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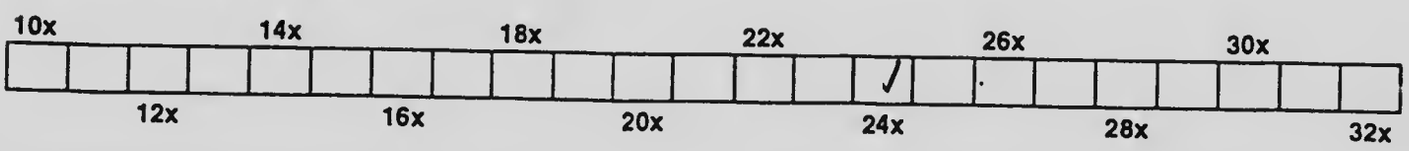

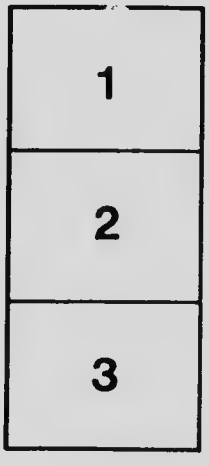

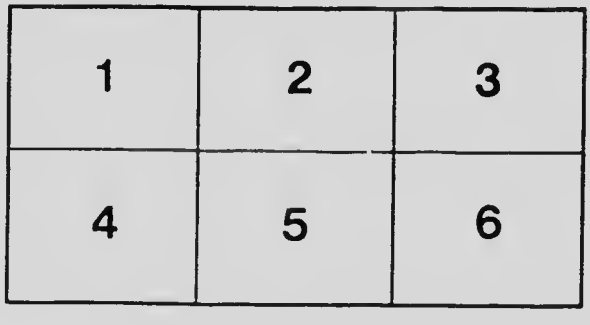

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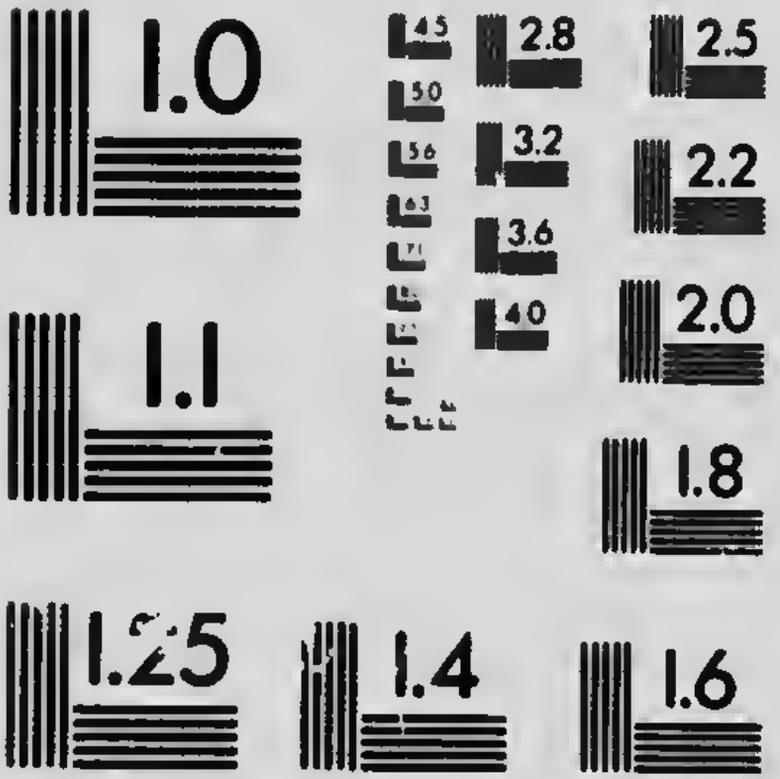

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DOMINION OF CANADA
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BRANCH OF THE SEED COMMISSIONER

SUMMARY OF ILLUSTRATED LECTURES

ON

SEED GRAIN

CONDITIONS OF THE SEED TRADE, WEEDS AND WEED SEED IMPURITIES IN COMMERCIAL GRAINS, GIVEN AT FARMERS' MEETINGS IN THE PROVINCES OF MANITOBA, SASKATCHEWAN AND ALBERTA

BY

GEORGE H. CLARK
Seed Commissioner

OTTAWA
GOVERNMENT PRINTING BUREAU
1905

SEED OF CEREAL GRAINS

ITS FUNCTION IN THE LIFE OF THE PLANT.

More than five and a quarter million acres of land in Manitoba, Saskatchewan and Alberta will probably be sown to wheat, oats and barley during the coming spring months. The expense of preparing this land for the seed is practically the same, whether good or inferior seed is used, and the harvesting of the crop, be it large or small, is nearly the same. The value of the seed on an acre of land is small and the difference in value between the best obtainable seed and seed of indifferent quality becomes insignificant when compared with the other expenses. It will therefore be seen that, while other expenses may remain practically the same, an increase of fifty cents per acre on account of using seed of superior quality may easily mean a tenfold increase in the net profits from the crop.

ROTATION OF CROPS.

The kinds of farm crop that are best to grow in any district will, of course, depend very largely on the market demand for the output. The growing of cereal grains from year to year is a practice that does not provide suitable opportunities for combatting weeds, and insect and fungous pests. By alternating crops of wheat, oats and barley with such crops as field roots, pease, grasses and clovers, where they can be grown to advantage in rotation with smaller grains, much can be done to eradicate weeds and thus do away—in districts where soil moisture is not of first importance—with the necessity of summer fallowing every three or four years, which is really an expensive though much needed process for destroying weeds on farms where a system of rotation is not practised.

VARIETY.

It is of first importance that the variety of wheat, oats or barley, that is grown, be of good commercial value and well suited to the climate and particular soil on which it is used. To get reliable information as to the best variety in use, it is well to study the results obtained by neighbouring farmers, to look to the reports from the nearest experiment stations, and, where care is taken to keep varieties separate, it may be advisable to do a little systematic testing of varieties on the land where they are wanted for use.

A visit to experimental farms at Indian Head, Brandon or elsewhere when the grain on the test plots is nearing maturity, affords an excellent opportunity to study the desirable and undesirable qualities of the various varieties, between many of which there are wide differences in the quality of grain, length and strength of straw, susceptibility to rust, earliness, and in the ability of the variety to give a large yield per acre.

DIFFERENCES BETWEEN STRAINS OF SEED OF THE SAME VARIETY.

Nature intended that the energies of all plants be bent on the production of seed or other reproductive organs that will carry the life of the plant over to the next gen-

cration. In this, nature's aims are for the benefit of the plant rather than for the benefit of man. If wheat or oats be grown under conditions where the individual plants have to fight for their existence on account of weeds and a poorly cultivated soil, the plant will adjust itself so as not to form more heads or more kernels in the head than it is able to fill and mature. But man has at his disposal the means to improve on nature's methods much to his own advantage.

The beef and dairy breeds of cattle have been improved by feeding, breeding and selecting the best from the best of each succeeding generation. It is true that if the system of selection be not kept up with improved breeds of live stock, the improved herds will rapidly deteriorate and become less profitable to the farmer. It is likewise equally true that if our grain crops do not receive reasonable care in the matter of cultivation and selection they also will become 'run out' and less profitable.

By selecting the best from the best from generation to generation, the sugar beet has been improved until the sugar content has been raised from 9 to 15 per cent. Vilmorin, of France, commenced the work of selecting sugar beets three generations ago. He selected first the sugar beets of the desired type and from these he cut out a small piece and determined their percentage of sugar. On his breeding plot he transplanted and saved seed only from those mother beets which contained a high percentage of sugar.

Vilmorin also commenced to grow and select wild carrots seventy-four years ago. We have reaped large benefits from his skill in the improvement of our cultivated carrot, which is now quite largely grown all over Canada as a vegetable and stock food. We also have with us the original wild carrot, which is a common weed in many districts in Canada.

In the spring of 1893 Prof. Zavitz of the Ontario Agricultural College, Guelph, commenced the work of selection of seed with a variety of oats known as 'Joanette Black.' A quantity of large, plump, black oats and an equal number of oats that were lighter in weight and lighter in colour were selected by hand from a bulk lot that grew in a field on the farm. Each of these two selections were sown on plots that were uniform in quality and size. Selections were made in each of the following years from the product of each of the two plots of the preceding year. That is, large plump, black oats and the oats that were lighter in weight and lighter in colour were selected from the crop produced from similar seed the previous year. The selection of the large, plump kernel year after year made for the gradual improvement in the yield and quality of the crop, while the influence from the selection of the kernels that were lighter in weight and lighter in colour tended in the opposite direction. At the end of twelve years there was a difference of twenty-six bushels per acre in favour of the crop from the large, plump seed, which also weighed ten and a half pounds per measured bushel more than the grain produced from the lighter seed. Here indeed is an illustration of the difference there may be between two strains of seed of the same variety.

The seed of Red Fife wheat and Banner oats grown by Messrs. A. Mackay, of Indian Head, and S. A. Bedford, of Brandon, has the capacity to give a much larger yield of grain than the seed of the same varieties that is sown on the average of farms in western Canada. The strains of seed grain of varieties that were obtained ten or twelve years ago are much improved to-day to what they were when first sown on the experimental farms.

Much more evidence could be given to show that the farmers in the grain growing districts in the west may adopt practical means by which they can increase the yield and improve the quality of their crops of wheat, oats and barley; and that without proper care in the growing and selecting of seed the yield and quality of cereal grains will depreciate from year to year. One other illustration, however, may suffice.

The State Department of Agriculture for Illinois co-operated with some of the leading corn growers in the formation of a Corn Breeders' Association. The members of this Corn Breeders' Association keep accurate records of the yield of corn from their breeding plots or small fields, on which they do the work of special selection in

order to get good seed for the rest of their farms. The state authorities do the work of examining selected seed to determine its gluten content, the object, in some cases, being to breed up a strain of corn having a greater feeding value. The work has been carried on now for four years, with the result that the gluten content of the corn has been increased by 25 per cent, and an increase of 50 per cent in yield of shelled corn per acre has been made by many of the members who have carried on the work systematically.

THE NATURE AND FUNCTION OF CEREAL SEEDS.

(Illustrated by grain of wheat.)

A kernel of wheat, oats or barley contains a living germ or embryo surrounded by a supply of food in the form of starch and gluten. In the ripened grain this embryo plant will lie dormant for several years. Wheat rich in gluten seems to retain its vitality much longer than that of soft starchy sorts. If kept in a dry cool place the seed of cereal grains may safely be used for seeding, when three years old. Seed that is six or seven years old may show a comparatively high percentage of germination, but the vital energy of the young plant produced from old seed is much weakened. This is not the case with all kinds of seeds. The seed of Stinkweed (*Thlaspi arvense*) is known to put forth a vigorous growth after having laid dormant for many years. In fact, some of the seeds of many species of wild plants will not germinate until they have had a rest period. While with others the embryo will die if germination is not started within two or three years after they are ripe.

Nature provides a supply of food—the starch and gluten contained in the grain—to meet the needs of the young plant during the process of germination and until the roots and leaves are able to obtain a supply of food from the soil and from the air. This natural supply of food in cereal grains is always entirely used, whether the food in the soil be supplied in plenty or otherwise.

The food that surrounds the embryo is an important factor in giving the young plant a good start in life, thus providing it with a fair chance to make the best of its opportunities. The young plant grows at first exclusively at the expense of the seed. Like the sucking animal, it is unable at first, independently, to obtain a living for itself. Under favourable conditions for growth, the young plant from a shrunken or frozen seed may attain to relative vigour, but the chances are very much against it in its struggle for life, when the conditions of soil and climate are unfavourable to rapid germination and growth.

THE PROCESS OF GERMINATION.

During the process of germination the seed first absorbs a large amount of moisture. This, under favourable climatic conditions, stimulates the embryo into active life. The food supply becomes softened and is gradually liquefied and absorbed by the young plant. From a grain of wheat, oats or barley the primary root first appears, next the leaf and then two additional or secondary roots. Numerous fine hairs are developed on the newly formed roots and these come more closely into contact with the minute particles of soil from which they extract moisture, thus obtaining from the soil such plant food as may have been dissolved by the moisture or by the acid secreted by the root hairs.

TEMPERATURE.

The writer has been able to get a few kernels of hard wheat to germinate on melting ice, but it may be said that 40° F. is the lowest temperature at which wheat will germinate. A temperature ranging from 68° to 86° F. is the most favourable for a rapid and healthy growth of cereal grains. At lower temperatures the embryo plant

is less active and the starch and other food in the grain is less rapidly changed into liquid form.

DEVELOPMENT OF THE YOUNG PLANT.

The temperature at which germination and the early growth of the young plant takes place materially influences the development of the plant. A continued low temperature during early growth is said to retard the development of new buds which form within the leafy sheath and around the base of the first stem. In checking the formation of new buds, nature aims to make sure that the plant of wheat, oats or barley will reproduce its kind by putting forth all its energies in an endeavour to mature seed in a lesser number or in one single head. The process of developing additional buds producing stools appreciably prolongs the time required by the plant to reach maturity, which is of much importance to the economy of the plant in climates where the season for growth is short. Because of prolonged cold weather during the early growing season, the stand of plants in the grain crops may be comparatively thin, even from fairly thick seeding. Nature, however, abhors a vacuum, and if the conditions for early growth be favourable several stems and heads of grain may be formed from a single seed to enable the plant to make the best use of all the space provided, unless all of the space be at first taken up because of thick seeding. If only a moderate amount of seed be used and the process of stooling be checked on account of excessive cold, poor seed or late seeding, the waste space is usually occupied by a later growth of weeds and other hardy indigenous plants. It will be seen then that if good strong seed be early sown on a well cultivated and fertile soil, a limited amount of seed will suffice and a thick stand of plants and a heavy crop may be had from very thin seeding, provided that the conditions for early growth be favourable. One bushel and a half per acre of 'No. 1 hard' Red Fife wheat would provide about 44 seeds per square foot of land. If two bushels per acre be sown, each square foot of land should receive on an average 54 grains.

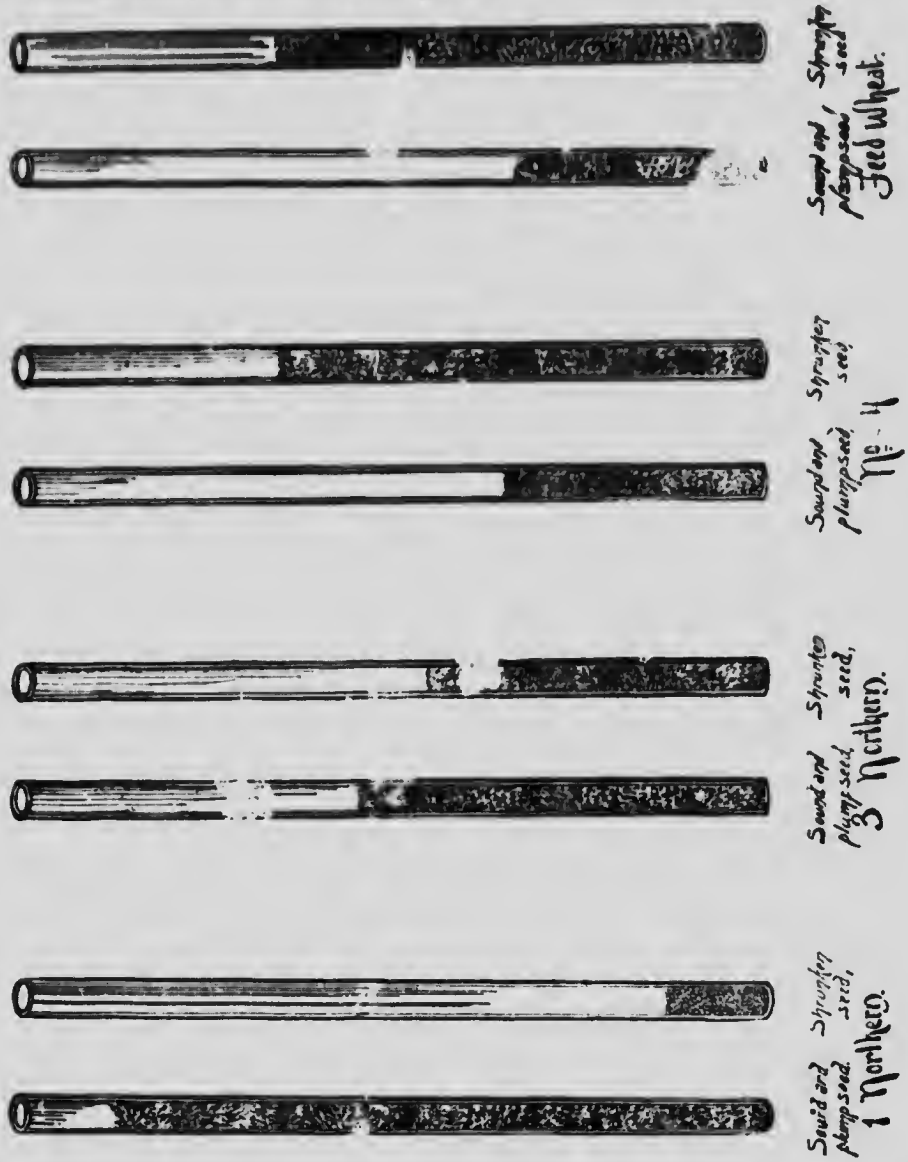
PROPORTION OF SOUND AND PLUMP SEED TO SHRUNKEN SEED IN VARIOUS STANDARD GRADES.

For the purpose of comparing the relative proportions of sound plump seed, representative samples of wheat, from standard grade lots of 'No. 1 Northern,' 'No. 3 Northern,' 'No. 4' and 'Feed' were obtained from the Chief Inspector of Grain at Winnipeg through the courtesy of Mr. David Horn. Each of these standard samples were uniformly separated into two parts, (*a*) sound and plump grains, and (*b*) shrunken grains. The following table shows the per cent by weight and also by number of the sound, plump grains and also of the shrunken grains in each lot:—

	Weight of sound and plump grains.	Weight of shrunken grains.	Number of sound and plump grains.	Number of shrunken grains.
	Per cent.	Per cent.	Per cent.	Per cent.
No. 1 Northern	92	8	83	17
No. 3 Northern	60	40	49	51
No. 4	39½	60½	30½	69½
Feed	38	62	28½	71½

The shrunken grains, although much lighter in weight, are fed through a grain seeder in operation in only a slightly greater proportion by number. A seeder gauged

to sow one bushel and a half per acre should sow from 95 to 100 pounds of the standard grade 'No. 1 Northern'; 90 to 95 pounds of 'No. 3 Northern'; 85 to 90 pounds of 'No. 4,' or 80 to 85 pounds of 'Feed' wheat. The following illustration is given, to show the relative volume, in glass tubes of the sound and plump grains and the shrunken grains in each of the four grades:—



Since the development of the young plant from the weaker seed is retarded by adverse weather conditions to a far greater extent than that from the strong seed, no fixed rule will apply as to the additional amount of the poorer seed that should be used in order to obtain a stand equivalent to that produced from the better seed. Should climatic conditions, at any time, make it necessary to use seed grain that is frozen or shrunken—especially with oats or barley—one hundred average grains should

be counted out and tested for vitality. An allowance may then be made for the non-vital seed, so that the pure living seed sown will be equivalent in *weight* to the amount of sound, plump seed, which is usually sown in the average season.

A close observation of any field of wheat sown from shrunken seed—although the general appearance of the crop may be good—will usually show the presence of many weakly plants with but a single stem that is shorter than the average and bearing a short head containing from 25 to 40 grains. A crop of this kind may give good returns for milling purposes, but the effect of using seed year after year from such crops makes for deterioration in the vigour of the crop as a whole and materially reduces the productive capacity of the seed.

To illustrate more clearly the differences in vigour between the plants of wheat grown from grain produced from large plump seed and those from shrunken seed, one hundred kernels from each were selected by hand from the grades supplied by Mr. David Horn and planted in rich black loam and also in sand. The photo herewith reproduced shows the growth from different lots at three weeks. Plate II.

PRACTICAL METHODS OF GROWING AND SELECTING SEED GRAIN.

Although too much cannot be said regarding the importance of using good sound grain for seed purposes, equal recognition should be given to the selection of large, early maturing heads from vigorous plants as a practical means to keep the crop true to a desirable variety and to eliminate the weakly and less productive plants which result from the natural process of deterioration. On a large grain farm it would not be practicable to undertake to select large heads of wheat, oats or barley to get good seed to sow more than, perhaps, an acre of clean land. That would require about 100 pounds of well-ripened heads, and experience has shown that one man would require nearly two days to select that amount by hand from a field of standing grain.

No system of growing and selecting seed grain as a means to bring about improvement in both yield and quality, however good, would be complete unless selection were also applied to the plant itself. In this respect the fundamental principles are similar to those adopted in the improvement of poultry, in the process of which more attention is given to the selection of the birds themselves than to the selection of eggs of certain size and form. In the improvement of the sugar beet, the carrot, the cotton plant, Indian corn and other crops that are grown in an extensive way, those fundamental principles of selection were recognized and practical methods were devised to apply them.

The plan recommended for adoption in the selection of cereal grains—wheat, oats and barley—is simple and quite practicable to the average grain grower. To commence with, a small supply of the best obtainable seed should be secured and sown on clean land, new land or good summer-fallow preferred. Such a plot of the best and cleanest land should be provided every year, and used as a base of supply on which to grow pure seed of the best variety. In order to keep the product of the breeding plot pure, extra care is required to avoid having the grain mixed at time of threshing or while in storage, but the increased value to the whole crop will many times repay for the special attention that is needed to keep the base of supply unadulterated.

With such a plot of land provided every year, the selection of large early ripening heads could be adopted to good advantage and would give handsome returns in the succeeding crops on the farm. The gathering of large heads can best be done in the field when the crop has just reached maturity, but may be done from the sheaves at any time before threshing. The crop on the seed plot should always be left until fully ripened before being cut.

Much benefit would result if the selection of the best developed heads of grain were made every two or three years only. In addition to eliminating undesirable foreign varieties, this plan would go far toward discarding the less vigorous individual plants. It would be much more effective, however, to have the work of hand-selection carried on from year to year without interruption.

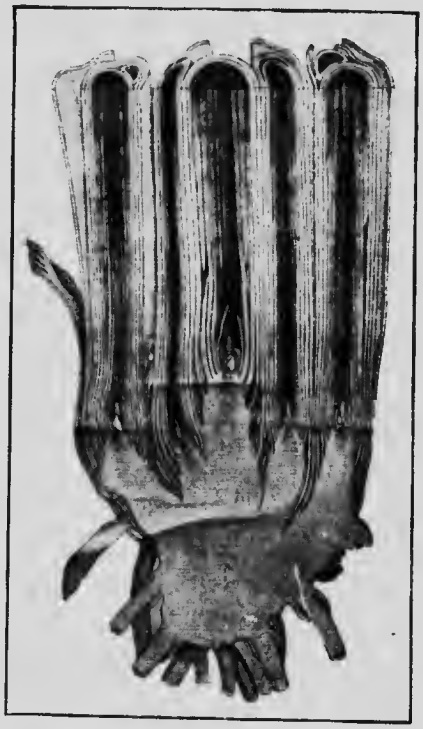
a *b* *c* *d*

a. Grain of wheat with embryo exposed.
b. Section showing embryo plant.
c. Section through centre of grain.
d. Section through embryo.

a *b*

a. Young plant showing development of root-hairs.
b. Section through centre of plant *a*. (enlarged).

a

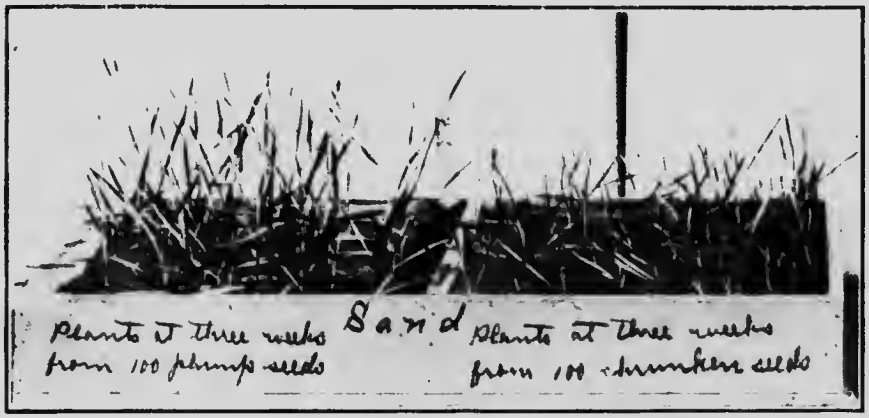


b

a. Wheat plant showing several stalks (stools) from a single seed.

b. Section through part of leaves, stem and root of *a* (enlarged). Note the development of buds and position of the already perfectly formed heads.


Rich black loam
Plants at three weeks from 100 plump seeds
Plants at three weeks from 100 shrunken seeds


Sand
Plants at three weeks from 100 plump seeds
Plants at three weeks from 100 shrunken seeds

The Canadian Seed Growers' Association keeps records of and issues certificates of registration for approved seed that has had the benefits of selection for three consecutive years. An annual catalogue is issued by that association, giving the names and addresses of producers of registered seed and the amount of seed they may have for sale. Such information may be had on application to their secretary at Ottawa.

Already there is a large number of farmers carrying on the work of seed growing as a special industry under the general guidance of, and with such assistance as the Canadian Seed Growers' Association is able to give them. Some of the members of the association living in the provinces of Saskatchewan and Manitoba have selected seed wheat every year for six years, and many have taken up the work during the last two years.

During the years 1900, 1901 and 1902, one hundred of the best heads from every seed plot in Canada were sent to Ottawa for examination. The yield per acre of threshed and cleaned seed grain from the seed plots was also reported during the same period. The following table shows the average for all provinces of the number of grains per head and the yield per acre of wheat and oats as shown by reports received from those who commenced the work in 1900 and continued throughout the three years:—

SPRING WHEAT.

Year.	Average number of grains per head.	Average weight of grain per 100 heads.	Average yield per acre.
		Grams	Bush.
1900	42·9	112·9	25·39
1901	46·9	162·6	30
1902	51	183·3	35·4.

OATS.

1900	116·9	301·6	54·08
1901	121·9	343·3	59·44
1902	140·5	385·5	73·72

In carrying out the work of hand selecting large heads of wheat, special care must be taken when mixtures of undesirable foreign varieties, that are characterized by having extra large heads, are present. For instance, should White Russian wheat be mixed with Red Fife it would become necessary to hand-pick the threshed grain before being sown on the seed plot, in order to eliminate the former variety.

TREATMENT OF SEED GRAIN FOR SMUT.

Both the loose smut and bunt of wheat can be prevented to a great extent by following the system of growing and selecting seeds adopted by the Canadian Seed Growers' Association. The danger from smut infection in the breeding plot or base of supply is reduced to a minimum of loose smut and is almost eliminated in the case of bunt. The reports of members of the association in Manitoba and Saskatchewan, who are growing seed wheat, show that the general farm crop produced from the same strain of seed is particularly free from bunt.

When bunt or loose smut is present in wheat, oats or barley to be used for seed, much can be done to remove it by thorough cleaning with a fanning mill. Such seed, however, should always be treated in a way to effectively destroy any smut spores that may be lodged in creases of the grain.

The bluestone (copper sulphate) treatment has proved to be an effective remedy for bunt in wheat. After making exhaustive tests with various treatments for smut, with solutions of iron sulphate, copper sulphate and agricultural bluestone, Prof. Frank T. Shutt, chemist, Experimental Farm, Ottawa, observes that the results of his experiments 'seemed to indicate that none of the solutions tried are efficacious in preventing the development of loose smut.' His observations of the effect of such treatments on the vitality of the seed, is summarized as follows:—

'1. That the copper sulphate, used alone or with iron sulphate (as in agricultural bluestone) lowers the percentage of vitality, corroborating previous results.

2. That the subsequent immersion in lime-water of wheat treated with copper solution lessens the injurious effect of the latter upon the vitality of the germ.

3. That the iron sulphate, as in previous experiments, as a rule does not affect the vitality of the wheat.

4. The differences between the wheats 'thoroughly sprinkled' and 'immersed for five minutes' are such that we may consider these methods as equivalent, as regards effect upon the vitality.

The reports (of plot tests with seed wheat treated as above by Prof. Shutt) received from the Brandon and Indian Head Farms may be summarized in the following sentences:—

1. That sulphate of iron is *not* efficacious in destroying smut spores.

2. That the sulphate of copper treatment is the most effective of all experimented with, in preventing the development of smut.

3. That agricultural bluestone occupies, usually, a position between these two salts in reducing the amount of smut.

4. That the subsequent immersion in lime-water of seed treated with solutions of copper sulphate and agricultural bluestone, lessens the effect of these compounds as smut preventives, and is not therefore to be recommended.

Our advice, therefore, has been: thoroughly sprinkle or immerse for five minutes the seed wheat, using a solution of bluestone (copper sulphate) 1 lb. to 8 gallons; dry the seed and sow as soon as possible.'

FORMALINE TREATMENT:

The treatment with diluted formaline has proved to be effective for both loose smut in oats and bunt in wheat.

Various strengths of the solution have been recommended. If it be practicable to immerse the seed for twenty or thirty minutes, one pound of formaline to forty gallons of water is sufficient to destroy the vitality of the spores of either loose smut in oats or bunt in wheat. When a large quantity of seed has to be treated or should it be necessary at any time to adopt the method of sprinkling the grain and afterwards mixing the bulk thoroughly so that all the grains be well moistened by the solution, it is thought advisable to make the solution somewhat stronger, probably one pound (about one pint of formaline—40 per cent solution of formaldehyde) to twenty-five gallons of water would give satisfactory results if the seed be well mixed after sprinkling. Solutions considerably stronger than this have been used and are sometimes recommended. Nine ounces of formaline to ten gallons of water—about one pint of the liquid to 18½ gallons of water—would seem to have the effect of appreciably lowering the percentage vitality of the seed and in reducing the vital energy of the young plant. In this respect the influence of formaline is not dissimilar to that of bluestone, and it should be remembered that the stronger the solution in either case the greater injury to seed, and therefore a larger amount of seed thus treated should be used. After treatment with either bluestone or formaline, it is well to have the seed dried and sown as early as possible. Allowance should always be made for the swollen condition of the seed.

QUALITY OF SEEDS SOLD IN THE TRADE.

For the purpose of obtaining some definite information regarding the quality of the agricultural seeds retailed by seed vendors to the farmers of Manitoba, Saskatchewan and Alberta, a number of samples were last year secured by direct purchase from retail merchants. Information was obtained with most of the samples showing their origin, the name and address of the seller and the price charged to farmers. The following table gives a summary of the results of the analyses of a few representative samples that were examined in the Seed Laboratory at Ottawa:—

RESULTS OF SEED INVESTIGATION, 1905, MANITOBA, SASKATCHEWAN AND ALBERTA.

Laboratory test number.	Kind of Seed.	Place where bought.	Per cent of pure and living seed.	Per cent of seed that germinated in 4 days.	Retail price to farmers.	Actual cost to farmers for pure and living seed.	Total number of weed seeds per lb.
1202	Oats	De Winton, Alta	97·94	91·5	60c. per bush.	61c. per bush.	45
1180	"	Ellisboro' Sask	97·68	97	60c. "	61c. "	99
1158	"	Gilbert Plains, Man.	63·89	48·5	25c. "	39c. "	108
1245	"	Great Bend, Sask	49·40	20·3	42c. "	85c. "	18
1203	Barley	De Winton, Alta.	95·94	97	50c. "	52c. "	270
1175	Hungarian Grass	Oxbow, Sask	79·30	78·5	$3 "	$3.80 per bush.	810
1237	Millet	Alameda, Sask	91·64	92·8			5,580
1200	R. Clover	De Winton, Alta	89·49	89·3	25c. per lb.	28c. per lb	1,980
1157	Alfalfa	Stirling, Alta.	55·10	59	15c. "	27c. "	8,100
1073	Alsike	Shell Brook, Sask.	82·80	73·5	20c. "	24c. "	450
1199	"	De Winton, Alta.	88·43	86	25c. "	28c. "	1,575
1159	Timothy	Gilbert Plains, Man.	79·89	72·8	$4 per bush.	$5 per bush.	15,300
1201	"	De Winton. Alta.	87·39	86	7c per lb	8c. per lb	900
1174	"	Oxbow, Sask.	85·15	87	$2.50 per bush.	$2.90 per bush.	9,225
1072	"	Shell Brook, Sask.	91·96	86·5	7c. per lb.	8c. per lb.	900
1043	"	Ellisboro', Sask	87·17	84	7c. "	8c. "	2,925
1155	Rye Grass	Stirling, Alta.	89·23	88	10c. "	11c. "	
1204	Bromus Inermis	De Winton, Alta.	76·65	54·5	7½c. "	10c. "	4,275
1161	Brome Grass	Gilbert Plains, Man.	56·32	51·5			7,875
1156	"	Stirling, Alta.	43·93	39·5	10c. per lb	23c. per lb.	450

The per cent of pure living seed as shown in the table is determined from the proportion by weight of pure seeds of the kind represented and the total per cent of seeds that germinated according to the standard regulations for seed testing. The per cent of seeds that germinated in four days is given, however, as it is considered to be a more accurate indication of the use value of the seed when sown under ordinary conditions. The retail price to farmers, as shown in the table, was the price charged for the seed when sold in bulk lots; and the actual cost to farmers for pure living seed was calculated after deducting the loss on account of dead seed, weed seeds and other foreign matter. This loss in a number of samples amounted to considerable, the actual cost of pure living seed being almost twice that of the retail price in a few of them, but the most serious and far reaching loss to farmers is in sowing seed containing large numbers of noxious weed seeds.

Wild oats and wild buckwheat or black bindweed were the most common impurities found in the wheat, oats and barley. In the smaller seeds the variety of weed seeds was much greater, and included white cockle, Canada thistle, dock and many species of weeds that are comparatively new to the west.

Reliable seed merchants do not retail seeds of any kind that are inferior in quality to the average of the seeds sold among the farmers themselves. The chief evil of the seed trade arises in the importation and distribution in a locality, of commercial seed containing seeds of extremely noxious weeds. The trade in grass and clover seeds,

particularly, is an exceedingly fruitful medium for the introduction and dissemination of noxious weeds from locality to locality and from province to province.

SEED CONTROL ACT, 1905.

With a view to supplement educational work and provide purchasers of seeds with the means by which farmers may protect themselves against the introduction of noxious weeds on their farms, the Dominion Parliament passed the 'Seed Control Act, 1905,' a copy of which may be had on application to the office of the Seed Commissioner, Department of Agriculture, Ottawa.

The main provisions of the Act demand that seed merchants place the names of certain noxious weeds plainly written on a label and attach it to the bag or bin when the seeds of such weeds are present in seed offered for sale. Section 4 provides a standard of quality in respect to both purity and vitality of timothy, alsike and red clover seeds that are represented to be of first quality. Section 6 provides a minimum standard below which timothy, alsike and red clover seeds cannot be sold for seeding in Canada. This standard is based on the proportion of seeds of weeds named in the Act to the pure seeds of the kind sold or offered for sale.

Sellers of seeds are justly protected against negligent or evilly-disposed seed purchasers. In case of dispute between purchaser and seller, prosecution can be made only when a representative sample of the seed in question has been submitted and tested by an official seed analyst, and such sample must be taken and inclosed in a sealed package, either in the presence of the seller, or in the presence of two non-interested witnesses, within seven days after the sale of the seed.

IMPURITIES OF COMMERCIAL GRAINS.

Out of 27,800,450 bushels of wheat of the crop of 1905 that passed inspection at Winnipeg up to November 16, 3,105,971 bushels, or 11¼ per cent were rejected on account of noxious impurities; 1,620,597 bushels were rejected on account of weed seeds and 1,485,464 bushels because of the stinking smut. Were it not for this impurity the wheat would have graded No. 2 Northern and better. This represents the loss to the producer amounting to about seven cents per bushel, or a total of $113,435.49 on that portion of the crop that had passed inspection up to the date named.

In order to obtain some definite information as to the nature of the noxious impurities in commercial grains produced in the western provinces, forty samples, each taken from rejected car lots of the crop of 1905, were obtained through the kindness of the Chief Grain Inspector at Winnipeg, and analysed in the seed laboratory. The following table gives the number of the car; point of shipment; the per cent by weight of impurities, and the proportion by number of the various kinds of impurities found in each of the forty samples examined:—

Impurities in Samples of Commercial Grain, taken from car lots inspected at Winnipeg, 1905.

Car Number.	Point of Shipments.	Weight of Impurities in 100 lb.	Kind and Number of Foreign Seeds per Pound.												
		Lb.	Wild Oats.	Great Ragweed.	Wild Buckwheat.	Lamb's Quarters.	Purple Cockle.	Cow Cockle.	Ball Mustard.	Hare's Ear Mustard.	Stinkweed or Frenchweed.	Smut.	Other kinds of Weeds.	Other kinds of Grain.	Total Impurities.
.....	Carman..	11	204	.....	324	972	114	18	168	12	.....	.....	522	1,308	3,762
54804....	Shanawan	8	1,026	72	126	1,251	.....	.....	54	30	1,368	.....	612	138	5,310
148296....	Altona.....	7	1,140	.....	210	336	60	222	6	228	6	6	294	78	2,566
38178....	Culross.....	12	930	.....	258	1,584	48	126	18	.....	12	6	78	786	3,840
142942....	Reston.....	4	.....	.....	468	858	1,044	.....	.....	.....	.....	.....	42	66	2,478
37524.. .	Carroll	8	450	.....	180	.....	1,920	372	.....	.....	.....	6	6	66	3,000
36304....	Darlingford	8	1,308	.....	204	2,406	.....	.....	324	276	114	.....	1,368	174	6,174
52754....	Macdonald.....	6	1,116	.....	60	18	6	.....	60	.....	120	.....	126	... ...	1,506
56922....	Elm Creek.....	6	594	.....	60	1,476	30	.....	60	12	.....	18	168	252	2,670
147882....	Winkler.....	7	970	.....	1,326	4,380	222	270	.....	708	114	.....	810	66	8,866
4356....	Rossburn	2	12	.....	102	42	.....	.....	36	.....	.....	561	6	.....	762
142238....	Morris.....	5	144	450	.....	.....	6	.....	18	.....	.....	.....	222	48	888
145300....	Stonewall	4	456	.....	84	24	.....	.....	186	.....	42	.....	54	96	942
22516....	Plum Coulee.	6	870	.....	342	420	78	322	.....	54	144	.....	240	60	2,430
24466....	Winkler.....	7	672	.....	672	432	60	84	.....	36	18	.....	324	192	2,490
147506....	Rathwell..	1	42	.....	36	24	.....	18	.....	.....	.....	6	24	.....	1,561
4308....	Swan River....	7	102	.....	4,452	1,761	.....	.....	.....	.....	.....	18	546	42	6,924
20232....	Headingly..	5	84	.....	42	6	408	66	.....	.....	.....	.....	6	520	1,132
15778....	Fannystelle.....	7	198	18	306	56	888	78	24	.....	.....	.....	150	438	2,156
32358....	Arnaud....	7	18	.....	1,338	1,284	18	12	.....	.....	.....	.....	1,428	18	4,116
25466....	Woodlay.....	7	1,074	.....	84	66	.....	.....	720	18	.....	6	66	216	2,250
31610....	Shanawan	4	12	606	456	84	.....	90	30	.....	48	30	84	102	1,542
17150.. .	Methuen.	4	168	450	138	504	18	42	.....	.....	.....	6	534	66	1,926
146326....	Gainsboro.....	6	.....	6	162	4,476	201	1,620	.....	174	.....	.....	402	30	7,164
11486....	Broadview.....	3	6	.....	492	144	.....	.....	.....	.....	.....	132	21	66	864
37262.. .	Rosthern	5	726	.....	282	396	.....	6	.....	12	.....	6	6	54	1,488
20484....	Balcarres	4	66	.....	648	.....	.....	.....	.....	6	.....	84	42	216	1,062
32332....	Pasqua	5	24	.....	258	.....	336	72	.....	96	.....	.....	.....	402	1,188
16282 ..	Caron.....	3	.....	.....	678	72	12	6	.....	.....	6	42	.....	6	822
36050....	Balcarres	15	.....	.....	342	174	.....	.....	.....	.....	.....	48	41,646	150	42,360
42726....	Lemburg	2	12	.....	588	306	.....	.....	.....	.....	.....	66	42	72	1,116
2710	Orrville, Ont.....	8	114	.....	132	.....	.....	6	24	18	.....	.....	18	234	552
42668....	Osborne, Ont.....	5	18	714	108	198	21	.....	6	.....	186	.....	1,752	72	3,678
2658....	Roblin, Out	7	.....	.....	1,164	.....	.....	.....	18	6	.....	1,026	.....	224	2,438
1328....	Enterprise, Ont.....	4	6	.....	384	.....	1,080	84	.....	.....	.....	.....	.....	42	1,596
36288....	Bethany, Ont	5	42	.....	618	2,904	.....	.....	18	156	.....	60	474	540	4,812
36794....	Varcoe?.....	4	834	.....	6	24	.....	.....	6	6	.....	42	24	78	1,020
38166....	Waldon?..	22	5,256	.....	84	42	.....	.....	156	.....	1,092	.....	642	288	7,560
35580....	Warman ?.....	21	84	.....	3,252	1,950	6	.....	.....	18	.....	570	12	78	6,000

The above table cannot be taken to accurately represent the extent to which the various kinds of weeds are distributed throughout the various districts, inasmuch as many of the most noxious weeds—weeds that do the most injury to a crop of growing grain—produce seeds that fall at or previous to the time of harvesting, or are so small that they are almost entirely removed by the threshing machine and cleaning apparatus at the elevators before the grain is shipped.

Wild oats, ragweed, bindweed or wild buckwheat, lamb's-quarters, pigweed, cockle, smut, and other kinds of grain such as barley and oats are doubly objectionable in the wheat crop because they are more difficult to remove from the threshed grain, and if removed at all, the grain must have special cleaning, the cost of which must surely be borne by the producer. The seeds of most weeds of the mustard family including wild mustard, ball mustard, hare's ear mustard, tansy mustard, tumbling mustard, stinkweed and false flax are very small, and although the weeds may be present in abundance and do serious injury to the crop, their seeds are mostly left in the fields or are found with the elevator screenings.

In referring to the nuisance caused by impurities, Mr. David Horn, Chief Inspector of Grain, says (November 4, 1905): 'We have now inspected 20,000,000 bushels of this crop (crop of 1905) of which 85 per cent is high grade, that is, No. 2 Northern and better. We have never before had so much rejected for being mixed with wild oats, barley, cockle and ragweed. The terminal elevators cannot take this out without special cleaning and for this they have to make special charge. The percentage of cars rejected in this way is nearly double what it was last year and last year was serious enough. This matter of foreign grain and impurities is becoming yearly more serious and cannot be too earnestly dealt with, the loss to the producer is so serious and the dissatisfaction on all sides is so aggravating.'

USE SEEDS THAT ARE KNOWN TO BE VITAL.

Seed of wheat, oats and barley, is usually taken from the general crop on the farm or procured from a neighbouring farmer. In either case some definite knowledge may be had as to whether the vitality of the seed has been injured. It is well known that even a hard frost is not fatal to the germ of unripened wheat. The vitality of oats or barley, however, is seriously injured if the grain be frozen before being fully ripened.

It is much to be recommended that all seeds used on the farm be first tested to determine the actual per cent of vital seeds, and particularly so when the origin of the seed is not known. Then if only 50 per cent of the seed will germinate, and better seed cannot be secured, a double quantity of it may be sown and thus a partial failure of the crop might be avoided with very little extra expense. Many of the farmers of Alberta experienced severe losses in their crop of 1904, because of neglect in this particular. Of those seeds that enter largely into commerce, the root crop and garden vegetable seeds are found most frequently to contain a considerable per cent of dead seed, in all probability due to old seed having been mixed with good fresh seed.

HOW TO MAKE GERMINATION TESTS ON THE FARM.

Perhaps the most satisfactory method of making germination tests on the farm is to count out one hundred average seeds and plant them in a pot or box of moist soil. After planting, the soil should be kept moist, but not wet, and about the temperature of an ordinary living room. Reliable tests of practically all kinds of seeds used on the farm may be made in this way during the winter months. The time required to get accurate results by this method would be approximately ten days for cereal grains and clover seeds, and from fourteen to twenty days with seeds of most grasses, root crops and garden vegetables.

Much quicker returns are to be had from germination tests between blotting paper or woollen cloths. Dip a piece of blotting paper or cloth in luke-warm water; allow

the excess of water to drip off and then place it on an ordinary dinner plate; scatter one hundred seeds over the surface of the blotter or cloth and cover with a like piece that has been dipped in water; then invert a second plate of similar or smaller size to serve as a cover. With such a germinating bed, care should be taken so that the seeds will not be wet at any time after the first day. They should be sparingly moistened twice each day and kept as nearly as possible at a temperature ranging between 65° and 90° F. The number of cereal seeds that have germinated after four or five days may safely be taken as a guide in estimating the quantity of seed to sow.

Mangel and beet seeds, some of the finer grass seeds and various kinds of flower seeds can best be germinated by placing them in an empty saucer belonging to a flower pot or other porous dish which may be kept moist by being set on a cloth or mat that is saturated with water.

Samples of seeds (5 lb. and under) for purity or germination tests will be carried free by mail and promptly tested and reported upon free of charge to farmers if addressed: 'Seed Commissioner, Department of Agriculture, Ottawa.'