examination of seed to tell its quality. Even expert seedsmen cannot tell by merely looking at them.

By Mr. Ross (Ontario):

Q. Can you tell us the process of testing this seed?

A. Yes. We have first of all the sample of the seed to be tested thoroughly mixed; then a small portion of that is taken for examination.

Q. One pound?

A. Oh, no, a small quantity will do, usually about ten grammes. The portion selected is spread out on paper of a colour to suit the seed; and girls who are trained in the work separate the various sorts of impurities from the real seed. Then the latter is weighed and that gives the per cent of pure seed. Then 200 seeds of that are put in

a germinator and tested as to their vitality and 200 more are put in another place. We do it always in duplicate. This gives us the percentage of vitality in the seeds. Then an expert examines and classifies the weed seeds which have been separated in the first place by the girls.

Q. What is the germinator like?

A. It is an apparatus made of copper and surrounded by a water jacket two inches in thickness; that is kept at the proper temperature by a little gas flame which is gauged by a gas thermoregulator. Little trays are run in, and on these is placed the seed between folds of blotting paper moistened every day; the test lasts from three to five days for a preliminary test, and in some cases fourteen days for a final test. You will find that fully described in the bulletin of which members can have some for distribution. That is why I do not take up the time of the Committee to explain details this morning at any greater length. In this proposed Bill, which it would not be well to discuss to-day, but which I hope will come before the Committee, the intention is to forbid entirely the sale of seeds for seeding purposes if they contain any of twelve of the worst weeds in Canada. That is in practice in the North-west Territories now in regard to cereal seeds. The Bill totally forbids the sale of any seed for seed purposes that contains any of twelve of the worst weeds that are named. Then it enacts that all seed offered for sale for seed purposes should be graded and sold in grades under recognized standard grade names.

Q. Graded by whom?

A. The Bill itself provides for that, according to the standards in the Bill. For instance to-day a man will have three grades of seed, one of which he calls 'Reindeer,' one 'Fox,' and another 'Dog.' Another dealer will sell the same grades of seed in three grades which he calls 'Whale,' 'Shark' and 'Herring,' names that mean absolutely nothing as applied to seeds. Now it seems to be the opinion of the men who have given this most thought that everybody selling seed should be compelled to grade it, under at least one of four well recognized and defined grades: Grade No. 1, grade No. 2, grade No. 3 and grade No. 4, or screenings. Grade No. 1 must be free from certain named weeds, and must contain not less than 90 per cent of the pure vital seed of the kind that it is represented to be. Grade No. 2 must be free from some weeds named—not so many named as for grade No. 1—and must contain not less than 80 per cent of pure vital seed. Grade No. 3 must be free from still fewer weeds and contain not less than 70 per cent of pure vital seed. Anything under 70 per cent of pure vital seed of the sort described, must be graded as No. 4, or screenings. Then any farmer buying seed and wishing to know whether it is up to the grade represented, may send a sample to the seed laboratory here, and have it tested for him by the department.

Q. Do you think that is reasonable for the trade?

A. Very reasonable, and if the trade will co-operate with us it will be to the mutual advantage of the seedsmen and the purchasers.

Q. What would be the average of good seed in those samples of red clover there?

A. You mean these samples we have been speaking about, purchased in eastern Ontario?

Q. Yes, what is the average of them, about 83 per cent I think?

A. About that of pure vital seed. Then let me say this further. That is not the average of Red Clover grown in Ontario or in Canada, but the average of what we bought. The very best clover seed grown in the country is cleaned thoroughly and sold out of the country in markets where they have regulations and restrictions and where farmers would not buy poor seed at all; and in some instances, I am sorry to say the screenings are scattered over the farms of Canada. If the law would compel seedsmen to burn all that rubbish that contains weeds, the country—if need be—could pay fifty prices for it and then get off cheaper than by letting it get sown.

Q. Who would grade these seeds?

A. The seedsmen should have them graded.

Q. A great deal of the seed is sold in the country by the merchant to the farmer, and the merchant has no appliances for testing.

A. Any one could send a specimen to the laboratory here and get a preliminary report of the result in four or five days.

By Mr. Cochrane:

Q. For instance, I raise clover seed, say, and sell it to a merchant at Brighton and he sells it to the farmers, who did not raise their own seed. They purchased it. How could I grade that seed on the lines of the Bill you propose?

A. Either the grower or the man who buys from the grower, to sell again, would take some representative sample, put it in a small bag, send it by mail—it comes free—to the seed laboratory here; and in a few days he would get back an exact statement of the percentage of purity and of the vitality.

By Mr. Robinson (Elgin):

Q. It is a very difficult thing to clean the weeds out of the clover seed is it not?

A. It is difficult; but it will lead to this good practice I think, that by and by growers will 'rogue' their seed fields as it is called, that is they will go through and pull out the weeds while the crop is growing.

Q. There is no sieve made that will take out all the weed seeds?

A. Not all the weeds. There are so many different sizes and weights. I mention the matter of this Bill because I have the authority of the Acting Minister of Agriculture for saying that while the Bill has not yet been introduced, it is more than likely that it will be referred to this Committee; and on that occasion, if the Committee desire, I should be glad to come to the Committee and discuss that Bill with them. I mention this now so as to attract the attention of the Committee to the subject.

By the Chairman:

Q. Practically we have the principle involved in this Bill applied to grain in the north-west, to the inspection of grain.

By Mr. Thompson (Grey):

Q. Grain is a very different thing from seeds.

A. The price paid is according to the grade, and when there is a dispute about the grade it is referred to the Government Inspector. There is no difficulty in getting judgment in a couple of days.

By Mr. Cochrane:

Q. If the law is made so that the seed would have to be graded, that would all have to be done before it is sold.

By Mr. Ross (Ontario):

Q. Did you say you could take the weeds out of the clover field?

A. That is done now very often; it is the easiest and most effective way.

By Mr. Lennox:

Q. Does that chart show the prices prevailing in the different places named at the same time? For instance, at Barrie \$7.20 was the purchase price, while at Bradford, which is only a few miles distant, the price is quoted at \$11. Were these the prevailing prices at these places at the same time?

A. This is for alsike and that is for red clover; it is different seed you see.

Those were the prevailing prices practically at the same time, because the collection of seed was made in the spring, all about the same time.

IMPROVEMENTS BY SYSTEMATIC SELECTION.

I would like to speak about the large seeds, that is the seeds of cereals, and the use of seed growers' associations to improve those seeds in Canada. The systematic selection of seeds means the selection according to a system, and that a system planned and applied with intelligence. Some plants have greater power to overcome obstacles than other plants, as some animals have greater power in that respect than others. And the characteristics, like those in animals, are transmitted from ancestors to their descendants. That is the meaning of the breeding of improved horses, cattle and other domestic animals. Characteristics are inherited by plants from their ancestors; that rule of life seems to run through the whole range of living things. In animals and in plants also there is a constant variation; it seems as though all nature was making an effort to fit in, to fit into conditions, into environments, and therefore modifying itself a little in that effort. If you have crossed the plains you have seen the long legs and running shape of the plains Indian; and if you have gone to British Columbia and watched the fishing coast Indians you have seen the short legs, the big trunks, and the strong arms that are required by fishing men. Anybody can tell by looking at the two what occupations their ancestors have followed for many generations. If you have watched the Clydesdale horse, you have seen the comparatively straight shoulder, the great weight and thick muscle; and if you have seen the race horse, that can come down the track at the Derby and come in first, you have seen the fine tough bone, the hard sinews, the sloping shoulders, and the relatively great girth of heart. That is the result of the effort of nature to fit in to the style of life that had to be lived.

There are many causes of variation. If you cross a Thoroughbred stallion and a Clydesdale mare, you can never tell what you will get; which character will prove the prevailing one. You can bring about variation, but you can not tell which way the variation will go; and nobody can tell yet. Once there was a man named Mendel, who lived some forty years ago, an obscure and quiet life, and who discovered one of the laws of transmission; we have discovered it and him again now, making him one of the great discoverers of Europe. Mendel's law of life laid down the principle that in cross-breeding of some plants certain definite characters of parent seeds will come out in certain definite proportions in the hybrids.

If you change the supply of food you cause variation; and a change to different conditions of climate brings about variation also. These are the three main causes of variation: the crossing in breeding, the changing of the supply of food, and a change in the conditions of climate. Moreover, if you do not change any of these, you still have a tendency to variation inherent in the life of the plants themselves. The intelligence and skill of selection for breeding is determined by the ability to recognize the characters, the good qualities that are wanted, and by the skill to select individuals for mating that have these good qualities and can transmit them.

SELECTION OF SUGAR BEETS.

Let me give you an illustration. In France and in Germany sugar beets now produce twice as many pounds of sugar per acre—twice as many pounds of refined sugar per acre—as they did before the improvement of the sugar beet was undertaken in a systematic manner; that is with the same soil, the same climate, and the same kind of fertilizer; and the result is twice as many pounds of sugar per acre. That work was begun by Vilmorin, of Paris, three generations ago; his grandson is at the head of the business now, and the system is also practised in Utah by the Mormons. The sugar beet growing there could not succeed at all if the practice was not kept up continuously.

First of all a field of sugar beets is taken and the finest beets of smooth shape, well formed and of medium size are selected, those that average from $1\frac{1}{2}$ to 2 pounds. These choice specimens of the root are harvested and kept in a cool place until spring, when they are planted. You know the sugar beet is a biennial, growing what we call

the beet root the first year from seed, which root being planted the next year yields seed; that seed is sown for the crop of beets for sugar making. These selected beets then are stored in a cool place; and before the time for planting a small core is taken out of each beet; the juice is pressed out and that is tested for the percentage of sugar and purity. All the beets that test over 15 per cent of sugar are put by themselves; and all that test above 16 per cent are put in another lot. These are the two sets of mother beets. These are planted under favourable conditions, with plenty of room. The seed from each beet, each mother plant, is sown in a separate row. The grower finds which row gives him the best value of beets in total yield, in weight per beet, in shape and position of growth and in percentage of sugar and purity of juice. Out of the rows that give the highest general average the best beets are picked again. These are tested again for sugar content and purity and these become the mother beets of the third year. Their seeds are again planted in separate rows and the seed from that crop is sown in the general field. The sugar beet growers keep up continuously the practice of having seed from the best mother plants. By that process the sugar content of the sugar beet crop has been raised from about 9 or 10 per cent to between 15 and 16 per cent all over France. That is the result of systematic, intelligent selection of the best plants and the use of the seeds from those plants continuously year after year.

However, beets cross-pollinate. The pollen from one row of beets will cross with those of others. The growers adopt the plan of planting mother beets where only the good beets can cross-pollinate with each other.

SELECTION AS APPLIED TO INDIAN CORN.

There has been an almost similar method of improvement applied to the Indian corn crop. Some four years ago, when I gave evidence on the same subject, I cited the case of a grower in the United States who had increased his yield of Indian corn 25 per cent by four years of such selection. I have been following that subject ever since with increasing interest, and I have seen the most astounding results, if I may use that word, from that procedure. Only last year there were formed in Illinois two corn breeders' associations, to carry out in a commercial way the very practice I advocated here in 1899, applying it to Indian corn. The growers choose for this purpose—and since we grow a good deal of corn in Canada, in southern Ontario, it is important to our country—they choose seed ears with reference to the individual character of the plant on which the ear is produced. That is one of the rules. The plant used must be representative as an excellent, superior plant of the variety. Then they choose the ears that conform to certain standards in regard to length of ear, diameter, closeness of grains and the ear being covered to the very tip with kernels of corn. I obtained from Illinois last year—I went there to see this in some special places—some corn ears that were covered with kernels right over the end.

By Mr. Ross (Ontario):

Q. You could not see the tip?

A. No, there was a grain of corn right in the very end. But such improved corn will go back in a few years unless the systematic selection be kept up. Every sort of grain which has been improved by cultivation and selection will degenerate unless kept up by selection.

Q. Is that a tendency of all plant life, to change?

A. Yes, to vary both ways; and the variation of improved varieties is likely to be backward unless continuous intelligent selection is kept up.

These corn breeders' associations require each of their members to have a breeding plot. Each such plot must have not less than 25 rows of corn by 100 hills long; each separate row planted with kernels from only one selected ear. For their stock seed, they go through the rows, as the other growers go through the sugar beet rows. They see which row on the average gives the best crop. If any row shows inferiority they

must detassel the plants of the whole of that row before they flower, and so prevent cross-pollination. The seed ears from the row that shows the highest yield and quality are taken for the 25 rows or more of next year's breeding plot; and that plan is kept up continuously. The few great corn growers in the United States who have had their names attached to special varieties, have been quietly doing similar work for years, and now the system of selection is being organized for general application. There is a limitation to the extent of the selection of rows. Any one with a breeding plot is not allowed to take from more than 40 per cent of the rows for seed. The limit is 40 per cent, evidently because there is a tendency downwards.

By Mr. McGowan:

Q. Are they doing anything of this at the experimental farm?

A. I think they began it there two years ago.

Another matter of very deep interest to me and also to the country I think, are the facts brought to light by an effort begun at the experiment station in Illinois some six years ago to improve the quality of Indian corn in this way. They had analyses made of the very best corn they could find for a high percentage of protein. They found the good corn contained about 9 per cent of protein. Wheat contains from 12 to 13 per cent of protein. Then they planted rows from the ears that had the highest percentage of protein, and last autumn they had some corn growing in a plot that showed an average of over 15 per cent of protein, or 2 per cent higher than that of wheat. That is an amazing achievement for this continent; for if you have Indian corn richer in protein than wheat, what an immense benefit and advantage it will be in the feeding of cattle, the production of bacon and even in the nourishment of human beings from the cereal direct.

SELECTION OF SEED AS APPLIED TO CEREAL CROPS.

Let me now come to another part of this subject, one that we have been working out in Canada for the past four years. I think we are now ready for a great advance in it. In 1899 I said in my evidence before this Committee:

'The safe practice for the farmers is to select large and heavy seed from any strain which is of good quality for the market, and which has been productive in their locality. A still greater improvement than that is practicable. The selection of seeds from the largest, earliest, most vigorous plants as they grow would give the very best seeds from that strain or variety. The power to overcome obstacles, which is in evidence in the largest and most vigorous plants, is worth seeking in the seeds from such plants.

'One day's work of selection when the crop is ripe would yield the farmer enough heads from the best plants for two bushels of cleaned seed. That should be cleaned thoroughly, and the small light seeds taken out by a stiff fanning and sieving. These two bushels (more or less) of selected seed should be sown on a plot of well prepared fertile land. The crop from that will furnish seed for the general crop of the farm of that class of grain. It is important that that plot should be in the best possible condition for crop growing. The productive qualities of those selected seeds are improved by being grown on land which bears large crops. Before the crop from the seed grain plot is harvested, a selection of the heads from the most productive and vigorous plants should again be made. These furnish the seed for the seed grain plot the succeeding year. The seed grain plot itself should be one on which a well manured root or green crop or a clover crop was grown the previous year. In a few years a farmer could grade up the strain of seed on his farm to yield from 10 to 20 per cent more per acre. Even if he does not follow that systematic selection, if he sows only heavy, plump seeds, *from the largest yielding crop he can find in his locality*, he will derive very great benefit.'

Now I verily believe that, not only from my reading but from my observation and experience. I also believe in the wholesomeness of putting into practice the faith that is in me. That summer—1899—I put aside \$100—my own money, not the public funds—to offer in prizes to Canadian boys and girls who would send me the largest heads from the biggest plants of wheat and oats from their fathers' farms, partly to feel the way whether the country could be got ready to accept and adopt the principles and practice and partly to interest and educate the boys and girls. I had a wonderful response, and I paid that money in prizes with as much enjoyment as any money I ever spent. The letters I got from farmers and from their boys and girls were so suggestive and encouraging that in the following winter I went to my friend Sir William C. Macdonald and said: 'Here is a great chance to do some educational work in progressive agriculture; education not by reading alone but by having something interesting to do, something attractive, something definite, something beneficial to the whole community, something easy and yet with plenty of difficulties. A man may fail to appreciate the educational advantages set out in a written statement, but here is something for the boys and girls which the farmer can see for himself to be beneficial and which would be so helpful and instructive to boys and girls that they would go on with it; and the habits of observation and thought and study would go on with them.' He asked me what I would like, and I told him I would like him to give me \$10,000 for prizes—the price of two farms—to set and keep this thing going for three years. I got the money with all good will—my little \$100 came back a hundredfold—to offer as prizes to boys and girls to encourage them to observe and study this matter of getting the largest heads of the most vigorous plants and growing seed from those heads by itself. The agents who become instruments of progress in farming and other affairs are men and women or boys and girls, knowledge and wealth. In this we had the wealth from Sir William C. Macdonald, I happened to have the knowledge at first and the boys and girls did the work under the incentive of the prizes. The effort has resulted in the most satisfactory progress all over Canada, from the Atlantic seaboard to the other coast. There was a yearly competition in and for every province; and also a main competition extending over three years; every boy or girl living on a Canadian farm who was under 18 years of age on January 1, 1900, could enter as a competitor. I offered ten prizes in every province for oats and ten for wheat, the prizes in the yearly competitions ranging from \$25 for the first, down to \$5 for the tenth. The boys or girls who sent me one hundred of the largest heads of wheat or oats from a crop grown on their father's farm received prizes to the number I have stated. One condition was that each competitor selected by hand out of the same crop enough similar heads to plant a quarter of an acre the following year. The purpose was not to get the largest heads sent in, but to induce the children to plant a quarter of an acre with grain from large heads. The next year they would have an object lesson, they and their fathers, as to the value of such seeding. That was done during three years, and 485 prizes were paid, to the amount of \$5,417, on the yearly competitions. A boy could not be expected to work and wait three years for his first chance of a prize, and therefore, we had to have that 100 largest heads competition annually to keep the boys and girls. The main competition consisted in sowing a quarter of an acre every year with seed from the largest heads selected from the most vigorous plants of the previous year's plot; and the main competition was based on the yields from those.

By Mr. Ross (Ontario):

Q. That is, in the second year the seed was selected from the biggest heads from this special or stock plot?

A. Yes.

By Mr. Robinson (Elgin):

Q. Did you have Indian corn too?

A. No, only oats and wheat. Then they had to select from the plants bearing the most vigorous heads 35 pounds of oat heads and 50 pounds of wheat heads. That

crop was produced from seed selected from the plot grown from the seed from big heads of the previous year. We are trying to establish a system whereby that practice, or the application of the principles underlying it, will be kept up, so that it can never be lost out of the farming of Canada. You see what a splendid vista of progress and promise and profit that opens up. In that main competition we have paid altogether 174 prizes, amounting to a total of \$5,425, so that altogether we have paid \$10,842 in prizes. The \$10,000 which Sir William C. Macdonald put into the bank, with the interest, has brought me out square, plus a great deal of valuable information, plus much happiness in administering the work.

By Mr. Ross (Ontario):

Q. I suppose you will give us the result of your experiment?

A. Yes; but the results reached are not easy to define. Only 450 competitors went through with the competition; that is, only that number had selected seed for the quarter-acre seed plots up to and including the third year. About 800 started in, but all of them did not continue to the end. It was necessary that teachers or parents should supervise the measurements and weighings and send us certificates as to the work. I also got our dairy instructors, institute lecturers and travelling inspectors to help in the work by visiting these children wherever it was practicable and convenient. In addition I wrote the competitors three or four letters a year, asking them for information and encouraging them. That has brought about a fine relationship between these young people and our department. Some of them are getting their fathers to send them to an agricultural college, others are staying longer at school.

Regarding the crops which were grown in 1902 from the selected seed, 92 per cent of the reports said on behalf of parents and guardians that the quarter-acre plots carried crops decidedly more vigorous and heavy than the crops from the same varieties of grain grown on the same farm in the same season from unselected seed. That was the report of 92 per cent of the parents or guardians.

Let me restate some features of the competition to make them clear. The competitor was required to pick by hand the largest heads from the most vigorous and productive plants, in sufficient quantity to obtain seed from those heads to sow a quarter of an acre, which became the stock seed grain plot. Before the crop of the quarter of an acre was harvested, the competitor again selected by hand the largest heads from the most vigorous plants, in sufficient quantity to sow the quarter of an acre, which became the stock seed grain plot for the following year. Out of the large heads selected every year the competitors sent to me at Ottawa one hundred of the largest. A careful record was kept of the number of grains per hundred heads, and also the weight of grains per hundred heads. These boys and girls were not biased in favour of any theory, but the records of their work show that there was a remarkable increase in three years in the number of grains per hundred heads, and also in the weight of the grains per hundred heads. The percentage of increase from the crop of 1900 to that from the crop of 1903, on the average for all Canada, was 18 per cent of increase in the number of grains per hundred heads of spring wheat, and 28 per cent of increase in the weight of grains per hundred heads. In oats the figures were 19 per cent of increase in the number of grains per hundred heads, and 27 per cent of increase in the weight of grains per hundred heads. That is a record from several hundred seed grain plots operated by boys and girls. The plots and farms where these seed grain plots were carried on, were visited in many cases, and it was learned that the operators themselves, and neighbouring farmers, said that the crops grown on these plots from selected seed were heavier and better, and that the plants were more vigorous than those produced on the other parts of the farm from the ordinary seed of the same variety without systematic selection. When results so notable as those can be gained by three years of intelligent labour, what do you think is possible in thirty years, when this practice becomes the common one for grain growing on the farms throughout Canada?

I do not say that these results—these increases—were altogether due to improvement of the seed by selection. There is the acquired skill of the boys and girls in picking the best heads, due to trained observation. There is the better cultivation of plots to be noted. When these and other contributing factors are all allowed for, there is still much of the improvement to be attributed directly to the systematic selection. The general testimony to the superiority of the quarter-acre seed plots is confirmatory of that.

By Mr. Robinson (Elgin):

Q. Did all the provinces take part in that competition?

A. They all took part, and nearly in proportion to their agricultural population.

By Mr. Cochrane:

Q. Is it not a fact that the same seeds grown continually under similar conditions will deteriorate?

A. Some farmers have been doing this kind of thing, applying a principle of selection in a rough way, for many years; as they have done in Scotland for thirty years to my own knowledge with advantage. I do not know of any case in which the seed has run out or deteriorated if annual selections have been made of the best seed or even of seed from the best part of the crop.

Q. I have found that it is a good thing to change seed in a locality sometimes.

A. That may be in some instances; but I do not know of a single case where the seed has run out during systematic selection. In Fifeshire, where they grow heavy crops, it is a common practice there for the farmers to pick out an acre or more on their fields where the heaviest and best crop grows, save that, and stack it by itself, for seed.

Q. Do you think it has a beneficial effect to have the heads selected only while growing?

A. If the head of seed came from a weak plant, even although it was a large head, it would not have the inheritance of vigorous productive qualities. It is not merely the long, large head or ear that is wanted, but the large head full of plump, well ripened seeds from the large vigorous plant that is wanted.

By Mr. Wright:

Q. We have been handling pease, as you know, for many years and we have found it to be a certainty in the case of farmers with light soil, that their pease grown on that light soil deteriorate and in three or four years become extinct, while farmers that have clay land can grow pease year after year and they do not appear to deteriorate at all.

A. Perhaps you will find that the bacteria that nourished the pea plant is much more abundant in lime and clay soil than in sandy soil. With regard to the effect of the nourishment of the crop on the quality of the seed from it, I remember going across the great wheat field at Rothamsted, England, with Sir John B. Lawes, who I think was the greatest authority on crop growing that the world has known so far. He had grown wheat on that field for something like forty-eight years under constant, continuous and regular supervision. I suppose there were perhaps twenty-five or thirty plots in that field, each plot would be twice as wide as this room, and then there was a passage between the plots; each plot was drained, and drained into a cemented trench at the far end; the drainage had been collected and analysed for many years, so that they knew exactly what came out of the field both in the crop and in the drainage. On the plots of the field different fertilizers had been used. On the first plot barn yard manure had been applied every year, the average crop being over 36 bushels to the acre. On the next plot commercial fertilizers had been used and it had given about the same yield per acre. The next plot had got absolutely nothing for over forty years; it had received nothing at all in the way of manure or fertilizer; and gave a crop on an

average in recent years of about 13 bushels per acre: as Sir John said to me, 'the average crop of the United States with her virgin soil.' There was a field that had been in wheat for over forty years, but not with the same variety of wheat always. Sir John said he was sorry he had missed one point in his investigations. I put this question to him: 'You sow the same variety all over the field; here is a plot that will give you 36 bushels per acre and here is another plot that will give you 13 bushels per acre. Have you tried sowing seed obtained from a badly nourished crop side by side under the same conditions with seed from the well nourished crop?' He said he had not tried that. Then I inquired what difference he thought there would be. He said he thought that the influence of that heavy crop—36 bushels per acre—would be felt for three crops afterwards as compared with seed obtained from the 13 bushel plot. Now that is the opinion of a man—the opinion of, I think, the wisest man I ever met on agriculture—to the effect that for three successive crops you would find advantage from using seed from a well nourished crop. Every quarter-acre seed plot can be specially well cultivated; and then you can get the seed from the larger and more vigorous plants; thus you get not only the reinforcement of vigour by the selection of the large heads, but also get the seed from extra strong plants for general use on the farm.

ORGANIZATION OF A SEED GROWERS' ASSOCIATION.

I would like to state what we propose to do and what we have already done in connection with this Macdonald seed grain competition. We have about 450 farmers or farmers' children in Canada who have each on hand now, enough seed for about a quarter of an acre, obtained by this special selection for three years. A number of them have been organized into a seed growers' association; and provision has been made to take in everybody who wants to come in on the same terms. Provision will be made for registering seed selected in that way, and having it sold under registration numbers for seed purposes as distinguished from seed grown for food or milling purposes.

I think the best course I can follow perhaps is to read to the Committee this announcement of the Macdonald-Robertson Seed Growers' Association, which sets out very briefly and clearly the objects and methods of the association.

By Mr. Ross (Ontario):

Q. How many varieties of wheat were sown by these 450 farmers?

A. I do not know, but they sowed the common variety grown in the neighbourhood; we made no restrictions about that.

The announcement of the Macdonald-Robertson Seed Growers' Association is as follows:—

With a view to encouraging further the production and general use of seed of superior quality for farm crops, the Honourable the Minister of Agriculture for Canada has authorized me to announce that the Department of Agriculture will grant such assistance as may be necessary to enable an association or associations of producers of improved and registered seed to carry on effective work.

In all kinds of farm crops the yield per acre may be materially increased and the quality substantially improved by the use of seed which has been graded up by careful growing and systematic, intelligent selection, continued without interruption from year to year.

The qualities known as vigour of growth and productiveness in individual plants, are transmitted through their seeds to the succeeding crops quite as surely as any desirable characteristics are transmitted to animals from their ancestors.

All seed for general use should be obtained from varieties of which the quality has a relatively good market value, from crops which have attained a high degree of productiveness, and from localities where the climatic conditions are not much different from those where the seed is to be used.

All farms and all kinds and conditions of soils are not well adapted for the production of seed of superior quality, of all kinds of crops. Grain, and other seeds, for seed purposes, should be produced on lands that are free from noxious weeds and capable of producing those crops at their best in quality and in yield per plant.

There is a need and opportunity in every agricultural locality in Canada for a few farmers to make a specialty of growing high-class seed in quantity for the purposes of seed as distinguished from grain for feed or food. There would be immediate profit to all growers who managed that special branch of farming with care and intelligence. Other farmers would seek from them the supplies of seed for their general farm crops.

The best results for all concerned are to be obtained from organized effort, under intelligent direction. Associations of farmers making a specialty of growing grain and other crops for seed purposes on well kept and highly conditioned farms, should be organized as a means of improving their seed and of educating buyers and farmers generally on the value of pure-bred registered seed.

I. Some four hundred and fifty of the parents of competitors who have been operating plots in the Macdonald seed grain competition have expressed their intention of continuing the work of producing pure-bred seed by hand selection. They with others who may join us, will become the original members of the Macdonald-Robertson Seed Growers' Association for the Dominion of Canada.

I desire that seed growers who have given special attention to the production of wheat, oats, barley, rye and corn during the past few years should also become operating members of this association and make provision for operating a seed plot.

II. The object of the association will be to advance the interests of seed growers,—

- (1.) By forming regulations as to methods;
- (2.) By publishing information as to standards;
- (3.) By issuing certificates of registration which will distinguish between hand selected pure-bred seed and ordinary grain; and
- (4.) By such other means as may become expedient from time to time.

Provisional directors of the association are to be called together at some future time to consider and revise the rules and regulations which have been drafted for the guidance of those who operate seed plots in 1903. Arrangements may also be made for the formation of district and local associations in the various provinces.

III. The Macdonald-Robertson Seed Growers' Association for the Dominion shall consist of honorary and operating members.

(2.) Persons who may be engaged in agricultural research work, or who may be otherwise interested in the progress of agriculture, may be admitted as honorary members. When appointed or elected as honorary members of the association, they will be eligible to any office, and enjoy the same rights and powers as operating members.

(3.) To be eligible as an operating member the applicant must be a producer of improved seed, and must each year conduct a hand-selected seed plot, consisting of not less than one quarter acre of land.

IV. By the term 'hand-selected seed plot of the first year,' is meant a piece of land bearing a crop produced direct from seed obtained by selection, by hand, of the heads or ears from plants appearing relatively large and vigorous for the variety.

(2.) By the term 'hand-selected seed plot of the second year,' is meant a piece of land bearing a crop produced direct from seed obtained by selection, of the heads or ears from plants appearing large and vigorous for the variety on a hand selected seed plot of the first year.

(3.) By the term 'hand-selected seed plot of the third year,' is meant a piece of land bearing a crop produced direct from seed obtained by selection, by hand, of the heads or ears from plants appearing relatively large and vigorous for the variety on a hand-selected seed plot of the second year.

V. It is permissible to select heads in sufficient quantity to sow a hand selected seed plot or plots of a total area not greater than four times the size of the plot from which they were selected.

VI. To entitle the seeds of wheat, oats, barley or rye to be eligible for registration by the Macdonald-Robertson Seed Growers' Association, they must be produced on a well cultivated registered seed plot from a crop that has followed in rotation,—

- (1.) After clover, pease, beans, or some other leguminous crop; or
- (2.) After a cultivated crop, such as Indian corn, turnips, mangels, carrots, beets or potatoes; or
- (3.) After a summer fallow.

VII. There will be three distinct classes of registration for seeds.

(2.) In the pure-bred class there will be registered as 'pure-bred registered seed' only seed obtained from heads selected by hand from the plants relatively the largest and most vigorous on a registered hand selected seed plot of at least the third year. The registration certificate of 'pure-bred registered seed will show the number of years of antecedent selection, as for instance 'pure-bred registered seed of the fourth year' or of the tenth year, as the case may be. Such seed will be suitable for use on hand-selected seed plots to produce 'improved registered seed.'

(3.) In the improved class there will be registered as 'improved registered seed' only grain obtained from a crop produced from pure-bred registered seed. The registration certificate of improved registered seed will show the number of years of antecedent selection of the crop from which it was obtained, as for instance 'improved registered seed from a crop of the third year,' or of the tenth year, as the case may be. Such seed will be suitable for use on improved seed plots to produce 'general crop registered seed.'

(4.) In the general crop class there will be registered as 'general crop registered seed' only seed obtained from a crop produced from improved registered seed. Such seed will be suitable for use for the general crop of the farm, and the product from it will not be eligible for registration.

The diagram at the end of this announcement will help to make clear the system of selection and registration.

VIII. Records will be kept on which will be entered,—

- (1.) The names and addresses of the members of the association or associations;
- (2.) The size of the hand selected seed plot of each operating member;
- (3.) The size of the improved seed plot of each operating member;
- (4.) The yield per acre of each registered plot; and
- (5.) The disposal of the seed from each registered plot where certificates of registration are issued.

IX. The Commissioner of Agriculture and Dairying will in the meantime control the issuing of all certificates of registration of seed plots and seed, and take such steps by way of inspection, supervision of the operation of seed plots, and otherwise, as

shall safeguard the certificates from being used fraudulently or in any manner contrary to the regulations or to the interests of the members of the association or those engaged in the production of pure-bred registered seed.

X. In the production of registered seed it is recommended that the hand-selected seed plots and the improved seed plots be sown much thinner than has been the common practice in the locality. The thin sowing will to a great extent give individual plants an opportunity to stool or tiller. The aim should be to obtain a maximum of vigour and of yield per plant rather than a maximum of bushels per acre on the seed plots.

XI. Where a grain drill is used for the hand-selected seed plot, it is recommended that at least one tube in every four be plugged or stopped up. That will leave space between every three rows of grain convenient for the operator to pass along to gather the large heads from the most vigorous plants. There will be also some other advantages from that practice.

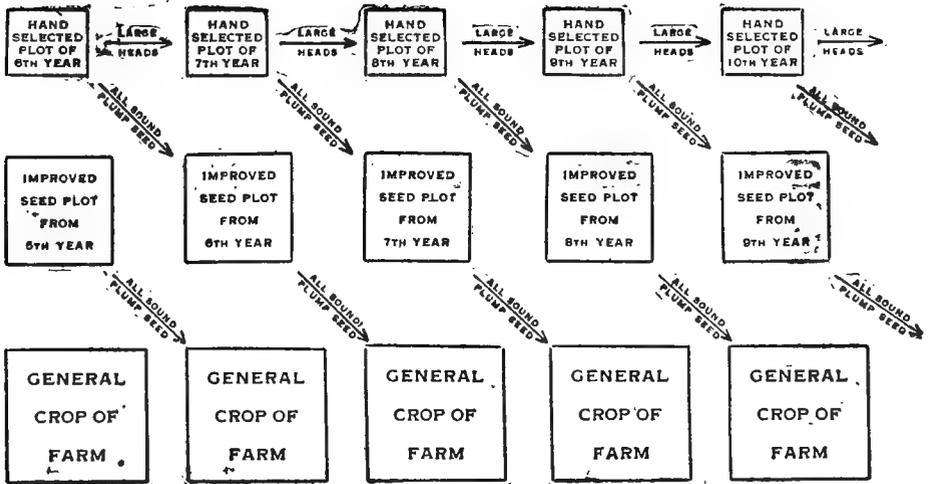
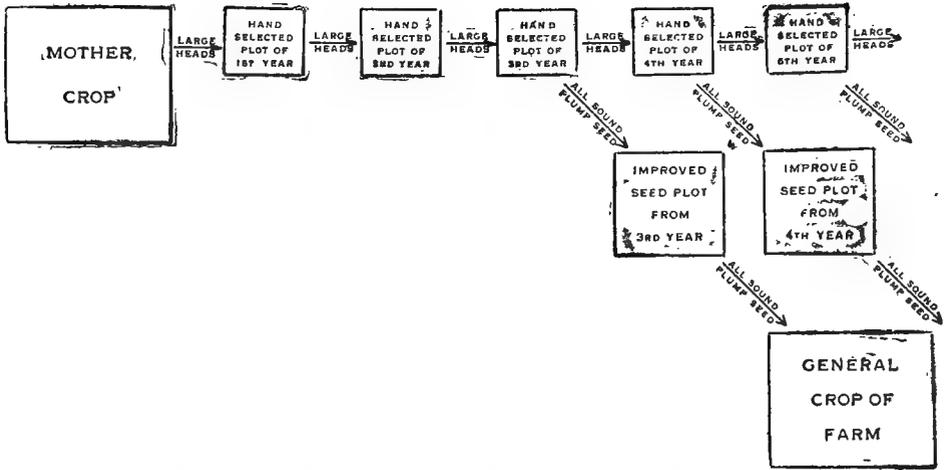
XII. Farmers who are not in possession of seed from a hand-selected seed plot and who wish to join the association as operating members for 1903, should secure good, sound, plump seed of a variety of good market quality, known to be suitable to the locality, and, if possible, from a crop which gave a heavy yield. From the crop produced from such seed, on a specially prepared plot sown thin as recommended, the heads from the largest and most vigorous plants would be selected by hand this season for the hand selected seed plot of the first year, to be grown in 1904.

XIII. The members of the Macdonald-Robertson Seed Growers' Association are not required to pay any fees, or to undertake any obligations to contribute to the expenses necessary for managing the work connected with the organization.

XIV. It is desirable that the membership of the association be not too large at first. It is to be borne in mind that at the present time most farmers do not appreciate the value of selected seeds; and as seed grain improved by a system of hand selection cannot be produced at the same cost as grain grown and sold for food purposes, it will be prudent to push the growth of the association only in keeping with the growth of demand for registered seed. However, a limited number of operating members from every county is desired.

Applications for membership should be addressed to the Commissioner of Agriculture and Dairying, Department of Agriculture, Ottawa.

CHART TO SHOW METHOD OF SELECTION.



JAS. W. ROBERTSON.

Dated.....190...

at.....

To JAS. W. ROBERTSON,
Commissioner of Agriculture and Dairying,
Ottawa, Ont.

SIR,—I hereby apply for membership in the Macdonald-Robertson Seed Grow-
ers' Association. I intend to operate a seed plot or plots in accordance with the
rules and regulations of said Association.

Please
write
clearly.

}

Name.....

Post office.....

The farm on which the seed plot will be is,—

Lot.....

Township of.....

County of.....

Province of.....

Cut off at this line. In a closed envelope it will be carried free by mail.

By Mr. Ross (Ontario):

Q. Is Sir William Macdonald still going to continue the giving of prizes?

A. They were given only for three years, but Sir William has said that if the government is not willing to stand behind the seed growers' association with enough money to make the thing national he will be glad to do it. I have said it is a question that so concerns the nation that I have asked the Minister to put in the estimates a sum sufficient to do this on behalf of the government. It is intended then to let the Macdonald-Robertson Association become the Dominion of Canada Seed Growers' Association. We expect to have a Bill, perhaps this session, to make these associations subject to the control of the department as the live stock associations are.

Q. Quite right!

By Mr. Thomson (Grey):

Q. Are these associations distributed throughout the provinces?

A. The members of the one association are distributed pretty well throughout all the provinces; the places where we had the largest percentage were in the French part of Quebec and in Prince Edward Island. We expect provincial and district associations will be formed.

By Mr. McGowan:

Q. I should think there would be no need to give prizes.

A. No, there is no need to give prizes, but it would seem desirable, after these associations are started in each county or group of counties perhaps, that the man who keeps his plot best, has it cleanest and has the best yield, should obtain some recognition, a prize perhaps like those at agricultural exhibitions.

By Mr. Erb:

Q. You recommend selecting the very largest heads of wheat; but when selecting sugar beets you advise choosing the medium sized root. What is the difference?

A. The difference is this, that a large head of wheat contains more grains of wheat, of as good quality, than a small head, whereas a very large beet contains a smaller percentage of sugar than a medium sized one. The sugar grower desires to get the largest quantity of sugar per acre and finds that in a crop of roots of medium size. We find in grain the larger the plant the better. In many instances in the competition we found the number of bushels per acre almost double the number of grains per head.

Q. Is it found that the larger beets do not contain such a large percentage of sugar as the medium sized?

A. That is the rule, I believe, to pick out the medium sized for mothers.

By Mr. Robinson (Elgin):

Q. Is that found to be the rule, twice the number of bushels per acre that there are grains per head?

A. That appeared to be indicated by the observations that have been made in the Macdonald competition.

Some beets have the habit of growing out of the soil more than others, and the growers discard that kind of beet because the part above ground contains less sugar and—

Q. What did you say about the part above the ground?

A. It is found to be largely mixed with impurities difficult to separate from the sugar.

By Mr. Erb:

Q. But they select large beets after testing.

A. They select medium, smooth beets first and from these rows they take the larger on the average if they are smooth.

By Mr. Robinson (Elgin):

Q. They don't test the whole of the beet but only a small portion of it.

A. They take out a little core and so leave the beet in a condition to grow when it is planted.

Mr. WRIGHT.—Mr. Chairman, the professor has given us a very good idea in one respect as to what Sir William C. Macdonald is doing for the cause of education in general, and particularly with reference to farming. Now we have not too many men like Sir William C. Macdonald, and perhaps there are only three other men who stand out pre-eminently in this country as those who have assisted the cause of education—McGill, McMaster and Lord Strathcona. Now I would like to have Professor Robertson give us some idea some other day as to the other work he is doing with the assistance of Sir William C. Macdonald in the matter of education as it bears on the cause of agriculture. You know a large work has been done and is likely to be successful in a large number of public schools for the carrying on of manual training, and I would like to know if he could give us some information about it. It is hardly under the Agriculture Department, but he might be able to give us some information which I think will be valuable to the Committee and the country.

Professor ROBERTSON.—If the Committee likes I will be very willing to come before them in that way. I have the authority of the Minister, I had the authority of the government some years ago, to take what time was necessary to administer the Macdonald Manual Training Fund to establish manual training in Canadian schools. I did not do that as Commissioner of Agriculture, but as James W. Robertson, of Canada. We have manual training established and maintained by the Macdonald fund in twenty-one towns. The local authorities in many other places are this year supporting the classes themselves. There are forty-six manual training teachers on the pay roll, from British Columbia to Charlottetown, whom I pay monthly. Sir William C. Macdonald has further given me a large sum of money to use in the improvement of rural schools and in the giving of object lessons of school gardens and instruction in domestic subjects.

Mr. Ross (Ontario).—That is nature studies ?

Professor ROBERTSON.—Nature studies, household economy and manual training, having the children trained to exercise their intelligence on the things they see about them. I am a citizen of Canada and I have the consent of the Minister of Agriculture to use what time I need, even in office hours—my leisure time is my own—in order to carry on this most valuable work which Sir William's wisdom, good-will and generosity have made possible. It is rather a big scheme. I gave an address recently in Halifax, N.S., and the legislature accepted the policy as a whole. They are going to establish a college of agriculture at Truro and have a Bill before the House, voting \$36,000 to assist in the consolidation of rural schools. I am to go before the legislature of New Brunswick next week. While education is a provincial matter, I am not interfering with provincial rights, but am co-operating with the provincial authorities to bring about improvements which they also desire.

Mr. ROBINSON (Elgin).—What does this manual training consist of ?

Prof. ROBERTSON.—A room is set apart in any school where it is adopted; it is equipped with benches and tools; and the boys give an hour and a half or two hours a week to practical work there under instructors, making drawings and making articles in wood.

Mr. ROBINSON (Elgin).—I think we should get that information before us.

Having examined the preceding transcript of my evidence of April 15, I find it correct.

JAS. W. ROBERTSON,
Commissioner of Agriculture and Dairying.

