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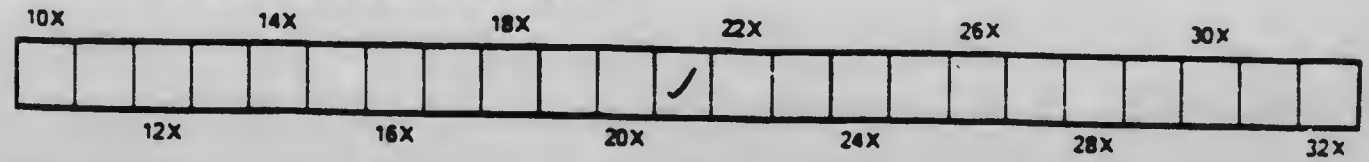

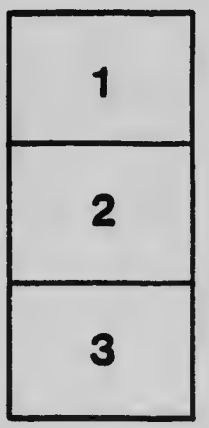

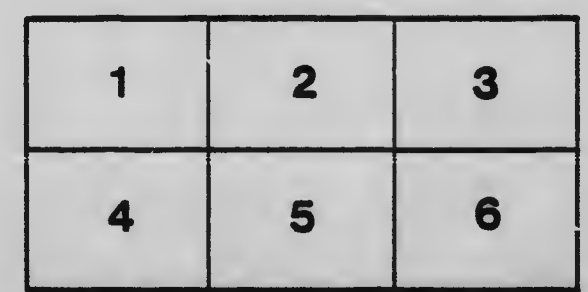

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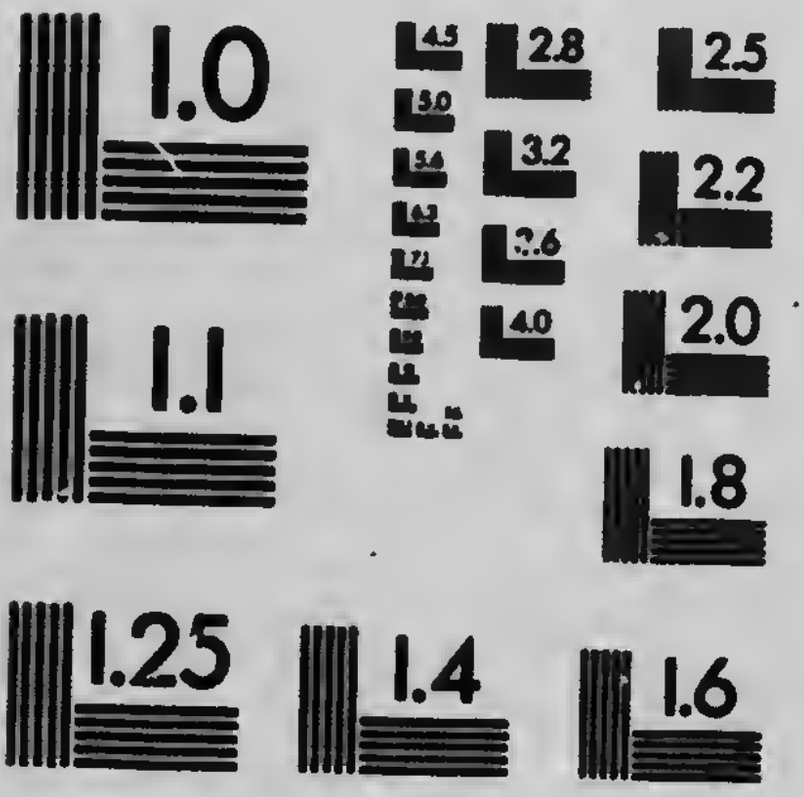

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Government of The Province of Saskatchewan
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Field Husbandry Bulletin No. 1

WHEAT GROWING IN SASKATCHEWAN

Department of Field Husbandry
College of Agriculture
University of Saskatchewan
Saskatoon

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WHEAT GROWING
IN
SASKATCHEWAN

Department of Field Husbandry
College of Agriculture
University of Saskatchewan
Saskatoon

Courtesy The Agricultural Development Co., Stranraer, Sask.
Marquis Wheat in the Banner Season of 1915. 50 Bushels Per Acre.

WHEAT GROWING IN SASKATCHEWAN

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INTRODUCTORY

The wheat crop of Saskatchewan is over twice as valuable as the total of all other crops grown in the Province. More than one half the total wealth now being produced annually in the Province comes from the soil in the form of wheat.

In 1898 our wheat crop was grown on 276,000 acres,—in 1915 it occupied 7,000,000 acres. Eighteen years ago the production of wheat in this area was about 5,000,000 bushels,—last year it was 175,000,000 bushels. In 1898 the total value of the wheat crop to the farmer was less than $3,500,000,—in 1915 it was $145,000,000.

The rapid development of wheat growing in Saskatchewan during the last ten years has been at once the boast of her citizens and the chief cause of many of the economic problems her wheat growers have had to face.

The history of the development of this industry here has been attended with many soil, climatic and economic difficulties. In recent years some of these have been lessened and some overcome, but many yet remain unsolved. The purpose of this report is to add to the experience of the wheat grower the experimental evidence gathered during the last few years from the investigation work undertaken and carried on by the Department of Field Husbandry in connection with the University of Saskatchewan.

Farming is a business. To be successful it must be profitable. To be profitable the cost of production must be less than the selling price of the product. The price is largely but not wholly beyond the influence of the wheat grower; the cost of production is partly but not wholly within the power of the farmer to control. The causes of failures are due to (1) poor crops or (2) poor management, either by the individual or the state.

It is not our purpose here to refer to the subject of farm management or the economic questions arising out of the production and distribution of farm crops but rather to discuss the means of controlling the yield of crops and the relative profits from different methods of production.

The conditions that must be provided by nature or by man before crops will grow are six in number:—

1. The Seed.
2. Plant Food.
3. Moisture.
4. Heat.
5. Light.
6. Air.

Nothing else is essential to the production of large yields. All causes of low yields trace back to an insufficient or poorly balanced supply of one or more of these things.

The chief means at the disposal of Saskatchewan farmers for influencing these conditions and thereby controlling in some degree the cause of poor crops of wheat are:

(1) The choice, selection and breeding of crops.
(2) Suitable crop management practices.
(3) Suitable methods of managing the soil.

The first of these includes:

(a) The choice of suitable varieties, and
(b) Selection and breeding.

Crop management includes:

(a) The care and treatment of the seed.
(b) The time, a ount and depth to sow.
(c) The time and method of harvesting and curing.

Soil management includes:

(a) The ime, method and amount of tillage, for (1) prairie sod; (2) stubble land and (3) the fallow.
(b) The rotation of crops.
(c) The use of manures and fertilizers.
(d) Irrigation and drainage.* and
(e) Inoculation with nitrogen fixing bacteria.*

The experiments reported in the following pages are classified under these headings. They do not cover the whole field of the things that man may do to prevent low returns, but they do cover the more common and essential practices of wheat growing as it is followed in Saskatchewan.

*Not discussed in this report.

THE CHOICE OF VARIETIES

The chief factors that determine the value of any variety of wheat are yield and quality. In this climate both of these are often dependent upon the time of ripening, hence yield, quality and early maturity may be considered major factors in determining the relative value of varieties here. Other variety characters of minor importance that affect the yield or quality are the tendency to shatter, the resistance of the straw to disease and the strength or stiffness of the straw. Information on all of these points, as furnished by crops grown on a brown clay loam soil at Saskatoon, has been secured and is presented in the tables and observations that follow.

Table 1.—Six-Year Average on Fallow or Breaking

From the results it will be observed that Kubanka and Marquis were the most productive on fallow or breaking and that Kubanka and Red Fife were the most productive on fall plowing. The most profitable on fallow or breaking was Marquis while Red Fife and Kubanka were the most profitable on fall plowing.

Kubanka is a "Durum" wheat not yet grown to any extent in Canada. In arriving at the relative profit it was given the arbitrary values of 65c and 60c per bushel respectively as compared with 70c per bushel for the other varieties. This is purely arbitrary and perhaps unfair. For fuller discussion of this wheat see Field Husbandry circular on "Durum Wheat."

Prelude wheat was grown in this test for five years but discarded on account of low yield, serious tendency to shatter and short straw.

The Hybrid Wheats—Preston, Stanley, Huron, Percy, Bishop and Chelsea,—have also been grown but all were discarded because of low milling or baking qualities. They were all early and quite productive.

The Blue Stem Wheats of the Dakotas have been discarded on account of their lateness in maturing and a tendency to shatter.

Taylor's Wonder, a white wheat was grown for two seasons. In 1915 it produced a larger yield than any other and it milled very well. In 1916 it was found to be very susceptible to rust and yielded less than all other standard wheats. It will be continued in the test until we get more information regarding its productiveness in normal seasons.

Kitchener—A pedigree selection out of Marquis made by Seager Wheeler, Rosthern, has been grown one year. It seems very similar to Marquis in all important characteristics. We shall continue it in the test.

A winter wheat—"**Buffums No. 17**" has proven hardier with us than any other winter sort. We cannot recommend it to farmers except for experimental purposes, but we shall nevertheless carry it on in our tests.

"**Club**" the chief wheat of the Pacific Coast region has been discarded because of its low baking value.

Table II.—No. of Days between seeding and harvesting leading varieties of wheat at Saskatoon.

Variety—	2-year average on fall plowing	5-year average on breaking & fallowing
Kubanka	118½	123
Marquis	119	119
Red Fife	120	123
White Fife	120	124
Pioneer*	110	114

*Relative figures—not grown in all years.

Heads of Leading Varieties and Types of Wheat in Saskatchewan. (1) Kubanka; (2) Marquis; (3) Red Fife; (4) White Fife; (5) Pioneer; (6) Prelude.

Heads of Discarded Varieties Or Those of Minor Importance. (1) Bluestem; (2) Preston; (3) Stanley; (4) Huron; (5) Chelsea; (6) Percy; (7) Bishop; (8) Club; (9) Alaska; (10) Polish; (11) Taylor's Wonder; (12) Buffum's No. 17.

On fallow, Kubanka and the Fifes are later in maturing than Marquis and Marquis later than Pioneer. On fall plowing there seems to be little difference between the first three. A still earlier wheat called Prelude was discarded owing to its low productiveness.

Table III.—Relative milling and baking value of some standard varieties and some new introductions (average of 1914, 1915 and 1916 figures).

VARIETY	YIELD OF FLOUR IN PER CENT.	COLOR OF FLOUR	WET GLUTEN IN PER CENT.	VOL. OF LOAF IN CU. IN.	ABSORPTION OZS.
Kubanka	75.97	yellow white	42.47	168	7.46
Marquis.	75.74	creamy white	40.47	196	7.51
Red Fife	75.30	creamy light white	43.04	183	7.39
*White Fife	71.3	white cream light dull	42.00	202	7.00
Pioneer	74.74	creamy white light grey	48.14	197	7.20
Prelude	74.5	creamy dull white	51.8	198	7.00
Taylor's Wonder	74.04	light cream	34.00	201	6.96
Buffum's No. 17 (winter)	73.50	creamy light white	41.47	166	6.63
Alaska	73.97	yellow white	37.57	1507	7.58

*Average of two years only.

The tests to determine the milling and baking qualities of the different wheats under trial were conducted by the Howard wheat and flour testing laboratory of Minneapolis. The headings in the table indicate the more important points considered in determining the milling and baking value.

Flour is the most valuable mill product obtained from wheat, hence the percentage of flour derived is the factor of greatest importance to the miller. He desires a wheat capable of producing a high "yield" of flour.

The chief qualities that at present determine the baking value of flour for bread making are, color, water absorption and volume of loaf.

1913

1914

1915

1916

Volume and Character of Leaves from Different Varieties of Wheat Grown at Saskatoon.
(R.F.I.H. is Red Fife; B.17 is Buffum's No. 17; 195F is Pioneer.)

The color of flour is important from the commercial standpoint, as both the housewife and the baker prefer a white flour for bread making.

The absorption or quantity of water used per unit of flour bears a very important relationship to commercial worth, as other things being equal the more water that can be worked into a given weight of flour, the more pounds of bread it will make. This is of particular importance to the commercial baker, who desires to make as many pounds of bread as possible from a barrel of flour.

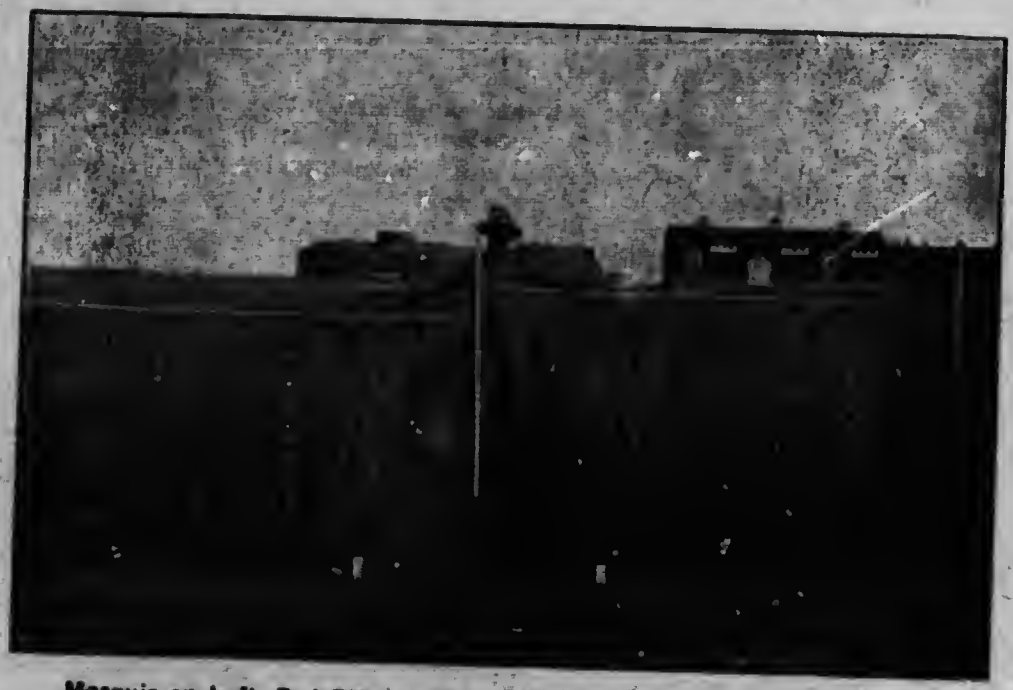
The volume of loaf refers directly to what is termed the "baking strength" of a flour. This characteristic is of greatest importance to the baker. He recognizes that a dough to yield bread of good quality including size, and uniformity of the "pores" or crumb texture must be elastic. The greater the elasticity the larger the volume of the loaf and consequently the greater its "baking strength."

It will be noticed that in most cases the flours which are high in wet crude gluten, as a usual thing, yield loaves larger in volume. This does not always hold true, however. The durum flours represented in the above table by Kubanka, carry a high percentage of gluten, but the loaf is seldom exceptionally large, owing to the low "quality" of the gluten.

Numerous tests emphasize the fact that wheats of the Marquis and Red Fife type conform very closely to the demands of the miller and baker. They seem to possess in an unusual degree the desired composition and quality. Unlike some of the wheats shown in the above table, notably Taylor's Wonder, they possess the additional advantage of having a red skin and therefore grade higher and command a better price.

Summary Notes on Variety Characteristics

1. **Kubanka**—High yield, good quality, rather late in maturing
   Straw—Long, flexible and slender, quite resistant to rust.
   Heads—Rather short and very compact, bearded, brownish-yellow chaff, non-shattering.
   Seed—Medium to heavy weight, bright yellow, long and narrow, large size.
   Recommended for trial only in Southern and South Western Saskatchewan. Not yet grown to any extent in the Province. Judged by our present standard is not considered a suitable "bread" wheat. (See Field Husbandry Circular on "Durum Wheat.")



Marquis on Left, Red Fife on Right—Showing Characteristic Difference in Length of Straw

2. **Marquis**—High yield, excellent quality and medium early.

Straw—Medium long, strong, and somewhat resistant to rust.

Head—Medium long and slightly compact, pointed, bald, although in some instances a few conspicuous awns are present. Chaff straw-yellow color; non-shattering—berries held so tightly that complete separation is sometimes difficult.

Seed—Very heavy; dark red, rather short and blocky; medium in size.

Recommended for heavy soils and fallowed lands in the more moist regions where fall frosts are feared and where a rather short straw is preferred.

3. **Red Fife**—High yield, excellent quality, late in maturing.

Straw—Long, strong and somewhat rust resistant.

Head—Medium to long and slightly open, tapering, bald although a few short awns are usually present, especially at the apex; shatters slightly.

Chaff, straw-yellow color.

Seed—Medium to very heavy; pale red; medium long and tapering, medium size.

Recommended for the lighter and earlier types of soil, for the drier parts of the province and for all regions where fall frosts are not feared and where long straw is desired.

4. **White Fife**—High in yield, excellent quality, rather late in maturing.

Straw—Long, strong, rust resistance only fair.

Heads—Medium to long and slightly open; tapering, bald, chaff, straw-yellow color; shatters slightly.

Seed—Medium to very heavy; amber white; medium long and tapering.

This variety has nothing to recommend it over Red Fife and is in disfavor owing to the color of the bran. It has not shown itself to be dissimilar to Red Fife in any important quality.

5. **Pioneer**—Medium yield, high quality, very early.

Straw—Medium to short and rather weak—lodges readily; by virtue of its earliness tends to avoid rust rather than to resist it.

Head—Medium to short and rather open; tapering; bearded; chaff, straw-yellow color, shatters slightly.

Seed—Medium heavy; pale dull red; medium long and tapering; small sized.

Recommended for all regions where Marquis does not mature, where earliness and a fair length of straw is desired, and where a weak straw is not a serious objection.

6. **Prelude**—Very light yield; excellent quality; very early in maturing.

Straw—Very short and weak; like Pioneer it tends to avoid rust by being early.

Head Short and rather open; bearded; chaff brownish yellow color; shatters very easily.

Seed—Medium heavy; dull reddish color; rather short and tapering, small sized.

Recommended only for regions north of the present wheat growing area. On account of its low yield it is not worthy of a place where Marquis matures.

Typical Seeds of Different Varieties of Wheat, Showing Dorsal and Ventral Surfaces and Cross Section of Each.

Discarded Sorts (Upper and Middle Row) (1) Bluestem; (2) Preston; (3) Stanley; (4) Huron; (5) Chelsea; (6) Percy; (7) Bishop; (8) Club; (9) Alaska; (10) Polish; (11) Taylor's Wonder, and (12) Buffum's No. 17 (Winter Wheat).
Leading Sorts (Lower Row (1) Kubanka; (2) Marquis; (3) Red Fife; (4) White Fife; (5) Pioneer, and (6) Prelude.

7. **Alaska**—Medium yield; very poor quality; medium early.

Straw—Rather long and strong; quite rust resistant.
Head—Short, thick and much branched; bearded; chaff dark reddish amber color; non-shattering.
Seed—Medium heavy; yellowish, creamy white; medium long and rather coarse; tapering; large size.

This wheat is less productive; much inferior in quality and rather later in maturing than our standard sorts, such as Marquis and Red Fife. Its merits have been much overrated by interested individuals and small quantities of seed have been sold at fabulous prices, first in one part of the country, and then in another. Only those who are ignorant of its real qualities ever purchase it, but it seems that there are always some who are ready to be taken in by the appearance of the branched head. They seemingly do not realise that in order to be productive a variety must have not large heads alone, but with that a large number of heads per acre. In the latter respect this sort is very disappointing. No one should be persuaded to purchase seed of this variety at any price.

8. **Taylor's Prolific**—

High yield, fair quality; medium early.
Straw—Long and strong; quite susceptible to rust.
Heads—Long and quite compact; bald; chaff light, pale straw-yellow color.
Seed—Medium heavy; white; medium long and tapering; medium size.

In quality this wheat is unlike any of the foregoing with the possible exception of Alaska. It is soft and rather starchy.

Not recommended.

SELECTION AND BREEDING

The term, selection, as ordinarily used, may refer to any one of three different methods of improvement.

First, selection of the seed as by the use of the fanning mill.

Second, selection of heads as practiced by members of the Canadian Seed Growers Association.

Third, the selection of individual plants as followed by a few seed growers and most breeders.

Each of these methods has some advantages and some limitations.

Selecting Seed with a Fanning Mill

During the past two years (1914 and 1915) an equal weight of both well matured plump kernels, and small shrunken seed was removed by hand from samples of No. 1 Northern wheat. These were sown at 1½ bushels per acre in the seasons mentioned. The well matured, plump seed yielded 37 bus. 58 lbs. per acre, while the small, shrunken seed yielded 33 bus. 11 lbs. When samples of these two separations were planted at an equal number of seeds per acre the plump well matured seed yielded 40 bus., 35 lbs., while the small, shrunken seed yielded 35 bus., 2 lbs. These figures illustrate the fundamental principle that well developed, plump seed normally produces the most vigorous plants.

The only practicable means of applying this principle to the preparation of grain for seed is by the use of the fanning mill. In order to determine the value of the fanning mill as a means of separating the less desirable from the better seeds in a sample of No. 1 Northern wheat this grade was thoroughly cleaned by a Clipper mill during each of two seasons. A sample of the cleaned seed, another of the original uncleaned seed and a third of the light shrunken seed were planted with the following results:-

Table IV.—The effect of cleaning No. 1 Northern Wheat on yield.

	2-year average yield
Cleaned grain	40 bus. 41 lbs.
Uncleaned seed	39 bus. 52 lbs.
Light and shrunken grain	38 bus. 15 lbs.

The fanning mill when properly adjusted and well handled will separate most weed seeds, any injured and shrunken seeds and nearly all smut balls from seed wheat, leaving the larger, plumper and heavier berries. Its greatest usefulness is observed when seed lacks uniformity and contains weed seeds. Its lowest efficiency is when the grain is all well matured, as was the case in the test reported. Under other conditions the increase resulting from the use of the fanning mill would probably have been much greater. Plans are now under way to study this matter further by using not only No. 1 Northern seed but samples affected with various degrees of rust, frost and weeds (see page 18 for discussion of the fanning mill in relation to weed control).

The hereditary power of a pure line variety of wheat cannot be improved by selecting seed with the fanning mill or even

by hand but the greater vigor of the larger, plumper ber
may express itself in larger yields for more than one gen
tion. If the variety is a mixed one the strain, whether de
able or undesirable, having the largest seeds will be reprodu
and those having the smaller seeds will gradually be discard
This may or may not result in "better seed" depending
whether the large seeded sorts are desirable or undesirable

The Selection of Wheat Heads.

The continuous selection of typical well matured hea
from a mixed variety at harvest time enables one to improv
its purity, to obtain greater uniformity of ripening and
somewhat greater yield of a better grade of wheat. Thes
advantages are not secured under farm conditions by selectin
heads from pedigreed varieties that have been kept pure.

The favorable result of the head selection method ha
been apparent in variety tests here where different strains o
Red Fife, a mixed race, have been compared. A strain obtain
ed from Mr. Dash of Hillesden, has over a period of years out
yielded all other strains of this variety. It also shows less
variation than any other.

The head selection method of improvement is practically
useless insofar as immediate improvement in productive
power of a pure line variety is hoped for, but it is very
useful and very necessary in the control of purity and in the
prevention of admixture of other varieties and weeds.

Plant Selection.

In this method of improving wheat, the plant is taken as
the unit rather than the head or the seed. It is the most
advanced method of selection but unfortunately it is not a
practicable one for the average farmer for the reason that it
involves so much labour in the selection work itself and later
in keeping accurate and satisfactory records of performance.
To get the best results one must study large numbers of
plants under controlled soil conditions. He must keep the
progeny of each pure, then test them accurately side by side
for a number of years and only then increase such strains as
are most stable, most productive and generally the most
desirable.

During the past three years the department has studied
upwards of 35,000 individual plants and kept a record of the
performance of a large percentage of these. It is very appar-
ent that such work ought very properly to be left to the

experimental stations to perform. There can be no objection, however, to the individual attempting it, but his chances of success are not great in proportion to the labor and patience involved.

No new strains resulting from this method have yet been distributed by the department but many are now being tested out and the best of these will be increased and made available to farmers as soon as they prove themselves superior in quality, purity or productiveness.

Cross Pollination Or Breeding.

Crossing aims to combine the desirable qualities and to eliminate the undesirable qualities of two parents. It requires years of persistent effort even after securing the necessary cross to eliminate the unfit, to discover the fit and then to determine the ability of the latter to produce a high yield of good quality.

During the past two seasons over 1500 crosses have been made. Red Fife, a rather late maturing, high quality, bald wheat was crossed on the early bearded Prelude and Pioneer varieties in an effort to get an early, beardless, non-shattering wheat. Marquis, an early maturing, high quality wheat, has been crossed on both Prelude and Pioneer with the same object in view. Kubanka, a rust resistant variety of Macaroni wheat has been crossed on Marquis, Prelude and Pioneer the hope of getting an early rust resistant wheat producing flour of high quality. Taylor's Wonder, a very prod... whi... wheat, but very subject to rust and low in quality ... been crossed on Marquis and Prelude in the expectation of getting greater productiveness in the two last mentioned without losing their high quality.

SEED TREATMENT.

Table V.—Showing influence of formalin on the control of covered or stinking smut (seed "tagged" but containing no smut balls).

Treatment—	% of diseased heads in crop
Seed treated (1 lb. to 40 gals. water)	.00
Seed untreated	46.72

Table V. demonstrates what is already well known, viz. that thorough treatment of tagged wheat with formalin will prevent the occurrence of the disease in the crop produced from such treated grain.

1 2 3 4
The Formalin Treatment Controls "Bunt," "Covered" or "Stinking Smut." Two sheavee on left from "treated" seed; two on right from "untreated seed. (1) Proportion of diseased plante from treated seed; (3) Proportion of diseased plants from untreated seed.

Table VI.—Influence of formalin on the control of covered or stinking smut (seed containing smut balls and "tagged" grains as well).

Treatment—	% of diseased heads in crop
Smut balls floated off and seed treated	.00
Smut balls not floated off and seed treated	4.72

Ta le VI. indicates that some disease spores inside smut balls are not killed by the treatment, thus making possible the infection of seeds even after treatment. It illustrates the necessity for removing these balls with the fanning mill before treatment or by some other means at the time of treating.

To Remove Weed Seeds

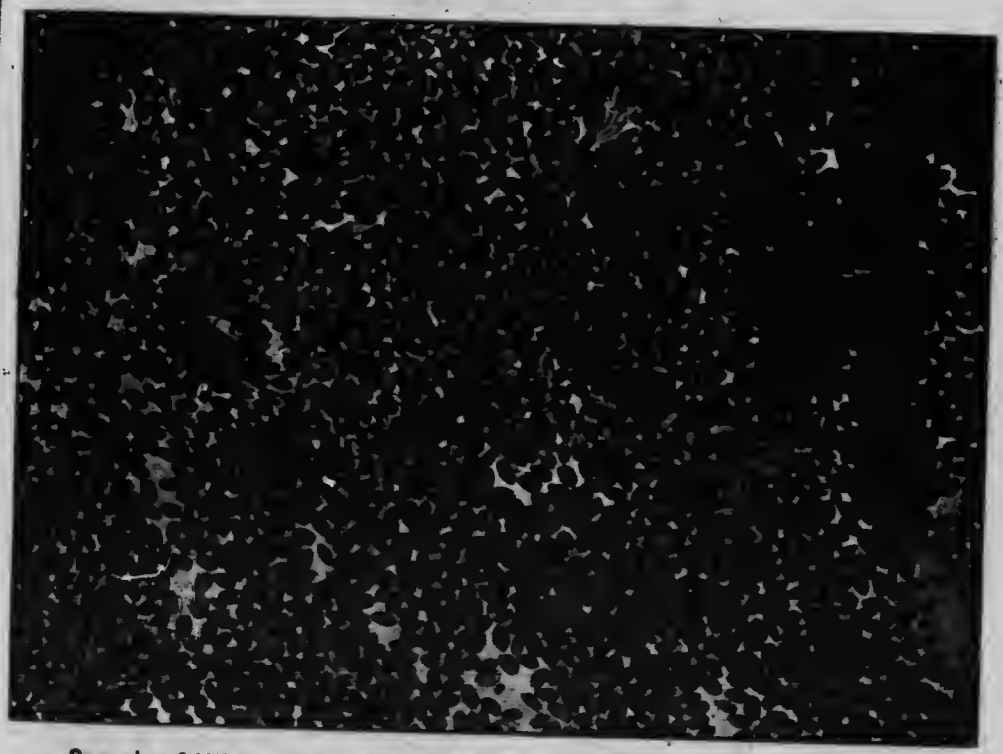
The weed menace which has become so acute in some sections of the Province is assuming greater and greater proportions. Many instances have been brought to the attention of the department where large numbers of weed seeds, noxious and otherwise, were sown. One instance will serve to give point to the gravity of the question of clean, healthy vigorous seed:

A sample of 5 lbs. of wheat was taken from a drill which was being operated in a field in the central part of the Province. The sample was forwarded to the department of Field Husbandry. One pound was drawn from it and on careful analysis was found to contain the following impurities :—

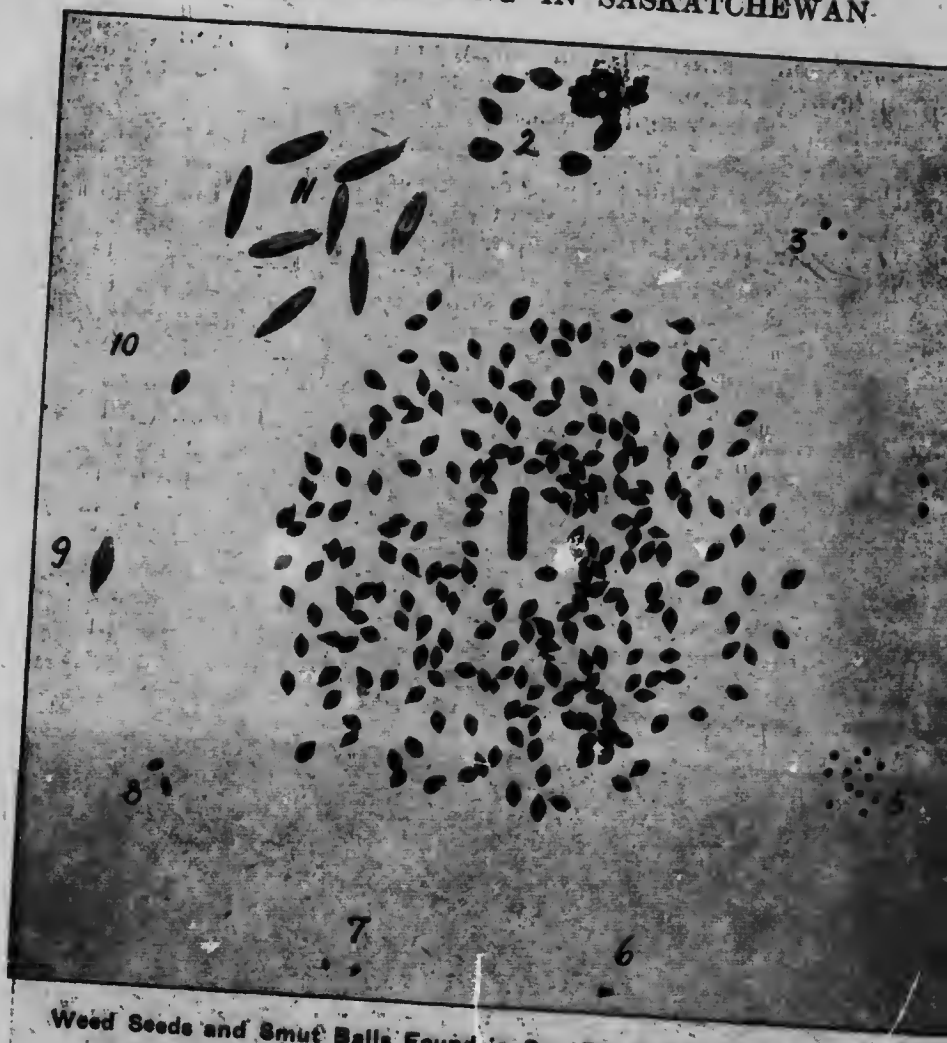
Seven smut balls, 226 wild buckwheat, 2 wild mustard, 2 ball mustard, 12 lamb's quarters, 1 blue burr, 2 docks, 2 hare's ear mustard, 1 barley and 8 oats.

If each of these figures were multiplied by 90, the result would be the exact number of weed seeds sown on each acre of ground if the seeding were done at the rate of 1½ bus. per acre. In other words this apparently fairly clean sample would place on each acre of ground, 22140 weed seeds, 630 smut balls and 900 seeds of other kinds of grain. In the light of the test reported below all these weed seeds could have been removed by passing the sample through the fanning mill once.

In order to throw light on the efficiency of a well operated fanning mill as a means of removing weed seeds and small, light and shrunken grain and thereby improving the seed value of the threshed sample of wheat, a cleaning test was attempted in the fall of 1915. A Clipper mill was used. It was set up in such a manner as to make the best use of the wind blast. The screens used were those that would remove the greatest amount of small, light and broken seed. The wheat was passed through three times, each cleaning being sampled and weight of screening, shrunken grain and weed seed recorded. Purity and germination tests were conducted later.



Sample of Wheat Taken from a Farmer's Drill. It looks quite clean but 1 pound of it contained the weed seeds shown in the photo on next page



Weed Seeds and Smut Balls Found in One Pound of Wheat That Was Taken from a Farmer's Drill: (1) Wild Buckwheat; (2) Smut Balls; (3) Wild Mustard; (4) Ball Mustard; (5) Lamb's Quarters; (6) Blue Burr; (7) Dock; (8) Hare's Ear Mustard; (9) Barley; (10) Flax; (11) Oats.

Table VII.—Showing the number of weed seeds per pound and per 1½ bus. in cleaned and uncleaned grain.

	No. of noxious weeds per lb.	No. of weed seeds per acre if seeded at the rate of 1½ bus.
Original seed	12	1080
Once cleaned	4	360
Twice cleaned	free from weed seeds	0
Three times cleaned	"	0

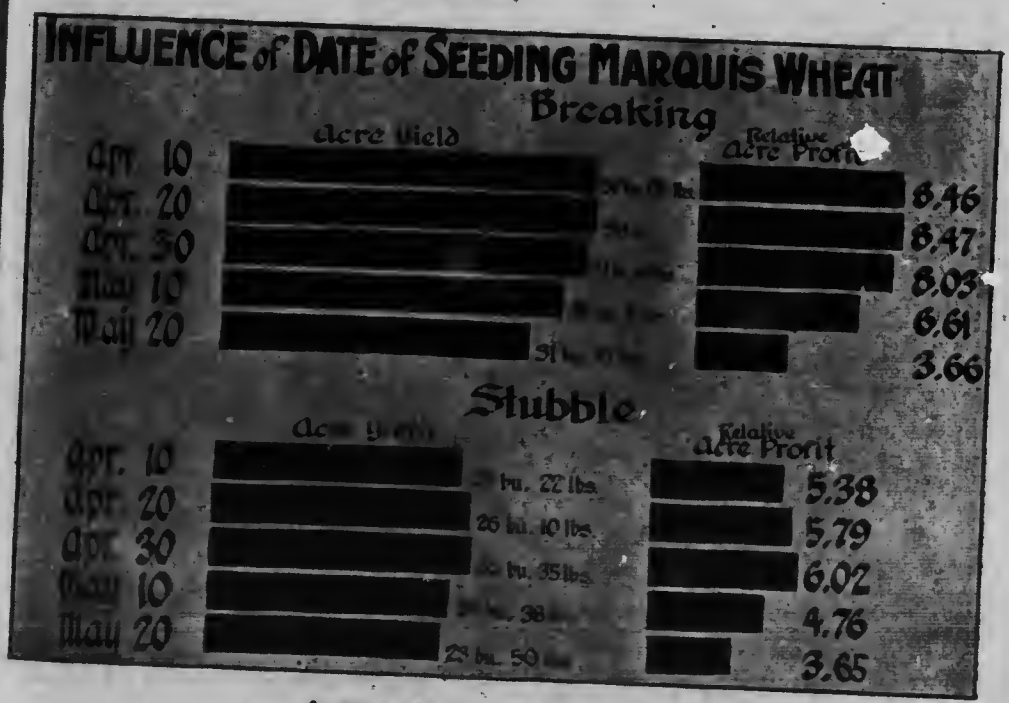
The following observations were made as a result of this work:

1. All the small weed seeds (wild buckwheat and mustards) and some of the larger ones (blue burr) were removed with the first cleaning.
2. The balance of the larger weed seeds were removed with the second cleaning.
3. Barley and oat impurities were not all taken out even with three cleanings.
4. The weight per measured bushel of the original seed, viz.: 61½ lbs. was increased 2 lbs. by one cleaning, 2½ lbs. by two cleanings and 2¾ lbs. by three cleanings.
5. Approximately 7% of the original seed was removed in the form of screenings by one cleaning, an additional 4% by two cleanings and a still additional 2% by three cleanings.
6. The percentage of germinable seeds was increased despite the good quality of the original sample.
7. The cleaned grain surpassed the screenings in germination by 4%.

This work is the beginning of a series of more comprehensive experiments looking toward the solution of the question of securing cleaner seed.

SEEDING

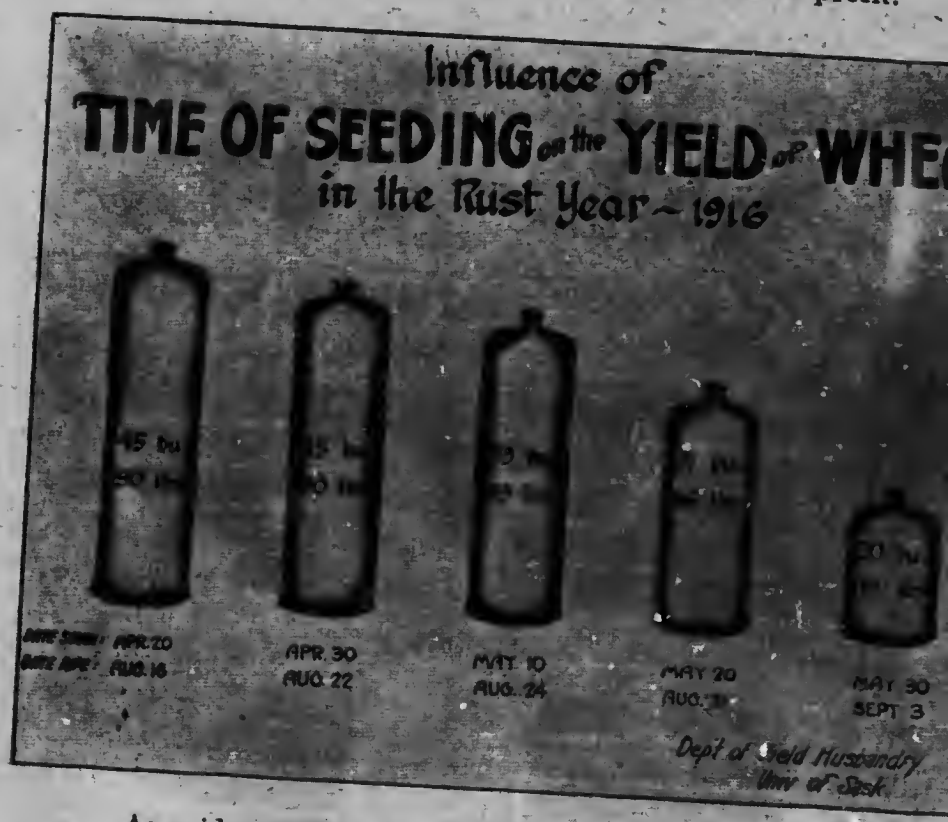
Table VIII.—The Time to Sow.



Average 3 Years 1914-15-16.

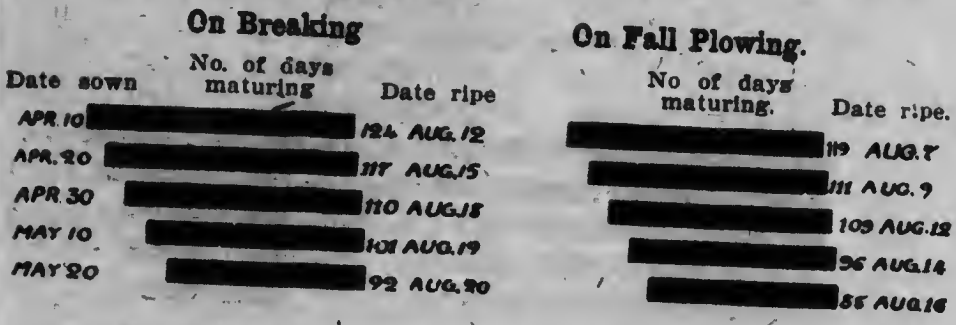
These figures are the average of the years 1914, 1915, 1916 results. They indicate that the best time to sow both fall plowed stubble and on breaking was between April 1 and April 30th, and that both the yield and profit decrea rapidly from seedings made after the last of April. The la est return on breaking was from the April 20th seeding wh the largest on fall plowing was from the April 30th seedi thus suggesting that the fallow might profitably be seed first. This would probably be wise in practice if the fall were always dry enough to sow. But sometimes it is too w in which case seeding the fall plowing would be the desira thing to do providing it were in fit condition.

It is interesting to note that the April 20th seeding breaking produced over twice the profit of the May 20th see ing, while on stubble it produced $2.14 more acre profit.



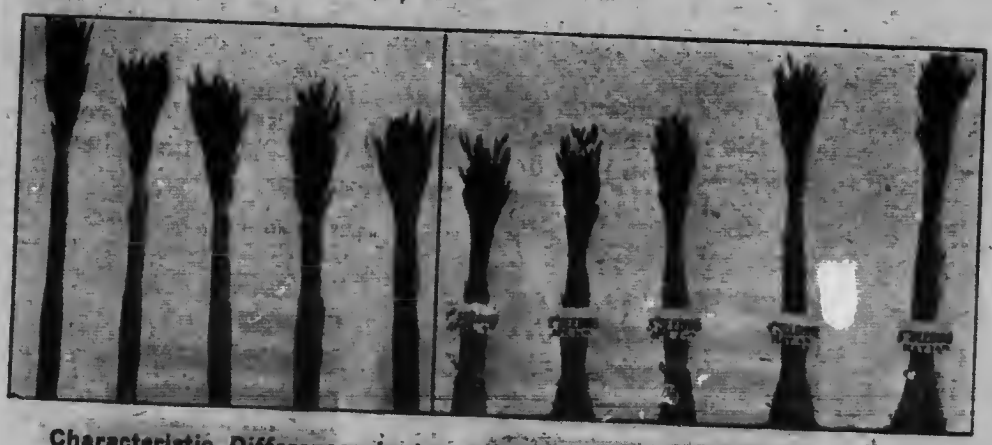
As evidence of the value of early maturity in lessening the ravages of rust, readers should note the rapid decrease in yield in the rust season of 1916 from the seedings made subsequent to April 20th.

Table IX.—Influence of the time of Seeding on the Date of Maturity of Marquis Wheat.



These figures indicate that while land seeded ten days before adjoining land does not ripen ten days before it, yet it does ripen earlier and thus lessens the danger from fall frosts. In the three years this work has been under way a delay of forty days in the time of planting has resulted in an average harvest only eight or nine days delayed. In the middle of April a difference of ten days in the time of seeding resulted in a difference of nearly three days in the ripening of the crop, while in the middle of May a difference of ten days in the time of seeding resulted in a difference of only 1½ days in the time of ripening.

In areas where crops do not ripen before the last of August the late seedings are likely to ripen much later relatively than these figures indicate.

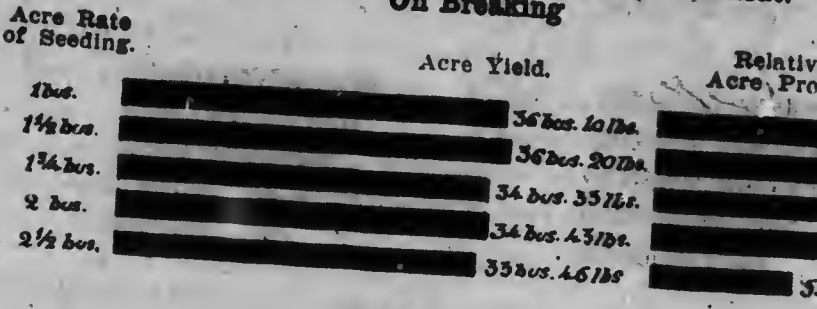


Characteristic Differences in Length of Straw in "Dates of Seeding" Test in Different Seasons. Straw on Left Grown in the Dry Summer of 1914; Those on Right in Wet Summer of 1915.

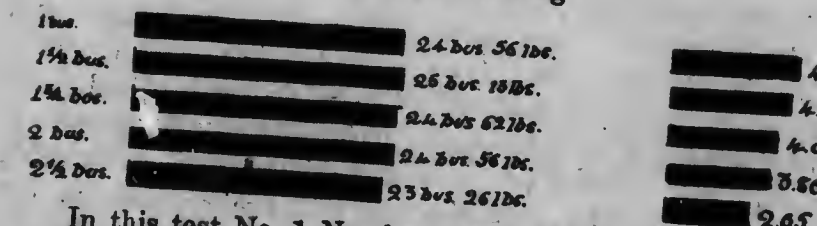
The Amount to Sow.

Table X.—The influence of the rate of seeding on th Yield and Relative Acre Profit—Marquis Wheat.

On Breaking



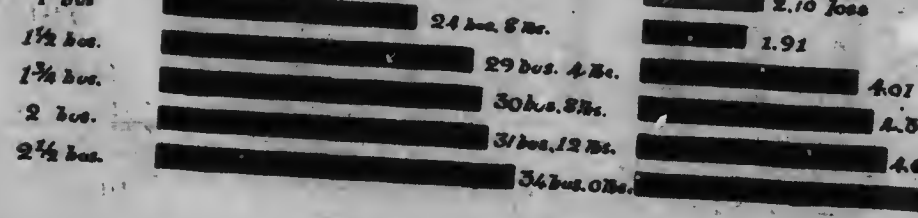
On Fall Plowing

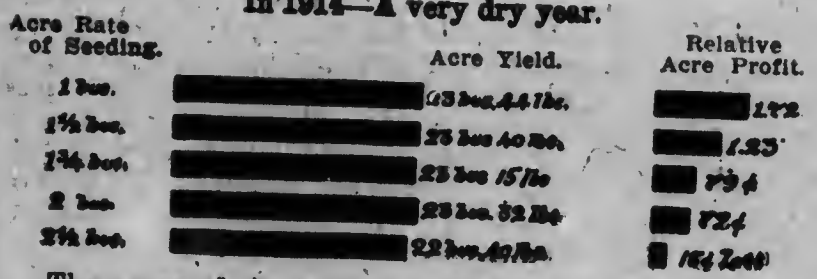


In this test No. 1 Northern seed of high germination strong vigor was used. The highest yield on breaking from the 1½ bus. rate, and on fall plowing from the 1 rate. The greatest profit was secured in both cases from 1 bus. rate.

In this connection it should be remembered that in e of the years this test has been under way the crop matu fully before fall frosts came, otherwise the heavier seedi would have shown up better. This point is well illustrated the next table.

Table XI.—The Influence of the rate of seding on the ac yield and Relative Acre Profit in the Early Fall fro season of 1911 and the dry season of 1914—Marquis Whe In 1911—An early fall frost year.





The cause of the higher yields from the heavier seedings in 1911 is to be found, we believe, in the fact that the more heavily sown plots were much earlier (see Table XII.) and being more mature when frost came suffered less from it. Thick seeding seems to promote early maturity and is therefore a good practice where fall frosts are feared. On the other hand a thinly seeded crop stands dry weather better and should be practiced where drought is more to be feared than frost.

Table XII.—Influence of the rate of seeding on the number of days betwen seeding and harvesting Marquis Wheat.

Rate of Seeding Per Acre.	Early Fall Frost Season on Fallow.	Dry Season 1914 on Corn Ground.	3 year av. yield on fall plowed stubble.	3 year av. yield on breaking or corn ground
1 bus.	130 days	106 days	112 days	117 days
1½ bus.		104 days	111 days	114 days
1¾ bus.	127 days	104 days	110 days	114 days
2 bus.	124 days	103 days	109 days	113 days
2½ bus.	122 days	102 days	109 days	112 days

A Characteristic Difference in Length of Straw from Different "Rates" of Seeding.

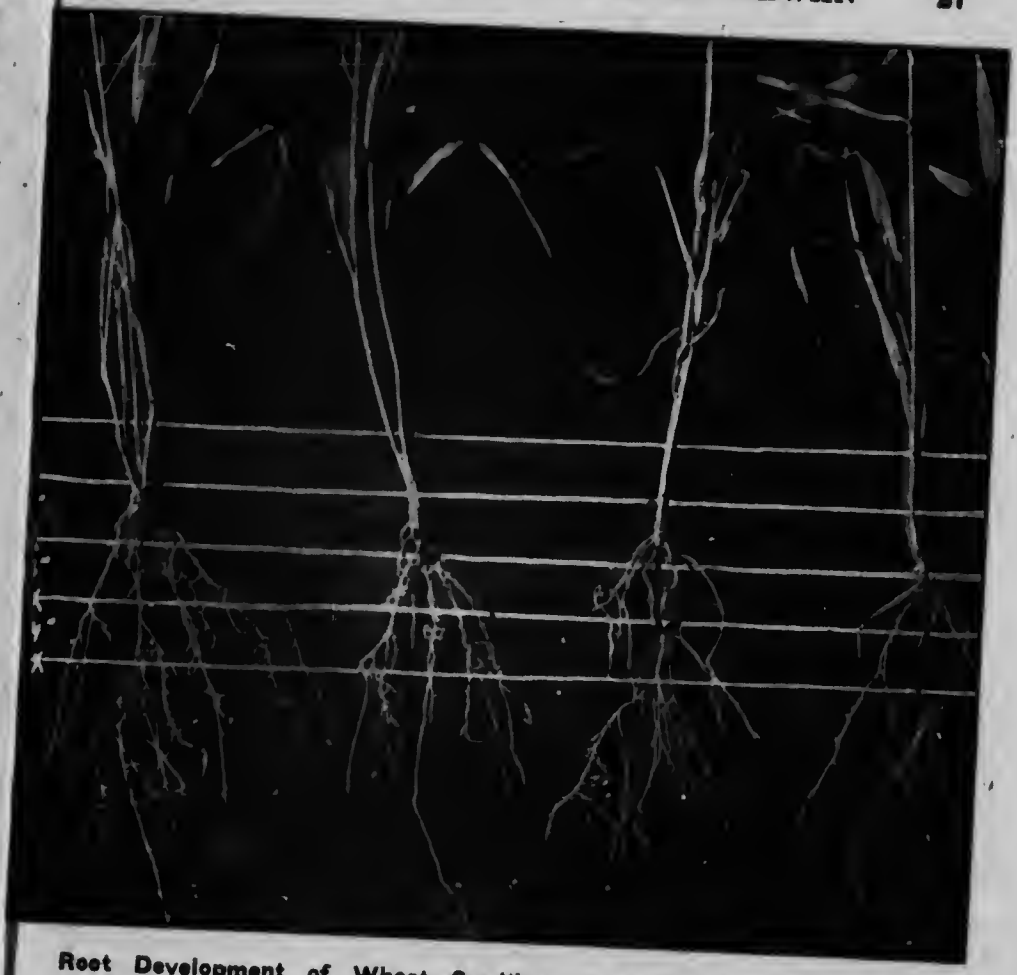
These figures indicate that thicker seeding p
earlier maturity and that in the last three years the r
was hastened at the rate of two days per half bushel
in the rate of seeding on fall plowing and at the rate
three days per half bushel increase on breaking an
ground. In the cool moist season of 1911 the differen
much greater amounting to nearly five days per half.
In the dry season of 1914 it was less, amounting only to
one day per half bushel increase in rate of seeding.

The Depth to Sow

In the years 1915 and 1916 wheat was seeded a
different depths, viz.: 1", 2", 3", and 4", respec
on well prepared clay loam fallow. Careful observations
made on the germination, time of coming up, early and
root development, tillering and subsequent top-growth
was plainly evident that seeding to a greater depth tha
inches under these conditions was too deep. The deep see
resulted in retarded germination, later coming up and a se
development of roots at a distance of about 1½ to 2 in
from the surface of the soil. Some plants started a see
third and even a fourth weak root system, but such plants
up only one stem on which was borne but one short, po
filled head. Deep seeding in this test was associated
light tillering and light yield.

The fact that in the 3 in. and 4 in. seedings the main r
developed one or two inches above the seed, indicates t
under these conditions the seed was sown too deeply. In
opinion it should not in all cases be assumed that because th
secondary roots appear at a point above the seed the lat
has necessarily been sown too deeply. It may or may
have been. At the time of seeding the moisture conditions
the soil for the next two weeks is never known. Shallow so
seeds may not germinate. Deeply sown ones may decay.
is generally wise to sow into the moisture if the latter is wit
in three inches of the top. If lower, no one knows how deep
sow. It is apparent that within certain limits the plants ada
themselves to the conditions found as shown by their abili
to send out roots where they will do the most good, eve
though the seed may have been placed too deep in the soil.

In our studies, under favorable soil conditions, the greates
root development took place at about 1½ inches beneath th
surface of the soil. Shallow seeding was best in these case
but under dry conditions deeper seeding would probably have
resulted more favorably. From 1½ to 2½ inches appears to
be the optimum depth provided the land is moist that near the
surface.



Root Development of Wheat Seedlings from Different Depths of Planting.

From our observation on this work it would appear that the following points should be kept in mind when seeding wheat:

1. That moisture, heat and air in the soil are all essential to germination.
2. That quick, strong germination generally results in more vigorous plants.
3. That early germination and growth results in earlier maturity.
4. That there seems little reason to believe that where there is a backward leaf growth the plant is "developing a better root."

5. That on soils that drift or where the surface and dry it is better policy to err on the side o too deeply than sowing too shallow.

6. That seeding into the moisture is generally a s tice to follow but, if it be followed, the should not be lower than three inches from the of the soil, except in very dry areas on very warm soils.

THE TIME TO HARVEST

Table XIII.—The effect of the time of cutting on the and weight of kernels (*) of Marquis wheat.

1915	Wt. per bus.		Grade	Wt. k
1st cutting, milk stage	50	lbs.	Feed	23.73
2nd cutting, early dough	62	lbs.	2 Northern	27.87
3rd cutting, late dough	63	lbs.	1 Northern	27.60
4th cutting, hard glazed	64	lbs.	1 Northern	28.49
1916				
1st cutting, milk stage	57½	lbs.	No. 5	23.95
2nd cutting, early dough	60¼	lbs.	2 Northern	25.96
3rd cutting, late dough	64¼	lbs.	1 Northern	31.06
4th cutting, hard glazed	64¼	lbs.	1 Northern	32.53

(*) In this case the relative 1000 kernel weight is a relative yield since an average sample of all kernels was for weighing.

It is apparent in both of these tests that the later t ting was done up to the "hard glazed" condition, the the yield and the better the quality secured. No attem been made to determine the relative losses from shat The practical man realizes, however, that the loss fro cause is greatest in the most mature grain and less earlier cuttings.

Milk Stage — Early Dough — Late Dough — Hard
Loaves from Baking Tests of 1915 Crop "Dates of Cutting."

Milk Stage — Early Dough — Late Dough — Hard Glazed

Loaves from 1913 "Dates of Cutting"

Table XIV.—Effect of time of cutting on the kernel weight.*

(In grams.)

Date when cut	Wt. of 1000 kernels of "Marquis"	Wt. of 1000 kernels of "Red Fife"	Wt. of 1000 kernels of "Taylor's Wonder"	Aver. wt. of 1000 kernels
Aug. 18	34.867	28.267	35.270	32.801
Aug. 22	35.403	†31.925	36.036	34.455
Aug. 26	35.131	‡33.682	36.866	35.226
Gain between 1st & last cut'g	1.54%	19.16%	4.52%	x8.41%

* 1st cutting "soft dough," 2nd "medium dough," 3rd "ripe," except in Marquis, which was "medium dough," "ripe" and "very ripe" respectively.

† Cut Aug. 24th. ‡ Cut Aug. 29th.

x Average increase between 1st and last cutting.

These figures further emphasize the fact that the grains continue to gain in weight until complete ripeness or full maturity is attained. All of these crops were considerably rusted yet they continued to improve as maturity advanced, showing that in these cases at least early cutting on account of the presence of rust would not have been wise. This does not mean that in a very seriously rusted field, the grain would continue to improve, but it suggests the advisability of leaving grain uncut at least until it is severely affected.

Table XV.—The effect of cutting wheat while still g the development of the grain.

DATE CUT	WT. OF 1,000 KERNELS. STRAW REMOVED WHEN CROP WAS CUT	WT. OF 1 STRAW WHEN C
August 19	21.035 grams	23.43
August 21	23.740 "	23.04
August 23	25.825 "	28.62
August 25	25.725 "	27.73
August 27	28.520 "	29.19
August 29	25.635 "	26.1
August 31	29.230 "	30.75
Sept. 2	28.260 "	30.52
Average	25.977 "	27.49

This study was planned to throw light on the of the filling of the grain after a crop is cut green. It apparent from a comparison of the figures in the seco third columns, that the kernels from the heads in wh straw was retained till the plants were dry, developed erably more than those cut at the same time, but hav straw removed at once, thus demonstrating that some ment of nourishment from the stem to the seed takes p an immature plant even after it has been cut.

The figures also illustrate that the grain continues in weight until mature, even in the presence of consi rust (this crop was considerably affected).

SOIL MANAGEMENT

The three chief means of controlling soil producti that are available to Saskatchewan farmers are: Tillag practice of suitable crop rotations, and the use of fert The tables that follow and the observations made, gi results of the tillage, rotation and fertilizer work done t

TILLAGE

The tillage problems of Saskatchewan fall naturall three groups:

(1) The tillage of prairie sod.
(2) The tillage of stubble land.
(3) The tillage of the fallow.

In each of these, the things that are important to for each different set of soil and climate conditions, a type of tillage machine to use, the time to use it an amount to use it.

The experiments discussed below throw some ligh each of these phases of tillage operations as carried o a heavy loam soil in the Saskatoon district.

The Tillage of Prairie Sod.

Table XVI.—The time of "breaking" prairie sod.

Time of Breaking	Aver. Yield Two Years	Aver. Acre Value	Relative Acre Cost	Relative Acre Profit	Rel. Prof. on Investment	Relative Bus. Cost
	bus. lbs.					
Broken June 10....	36 45	25.72	17.28	8.44	23.4	.61
Broken July 10....	33 58	23.78	17.39	6.39	17.7	.66
Broken Aug. 10....	28 40	20.07	16.26	3.81	10.6	.74
Broken Sept. 10....	23 22	16.36	15.27	1.09	3.0	.87
Broken following spring.....	22 27	15.71	14.12	1.59	4.4	.86

There should be no difficulty in interpreting this table. It indicates that delay in time of "breaking" after the tenth of June decreases the acre profit at the rate of $2.45 per acre per month. In other words one month's delay in breaking means a loss of more than the average net profit derived by the average Saskatchewan wheat grower.

For the information of the reader two points should perhaps be referred to,—(1st) all of these plots received the same amount of work with the exception that the earlier plowings were harrowed three times, twice and once respectively, more than the September and spring plowings, and (2nd) that in order to control grass more tillage is usually necessary on early breaking than is required on land broken late. At the same time the early breaking retains more moisture and the sod rots more thoroughly than if breaking is left until late in the season.

Part of the increased cost of the early breaking then is due to more tillage, and the remainder to the cost of handling the greater crop that it produced.

It is interesting to note that in the fall preceding the 1916 crop the June 10th breaking contained in the upper acre six and two-thirds inches of soil 182 tons of water; the July breaking 139 tons; the August breaking 100 tons, and the September breaking 92 tons.

Table XVII.—Showing the effect of "Breaking" shallow and backsetting vs. Deep Breaking and surface cultivation on the yield of Marquis wheat.

	1915 crop	1916 crop
Broken shallow and backset	34 bus. 10 lbs.	36 bus. 36 lbs.
Broken deep and surface cultivated as needed	37 bus. 1 lb.	36 bus. 29 lbs.

In this study two important points have been observed.

First—That backsetting does not increase the yield when the native vegetation—grasses, etc.—is completely killed by once plowing followed by surface cultivation.

Second—That backsetting is useless under such dry conditions as obtained in 1914, where the sod did not rot before backsetting. Backsetting done that year decreased the yield nearly seven bushels per acre.

Table XVIII.—Showing effect of "Breaking shallow and backsetting" vs. Deep Breaking and surface cultivation on the yield of the second crop after breaking land thoroughly disced in fall and spring, but not plowed.)

Broken shallow and backset	14 bus. 36 lbs.
Broken deep and surface cultivated as needed	4 bus. 11 lbs.

These figures illustrate very forcibly the chief objection to once plowing of the sod, viz., its inability in some seasons and in some soils to completely kill all the native vegetation. This fault is often not evidenced in the first crop but if the land is left unplowed, even though well disced, the second crop often acts as in this test. The decrease here was in our opinion due wholly to the presence of grass in the once plowed plot and its relative absence in the twice plowed one. This breaking was done on land that contained considerable native quack grass. The tests reported in table XVII. were conducted on less grassy land and in a very dry season.

Table XIX.—Showing effect on the yield of Marquis wheat of diffrent kinds and amounts of surface cultivation after "backsetting" land that was broken the same season.

(Land broken in 1914 and 1915—yields are from first crop from each.)

	1915 CROP BUS. LB.	1916 CROP BUS. LB.	AVERAGE BUS. LB.
Broken and backset, double disced, packed and harrowed.....	34 10	36 36	35 23
Broken and backset, double disced and harrowed	33 13	36 27	34 50
Broken and backset, harrowed.....	28 12	35 17	31 44

In 1914 backsetting left the soil very rough, dry and lumpy and the more surface cultivation it was given the higher the yield obtained (see 1915 yields). Both double discing and packing proved very profitable.

The 1915 backsetting left the soil in perfect tilth and the extra work increased the yield but hardly enough to pay for the extra cost.

We have observed, when the soil is mellow and in fine tilth after backsetting as is generally the case where the sod is well rotted, that packing and double hallowing is all the tillage that is necessary and that when the soil is lumpy and rough or grassy discing is advisable.

Table XX.—Showing the effect of packing after "breaking" but before "backsetting" on yield of Marquis (la tilled in 1914 and 1915, yields are from first crop of each

	1915 CROP BUS. LB.	1916 CROP BUS. LB.	AVER BUS.
Broken shallow, firmed down by packer then backset and well harrowed..	30 17	37 51	34
Broken shallow, then backset and well harrowed	28 45	35 23	32

Firming the breaking as soon as possible after breakin (1) encourages the rotting of the sod by forcing it against th more moist subsoil and (2) results in the development of larger amount of "available" plant food. It pays well on a soils not infested with creeping rooted plants. On the latte it is sometimes wise to leave the furrow slice unpacked for few days so that it may dry out and thus aid in killing the un desirable plants.

Average 2 Years, 1915-16

Summary of Observations and Experiments on Breaking Prairie Sod.

The main purposes in tilling prairie sod in semi-arid climates are

1. To kill the native vegetation.
2. To store moisture in the soil and conserve it there and
3. To prepare a suitable seed bed or home for the plant.

The best means of achieving these functions in Saskatchewan seems to be

1. Break early in the rainy seeason.
2. Plow all the land and turn the furrow over flat.
3. Pack after breaking.
4. Disc deep breaking as soon as it can be done without turning up sods.
5. Cultivate sufficiently during the season to control the growth of native plants and to prevent baking.
6. If once plowing does not kill the grass and small shrubs, backset after the sod has decayed.
7. Don't backset if sod is not rotted.
8. Land intended to be backset should be broken shallow; that not to be backset, deeper.
9. Backsetting should be made firm and then harrowed.
10. Cropping spring breaking except to corn is undesirable, in dry areas.
11. Scrub land should be plowed deep, as much of the vegetation as possible turned under, and the land packed and surface cultivated but not backset.
12. The more humid the district the later the plowing may be done.

The Tillage of Stubble Land.

Table XXI.—Showing the effect of the time of surface cultivation of stubble land (wheat or flax stubble) **on the yield of wheat** (three year average).

	yield per acre 1914	yield per acre 1915	yield per acre 1916	Average
	bu. lb.	bu. lb.	bu. lb.	bu. lb.
Double disc and harrow in fall	13 39	25 56	40 46	26 47
Double disc and harrow in spring	11 24	22 59	38 26	24 16
None.....	10 23	22 57	30 48	21 23

This stubble was free from grass and weeds and the soil was in good tilth. The results indicate that for these years fall discing resulted in 2½ bus. larger yield than spring discing and that spring discing gave 2 bus. 35 lbs. more than untilled stubble.

In the autumn preceding the 1914 crop, early fall discing increased the yield 1 bus. 10 lbs. over late fall discing, but in the average yield of the next two seasons which were preceded by moist autumns, early fall discing yielded 1 bus. 20

lbs. less than late fall discing. The early fall cultivation p
duced a considerable growth of volunteer plants while
later work caused no growth. The decrease we believe was
to the loss of moisture through the volunteer plants the cu
vation started into growth. It suggests the advisability
early fall discing to control weeds.

**Table XXII.—Showing the effect of the time and depth
plowing wheat and flax stubble, pea stubble, pota
ground and corn ground on the yield of wheat.**

Treatment	5 yr av yield per acre on wheat and flax stubble	1916 yield on pea ground	1916 yield on potato ground	1916 yield on corn ground	Average
	bu. lb.	bu. lb.	bu. lb.	bu. lb.	bu.
Plowed 3 in. deep in fall	23 37	43 47	49 02	48 45	41
Plowed 3 in. deep in spring	23 17	45 42	46 32	47 30	40
Plowed 6 in. deep in fall	22 53	42 13	47 22	47 22	40
Plowed 6 in. deep in spring	23 18	40 25	36 57	48 05	37

On this brown clay loam soil in the years 1914, 1915 an
1916 there was little difference in the average yield fro
fall or spring, or deep or shallow plowing. This land was no
grassy, nor did it have a "hard pan" subsoil. Under eithe
of these conditions the deep plowing would probably hav
given better returns.

The spring plowing was always done in April or it would
have given lower returns. We have conducted no tests tha
show it but our observations suggest that the chief objection t
spring plowing in Saskatchewan is that it can seldom be done
early enough for best results with wheat.

The explanation for the low yield from deep spring plow-
ing is probably to be found in the fact that it was done early
in the spring when the lower layer of plowed soil was rather
too wet to be in the best condition for plowing.

In all these tillage tests the only spring cultivation the
autumn tilled plots received was double harrowing. In some
cases this was not sufficient to prepare a good seed bed. This
was perhaps not fair to the fall cultivation. In future a good
seed bed will be prepared in the spring even on the fall tilled
land and the extra cost will be charged to the plot.

Table XXIII.—Showing the effect of different kinds and amounts of tillage of "wheat and flax" stubble, pea stubble, potato ground, and corn ground on the yield of wheat (all plowed shallow in fall).

Fall Treatment	3 yr av yield on wheat & flax stubble	2 yr av yield on pea stubble	2 yr av yield on potato ground	yield on corn ground	1916 Average
	bu. lb.	bu. lb.	bu. lb.	bu. lb.	bu. lb.
Disced, packed, harrowed	20 41	36 44	40 58	48 45	36 48
Disced and harrowed	20 54	36 21	40 06	48 03	36 22
Harrowed	17 36	35 33	37 46	46 07	34 16
None	16 42	33 30	33 47	45 00	32 15

This table shows that the more of the tillage indicated that was given fall plowed land, the greater the yield. Harrowing increased the yield 2 bus. per acre, and discing and harrowing nearly 4 bus. per acre, while discing, packing and harrowing increased it slightly over 4½ bus. per acre. In this test, harrowing, the cheapest operation, paid best and discing the next best, while packing hardly more than paid its way.

We now regret that we did not have a test for "packing and harrowing." We think this on grass free soil in good tilth would give us nearly as large an increase and a considerably more profitable one than did "discing and harrowing." We are now using "packing and harrowing" as a standard preparation on all grass-free land that plows up in good condition, and in future we shall add it to the test.

Table XXIV.—General summary of the effect of various tillage practices on the yield of wheat on 'wheat and flax' stubble, pea stubble, potato ground and corn ground.

Treatment	5 yr av yield on wheat & flax stubble	2 yr av yield on pea stubble	2 yr av yield on potato ground	2 yr av yield on corn ground	Av on pea, potato and corn ground
	bu. lb.	bu. lb.	bu. lb.	bu. lb.	bu. lb.
No cultivation..... (grassy stubble)	9 50				
No cultivation..... (clean stubble)	17 59	37 28	39 37	41 41	39 35
Surface cultivation..... (clean stubble)	22 25	37 07	39 33	40 55	39 11

Burned and surface cultivation (c. s.)	22	49						
Deep spring plowing....	23	18	34	27	37	13	45 50	39
Deep fall plowing.....	22	53	35	23	40	52	42 22	39
Shallow spring plowing.	23	17	38	43	46	42	46 48	44
Shallow fall plowing....	23	37	36	44	40	58	41 11	39

A careful study of Table XXIV. together with the not and observations for the different years thee work has been u der way indicates that one of the chief causes of poor crops o stubble fields is the presence of "grass." All our work show that when grass is present only plowing will control it. Whe grass is not present plowing may not be necessary. The prob lem then becomes one of saving moisture, handling the stubbl preparing a seed bed and keeping down the cost. Neithe deep nor shallow plowing, nor fall nor spring plowing, when done well and in the proper time have shown much differenc on the average yield after wheat and flax (although shallow spring plowing has in these tests proven superior to the other on pea, potato and corn ground). Plowing generally result in larger yields than surface cultivation and it leaves the land in better condition for the second crop after, but on summer fallow stubble, on a soil that does not bake in the spring and that is free from grass it has not paid as large net returns a surface cultivation.

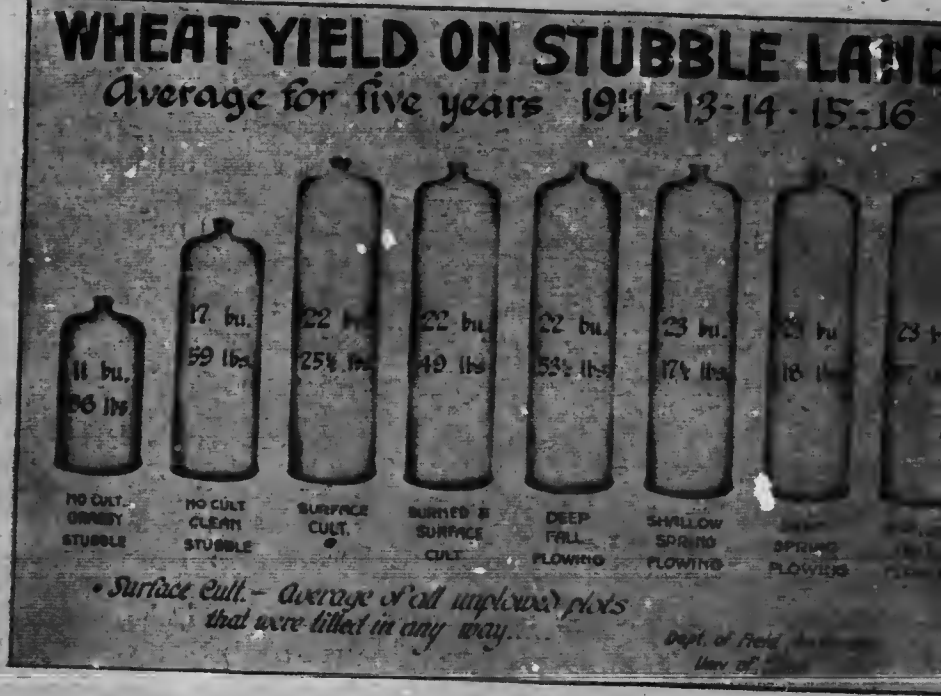
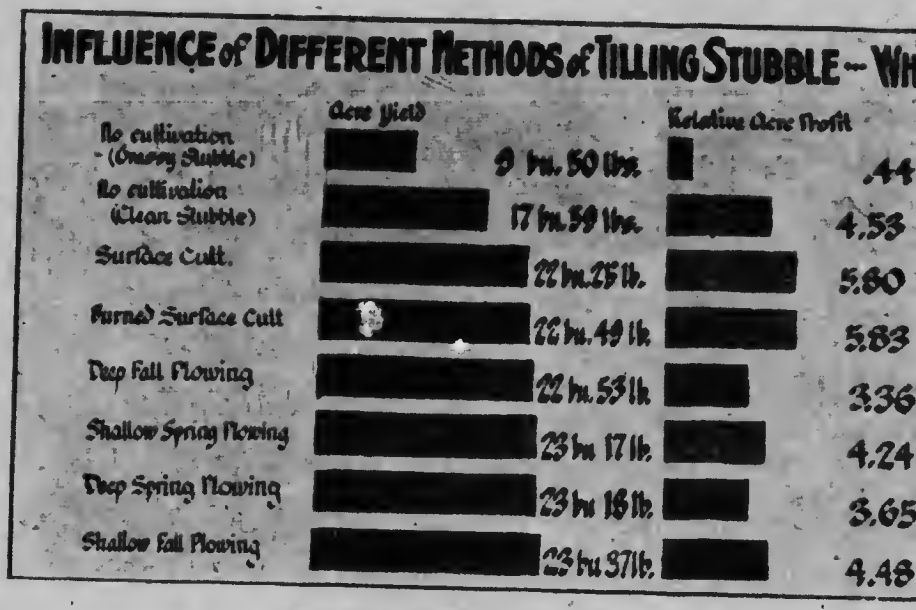


TABLE XXV.—Showing Relative profits from vario us methods of tilling wheat and flax stubble.

Treatment	Aver. Yield (5 years) bu. lb.	Aver. acre value at 70c	Relative acre cost less interest	Including Interest	Relative Acre profit	Relative profit on investment of $36 acre	Relative bus. cost.
No cultivation (grass).......	9 50	$ 6.88	$ 6.44	$ 8.96	$ .44	1.2%	.91
No cultivation (clean)......	17 59	12.60	8.07	10.59	4.53	12.5%	.59
Surface cultivation..........	22 25½	15.70	9.90	12.42	5.80	16.1%	.55
Burned and surface cultiv'n..	22 49	15.97	10.14	12.66	5.83	16.2%	.56
Deep spring plowing........	23 18	16.31	12.66	15.18	3.65	10.1%	.65
Deep fall plowing...........	22 53½	16.02	12.66	15.18	3.36	9.3%	.66
Shallow spring plowing......	23 17½	16.30	12.06	14.58	4.24	11.7%	.63
Shallo wfall plowing........	23 37	16.53	12.05	14.57	4.48	12.4%	.62
Average..............	20 46	14.52	10.49	13.02	4.03	11.2%	.64

*Includes interest at 7% on land and equipment valued at $36.00 per acre.



Averages of Five Years Results

TABLE XXVI.—

Tables XXV. and XXVI. show the relative profit realized on wheat grown on wheat and flax stubble tilled in various ways during each of the last five years. This table shows clearly that yield is not necessarily a measure of profit. Clean stubble that received no cultivation yielded only 17 bus. 59 lbs per acre but gave a net profit of 12.5% whereas deep fall plowing which gave a yield of 22 bus. 53½ lbs. per acre rendered a net profit of only 9.3%.

A little explanation may be given that will perhaps account to some extent for the fact that the profit is relatively low from all plots that were plowed. The previous crop to that from which these figures were taken was grown on summer-fallowed land. There is no doubt but that the influence of the fallowing was felt by the crops from which these figures were obtained. The favorable influence of the fallow is relatively greater upon a crop grown on fallow stubble that receives no cultivation than it is upon the crop grown on fallow stubble that has been plowed before sowing. Each plot was in a condition of fairly good tilth before the second crop was sown and the additional tillage (especially plowing) did not increase the yield sufficiently to pay the extra cost of the cultivation. The only case where this does not apply is in that of "no cultivation of grassy stubble." This plot really required plowing to eradicate the grass and would probably have responded to plowing by giving an increased yield worth much

more than the cost of the additional tillage. In fact, this result was secured in 1914 when grassy stubble that was plowed yielded 13 bus. 30 lbs. while grassy stubble that was disced yielded only 5 bus. per acre.

Quack Grass is one of the chief causes of low yields in the second crop after poor breaking. Note the "creeping" roots. The native quack is not quite so persistent as the eastern species.

Up to the present time no means have been found of ac
ately estimating the influence of a fallow upon the suc
crop or how much of the cost of fallowing should be cha
to the first and how much to the second crop. In the abs
of such figures we can only state that we believe that the fa
has considerable beneficial influence upon the second c
and providing the fallowing is done thoroughly and no g
is present in the land after the first crop, greater rela
profits can often be obtained from the second crop if the l
is merely surface cultivated than if it is plowed before
second crop is sown. If this land had been "grassy" plow
would in all probability have shown much higher profits t
any of the other treatments.

**Table XXVII.—Various methods of tilling flax, pea, pot
and corn stubble—1915 and 1916.**

Treatment	Aver. yield (2 years)	Aver. acre value wheat at 70c.	Relative acre cost	Relative acre profit	Rel. profit on invest.	
Flax Stubble—	bu. lb.					
No cultivation.....	32 07½	$22.45	$10.31	$11.67	32.1%	
Surface cultivation..	35 57	25.16	12.74	12.42	34.5 "	
Deep spring plowing.	33 33	23.43	15.06	8.37	23.3 "	
Deep fall plowing...	31 34	22.10	14.80	7.30	20.0 "	
Shallow spring plow'g	32 16	22.59	14.25	8.34	23.1 "	
Shallow fall plowing.	33 51	23.00	13.98	9.03	25.0 "	
Average....	33 02	23.13	13.61	9.51	26.2 "	4
Pea Stubble—						
No cultivation.....	37 38½	26.23	12.80	13.43	37.3 "	
Surface cultivation..	37 07	25.98	12.95	13.03	36.2 "	
Deep spring plowing.	34 37	24.12	15.25	8.87	24.6 "	
Deep fall plowing....	35 23	24.77	15.61	9.16	25.4 "	
Shallow spring plow'g	38 48½	27.10	15.43	11.67	32.4 "	
Shallow fall plowing	36 44½	25.71	14.55	11.16	31.0 "	
Average....	36 39	25.65	14.43	11.23	31.1 "	4
Potato Stubble—						
No cultivation.....	39 37	27.73	12.19	15.54	43.1 "	
Surface cultivation...	39 33	27.63	13.39	14.29	39.7 "	
Deep spring plowing.	37 13½	26.05	15.77	10.28	28.5 "	
Deep fall plowing...	40 52	28.61	16.61	12.00	33.3 "	
Shallow spring plow'g	46 42	32.69	16.90	15.79	43.8 "	
Shallow fall plowing.	40 53½	28.68	15.13	13.55	37.6 "	
Average....	40 49	28.57	15.00	13.57	37.7 "	42

Corn Stubble—						
No cultivation.....	41 40	29.17	13.57	16.60	46.1 "	.36
Surface cultivation..	40 55	28.64	13.65	14.99	41.6 "	.37
Deep spring plowing.	45 50	32.08	17.36	14.72	40.9 "	.43
Deep fall plowing...	42 33	29.66	16.90	12.76	35.4 "	.46
Shallow spring plow'g	46 48½	32.76	16.94	15.33	43.9 "	.41
Shallow fall plowing.	41 11	28.33	15.49	13.84	37.0 "	.43
Average....	43.03	30.19	15.43	14.71	40.8 "	41.00

* Not including interest on investment.
† Including interest on investment.

Table XXVII. is somewhat similar to table XXVI. and shows the relative profit from different methods of tilling flax, pea, corn, and potato stubble, but for two years only. Again we find that the profit from plowed land is relatively low in most cases and the same reason as that given above (page 40) accounts for this to some extent. The plentiful rainfall during the summer of 1916 had a greater relative influence upon the plots that received no cultivation than upon those that were plowed. In a dry season it is probable that the unculitvated plots would have suffered more than the plowed plots and less difference be shown in the profit column.

Although the average profit from the four plots that received no cultivation is 39.4% while that from those that were plowed deep in the fall is only 28.5% it does not follow that it is always better to leave land uncultivated than to practice fall plowing. The method to be practised depends upon the condition of the land after the first crop is taken off, and while plowing does pay its way where it is necessary it will not always pay the greatest profit where it is not necessary. This point is further brought out by the fact that the highest profit of all was obtained from uncultivated corn stubble. The corn had been frequently intertilled during the previous year and the land was in good tilth after harvest, and deep fall plowing for the wheat crop only increased the yield 42 lbs. per acre over the uncultivated plot and decreased the profit by 10%.

This table agrees with the accepted practice of the older agricultural countries, viz., that surface cultivation after intertilled crops is on most soils a more profitable procedure than plowing. Of course if the intertilled crop is not kept clean these results cannot be expected, nor are they likely to be secured on soils that bake in the spring.

It is interesting to note that the greatest average profit was from wheat on corn ground, the next greatest from potato ground, the next from peas and the last from flax.

These and the two year averages that follow were obtained in the two most favorable seasons we ever had, hence the relatively high yields and profits.

Summary of Observations and Experiments on the Tillag Stubble Land

The causes of low yields on stubble fields are usually in number. The most common ones are:

1. The low moisture content of the soil.
2. The presence of grass, shrubs and weeds.
3. A poor seed bed.
4. Insufficient "soluble" plant food.
5. The stubble itself.

The best means of controlling these conditions ar follows:

1. Plow "Grassy" fields.
2. Cultivate as early in fall as possible.
3. Don't work tight clay soils when too wet.
4. Harrow plowed land as soon as possible after plow
5. Pack the furrow slice firmly against the furrow bot
6. Burning stubble is often immediately profitable, it is permanently wasteful of soil fertility.
7. Surface cultivation is sometimes preferable to p ing.
8. Harrow the growing crop when there is cause so doing.
9. Sow the seed into the moisture—not just to it.
10. The best time to plow, whether in fall or spring, the best depth to plow, whether deep or shallow, va considerably under different conditions. The de at which the best job can be done, and which lea the soil in the best tilth is generally the most s factory for stubble plowing.

The Tillage of the Fallow.

Table XXVIII.—Showing the effect of the time of Plow the Fallow on the acre yield and relative Profit—Marq Wheat.

Time of Plowing.	Acre yield (3 year average)	Relativ Pr
JUNE 1st.		
JUNE 15th.		
JULY 1st.		
JULY 15th.		6.

The chief purpose of the fallow is to store and conse moisture. If the heavy rains of June "run off" the surface the soil, such portions at least can neither be stored nor c served. If weeds and volunteer plants pump moisture out

the land before plowing, the amount they so use cannot be conserved.

Early plowing of the fallow opens up the soil to receive the heavy June and early July rains, and what is more important, it prevents the wastage of moisture by weeds and volunteer plants in the early summer.

An early fallow may require considerably more surface cultivation in the more humid parts in wet years, and, if so, the cost of fallowing is increased. It then becomes the business of the crop grower to find out for himself whether under his conditions it pays to plow quite so early. Drifting soil is also sometimes worse on early and well worked fallows.

But even in the face of these arguments in favor of early fallowing, dirty land should not be plowed until the weed seeds on the surface can be made to germinate, otherwise they will be turned under only to grow and give trouble in a later crop.

The chart and figures plainly indicate the value of early plowing from the point of view of production and profit where no weeds nor grass are present and where "drifting" is not a serious problem.

Weeds Growing on Fallow Not Plowed Till July 15th. Weeds and other volunteer plants on the fallow are the chief causes of poor results from late plowing.

Table XXIX.—Showing the effect of the depth of plo and of subsoiling the fallow on the acre yield of whe

Depth of Plowing	1914	1915	1916	Aver
Plowed 3 in. deep	27bus. 15 lbs.	41bus. 36 lbs.	40bus. 18 lbs.	36bus.
Plowed 6 in. deep	30bus. 15 lbs.	36bus. 11 lbs.	44bus. 18 lbs.	36bus.
Plowed 9 in. deep	26bus. 35 lbs.	31bus. 41 lbs.	46bus. 51 lbs.	35bus.
Plowed 6 in. deep and subsoiled		28bus. 26 lbs.	50bus. 18 lbs.	

In the absence of grass, a dense plow "sole," an impervious subsoil—the things that usually determine the depth to plow—deep plowing has not given larger yields plowing a medium depth.

There was no "hard pan" in this soil, the land was and in good physical condition, and two of the years were "wet" ones. There is little that is conclusive about figures for these conditions. We regard 6 inches to 7 i as the best depth for fallowing. Deeper plowing than on shallow soils is likely to bring up rather too much soil and place the fertile surface soil too deep for best re although this objection to deeper plowing would not hol "deep" soils nor even on normal ones, where grass and sh are serious pests.

Subsoiling for wheat gave rather indifferent and steady results, one year decreasing the yield 7¾ bushels the next increasing it nearly 6 bushels. Unless there "hard pan" or other semi-impervious strata at the botto the furrow slice, it seems extremely doubtful that subsoilin be made a pr[illegible]table practice in wheat growing.

Table XXX.—Showing the effect of twice plowing of fallow on the acre yield of wheat.

	1914 Bus. lbs.	1915 Bus. lbs.	1916 Bus. lbs.	Ave Bus
Once plowed.....	30 15	36 11	44 8	36
Twice plowed.....	25 32	30 26	44 20	33

When much grass is present in the field to be fallo twice plowing has proven a good practice. In some a where weeds are very troublesome, particularly in wet y twice plowing may be forced upon one. In some other pl where soil "drifting" is common, the volunteer plants ar grow for a time for the double purpose of holding the and adding organic matter when plowed under. At the pense of moisture this plan lessens the risk of summer dri and increases the organic matter of the soil.

But on normal soils free from grass once plowing with us yielded 3½ bushels more wheat per acre than t plowing and at a smaller acre cost.

Table XXXI.—Showing the effect of growing a pasture crop on the fallow on the acre yield of wheat the following season.

Fallow treatment	1914 Bus. lbs.	1915 Bus. lbs.	1916 Bus. lbs.	Average. Bus. lbs.
Rape in rows.....	22 15	29 51	34 53	29 00
Oats and Clover (sown thinly).....	18 55	33 56	46 31	33 07
None.....	30 15	36 11	44 18	36 55

Pasturing the fallow lightly is a desirable practice in moist regions, on some heavy soils, on "drifting" soils, and in areas where fall frosts are feared. In these places it aids in producing an earlier and therefore a safer crop, and of course it lessens "blowing."

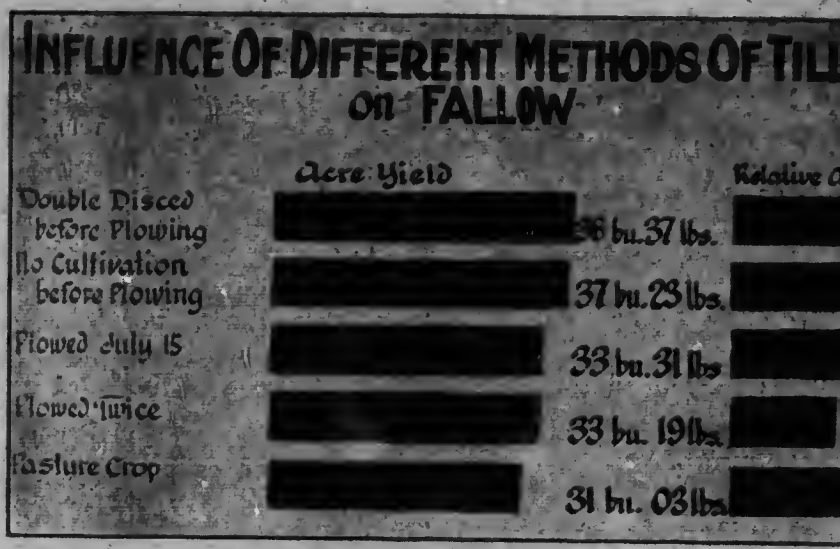
But on soils that do not blow in the drier parts of the Province, pasturing the fallow lessens the moisture content of the soil and lessens the yield. In the dry season of 1914 the decrease was as much as 14 bushels, but in the good year following it was only 2¼ bushels with oats and clover and 6 1-3 bushels with rape. Even though the pasturage removed was not a heavy crop, the yields were decreased more than where a corn crop was grown. A portion of this decrease was probably due to our inability to get a perfect seed bed after the pasture crop in the fall.

Table XXXII.—Summary Chart showing the influence of different methods of tilling the fallow on the acre yield and relative acre profits (3 year average).

Treatment.	Acre yield. bus. lbs.	Acre value at 70c per bus.	Relative acre cost less Int.	Relative acre cost plus Int. for 2 yrs.	Relative acre profit.	Relative profit on investment % per year.	Relative bus. cost *
Surface cultivation before fallowing..	38-37	27.03	17.91	22.95	9.12	13.66	59.48
No cultivation before fallowing...	37-23	26.17	16.67	21.71	9.50	13.19	58.07
Plowed June 15...	33-31	23.46	17.77	22.81	5.69	7.90	63.05
Plowed twice.....	33-19	23.32	18.25	23.29	5.07	7.04	69.90
Modified by sowing thin pasture crop on fallow.....	31-30	21.73	15.52	20.56	6.21	8.62	66.21

* Including interest for two years.

This summary chart shows the fallow practices that have resulted in the highest yields and those that have given the largest net returns. On good soil that was free from grass and weeds, discing before plowing increased the yield but decreased the profit. Under other conditions we think it would be different. Late plowing decreased both yield and profit con-



Average of Three Years Data

siderably. Twice plowing did not differ in yield from plowing, but returned a lower profit on this grass fre The pastured fallow produced the lowest yield, but credited with the pasture, produced more profit tha or twice plowing but less than June 15th plowing.

Summary of Observations and Experiments on the Till the Fallow.

The purpose of the fallow is:

(1) To store and conserve in the soil a portion year's moisture for the use of the next year'

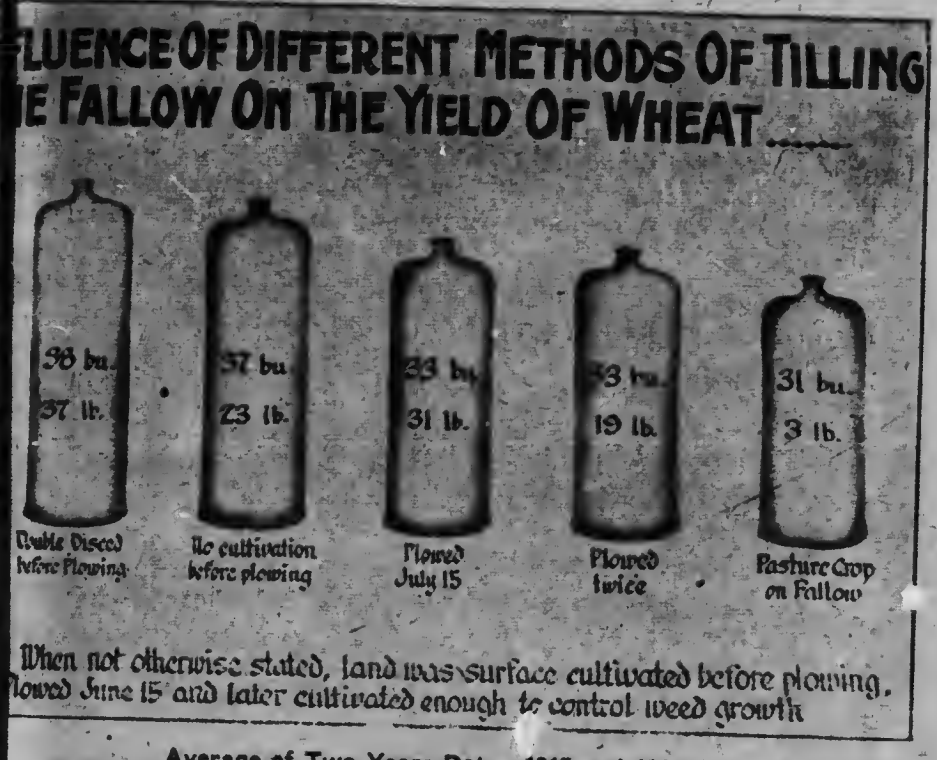
(2) To develop "available" plant food.

(3 To aid in the control of weeds, and

(4) To permit under our present system of farm more economical distribution of the power nec to prepare the land for a crop.

The chief means by which these ends can be at by Tillage on the average farm are as follows :

1. Land to be summerfallowed should, if possible tivated in the previous fall or in the spring som before plowing.
2. The fallow should be plowed in the rainy sea
3. It should be plowed to a fair depth.



Average of Two Years Data—1915 and 1916

4. The plowing should be harrowed immediately after it is done.

5. The germination of weed seeds should be encouraged but the growth of weeds after germination should be prevented.

6. The evaporation of moisture should be lessened by maintaining a soil mulch.

7. The fallow on most normal soils is ready to sow after harrowing in the spring.

8. Objections to Summerfallowing:

When properly carried out the fallow conserves water, develops available plant food and aids in controlling weeds; but it does this at the expense of the most valuable constituents of the soil, viz., organic matter and nitrogen, which are both dissipated in the process. The fallow is immediately profitable but it would seem that we must find a substitute for it or pay the cost in the wastage of permanent "fertility."

Summary of Practices that Promote Early Matu

The fallow crop is usually the latest to mature. therefore, fitting that reference should be made here of the practises that promote earlier maturity. Space d permit elaborating on these, but evidence supporting e be found in the experiments discussed under other hea the report.

Among the more common practices that promote maturity or lessen the danger from fall frosts are:

1. Thick seeding.
2. Packing.
3. Early seeding.
4. Shallow seeding with a press drill.
5. Less frequent fallowing.
6. Pasturing the fallow.
7. Late plowing of the fallow. Late breaking, plowing of the fallow.
8. Surface drainage of uneven land.
9. The use of intertilled crops or hay crops where and profitable.
10. The use of the early classes and early vari grain.
11. The use of frost resistant crops.

CROP ROTATIONS

Most old agricultural countries have found the c cropping that gives the greatest monetary return co with the maintenance of productiveness. Practically formation on this question is available in Western Can in the not distant future—even now on many soils—cr tions other than a fallow followed by from two to fou crops, should be established. To get light on this sub rotations of annual crops and 40 including perennial cro started in our investigation field in 1914. Two years' have been secured from the former. Those in which v used are presented here without comment further than that after intertilled crops that were kept clean wh given exceptionally good yields even when compared w lowed ground.

The first figures from the Pérennial crop rotations available next year.

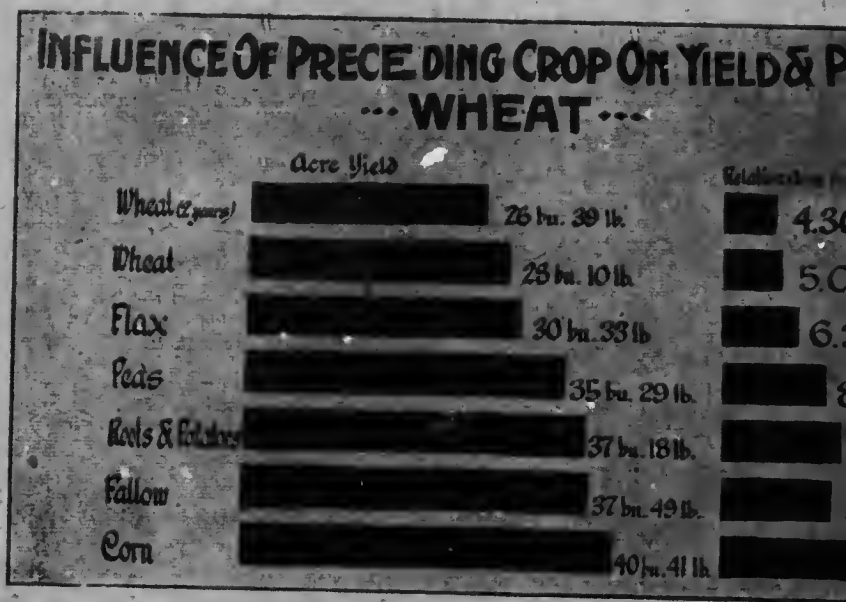
Table XXXIII.—Showing influence of the preceding crop on the acre yield of Marquis wheat.

Preceding crop	1915	1916	Average. (2 yrs.)
	Bus. lbs.	Bus. lbs.	Bus. lbs.
Wheat (two years)	23 39½	29 38½	26 39
Wheat	24 51	31 29¼	28 10
Flax	27 53	33 13	30 33
Peas	32 7	38 52	35 29
Roots and Potatoes	33 25½	41 11½	37 18
Fallow	38 32½	37 5	37 49
Corn	34 44	46 38½	40 41

Table XXXIV.—Showing the influence of wheat, flax, peas, potatoes, corn and fallow on the yield of Marquis wheat (average of many tillage tests across each of these kinds of stubble or fallow).

Previous crop.	Acre Yield of Marquis 1915 Bus. lbs.	1916 Bus. lbs.
Wheat	25 00	
Flax	23 41½	42 58
Peas	29 31½	43 8
Fallow	34 47	44 5
Potatoes	35 2	47 10
Corn	36 33	47 39

Table XXXV.—



In above chart, relative acre profit after fallow should read 8.33 ins

Table XXXVI.—Relative Profits from wheat in Ro
Tests.

Previous crop	Average yield 2 years	Average acre value at 70c	Relative acre cost*	Relative Acre Profit	Relative Profit on Invest†
Wheat (2 years)	26 39	18.65	14.35	4.30	11.92
Wheat	28 10	19.72	14.63	5.09	14.1
Flax	30 33	21.39	15.07	6.32	17.5
Peas	35 29	24.84	15.99	8.85	24.5
Roots and Potatoes	37 18	26.11	16.33	9.78	27.1
Corn	40 41	28.48	16.94	11.54	32.0
Fallow	37 49	26.47	18.14	8.33	23.1

* Not including interest. † Including interest.

The influence of the previous crop on the yield of wheat and the acre profit is shown in Table XXXVI. The first line gives the figures from a plot that had two crops of wheat on it previous to the one from which these data were taken. The rest of the land was fallowed the year preceding that in which the wheat, flax, peas, roots, potatoes and corn were grown. The yields and profit show a gradual increase in the order the crops are named. All plots were tilled alike after the first crop and the difference in the cost per acre of each is entirely due to the difference in cost of handling the respective crops.

The acre value of the crop after fallow (bottom line) is almost as great as that after corn, but the cost of working the fallow was so much greater that the profit is lower than from the crop on corn stubble. Strictly speaking, it is not just to charge the full cost of fallowing to the first crop because the second also receives some benefit from it, but in the absence of reliable figures to show how much of the cost should be charged to the first crop and how much to the second, we have temporarily charged the full cost to the first crop.

With reference to the corn land, it should be noted that the corn was grown on fallow (as also were the roots, peas, and all other crops except the wheat in the first plot.) It is possible that the yields would not have been so high after corn, had the corn been grown on fall or spring plowing. Those who may think of using corn as a substitute for fallow should keep this point in mind.

FERTILIZERS

The maintenance of productiveness by the use of manures and fertilizers has not yet been given much consideration by the western farmer, nor is it likely to receive his serious study for some time except on the lighter and very heavy soils—those that are not rich and those that blow or are cold and produce late crops.

Whether it is profitable or not to use manure on land is still in many places a vexed question. Commercial fertilizers are not now considered worthy of serious thought. On most of the land in the Province neither manures nor fertilizers are very necessary yet, but the history of agriculture in older countries teaches us that a time will come when one or other or both will be necessary. What has happened on other virgin soils in the past will happen on our virgin soils in the future. It is in anticipation of this date that experiments are being conducted in order to ascertain what fertilizers will give the most profitable returns while still maintaining the fertility

of the soil. These tests include the application of bar manure alone, commercial fertilizers alone and various binations of manure and fertilizers. It is proposed to these every sixth year when the land is in fallow and t the land ordinary tillage during the other years betwee application.

The rapidity with which the plant food contained i tilizers becomes available for use by the plant varies acc to its solubility or availability, hence it is necessary to cr land for several years between each application so that s ient time may elapse for most or all of each fertilizer to opportunity to show its effect on yield.

It is therefore not to be expected that the increa yield obtained in the first crop from the use of most ferti will be of sufficient value to pay the cost or even the lab handling such ones as farm manure. Only after several have been removed can we reasonably expect the full b of the fertilizer to have been shown.

In this test, six years including four crops and two fa is given each application to show what its effect on crop y will be.

The project has been under way only three years an have thus far harvested only two crops from land that rec the fertilizers three years ago. Table XXXVII. gives first year effect on wheat in 1915 and the first year effe the next application on Winter Rye in 1916. The table a bottom summarizes these results.

Table XXXVII.—Showing the effect of fertilizers on yield of Marquis wheat in 1915 and winter rye in 191

Treatment—	Wheat 1915 bu. lb.	Winte 19 bu.
Fresh manure and rock phosphate	38 28	52
Manure heavy, rotted	36 13	50
Manure heavy, fresh	37 43	53
Manure light, rotted	41 43	53
Manure light, fresh	37 31	54
Nitrogen, phosphorus, potassium	37 41	52
Fresh manure, nitrogen, phosphorus	44 13	54
Fresh manure, nitrogen, potassium	34 53	52
Fresh manure, phosphorus, potassium	42 18	54
Fresh manure, nitrogen, phosp's, potassium	39 03	52
Nitrogen	36 38	54
Lime	34 38	53
Irrigation	34 33	
None	32 32	47

Summarizing the Above Table

Manure	38 15	52 43
Manure and fertilizers	40 06½	53 30½
Commercial fertilizers	37 41	52 40
None	32 32	47 30

All of these fertilizers including farm yard manure produced an increased yield even on land that is new and very rich. It was cultivated only three years and produced only two crops before this test commenced. After four or five crops have been taken off this land we shall be able to say whether any or all of the fertilizers have been profitable. The increased value in one crop does not approach the cost of the commercial fertilizer nor the cost of handling the manure.

APPENDIX

HISTORY OF WHEAT

The Geographical origin of wheat as well as th
when it became a cultivated plant has never been def
determined. It is believed, however, that its cultivat
much older than the history of man and that at the da
history it was indigenous in Western Asia.

Hunt (1) states that "very ancient monuments much
than the Hebrew scriptures show its cultivation already
lished....The earliest lake dwellers of Switzerland cult
a small grained variety of wheat as early as the ston
The Chinese grew wheat 2700 B. C....."

De Candolle (2) believed the Euphrates Valley w
principal habitation of wheat in prehistoric times. He says
area (in Western Asia) may have extended toward Sy
the climate is very similar but to the east and west of W
Asia wheat has probably never existed as a cultivated
anterior....to all known civilization."

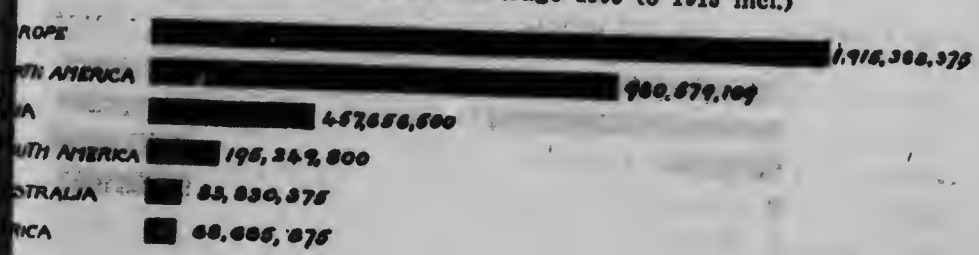
Carleton, (3) discussing the present range of wheat
"The subspecies of wheat have a range of cultivation thr
out the world, both as to elevation and latitude, greater
that of any other cereal, and probably greater than that o
other crop, except that barley is grown at slightly highe
tude and some instances at a higher elevation. Wheat is
grown successfully in practically the hottest and colde
civilized countries—in the tropics of the Philippines, Equa
Africa, Brazil and Costa Rica and near to the Arctic Cir
Europe and North America. Four years ago (1911) B
East Africa began supplying wheat almost sufficient fo
own needs, and the crop also did well in Uganda and Ni
The Scoptsi people have succeeded with wheat and othe
eals north of Yakutsk in Siberia. In Finland and Scandi
even winter wheat reaches over sixty degrees north. At
Vermilion, almost 600 miles north of Winnipeg a flour
has been in operation many years. Onega wheat thrives
Archangel; while Romanov and Fife mature grain in 100
at Fairbanks, Alaska, two degrees from the Arctic Circle."

(1)—"Cereals in America."
(2)—"Origin of Culitvated Plants."
(3)—"The Small Grains."

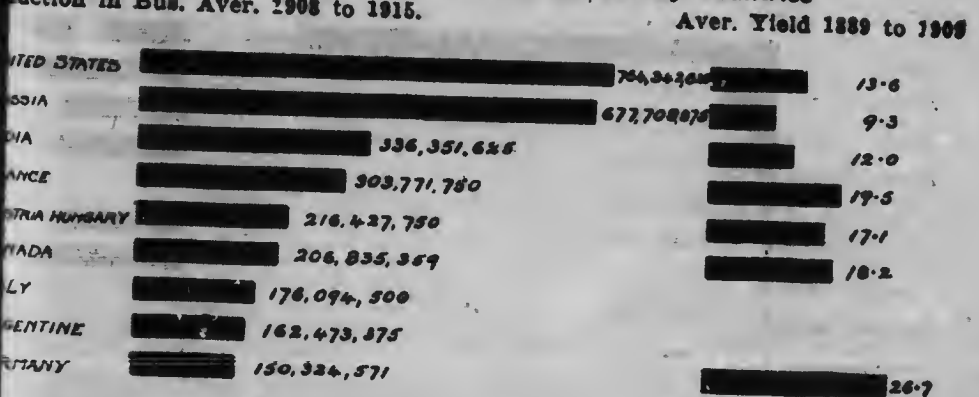
THE PRODUCTION OF WHEAT

Where the World's Wheat is Grown—By Continents

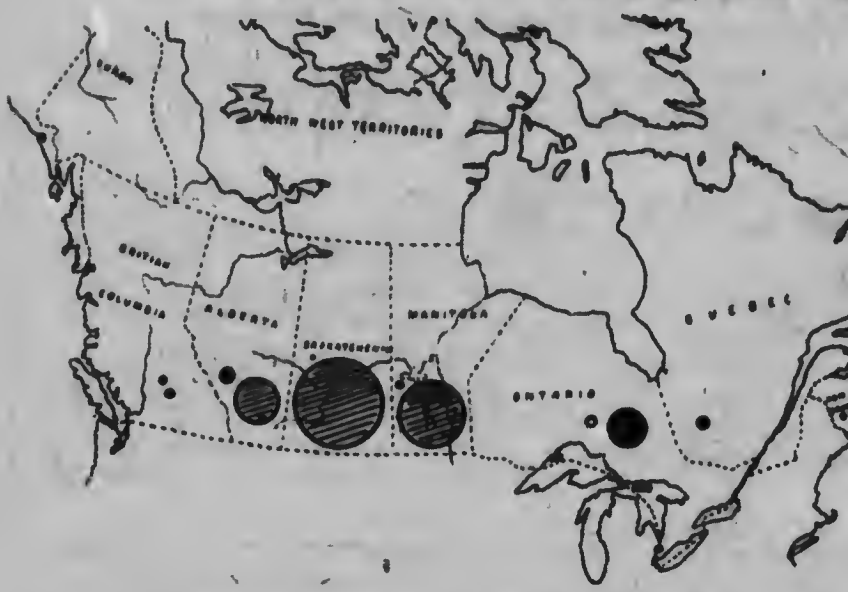
Where the World's Wheat is Grown—By Continents
(In Millions of Bushels—Average 1908 to 1915 incl.)



Where the World's Wheat is Grown—By Countries

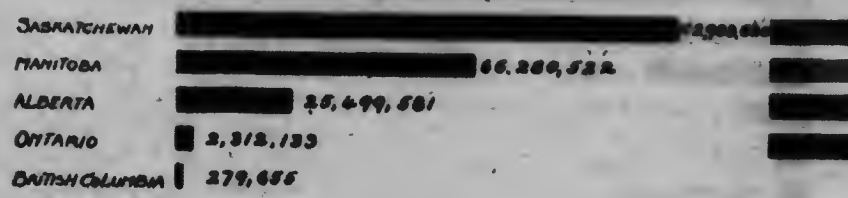


Where the Canadian Wheat Crop is Grown—By Provinces
(Hatched Areas, Spring Wheat. Solid Black, Winter Wh



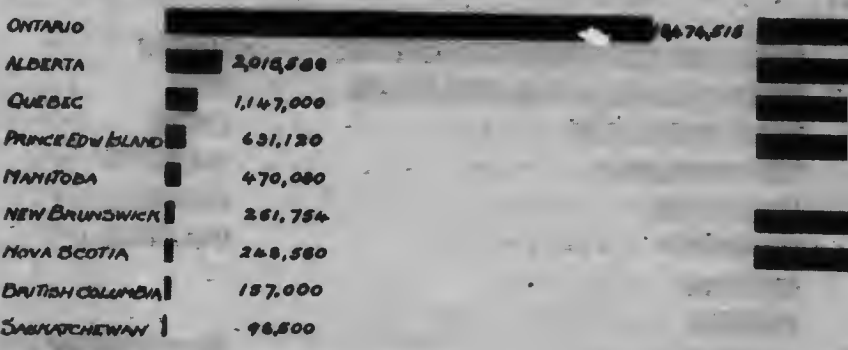
Where the Canadian Crop of Spring Wheat is Grown

Aver. Production in bus. 1911 to 1915.

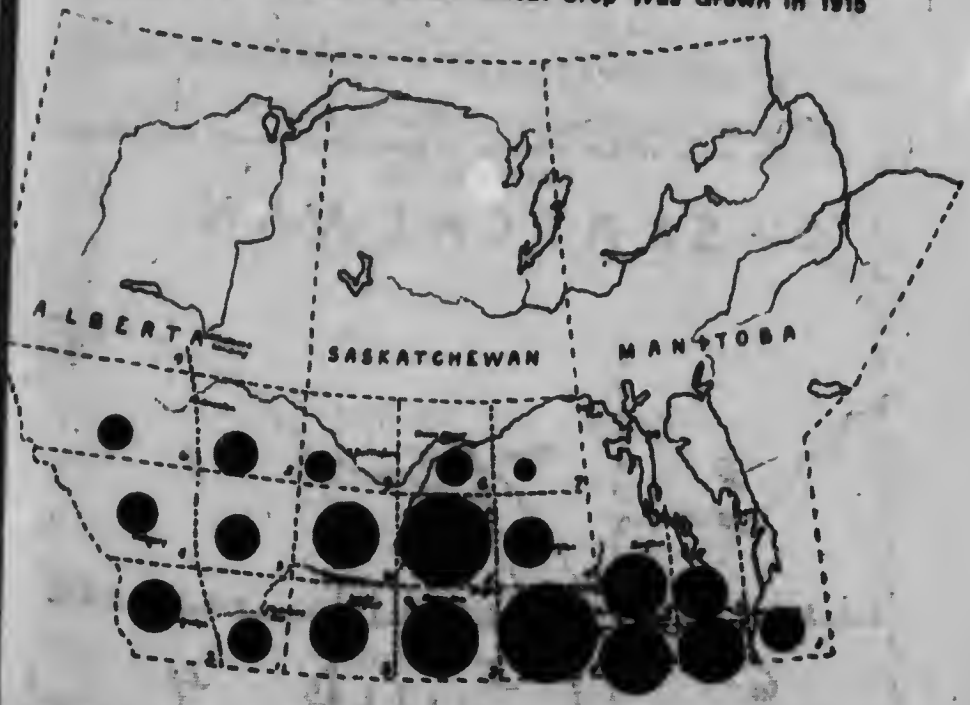


Where the Canadian Crop of Winter Wheat is Grown

Aver. Production in bus. 1911 to 1915.

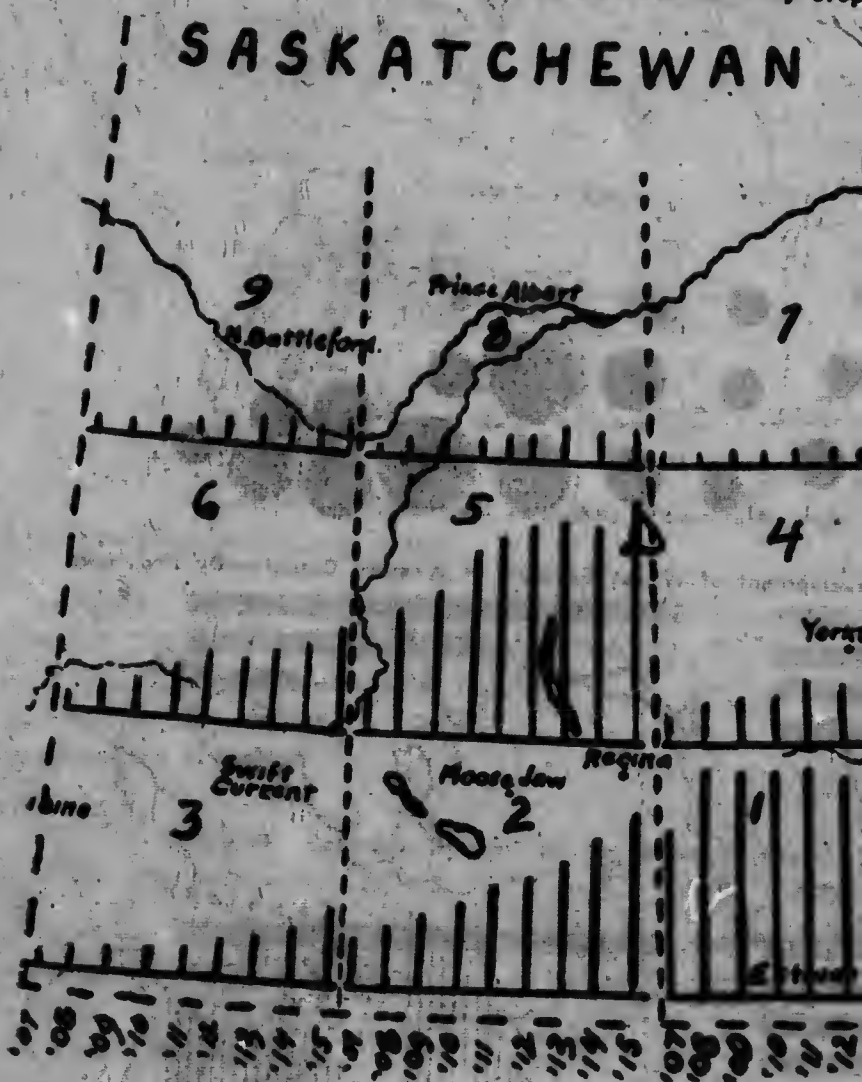


Where the Western Canadian Wheat Crop Was Grown in 1915



The Development of Wheat Growing in Western Canada—By Provinces

The Development of Wheat Growing in Saskatchewan—By Crop



Acreage Sown to Wheat in Different Years, Showing Development of Wheat Culture in Saskatchewan, Manitoba and Alberta.*

	Saskatchewan	Manitoba	Alberta
1898.....	276,253		
1899.....	328,459		
1900.....	382,540	1,457,396	
1901.....	469,953	2,011,835	
1902.....	580,860	2,039,940	
1903.....	777,822	2,442,873	
1904.....	910,359	2,369,118	
1905.....	1,130,084	2,643,588	
1906.....	1,730,586	3,141,537	171,127
1907.....	2,047,724	2,789,553	207,900
1908.....	3,703,563	2,850,640	317,633
1909.....	4,085,000	2,642,111	426,639
1910.....	4,664,834	2,962,187	592,960
1911.....	5,232,248	3,339,072	940,164
1912.....	5,384,092	2,823,362	1,078,685
1913.....	5,760,249	3,141,218	1,126,833
1914.....	6,003,522	3,366,200	1,039,491
1915.....	6,884,874	3,664,281	1,669,076

*From Reports of Provincial Department of Agriculture.

Acreage Sown to Wheat in Saskatchewan By Crop Districts, Showing Development of Wheat Growing in Each.*

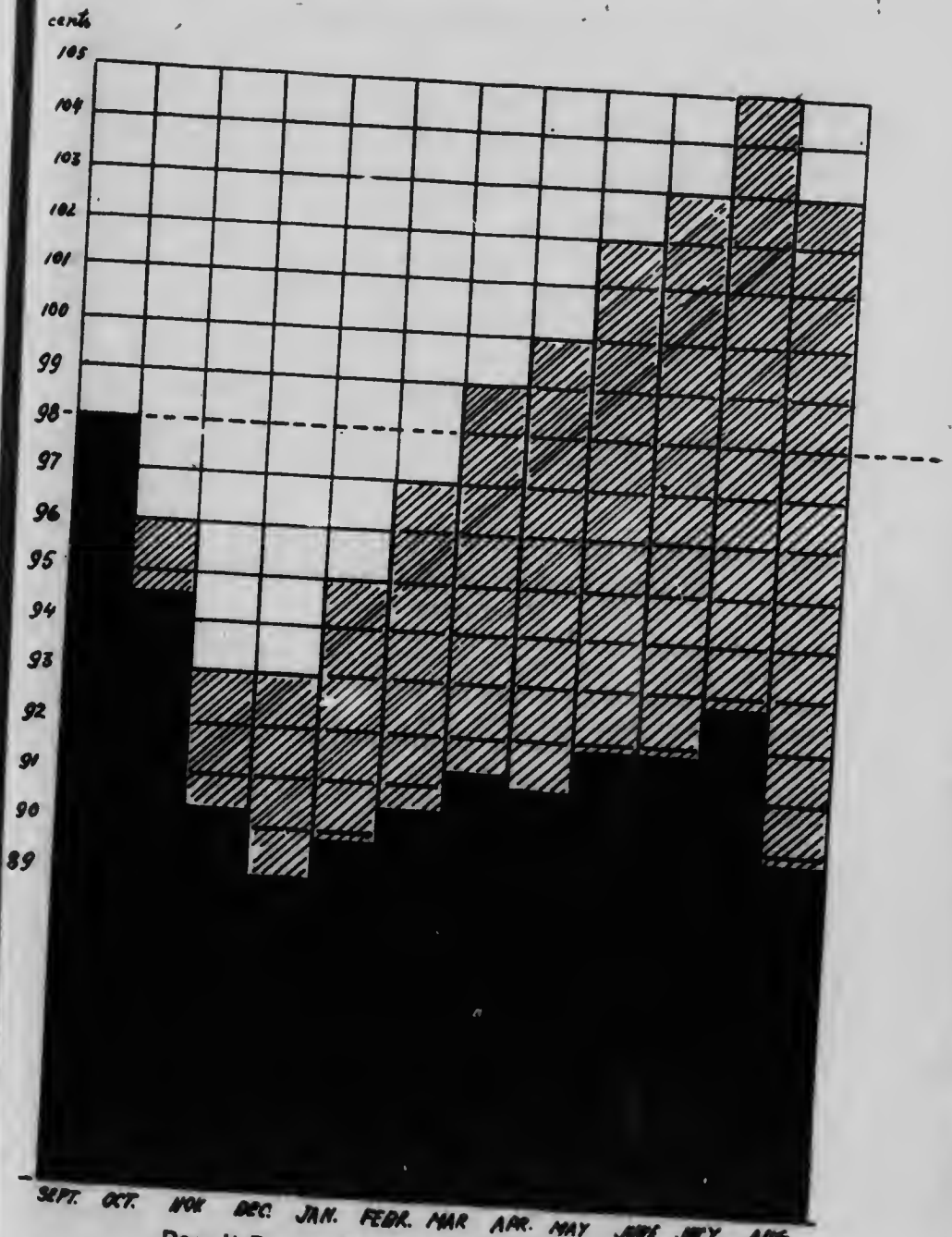
Dist.	1907	1908	1909	1910	1911	1912	1913	1914	1915
1...	1,137,443	1,692,497	1,684,000	1,639,762	1,697,655	1,615,001	1,664,172	1,630,888	1,777,667
2...	284,215	453,664	523,000	620,358	738,357	777,669	940,979	1,091,535	1,277,095
3...	11,650	62,965	121,000	170,644	229,929	261,611	340,094	428,518	557,073
4...	182,592	270,683	280,000	303,923	422,889	385,905	370,468	377,877	438,337
5...	315,345	878,286	1,057,000	1,348,922	1,390,752	1,472,889	1,502,346	1,502,346	1,697,650
6...	39,108	165,684	198,000	318,531	415,553	485,592	563,286	608,348	717,850
7...	8,647	18,745	26,000	20,841	32,059	28,555	26,841	27,109	31,175
8...	48,586	84,935	90,000	114,968	159,762	173,555	182,232	184,054	206,140
9...	20,048	76,104	106,000	126,885	140,598	182,615	169,831	152,847	181,887

Average Acre Yield of Wheat in Saskatchewan By Crop Districts.*

Crop Dist.	1907	1908	1909	1910	1911	1912	1913	1914	1915	Aver.
1.....	12.24	13.28	18.1	16.7	17.2	18.0	17.0	15	21.7	16.58
2.....	15.16	17.63	24.7	19.4	21.2	23.0	22.0	13	26.2	20.25
3.....	17.81	9.82	18.5	10.9	16.8	21.7	17.0	2	31.0	17.28
4.....	13.14	13.13	25.1	22.7	20.8	19.0	22.0	14	26.5	19.60
5.....	15.72	13.32	24.5	13.2	18.7	19.7	20.0	12	23.7	17.87
6.....	16.14	10.27	23.9	7.5	16.8	21.5	18.0	10	30.3	17.16
7.....	17.07	13.48	23.1	21.4	17.9	23.4	25.0	17	29.7	20.89
8.....	14.98	15.61	25.7	19.0	20.3	22.5	23.0	13	25.4	19.93

6.....	16.14	10.27	23.9	7.5	16.8	21.5	18.0	10	36.3	17.16
7.....	17.07	13.48	23.1	21.4	17.9	23.4	25.0	17	29.7	20.89
8.....	14.98	15.61	25.7	10.0	20.3	22.5	23.0	16	25.4	19.28
9.....	19.06	13.52	26.8	13.1	17.0	17.3	20.0	15	25.6	18.54

*From Reports Saskatchewan Department of Agriculture.



Does It Pay the Farmer to Hold His Wheat?

of hatched column shows average of high and low monthly prices at Winnipeg he seven years preceding Sept., 1914. Hatched area in each column represents of holding. Top of solid column indicates net price by months.

Cost of Producing Wheat

North Atlantic States (U.S.A).....
South Atlantic States (U.S.A.).....
South Central States.....
East North States.....
West North States.....
Far Western States.....
United States.....
Manitoba .....
Saskatchewan .....
Alberta (spring) .....
Alberta (winter).....

* Calculated from U. S. census data, 1909.

† Calculated from Dominion of Canada census data, 191
Provincial Department of Agriculture estimates of

Method Used By the Dept. of Field Husbandry in Arriv
"Relative Profits" from Different Methods of
Producing Wheat

The yield is not always a fair measure of the total o
tive profit gained from any particular cultural practice f
reason that it does not take into consideration any diffe
there may be in the cost of production. A ten bushe
acre yield on stubble land given no cultivation might s
profit over the cost of sowing and harvesting, wher
twenty bushel yield on summer-fallowed land might s
net loss when balanced against the cost of plowing, di
packing, harrowing, seeding, cutting and two years in
or rental charges against the land.

Neither is the value of the crop, as determined b
yield and the grade, a correct appreciation of the value
given method or operation, and for the same reason, viz.
it indicates gross and not net returns.

The notes that follow indicate the method used in ar
at the "relative profits" resulting from different metho
handling the land. The figures are not intended to give a
ate data on the cost of producing wheat by any parti
method, or the actual or possible profit derived from
practices. These can be determined only after the actua
in each of the different operations has been determined.
by giving estimated values even though they be arbitra
the different operations followed, the relative profits fro
ferent methods may be arrived at.

When determining these arbitrary values, we endeavored to make them approximate fairly closely the actual cost to the average farmer, under average conditions. Anyone who desires to get at the relative profits from these methods on his own farm may modify the charges given the different items to suit the conditions under which his operations are conducted. Our arbitrary charges are based on the approximate cost to the farmer doing his own work with his own teams and implements and not what it would cost him to hire the work done. Our figures will be found too high for some conditions and too low for others. Nevertheless they will serve to show the relative cost of production by different methods; and from the relative cost and relative value the relative profit may be found.

The arbitrary values given to the different operations performed in the growing of wheat are as follows:

Harrowing (once)	$ .18	per acre
Single discing	.40	" "
Double discing	.80	" "
Spring Tooth or Duck Foot Cultivating	.40	" "
Shallow (3-in.) stubble plowing	1.80	" "
Deep (6-in.) stubble plowing	2.40	" "
Shallow (2½ to 3-in.) sod plowing	2.40	" "
Deep (5-in.) sod plowing	2.80	" "
Packing	.30	" "
Burning Stubble	.25	" "
Drawing off stubble	.12	" "
Seeding	.36	" "
Cutting	.50	" "
Stooking	.20 to .30	" "
Threshing wheat	.12	per bus.
Threshing oats	.08	" "
Threshing barley	.10	" "
Twine	.20 to .40	per acre
Marketing wheat (hauling 5 miles)	.05	per bus.
Selling price	.70	" "
Seed (cleaned and "treated")	.95	" "
Controlling weeds (hand pulling)	1.00	per acre
Depreciation on machinery	.50	" "
Investment	36.00	" "
Superintendence or management	1.00	" "

A few words of explanation with regard to the method used in arriving at these values may help to make them better understood.

We assumed that a man and four horses were worth $7.20 per day. We also assumed that this outfit could cover in one day the areas indicated in the table below. On this basis the values given in the above list were arrived at.

Estimated Acreage Covered By Four Horse Team in On	
Single Harrowing	40
Single Discing	18
Double Discing	9
Cultivating	18
Shallow Stubble Plowing	4
Deep Stubble Plowing	3
Shallow Sod Plowing	3
Deep Sod Plowing	2.
Packing	24
Seeding	20
Cutting	14.

Existing conditions such as light or heavy land, bus open country, length of field, number of sloughs, etc., c the area that it is possible to cover in a day, but in prairie, on loam soil with a half mile furrow, the above age seemed to us approximately correct.

Drawing Off Stubble—Stubble land that is disced an plowed necessitates the removal of loose stubble before, d or after harrowing in order to facilitate even seeding, a do this over a fairly large field would probably cost i neighborhood of 12c per acre.

Stooking—The cost of stooking was assumed to de upon the yield and the following charges were made:

	Cos
20 bus. yield per acre	20c per
30 bus. yield per acre	25c "
40 bus. yield per acre	30c "

Twine—The yield is not always a correct measure o quantity of twine used, but in these calculations it wa sumed to be so. The cost of twine was placed at 1c per b of grain.

Marketing—The distance grain has to be hauled to ket varies widely. The average cost was taken as 1c per per mile for wheat and the average distance from mark being 5 miles. To haul wheat 5 miles would therefore co per bus.

Seed—The normal value of commercial wheat fit t used for seed is placed at 75c per bushel and the cost of c ing and treating the average quantity required for an at 20c. Thus the face value of the seed used would b round numbers, as follows:—

	Cost
1 bus. rate per acre	$ .95 per
1¼ bus. rate per acre	1.15 "
1½ bus. rate per acre	1.35 "
1¾ bus. rate per acre	1.55 "

Controlling Weeds——In the experimental work from which our data was obtained some pulling of weeds by hand was practised. $1.00 per acre has been allowed to cover the average cost of this item.

Depreciation of Machinery—The most difficult item of cost to estimate accurately is depreciation of machinery. The length of usefulness of different machines varies greatly according to how much they are used each year, the care they receive and, to probaly a greater extent, upon whether they are housed or not when lying idle. In the present estimates an item of 50c per acre has been included to cover depreciation of all machines used and this figure is based upon the average of a large number of estimates made in the United States on different farms and covering all implements, wagons, etc., generally used in grain farming. In case much specialized machinery (e.g. potato planter and digger, corn planter and harvester) is used, this figure would have to be modified somewhat.

Investment—On the average 320 acre farm, the total sum invested in land, fences and buildings (not including the farm home) was assumed to be about $12,000, or at the rate of $36.00 per acre. This sum is made up of the following items:

Machinery, tools, etc.	$ 960	or	$ 3.00	per acre
Buildings, including well	2,240	or	7.00	" "
Fencing	320	or	1.00	" "
Land	8,000	or	25.00	" "
Total	$11,520	or	$36.00	" "

Superintendence Or Management—In addition to the average wage included in the tillage, seeding, harvesting and other operations, an item of $1.00 per acre is included in all our estimates as the added value of the services of the owner or superintendent of the farm over that of the hired workmen.

Estimates of the cost of producing wheat made by different farmers and economists vary greatly, and items are included by some which are omitted by others. In many estimates rent or interest on investment is included, but no item covering the value of managerial ability. In such studies the balance represents the value of the farmer's ability as a manager, or in other words his "labor income." In our estimates an item is included to cover the average value of management but no sum for interest on investment or rent of land; hence the "profit" or "loss" shown is in reality the net interest on investment and when compared with the total value of the investment

shows the profit or loss per cent. on the year's operations allowing a workman's wage plus $1.00 an acre to the ma of the farm.

Strictly speaking it is immaterial which of these pl followed so long as it is specifically stated just what the or loss represents. We believe, however, that the impo question in any business operation or investment is "wh the per cent. profit or loss on the capital invested?" or " is the profit per acre?" Hence the comparison of "the c producing wheat" and "the value of the crop," should the actual profit or loss per cent. on the total capital inv in the enterprise or the profit per acre under crop.

Curing Wheat—Stooking Versus Stooking and Stacki

When dry, wheat will keep for an indefinite pe In the process of ripening it loses most of its mois When it is cut "on the green side," however, it carries co erable moisture and even when quite mature it often con more than permits safe storage. Under these condition grain must be "cured," that is, permitted to lose its exce moisture, otherwise it may "heat" or grade "tough "damp," or spoil in the bin.

To remove this risk and as well to facilitate threshing permit some further filling of the seed "stooking" or s ing or both are practised before threshing. Stooking per (1) the drying process to go on, (2) the movement of nourishment from the stems of immature grain to the seed (3) lessens the danger of serious injury from weathering.

For the first few days after cutting, stooking is the efficient way of 'curing.' If the stooks cannot be thre shortly after they are dry, two difficulties face the gro (1) the grain commences to suffer from weathering, and tillage of the land is not very practicable while the st remain in the field. To overcome these difficulties stac is sometimes followed.

Stacking prevents further deterioration from weathe in fact some improvement in quality usually results fro It leaves the land unobstructed and free to be cultivated. is a cheap form of storage and in areas where there are few threshing machines to do all the work in good seaso should be practised. To the small farmer whose acreage not tempt the thresher to come to him early, it is a measur safety.

But stacking costs money.

The grower must determine for himself whether under his conditions the virtues of stacking more than offset the cost. Under many conditions they do. Under some conditions they do not. Where a man is sure he can get his threshing done early after harvest, it probably will not pay in normal seasons to stack. When he is not sure when the thresher will come, and particularly where his acreage is small and the season more or less wet, he would be wise to stack his grain.

Stacking*

Location of the Stack—Select a high place which has good, natural drainage, but not far enough away to make the hauling too expensive. In some humid countries wooden rails or other materials of similar nature are often placed on the ground and the stacks built on these, but in the west, in a normal year, this precaution is not necessary provided the stacks are built on the higher land.

Starting the Stack—Start in the centre with two bundles precisely as you would build a stook. Lay up the bundles against the sides of the stook until you have a circle as large as the base of the stack which you wish to build.

Building the Butt of the Stack—After the first layer has been built, the second layer should be started on the outside, breaking joints, laying the bundles with the butts to the outside and the heads to the centre. The butts on the outside row should be perpendicular with the butts on the lower layer. The second row should be built around with the butts coming to the band of the first row and so on until the centre of the stack has been reached, when the builder will start on the outside the same as before.

Care should be exercised to get the first four or five layers solid before beginning to bulge the stack. After the wall has been built perpendicularly for about four or five feet, the outside rows should begin to be slightly shoved out. This bulging should be continued until the body is high enough to begin to draw in or top off. This is usually at about seven to nine feet high.

Topping Off the Stack—When this is begun the centre should be built differently. The outside row should be laid the same as before with the exception that the butts of the sheaves should be placed rather nearer the centre than before. The second row should not be laid to the bands of the first as in the

*Adapted from article by Prof. Harrison, Man. Agr. College.

butt of the stack, but should just nicely overlap the head
centre rows should be laid in the same way, the thi
overlapping the heads of the second, the fourth those
third, etc. When the centre has been reached, building
way, start on the outside again and lay the butts of
row about four inches in from the butts of the secon
Build the centre up again by laying the next row w
butts to the bands, as in the butt of the stack. In th
build two layers in the centre and one on the outside.
the stack is topped, each time that one layer is laid
the outside, the double layer should be built in the
This is done to give the outside sheaves a greater slope
the rain. The butts of each successive outside layer
of course, be laid inside the butts of the lower layer abou
or five inches. There is no need to put a high top on the
as it is the slant of the sheaves rather than the height
top that enables the stack to shed water. The cop shea
the peak of the stack should be put on precisely the sa
you would cap a stook to shed the rain. These sheaves
held in place with a weighted rope or wire, or by using p
sticks.

General Hints on Stacking

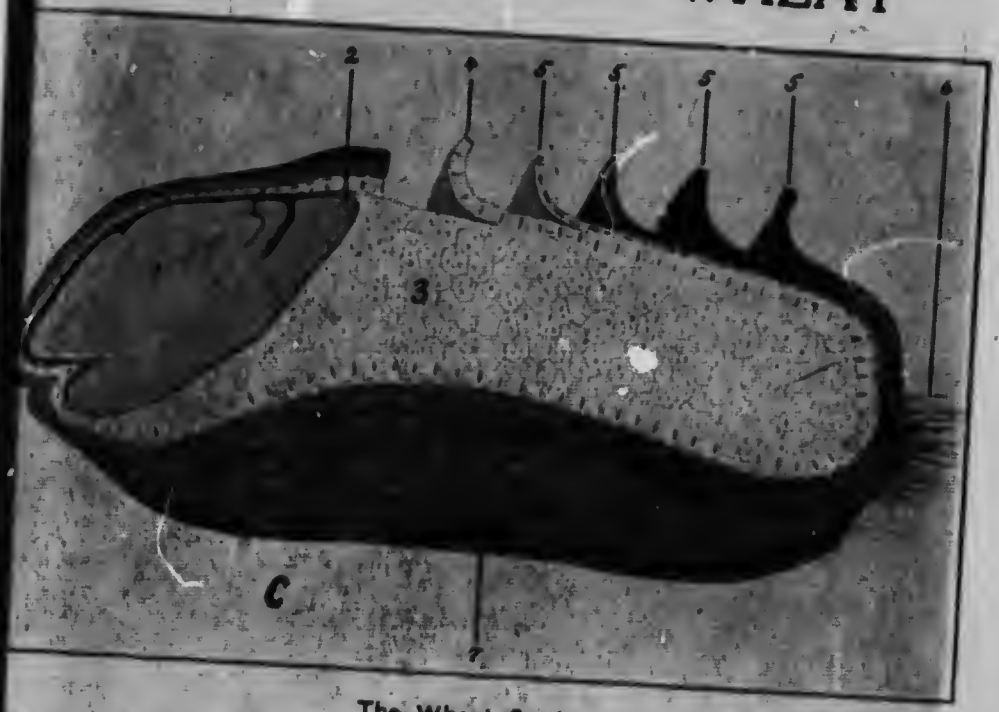
The entire stack should be built with a fork, and w
tramping on the outside row of sheaves. This necess
walking on and firming the centre of the stack and thus
ing it more solid than the outside, so that in settling th
side row will settle as much or more than the centre.

The stack should not be too large or too high, as this
to the cost of stacking. A five-load, round stack is the
economical to build.

If a long stack is preferred, more grain can be put i
with less labor, but it takes a more expert stacker to ke
dry. The general principle of building, however, is the
as in the round stack. An inexperienced builder alway
difficulty in keeping the corners level.

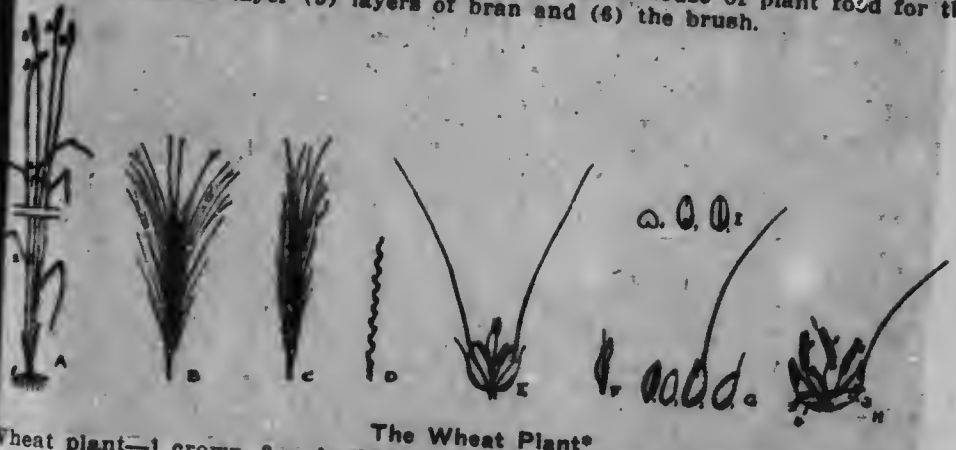
There are usually two or three good stackers in
neighborhood and if a farmer intends to stack it woul
advisable to watch one of these build a few stacks befor
tempting the job alone. It is very difficult to learn ho
build a stack from a brief description of the operation.
"leaky stack" the grain is in worse condition than if it
been left in the stook. It not only becomes damaged but
spoils. Don't stack when the stooks are damp.

THE BOTANY OF WHEAT



The Wheat Seed

to of model of longitudinal section through wheat seed showing (1) Embryo or lature plant (2) Scutellum (3) Endosperm or store house of plant food for the ryo (4) Aleurone layer (5) layers of bran and (6) the brush.



The Wheat Plant*

Wheat plant—1 crown, 2 node, 3 head or spike, 4 internode; B, wheat head, side ; C, wheat head, edge view; D, rachis; E, spikelet; F, sterile flower of spikelet; empty glume, 2 flowering glume, 3 seed, 4 palea; H, Flower—1 stamen, 2 pistil, owering glume, 4 palea; I, seed—1 ventral side, 2 germ side, 3 cross section. apted from reproduction in "A Manual of Agriculture," by Call & Schafer—By rtesy of MacMillan.

The Early Growth of the Wheat Plant

The Different Species of Wheat—T. Monococum Not Shown.

Classes and Types of Wheat*

The cultivated varieties of Triticum according to Kornicke and Wernert whose classification will in the main be followed in this discussion may be grouped into eight species and sub-species, as follows: Triticum vulgare, T. compactum, T. durum, T. turgidum, T. polonicum, T. spelta, T. dicoccum, and T. monococcum. Only T. vulgare, T. polonicum and T. monococcum are considered to be distinct species in all classifications. The other five are generally classed as sub-species of T. vulgare, though T. compactum is sometimes not even elevated to that rank. Three only of the above species and sub-species will be considered here, because they are relatively of much the greatest importance. These are T. vulgare and T. compactum or the socalled bread wheats and T. durum, or macaroni wheat.

The Bread Wheats—T. vulgare and T. compactum

These, and especially the former, are the most valuable and widely distributed groups of wheat in the world and are represented by a greater number of varieties than all the other species taken together.

* Adapted from Carleton's "Basis for the Improvement of American Wheats."

†Kornicke, Fr. and Werner, H. Handbuch des Getreidebaues 1885.

T. vulgare or common wheat is generally divided into a number of botanical sub-species and varieties based upon the presence or absence of beards, the nature and color of chaff, or the color and quality of grain. For our purpose, however, it will be more useful to consider that there are five great subdivisions of the species classed as types, based not upon botanical characters, but upon characteristics induced by the influences of soil and climate, as follows: (1) Soft winter wheats, (2) Hard winter wheats, (3) Hard spring wheats, (4) White wheats, (5) Early wheats.

Description and Distribution

(1) The soft winter wheats vary in color of grain from amber to white, and are produced under the influences of considerable moisture and mild, even temperatures, and are distributed in the Eastern United States and Canada, Western and Northern Europe, Japan and in portions of China,, India, Australia and Argentine.

(2) The hard winter wheats are red-grained, usually bearded, possess a relatively high gluten content, and are more limited in their distribution. They are grown usually on the black soils and under the influences of a climate characterized by extremes of temperature and moisture, but especially by dry, hot summers. They are found chiefly in the States of Kansas, Iowa, Missouri and Oklahoma in the United States, in Hungary and Roumania, in southern and southwestern Russia, and to some extent in the western provinces of Canada, northern India, Asiatic Turkey and Persia.

(3) The hard spring wheats are also red grained and rich in gluten content, and are adapted to conditions of soil and climate identical with those just mentioned for hard winter wheats, with the exception that the growing season is shorter and the winters too severe for winter varieties. They are found in Central and Western Canada, the Northern States of the plains of the United States, east Russia and western and southern Siberia.

(4) The white wheats are soft and very starchy, but possess grains a little harder and much drier than those of the soft winter wheats. They are either fall or spring sown, and are sometimes sown in both seasons in the same locality. They are grown chiefly in the Pacific coast and Rocky Mountain States of the United States, in Australia and in Chile, Turkestan, and the Caucasus.

(5) The early wheats are often soft or semi-hard and generally amber to red in color of grain, but are distingnshed

from the other types chiefly in their ability to ripen early. They are found in Australia and India, are represented by a very few varieties in the Southern States of the United States and include some of the dwarf wheats of Japan.

The varieties of the species vulgare naturally include the most diverse characters, because of their cultivation under so many different conditions. Their greatest characteristic as a whole, however, is, of course, the well known quality of producing a light loaf. For this reason the term "bread wheats" is usually applied to them. Nevertheless it should be noted that the difference between the best and poorest sorts of this species for bread making is fully as great and sometimes greater than between some varieties of different species. The hard, red-grained varieties are by far the best both in respect to their protein content and our present system of roller milling. They include Red Fife, Marquis and Blue Stem, Turkey, Mediterranean and Fulcaster of Canada and the United States; the Ghirkas, Ulka, Crimean and Buivola of Russia; and the Theiss and Banat of Hungary and Roumania.

On the other hand, the white wheats and soft winter wheats give the best results in the manufacture of crackers. Several of the most popular breakfast foods are also made from white wheats. In a few instances macaroni is made from the hard spring wheats and the white wheats, but not extensively. No varieties of the bread wheat group are well adapted for this purpose.

The special qualities that are found in varieties of T. vulgare may be summarized as follows:

(1) Excellence of gluten content for bread making.
(2) Excellence of certain varieties for cracker making.
(3) Yielding power of certain sorts.
(4) Hardy winter wheats.
(5) Resistance to drought (in some varieties).
(6) Early maturity (in some varieties).

T. Compactum—Club or Square Head Wheats

By most writers this is not even ranked as a sub-species, but the different varieties certainly form an isolated group which is quite complete in itself and distinct from all other wheats, and which will therefore be considered here as a distinct species. The various varieties are commonly known under the names "club" or "square head."

Besides producing the class of flours desired in certain localities, club varieties are very good for cracker making and

for the more starchy kinds of breakfast foods. They are grown either as spring or winter varieties except in Turkestan, where the winters are too cold for fall sowing.

Club wheats are at present cultivated chiefly in the Pacific coast and Rocky Mountain States of the United States, in Chile, Turkestan, and Abyssinia, and to a slight extent in Switzerland, Russia and some other local areas in Europe. The special qualities of the group are as follows:

(1) High yielding power.
(2) Stiffness of straw.
(3) Freedom from shattering.
(4) Early maturity (in some varieties).
(5) Drought resistance (in some varieties).
(6) Excellence of certain varieties for cracker making and breakfast foods.

Durum Wheats—T. Durum

The durum group furnishes the great bulk of the world's supply of macaroni, though a considerable amount of these pastes is made from Poulard and Polish varieties and a small quantity from the common bread wheats. There is now not the least doubt that some of the durum wheats used for macaroni can be successfully grown in parts of Canada and the United States. The idea that they cannot be successfully used for bread is also being rapidly exploded. Durum wheats are being extensively used for bread making in the United States and in Southern Russia, where the milling of this hard wheat has developed to a high degree of perfection. In these countries this wheat is fast becoming very popular for bread making.

Durum wheats are adapted for soils rather rich in nitrogenous matter, and somewhat alkaline, and give the best results in a hot, dry climate. They are quite drought resistant.

Almost all varieties are adapted only for spring growing except in mild latitudes. They are grown in Spain (where they predominate over all other groups) and other Mediterranean countries, in south and east Russia, Asia Minor, in the semi-arid states of the United States and to some extent in Mexico, Chile and Argentine.

The special qualities possessed by this group are briefly:

(1) Excellence of gluten content for making macaroni and other pastes.
(2) Resistance to drought.
(3) Resistance to rust.

Cross Pollination and "Breeding" Wheat

The term "cross bred" is used when referring to the crosses produced between different varieties and strains of the same species and the word "hybrid" when referring to new forms produced by crossing plants which are classed by botanists as distinct species such as flour and macaroni wheats. Cross pollination causes considerable variation in the second generation after crossing and thus gives greater opportunity for the selection of desirable plants.

To cross pollinate wheat successfully a knowledge of the wheat flower and its essential parts is necessary. The important parts of any flower are the stamens and the pistils. These are the socalled sexual organs of the plant.

The stamens consist of two parts—the stalk or filament and the enlarged upper part, the anther, which contains the yellowish dust called pollen so abundant on most flowering plants. The pollen grains are male reproductive cells.

The pistil is composed of three parts. The upper end or stigma, the lower end or ovary and the connecting part called the style. The stigma consists of three feathery appendages which when mature are sticky and thus hold the pollen grains that may fall upon them. When pollen falls upon the mature stigma, whether by natural means or by artificial "crossing" it comes in contact with the moist surface and starts to grow or elongate. It makes its way down through the style, to the ovary—that part of the pistil which contains the female egg cells. The nucleus of the male egg cell passes down through the pollen tube and unites with the nucleus of the female egg cell. This union of the male and female nuclei constitutes fertilization, after which the development of the seed or reproductive part begins.

Emasculation

The first step in the crossing process is what is called emasculation. This consists in removing the anthers in order to prevent self pollination. This operation is simple and is performed before the anthers reach maturity. The glumes are easily parted and the three stamens are removed usually by a small pair of sharp pointed tweezers. The stamens stand somewhat separated but can readily be removed at one operation. Usually three spiklets of two flowers each are used on each head of wheat, the others being removed before emasculation. The whole head is then wrapped with light toilet paper or cotton to protect it from foreign pollen until the pistil becomes receptive. A small numbered label is then attached on which is recorded the date of emasculation and any other notations which the operator desires to record.

Pollination

As soon as the stigmas of the emasculated flowers become receptive, pollen from the other plant is applied. In wheat this condition is shown by the appearance and position of the three feathery appendages of the pistil. When receptive these appear moist and sticky and stand quite upright, the feathery portion being widely spread. After pollination the whole head is immediately re-wrapped to prevent, as before, possible fertilization by foreign pollen. After fertilization has taken place and the seed has started to develop, the covering is removed from the head to permit of the more natural development of the seeds.

Content and Market Value of Important Plant Food Elements in Wheat (After Hopkins)

	Pounds			Market Value.			
	Nitrogen	Phosphorus	Potassium	Nitrogen	Phosphorus	Potassium	Ttl.
25 bu. wheat	35½	6	6½	5.32	.18	.39—	$5.89
1¼ tons wheat straw . .	12½	2	22½	1.37½	.06	1.35—	3.28½

For every 100,000,000 bus. of wheat exported the potential value of the soil is lessened by $23,500,000 and if the straw is burned the market value of the nitrogen lost is $5,500,000.

THE JUDGING OF WHEAT

Score Card for Market Wheat

Weight per bushel	20	points
Quality—		
(a) Texture	10	"
(b) Color	6	"
(c) Lustre	4	"
Soundness—Frost, binburning, sprouts, moulds..	20	"
Condition—		
(a) Moisture content	10	"
(b) Smut	10	"
Foreign Matter—Weeds, other grain and dirt....	20	"
Total	100	"

Score Card for Standing Fields of Seed Wheat

Name of variety		
Suitability of variety		
Freedom from weeds	5	points
Freedom from other varieties	25	"
Freedom from other kinds of grain	15	"
Freedom from attack from smut, rust and insects	10	"
Apparent yield considering vigor of growth and uniformity, size of head, stiffness of straw and thickness of stand	15	"
Earliness	10	"
	10	"
Total	100	"

Score Card For Seed Wheat

1.	Suitability of variety	8	points
2	Vitality—		
	(a) Soundness	18	"
	(b) Plumpness	12	"
	(c) Lustre	5	"
3.	Purity—		
	(a) Weeds	25	"
	(b) Diseases	10	"
	(c) Other kinds of grain	8	"
	(d) Broken grains, dirt, chaff, etc	5	"
4.	Trueness to type—		
	(a) Class	5	"
	(b) Variety	4	"
	Total	100	"
	(Wt. per bus. ,)		

How to Apply the Points of the Score Card for Seed Wheat

1.—Suitability of Variety—

(a) High yield, high quality and earliness are the important qualities desired in wheat.

Red Fife is preferred in areas having a long growing season. Marquis where there is danger of frost. Pioneer where there is greater danger of fall frost. and Prelude where no other productive sort can be matured.

2.—Vitality—

(a) **Soundness.** Bin-burned, frosted, moulded, decayed or weevil eaten grains seriously interfere with the percentage and vigor of germination of a sample. Cut in proportion to the percentage and degree of unsoundness found.

(b) **Plumpness**—All kernels should be uniformly plump. This guarantees ample food for the young seedling. Shrunken shrivelled or angular kernels usually indicate immaturity and always result in less vigorous plants. A normally ripened and carefully stored plump seed usually produces a strong, vigorous seedling. Cut in proportion to the percentage and degree of shrunkenness.

(c) **Lustre**—The seed coat should be smooth, clear, clean and bright. A dull, faded, bleached appearance is associated with age or weathering; such seeds are slow and uneven in germination. Cut according to degree of injury from these causes.

3.—Purity—

(a) **Weed Seeds**—For obvious reasons samples should be free from weed seeds. These are undesirable, both from the point of view of weed control and their effect on the commercial value. Reject all samples containing wild oats. Cut five points for each false wild oat, three points for each seed of mustard, three points for each seed blue burr and cockle, one point for each seed of wild buckwheat, and relatively lighter for such seeds as lambs quarters and pigweed.

(b) **Disease**—Tagged wheat and smut balls are very objectionable both in seed wheat and commercial grain. Cut four points for the presence of each smut ball and one-half point for each tagged kernel.

(c) **Other Kinds of Grain**—Grains of oats, barley or rye in wheat represent a complete loss when less than 5%. Cut one point for each seed found.

(d) **Broken Grains, Dirt, Chaff, Etc.**—To the extent that useless impurities are present in grain it is lessened in seed value. Cut one point for each per cent. of such impurities.

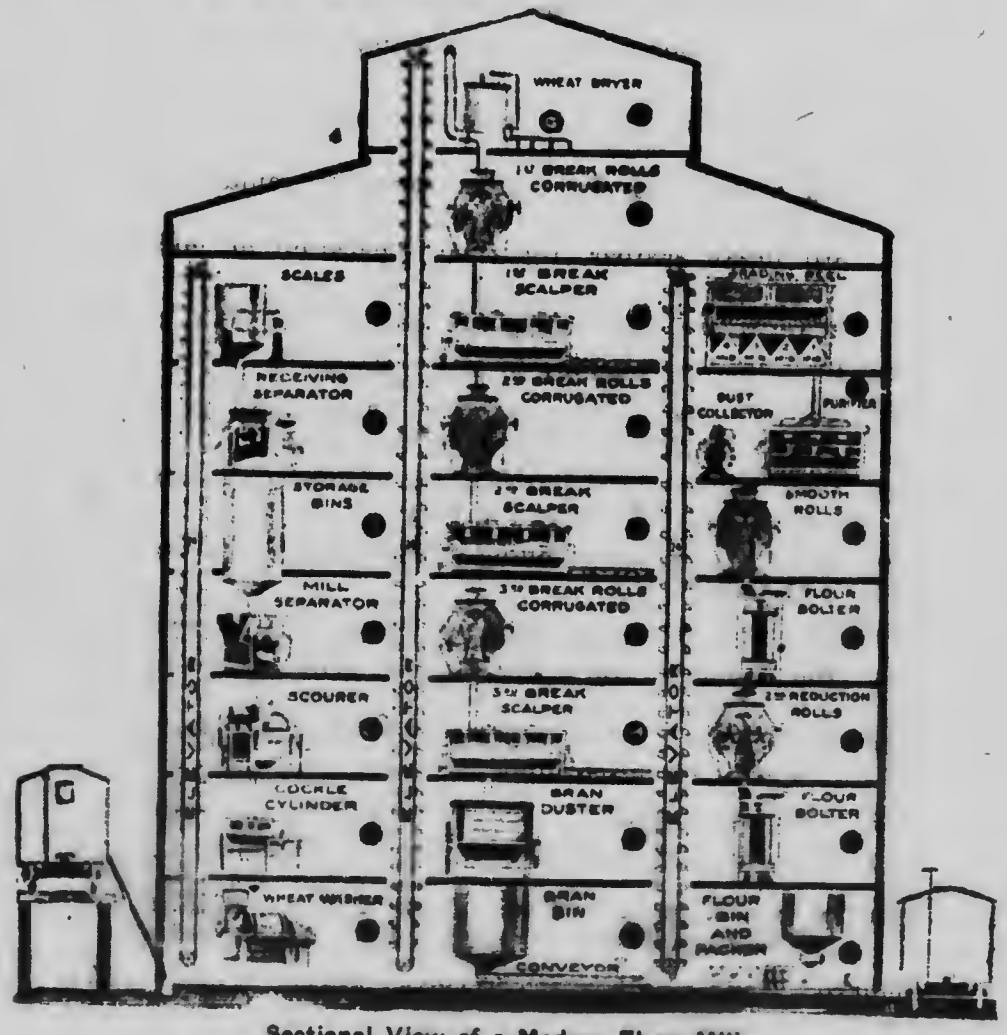
(e) **Trueness to Type**—A mixture of varieties is objectionable in seed grain as the crop from it invariably grades lower and generally yields less than from pure varieties. Cut one point for each different type of wheat found and one-quarter point for each seed of another variety of the same type.

THE MILLING OF WHEAT

(1) Scales, for weighing wheat as it is received.

(2) Receiving separator, for separating other kinds of seeds from wheat.

(3) Storage bins, for reserve supply of wheat in advance of mill requirements.



Sectional View of a Modern Flour Mill
Courtesy Washburn Crosby Milling Co.

(4) Mill separator, for further separating foreign seeds from wheat.

(5) Scourer, for removing dust from wheat kernels.

(6) Cockle cylinder, for removing all round seeds.

(7) Wheat washer, for thoroughly cleansing the wheat.

(8) Wheat dryer, for drying wheat after washing.

(9) 1st break rolls, for rupturing bran, enabling bran and germ to be separated from interior.

(10) 1st break scalper, for sifting middlings through bolting cloth to separate from bran.

(11) 2nd break rolls, for further loosening the middlings from bran.

(12) 2nd break scalper, for separating more middlings from bran.

(13) 3rd break rolls, for further loosening middlings from bran.

(14) 3rd break scalper, for final separation of middlings from bran.

(15) Bran duster, for dusting low grade flour from bran.

(16) Bran bin, for packing bran for shipment.

(17) Grading reel, for separating middlings by sifting through various sizes of bolting cloth.

(18) Dust collector and purifier, for cleaning and purifying middlings by air and sifting.

(19) Smooth rolls, for grinding purified middlings very fine to flour.

(20) Flour bolter, for sifting flour from purified middlings.

(21) 2nd reduction rolls, for further grinding of purified middlings.

(22) Flour bolter, for separating flour from purified middlings of second grading.

(23) Flour bin and packer, for packing flour for shipment.

(24) Elevator, for raising products to the various machines.

Relative Proportion of Different Parts of Wheat Seed to Total Weight (After Hunt, Quoting Bessey & Snyder)

Embryo	6-7%
Aleurone Layer	3-4%
Endosperm	82-86%
Seed covering or bran	5%

AVERAGE MILL PRODUCTS IN DIFFERENT GRADES OF WHEAT—1907-1914 incl.†

Grade.	Screenings.	Flour.	Bran.	Shorts.
No. 1	2.13	70.12	10.68	16.75
No. 2	3.19	69.20	12.41	15.43
No. 3	4.49	69.41	12.59	15.23
No. 4	6.14	66.34	13.18	17.04
Rejected	6.68	67.16	16.09	15.15

Showing Per Cent. of Mill Products Produced By Several Varieties—1907-1914 Incl.†

Variety.	Number of Samples	Percent Produced of Flour.	Bran.	Shorts.	Loaf Volume c. c.
Fife	75	69.60	12.35	15.60	2373
Bluestem	325	69.78	13.93	13.93	2419
Marquis *	26	71.04	15.15	14.73	2499
Velvet Chaff	59	67.11	12.80	17.27	2398
Winter Wheat	38	69.86	13.69	14.33	2295
Durum	127	69.01	8.76	19.14	2071

* 1913 and 1914 only.

† Bulletin No. 114 North Dakota Agr. College, Fargo.

Some Milling and Baking Characteristics of Different Types of Wheat and Grades of Flour*

	Dry Crude Gluten	Starch	Volume of Loaf (Cu. Ins.)	Weigh. of Loaf (ozs.)	Water Used (ozs.)	Dough per bbl. (lbs.)	Bread Yield per bbl. (lbs.)
Spring Wheat Flour							
First patent..	12.0	71.5	205	17.38	6.63	304	284
Standard pat.	12.3	70.8	206	17.44	6.69	305	285
Straight	12.3	70.4	206	17.44	6.69	305	285
First clear...	13.9	65.9	181	17.25	6.38	300	282
Graham ..... (whole grain)	13.1	59.8	168	17.50	6.50	302	286
Hard Winter Wheat Flour							
First patent..	11.8	71.6	196	17.25	6.56	303	282
Standard pat.	12.1	71.2	196	17.31	6.56	303	283
Straight	12.2	70.9	194	17.31	6.63	304	283
First clear...	13.8	66.1	161	17.38	6.44	301	284
Graham ..... (whole grain)	12.6	59.2	149	17.56	6.56	303	287

*Courtesy Howard wheat and flour testing laboratories, Minneapolis

	Dry Crude Gluten	Starch	Volume of Loaf (Cu. Ins.)	Weight of Loaf (ozs.)	Water Used (ozs.)	Dough per bbl. (lbs.)	Bread Yield per bbl. (lbs.)
Soft Winter Wheat Flour							
First patent..	9.2	75.0	168	17.25	6.44	301	282
Standard pat.	9.2	74.6	169	17.31	6.50	302	283
Straight	9.4	74.2	172	17.31	6.50	302	283
First clear...	11.0	69.4	138	17.50	6.56	303	286
Graham ..... (whole grain)	9.8	63.8	96	17.50	6.44	301	286
Pacific Coast Wheat Flour							
First patent..	9.3	76.4	163	17.56	7.00	310	287
Standard pat.	9.5	75.3	164	17.63	7.00	310	288
Straight	9.5	75.0	160	17.63	7.00	310	288
First clear...	9.6	72.0	115	17.94	6.75	306	293
Graham ..... (whole grain)	9.7	66.9	100	18.00	6.75	306	294
Spring Durum Flour							
First patent..	11.5	70.9	154	17.31	6.38	300	283
Standard pat.	11.6	70.0	151	17.31	6.38	300	283
Straight	11.9	69.5	151	17.38	6.44	301	284
First clear...	13.1	63.5	98	17.63	6.56	303	288
Graham	13.3	60.2	140	17.63	6.69	305	288
Rye Flour							
Patent (white)..		70.3	61	17.44	6.63	304	285
Straight (med.).		68.8	58	17.44	6.63	304	285
Dark rye.....		64.0	47	17.56	6.75	306	287
Graham (meal)..		60.8	50	17.56	6.75	306	287
Straight Flour							
Spring wheat.	12.3	70.4	206	17.44	6.69	305	285
Hard winter.	12.2	70.9	194	17.31	6.63	304	283
Soft winter...	9.4	74.2	172	17.31	6.50	302	283
Pacific coast..	9.5	75.0	160	17.63	7.00	310	288
Spring durum.	11.9	69.5	151	1738	6.44	301	284
*Marquis	14.3	...	200	17.87	[illegible]	312	290
*Red Fife....	14.7	...	193	17.88	7.17	313	292
*Taylor's Wdr.	12.3	...	199	17.44	6.53	307	284
*Kubanka ...	14.1	...	181	17.98	7.27	314	293
*Pioneer	15.7	...	192	17.94	7.16	313	293
*Prelude	17.8	...	195	18.00	7.28	315	294
*Buffum No. 17 (winter wheat.)	14.2	...	175	17.46	6.71	306	285

* Saskatchewan grown.

THE GRADING OF WHEAT

Wheat Grades As Defined in Canada Grain Act

"Grades Generally"

(See Section 107 Below.)

Qualities of Grain—105. The grades of grain shall be as stated in this section:

Spring Wheat—No. 1 spring wheat shall be sound and clean, weighing not less than 60 pounds to the bushel.

No. 2 spring wheat shall be sound and reasonably clean, weighing not less than 58 pounds to the bushel.

No. 3 spring wheat shall comprise all sound wheat not good enough to grade as No. 2, weighing not less than 56 pounds to the bushel.

Rejected spring wheat shall comprise all spring wheat fit for warehousing, but too low in weight or otherwise unfit to be graded as No. 3.

Goose Wheat—No. 1 goose wheat shall be plump and clean, weighing not less than 61 pounds to the bushel.

No. 2 goose wheat shall be plump and reasonably clean, weighing not less than 59 pounds to the bushel.

No. 3 goose wheat shall comprise such as is not good enough to be graded No. 2, reasonably clean and weighing not less than 55 pounds to the bushel.

Winter Wheat—Extra white winter wheat shall be pure white winter wheat, sound, plump and clean, weighing not less than 62 pounds to the bushel.

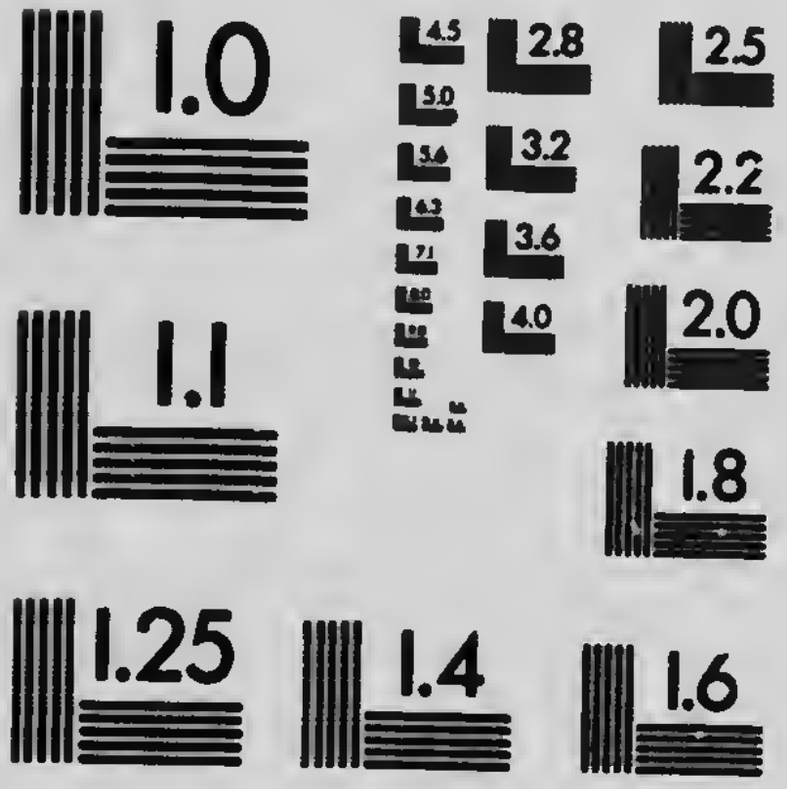
No. 1 white winter wheat shall be pure white winter wheat, sound, plump and clean, weighing not less than 60 pounds to the bushel.

No. 2 white winter wheat shall be white winter wheat, sound and reasonably clean, weighing not less than 58 pounds to the bushel.

No. 1 red winter wheat shall be pure red winter wheat, sound, plump and clean, weighing not less than 62 pounds to the bushel.

MICROCOPY RESOLUTION TEST CHART

(ANSI and ISO TEST CHART No. 2)



APPLIED IMAGE Inc
1653 East Main Street
Rochester, New York 14609 USA
(716) 482 - 0300 - Phone
(716) 288 - 5989 - Fax

No. 2 red winter wheat shall be red winter wheat, sound and reasonably clean, weighing not less than 60 pounds to the bushel.

No. 1 mixed winter wheat shall be white and red winter wheat mixed, sound, plump and clean, weighing not less than 61 pounds to the bushel.

No. 2 mixed winter wheat shall be white and red winter wheat mixed, sound, plump and clean, weighing not less than 59 pounds to the bushel.

No. 3 winter wheat shall include winter wheat not clean and plump enough to be graded No. 2, weighing not less than 57 pounds to the bushel.

No Established Grade. 106. "No established grade" shall include all grain not classified in the foregoing grades in Western Inspection Division.

107. The grades mentioned in this section apply only to grain grown in the Western Inspection division and in respect of the several kinds of grain specified shall so apply to the exclusion of the grades defined in the last two preceding sections.

Spring Wheat—No. 1 Manitoba hard wheat shall be sound and well cleaned, weighing not less than 60 pounds to the bushel, and shall be composed of at least seventy-five per cent. of hard red Fife* wheat.

No. 1 hard white Fife wheat shall be sound and well cleaned, weighing not less than 60 pounds to the bushel, and shall be composed of not less than sixty per cent. of hard white Fife wheat, and shall not contain more than twenty-five per cent .of soft wheat.

No. 1 Manotoba northern wheat shall be sound and well cleaned, weighing not less than 60 pounds to the bushel, and shall be composed of at least 60 per cent. of hard red Fife* wheat.

No. 2 Manitoba northern wheat shall be sound and reasonably clean, of good milling qualities and fit for warehousing, weighing not less than 58 pounds to the bushel, and shall be composed of at least forty-five per cent. of hard red Fife* wheat.

Any wheat not good enough to be graded as No. 2 Manitoba northern shall be graded No. 3 Manitoba northern at the discretion of the inspector.

*Recently amended to include Marquis.

No. 1 wheat rejected for smut and scoured shall be graded as scoured of the grade to which it belongs.

No. 2 wheat rejected for smut and scoured shall be graded as scoured of the grade to which it belongs.

No. 3 wheat and lower grades rejected for smut and scoured shall be graded as scoured of the grade to which it belongs: Provided that wheat which is inspected No. 3 northern scoured, or lower, may be graded in such regular grade, not higher than No. 3, as the inspector determines.

No. 1 wheat inspected as "no grade" for moisture and dried shall be graded as dried of the grade to which it belongs.

No. 2 wheat inspected as "no grade" for moisture and dried shall be graded as dried to the grade to which it belongs: Provided that on the written order of the owner any No. 1 dried or No. 2 dried wheat may be graded as No. 3 northern.

No. 3 wheat and lower grades inspected as "no grade" for moisture and dried shall be graded as dried of the grade to which it belongs: Provided that wheat which is inspected No. 3 northern dried, or lower, may be graded in such regular grade, not higher than No. 3 northern, as the inspector determines.

Winter Wheat—No. 1 Alberta red winter wheat shall be hard, pure red winter wheat, sound and clean, weighing not less than 62 pounds to the bushel.

No. 2 Alberta red winter wheat shall be hard red winter wheat, sound and clean, weighing not less than 60 pounds to the bushel.

No. 3 Alberta red winter wheat shall include hard red winter wheat not clean enough or sound enough to be graded No. 2, weighing not less than 57 pounds to the bushel.

No. 1 Alberta white winter wheat shall be pure white winter wheat, sound and clean, weighing not less than 60 pounds to the bushel.

No. 2 Alberta white winter wheat shall be white winter wheat, sound and clean, and weighing not less than 58 pounds to the bushel.

No. 3 Alberta white winter wheat shall include white winter wheat not clean enough nor sound enough to be graded as No. 2, weighing not less than 56 pounds to the bushel.

No. 1 Alberta mixed winter wheat shall be red and white winter wheat mixed, sound, plump and clean, weighing not less than 61 pounds to the bushel, and containing not less than 50 per cent. red winter wheat.

No. 2 Alberta mixed winter wheat shall be red and white winter wheat mixed, sound, plump, clean, weighing not less than 59 pounds to the bushel.

All Grain

"No Grade" Grain. 115. All good grain that has an excessive moisture, being tough, damp or wet or otherwise unfit for warehousing, shall be entered on the inspecting officer's books as "no grade," with his notations as to quality and condition.

Condemned. 2. All grain that is in a heating condition or is badly binburnt whatsoever grade it might otherwise be, shall be reported and entered upon the inspecting officer's books as "condemned" with the inspector's notations as to quality and condition.

Rejected. 3. All grain that is unsound, musty, dirty, smutty or sprouted, or that contains a large admixture of other kinds of grain, seeds or wild oats, or from any other cause is unfit to be classed under any of the recognized grades, shall be classed as "rejected," with the inspector's notations as to quality and condition.

Weight. 4. All grain shall be weighed and the weight per bushel recorded in the inspecting officer's book.

Scoured Grain. 5. No grain that has been subject to scouring or treatment by the use of lime or sulphur shall be graded higher than No. 3.

Weight. 116. In the inspection of grain the weight shall not alone determine the grade.

Inspector's Reasons. 117. All inspecting officers shall make their reasons for grading grain, when necessary, fully known by notations on their book.

Commercial Grades

Commercial Grades Established. 47. If a considerable portion of the crop of wheat or any other grain for any one year in any division has any marked characteristics which exclude it, to the prejudice of the producer, from the grade to which it otherwise belongs, special grades, may be established therefor in the manner hereinafter provided, and shall be called and known as commercial grades.

Selection of Grades

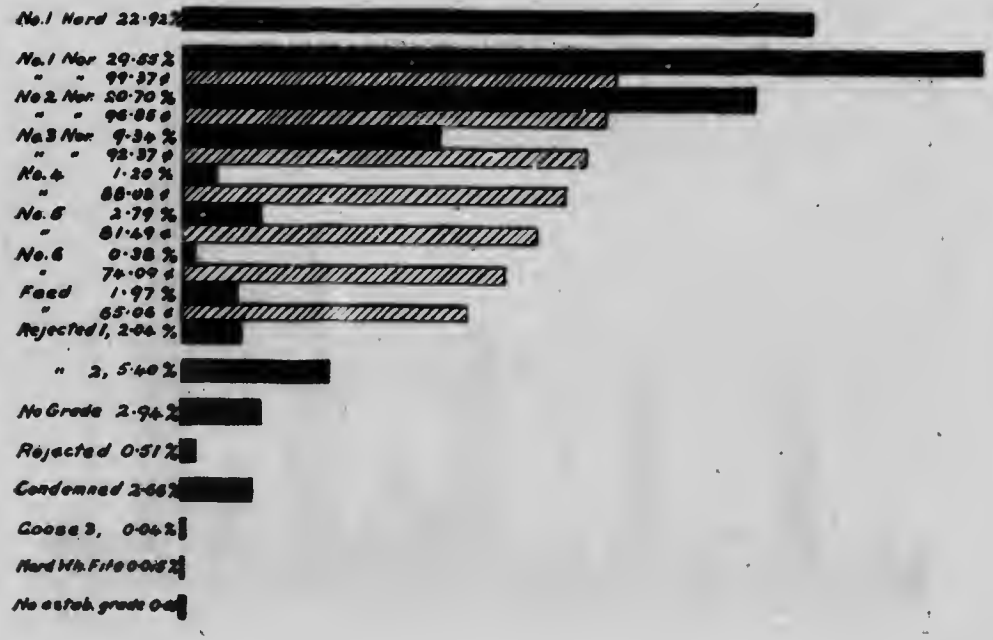
Commercial Grades—How Selected. 87. Should the climate or other conditions result in the production of a considerable proportion of grain, other than oats, not capable of being included in the classification provided for in this Act, the grain

standards board for the division shall be convened for the selection of commercial grades and samples whenever the chairman of the said board is notified by the chief inspector or five members of the said board that such a course is necessary.

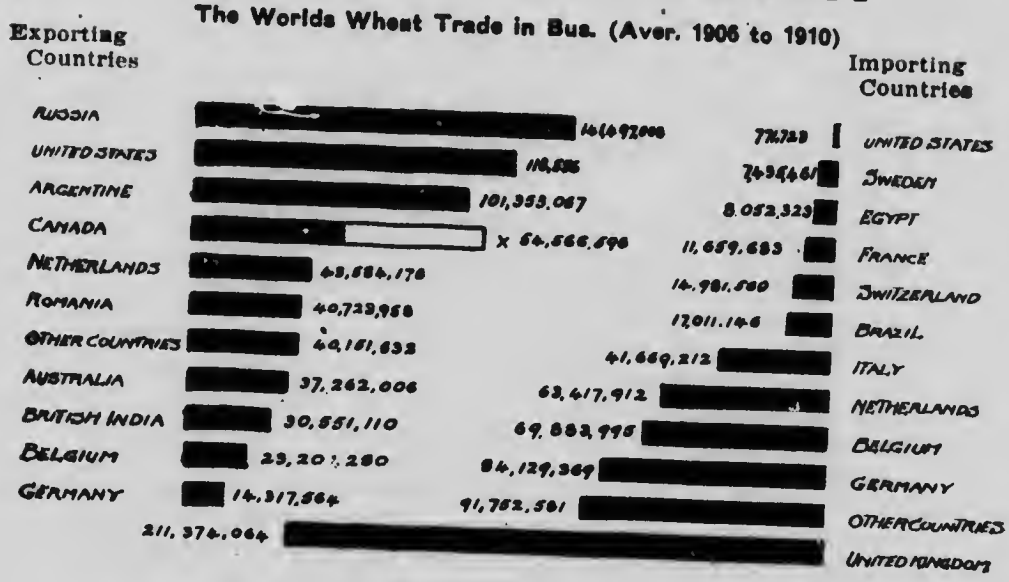
Their Use. 2. Inspecting officers shall grade all classes of grain which cannot be graded according to this Act, in accordance with the commercial samples so selected by the board.

Further Selections By a Committee of the Board. 88. In case the lateness of harvesting or climatic conditions prevent the procuring of proper and representative samples of any quantity of grain of the crop of that year in time for the purposes of inspection thereof and action thereon at any meeting of the grain standards board convened for the purpose of selecting commercial grades, the board at such meeting may authorize a committee of such number of its members as it may appoint to meet at a later date and to select such further commercial grades and samples as the character of the samples so procured may require; and the commercial grades and samples so selected by such committee shall be deemed, for all purposes of inspection and grading, to have been chosen by the full board.

Average grades and prices of the Western Canadian Wheat that passed inspection at Ft. William.
(Grades average—1909 to 1915—Prices average 1908 to 1914)

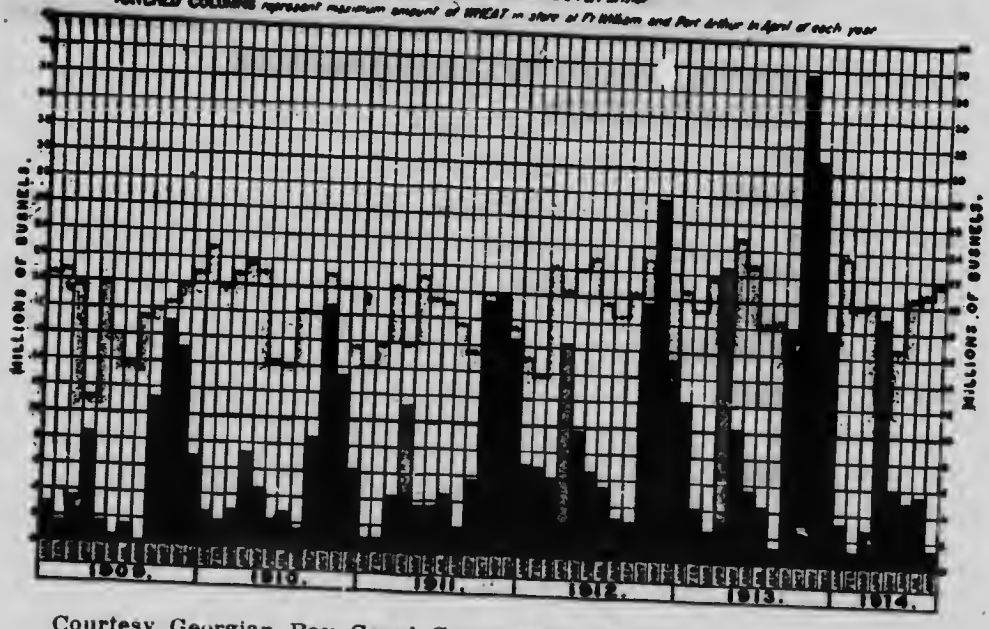


THE TRADE IN WHEAT



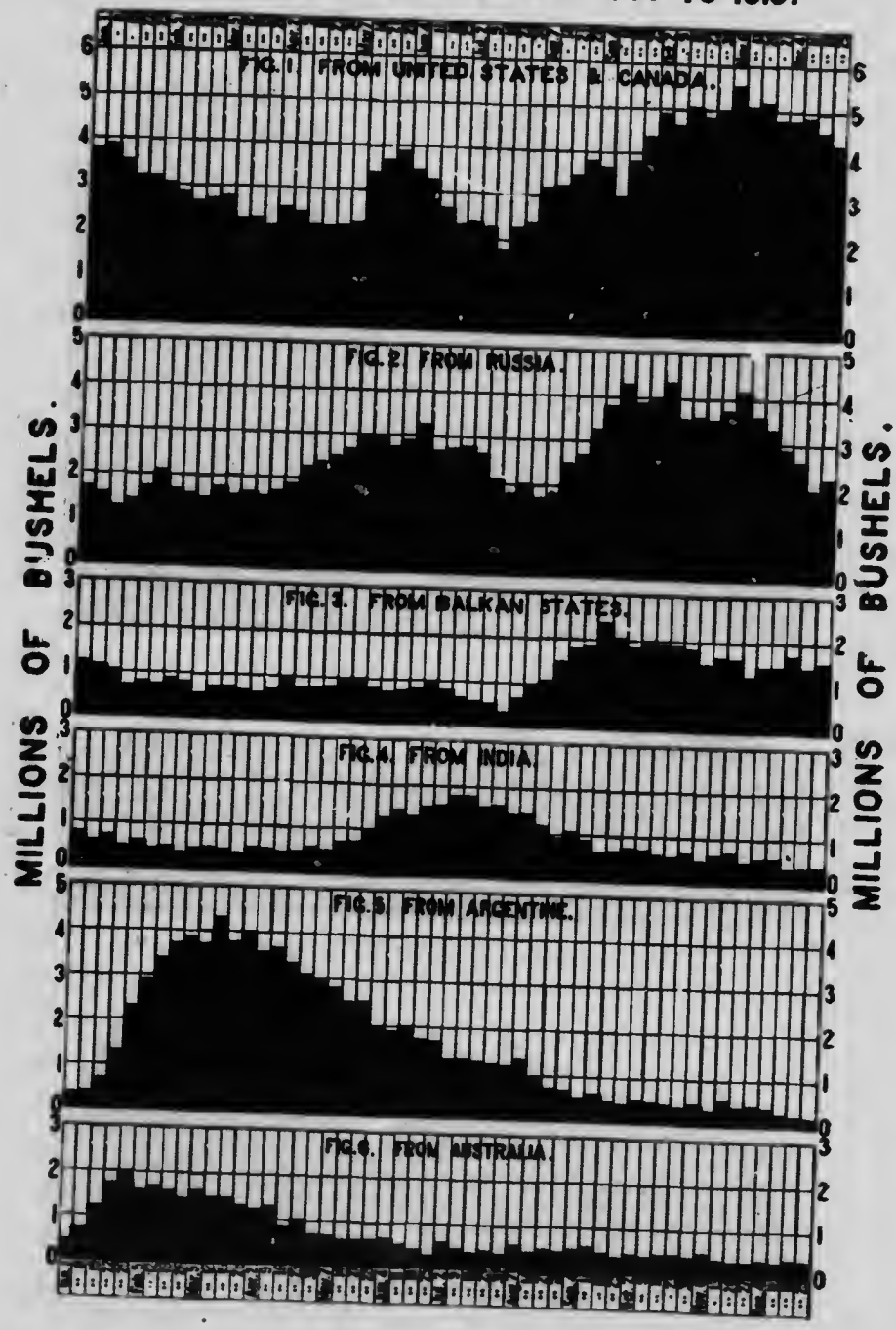
COMPARISON BETWEEN
TOTAL SHIPMENTS OF WHEAT AND FLOUR TO UNITED KINGDOM FROM ALL COUNTRIES.
AND
QUANTITIES OF WHEAT MARKETED AT FT. WILLIAM & PORT ARTHUR.

DOTTED LINE represents world's shipments of WHEAT and FLOUR to United Kingdom
SOLID BLACK represents monthly receipts of WHEAT at Ft William and Port Arthur
HATCHED COLUMNS represent maximum amount of WHEAT in store at Ft William and Port Arthur in April of each year



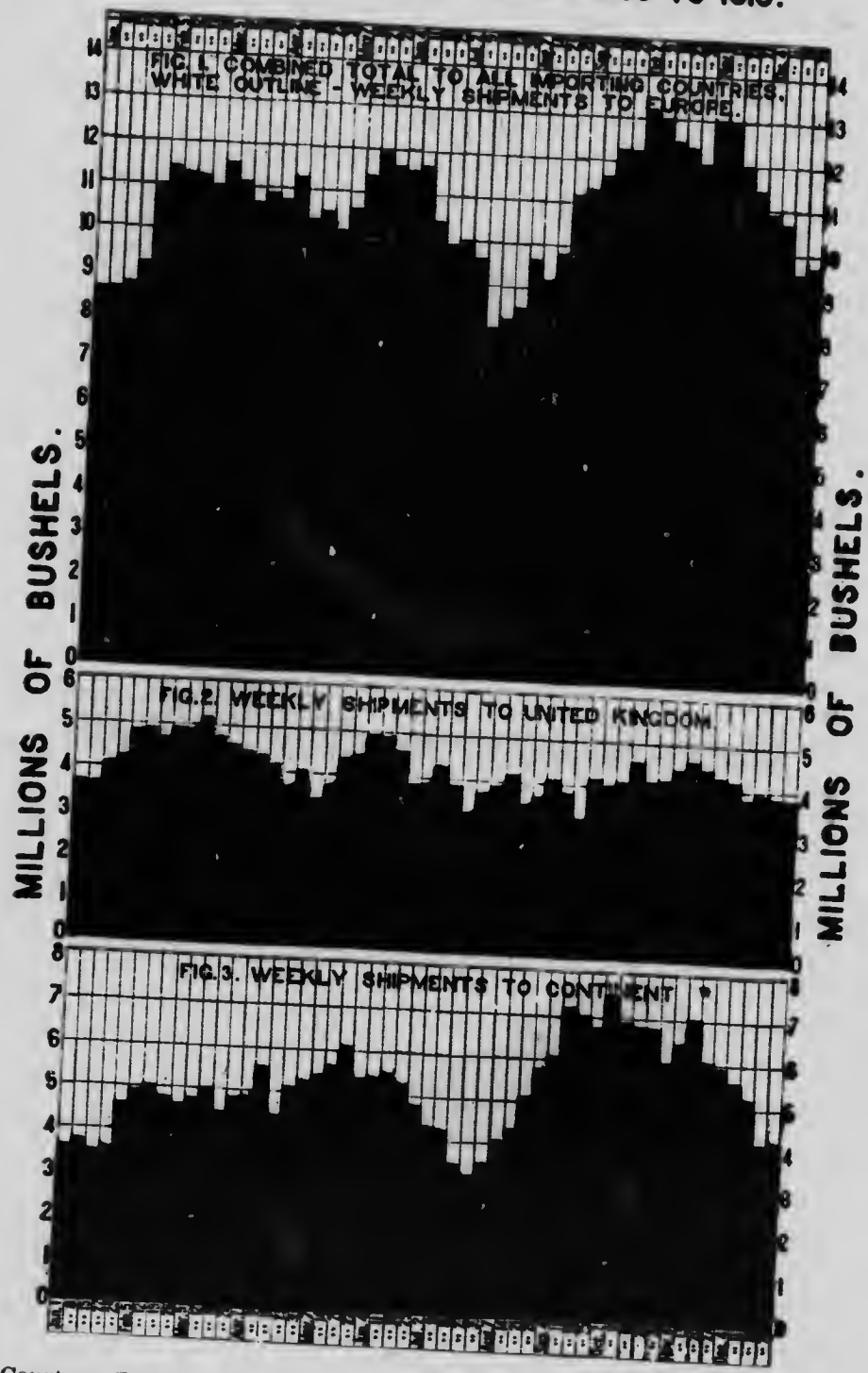
Courtesy Georgian Bay Canal Commission—Sanford Evans, Chairman.

WEEKLY SHIPMENTS OF WHEAT AND FLOUR
SHOWING QUANTITIES FROM CHIEF EXPORTING COUNTRIES AVERAGED FOR 9 YEARS. 1905 TO 1913.



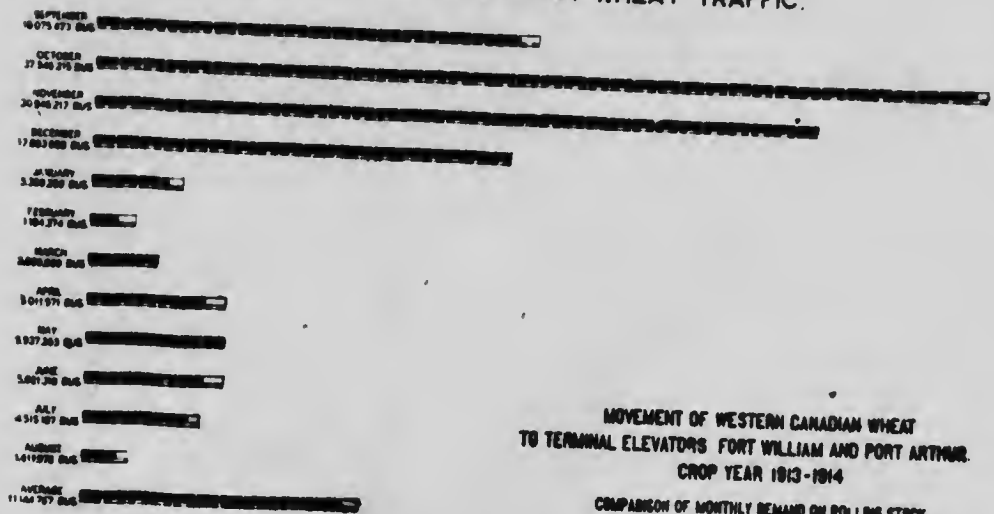
Courtesy Georgian Bay Canal Commission—Sanford Evans, Chairman.

WEEKLY SHIPMENTS OF WHEAT AND FLOUR
AVERAGED FOR 9 YEARS, 1905 TO 1913.



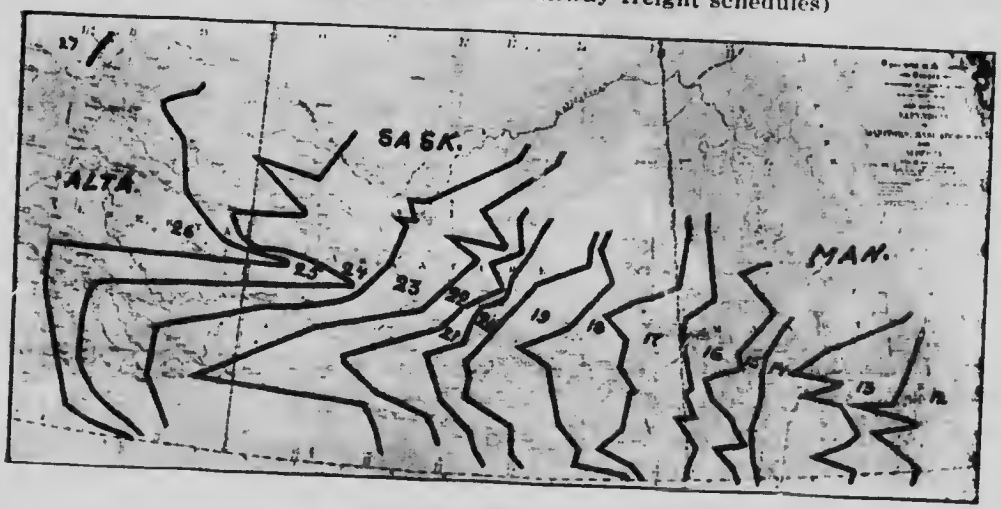
Courtesy Georgian Bay Canal Commission—Sanford Evans, Chairman.

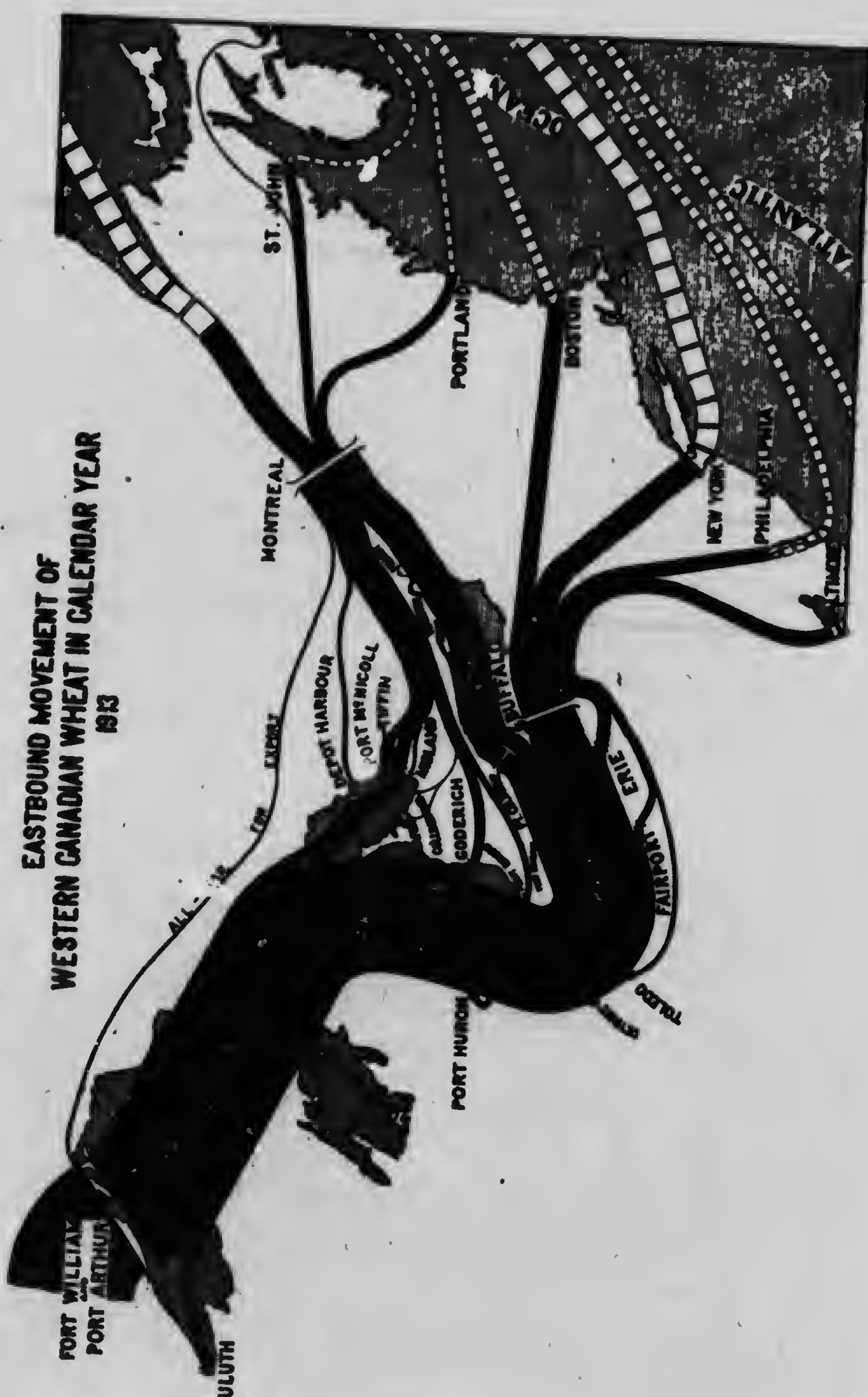
FREIGHT CARS ENGAGED IN WHEAT TRAFFIC.



Courtesy Georgian Bay Canal Commission—Sanford Evans, Chairman.

Freight rates on wheat from points in Western Canada to Head of Lakes in cts. for 100 lbs.
(Constructed from railway freight schedules)





Courtesy Georgian Bay Canal Commission—Sanford Evans, Chairman.

Average Freight Rates from Head of Lakes to Montreal

(Summarized from Georgian Bay Canal Commission Report.)

1909	
1910	4 2-3c
1911	4 1-4c
1912	5 1-10c
	5 4-5c

Ocean freight rates on wheat from ports named to United Kingdom. (Cents per bushel. Average for six years ending 1914.)

(From Georgian Bay Canal Commission Report.)

	New York.	Odessa.	Karachi.	River Plate Down River.	Sailer Australia
1909	3.485	4.340	9.487	6.105	14,428
1910	3.947	5,786	10.854	5.658	15.815
1911	3.288	5.180	10.239	5.001	14.152
1912	7.593	7.809	14.761	13.528	19.033
1913	5.611	7.142	12.177	10.327	20.747
1914	8.757	4.504	9.721	10.542	14.350
Average	5.447	5.797	11.206	8.526	16.420

Average Ocean Freight Rates by Months on Heavy Grain Between Montreal and Liverpool—1909 to 1914

(From Saskatchewan Grain Market Commission Report.)

	1909.	1910.	1911.	1912.	1913.	1914.
May	4.750	3.375	3.937	6.000	8.625	4.312
June	3.375	3.438	3.937	6.750	8.250	5.250
July	2.625	2.937	3.937	6.375	8.625	6.000
August	3.562	2.437	4.500	6.375	7.125	6.000
Sept	5.250	3.187	5.250	6.187	6.750	7.312
October	5.250	4.500	5.156	10.125	7.125	7.875
Nov	5.625	4.312	5.437	10.125	7.500	11.812
Total	25.737	24.186	32.154	51.937	54.000	48.561
Average	3.677	3.455	4.593	7.419	7.728	6.936

Does It Pay the Farmer to Hold His Wheat?*

	Average price per bushel, Wpg., 1907 to 1914.	Cost of Holding. Extra Handling Per Bus.	Storage and Insurance, Per Bus.	Interest Per Bushel.	Waste and Shrinkage. Per Bus.	Total Cost of Handling	Rel. Net Price.	Net Gain Over Dec. Price Cts. Per Bus.
September...	98	..	..	..	..	..	98	9
October.....	96	¼	½	½	¼	1½	94½	5½
November....	93	¼	1	1	½	2¾	90¼	1¼
December....	93	¼	1½	1½	¾	4	89	00
January.....	95	¼	2	2	1	5¼	89¾	¾
February.....	97	¼	2½	2½	1¼	6½	90½	1½
March.....	99	¼	3	3	1½	7¾	91¼	2¼
April.....	100	¼	3½	3½	1¾	9	91	2
May.....	102	¼	4	4	2	10¼	91¾	2¾
June.....	103	¼	4½	4½	2	11¼	91¾	2¾
July.....	105	¼	5	5	2	12¼	92¾	3¾
August.....	103	¼	5½	5½	2	13¼	89¾	¾

* As answered by the average of "high" and "low" monthly prices at Winnipeg for the years 1907 to 1914, less the cost of holding.

NOTES ON SHIPPING GRAIN

How to Get Your Car

1. Under the Canada Grain Act, a Car Order Book must be kept at every shipping point where there is a station agent.

2. When you want a car, see the station agent and sign your name in the Order Book, tell the agent what size of car you want and where you want it placed.

3. When it comes near your turn, watch the book closely, so that you will not lose your car. If you live some distance from the station, perhaps you can arrange for someone who lives close by to warn you, and then let you know when your car has arrived.

4. You must, when told that your car is placed, declare your intention to load, or the car may be given to someone else.

5. No persons, either elevator company or farmer, can have more than one unfilled order on the book at one time.

6. An agent cannot refuse to allow your name to go on the Order Book if you have grain to ship.

7. Cars must be supplied to shippers in the order in which the names appear on the Order Book.

8. If the car supplied for you is not the size you ordered, you can refuse it and demand the first one that comes of the required size.

Rules for the Loading of Cars

1. Examine the cars carefully for leaks.

2. Close the small end doors and fasten them; do not simply close them. Then see that they are tight.

3. If there are grain lines painted on the inside of the car, load as nearly as possible to the lines. If there are none, ascertain the capacity of the car, as given on the outside of the car, and load that amount as nearly as possible. The capacity of the car in cubic feet can be obtained by multiplying the length by the breadth and again multiplying the result arrived at in this way by height of the grain line above the floor. The approximate capacity in bushels of wheat can be obtained by multiplying the product so obtained by 8 and dividing by 10.

4. If possible, have all grain weighed before loading, and carefully preserve the scale tickets in case any difficulty in settling claims with the railway companies for shortages should arise.

5. The grain should be loaded level in the car, for if, as the result of the tendency of the grain to level off in transit, the average height of the grain in the car is higher than the grain doors, there will necessarily be some leakage. It is always desirable to have the average level of the grain a few inches below the height of the grain doors.

6. The grain doors should be fastened tightly and securely. The shipper should exercise great care in seeing that all the car doors are carefully sealed by the railway agent, and in case of cars shipped from stations at which the railway company has no agent, the cars should be sealed by the conductor.

7. The time allowed for loading a car is 24 hours from the time the car is placed at the disposal of the shipper. A

charge of $1 per day is made for each day used after the 24 hours have expired. Thus, if you detain the car three days for loading, a charge of $2 will be made. This amount is simply added to the freight charges, and is paid at Fort William or Port Arthur.

8. Freight must be paid on the full stencilled capacity allotted to the car. The maximum weight of a carload should not be more than 10 per cent. in excess of the stencilled capacity. If the maximum weight is exceeded, the car may be stopped en route and the overload removed at the expense of the shipper and the amount of the overload shipped to destination at the less-than-carload rate.

9. It never pays a shipper to load a poor quality of grain at the bottom of the car and a better quality on top with the expectation of having his grain graded by the higher standard. The grade given will invariably be that of the poorest grain in the car, as the Government Inspector has no other recourse in a case of this kind, Sec. 34 of Chapter 27 of the Canada Grain Act reading as follows: "No inspecting officer shall in any case make the grade of any lot of grain inspected by him above that of the poorest quality found therein."

The Shipping Bill

After having applied to your local railroad agent for a car, and having received and loaded it, examine the shipping bill which you receive from the agent to assure yourself as to the following points:

1. That the car number is correct.

2. That the capacity of the car and the number of bushels loaded are correctly stated.

3. That the name of the station from which despatched and the date appear in the proper space.

4. That the car is consigned to the order of yourself, your bank, or your grain dealers at Fort William if on the C.P.R. or G.T.R., or at Port Arthur if on the C.N.R. The same instructions as to shipping to order will apply if it is desired to consign the grain to the care of the railroad elevators at either of these points.

5. That the agent's signature appears at the bottom in the proper place. Where there are no grain lines on the car, have the agent make the following notation over his own signature: "No grain lines on this car." This may be found of value in cases of dispute with the railway companies by reason of improperly loaded cars.

Be sure and get the shipping bill signed by the railroad agent as soon as the car is loaded. In case of fire or accident the company is not responsible unless the shipping bill is signed.

It is also desirable that the shipping bill should contain instructions to advise the shipper's representative at Winnipeg. This will enable the commission merchant looking after the shipment to look carefully after the grading, as the Inspector's certificate will be sent to the representative. A letter should also be sent the commission merchant who is to look after the grain, giving him full instructions as to how the shipment is to be handled and to whom the returns are to be made.

Elevator Charges

No storage is charged the shipper on grain unloaded into any of the terminal elevators at Fort William or Port Arthur for the first ten days the grain is in store, but after that time storage is charged on the net number of bushels unloaded from the car at 1-30c per bushel per day, which is equal to practically 1c per bushel per month.

The other charges for handling grain at the terminal elevators are as follows:

On Grain carrying a return of other grain of commercial value (such as flax cleaned from wheat) for first separation, computed on gross weight of car, an additional charge of one cent (1c.) per bushel; for each subsequent separation, computed on balance for separation, a further charge of one cent (1c.) per bushel.

On Wheat carrying a return of screenings, an additional cleaning charge of one-half cent (½c) per bushel.

On Tough Grain, drying, one-half cent (½c) per bushel.

On Damp or Wet Grain, drying, four cents (4c) per bushel.

On Bulkheads, for their removal and other additional expense in handling and unloading cars, $3.00 for each bulkhead.

Wheat Screenings

On Wheat, carrying a dockage of 5 per cent. or more after deducting 1 ½per cent. of the gross weight for waste, a return will be made for the balance of the screenings. No other returns for screenings will be made.

Allowance for Invisible Loss and Shrinkage

On all Grain received deduction from the gross weight to cover invisible loss and shrinkage in handling will be made as follows:

On Wheat	30 lbs. per car
On Flax	28 lbs. per car
On Oats	50 lbs. per car
On Barley	50 lbs. per car

Dockage

In all cases where a price is given "on track" the shipper pays the freight on the dockage, if any. For instance, if the wheat is not clean, and the Government inspection and weight shows 10 bushels dockage or 1 per cent. on a 1,000 bushel car, the freight on 10 bushels or 600 pounds would have to be paid by the shipper, and would be dedueted from the proceeds of the grain by the purchaser.

RULES AND REGULATIONS FOR COUNTRY ELEVATORS Issued By the Board of Grain Commissioners For Canada for the Year Ending August 31, 1917

Subject to the capacity of the elevator and the nature of the construction, all grain tendered must be taken into store upon the following terms and conditions, and under the provisions of the Canada Grain Act. 1912.

Maximum Rates

Receiving, elevating, spouting, insurance against fire, storing for the first fifteen days and putting into cars on track. No elevator shall charge more than one and three-quarter cents per bushel. Storage not otherwise provided, including insurance against fire for each succeeding day after the first fifteen days shall not exceed one-thirtieth of one cent per bushel.

Shrinkage for Stored Grain

No elevator shall take more than one-half of one per cent. to take care of shrinkage and waste in handling, storing and transmitting the grain to a terminal.

No elevator shall take more than one per cent. shrinkage on tough, damp and wet grain.

Shrinkage on Cash Grain

On street grain no elevator shall take a greater dockage than that shown by a proper test over a number ten sieve, except where grain contains foreign grain or seeds which cannot be taken out by a number ten sieve.

Dockage

No elevator shall take a greater dockage than that shown by a proper test over a number ten sieve, except where grain contains foreign grain or seeds which cannot be taken out by a number ten sieve.

Every elevator must be equipped with the necessary sieves and scales for making proper tests, and the elevator operator must make the tests in the presence of the owner of the grain when requested.

General

When tough, damp or wet grain is taken into store it shall be at the owner's risk, and the elevator operator shall have the right to ship it immediately to a terminal elevator for treatment.

The owner shall have the right to name the terminal elevator to which it shall be shipped.

Rules and Regulations for Country Elevators

1. In shipping or delivering any grain stored in a country elevator, the net weight on the ticket or tickets shall be final; unless an investigation by the Board of Grain Commissioners shows reason for the contrary. The shipper to be paid in case of short shipment up to the amount of his or her ticket or tickets for the full billing capacity of the car at the same price as the car was disposed of.

2. All shipping bills for grain shipped through an elevator shall be made out by the elevator agent, and he shall advise such parties as the owner may instruct.

3. The elevator owner shall, on all grain shipped through the elevator, have the right to retain and hold the shipping bill until he receives a guarantee from the owner of the grain, another elevator owner, a licensed commission firm or individual, or any one else that the car may be sold to, that they make proper adjustment as to the weight and grade. Upon receipt of storage tickets and lawful charges, the elevator owner shall deliver either the shipping bill to the party presenting the ticket or tickets, or a terminal warehouse receipt for the full amount of the grain called for in the ticket or tickets presented, up to the full carload.

4. The owner of grain in an elevator wishing such grain shipped to any point other than a terminal point, or where Government weights cannot be obtain, the owner of the grain must then accept the elevator weights at the shipping point as final, unless the owner of the grain proves the shipping weights are not correct. Provided, however, that the owner of the grain can always demand an affidavit as to the actual grain shipped or delivered from the elevator operator and receiver of said grain respectively.

5. "No owner or operator of a country elevator or warehouse shall sell, assign, mortgage, pledge or hypothecate any

grain stored in such elevator or warehouse, for which graded storage tickets or 'subject to grade and dockage' tickets or special bin tickets have been issued, and the owner or operator may be required by the Board to produce at any time proper registered warehouse receipts or bills of lading for such grain as has been shipped from the country elevator or warehouse, and for which there is still outstanding graded storage tickets or 'subject to grade and dockage' tickets or special bin tickets."

Rules and Regulations for Storing Grain in Country Elevators Where There is Disagreement as to Grade and Dockage

1. The ticket or tickets issued under and by virtue of these rules and regulations must have incorporated therein at the time of issue, the grade offered by the elevator owner or operator to the owner of the grain, and the following words: "Subject to Inspector's Grade and Dockage."

2. The owner of the grain can only demand the quantity that the storage ticket or tickets call for.

3. In case there is a dispute as to the weighing accuracy of the receiving scales, it shall be incumbent upon the owner of the elevator to prove that the scales are weighing accurately.

4. A proper sample must be drawn from each wagon load by the elevator operator at the time of delivery, in the presence of the party delivering same, and such sample must be drawn satisfactorily to both the deliverer and the operator.

5. Such sample must be placed in a receptacle satisfactory to the owner of the grain.

6. After the grain is delivered the sample drawn must be properly mixed in the receptacle in which it has been placed. The owner and the elevator operator shall then take out of the quantity mixed at least three pounds, and place it in a receptacle which must be numbered and sealed, and so made that it can be securely locked. The receptacle shall be supplied by the elevator owner, and secured by a padlock. The lock shall be provided by the owner of the grain, and he shall retain possession of the key. The receptacle and key shall thereupon be immediately forwarded to the Chief Inspector of Grain, Winnipeg, Man., all charges prepaid. After receiving the inspector's certificate, showing grade and dockage, the operating agent shall issue a storage ticket, showing grade and dockage, as given by the chief inspector, for the full amount

of grain taken into store, and shall deliver to the owner at his request, in not less than carload lots, on track or at a terminal point, the grade and quantity the storage tickets call for, after the owner has surrendered the storage receipts and paid or tendered all lawful charges against said grain.

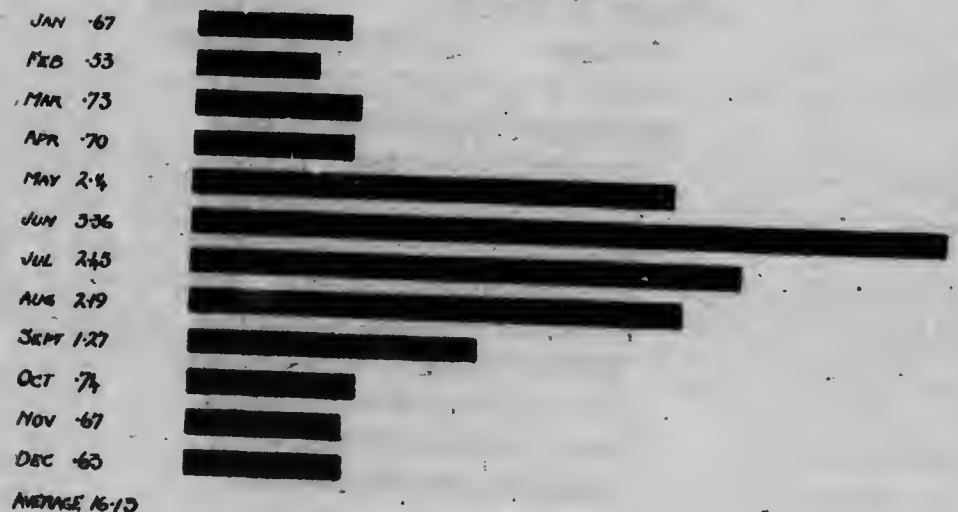
7. The owner of the elevator shall, in all cases where grain is taken into store under the foregoing conditions, guarantee the grade and weight as specified in the storage ticket or tickets.

8. At the time of delivery of any grain where a ticket of this kind is being used, and it is agreed upon by the owner of the grain and the elevator operator that the grain is tough, damp or wet, and the elevator operator marks such ticket or tickets, "Out of condition, tough, damp or wet," then whatever grade such sample may receive from the chief inspector it will still grade "Tough, damp or wet."

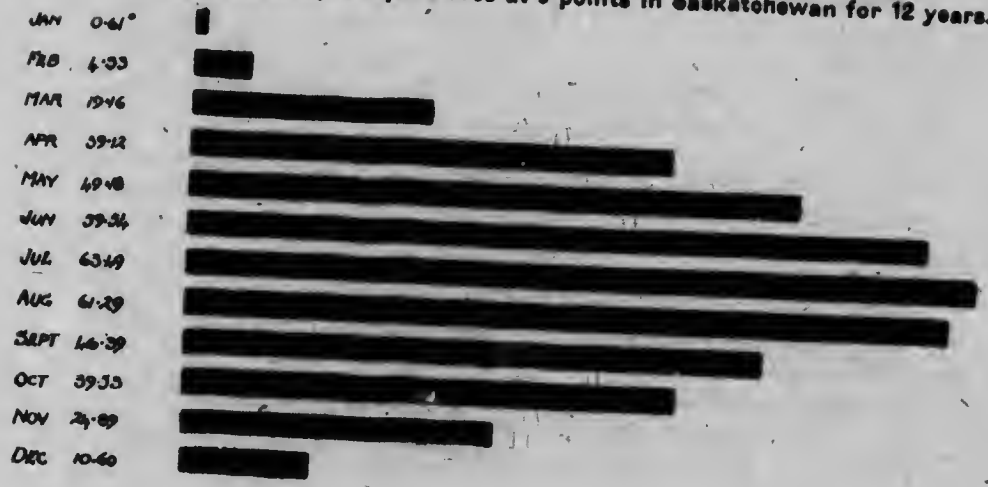
9. If the elevator operator fails at any time to draw and preserve such samples in the manner stated, in the case of dispute the onus will be on the elevator operator to prove the proper grade, and not on the owner of the grain.

The Climate of Saskatchewan

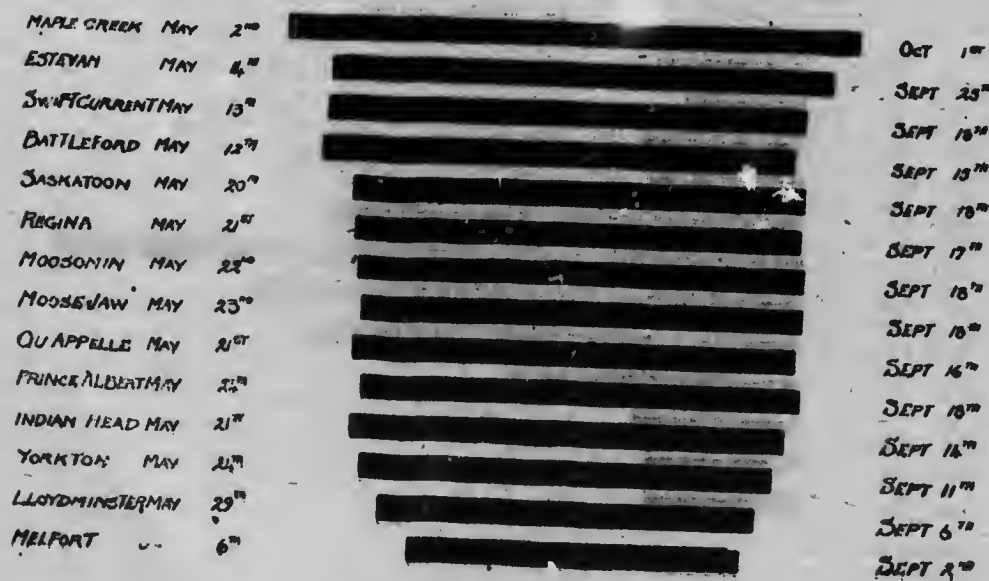
Average monthly Precipitation at nine points in Saskatchewan for eleven years.



Average monthly temperatures at 9 points in Saskatchewan for 12 years.



Average date of last spring frost of 3 degrees and first fall frost of 3 degrees with number of days between at different points in Province.
(Summarised from data supplied by the Dominion Meterological Service. Average for years 1904 to 1915 incl.)



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