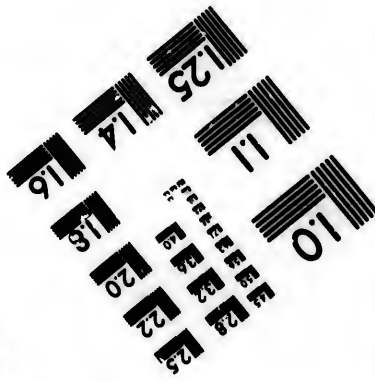
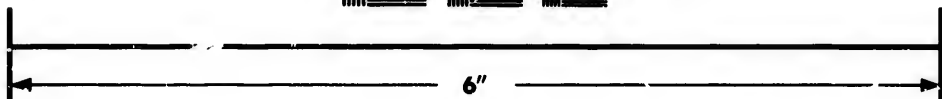
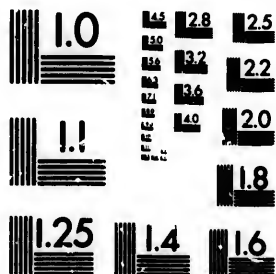


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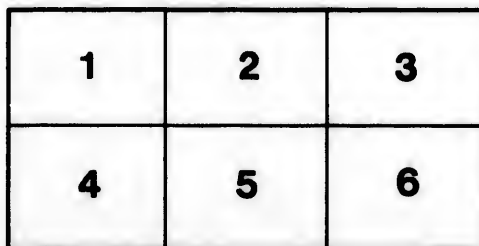
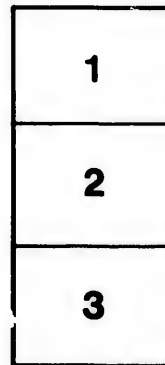
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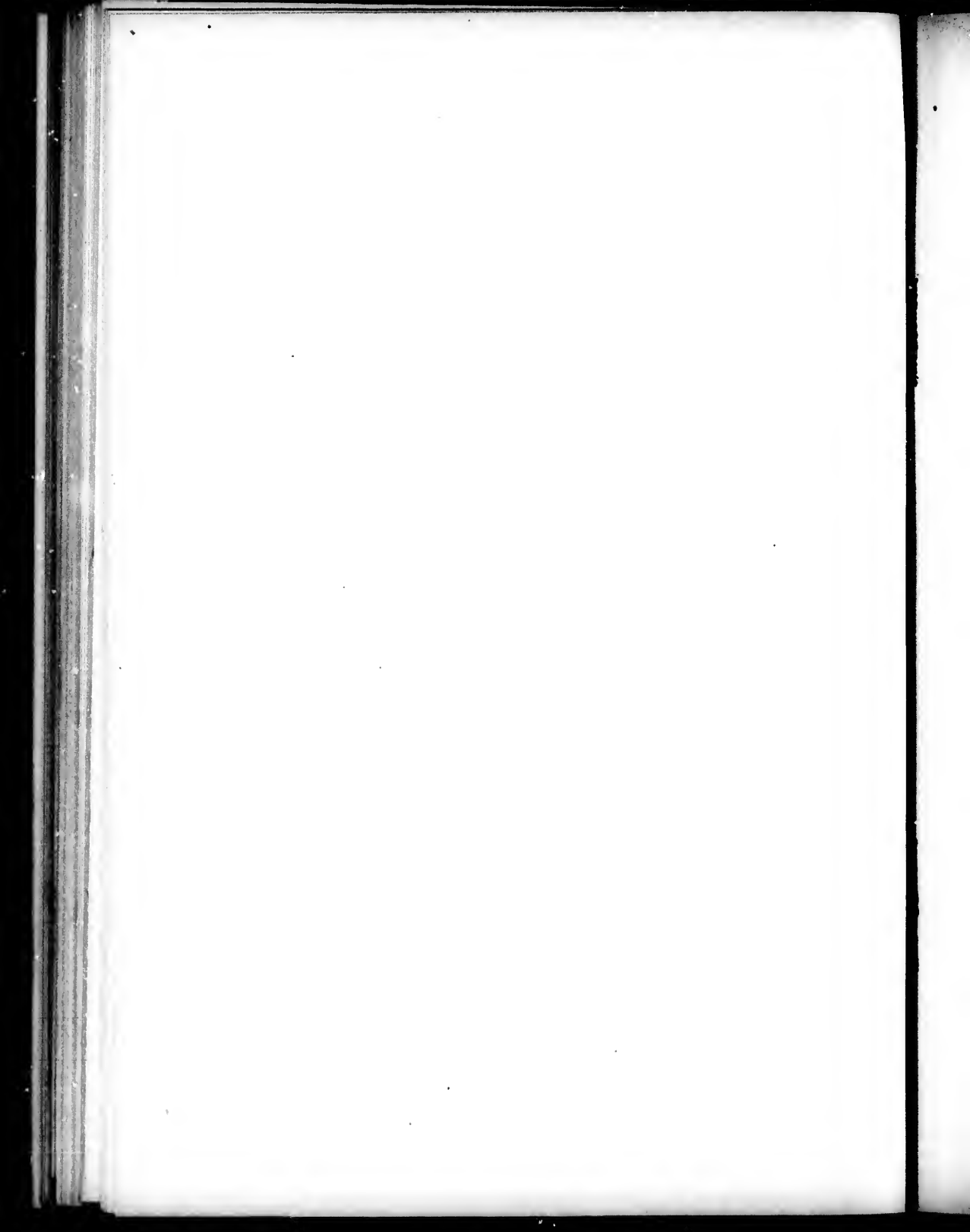
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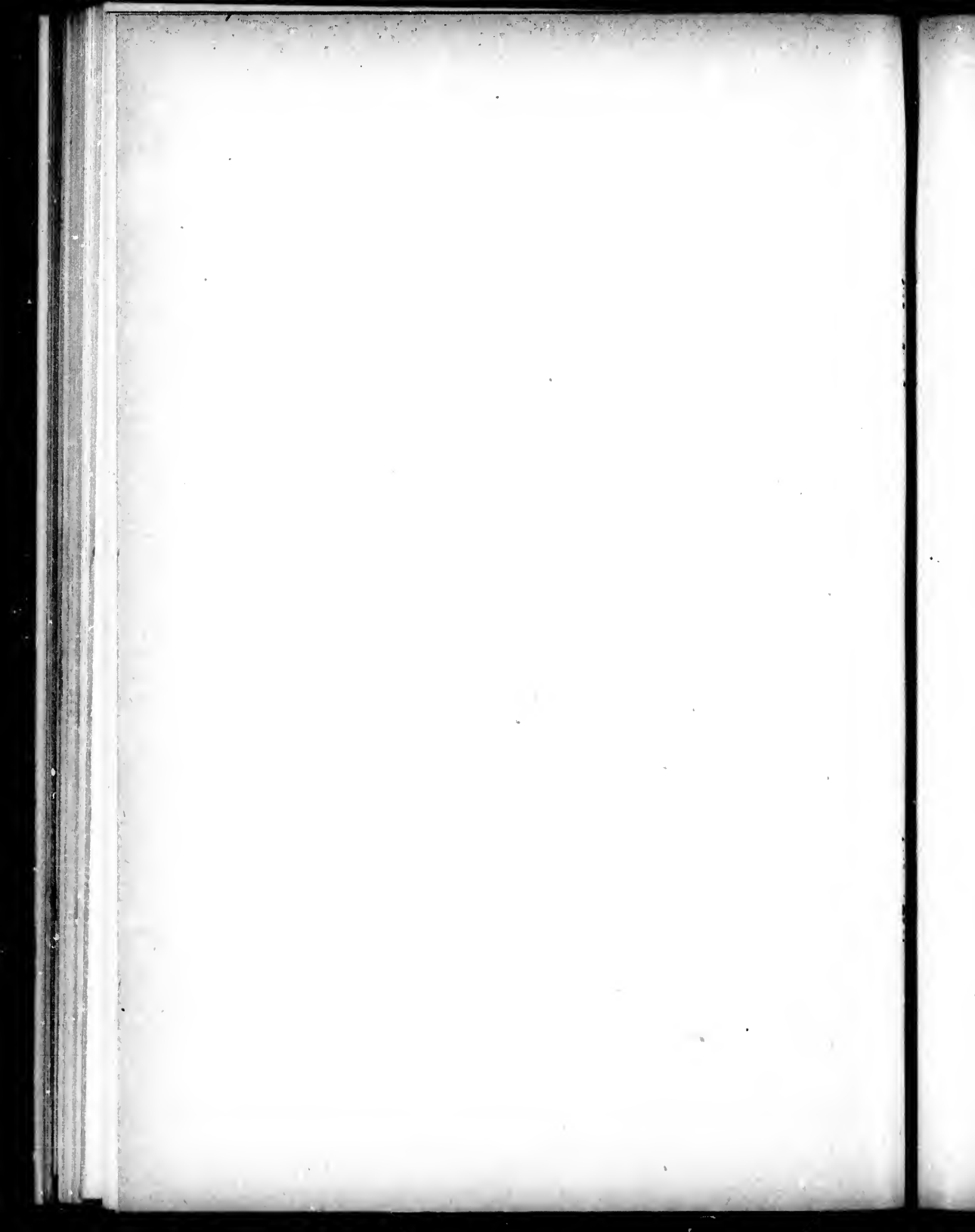
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CENTRAL EXPERIMENTAL FARM,
DEPARTMENT OF AGRICULTURE,
OTTAWA, - - - CANADA.

BULLETIN No. 6.

JANUARY, 1890.



CENTRAL EXPERIMENTAL FARM.

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DEPARTMENT OF AGRICULTURE,

OTTAWA, - - - - - CANADA.

BARLEY.

BY WM. SAUNDERS, F.R.S.C., F.L.S., F.C.S.,

Director Dominion Experimental Farms.

The barley crop is one of great importance to the farmers of Canada. The annual product of this cereal for the past seven years in Ontario alone is estimated by Mr. Blue, in his Agricultural Statistics of Ontario, at nearly twenty millions of bushels, while the crop for 1888 is put at over twenty-three million bushels. Statistics from other provinces in the Dominion are not available, but their products would largely augment the figures given. Canadian barley is usually of good quality, and the surplus, not required for home consumption, has heretofore commanded a ready sale, at remunerative prices to maltsters in the United States, and such sales have averaged, during the past eleven years, 9,135,455 bushels annually, yielding an average yearly revenue to Canadian farmers during this period of \$6,587,592. The export of barley has materially increased of late years, and as the country becomes more thickly settled and a larger area of land brought under cultivation there will, no doubt, be still larger quantities of this grain to dispose of. During the eleven years referred to, the production of barley in the United States has increased from about 42 million bushels in 1878 to 58 millions in 1889, but the increasing consumption has kept up with the increased supply, and hence the demand for Canadian barley has until recently been maintained.

SUBSTITUTES FOR BARLEY.

The demand for barley for the manufacture of beer in the United States has of late been materially lessened by the use of various substitutes. From official returns published in the United States, it appears that while $2\frac{1}{2}$ bushels of barley were used in the manufacture of a barrel of beer in 1888, only one bushel was used

for the same quantity in 1889, the balance being chiefly made up of corn, rice and glucose. As these ingredients enable the brewer to make his beer at less cost than from barley alone, it is scarcely probable that Canadian barley, however good it may be, will continue to find a market in the United States in such quantities and at such prices as in the past.

MARKET OF GREAT BRITAIN.

It is important then for Canada, that other outlets be provided for the surplus barley, and the only other country which requires more barley than it produces is Great Britain. The average importation of barley into the United Kingdom for the past eleven years has been about 33 million bushels, the imports for 1888 having been over 40 million bushels. A considerable quantity of this is six-rowed barley, but that is used only for grinding and distilling, and commands but a low price; the grain used for malting for which there is a very large demand is two-rowed barley, and of this there are many varieties, all of which, when of good quality, bring relatively high prices. The quota of barley which Canada has sent to Great Britain for the ten years ending with 1887 average 112,000 bushels. In 1878 it was 524,569 bushels, in 1887 only 5,827 bushels, showing that we have practically lost the small market we had there, and for the reasons that we have not grown the varieties of barley which the English maltster requires, and that our six-rowed barley has commanded a better price in the United States than could be obtained for it in Great Britain.

TWO-ROWED *versus* SIX-ROWED BARLEY.

The British brewer's preference for two-rowed barley is very strong, and the question is sometimes asked whether that preference is founded on the greater intrinsic worth of this sort, or on prejudice arising from long usage. To submit this point to a practical test, a sufficient quantity of the two-rowed malting barley was imported from Great Britain in the early part of 1889 and a like quantity of the best six-rowed barley purchased here. These were sent to a competent Canadian maltster and brewer and both lots made into beer, and from the report received of the results of this comparative test we learn that the two-rowed barley yielded 13 per cent. more of extract than the six-rowed, showing that the preference for this barley is well founded. The covering or husk forms about one-

sixth of the weight in two-rowed barley, and from one-fourth to one-fifth of the six-rowed ; this will account for a part of the difference.

It must ever be borne in mind that on no account should the two-rowed and six-rowed varieties of barley be mixed, for when that is the case the sample is of little value for malting purposes, and for this reason: In the manufacture of malt the barley is first steeped to soften it, and when it has reached the proper condition is spread on the floors of the malt-house to germinate, growth is allowed to advance to a certain stage and then suddenly stopped by rapid drying. The plump kernels of the two-rowed barley take longer to soften and are slower in germinating than the comparatively thin grains of the six-rowed, hence the six-rowed will pass through the different stages in the process and be ready for drying from one to two days sooner than the two-rowed. To leave the six-rowed that length of time on the floor after it is ready for drying would result in decay and the growth of mould which would seriously injure the quality of the malt. For this reason no maltster will have anything to do with mixed barleys.

CAN TWO-ROWED BARLEY BE SUCCESSFULLY GROWN IN CANADA ?

This is a vital question, which demands careful consideration. Since the establishment of the Experimental Farms of the Dominion an extensive series of experiments have been planned and carried out for the purpose of obtaining evidence on this point, and of ascertaining what varieties of two-rowed barley are most suitable and what districts are likely to produce the best samples. These tests have been undertaken on a comparatively large scale by the several Experimental Farms, and in order that the experiments might be made to cover as large an area as possible, sample bags of two-rowed barley of about three pounds each have been distributed among farmers throughout the Dominion for test.

RESULTS OF TESTS ON THE EXPERIMENTAL FARMS.

The cultivation of barley on the Central Experimental Farm has been carried on with many sorts and in several different methods. Experiments with field crops have been conducted to ascertain the relative yield and quality of the several varieties under such conditions, and also with the individual sorts grown under exactly the same circumstances, with the view of testing their relative tendencies to fertility. The fact is too often overlooked that there is in

every variety of grain, and indeed in every kernel of each variety, an inherent impress of vigour and productiveness which favourable conditions will always bring out and which unfavourable conditions cannot entirely suppress. With the view of obtaining light on this very instructive problem the following methods were adopted which have been carried out for the past two years on the Central Farm :

A very uniform piece of land was selected—a sandy loam rather light in character—this had received a coating of barnyard manure in the spring of 1887, which was followed by a crop of spring wheat. The land was ploughed early in the autumn and lightly ploughed and harrowed the following spring. Fifty kernels of each variety of barley were planted in two rows, the grains being placed a foot apart and with two feet of space between each sort. Every seed had thus ample room for development, and when the grain was two or three inches high a uniform top dressing was given to the whole of a mixture of fertilizers in the following proportions per acre—200 lbs. of nitrate of soda, 500 lbs. of bone dust, and 1,000 lbs. of unleached woodashes. The growing grain was occasionally hoed to keep the ground free from weeds and when ripe the crop of 1888 was harvested as follows :—One of the best examples of each sort was threshed and cleaned separately, the number of heads counted and the yield ascertained ; a second selection of three or four more of the most vigorous plants were similarly treated, and those remaining were harvested together and their average yield obtained. During 1889 the same varieties were planted with such additional sorts as could be got and the whole of the plants in each case harvested and threshed together. In the following table the results of these tests are given, the number of heads on the single selected plant in 1888, also the yield, the average number of grains obtained from the second selection of three or four plants, the number of plants remaining and the average yield of these unselected ones, followed by a column in which the average of the whole is given. The number of single plants of each sort which matured in 1888 is also given and the average yield in each case. A ready means is thus afforded of comparing the fertility of the different varieties, also the results obtained from the same variety for the past two years.

Those sorts for which a record is given for 1889 only were not obtained until the spring of that year.

TWO-ROWED MALTING BARLEY.	RECORDS FOR 1888.						1889.	
	Single selected plants.		Second select n. Average No. of grains.	Unselected plants. Average No. of grains.		Total average.	No. of plants.	Average No. of grains.
	No. of heads.	No. of grains.		No. of plants.	Average No. of grains.			
1 Annet Scotch.....	44	778	493	27	314	359	45	628
2 Australian.....	23	523	366	43	278	290	46	684
3 Bestehorns.....	42	834	630	39	498	515	40	783
4 Beardless.....	..	..	..	..	..	..	17	596
5 California.....	33	680	755	41	537	554	43	549
6 Chevalier (from Germany)....	28	498	373	37	325	333	44	546
7 Chevalier, Danish.....	51	1203	733	40	512	543	45	691
8 Chevalier Danish Printice ...	36	832	593	40	421	445	43	653
9 Chevalier, Improved, O. & M.	29	581	436	43	300	317	26	430
10 Chevalier, Scholeys.....	38	799	599	34	419	442	40	533
11 Chevalier, Hallet's Pedigree.	61	907	509	41	380	400	43	583
12 Carter's Prize Prolific....	..	..	..	..	..	..	45	546
13 Cheyney.....	29	694	687	34	446	471	40	605
14 Danish (from London Market)	49	997	950	37	623	656	48	613
15 Denmark (from Germany)....	29	702	569	39	544	549	46	722
16 Dutch (from Germany).....	37	816	719	40	348	384	..	..
17 English Malting.....	42	886	412	30	481	487	43	666
18 Emperor.....	27	633	519	41	440	449	41	624
19 Golden Drop.....	28	684	694	38	446	469	36	656
20 Golden Melon (from Germany)	36	784	657	33	476	499	38	693
21 Golden Melon, Impr'd O. & M.	33	776	564	39	406	425	37	610
22 Italian.....	41	962	490	40	452	466	46	684
23 Kalina.....	17	332	428	40	355	361	43	652
24 Imperial.....	32	663	428	32	284	306	46	600
25 New Zealand.....	58	1114	918	33	692	721	46	794
26 Odessa.....	31	677	..	12	439	457	44	933
27 Peacock.....	27	746	463	36	476	481	41	543
28 Prolific.....	48	609	726	33	454	469	44	686
29 Phoenix von Thalen.....	23	529	436	40	307	322	45	715
30 Peerless White.....	36	913	777	41	540	564	39	616
31 Screened French.....	49	1014	672	40	389	422	44	586
32 Swedish.....	56	943	939	30	590	601	45	644
33 Thanet, Improved.....	23	749	737	39	508	529	42	707
34 Victoria.....	43	360	303	31	361	354	43	732
35 White Erfurt.....	32	686	762	41	426	454	46	686

The dates of sowing and harvesting have also been recorded and the average time required for the two-rowed barleys in 1888 was 86 days, and in 1889 111 days, showing a wide difference in this respect between the two seasons, the former of which was very dry, the latter very wet—probably 95 to 100 days would be about the average of a series of years in the Ottawa district.

All the varieties of two-rowed barley are later in ripening than the six-rowed sorts, the difference varying from five or six to ten or twelve days.

In comparing the average results for 1888 with those for 1889, it will be seen that all the varieties have yielded better during the year, some of them giving double, and in one or two instances nearly three times the crop of the previous year. The season was not very favourable, although perhaps more so for barley than that of 1888. A part of this increase is no doubt due to the fact that the seed from which these late samples were produced was all carefully selected, the kernels large and plump and taken from the grain grown as single plants in 1888, whereas those sown in 1888 were average grains taken without selection from a field crop. Possibly some portion of the increase may also be due to acclimatization, for it is an undoubted fact that barley brought from another, and perhaps dissimilar and distant climate, seldom does so well the first year as it will the second or third season.

Several varieties of two-rowed malting barley were not received in time to be sown with the others, and the kernels were planted a foot apart like the others, but from 10 to 16 days later. The results are instructive as pointing to the advantage of early sowing :—

	No. of plants.	Average No. of grains.
Selected Chevalier O. and M.....	37	177
Early Minting.....	37	141
Peerless White.....	35	197
Californian Chevalier.....	29	169
Dutch.....	37	174
Frobestier.....	33	142

FIELD CROPS OF TWO-ROWED BARLEY ON THE EXPERIMENTAL
FARMS, 1890.

	Central Exp. Farm.		Exp. Farm, Brandon, Manitoba.		Exp. Farm, Ind. Head, N. W. T.		Exp. Farm, Nappan, N. S.			
	Yield per acre.	Weight per bush.	Yield per acre.	Weight per bush.	Yield per acre.	Weight per bush.	Quantity sown.	Weight of yield.	Weight per bush.	Weight per bush. of seed imported.
	Bus.	Lbs.					Bus.	Lbs.	Lbs.	
Beardless.....	50½	51½	..	54½	27½	55	..	..	..	56
California.....	21½	49½	..	..	..	..	..	..	..	..
Carter's Prize Prolific.....	31½	50½	..	54	..	..	4	2622	52½	54½
Chevalier Danish.....	31½	50½	27½	56	12½	55	2	748	51½	57
Chevalier, Danish Printico...	36½	50½	..	55½	14	53½	2	644	52	..
Chevalier Improved O. & M..	..	..	..	..	26½	53	..	..	..	..
Chevalier, Selected O. & M..	31½	51	..	..	12	52	3 lbs.	41	52	..
Early Minting.....	25½	50½	..	..	13½	53½	..	..	..	..
English Malting.....	34½	50½	27	53	23½	53½	..	..	..	54½
Golden Melon Improved.....	26	48½	..	54½	17½	55	..	..	..	58
New Zealand.....	26½	51	..	55½	23	54	1 bus.	350	52½	..
Peerless White.....	36½	51	..	54½	18½	52	3 lbs.	40	52	..
Swedish.....	49	50½	..	55	24½	55½	..	..	..	..
Thanet Improved.....	44	48½	..	55	21½	52½	..	..	..	..
Saale.....	22	51	..	..	19½	53	6 lbs.	74	51½	55½

Ten varieties were grown in field plots on the Experimental Farm at Brandon, but the yield per acre is given of two only for the reason that these were sown on summer fallow, the others on wheat stubble, and under such different conditions any comparison as to yield in a dry season would be misleading and throw discredit on varieties which would have made a good record on summer fallow. In these instances the weight per bushel only are given. The yield on wheat stubble varied from 14 to 6½ bushels per acre.

The Superintendent of the Indian Head Farm, when submitting his report, says:—Thanet and Danish Chevalier were greatly injured by winds. The small yield and light weight of Saale, Early Minting, Selected Chevalier and Peerless White is, no doubt, owing

to their having been sown so late. The seed was very fine, and had they been got in early would have made much better returns."

The samples of the crops received from Brandon and Indian Head are very bright and handsome, those from Nappan, N. S., and those grown at Ottawa are good samples, but more or less discoloured.

The Carter's Prize Cluster and Saale barleys were obtained from James Carter & Co., London, England; Beardless, Improved Chevalier, Selected Chevalier, Early Minting, Improved Golden Melon, Peerless White and Improved Thanet, from Oakshott & Millard, Reading, England; Danish Chevalier and Danish Printice Chevalier, through the courtesy of the President of the Danish Royal Agricultural Society at Copenhagen: Danish, English Maltting, New Zealand and Swedish from Harris & Co., London, England, and the other varieties from Haage & Schmidt of Erfurt, Germany. All the samples of seed imported were unusually fine and weighed from 54 to 57 pounds per bushel.

RESULTS OF BARLEY DISTRIBUTION.

We shall next consider the results obtained by farmers in different parts of the Dominion from the samples of two-rowed malting barley, which were distributed for test. 946 sample bags were sent out containing from 2 $\frac{3}{4}$ lbs. to 3 lbs. each. Some of the farmers have reported promptly, but a large number of the reports are yet to come in. The following are taken from among the more favorable results:

Carter's Prize Prolific.

This variety, judging from thirty reports received, has succeeded remarkably well. In Ontario, Henry Jennings, of Victoria Square, got 176 lbs. weighing 53 lbs. per bushel; Henry R. Wilson Winona, 147 lbs., which weighed 55 $\frac{1}{4}$ lbs. per bushel; Duncan McDonald, of Glen Robertson, Glengarry, had 120 lbs., weighing 52 $\frac{1}{2}$ lbs. to the bushel, and Colin Philips, of Brougham, got 110 lbs. which weighed 54 lbs. per bushel.

In Quebec, Duncan Stewart, of Inverness, had 60 lbs., which weighed 53 $\frac{1}{4}$ lbs. per bushel, and Joseph Guérin, of St. Gabriel de Montréal, 45 lbs., weighing 51 $\frac{1}{2}$ lbs. per bushel.

In New Brunswick, W. T. Hall, of Georgetown, had 47 lbs., weighing $48\frac{1}{2}$ lbs. per bushel, other samples sent from this Province weighed $53\frac{1}{2}$ and $50\frac{1}{2}$ lbs. per bushel, but the yield is not given. No reports on this barley are yet in from Nova Scotia. In Prince Edward Island, Benjamin Cole, of Centreville, got 95 lbs., an extra good sample which weighed 50 lbs. to the bushel.

In Manitoba, McKee Bros, of Heaslip, had a yield of from 80 to 90 lbs., weighing 51 lbs. to the bushel, and Duncan McCuaig, of Portage la Prairie, 68 lbs., which weighed $52\frac{3}{4}$ lbs. per bushel. Major Boulton, of Shellmouth, sends a sample which weighs 52 lbs. to the bushel, but was unable to give the exact yield.

From Moose Jaw, N. W. T., Mr. John Smail had a yield of 100 lbs., which weighed 53 lbs. per bushel, and from British Columbia comes a report of the largest yield yet recorded, Mr. S. A. Agassiz, of Agassiz, had a crop of 365 lbs. from $2\frac{1}{2}$ lbs. of seed.

Danish Chevalier.

This variety also promises well. From Ontario samples have been received from George Fisher, of Freeman, who harvested 125 lbs. from 2 lbs. 13 ozs. of seed, weighing $54\frac{1}{2}$ lbs. per bushel; Daniel Baxter, of Belmont, had 115 lbs.; J. J. Coyne, Chesterville, 96 lbs., which weighed 48 lbs. to the bushel; A. W. Peart, of Freeman, 94 lbs., weighing 53 lbs. per bushel, and Thomas Manderson, of Myrtle, 75 lbs., weighing 53 lbs. per bushel.

From Quebec, John Murphy, of Dalling, reports a yield of 45 lbs., weight 48 lbs. per bushel.

In New Brunswick, James Kerr, of Summer Hill, Queen's Co., had 130 lbs., weighing $47\frac{1}{2}$ lbs. to the bushel, and from Prince Edward Island, Fred R. Mellish, Union Road, Montague Bridge, reports a yield of 42 lbs., weighing $49\frac{1}{2}$ lbs. per bushel. From the North-West Territories a very bright and handsome sample was sent by J. L. Hawk, of Medicine Hat, who harvested 57 lbs., weighing $56\frac{1}{2}$ lbs. per bushel. Reports from other Provinces have not yet been received.

Danish Printice Chevalier.

Very few reports have yet been received of the tests of this variety. In Ontario, Thomas Manderson, of Myrtle, had a crop of

83 lbs., weighing 53 lbs. to the bushel ; J. Baxter, of Pickering, 48 lbs., which weighed 52 lbs. per bushel, and John A. Bruce & Co., of Hamilton, 42 lbs., weighing 52 lbs. per bushel.

From Nova Scotia, C. Newcomb, of Weymouth, reports a yield of 122 lbs. The other Provinces have not yet been heard from.

English Malting.

Of this variety the following reports are from Ontario : A. W. Brown, of Rebecca, had 130 lbs. from $2\frac{3}{4}$ lbs. seed, which weighed $52\frac{1}{4}$ lbs. per bushel ; Mr. McNaughton, of Greenock, Guelph, 102 lbs., weight $53\frac{1}{4}$ lbs. per bushel, Wm. Graham of Peterboro', reports 68 lbs., and Thomas Manderson, of Myrtle, 67 lbs., weighing 54 lbs. per bushel.

In Quebec, Wallace Oliver, of Magog, had 45 lbs., weighing 51 lbs. per bushel. From Nova Scotia, Donald McLennan reports a yield of 3 pecks from $2\frac{3}{4}$ lbs. seed, weighing $52\frac{1}{2}$ lbs. per bushel, and in Prince Edward Island, John McDonald, of St. Peters Lake, had 50 lbs., weighing $54\frac{2}{3}$ lbs. per bushel.

Major Boulton, of Shellmouth, Manitoba, sends a good sample of this barley grown by Denmark and Martin, of Russell, Manitoba, weighing $52\frac{1}{2}$ lbs. per bushel, but is unable to give the yield. From British Columbia, Donald Graham, of Spillamacheen, reports a yield of 174 lbs. from $2\frac{3}{4}$ lbs. of seed, and W. A. Johnson, of Quesnell, 64 lbs., weighing $50\frac{3}{4}$ lbs. per bushel.

Beardless.

Beardless barley is scarcely a correct name for this variety, as it is bearded like other sorts, but often sheds its beard when fully ripe, and in every plot there will be found more or less of wholly or partially naked ears as the time of harvest approaches ; the beard dropping so readily from the grain when mature is a great advantage in threshing and cleaning.

Very few reports have yet been received of the test of this handsome barley and in most of those at hand the yield is not given.

J. Dearness, of Granton, Middlesex, Ont., got 55 lbs. from 3 lbs. of seed. John A. Bruce & Co., of Hamilton Ont., from a like quantity obtained 40 lbs., weighing 54 lbs. to the bushel. The other Provinces are not yet heard from.

The results now submitted of the tests of these five leading varieties of two-rowed malting barley over a very large area in Canada are sufficient to show that even in an unfavourable season for barley-growing there is a wide territory over which two-rowed barley for the English market can be grown with advantage, and the yield obtained from the samples sent out as well as in field culture at the Experimental Farms would indicate that heavier crops of two-rowed barley of the varieties named could be raised than of the ordinary six-rowed barley. It is not practicable to entirely change any important crop in a single season, especially when it covers so large an area; it is better for many reasons that such a change should come more slowly, but it does seem feasible to bring this about to a very large extent within a comparatively short time.

IMPORTANCE OF PURE SEED OF GOOD QUALITY.

From what has been said as to the absolute necessity of having the two-rowed barley unmixed if it is to command a ready sale, good pure seed is the first necessity. The quantity of pure seed now available at the several Experimental Farms is probably sufficient to give to every farmer who will apply for it a 3 lb. sample. If this quantity is carefully and early sown on a good piece of land, well prepared, the average return is not likely to fall much below two bushels, and with two bushels of pure seed available for the spring of 1891, sufficient to sow an acre or more, every possessor of such barley will probably have from 25 to 40 bushels available for sowing in the spring of 1892, and with a little extra care I am convinced that the yield could be made to exceed this estimate. In this way a practicable solution of the difficulty of supplying Canadian barley growers with good seed of pure two-rowed barley would be had and from that time forward two-rowed barley could be grown in large quantities for the English market. Whether it might not be desirable to hasten this change by the importation of a few thousand bushels of good seed for sale to farmers is a question well worthy of careful consideration. The two-rowed would not be likely to supercede the six-rowed in every locality. A very large quantity of barley is required every year for feed, and the fact that the two-rowed sorts are on an average from a week to ten days later in ripening than the six-rowed, might be an objection to their growth in some places.

The large yearly outlay by the United States maltsters in the purchase of Canadian barley has long been the subject of serious consideration. In 1885-6 the Chemical Division of the Department of Agriculture at Washington undertook the analysis of a large number of samples of barley; of these, 60 were obtained from different parts of the United States and 12 from Canada. The Canadian samples were all from the Province of Ontario and from commercial sources. Mr. Clifford Richardson was intrusted with the work and the results of the analyses were favourable to the Canadian samples. In summing up his conclusions Mr. Richardson says: "it may safely be said that the Canadian grain is the best in the market and superior to our own." After comparing the results of his own work with 127 analyses of European barley he says: "the specimens which have been examined from Canada are well above foreign averages in starchiness. Experience and care have taught the Canadians, in connection with their favourable climate, the means of producing an excellent grain superior to other parts of the country." He further states: "our investigations as a whole seem to prove that, while at present Canadian barleys are superior to those grown in the United States, the result is due more to a lack of understanding of the proper localities and methods of cultivation than in any obstacle in the way of extending the production to an extent to do away with our dependence on importation. Field experiments are now most desirable as a means of deciding upon the best varieties and methods as soon as a study of the climatic conditions shall enable us to select those portions of the country best suited to this cereal."

Since the publication of this report the means for carrying on such experimental work have been liberally supplied by the United States Government, and in every State in the Union Experiment Stations have been established which are subsidised by the Federal Government. In the estimates for the current year \$630,000 is appropriated directly to the Experiment Stations to aid them in carrying on their work, and in addition to this, \$1,359,000 for the other work carried on by the Agricultural Department, a large sum being devoted to special lines of scientific investigation having a direct bearing on agriculture. In commenting on the necessity for these appropriations, the Secretary of Agriculture, in his report for 1889, says the "amount should not be measured by the past, but rather by

what a great agricultural country should pay at this time towards sustaining, protecting and promoting a calling which lies at the foundation of its prosperity and power."

The stimulus which this activity and large expenditure is giving to agriculture among our neighbors will, no doubt, result in improved methods in farming, and increased returns to the nation, and they are mentioned in this connection mainly for the purpose of impressing upon Canadian farmers the fact, that apart from the question of the use of substitutes for barley—which is probably the main cause of the present depressed condition of the barley market—it is not likely that the United States will long continue to be so largely dependent on Canada for good barley. Hence it is important that our farmers bestir themselves, and by bringing more skill to bear on their work, growing those crops which are best suited to their land and likely to give the best returns, and carefully selecting good seed, make the most of the fertile soil and good climate with which they are favoured. It is not to be expected that malting barley of high quality can be grown in every part of Canada; many districts will, no doubt, be found where it will attain a greater degree of perfection than in others. This has been the experience in Great Britain, where Suffolk, Norfolk and parts of Essex and Herts are held to be specially adapted for barley; similar experience has also been had on the continent of Europe. The only way to ascertain where specially favourable conditions exist, is by testing this grain in every promising locality, noting the results and repeating the tests until sufficient facts are available on which to base conclusions.

TWO-ROWED BARLEY IN DENMARK.

In proof of what may be done to improve the barley crop of a country, the case of Denmark, now a large exporter of malting barley to Great Britain, may be cited. In a recent number of the *Journal of the Royal Agricultural Society of England*, is a paper on barley from a maltster's point of view, by Robert Free, in which he says: "Only a few years ago the barley production of Denmark was practically confined to a coarse thick-skinned native grain, suitable only for distilling or grinding, and the change is mainly due to the energetic action of the Danish Royal Agricultural Society with the assistance of the Government. In 1883, a committee of the society was formed to ascertain by what means of

cultivation, &c., the best possible quality of barley, yielding the greatest commercial value, might be obtained, and a subvention of £300 per annum was granted by the State to the society for this purpose. The committee accordingly distributed some 800 lots of seed, each consisting of half a hundred-weight of fine Chevalier barley, to farmers in districts where it was found that barley could be profitably grown. The condition was imposed upon every recipient that he should report the results of the experiment, and an annual exhibition of malting barley was established at Copenhagen, where their commercial value was appraised by experts. It has been found that in every case, out of seven or eight kinds of imported seeds, the 'Chevalier' gave the most profitable returns to the farmer, and this has naturally led to its general adoption.

The experiments in cultivation have also had an important influence. Early sowing was found to be most satisfactory, for the spring in Denmark is generally dry, and it is therefore desirable to get the seed into the ground while it retained some of the winter moisture. As to harvesting, it was ascertained that the best time to cut was when the grain was fully matured and the ears began to droop. Useful hints based on the experience gained were also circulated among the growers by the Society as to stacking, threshing and storing, and the practical result of the whole has been to revolutionize this branch of agriculture in Denmark, the annual money outlay, be it observed, amounting to no more than £300. It is now estimated that one-third of the arable land in Denmark is devoted to barley culture, and the total yield is about 2,750,000 quarters."

HINTS ON BARLEY-CULTURE.

The opinion is generally held by farmers in Great Britain that land to be used for barley-growing should be prepared beforehand by manuring some preceding crop, and that the application of barnyard manure to a crop which remains on the land so short a time as barley does is not likely to produce satisfactory results. The roots of barley grow rapidly but do not strike deep; they are comparatively feeble and short lived, and are not adapted to use such fertilizing materials as are not fully prepared to be taken in. On the other hand, it is important not to use such manures as would stimulate growth too rapidly, which would make the crop run to straw rather than to grain. In Germany where large crops of barley are grown it is common to grow two crops in succession,

after a crop of sugar beets, for which the land is heavily manured. Few crops respond more readily to generous and judicious feeding than barley, or languish more decidedly where food is wanting. In England, when the land is otherwise in good order, barley is usually dressed with such artificial fertilizers as are readily soluble, such as two or three hundred pounds of superphosphate, with from 50 to 100 lbs. of nitrate of soda per acre, applied before seeding.

A moist soil is necessary to start the plants promptly: when too dry germination is apt to be long delayed. One of the chief reasons why sandy soil is not found suitable for barley is that such soil is not capable of holding moisture to the same extent as a loamy soil. Experiments conducted in Germany have demonstrated that a rich loamy soil a foot deep will hold and retain more than double the quantity of water which a light sandy soil can retain. Hence, having twice as much water at the start, supplemented by summer showers, loamy soil is placed at an immense advantage over sandy soil, apart from the question of nutriment. This also is one of the chief reasons why sandy soil, no matter how heavily manured, rarely gives crops as good as can be obtained with less fertilizing from good deep loams.

On the other hand, a wet soil is detrimental, and land for barley-growing should be well drained. A light, rich, friable loam is generally regarded as the most suitable soil for barley, although it does well on a clay loam if thoroughly worked until it is reduced to a fine mellow condition. A well pulverized and clean seed bed is all-important. Barley is said to do best in a warm, dry atmosphere with occasional light showers; a free circulation of air and plenty of light are also essential conditions to success. The questions of admission of light and circulation of air have an important bearing on thick seeding; the width between the rows and the direction in which the rows should run also require further and frequent tests. Weeds probably do more harm to such crops by the exclusion of light and air than from what they take in the way of nourishment from the soil. Early sowing is also much favoured, sowing as soon as the ground is dry enough to be well pulverized. This is said to counteract the tendency to over-luxuriance, which sometimes injures the crop in rich soils. When drilled, two bushels of seed to the acre is commonly used; some farmers use less, but a full allowance of seed prevents excessive tillering and consequent irregular and later ripening.

The selection of good, plump seed cannot be too strongly urged, as so much depends on giving the plants a good start at the outset. Experiments have shown that selected, extra heavy seed, has produced nearly three times the weight of actual growth in the first fifteen days after sowing than was obtained from light seed. It is important, especially in districts liable to drought, that this vantage point of growth in the beginning should not be overlooked. From the time when the blade appears above ground to the time of the appearance of the ear the plant is most active in gathering and storing in its stems, leaves and roots food for the maturing of the grain, and during the growth of the grain a transfer takes place of a large part of these stores of food from the leaves and roots to the seed ; hence it may be said that a crop of barley is comparatively safe as to food supply when the plants have reached in full vigour that stage in their growth when seeds have begun to form in the ears.

“ Barley for malting,” says an eminent English maltster, “should be allowed to ripen thoroughly before harvesting, for thus only can a really mellow grain be secured. When cut too early the grain becomes steely, and hence of far less value to the maltster.” Some Canadian growers advocate cutting early so as to secure a brighter barley, but this is a mistake. It is better to run the risk of a little discoloration—for this does not materially injure barley for malting—than to cut it before it matures. In threshing, great care should be exercised to avoid breaking the grains, as broken kernels reduce the value of the grain, are worthless for germinating and injurious to the malt. After threshing, and when put into bins or heaps on the barn floor, the heaps should at first be turned over every few days, otherwise the moisture in the grain may result in its acquiring an earthy flavour, which will greatly injure it. Before being marketed the grain should be thoroughly cleaned and put through the fanning-mill often enough to blow out and separate all the light and broken grains ; and all admixture with foreign seeds should be carefully avoided ; a good, plump, clean sample commands a higher price, and a readier sale, and the light grain separated can be profitably used as feed.

It is believed that two-rowed barley will produce on an average as many measured bushels as six-rowed. Taking the market reports in the “Mark Lane Express” of London, for the five weeks end-

ing January 6th, we find that malting barley from Austria has ranged in price from 34 to 38 shillings per quarter of 448 lbs., from California 35 to 40, while the Saale barley has commanded from 40 to 44 shillings. Taking as the basis for an estimate the barley from Austria, the English shilling at 25 cents and allowing 20 cents per bushel to cover expenses of transport from Toronto or Montreal to Liverpool or London, this would leave for the grower here from 86 to 98 cents per bushel of 56 lbs. With such possibilities in view and the pressing necessity of securing other and more permanent outlets for at least a portion of the surplus barley of this country, this subject is one which should command careful consideration and united effort.

SIX-ROWED BARLEY.

The six-rowed barleys are often spoken of as four-rowed; there are, it is said, varieties of four-rowed barley in cultivation, particularly in Scotland, but none of these have yet come under my observation. Among the varieties of six-rowed barley, differences as to relative fertility and vigour are found similar to those among the two-rowed sorts. The following have been grown as single plants, treated in exactly the same manner as the two-rowed barleys, and with the results given in the table :—

	RECORDS FOR 1888.					1889.		
	Single selected plant.		Second select'n. Average No. of grains.	Unselected plants.		Total average.	No. of plants.	Average No. of grains.
	No. of heads.	No. of grains.		No. of plants.	Average No. of grains.			
Baxter's New Six-rowed .....	..	..	..	..	..	38	841
Bombay Karachi.....	21	514	483	38	361	378	678	
From Assiniboine Reserve N. W. T. (Grown by Indian named Rabbit Skin.)	21	1197	729	36	421	471	945	
Greek Six-rowed.....	15	600	713	41	196	250	852	
Imperial Improved American...	48	1892	1365	33	806	881	1233	
Mensury	13	613	601	36	640	636	1201	
Oderbruch	16	762	629	36	579	589	809	
Odessa Six-rowed.....	16	687	727	25	690	695	826	
Petschora.....	24	825	545	28	448	472	1033	
Polar.....	15	789	414	33	332	353	916	
Rennie's Improved Six-rowed...	17	980	895	36	572	614	921	
Smyrna.....	22	740	690	41	203	238	933	
Spring....	16	1075	839	28	636	675	1034	

Baxter's new six-rowed barley is a promising sort, which originated with Mr. J. Baxter, of Pickering, Ontario, and was received for test in the spring of 1889. At that time Mr. Baxter wrote as follows : "I have a small quantity of a new barley (or improved) six-rowed ; it is a short, thick kernel, weighs 56 pounds to the bushel, about ten days earlier than our common six-rowed, good straw. This barley originated with me four years ago, from one grain ; with three years sowing I have $1\frac{1}{2}$ bushels." Mr. Baxter was requested to send a small quantity for trial, which he kindly did. The sample was very plump in berry, and shorter than usual, but there was not enough of it to test the weight per bushel. The yield of the single plants given above shows this to be a fertile variety ; the grain is shorter and more rounded than any of the other sorts, and from a small plot in the field a crop was grown equal to $36\frac{1}{2}$ bushels per acre. The grain grown was not as plump as the seed sown, and weighed 48 lbs. to the bushel ; and a further sample from Mr. Baxter's own crop of this year weighs 50 lbs. per bushel. The claim made for earliness is not thus far fully borne out in our experience, as will be seen from the following :—

	Sown.	Harvested.	Time of Maturing.
Baxter's New Six-rowed	May 6	August 5	91 days.
Bombay Karachi	" 4	" 4	92 "
From Assiniboine Reserve	" 9	" 7	90 "
Greek Six-rowed	" 4	" 5	93 "
Imperial Improved American	" 6	" 10	96 "
Mensury	" 4	" 5	93 "
Odessa Six-rowed	" 6	" 5	91 "
Petschora	" 9	" 1	84 "
Polar	" 9	" 1	84 "
Rennie's Improved Six-rowed	" 4	" 1	89 "
Smyrna	" 6	" 4	90 "
Spring	" 6	" 5	91 "

Petschora and Polar were both one week earlier than Baxter's barley, but the grain is not nearly as plump. These two barleys (which are probably identical) have, however, improved since they were imported two years ago, as will be seen by reference to the results both from single plants and field crops. The Petschora was brought from the neighbourhood of the Petschora River, in the northern part of Russia, and the Polar from latitude 67, in the

same country, north of Archangel and within the Polar circle. The locality where this barley was grown is said to be the extreme northern limit for the cultivation of cereals in Europe. From many careful comparisons made at different periods in their growth, I am of opinion, notwithstanding the difference in yield of single plants, that the barleys known under these two different names are identically the same.

Results of Field Crops.

	CENTRAL EXPERIMENTAL FARM.	
	Yield per Acre.	Weight per Bushel.
Baxter's New Six-rowed.....	36 $\frac{1}{4}$	47 $\frac{1}{4}$
Bombay Karachi.....	29 $\frac{1}{8}$	36 $\frac{1}{2}$
From Assiniboine Reserve.....	45	46
Greek Six-rowed.....	53	44 $\frac{3}{8}$
Imperial Improved American...	43	40 $\frac{1}{4}$
Mensury.....	21 $\frac{3}{4}$	46 $\frac{1}{4}$
Oderbruch.....	26 $\frac{1}{2}$	44
Odessa Six-rowed.....	61	45 $\frac{3}{8}$
Petschora.....	30	43 $\frac{1}{2}$
Polar.....	34 $\frac{3}{4}$	44 $\frac{1}{4}$
Rennie's Improved Six-rowed...	45 $\frac{1}{2}$	45 $\frac{1}{4}$
Smyrna.....	..	46 $\frac{1}{2}$
Spring.....	45 $\frac{1}{4}$	44 $\frac{1}{4}$

The Mensury barley was sown on a piece of rather low land, which was quite dry in 1888, and hence not then underdrained; but 1889 being a very wet season, this plot was seriously injured by water, and hence the yield must not be taken as a fair criterion of what returns Mensury barley would give under favourable conditions. This barley, which weighed 46 $\frac{1}{4}$ lbs. per bushel at Ottawa, weighed 48 lbs. at Nappan, N. S., 52 $\frac{1}{4}$ lbs. at Brandon, 51 lbs. at Indian Head. Petschora weighed at Ottawa 43 $\frac{1}{2}$, at Nappan 48 $\frac{1}{2}$ lbs., at Brannon 49 $\frac{1}{2}$ lbs., and at Indian Head 51 $\frac{1}{2}$ lbs. Polar, which weighed 44 $\frac{1}{4}$ lbs. at Ottawa, weighed 45 lbs. at Nappan and 49 $\frac{1}{2}$ lbs. at Brandon.

BARLEYS FOR FEED.

Reference will next be made to the results of tests of a few varieties of barley which are grown exclusively for feeding, all of which—with the exception of the Earliest Two-rowed Black—are

hulless ; that is, they thresh out like wheat, clean from hull, and they cannot be used for malting. Most of them are very prolific, and where feeding barleys are required are well worthy of more extended trial than they have hitherto had. The first two on the list are two-rowed, the others are six-rowed.

	RECORDS FOR 1888.					1889.		
	Single selected plant.		Second select'n. Average No. of grains.	Unselected plants.		Total average.	No. of plants.	Average No. of grains.
	No. of heads.	No. of grains.		No. of plants.	Average No. of grains.			
Earliest Two-rowed Black.....	44	747	845	32	439	482	44	571
Large Two-rowed Naked.....	27	476	326	27	266	281	46	557
Guymalaye.....	16	819	562	38	418	441	44	1528
Small Blue Naked.....	27	1326	613	36	577	599	44	1362
Naked from Nepal.....	13	322	280	31	157	172	28	1175
Hulless Black.....	12	540	596	36	298	333	39	689
Six-rowed Wheat Barley.....	33	1705	1131	36	744	806	39	1713

These barleys are all very heavy. The large Two-rowed Naked from single plants weighs $61\frac{1}{4}$ lbs. per bushel, and from a field crop which gave $25\frac{1}{2}$ bushels per acre the weight was $54\frac{3}{4}$ lbs., time from sowing to harvesting, 90 days. Guymalaye weighed $57\frac{1}{2}$ lbs., time 89 days ; Small Blue Naked $55\frac{3}{8}$ lbs., time 89 days ; Naked from Nepal, $58\frac{1}{4}$ lbs., time 90 days ; Hulless Black, $60\frac{1}{8}$ lbs., time 90 days ; Six-rowed Wheat Barley, 55 lbs., time 89 days, and Earliest Two-rowed Black, 44 lbs., time 91 days. Perhaps a better idea can be given of the prolific character of these hulless sorts by giving the weight of yield in each case. From 46 kernels of Large Two-rowed Naked 3 lbs. $13\frac{1}{4}$ oz. was harvested ; from 44 kernels of Guymalaye 4 lbs. 8 oz. ; from 44 kernels of Small Blue Naked 3 lbs. $9\frac{1}{4}$ oz. ; from 28 kernels of Naked from Nepal, 2 lbs. $6\frac{1}{4}$ oz., from 38 kernels of Hulless Black, 2 lbs. $9\frac{3}{4}$ oz. ; and from 39 kernels of Six-rowed Wheat Barley, 4 lbs. 1 oz.

BARLEYS FROM INDIA.

Among the samples of cereals, &c., which were sent last year by the Government of India for test at the Experimental Farms in Canada, there were a number of varieties of barley selected from crops grown at different altitudes in the Himalayas, varying from 450 to 11,000 feet. Judging from the test of a single season, the following are the most promising. The grain is light in weight in most

instances, excepting the hulless sorts, which are very heavy. It is probable that all of them will do better another year, as by that time they will be somewhat acclimatized. All the varieties are six-rowed.

Barley from Palampur, Grown at an Altitude of 3,000 feet.

This barley is much like the common six-rowed of this country, and resembles the Bombay Karachi barley, grown from seed imported from the Corn Exchange, London, England. When received, the Palampur barley weighed $47\frac{3}{4}$ lbs. per bushel; it was sown on the 19th of April and harvested on the 3rd of August time, 107 days; it ripened on the Experimental Farm at Indian Head in 90 days. Grown as single plants, one foot apart, 35 plants gave an average yield of 935 fold; weight 45 lbs. per bushel. This barley grown at Brandon weighed 51 lbs., and at Indian Head $51\frac{1}{2}$ lbs. per bushel.

Barley from high elevation in the Simla District (Elevation not given.)

This proved to be a mixed barley of two distinct sorts, both six-rowed, weighing $48\frac{1}{2}$ lbs. per bushel. In No. 1 the ear is short, about 2 inches only, set very thickly with grain; No. 2 is about $3\frac{1}{2}$ inches long and less compact. Grown as single plants, No. 1 gave an average of 636 fold from 21 plants, and No. 2 of 787 fold from 16 plants. Weight of No. 1, 45 lbs. per bushel; No. 2, $43\frac{1}{2}$ lbs., yield of mixed sorts in field culture, $36\frac{3}{4}$ bushels per acre. Both were sown on the 19th of April and harvested 1st August, time, 105 days. At Indian Head this barley ripened in 90 days, and weighed 49 lbs. per bushel.

Barley from Seoraj, Altitude 7,000 feet.

This barley, which weighed $47\frac{1}{2}$ lbs. per bushel, was also mixed. A part of it seemed to be a variety of winter barley, which made a strong bushy growth of leaf but did not head out at all. Grown as single plants, the average yield from twelve plants which ripened was 646 fold; sown 19th April, ripened August 4th, time 108 days, weight per bushel, $44\frac{3}{8}$ lbs. At Brandon this weighed $49\frac{3}{8}$ lbs., and at Indian Head, where it ripened in 90 days, 52 lbs. per bushel.

Barley from the Kulu District, Altitude 7,000 feet.

This variety weighed $44\frac{1}{2}$ lbs. per bushel; it made vigorous growth of leaves, but the ears were produced unevenly at intervals. Grown as single plants, the average yield from 36 plants was 782 fold. This sort lodged badly, ripened late and weighed 39 lbs. per bushel; sown 19th April, ripened 12th August, time, 116 days. At Indian Head this barley ripened in 90 days and weighed 51 lbs. per bushel, and at Brandon $50\frac{1}{2}$ lbs.

Barley from the Kangra Valley, Altitude 3,000 feet. Weighed $48\frac{3}{8}$ lbs. per bushel.

Not a vigorous grower. In plots of single plants it produced an average of 617 fold from 44 plants, the grain weighing $47\frac{1}{2}$ lbs. per bushel; sown 19th April, ripened 1st August, time, 105 days. At Indian Head this barley ripened in 90 days and weighed $53\frac{1}{2}$ lbs. per bushel; at Brandon in 101 days.

Barley of Lahoul, Altitude 11,000 feet.

This is a hulless barley which weighed $58\frac{1}{2}$ lbs. per bushel, short plump kernels, some of them of a peculiar bluish colour. Grown as single plants the average yield from 34 plants was 553 fold, grain weighing 56 lbs. per bushel. The growth was vigorous, but it ripened late; sown 19th April, ripe 22nd August, time, 126 days. At Indian Head this ripened in 106 days, and weighed 64 lbs. to the bushel. At Brandon it ripened in 107 days.

Barley of the Spiti Valley, Altitude 11,000 feet.

This was also a hulless barley, of a faint steely blue colour, which weighed 58 lbs. to the bushel. Both these barleys are very different in appearance from any other varieties hitherto tested at the Experimental Farms. This is a short, plump grain, which ripens earlier than that from the same elevation in Lahoul. At Ottawa it was sown 19th April, ripe 2nd August, time, 106 days, weight, $57\frac{1}{2}$ lbs. per bushel. Grown as single plants the average yield from 24 plants was 351 fold. The growth was not vigorous but the heads were comparatively large, 3 to $3\frac{1}{2}$ inches long. At Indian Head this barley ripened in 90 days and weighed 62 lbs. per bushel; at Brandon it ripened in 101 days.

Several other sorts made a promising growth, but were received too late to give them a fair chance in comparison with the other varieties.

The importance of this subject can only be fairly seen when the magnitude of the interests involved are considered. The total barley crop of the Dominion is probably about 30,000,000 bushels, with an average yield of from 20 to 25 bushels per acre. While this is much larger than is produced in some countries, it falls below the average in Great Britain. Recent returns give the yield of barley in England, Scotland and Wales, for the year 1889, as 31.58 bushels per acre; in 1888 it was 33.14, showing a falling off last year of 1.56 bushels. The results of the tests given in this Bulletin show that there are great differences in the fertility of different varieties, and it is well known that favourable conditions of soil are essential to a vigorous growth. With fertile strains of vigorous seed and skilful and judicious management in the preparation of the soil there seems to be no good reason why the farmers of Canada should not be able to work their crops nearly, if not quite, up to the English standard. Such a result is worth striving for; every bushel added to the acre would amount to \$480,000 annually to the profits of the farmers, and taking the crop at 30,000,000 bushels, the yield at 25 bushels to the acre and the price 40 cents per bushel, the increase of one pound in weight to the bushel would result in an annual gain of \$250,000. With depending issues so great as this, no effort should be spared to place within reach of Canadian farmers the very best strains of seed which the world affords, and to disseminate among them all the information which can be gathered, bearing on the conditions essential to success.

