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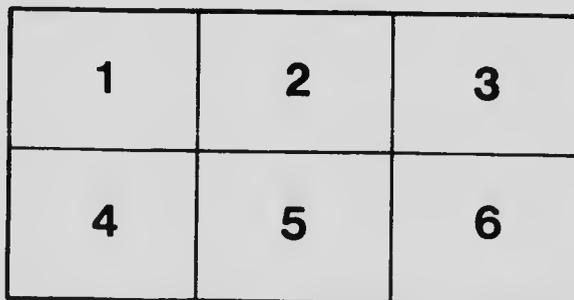
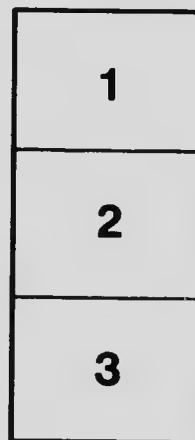
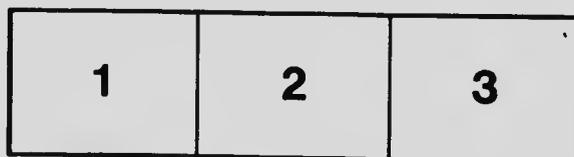
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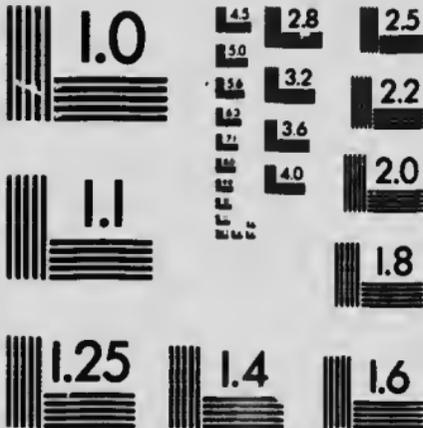
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Wheat Growing in Canada

BY

WILLIAM SAUNDERS

Director Dominion Experimental Farms

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WHEAT GROWING IN CANADA

By WILLIAM SAUNDERS, Director Dominion Experimental Farms



CANADA is widely known as a "land of plenty," and is frequently referred to as one of the future granaries of the world. The opinion has also been often expressed that the productive capacity of the land in the Dominion will, when the country is fairly settled, be more than equal to the task of supplying the Mother Country with all the wheat which her teeming millions require. Such statements are sometimes made in the absence of any definite ideas as to what the farming lands of Canada would probably be capable of producing annually if they were fairly well occupied by intelligent and industrious settlers.

The area of land suitable for the growing of agricultural crops in Canada is so vast that when presented in figures the mind needs a deal of training before their full significance can be grasped. The civilized world is gradually awakening to a somewhat hazy perception of the immense wealth laid up in the many millions of acres of fertile lands unoccupied here, and large numbers of immigrants are flocking to our shores. Commenters on these great possessions commonly pass over the large stretches of unoccupied territory in the Eastern Provinces, and direct attention mainly to the great Northwest country, a huge field for future enterprise, as yet very imperfectly understood even among our own people. In this article, it is the possibilities of the latter which will be primarily considered.

THE WHEAT AREAS

The following figures as to the quantity of land fit for settlement in the Province of Manitoba and the three Provisional Territories, Assiniboia, Saskatchewan and Alberta, have been obtained from official sources and may be accepted as approximately correct

for the areas in question:

	Total area Exclusive of Water. Acres.	Estimated Proportion Suitable for Cultivation.	equal to	Acres.
Manitoba	41,000,000	two-thirds	equal to	27,000,000
Assiniboia	57,000,000	seven-eighths	"	50,000,000
Saskatchewan	70,000,000	three-fourths	"	52,000,000
Alberta	64,000,000	two-thirds	"	42,000,000
Total				171,000,000

It is thus estimated that there are within the limits referred to after making allowance for lands unfit for agriculture, about 171 million acres suitable for cultivation, by which is meant land of such a degree of fertility as to admit of profitable farming. It is proposed to confine our discussion on this occasion to the possibilities of agricultural progress within this area, where the quality of the soil and the conditions of climate are fairly well known. We should not, however, deal justly were we to pass over the great north country lying beyond the boundaries of Saskatchewan and Alberta without a few words of explanation.

The 155 million acres of land in Athabasca, and a large slice of the 340 million acres in Mackenzie, will no doubt prove important factors in the future development of Canada, but what proportion of these vast districts will be capable of the profitable growing of crops is as yet a matter of conjecture. There are, however, some proofs available showing that it is possible to grow cereals to some extent in portions of these remote districts of which our knowledge is so fragmentary.

NORTHERN EXPERIMENTS

The writer has received samples from Dunvegan, on the Peace River, in Athabasca, 414 miles by latitude north of Winnipeg, of Ladoga wheat plump and well matured, weighing 64 lbs. per bushel; oats weighing 40 to 42 lbs. per bushel; six-rowed barley, 52 lbs. per bushel; and spring rye weighing 56 lbs. per bushel.

At Fort Vermillion, further down the Peace River, also in Athabasca,

591 miles north of Winnipeg, Ladoga wheat has been raised weighing 60 lbs. per bushel; oats, $41\frac{3}{4}$ lbs.; six-rowed harley, $51\frac{1}{4}$ lbs.; and spring rye $57\frac{1}{2}$ lbs. per bushel.

From Fort Providence, in Mackenzie, 710 miles north of Winnipeg, have come good samples of oats and spring rye; but the quantities received were too small to permit of their weight per bushel being determined.

From Fort Simpson, 818 miles north of Winnipeg by latitude, Ladoga wheat has been obtained which weighed $62\frac{1}{2}$ lbs. per bushel. In this instance a small percentage of the grain was injured by frost. This is the furthest point north from which samples of cereals have been received. The time between sowing and harvesting in these far northern districts is in some instances less than it is at the Experimental Farm at Ottawa. At Dunvegan the grain was sown May 7th and harvested August 21st, giving a growing period of 101 days. The same sorts of grain grown at Ottawa, taking the average of three years, require 106 days. At Fort Vermillion the time between sowing and harvesting was also 101 days. At Fort Providence 108 days were required to bring grain to maturity, from June 1 to September 17, and at Fort Simpson the wheat was sown June 7 and harvested September 22, giving a growing period of 107 days.

The long days are an important factor in bringing about this result: the influence of increased periods of light hastens the ripening of cereals very much. This view is supported by facts brought together during a careful series of observations made some years ago by a distinguished Russian investigator, Kowalewski. He experimented with spring wheat and oats, growing them in different parts of Russia, from the far north at Arkangelsk to the southern province of Kherson. He found that in the higher latitudes the grain ripens in a shorter period than in the more southern districts, the difference varying at different points from 12 to 35 days. This

author attributes the earlier ripening in the north largely to the influence of light during the long summer days. He also believes that the short seasons of quick growth have gradually brought about in these cereals an early ripening habit. In our experience with early ripening cereals, this habit is a permanent characteristic which they continue to manifest when grown in localities where the summer season is longer.

POSSIBILITIES

Leaving now any further discussion of these enormous northern territories, let us turn to the smaller and better known districts nearer the lines of railway. Of the 171 million acres in Manitoba and the three Provisional Territories, which are said to be suitable for cultivation, a very small part is yet under crop. In Manitoba there were 2,039,940 acres under wheat in 1902, and 1,134,385 acres in other farm crops, making a total of 3,174,325 acres. In the three Provisional Territories there were in all 625,758 acres in wheat, and about 363,879 acres in other crops, making a total of 989,637 acres, which, added to the acreage under cultivation in Manitoba, makes in all 4,163,962 acres. For this comparatively small area over 67 million bushels of wheat and nearly 59 million bushels of other grain were produced.

In 1903 the season was less favourable, and while there was an increase in the acreage of land devoted to wheat in Manitoba and the Territories the total production has been about 52 million bushels of wheat with about 54 million bushels of other grain. While the land prepared for crop in 1904 is considerably in excess of that for 1903 it is not likely to exceed $5\frac{1}{2}$ million acres in all, which is not much more than three per cent. of the land suitable for agriculture within the limits referred to.

Some comparisons may help us to understand the possibilities connected with these large but sparsely occupied districts.

The United States produces large quantities of wheat, sufficient to meet the demands of the home market for the feeding of a population of nearly 80 millions, and leaving a surplus, including flour for foreign export, equal to about 225 million bushels of wheat. From recent crop reports we learn that the total area under wheat in the United States in 1902, including winter and spring varieties, was 46,202,424 acres, which gave a crop of a little over 670 million bushels.

It does not follow that all the land fit for settlement in Manitoba and the three Provisional Territories is suitable for wheat growing. There are some localities where the season is too short to make wheat a sure crop, and farmers in such districts will find it more profitable to carry on mixed farming; but from the good crops which have been harvested during some years past in most of the settled or partly settled regions, it is evident that the greater part of the country is well suited for the growing of wheat of high quality.

Another consideration which would reduce the area annually available for wheat is that the land, to get the best results, should be summer-fallowed every third season, which means that it should not be cropped that year. Further, while many excellent farmers advocate the growing of two crops of wheat in succession, one on fallowed land, the second on stubble to be followed by fallow, it may be found more profitable in some localities to grow wheat in rotation with other crops.

On the other hand, the yield per acre of wheat in Canada is larger than it is in the United States. In 1902 the average crop given for the whole of the United States, including winter and spring wheats, is about 14.5 bushels per acre. The same year the average of spring wheat in Manitoba was 26 bushels, and in the Northwest Territories 25 bushels. In 1903, when the season was so unfavourable, the yield in Manitoba averaged 16.42 bushels per acre. In Ontario, in 1902, winter wheat averaged 25.9 and spring wheat 18.7 bushels.

The average of a ten years' record tells much the same story. A ten years' average for Manitoba from 1891 to 1900 gives 19 bushels of spring wheat per acre. During the same time South Dakota gives 10.04 and North Dakota 12.07. The wheat yield for the whole of the United States for the same period was 13.3 bushels per acre; while in Ontario, the only Province with statistics covering this period, we have an average of 19.4 of fall wheat and 15.2 per acre of spring wheat. This larger yield in Canada is no doubt partly due to the land being more productive, and partly to a more favourable climate, and in some measure to better farming.

A REASONABLE PROPHECY

The total imports of wheat and flour into Great Britain in 1902 were equivalent in all to about 200 million bushels of wheat. Were one-fourth of the land said to be suitable for cultivation in Manitoba and the three Provisional Territories to be cropped with wheat annually, and the average production equal to that of Manitoba for the past ten years, the total crop would be over 812 million bushels. This would be ample to supply the home demand for 30 millions of inhabitants (supposing the population of Canada should by that time reach that figure) and meet the present requirements of Great Britain three times over. It would be met only with a portion of the crop, and it leaves the large Eastern crop out of consideration altogether. From this it would seem to be quite probable that Canada may be in a position within comparatively few years, after supplying all home demands, to furnish Great Britain with all the wheat and flour she requires and leave a surplus for export to other countries. With a rural population on the western plains in 1902 of about 400,000, over 67 mil-

lion bushels of wheat were produced. Add to this the wheat grown in Ontario and the other Eastern Provinces and we already have a total of over 93 million bushels. These figures are full of promise for the future of Canada as a great wheat-exporting country.

WHEAT QUALITY

Under the climatic conditions which prevail in the Canadian Northwest, wheat of excellent quality is grown, which is much sought after by millers to mix with the flour of wheats of a lower grade, so that a desirable and uniform strength may be maintained in the flour they produce. This strength in flour, which is so highly developed in that made from No. 1 hard wheat grown in the Northwest, is due to the presence of a large proportion of gluten of high quality. The relative proportions of the more important constituents in wheat will depend on the character and tendencies of the individual variety, the climatic conditions under which it is grown, and the fertility of the soil. The chief constituents of wheat are gluten, starch and fat, all highly nutritious in their character. Starch forms the larger portion of the substance of the grain, ranging in spring wheat from 65 to 68 per cent.; gluten from 11 to about 13; and fat from about $1\frac{3}{4}$ to $2\frac{1}{4}$ per cent. Winter wheat contains a larger proportion of starch, from 70 to 74 per cent., and a smaller proportion of gluten, from 6 to 9 per cent. The proportion of fat is much the same in both classes of wheat. When a number of different sorts of wheat are grown side by side and under the same conditions, some will be found to contain a larger proportion of gluten, others a more abundant deposit of starch. In the better sorts of spring wheat, when grown in northern latitudes, where the summer season is short and the growth rapid, the proportion of gluten is usually increased, and under such conditions the grain improves in quality.

Chemical analyses of gluten have

shown that it consists of two different principles, known as gliadin and glutenin, and it is from the combination of these in the best proportion that the highest quality of gluten results. Hence, while the percentage of gluten may be regarded in a general way as indicating the quality of a wheat, a high percentage of this substance is not always a sure indication of the milling value of the sample. Both the percentage and quality must be had to produce a flour which will give to bread made from it that tenacity which results in a light, porous white loaf of the most highly esteemed character. The best spring wheats grown in the Canadian Northwest are noted for the high quality of gluten they contain and hence are in great demand.

At the Dominion Experimental Farms persistent efforts have been made from the outset to bring together from different countries the best and most promising sorts of wheat for trial, the qualities particularly sought being productiveness, earliness and strength of flour. These varieties have been grown side by side, under similar conditions, so that their relative value might be determined.

RED FIFE WHEAT

Among the spring wheats commonly grown at the time the Farms were established none was so highly or justly esteemed as the Red Fife, and the position it still holds is an eminent one. It is remarkable for its productiveness, for its high quality, and for its power of adapting itself to varying conditions of soil and climate. This wheat originated about sixty years ago, and in the *Canadian Agriculturist* for 1861 the following account of its origin is given:

"About the year 1842 Mr. David Fife, of the Township of Otonabee, Canada West, now Ontario, procured, through a friend in Glasgow, Scotland, a quantity of wheat which had been obtained from a cargo direct from Dantzic. As it came to hand just before spring seed time, and not knowing whether it was a fall or spring variety, Mr. Fife concluded to sow a part of it that spring and wait for the result. It proved to be a fall wheat, as it

never ripened. Three ears which grew apparently from a single grain. These were preserved and, although sown the next year under unfavourable circumstances, being quite late and in a shady place, it proved at harvest to be entirely free from rust when all wheat in the neighbourhood was badly rusted. The produce of this was carefully preserved and from it sprung the variety of wheat known over Canada and the Northern States by the different names of Fife, Scotch and Glasgow."

From this it would appear that the Red Fife has been in cultivation for more than half a century, and it does not show any tendency to deterioration. It gives as large a crop and is as high in quality as it ever was. It was taken from Ontario to Manitoba and the Northwest Territories, where it is believed to have improved in quality, and as grown there stands probably higher in the estimation of millers for the making of flour than any other known variety.

While the Red Fife has so many points of excellence, it is open to one objection, which sometimes proves a very serious drawback to its cultivation. It is rather late in ripening, and during the past fifteen years there have been several seasons when early frost in the Northwest have injured the grain so as to reduce its value very materially. Whenever this has occurred an outcry has been made by the farmers who have suffered, for an earlier ripening wheat.

In the endeavour to meet this demand varieties of wheat have been brought to Canada from many different countries, and grown for many years at all the Experimental Farms alongside of the Red Fife and other well-known sorts, and their periods of ripening and weight of crop carefully recorded. Some wheats have been brought from the colder districts in Northern Russia, verging on the Arctic circle, some from other countries in the northern parts of Europe, others from different altitudes in the Himalaya Mountains in India, from 500 to as high as 11,000 feet, which is about the limit for wheat growing in that range. Other wheats have been obtained in the Northern United States, from Australia, Japan and elsewhere.

Both the Russian and Indian wheats have usually ripened earlier than the Red Fife, but some have been inferior in quality, and others have given such small crops that the growing of most of them has been abandoned. Those we have had from Australia, also those from the Northwestern States, have been as late as, and many of them later than, the Red Fife, and show no advantages over that variety. Every promising sort obtainable has been tested under the different climatic conditions existing in Canada, without finding a single earlier ripening sort in cultivation elsewhere having the high quality of the Red Fife.

THE BREEDING OF NEW WHEATS.

Another method by which we have sought to obtain the desired end has been by the cross-breeding of wheats, with the object of combining the good qualities of two or more varieties. It was on July 19, 1888, when the first experiments were begun in the cross-breeding of wheat on the Experimental Farm, and since that time several hundred new sorts have been produced and tested. In originating many of these new productions the Red Fife has been chosen as one of the parents. One of the earlier importations from Northern Russia was the Ladoga, a wheat which after a thorough test proved on an average to be about a week earlier in ripening than the Red Fife; it was also fairly productive, but in quality did not compare favourably with that variety. A considerable number of crosses were produced between these two sorts, the most promising of which were multiplied until plots of considerable size could be grown. These were subject to rigid inspection from year to year, the less desirable sorts being promptly discarded so as to keep the number of varieties under trial within reasonable bounds.

Among the most promising of the numerous progeny from this cross are the varieties known as Preston and Stanley. The Preston is a bearded sort. The Stanley is beardless. Taking the average yield obtained on the

experimental plots on all the Experimental Farms for a period of nine years, the Preston has given a crop of 34 bushels 41 lbs. per acre, while the Red Fife has given 33 bushels 7 lbs. per acre, a difference of 1 bushel 34 lbs. in favour of the Preston. The Preston has also ripened uniformly earlier, the gain in time of ripening varying from four to six days.

The Stanley is a twin wheat with the Preston, both having had origin in the one kernel. The plant grown from the cross-bred kernel the first season produced heads which were uniformly bearded; but when the seed from this was sown the year following, some plants produced bearded heads and others beardless. Subsequently these two varieties were bred to type by discarding all the variations produced until the types became fixed. Stanley during a nine years' test has given an average crop of 32 bushels 2 lbs. per acre, which is 1 bushel 5 lbs. less than Red Fife for the same period. In earliness of ripening this variety is about the same as the Preston.

The White Fife, which has averaged 8 lbs. per acre more than Red Fife, during a nine years' trial, is grown to a considerable extent in some parts of Manitoba and the Northwest Territories; but, although highly esteemed by some, it is not held to be equal in quality to the Red Fife. This variety was also crossed with the Ladoga, and the best results obtained were Huron and Percy. Huron is a bearded variety which has also proven productive and early. During a nine years' test it has given a slightly larger crop than Red Fife, exceeding that variety by 4 lbs. per acre. It has also matured from four to five days earlier. Percy has given an average crop during the nine years' trial of 31 bushels 30 lbs. per acre, which is 1 bush. 37 lbs. per acre less than Red Fife for the same time. This also ripens earlier than Red Fife by from four to five days.

Another variety, known as Early Riga, was obtained by crossing one of the East Indian wheats, named Gehun, brought from a high elevation

in the Himalayas, 11,000 feet, with a Russian wheat known as Onega. The Onega was brought from near Archangel, one of the most northerly wheat-growing districts in Russia. These were both early varieties, but were not very productive. The early Riga was the best sort produced from this cross, and has proved to be one of the earliest ripening wheats known. During the five years it has been under trial it has ripened on an average from eight to nine days earlier than Red Fife. It has also proved fairly productive, having given an average crop for five years at all the Experimental Farms of 31 bushels 2 lbs. per acre, being 4 bushels 23 lbs. less than Red Fife for the same period.

A COMPARISON

The next point to consider is the quality of these cross-bred wheats and how they compare with Red Fife. To gain information on this point, three lots of samples were put up, consisting of two of Red Fife carefully cleaned and of the very best quality, with two each of Preston, Stanley and Percy. One of these was grown at Ottawa, Ont.; the other at Indian Head, N.W.T. One lot of samples was submitted to Mr. Julicher, the well-known wheat expert of the Pillsbury-Washburn Flour Mills Co. of Minneapolis, Minn. A second lot was sent to Lord Strathcona, High Commissioner for Canada, London, England, with a request that they be submitted to one of the best English wheat experts. The third lot was handed to the Chemist of the Experimental Farms, Mr. F. T. Shutt, for analysis. The samples sent to Lord Strathcona, were referred by him to Mr. Wm. Halliwell, technical editor of *The Miller*, who is regarded as one of the most competent authorities in England. He is said to have had twenty-five years' experience in practical flour milling and wheat buying. These samples were all sent under numbers, and no information was given as to their names.

The reports of the experts on these wheats show that they were all of good

quality. In Mr. Julicher's report the cross-bred sorts were all shown to contain as much gluten as, and two of the three varieties somewhat more than, the Red Fife, while the quality of the gluten in the cross-breds was placed at 100, and that of the two samples of Red Fife at 101. In some particulars the cross-bred sorts were rated a little below the Red Fife; but the differences were slight.

Mr. Halliwell, the English expert, rated the samples grown at Ottawa as lower in quality than those grown at Indian Head. In "milling structure" and "appearance" the Red Fife, Stanley and Percy, grown at Indian Head, were all placed on an equality, the estimation being indicated by 10 as a maximum number. In "strength" and "colour marks" the Red Fife, Stanley and Percy were all rated at 10; while the Preston was put at 9. In working these samples Mr. Halliwell compared them with others on the London Corn Exchange, and these in some instances graded lower than most of the Canadian samples, and none of them were equal to the best of the Northwest samples. As to value in the London market, Mr. Halliwell says that Percy, Red Fife and Stanley would sell at that date "off Mark Lane stands" at 34 shillings 3d. per 496 lbs., and Preston at 34 shillings—thus placing the Preston, on account of what he calls, in another part of his report, "a just perceptible difference," 3d. per 496 lbs. less in value than the other three, which is equal to about three-quarters of a cent per bushel.

The Huron wheat has not yet been reported on.

The Early Riga was subsequently sent to Mr. Julicher, who reports that it contained 14.2% of gluten against 11.9% in Red Fife; that the gluten is equal in quality and colour to Red Fife, and he gives it the same grading, viz., 101. The only point where a very slight difference is given is in the colour of the dough, which in Red Fife is said to be "white" and in Early Riga "creamy white."

The report given on these wheats by

the Chemist of the Experimental Farms agrees closely with those of the wheat experts. He finds the proportion of gluten highest in the Early Riga and second highest in Percy. In all these wheats he says: "Not only is the gluten satisfactory as to quantity but also as to quality. In noting the character of the wet gluten it was found to be slightly creamy in colour, firm, elastic and of uniform texture, denoting a 'strong' flour and one eminently suitable for bread-making purposes."

From these critical examinations and analyses, it will be seen that these cross-bred varieties grown in the Northwest compare favourably with the Red Fife both as to quality and yield, and there is no reason to believe that their general cultivation there would appreciably affect the quality or reputation of our Northwest wheat, and the earlier ripening of the cross-bred sorts would be a great advantage to the growers. Apart from the likelihood of escape from injury by early frost, the convenience in cutting of having a part of the crop ripen a few days earlier would be much appreciated. Where a settler has 200 or 300 acres of wheat of one sort all ripening together, and has limited help at harvest, he is obliged to begin to cut his crop before it is ripe or his wheat will shell badly before he reaches the end of his harvesting. The part cut first, before maturity will shrivel more or less, which involves loss in weight and depreciation in quality, due to unevenness in the sample, to which must be added such loss as may arise from shelling in the part cut latest. By sowing a part of the land with an earlier ripening sort such difficulties could be largely overcome, and would result in better and more satisfactory returns. Many farmers are determined to get earlier ripening sorts if such are obtainable, and it is gratifying to know that they can now be had, and of good quality. In a recent letter from a prominent farmer in Assiniboia he says:

"There is one thing I wish to say for your information. There are thousands of bushels of Preston wheat sold in the Northwest Ter-

ritories. It is sold as Red Fife. I am informed that nine out of ten buyers cannot tell the difference between Red Fife and Preston. A buyer was asked in W— his opinion of Preston wheat. He said 'I know nothing about Preston; I only buy Red Fife.' He was asked if he had purchased from Mr.—. He said 'yes' and I gave him the highest figure for his wheat.' He was surprised to hear that it was Preston. This writer further says, 'I grew Preston wheat this year. It was shelling out while my neighbour's Red Fife was green and frozen.'"

Mr. A. Mackay, Superintendent of the Experimental Farm at Indian Head, Assa., writing on this subject in his Report for 1903, says:

"I wish to draw the attention of Territorial wheat growers to the cross-bred varieties of wheat, Preston, Stanley and Huron, which have been tested for some years at the Experimental Farm. These varieties were sown in field crops later than Red Fife and were ripe, cut and in stook five to six days before frost came; while Red Fife was injured by the cold wave of September 5. Huron has always been near the top in yield here, and this year heads the list in productiveness. It also matured before frost came. Preston, Stanley and Huron were the only sorts out of nine varieties sown in field crops that will grade No. 1 Hard. Perc., although fairly ripe, had heads not matured which the frost injured."

In a favourable season, when the temperature is high enough to ripen wheat rapidly, the difference in time of ripening of such early sorts as Preston, Stanley and Huron as compared with Red Fife is reduced to about four days; but when the weather is cold and backward and the ripening process goes on slowly, the difference is increased, and, under such conditions, will often amount to from one to two weeks.

The reports on the Early Riga wheat are most gratifying. The proportion of gluten found in this variety is about 20 per cent. more than in Red Fife and the quality of gluten equal. To find a wheat superior in quality to Red Fife is what one would scarcely expect; but to find that superiority associated with so much earliness—from eight to nine days, as an average of five years' trial—is highly satisfactory. The general introduction of such a wheat will probably extend the wheat-growing area in Canada and make it successful in points further north than is possible with the varieties at present grown. The fact that it falls a little below Red Fife in yield is more than atoned for by its earliness and quality. The outlook in this connection is most encouraging, and the results a triumph of the skill of the plant breeder.

In view of the great importance of this branch of the work at the Experimental Farms, arrangements have been made to devote even more attention to it in future than has been given to it in the past. A special Division of Cereal Breeding and Experimentation has been formed. A series of important experiments has been commenced during 1903 along promising lines, and about 400 new varieties of wheat have been produced. The field is a boundless one, and the possibilities of success great. It is hoped that the skill and energy brought to bear on this line of work will bring further results of even greater value to the country.

SUMMARY

Land fit for settlement in Western Canada,
171,000,000 acres.

Of which there is now under cultivation,
5,000,000 acres.

Present production of wheat and other grains,
about 125,000,000 bushels.

Possible wheat production (one-fourth under crop
annually), 800,000,000 bushels.

