DOMINION OF CANADA
DEPARTMENT OF AGRICULTURE
DOMINION EXPERIMENTAL FARMS

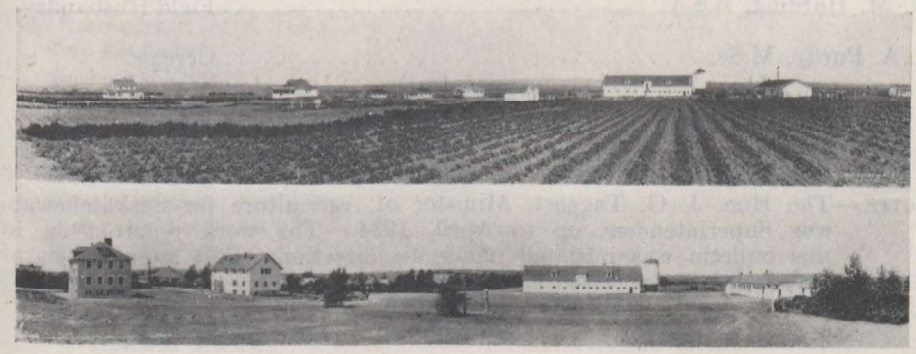
EXPERIMENTAL STATION

SWIFT CURRENT, SASK.

RESULTS OF EXPERIMENTS

1931 - 1936 INCLUSIVE

L. B. THOMSON, B.Sc.
Superintendent



Photograph of Station 1924 above and 1936 below

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NOTES.—The Hon. J. G. Taggart, Minister of Agriculture for Saskatchewan, was Superintendent up to April, 1934. The work reported on in this bulletin was initiated under his direction. Full appreciation of his services is expressed at this time.

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RESULTS OF EXPERIMENTS, 1931-36

INTRODUCTION

Previous to 1931 reports from this station were published annually. Since that time the experimental data have been analysed each year, and mimeographed circulars have been issued from time to time. In order to present a more complete analysis of the experimental work conducted, this report is published. Although it is concerned mainly with the data obtained during the past five years, all available results have been considered in arriving at conclusions. An endeavour has been made to avoid too much detail in order to present the results in as brief a form as possible.

Many inquiries are received from farmers on a variety of subjects relating to farm problems. In addition, information is needed by the agricultural extension worker for use in field work. Consequently, this report has been prepared to be of assistance to both the farmer and agricultural representative in southwestern Saskatchewan.

The soil on the Swift Current Experimental Station comes under the general classification of loam and varies from light loam to heavy clay loam. Two soil series (Haverhill and Cypress), which are predominant in a large portion of the grain-growing area of Southwestern Saskatchewan, are represented. Results obtained at this station will need to be modified where different soil types occur.

CLIMATE

Climate has long been recognized as one of the major influences in determining the type of agriculture followed in any particular region. This is no less true in Southwestern Saskatchewan than elsewhere. Here the components of the climate most generally regarded as limiting factors are precipitation and available moisture.

Wide seasonal variations in climate, involving the frequent occurrence of years of low precipitation, make crop production particularly hazardous and necessitate the application of suitable cultural practices together with the use of well-adapted crops and varieties. Local variations in climate, producing marked differences within a distance of a few miles, add to the complexity of a situation already complicated by the influences of diverse soil types and topographical irregularities.

However, a study of meterological records over a period of years does give some indication of the type of season common to southwestern Saskatchewan and, therefore, is of value. Climatic data have been recorded at the Dominion Meteorological Station in the city of Swift Current since 1886 and by the Experimental Station since its inception in 1922. These records, combined, give a fairly complete conception of the climate of this district.

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METEOROLOGICAL OBSERVATIONS

TABLE 1.—SUMMARY OF METEOROLOGICAL OBSERVATIONS

—	—	April	May	June	July	Aug.
Mean temperature	14 yr. average	39·5	51·9	59·2	66·0	61·9
	6 yr. average	40·2	54·5	61·0	67·4	62·1
Sunshine—hours daily	14 yr. average	6·8	7·7	7·8	9·7	8·1
	6 yr. average	7·2	8·2	8·2	10·5	8·3
Evaporation—inches	14 yr. average	.....	5·77	5·82	7·32	6·23
	6 yr. average	.....	6·63	6·36	8·12	6·63
Wind—miles per hour	14 yr. average	.....	9·0	7·7	6·2	6·1
	6 yr. average	.....	9·1	7·8	6·2	6·2
Rainfall—inches	14 yr. average	0·89	1·67	3·24	2·31	2·06
	6 yr. average	0·85	1·07	3·18	2·22	2·41

14 year average—1923 to 1936 inclusive.
6 year average—1931 to 1936 inclusive.

TEMPERATURE

Some idea of the temperature variations during the growing season can be obtained from Table 1. With the exception of 1930 when the average temperature was 0·9° higher for August than for July, July has been the hottest month in each year. The highest and lowest temperatures recorded in each of these months were as follows:—

—	High	Low
April	82°, April 27, 1934	−6°, April 6, 1929
May	97°, May 27, 1936	8°, May 5, 1929
June	102°, June 16, 1933	27°, June 1, 1936
July	103°, July 17, 1936	35°, July 5, 1934
August	100°, August 31, 1929	26°, August 22, 1928

It is worthy of note that, August excepted, the record high temperatures for each month have been experienced during the past four years.

SUNSHINE

The average number of hours of daily sunshine follows the same general trend as the temperatures, being highest in July, with August, June, May and April following in the order named. The highest figures have all been obtained in the past four years and are as follows:—

April, 1934 ..... 8·9 hours per day
May, 1936 ..... 10·5 hours per day
June, 1933 ..... 10·1 hours per day
July, 1933 ..... 12·3 hours per day
August, 1933 .... 9·1 hours per day

EVAPORATION

The evaporation for the various months follows the same general trend as the mean temperature and sunshine, the highest occurring in July.

WIND

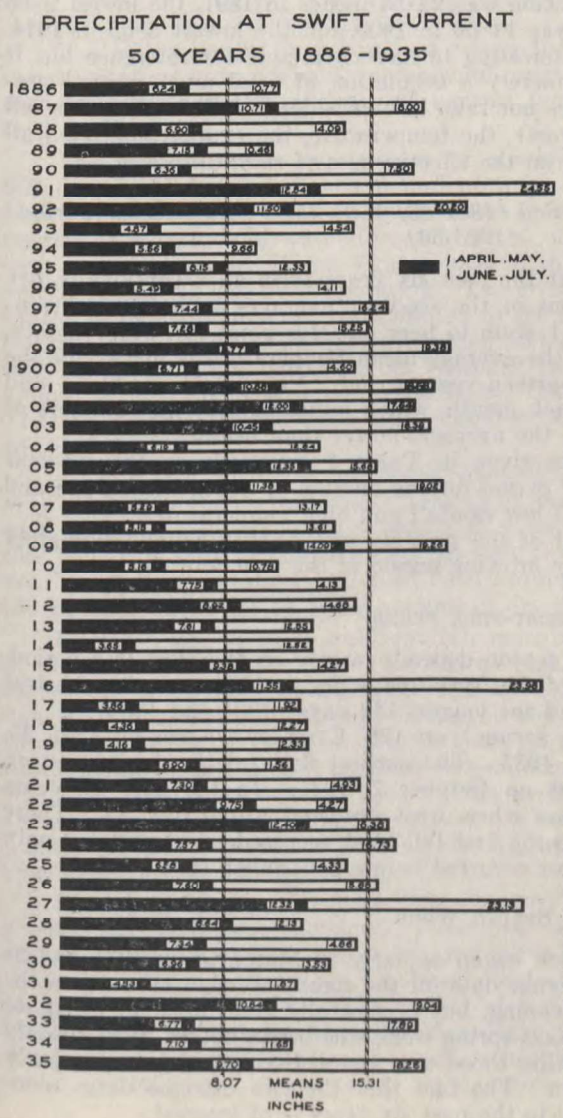
During the past six years soil drifting has been recognized as a serious problem in southwestern Saskatchewan. It has been evident that the worst drifting takes place in the spring, due largely to the fact that the highest winds

occur during that time. Figures on wind velocity in Table 1 illustrate this fact. The highest average velocity occurred in May with a progressive reduction in June and July. August remained about the same as July. Records for wind velocity in April have been kept for 1935 and 1936 only, but these indicate that the average velocity in April is not as high as in May.

An analysis of winds made by the Dominion Meteorological Service shows that during drought years the prevailing winds at Swift Current are from the northwest and southeast, but that in summer there is a tendency for winds from due south to predominate.

PRECIPITATION

Plate 1 shows the precipitation at Swift Current over a fifty-year period. The total bar for each year indicates that year's precipitation, the actual amount in inches being printed in at the end of the bar. The black portion indicates the seasonal precipitation (April, May, June and July), and the actual amount in inches has been inserted in that portion. Precipitation is the total inches of rainfall, plus the total inches of snowfall divided by ten.



This chart shows that precipitation does not run in cycles as is sometimes supposed.

In years where the seasonal average is above normal there has been a better than average crop (1915, 1916 (rusted), 1923, 1927, 1928, 1932 and 1935). The years which have had higher than average seasonal rainfall together with good fall moisture in the preceding year have been the exceptionally good years (1915, 1928). These observations do not hold in every case because there are so many other factors which have an effect on crops, but in the majority of cases they do apply and are worthy of note.

Twenty of the fifty years had higher than the average of 15·31 inches of precipitation while 30 years had lower than that average. Similarly, regarding seasonal precipitation, 20 of the years were above the average of 8·07 inches and 30 were below. This merely indicates that there were more years of abnormally high precipitation than there were abnormally dry ones. As

these comparatively wet years (1891, 1892, 1916, 1927) do not do as much good as a comparatively dry year does harm, part of their influence could be ignored in seeking an average. The normal could then be considered at a lower figure than the actual average indicates. In the dry climate of southwestern Saskatchewan it is the subnormal years which are the most important because they immediately present problems of drought.

If the highest 25 years are grouped together and the lowest 25 are also grouped, it is found that the dividing line between these groups is approximately 14·50 inches. In other words, there are 25 years with higher than 14·50 inches of precipitation and 25 with lower than 14·50. Arranging the seasonal precipitation in the same manner it is found that approximately 7·33 inches is the middle point. These two figures give a truer indication of normal precipitation than do the actual averages.

The highest annual precipitation was 24·55 inches in 1891, the lowest 9·66 in 1894. The highest seasonal was 14·09 in 1909 and the lowest 3·65 in 1914.

A chart of this nature is interesting to have available for reference but it must be remembered that it is merely a tabulation of total and seasonal precipitation, year by year, and does not take into consideration how the rains fell (whether in light or heavy showers), the temperature, the evaporation, etc., all of which have a distinct bearing on the effectiveness of rainfall.

Comparison of the Six-Year Period (1931-36) With the Fourteen-Year Period (1923-36)

It is generally conceded that the past six years form an exceptionally dry period in this area. Comparisons of the six-year averages with the fourteen-year averages, as made in Table 1, seem to bear out this point. In every month, from April to August inclusive, the average mean temperature is higher for the six-year period than for the fourteen-year period. Figures for sunshine and evaporation are also higher in each month, which indicates that the summers of the past six years have been, on the average, hotter than usual.

The average rainfall figures given in Table 1 are lower in the six-year period than in the fourteen-year period for the months of April, May, June and July, indicating a combination of low rainfall and high temperatures.

The average growing period of the past six years has been approximately six days shorter than the average growing period of the past fourteen years.

FROST-FREE PERIOD

The effective length of any season depends largely on the frost-free period. In this area the average length of the frost-free period is 125 days: the shortest period being 101 days (1930) and the longest 142 days (1931 and 1933).

The earliest date of the last spring frost (28° F. or lower) was on April 25, 1934, and the latest on June 3, 1935. The earliest first fall frost occurred on August 22, 1928, and the latest on October 7, 1931. In the past 14 years there have been only three years when frost occurred after May 22. There have been only three years when the first fall frost occurred in August and only four years when the first fall frost occurred before September 11.

Spring Work

At Swift Current spring work began as early as March 21 in 1931 and as late as April 27 in 1936. An average date for the commencement of work on the land, consequently, has little meaning, but is generally considered to be about April 15. During the past 14 years spring work was begun before April 10 only on two occasions, so that, omitting those two years, the spread between early and late seasons is just 17 days. The fact that the two extreme dates mentioned above have both occurred in the past six years is of interest.

Wheat seeding generally begins about one week later than the beginning of preliminary work. In one case (1931) seeding commenced one month later due to snow and cold weather.

Start of Wheat Cutting

The earliest date on which wheat has been harvested was July 27, 1936. The latest date was August 29, 1927. In only two of the past 14 years has cutting begun in July, and the usual time to begin cutting is around August 10. It is interesting to note that in 1936 work on the land began the latest in the fourteen-year period, while cutting started earliest; which shows the shortest growing season on record.

SOIL MOISTURE INVESTIGATIONS

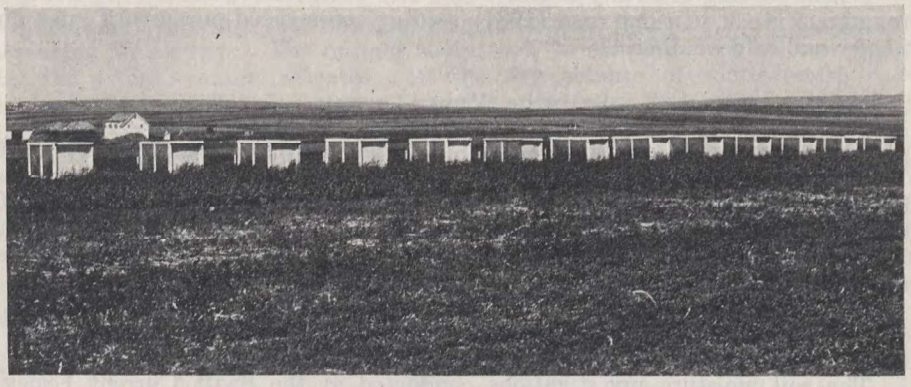
The soil moisture investigations conducted at the Swift Current Experimental Station have yielded valuable information as to the amount of water used by crops and the influence of various factors on the storage of moisture in the soil.

The average water requirement of a wheat crop on summer-fallow was 507 pounds of water for each pound of total crop, or 1,438 pounds for each pound of grain. The wheat crops grown on stubble land during the same period required 766 pounds of water for each pound of total crop, or 2,295 pounds for each pound of grain. These figures include the water transpired by the crop and lost from the soil by evaporation. The greater efficiency in the use of water by the summer-fallow crop is attributed to the larger reserve of moisture in the soil at seeding time. Such moisture is not subject to as great a loss by evaporation as the moisture derived from seasonal rainfall. The stubble crops were almost entirely dependent on the seasonal rainfall for their moisture supply. The other cereals crops have approximately the same water requirement as wheat.

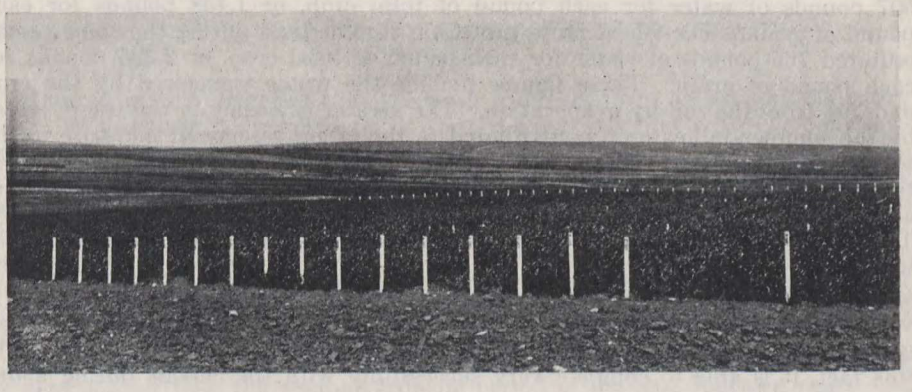
Experiments with various weeds have shown that the Russian thistle is very efficient in the use of water. This plant will produce a pound of dry matter with about 60 per cent as much water as is required by the cereals. Owing to this fact, it is able to compete very successfully with the cereals during a dry year. Tumbling mustard and stinkweed require over twice as much water as the Russian thistle for an equal amount of dry matter.

During years of subnormal rainfall more water is required for each unit of dry matter than in years of normal or high rainfall. When the rainfall is light there is a greater proportional loss by evaporation, as a rainfall of one-quarter inch and sometimes more falling on dry ground may be lost by evaporation within a few days. The crop receives no appreciable benefit from such a rain and the reserve of soil moisture is not increased. In all the experiments it was found that the crop had used all the available moisture by harvest time. In many cases all the available moisture is used up at an early stage in the plants' life and the crop is so severely injured that it does not fully recover even when additional rains occur.

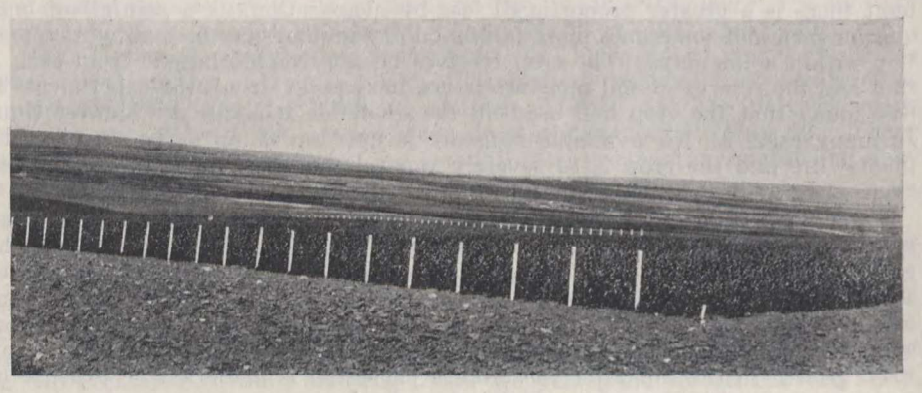
Summer-fallowing is practised for the twofold purpose of controlling weed growth and storing soil moisture. These two factors are closely related, as the growth of weeds, whether before or after ploughing, tends to materially reduce the soil moisture. (Evidence has been previously presented as to the amount of water used by weeds.) The period of moisture storage in summer-fallow extends from the harvest of the previous crop to the sowing of the next. Any weed growth in the fall after the crop is harvested is made at the expense of moisture that might be conserved for the next crop.



Experimental Plots—for sawfly infestation experiments.



Plots—Vernalization studies with cereals.



Cereal Plots—Studying drought resistant varieties of wheat.

It has been found that by the best methods of summer-fallowing from 21 to 42 per cent of the precipitation can be stored in the soil, but this necessitates complete prevention of weed growth and loss by run-off, and requires that the soil be kept in the best condition to facilitate rapid percolation of rainfall.

Early ploughing of the summer-fallow is beneficial if weed growth has not been kept down. When the weed growth is controlled by cultivation the time of ploughing has very little effect on the amount of moisture stored in the soil. There is evidence to show that cultivation can conserve as much moisture as ploughing. Of particular importance is the prevention of weed growth in the fall after the crop is harvested because it has been found that as much as 50 per cent of the total moisture stored may be accumulated from the after-harvest rains. In the fall, too, there is a better chance for the water to percolate into the soil to a depth where it will not be subject to loss by surface evaporation.

Early fall or late spring snows add to the moisture reserve. However, very little water enters the soil from snow thawing while the ground is frozen. The run-off is generally considered as lost moisture, though it may accumulate in a low area and then enter the soil.

The major object in summer-fallowing is to keep down weed growth from the time the previous crop is harvested until the next crop is planted. The methods employed must be designed to prevent soil drifting as much as possible. Weeds, such as Russian thistle, stinkweed, tumbling mustard and wild oats, also reduce very substantially the crop yield when allowed to grow with the grain, in that they consume large quantities of water which would be ordinarily used for crop production.

In a series of experiments where comparisons were made of the yield of crops, free of weeds and mixed with weeds, it was found that the weeds reduced the grain yield from 25 to 50 per cent.

While it is not possible for a farmer to keep his field perfectly free of weeds, he should keep in mind that every weed in his cropped land is using moisture that should have been used by a more valuable crop. If the moisture used in weed production were used for the production of grain, the returns from the cultivated lands would be much greater.

CEREALS

Cereal crops take a predominant and vital place in the agriculture of southwestern Saskatchewan. Wheat alone has, over a twenty-year period (1913-33), produced annually a marketable surplus per farm, in Crop Districts 3 and 4 averaging $1,294* and $1,180* respectively. In these two districts some 5¼ million acres are devoted to the growing of cereal crops each year and of this total about 4 million acres are in wheat. From 1923 to 1933, inclusive, Crop Districts 3 and 4 produced an annual average of approximately 62† million bushels of wheat, while the average production for the province was 214† million bushels.

Cereals are important not only for their marketable value as grain but also for their value as feed crops. Cereals provide the most dependable supply of hay and fodder that can be produced in this area, and the greater part of the oats and barley grown is used for sheaf feed, hay, and feed grain. Wheat has been used as an emergency hay crop in years of deficient rainfall, and as such has filled a very serious need. Fall and spring rye have also been called upon to contribute to the supply of feed and, when cut in the dough stage, make good hay.

* Figures supplied by the Saskatchewan Bureau of Statistics.
†Report of the Saskatchewan Bureau of Statistics.

In view of the importance of cereals in the area served by the Dominion Experimental Station at Swift Current a great deal of attention has been devoted to them. Variety tests and a program of cereal improvement by selection and breeding have been carried out to obtain the best varieties for the district. Tests of varieties have been conducted on summer-fallow in replicated rod-row tests since 1926. Such tests have included wheat, oats, barley, flax, spring rye, fall rye, peas, and beans.

The following report presents descriptions and brief discussions of the more satisfactory varieties, based on the results of these tests.

Spring Wheat Varieties

Numerous named varieties of wheat as well as large numbers of unnamed selections and introductions have been grown and tested. These fall into two general classes, the common or bread wheats and the durum wheats. In this report only the more outstanding varieties will be considered. In all cases Marquis wheat was used as a check variety and will be used for purposes of comparison in the discussion of varieties.

COMMON WHEATS

Marquis-Ottawa 15 (C.A.N. 1396) has a beardless head with short tip awns and smooth, white chaff, stiff straw of medium length and hard red kernels. It is medium early, holds its seed well and is susceptible to stem rust. Marquis wheat is high in yield and very high in milling and baking quality, having been taken as the standard of quality for our highest grades for years. Marquis is the most widely grown variety of spring wheat in Saskatchewan and will probably retain a leading position in southwestern Saskatchewan for some time to come.

Reliance (C.A.N. 1498) is a bearded wheat with white smooth chaff and hard red kernels. It matures at the same time as Marquis, is approximately an inch shorter and almost equals Marquis in straw strength. Over an eight-year period Reliance has yielded 116·9 per cent of Marquis, averaging 4·1 bushels per acre more than the check variety. Reliance is higher than Marquis in weight per bushel and in percentage yield of flour but slightly lower in percentage protein and in baking strength.* The flour is slightly yellower than that of Marquis. Reliance is recommended for growing in southwestern Saskatchewan.

Ceres (C.A.N.1263) is very similar to Reliance wheat in appearance, having bearded heads, smooth white chaff and being about one inch shorter than Marquis. Ceres is slightly earlier than Marquis, is almost equal in straw strength and has yielded 109·1 per cent of Marquis for the years grown. Ceres exceeds Marquis slightly in weight per bushel and is equal to it in milling and baking quality. Ceres is more resistant to stem rust than Marquis.

Komar (N.D. 1656-84) (C.A.N. 1724) originated from the same cross (Kota x Marquis) as Ceres and differs from Ceres in having slightly shorter beaks on the chaff and greater resistance to stem rust. Komar matures at the same time as Marquis, is equal to Ceres in straw strength and height and yielded 110·3 per cent of Marquis at this station, the average difference in yield being 2·4 bushels.

Early Triumph (C.A.N. 1291) is totally bald, has smooth white chaff and a fairly dense oblong head. It is slightly lower than Marquis in baking strength. At Swift Current it has yielded 104·3 per cent of Marquis, is slightly shorter, 2·4 days earlier and weighs less per bushel than Marquis.

* Handbook of Canadian Spring Wheat Varieties—L. H. Newman *et al.*

Supreme (C.A.N. 1543) is also totally bald and has smooth white chaff. Its kernels are medium in size, hard and dark red. The average yield of Supreme for nine years equals that of Marquis. It has the same weight per bushel, is slightly earlier and slightly shorter than Marquis. In baking strength it compares favourably with the check variety.

Red Bobs No. 222 (C.A.N. 1637) is a re-selection from Early Triumph and cannot be distinguished from it. It is very similar to Early Triumph in milling and baking quality, is equal to Marquis in bushel weight and is slightly earlier. Red Bobs No. 222 is about an inch shorter than Marquis and has yielded 98·1 per cent of Marquis over an eight-year period.

Garnet Ottawa 652 (C.A.N. 1316) is an early variety with a lax head carrying short tip awns and smooth white glumes. It is not suited to southwestern Saskatchewan conditions, yielding only 92·7 per cent of Marquis, being lower in bushel weight and in milling and baking quality. Garnet shatters very easily.

Reward Ottawa 928 (C.A.N. 509) is another early variety which has yielded even less than Garnet at Swift Current. It is higher than Marquis in weight per bushel, protein content and baking strength, and may be suited to small local areas on the Cypress plateau.

STEM RUST RESISTANT VARIETIES

Thatcher (Minn. 2302) (C.A.N. 1820) is a newly introduced variety developed at the University of Minnesota which is moderately resistant to black stem rust. It has been tested at Swift Current for two years and has given an average yield 106·8 per cent of that of Marquis. In bushel weight, size and plumpness of kernel it is inferior to Marquis and is somewhat dull in colour.

Apex (C.A.N. 1857) is a moderately rust resistant variety developed at the University of Saskatchewan from the cross (H.-44-24 x D.C.) x Marquis. At Swift Current it is intermediate between Thatcher and Marquis for yield. It is almost equal to Marquis in height, weight per measured bushel and matures about the same time.

Renown (C.A.N. 1856) was produced at the Dominion Rust Research Laboratory, Winnipeg, from H.-44-24 x Marquis. It is moderately rust resistant and has greater bushel weight and plumper seed than the other rust resistant varieties. In height and yield it is slightly inferior to Marquis.

Stem rust is not as serious a problem in southwestern Saskatchewan as elsewhere, but on low land, particularly in the eastern part of this area, losses do occur occasionally. In consideration of the probability that more suitable rust resistant varieties will soon be made available, the general introduction of the above varieties is not advised.

DURUM WHEATS

The durum wheats have sometimes been considered to be more resistant to drought than the common wheats. Results of yield tests carried on over a period of eleven years fail to demonstrate their superiority in this respect. Several varieties have outyielded Marquis wheat at Swift Current but other varieties of common wheat have even more significantly outyielded the check variety.

In resistance to damage by wheat stem sawfly the durums are superior to common wheats and might be grown to advantage on land heavily infested with wheat stem sawfly.

Only four varieties of durum wheat are considered in this report. These are Golden Ball, Pelissier, Mindum, and Kubanka.

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Golden Ball (C.A.N. 1314) has an oblong fusiform head with long black awns and white, hairy chaff. It is slightly shorter than Marquis, matures about three days later, and is less susceptible to wheat stem sawfly injury. For the three years Golden Ball has been under test it has yielded 117·6 per cent of Marquis with an average yield of 20 bushels per acre. For the same years Pelissier averaged 17·9 bushels per acre and Mindum 17·3 bushels. Golden Ball is lower in quality than the other durum varieties listed above.

Pelissier (Peliss) (C.A.N. 1461) differs from Golden Ball in having a broadly fusiform head and smooth white chaff. Like Golden Ball, it has long black awns. Tested for seven years, Pelissier has outyielded the better-known variety Mindum in all but two years and averaged 103·9 per cent of Marquis. It is slightly weaker in the straw than Marquis, 3·6 days later and some 2 inches taller. Recent selections from this variety appear even more promising than the original variety.

Mindum (C.A.N. 1418) has smooth yellowish or brownish chaff and awns of the same colour. It is two days later than Marquis, approximately 4 inches taller and has averaged 101·2 per cent of Marquis in yield. Mindum is generally taken as the standard for quality in durum wheats.

Kubanka (C.A.N. 1366) is similar to Mindum in appearance but has wider chaff and a denser head. Grown for one year longer than Mindum at Swift Current, its average yield is the same but compares less favourably with the Marquis check. Kubanka is also approximately one day later than Mindum.

Oat Varieties

Tests of oat varieties conducted at the Dominion Experimental Station, Swift Current, have included numerous varieties and diverse types. During the past few years all but the white-seeded varieties have been discarded and those retained have been, for the most part, open panicled.

The varieties Banner and Victory have been and still are the leading varieties of oats. However, other varieties are very promising and may partially replace them in the near future. Selected lines from the cross Alaska x Gold Rain developed at the Central Experimental Farm are particularly promising but have only received preliminary tests up to the present. The selection and development of the best lines from those under test should result in a decided improvement in our oat crop. In the meantime varieties that have been under test for a longer period of time should be considered.

Banner Ottawa 49 (C.A.N. 342) has open panicles and white kernels. It is a mid-season oat, tall, high in yield and generally recommended for growing in the greater part of Saskatchewan.

Victory (C.A.N. 426) is also a white mid-season oat very similar to Banner in time of maturity, height, straw strength and yield. Victory has a shorter, plumper kernel than Banner and is slightly superior in weight per measured bushel. It is also recommended for general use.

Banner 24-8 is a selection from Banner made at Swift Current in 1924. It resembles the parent variety in nearly all respects but has averaged 117·6 per cent of Banner in yield over a six-year period. This selection is to be increased for growing on a larger scale and for possible distribution.

Gopher (C.A.N. 14) is a white oat of excellent quality that matures about five days earlier than Banner. At Swift Current it has averaged 4 inches shorter than Banner and yielded only 94·7 per cent of the latter, the average difference being 2·4 bushels. Gopher is the best of the available early-maturing varieties and is recommended where earliness is desired.

Victory 25-7 was selected at Swift Current from Victory in 1925 and has shown a consistent superiority to the parent variety in yield. In other respects it closely resembles Victory.

Legacy (C.A.N. 460) is an oat of the same type as Banner. It matures from one to three days earlier and in yield has averaged 100·4 per cent of Banner for nine years. Being slightly shorter than Banner and having a smaller kernel, it is not recommended.

Eagle (C.A.N. 457) has been tested for four years at Swift Current and has yielded 109·4 per cent of Banner for that time. It matures at the same time as Banner, is 3 inches shorter and has a slightly higher weight per measured bushel. As new varieties with greater promise are in prospect, no advantage is seen in recommending or distributing this variety.

Vanguard (Winnipeg Strain R.L. 339: Hagira x Banner) is a variety particularly noted for its stem rust resistance. It has been tested at Swift Current for two years only, but has failed so far to measure up to Banner in yield or bushel weight. Since stem rust is not a problem in this territory it is not likely that this variety will be of value here.

Barley Varieties

Barley has not been an important crop in southwestern Saskatchewan up to the present time. The hot, dry nature of the growing season is adverse to the production of malting barley and is less suitable for the growing of high yields of barley for feed than for the production of other feed crops such as oats, spring or fall rye. Barley produces excellent yields in some seasons but is more susceptible than oats to injury from the hot, drying winds so prevalent in southern Alberta and southwestern Saskatchewan.

The introduction of new, better adapted varieties may increase the acreage devoted to barley. Among the more promising varieties are three smooth awned barleys—Sans Barbs Early, Ottawa 1014 E. 25 and Newal. These three, or barleys of the same type, are superior to the rough awned varieties for fodder, and since they yield equally well, or better, should replace the latter as rapidly as seed is made available. At present Hannchen, Trebi and Regal are recommended, while Colsess is the best of the hooded barleys.

Hannchen (C.A.N. 837) is a two-rowed nodding barley with white kernels and rough awns. At Swift Current it has given an average yield 124·2 per cent of that of O.A.C. No. 21 and is much superior in weight per measured bushel. It matures at the same time as O.A.C. No. 21, is about 4 inches shorter and has slightly weaker straw.

Trebi (C.A.N. 753) is a six-rowed, semi-nodding, rough awned barley with large greenish-blue kernels covered by thick, coarse hulls. In comparison with the check variety, O.A.C. No. 21, this variety has yielded 52·8 per cent more, matures at very nearly the same time, is approximately four inches shorter and weighs slightly more per measured bushel.

Regal (C.A.N. 742) is a six-rowed, smooth awned barley of the nodding type with white or yellowish kernels. It has yielded 27·8 per cent more than O.A.C. No. 21 in the four years it has been tested, matures at the same time, is about the same height and is slightly heavier per measured bushel. Regal is the recommended smooth awned barley but may soon be replaced by newer varieties of similar type.

Smyrna (C.A.N. 859) is a two-rowed high-yielding barley with extremely short straw. It is five days earlier and seven inches shorter than O.A.C. No. 21 and yields 58·7 per cent more. This variety has been grown for four years at Swift Current and will be tested further.

Stavropol (C.A.N. 749) is a six-rowed, semi-erect, rough awned barley with large white kernels which has yielded 149·0 per cent of O.A.C. No. 21 over a four-year period. It is intermediate between Smyrna and O.A.C. No. 21 in maturity and height, and lower in bushel weight.

Horn (C.A.N. 838) is a semi-nodding two-rowed barley with white kernels. Horn has yielded 135·9 per cent of O.A.C. No. 21 but is about three days later and is somewhat weak in straw. It does not appear to be as satisfactory as the more widely grown two-rowed barley Hannchen.

Colsess (C.A.N. 772) is a six-rowed hooded barley with white or yellowish kernels. For four years it has yielded 134·7 per cent of O.A.C. No. 21, but is slightly lower in bushel weight. It has a very strong straw of fairly good length and is useful for the production of feed grain or as an annual hay crop. Colsess matures approximately three days earlier than O.A.C. No. 21.

Sans Barbs Early (C.A.N. 1074) is a smooth awned six-rowed barley with white kernels and straw coloured chaff developed at this station from a natural cross between Black Barbless x Albert. In comparison with O.A.C. No. 21 Sans Barbs Early has yielded 40 per cent or almost 10 bushels more per acre, is equal in strength of straw, superior in weight per bushel and matures about four days earlier. In 1936 this variety demonstrated outstanding ability to resist damage from excessive heat and drought and appeared to be particularly suited to conditions in this territory.

Ottawa 1014 E. 25 (C.A.N. 1105) is almost identical to Sans Barbs Early but is slightly taller. It has been tested for two years at Swift Current and has performed as well as Sans Barbs Early and Newal.

Newal (C.A.N. 1089) is a smooth awned six-rowed white barley developed at Edmonton. Compared to Sans Barbs Early and Ottawa 1014 E. 25, Newal is equally promising but, with them, must be tested over a longer period before its relative value can be fully determined.

Fall Rye Varieties

The area devoted to the production of fall rye in the Swift Current territory is much smaller than the acreage seeded to oats but considerably larger than that occupied by barley. The greater part of the fall rye crop is grown in Crop District 4.

Tests of fall rye varieties over a twelve-year period have failed to show any large differences in yield between the more common varieties. In the few years that winter killing was a factor, Dakold proved to be superior in hardiness and for this reason is the most suitable variety for general use. Advance and Rosen have yielded well in most seasons but are not quite as dependable as Dakold. The seed of Dakold is small and mostly greenish in colour but some brown seeds are usually present in any sample.

Spring Rye Varieties

Tests of spring rye varieties have been carried on for a few years only, but in that time two varieties have consistently outyielded the others in the test. These are Prolific spring rye and a production of the Central Experimental Farm, No. 3836.

Prolific spring rye is superior to No. 3836 in size and uniformity of grain and in straw strength. It has large, comparatively smooth seeds which are uniformly green in colour. Consequently, Prolific is recommended as the most satisfactory variety of spring rye available.

Flax Varieties

Flax is grown to a very limited extent in southwestern Saskatchewan, it being estimated that the average acreage per farm is less than one acre. This condition is due chiefly to the fact that flax cannot compete successfully with Russian thistle and other annual weeds, and the handling of a weedy flax crop is a difficult and unsatisfactory process.

Tests of flax varieties in small replicated plots have been carried on since 1930, but in 1933 and 1934 the tests were destroyed by grasshoppers and drifting soil. Yield differences between the varieties for the remaining years were small. Arranged on the basis of average yields the varieties appear as follows: Novelty, Buda, Bison, Premost, Linota, and Crown. Other varieties have been tested for two or three years but have not yet demonstrated any outstanding qualities.

Novelty (C.A.N. 2135) yields well on new wilt-free soil but is susceptible to wilt. At Swift Current it is about one and a half inches shorter than Bison and yields approximately two bushels more per acre on clean land.

Buda (C.A.N. 2104) is a highly wilt-resistant variety which yields one bushel more per acre than Bison at Swift Current, matures at the same time and is about the same height. Buda has blue flowers and brown seeds.

Bison (C.A.N. 2100) is the most widely grown flax variety in Saskatchewan. It has blue flowers and brown seed, is moderately early, high in yield and averages 21·4 inches in height at Swift Curent. Bison is highly resistant to flax wilt and is generally recommended in Saskatchewan.

Linota (C.A.N. 2120) is another highly wilt-resistant variety which yields nearly as well as Bison. It is slightly earlier and equals Bison in height.

Crown (C.A.N. 2109) and *Premost* (C.A.N. 2138): these two varieties are very susceptible to flax wilt but on disease-free soil yield very well. Crown is second in popularity to Bison but must eventually be replaced due to its susceptibility to disease.

Redwing (C.A.N. 2140) is a highly wilt-resistant variety introduced from the University of Alberta. This variety has been tested at Swift Current for two years and yielded slightly less than Bison or Crown in both years.

Field Peas

Field peas have not found a place of any importance on the farms of southwestern Saskatchewan and are not likely to do so. They are, in general, less satisfactory than the cereals for the production of fodder crops, and no commercial possibilities for them are evident.

Good yields have been obtained in variety tests with comparatively small differences between varieties. The leading varieties from the standpoint of yield are Mackay, O.A.C. No. 181, Early Blue 0·21, and Guinivere (Sask. No. 1866). Early Blue is earlier than the other varieties mentioned by about ten days.

Field Beans

Field beans have even less likelihood of achieving importance than field peas in the territory adjacent to Swift Current. Yields are low and plant growth is restricted by the unfavourable nature of growing conditions. Selections from Navy 0·711 made at the University of Saskatchewan lead all other varieties in yield. Yellow Six Weeks has given higher yields than the other named varieties.

Tests of Farmers' Seed Grain for Purity

As a service to farmers in the district, samples of seed wheat, sent in for the purpose, have been tested in growing tests for purity of variety. This work has been carried on both in direct association with the farmers near the station and in co-operation with various grain companies, where greater distances are involved. Considerable benefit has accrued from this practice and it is hoped that full advantage of the arrangement will be taken in future by the farmers of the Swift Current and adjacent districts.

FIELD HUSBANDRY

Since meteorological records and past experiences indicate that drought and consequent low crop yields are likely to be frequent, it is necessary that farming operations be such as will yield the highest returns during the years when these unfavourable conditions prevail. Methods which are not productive during the drier years may not produce the highest possible yields in more favourable seasons and, therefore, should be discarded. A suitable cropping system combined with cultural methods which require the minimum of changes to suit a variety of seasonal and soil conditions is the logical objective.

Crop Rotations

The practice of summer-fallowing and raising two crops of grain is still the most common rotation followed in this area. With the adoption of strip farming methods and the realization that crops on fallow are the only dependable crops, a gradual change to the one crop and fallow rotation is taking place. On the lighter soil types where summer-fallowing cannot be practised, due to soil drifting, a rotation of wheat and fall rye is being widely used.

In older countries it has been found necessary to adopt the practice of rotating crops if a permanent type of agriculture were to be developed. Many different types of rotations have been tried out at this station to determine their relative merits for this area. These include such rotations as continuous wheat; fallow and one grain crop; fallow and two grain crops; as well as longer rotations which include grasses and legumes. The experimental results indicate that the most suitable rotation for this area is the one crop and fallow system. Although this system does not make any allowance for maintaining the fibre in the soil or for returning some fertility, these factors can be largely overcome by working as much of the stubble into the land as possible each year, and the use of commercial fertilizers when the need arises.

The yields of some of the rotations tested are presented in the following table. Figures given are the average yield of wheat per acre for the six years 1931 to 1936, inclusive.

TABLE 2.—YIELDS OF WHEAT PER ACRE IN VARIOUS ROTATIONS

Rotation	Wheat on Fallow	Wheat on Stubble
	Bush.	Bush.
Continuous wheat	.....	3·4
Fallow—wheat	11·3	.....
Fallow—wheat—wheat	8·4	4·0

The figures presented in the above table clearly point out that highest yields of wheat per cultivated acre have been obtained at this station, during the past six years, by summer-fallowing every other year. The reason for this is twofold; first—more efficient use of the available moisture, and second—less

weeds in the growing crop. (See section on Soil Moisture, page 9.) By fallowing every other year weeds are given very little opportunity to increase, and this is quite evident by the freedom from weeds, especially Russian thistle, in this rotation. A fallow and two crops tends to increase weed population and consequently lower yields result. With continuous cropping the weeds become so numerous that crops can only be grown under the most favourable conditions. If a continuous cropping practice must be followed, then the wheat-fall rye rotation appears to be the most promising. The fall rye is sown in the wheat stubble in the fall without any treatment of the land. The early spring growth of the rye tends to smother the weeds and for this reason the crop is usually free from weeds. The following spring the land is ploughed and sown to wheat. The spring ploughing kills all growth of volunteer rye and is also very effective in controlling annual weeds.

The longer rotations, which include grasses and legumes and which have been tested at this station, are of five to seven years' duration. The grass or legume crops occupy the land for a short period of time, usually two to three years, and are used for either hay or pasture. The hay or pasture is then broken up, summer-fallowed for one year, and then used for growing other annual crops. Twelve years of experiments have shown that such rotations are not likely to be successful, due chiefly to the difficulty of establishing stands of grasses and legumes in the drier years. During the past twelve years stands were successful in four years, thin and patchy in three years, and complete failures in five years. When stands were successful and when they were ploughed up at the end of the two- or three-year period, the amount of fibre introduced in the top six inches of soil by root growth was not enough to be of sufficient value to prevent soil drifting. Annual crops, such as Banner oats and spring rye, were used frequently as emergency crops to improve the thin and patchy stands obtained and to control weed growth, or to replace the catches that failed to survive. Under these circumstances, rotations which provide for a part of the land to be seeded down regularly each year and remain in use as hay or pasture for such a short period as two to three years cannot be considered as permanent. A more satisfactory method is to select land which is favoured with more than the average available soil moisture, such as may be supplied by natural run-off of water from melting snow or heavy rains. Where land values are low a part of the farm may be seeded to grass and left in sod for five years or more. When this is required, special care is necessary to ensure a stand as suggested under the heading of "Cultural Methods for Seeding Grasses and Legumes," which appears elsewhere in this publication.

Sequence of Crops

Where the farming practice is such that two or more crops are grown after fallow, it is very important to know the effect of the previous crop on succeeding crops. For example, it is quite generally believed that oats require more moisture and are more subject to damage from drought than wheat, and that crops following oats will yield less than those following wheat. This belief, no doubt, has originated because of the fact that oats are generally seeded late and on the poorer land. Under these conditions the above-mentioned observations are quite correct.

Experiments conducted at this station during the past five years indicate that oats will produce more pounds of grain per acre on either fallow or stubble provided they are given the same treatment as wheat. The following table shows the effect of the previous crop on yields of wheat and oats. The figures given are the average yield for the six years 1931 to 1936, inclusive:—

TABLE 3.—YIELDS OF WHEAT AND OATS PER ACRE FOLLOWING VARIOUS CROPS

Previous Crop	Yield of Wheat bush. per acre	Yield of Oats bush. per acre
Fallow	10·9	27·2
Corn	9·7	21·2
Wheat	3·2	9·4
Oats	4·0	10·5
Millet	4·7	13·8
Peas	5·5	11·2

The above figures give a fairly clear picture of the extent of moisture conserved or used during the previous year. Yields following corn compare fairly favourably with yields on fallow. Corn, of course, is cultivated during the season and the amount of moisture taken from the soil is limited to the number of plants and the spacing of such. The other crops are sown solid and consequently will use all the available moisture in the soil during their growing period. Peas and millet are harvested for hay, and as a result such land is able to store up the rainfall over a longer period in the fall than the grain crops. The difference in yields following wheat and oats may be attributed largely to weed growth. Oats can compete more successfully with weeds than the wheat, and as a result the oat stubble is cleaner than the wheat stubble. It is well known that Russian thistle in particular makes considerable growth after the grain is harvested. The wheat stubble, containing more of these weeds, naturally does not conserve as much of the fall moisture as the cleaner oat stubble. Consequently, yields following wheat may be lower than yields following oats to the extent of the difference of weed growth in the fall.

Summer-Fallow Substitutes

The practice of summer-fallowing leaves the land idle for one entire year. Such land is also most subject to soil drifting. Various methods of cropping so as to avoid the bare fallow have been tried. These methods include growing such crops as corn, potatoes, and grain in rows; growing fall rye, sweet clover, early-seeded oats and barley for hay and fallowing the remainder of the year; and the practice of fallowing until July 1 and then seeding oats or barley for hay. Of all the methods tested, corn appears to be the only crop which can be grown without seriously reducing the yield of grain the following year. Growing large acreages of corn to replace summer-fallow, however, is not a practical enterprise for southwestern Saskatchewan. Due to the excessive cultivation required, a very serious soil drifting problem may arise if corn were grown extensively.

Growing grain in rows on a large scale as a substitute for summer-fallow is not recommended because it is practically impossible to eradicate the weeds between the rows with ordinary farm implements. The bare summer-fallow affords the best opportunity to control weeds and decreases the weed seed population in the soil. The tendency of the summer-fallow substitutes is, therefore to defeat two main purposes of the summer-fallow, namely, conserving moisture and decreasing the weed menace. This, together with the reduced yields of grain following the summer-fallow substitute prevents recommendation.

Tillage and Seeding Methods for Grain Crops

SUMMER-FALLOW TREATMENTS

The main purpose of summer-fallowing in this area is to store up moisture for the following crop. In accomplishing this object, however, the tendency of the land to drift and the control of insect pests must be very seriously considered. Many different types of cultural treatments have been tested at this station since the year 1922 in an endeavour to find the most suitable method of summer-fallowing for this area. These include different dates of ploughing the fallow, different depths of ploughing as well as the ploughless fallow. These experiments indicate that conservation of moisture is entirely a matter of controlling weeds. The maximum amount of moisture could only be conserved by controlling weed growth from the time one crop is harvested until the succeeding crop is sown. This would mean working weedy stubble land in the fall immediately after harvesting and continuing cultivation throughout the fallow year. A serious problem of soil drifting may arise under such treatment. The next best method is to start cultivation of the fallow as soon as the weed growth becomes pronounced in the spring. The following table shows the effect of starting the fallow at various dates. Figures given are the average yield of wheat for the five years 1932-36 inclusive.

Treatment	Yield per Acre
(1) Plough May 15, cultivate as required	10·3
(2) Plough June 15, cultivate as required	8·6
(3) Leave until July 15, plough and leave	5·1
(4) Spring disk, plough June 15, cultivate as required	9·7
(5) Cultivate as required to July 15, plough and leave	10·0
(6) Ploughless fallow, cultivate as required	9·7

It will be noted, from the figures presented in the first three treatments, that the longer the delay previous to starting work on the fallow the lower the yields will be the following year. On the other hand, the figures in treatments 4, 5 and 6 go to show that as long as weeds are kept under control it does not matter whether the fallow is ploughed or not, nor does it matter when the fallow is ploughed. Weed control does not imply that the land should be kept absolutely black but it does mean that weeds should not be allowed to reach a height of more than 3 to 4 inches at any time. It is only after weeds reach this height that serious losses of moisture occur.

For controlling soil drifting, treatment No. 5 or 6 will probably be the most satisfactory. By controlling weeds in the early part of the season it will be found that the land remains moist and can be readily ploughed in July. The ploughing at this time turns up numerous clods, particularly in the loam soils, which will resist the action of winds during the fall and winter, whereas by ploughing earlier and then cultivating many of these clods would be broken down. Treatment No. 6, ploughless fallow, depends on a good trash cover, that is, leaving the stubble and dead weeds on the surface, to control soil drifting. In this method it is particularly essential that weeds be destroyed early. Weeds which produce too much growth are very hard to eradicate and frequently are missed by the cultivator or disk, and as a result cultural operations have to be made more frequently than if operations had been started sooner.

Of the major insect pests prevalent in this area there are two, wireworms and cutworms, which can be partially or completely controlled by careful treatment of the fallow. The most essential thing for reducing wireworm numbers is always to keep the fallow free from weeds from the middle of June to the end of July, when the newly hatched wireworms are first seeking food. The complete destruction of all large weeds must be ensured and, in cases where some of these have been missed by a machine, it is often practical economy to remove them by hand. Ploughing or other tillage should not be deeper nor

One-way Disk. Suitable implement for first operation on summer-fallow. Note the trash being left on the surface to prevent soil drifting.

Rod Weeder at Valjean, Sask., on sandy soil. A very effective implement for maintaining a trash cover.

more frequent than is necessary. Weed control operations should be so planned as to give a cultivation to a depth of three or four inches during the latter half of July, which will also destroy many of the fragile pupae of this pest then present in the soil.

For cutworm control it is essential that the land be left entirely undisturbed, whether by tillage or seeding of cover crops, from August 1 to September 15 so that the soil is crusted during the time the parent moths are laying their eggs.

TREATMENTS OF STUBBLE LAND

Since nearly one-third of the seeded acreage in this area consists of prepared stubble land it is essential that some information be obtained on the best methods of preparing such land. Considerable work has been done in this connection during the past 12 years and experience indicates that the degree of weed control attained by the different treatments has always been the determining factor in yield up to the limits allowed by the rainfall. Russian thistle is the most prevalent weed on this land, hence removing the thistle by burning followed by ploughing has usually produced higher yields than disking, for the reason that ploughing is much more effective in controlling this particular weed. Depth of ploughing has not been important. Whenever a clean running burn could be obtained, as on combine stubble, results have been good, although trouble from soil drifting may occur some years.

The use of the one-way disk has given very satisfactory weed control with correspondingly improved yields. When using this or other shallow tillage methods for second-crop wheat, experience indicates that extremely early work on the stubble is not desirable. Better weed control is generally obtained by deferring the tillage work until such a time that the crop may be seeded immediately. When seeding stubble land with the seeder attachment on the one-way disk it is usually advisable to have a packer attached behind the disk. This assures a more uniform germination and quicker emergence and hence better weed control.

Although rainfall is the limiting factor in yields it may at times be found inadvisable to sow crops on stubble land due to insects. This difficulty can be overcome to some extent at least, by the following: In years when grasshoppers are liable to be numerous all stubble land to be seeded should be ploughed to a depth of not less than 5 inches. This will greatly reduce the number emerging from the soil. Sawflies cannot be controlled by cultural methods but it will be found very beneficial not to seed wheat on wheat or rye stubble. Where wheat must be sown on infested stubble, seeding should be delayed as long as possible without running too serious a risk of fall frosts. Since sawflies rarely, if ever, survive in oat or barley stubble it is quite safe to sow wheat after such crops.

General Recommended Tillage Practices

PREPARING AND SEEDING SUMMER-FALLOW FOR CROP

Cultivation of the fallow before seeding is essential in order to kill all early spring weed growth and any weeds which may have survived the winter. On medium soil types the duckfoot cultivator is recommended for this purpose. Not only does it destroy the weeds but it also leaves the land in a ridged, lumpy condition to resist drifting with all possible trash or other protective cover undisturbed on the surface.

The double disk drill following the duckfoot cultivator places the seed down to moist, firm soil at a uniform depth without disturbing the lumpy surface or protective trash covering.

On lighter soil types the press drill is recommended following the duckfoot cultivator, while in heavy soil areas the disk harrow preceding the double disk drill is often the best practice where the duckfoot cultivator will not scour.

PREPARING AND SEEDING STUBBLE FOR CROP

The problem on stubble in the spring is to secure as thorough a weed killing job as possible and with the least possible cost.

The recommended practice on all soil types is to one-way disk, then follow one or two days later, to give the weeds a chance to die, with the double disk or press drill. Where excessive Russian thistle cover is present it will be necessary to remove, early in the spring, the majority of it by raking into rows, burning these rows without destroying the general stubble cover and then follow with the regular stubble tillage.

The plough and one-way disk are the most effective stubble tillage implements, but in a very clean, light stubble the duckfoot cultivator or disk harrow may be sufficiently effective on early spring weeds to give reasonable weed control. The double disk drill is recommended for all stubble land except in light sandy soil areas where the press drill is more effective. Both these drills give a uniform rate, spacing and depth of seeding which is essential to weed control. The press drill is recommended for the lighter soils because of the earlier and more uniform germination obtained. This reduces the damage from soil drifting.

SUMMER-FALLOW

The one-way disk used as soon after seeding as possible has given the most effective and economical results over a period of ten years at this station.

The plough is very effective for first operation on fallow but its action buries all protective trash and stubble which are very essential to the prevention of wind damage on open land.

The one-way disk is recommended for first operation on all soil types, except where an excessive amount of stubble is present and weed growth is not thoroughly destroyed at the first operation.

Second operation is best done with the duckfoot cultivator or rod weeder, thus leaving the trash on the surface for protection while killing all new weed growth.

Summer-fallow should not be disturbed during the cutworm egg-laying period. Consult the posters in your local post office for advice on this matter.

Summer-fallow should be left over winter in a rough condition to prevent soil drifting and to collect as much protective snow cover as possible.

FALL TILLAGE

Fall tillage of stubble has produced very low yields over a period of fifteen years and is not recommended for southwestern Saskatchewan. Many fall weeds die over winter and, provided they do not reach the flowering stage before freeze-up, they will act as a good protective cover on fallow. Stinkweed, which often overwinters, may be killed by early spring tillage. Fall tillage destroys the stubble protective cover and may cause winter or spring soil drifting.

Rates of Seeding

For the common cereals no definite rate of seeding can be recommended for all conditions. The following may be regarded as the normal range of rates for the different cereals in this area, and this rate may be modified according to the size and viability of the seed.

Wheat—1 to 2 bushels per acre.
Oats—1½ to 2½ bushels per acre.

Barley—1 to 2 bushels per acre.
Rye—1 to 1½ bushels per acre.
Flax—30 to 35 pounds per acre.

The lower rates are satisfactory on clean stubble land which is low in moisture.

In arriving at a suitable rate of seeding many factors have to be considered, such as weed population, type of soil, moisture supply and insect pests, particularly wireworms. When any of the above factors were abnormal, increased yields were obtained by the heavier rate of seeding. On clean fallow land maximum yields were obtained for wheat, barley and oats by seeding at 1½ bushels, 2 bushels, and 1½ to 2 bushels per acre respectively. Early sown oats gave better results with the heavier rate, and delayed seeding with the lighter rate. On heavy clay soils the heavier rate of seeding gave greater yields per acre.

The advantages of heavier rates of seeding are as follows: more even stand of grain; greater economy and convenience of harvesting; more uniform and earlier maturity; reduced weed population; and increased yields. In the heavier rates of seeding the kernels are slightly smaller but the grade and quality are usually not affected.

Dates of Seeding

Specific dates of seeding vary from season to season. With large acreages to cover it is impossible to do all the seeding at the best time. It is necessary, therefore, to study the effect of date of seeding on the yield of the various crops to obtain maximum returns.

Experiments conducted indicate that all cereals should be sown reasonably early to obtain highest yields. Late seeding has invariably produced lower yields.

The optimum date of seeding wheat will depend, to some extent, on the variety and the rate at which it is sown. Some varieties produce more when sown early, while others yield more if the seeding is somewhat delayed. It is frequently found, however, that wheat sown early has many more weeds to compete with than if the seeding is delayed for a week or ten days. The later seeding provides an opportunity to destroy one crop of weeds before seeding, and in so far as the weed competition is reduced the yields of wheat will be increased. In addition to this, very early seeding of wheat, because of its slow growth, is much more susceptible to wireworm damage than if the seeding is delayed for about a week. Late seeding is also more subject to damage due to the greater activity of the wireworms.

Oats, barley, and spring rye, due to their more rapid leafy growth and quicker development of a root system in the early stage, can compete with weeds much more successfully than wheat, and for the same reason are less subject to such severe wireworm damage. They are, therefore, more suitable for early seeding and earlier maturity, by which they escape the effect of high temperatures in July.

Early seeding of oats and barley has resulted in higher yields when compared to delayed seeding. It has also minimized the damage done by insect pests. Early seeding or oats lessens the damage often caused by "oat thrips" due to earlier maturity, and for the same reason the damage caused by the migrating grasshopper is lessened. A strip of early sown oats around a field of wheat will act as a sawfly trap and lessen the damage from this pest.

The time required to sow the comparatively small acreage of oats and barley grown on the average farm in this area is only a few days. Considering the great advantage to be gained by seeding oats and barley early and by delaying the seeding of wheat for a week or ten days, it is advisable to sow the

grain crops in the order—oats, barley, spring rye, and wheat. Sowing in this order will not only produce higher returns but will also result in cleaner crops which are more economically harvested, less damage from insects, and permit a much longer harvesting season.

Commercial Fertilizers

During the past ten years this station has studied the value of commercial fertilizers in plot and field areas. Co-operative experiments with farmers have also been conducted. The results of these experiments show wide differences in the returns. Since such wide variations occur, the conclusions to be drawn from this work must be based chiefly on observations made during the growing season.

The fertilizers containing phosphates stimulated early growth and stooling. The fertilizers other than phosphates have had little or no effect on the crop in the same period. The stimulating effect of the phosphates on early growth and stooling is sufficient to enable the crop to compete with weeds more successfully and at the same time decrease the damage from wireworms. In so far as these objectives are accomplished the yields of wheat will be increased.

From a fertility standpoint no consistent increases in yields have been obtained. There is, however, considerable variation on different pieces of land. Generally speaking, increased yields have only been obtained under favourable moisture conditions. Since the heavy soils are better able to retain the moisture, increased yields are more likely to occur on such land.

Strip Farming

Strip farming has been used with great success for many years in southern Alberta. It is becoming quite common in many areas of Saskatchewan where soil drifting is a serious menace. The success of this method in controlling soil drifting depends on two conditions. The first is that the strips must be relatively narrow to be effective. The width of strips may vary from 5 to 10 rods on the light or very heavy soils which are more susceptible to drifting, whereas 12- to 20-rod strips are satisfactory for the loam soils. The second is that careful methods of tilling the soil must be followed. A ploughless fallow which maintains a trash cover on the surface of the soil is advisable in all cases where the soil is very subject to drifting. The loam soils will readily maintain a lumpy or cloddy condition, and this is frequently all that is required. (See section on summer-fallow treatments for tillage methods.)

Cover crops may be used to good advantage in years when there is plenty of fall moisture and there are no grasshoppers present. They cannot be depended on year after year in this area because the above-mentioned conditions do not prevail.

It is generally considered advisable to lay down the strips in a north and south direction. Observations of many drifted areas show that the prevailing drifting winds come either from the northwest or southeast. Consequently, these winds would strike the strips at an equal angle whether they are placed east and west or north and south. The direction of the strips, therefore, is not of great importance in this area.

Strip farming has some inconveniences but the general opinion of the farmers using this method seems to be that these inconveniences are not as serious as they appear.

Further information regarding soil drifting and strip farming may be obtained from Publication No. 568, "Soil Drifting Control in the Prairie Provinces," obtainable from your nearest Dominion Experimental Station.

FORAGE CROPS

As fodder yields in southwestern Saskatchewan are not large, even in normal years, the experimental work at this station has been concentrated upon the testing of crops and methods of handling to give the greatest hay yield. The unfavourable weather conditions that have prevailed during the past five years have allowed a comparison of fodder crops under very rigorous conditions, thus making it easier to discard unsuitable types.

Types and Varieties

PERENNIAL GRASSES

Crested wheat has proved to be the most suitable grass for the generally dry conditions in southwestern Saskatchewan. Where conditions are somewhat more favourable, brome is quite satisfactory.

Crested wheat grass has recently been introduced into western Canada. It has become increasingly popular among growers because of its ability to maintain a stand and produce some crop under extremely unfavourable conditions. The ability of this crop to persist over a long period of years is a particularly valuable characteristic in dry areas where stands are difficult to establish. It is a very suitable pasture grass because of its feed value, its ability to supply fodder early in the spring, and its ability to endure drought and to revive quickly when rain comes. The Fairway strain has proved quite satisfactory and seed of this strain is readily available.

Brome has yielded as well as crested wheat when the stands were young and the moisture supply normal, but it has been inferior when the stands became older or the moisture supply more limited. While the stand will persist almost indefinitely, it becomes sod-bound after a period of years with the result that yields fall off markedly. It does not make good fall pasture as it becomes "flaggy" towards the end of the season.

Slender wheat has been one of the highest yielding grasses when the yields are based on first and second year hay crops. With successive later crops it does not show to good advantage and stands usually begin to die out after the second year. This lack of persistence necessitates ploughing up the old stand and seeding a new one at frequent intervals, a relatively costly and hazardous undertaking in this area. The plants are often attacked by the western wheat stem sawfly and are, consequently, a source of infestation for neighbouring wheat fields. Because of the lack of persistence, and because it begins growth rather late in the spring, this grass is less suitable than others for pasture purposes.

ALFALFA

Alfalfa has failed to produce a reasonable yield on very dry locations, and as a result should not be grown except where favoured by additional moisture, such as spring run-off. Better yields are usually obtained by sowing in rows and intertilling than by solid stands. Grimm has been the standard variety in western Canada for many years, but recently Ladak has received much favourable publicity. This variety consistently outyields Grimm in the first cutting but when two or more cuttings are obtained the total yield for the season is usually about the same. As yet there is not sufficient evidence in favour of Ladak to warrant it replacing Grimm in this area.

SWEET CLOVER

A number of the more common sweet clover varieties have been grown without a nurse crop on summer-fallow for the past four years. During this period Arctic has given the greatest hay yield. This white blossomed variety, while rather coarse, is tall growing and very vigorous even under quite dry conditions. Grundy County, Redfield's Yellow and Graham Brothers' Yellow have given better than average yields. The hay produced by Grundy County or Graham Brothers is finer and leafier than that produced by Arctic or Redfields. Redfields resembles Arctic during its growth but is much later in maturing. This variety appears to be particularly suited to very dry conditions. Alpha No. 1 and Alpha No. 3 are two varieties that are very leafy and produce a fine quality hay. They have not, however, yielded as well as the taller, more vigorous varieties such as Arctic.

Sweet Clover sown in 1936—showing one year's growth.

ANNUAL FODDER CROPS

Various annual fodder crops have been tested, over a period of years, for hay production. The cereals—oats, rye, barley and wheat—have been the most successful; peas, millet, corn and sunflowers have been moderately so; while soy beans; lupines, Lespedeza, annual sweet clover, Wallaby grass, Rhodes grass, Sudan grass, sorghum and others have either failed completely or have been inferior to the above.

CEREAL HAY CROPS

A number of different cereals, and combinations of them, have been grown on fallow in a two-year rotation for a number of years. A summary of the average yields obtained is presented in Table 2. The yield differences between crops are not large. Oats have given relatively better yields when moisture supplies were normal or above normal, while spring rye has given relatively better results in the drier years. This latter crop is particularly useful for

providing a fodder crop in the earlier part of the season as it grows well under cool conditions and matures quite rapidly. Such a crop is frequently useful in providing fodder to carry on farm operations in the latter part of the season. The hooded (beardless) barleys, as with oats, give relatively better yields in the more favourable years. This crop competes well with any weeds that may be present. During the past two years wheat has not yielded as well as the other cereals. It may be used quite satisfactorily, however, as an emergency hay crop.

Mixtures of barley and oats have been satisfactory for hay purposes. If spring rye is included in the mixture, a difficulty arises as to the time of harvesting because rye matures more rapidly than oats or barley.

TABLE 2.—AVERAGE YIELDS OF ANNUAL HAY CROPS FOR THE YEARS 1923-1936

Variety and Crop	Yield—tons cured hay per acre				‡Relative yield Banner equals 100
	13-year average 1923-36	10-year average 1927-36	8-year average 1929-36	3-year average 1934-36	
Banner oats	1·90	1·66	1·35	1·35	100
Common spring rye	1·77	1·67	1·52	1·64	93
Banner oats and peas	1·73	1·51	1·28	1·11	91
Siberian millet	1·64	1·37	1·47	1·37	86
Mackay peas	.....	1·65	1·63	1·47	100
*Feeder or Colsess barley and peas	.....	1·62	1·32	1·20	98
Spring rye and peas	.....	1·60	1·40	1·30	96
Feeder or Colsess barley	.....	.....	.....	1·35	104
Common spring rye, Banner oats and Feeder or Colsess barley	.....	.....	1·52	1·53	112
†Chancellor or Golden Vine peas	.....	.....	1·48	1·20	110
Banner oats and spring rye	.....	.....	1·46	1·48	108
Banner oats and Feeder or Colsess barley	.....	.....	1·46	1·35	108
Banner oats and millet	.....	.....	.....	1·47	109
Banner oats and late sown millet	.....	.....	.....	1·36	101
Marquis wheat	.....	.....	.....	.....	91

*Feeder barley grown 1927-31, Colsess—1932-36.
†Golden Vine grown 1928-34, Chancellor, 1935-36.
‡In each case the relative yield is based on the total yield for all the years the particular crop was grown and compared with the total yield of Banner for the same years.

MILLET

Siberian millet has compared favourably with the cereals in hay yield. Being, however, a warm climate crop, it grows poorly in cool seasons and is severely injured by any frosts that may occur. The hay produced is suitable for feeding cattle but not for horses.

PEAS

Peas have given satisfactory hay yields in these tests. The fodder produced is high in protein and, consequently, valuable in the rations of growing animals. Owing to their trailing nature, peas are difficult to handle. Furthermore, they compete poorly with any weeds that may be present. If they are to be grown, they should be sown on clean fallow. Chancellor is one of the better varieties.

Mixtures of peas and oats have not yielded as well as oats alone. The amount of peas present in the fodder has been so small, particularly in the drier years, that no marked improvement in the quality of the fodder resulted from their inclusion. Similar results have been obtained by mixing peas with spring rye and with barley. It is extremely doubtful whether the limited improvement in the fodder would compensate for the reduced yields and the cost of the pea seed.

SUNFLOWERS

Sunflowers, although productive, are of limited value since they must be fed as ensilage. Since the crop must be sown on fallow to obtain satisfactory yields, and since it exhausts pratically all of the available soil moisture, it is necessary to fallow prior to the growing of wheat. In tests that have been conducted the highest yields have been obtained with the variety Russian Giant.

CORN

During the past five years corn has not been as productive as the grain hay crops. The value of corn, however, for soiling, ensilage, fodder or hogging-off frequently warrants the production of this crop on farms carrying dairy herds or swine.

Some 50 varieties of corn have been tested at this station for fodder or ensilage purposes. Minnesota No. 13, Falconer and Northwestern Dent are the varieties that have given the highest yields of fodder.

Where corn is to be grown for grain the early maturing flint types such as Gehu, North Dakota White Flint or Improved Squaw give best results. Acclimatized and selected strains of flint corn may be sown quite early in the spring, and in normal years may be expected to produce a large percentage of ears that are mature enough for hogging-off purposes.

Corn may be continuously grown on the same land with very satisfactory results. When such a practice is followed it is possible to fence off a permanent corn plot which may be used for hogging-off year after year. Constant intertilling of the successive corn crops has the effect of reducing the weed population to relatively small numbers.

Cultural Methods for Grasses and Legumes

PLACE IN ROTATION

Experiments have been conducted over a period of 13 years to determine the place in a rotation to seed grasses and legumes. The grass crop consisted of a mixture of brome and slender wheat grass, and the legume crop was sweet clover alone. These crops were seeded as follows: alone on fallow; with wheat on fallow; with wheat on ploughed stubble; on fall rye in the spring; and between rows of corn before the last cultivation. From 1924 to 1928 soil moisture conditions were favourable and good stands were obtained from nearly all the treatments. Yields of cured hay ranging from 0·62 ton to 2·50 tons per acre were harvested. From 1929 to 1936 either no catches of grasses were obtained or the stands were very thin or patchy. An exception occurred in the year 1932 when yields of hay ranged from 0·10 ton per acre for brome and slender wheat grass sown with wheat on fallow, to 1·84 tons of white sweet clover sown alone on fallow. During the drier years, 1929 to 1936, however, grasses and legumes failed frequently, irrespective of the cultural treatment used. These results indicate that for this area these crops should not be sown in rotation. If cropping rotations of short duration are to include grasses and legumes, these crops must be sown regularly and produce stands each year in order to maintain their succession in relation to the cereal crops included in the rotation. This subject is dealt with further in relation to grain crop production under the heading of "Crop Rotations."

LOCATION FOR HAY OR PASTURE FIELDS

The difficulty of establishing grasses and legumes as a regular feature of a crop rotation of short duration has been previously pointed out. Thus attention must be turned to the possibility of establishing pasture or hay crops on areas which receive more than average soil moisture. Such conditions are found on low-lying land; where a flooding is obtained by spring run-off or heavy

rains, or where water is artificially supplied from a small irrigation reservoir. Examples of such pastures or hay lands can already be found in various parts of southern Saskatchewan. Small irrigation projects that can be constructed economically are the best means of ensuring a supply of water. Land for irrigation projects, however, must be carefully selected. On many farms where small irrigation schemes are not possible, natural depressions will be found that will receive the run-off water, although the supply of this available each year to such land is entirely dependent on the seasonal precipitation.

Consideration may also be given here to the possibility of seeding down to grass, for a period of five years or more, large areas of abandoned weedy land or large areas of grain land. Such land may be seeded down to grass with little or no previous cultivation of the soil, and the hay or pasture returns will be entirely dependent on the natural precipitation. Since such land is to be occupied by grass for a long period of time, special care in seeding is warranted to obtain a satisfactory stand, and suitable methods will now be discussed.

DATE OF SEEDING

For thirteen years, dating from 1924 to 1936, an experiment has been conducted to determine the best time to seed grasses and clovers. The seeding has been done at fifteen-day intervals beginning May 1 and extending to July 1. The stubble land used for the experiment was first ploughed and harrowed, and then packed before and after seeding. However, due to the loose, dry condition of the soil in some seasons, even the two packings were not always effective in firming the soil. This condition was responsible in some cases for delayed or poor catches. Best catches were frequently obtained from the earliest seedings, but the highest yields of a grass mixture were more often obtained from the later sowings. This fact is indicated by the following table which presents the five-year average yields for the period 1925-1929, when catches of grasses and clover were regularly obtained. Yields for the year following seeding, only, are given.

Date Seeded	5-Year Average—Yield per acre	
	Mixture—Brome, western rye and alfalfa	Sweet clover
	tons	tons
May 1	0·88	1·31
May 15	0·79	1·71
May 30	0·84	1·59
June 15	1·23	1·61
July 1	1·64	1·50

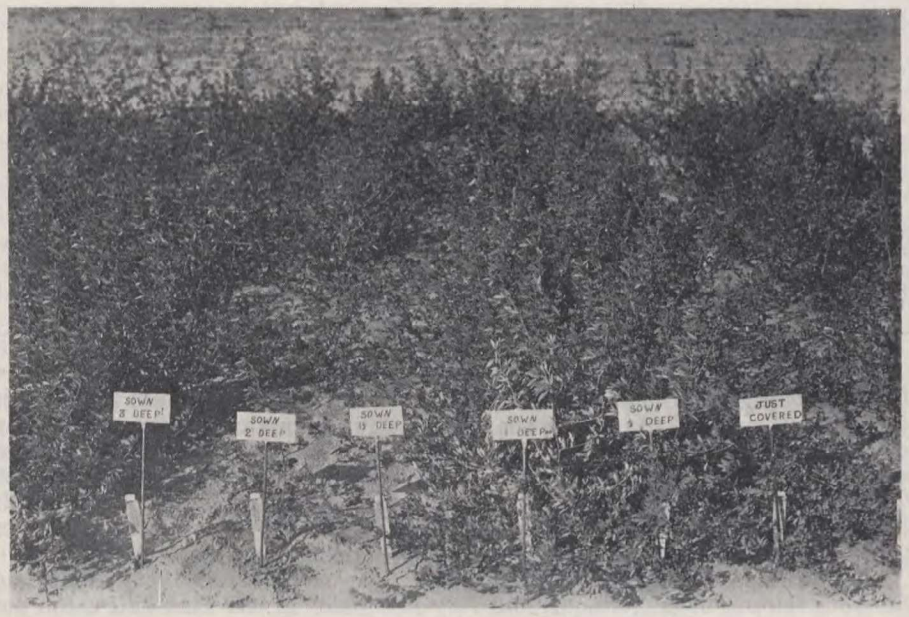
The yields of sweet clover were similar except for the May 1 seeding. Part of the reason for the difference in grass yields is explained by the fact that stands of grass, well established early in the season, utilize more moisture in the seeding down year than do the later sowings. It is also noteworthy that thin stands, established early in the season, soon become infested with a heavy weed growth which depletes the soil of moisture. Both these factors resulted in lower yields of the first-year hay crop. Clover was not affected to the same extent, as thicker stands were obtained which successfully competed with weed growth.

All seedings from May 1 to July 1, for the years 1929 to 1935, resulted in numerous failures or poor stands, and very low yields of less than half a ton per acre. These yields also included a considerable percentage of Russian thistle as hay.

As spring and summer seedings have not proved reliable in very dry years, attention for the past three years has been focussed on the possibilities of securing stands of grasses and legumes by seeding them in the fall on undisturbed stubble land, or else very early in the spring. The latter should be done as soon as it is possible to get on the land and before the regular spring wheat seeding operations begin. Seedings made in this way at this station resulted in good stands. Furthermore, observations in connection with reseeding operations under the Prairie Farm Rehabilitation Act indicate that seedings made just before freeze-up, or very early in the spring, are quite likely to give good stands of grasses and legumes in southern Saskatchewan and Alberta.

DEPTH OF SEEDING

Tests have shown that the highest per cent germination, and thickest stands, are secured when grass and legume seed, such as brome, western rye, alfalfa and sweet clover, are sown very shallow. The effect of seeding depth on subsequent stands is shown in the illustration. This photograph shows the thickness of stands of sweet clover when sown at the following depths: (1) 3 inches; (2) 2 inches; (3) $1\frac{1}{2}$ inches; (4) 1 inch; (5) $\frac{1}{2}$ inch; (6) just covered. It will be seen that deep seeding of from $1\frac{1}{2}$ to 3 inches has resulted in poor to very poor catches, whereas good stands were secured from seed sown at depths of $\frac{1}{2}$ to 1 inch. Seed that was broadcast and covered by a hand rake was not successful as the surface soil was very dry, and germination was consequently not as good as when sown a little deeper with a drill. Deep seeding, even though the soil was moist, has not produced good stands. Similarly, with very shallow seeding, when the season and top soil were dry, germination was delayed till rains occurred and patchy stands were obtained. Shallow seeding, combined with the cool, moist conditions usually prevailing very early in the spring or late in the fall, tend to promote good germination.



The effect of seeding depth on subsequent stands.

PREPARATION OF THE SEED BED

A good seed bed for small seeds, such as seed of grasses and legumes, is one that is firm, moist and has maximum freedom from early weed growth. Firmness is essential in order to facilitate shallow seeding, and stubble or abandoned weedy land, which is to be drilled in the fall or early spring, is usually firm enough to provide a good seed bed. When the soil is unusually hard and dry it is frequently advantageous to lightly disk or harrow just before seeding. A trash cover of stubble or dead weeds affords considerable protection from the wind and sun in the seedling stage. Summer-fallow which has been efficiently worked to destroy two or three crops of weeds during the fallow year, and which is not subject to drifting, is the best soil on which to establish permanent hay or pasture crops. If sown very early in the spring, while the soil is still moist, the land is usually firm enough to provide a good seed bed. If the soil is moist but loose, packing before seeding will aid in placing the seed at the proper depth. If the soil is dry and loose to a depth of 3 inches or more, packing is not advisable and seeding should be delayed until soil moisture conditions are favourable.

NURSE CROPS

Highest yields of hay have been secured when grasses, alfalfa and sweet clover have been seeded without a nurse crop. A test of grasses and legumes for the eight years, 1928 to 1935, shows that grasses and clovers sown with nurse crops of wheat and barley failed five years, when sown with flax they failed four years, with spring rye cut for hay three years, as compared to three years, failure when sown alone on fallow. The grasses and clover, seeded alone on fallow, were sown in June. Had these crops been sown early in the spring, the number of failures would likely have been further reduced, as indicated by the Dates of Seeding experiment for grasses and legumes. The disadvantage of seeding grasses without a nurse crop is that no crop is obtained from the land during the first year, except in the case of sweet clover in very favourable seasons. When the land is to be seeded down permanently, the added certainty of establishing a stand is considered more important than securing a yield from a nurse crop. If nurse crops are grown, it is desirable to cut the nurse crop for hay when in the early blossom stage, or sooner, so as to give the grass or legume seedlings a better opportunity to become well established. When the seed of the nurse crop and grass are mixed, shallow seeding is necessary to ensure germination of the latter. Where the top two or three inches of soil are dry, it is best to seed the crops separately. The nurse crop may be sown three or four inches deep and the grass may then be drilled, crosswise, at from one-half to one inch deep.

AMOUNT OF SEED TO SOW

Crested wheat grass and alfalfa are sown at the rate of 10 pounds per acre. Brome grass, western rye grass and sweet clover are sown at from 12 to 15 pounds per acre. Nurse crops sown with the grasses or legumes should be seeded at one-half their usual seeding rates.

SEED PRODUCTION

If the crop is to be used for seed production, it is usually seeded in rows 3 feet apart and at a rate of about one-third that of the ordinary 6-inch drill spacing. Cultivation between the rows should be practised often enough to control weeds. However, great care should be taken while the plants are young so that they will not be cultivated out or covered with soil.

FARM MACHINERY

Farm machinery investigations include three main lines, viz., farm power, tillage machinery and harvesting machinery. In addition, many other phases are studied in order to obtain as much information as possible in relation to the use of machinery on the problems associated with dry land agriculture. The investment and upkeep of farm machinery on the grain farm is high in relation to other items, therefore experiments have been planned to obtain definite information in order to solve the problems of the farmer. During the past fifteen years many changes have been made in farm machines. With the advent of the combine, rubber tires on tractors, the one-way disk, etc., many problems arose as to the adaptability of the new machines and their importance in volume production of grain at a low cost. Of recent years the problem of soil drifting has claimed the attention of the agricultural engineer because the type of farm machinery used is often the limiting factor in obtaining a solution to the problem.

Farm Power

The study of farm power began in 1930 for the purpose of determining the most suitable type of traction equipment for average sized power units used on the prairie. It was accepted, to begin with, that most motor units used in tractors were of equal merit in the various size ranges available, but that the numerous types of traction equipment required more thorough study under actual farm footing conditions. Three tractors were selected of standard make and design, each having approximately the same motor specifications, one of the heavy wheel type, one of the light wheel type, and the third of the track or crawler type. Each tractor was rated at 20 to 22 drawbar horse-power.

Preliminary tests were run to determine the best type of lug equipment, fuel, loads, speeds and other factors which might influence the economy or draft figures. It was found that 6-inch extension rims with three rows of six-inch spade lugs staggered on the 18-inch wheel face gave the most satisfactory traction for both types of wheel tractors. Where the one wheel had to travel in the furrow, the extension rim and one row of spade lugs were removed to secure better traction and prevent tramping the worked soil. An accurate recording dynamometer was used to secure the actual pull in pounds for each tractor. Wheel counters on each drive wheel or track recorded the slippage. A stop-watch recorded to time over a measured distance for speed records, and an auxiliary gas tank, connected to the carbureter by the three-way valve, was used to measure the fuel used on any given run. In this way an accurate record was secured of draft, speed, slippage and fuel for each tractor.

Alternate rounds with each tractor gave an assurance of exactly the same footing conditions, therefore making it possible to make direct comparisons between the tractors for any one set of footing or load conditions.

The conclusions drawn from this experiment conducted extensively over a two-year period were as follows:—

1. Wheel type tractors are the most economical for all average farm loads on relatively level land.
2. Wet weather conditions make all traction equipment uneconomical.
3. Track types are most economical under very adverse footing conditions or where more than 25 drawbar horse-power is required under normal conditions.
4. Wheel type tractors with over 25 drawbar horse-power would not secure economical footing. If slippage on the drive wheels exceeded 18 per cent a very sharp drop in economy resulted. Loads requiring over 25 D.B.H.P. cause slippage on wheel types of over 20 per cent.
5. Track type tractors showed less than 3 per cent slippage for all farm loads.

Tractor equipped with pneumatic rubber tires and wheel weights working summer-fallow with four-bottom 14-inch plough and packer.

The one-way disk preparing summer-fallow with draught recording apparatus used to determine the pounds of draw-bar pull and power required for different widths of cut and speed of travel.

6. Sharp, rolling land greatly affects the traction of wheel type tractors, while track types are very much less affected under these conditions.
7. Tractors developing 80 per cent of the Nebraska test* rating on the drawbar under normal farm loads are working at full capacity due to great load variations with all farm machinery.
8. A wide selection of speeds is necessary for best utilization of tractor power for farm work. Three-speed tractors gave better all-round economy for varying loads than did two-speed tractors.
9. The heavy wheel type gave best fuel and slippage results under average loads.
10. The track type gave the highest fuel and footing efficiency under very heavy loads at low speeds.
11. In high gear the wheel types gave best efficiency.
12. The wheel type tractors were most easily handled with the farm loads pulled and over the type of footings tested.

These tests were further supplemented in 1936 by an extensive experiment covering the newly developed pneumatic rubber tires for farm tractors.

Pneumatic Rubber Tires on Tractors

In 1933 a set of 12·75 by 28-inch traction tires and wheels were purchased for the 22-36 horse-power heavy wheel type tractor. They were of the shallow tread type and were used on this tractor for all farm operations for a four-year period, resulting in 2,750 hours of traction wear.

During the season of 1936, when the tires were about 50 per cent worn, a series of tests was conducted to study the efficiency of pneumatic tractor tires in comparison to steel wheel equipment. The one tractor was used and changes from steel to rubber were made in order to assure similar working conditions.

Rolling resistance for each type of wheel equipment was determined by pulling the test tractor and operator with each set of equipment over the various footings with another tractor offset in such a manner that the pulling tractor did not alter the footing conditions for the test tractor. The dynamometer record of each such test was used as the determining factor in calculating variations in rolling resistance for all types of conditions encountered.

An analysis of the results shows that there is a saving in fuel consumption when rubber tires are used. A summary of the results is shown in Table 7.

Table 7.—FUEL SAVING WITH RUBBER TIRES

	Per cent
Ploughing	9·4
One-way disking	24·36
Cultivating	5·58

An analysis of the figures shows that the fuel efficiency of steel equipment fluctuated more under varying loads and footings than did the rubber equipment, which was more consistent under the same conditions. This fact is explained partly by the relatively low rolling resistance and small fluctuations for different footings of rubber equipment. The extra reserve of power available in the motor allows for economy in fuel consumption, and as the same load can be pulled in high gear there are fewer revolutions of the crankshaft per mile of travel and, therefore, less fuel used. This reduction in motor revolutions is partially overcome by a greater number of drive wheel revolutions per mile of travel, due to the small diameter of the rubber-equipped wheels.

Where light loads are pulled, with dry footing conditions there is less advantage in rubber equipment. Steel equipment, however, has a very high slippage under these conditions, being practically the same as rubber.

*The University of Nebraska has been recognized by manufacturer and farmer alike as the official testing station for tractors in North America during the past eighteen years.

Throughout these tests the rubber-tire equipment has a consistently higher slippage than that of steel equipment. This factor must be recognized as an inevitable feature of rubber, but these tests prove the very important point that steel equipment also has a relatively high percentage slippage which must be taken into consideration. The percentage difference between rubber and steel equipment on the average is very slight but in some instances the rubber equipment is subject to very high slippage.

It must be pointed out that all these tests were conducted during a period when the footing conditions were particularly suitable for steel equipment. The solidity of the soil aided considerably in favouring the speed of steel equipment since lug penetration was not as deep as normal while rubber equipment is a surface contact type which does not vary with the penetration of the soil.

From these tests it is well to point out that the greatest economy was secured for rubber-tired equipment on stubble land; therefore, since by far the greatest percentage of tractor work in Western Canada is done on stubble footing, or hard-packed fallow footing which gives practically the same results, the difference will be generally in favour of rubber.

Due to the fact that the tractor used throughout these tests was originally designed for steel wheel equipment, the top speed was only slightly over 3·25 M.P.H. with rubber and 3·5 M.P.H. with steel equipment, both without slippage. The newer types of tractors are so designed that higher working speeds are available with rubber equipment, and, in view of the experience gained during these tests, it is concluded that this tractor could more economically *pull the same loads at from 1 to 2½ M.P.H. more with an actual reduction in per cent slippage.*

Minimum slippage occurred with rubber equipment when the motor was sufficiently throttled down to balance the soil contact resistance and the available power. Whenever the footing was such that rubber equipment was slipping or "spinning" excessively under load, this condition could always be corrected and the load pulled out with a minimum of slippage by reducing the speed of the motor by throttling and hand feeding to provide *only enough power to turn the wheels.* Higher operating speeds would obviate the necessity for hand governing to a great extent since there would be a better balance between load and available power in the motor.

Particular note should be taken of the fact that, in addition to the tractor having unsuitable speeds for best economy with rubber equipment, the shallow tread tires of 1933 manufacture were being used. The new, deep tread tires are claimed to give from 60 to 100 per cent better traction than the type used during these tests. Again it should be pointed out that the test tires were 50 per cent worn, therefore the results for rubber in comparison with steel were at a disadvantage in this experiment.

Observations made by those conducting the tests were that the new tires of the deep tread type would particularly improve the results on loose land but would also increase the economy under other footing conditions, especially at peak loads.

To fully explain all phases of the results obtained in these tests it would be necessary to conduct a thorough experiment on load range, varying loads and grades for as many footing conditions and speeds as possible. The results of these tests would indicate definitely the maximum load point for each footing as well as for each speed.

It may be generally concluded that the figures obtained from these tests coincide very closely with former test figures for steel equipment and that the figures for rubber tire equipment may be considered as minimum efficiency where new tractors and new type tires are present.

Air Pressure and Tractive Efficiency

In order to secure more complete information on the proper relationship of wheel weights and air pressures for best tractive efficiency with rubber tire equipment for farm tractors, an experiment was conducted with varying air pressures and wheel weights on two typical footing conditions.

Weights varied from none per wheel to 560 pounds per traction wheel in 140-pound variations. Air pressures in the traction tires varied from a high of 20 pounds to a low of 5 pounds.

Speed, slippage, and draft were recorded in the previously mentioned manner. No fuel records were taken since a constant load was used to secure more uniform and comparative data on this test than could be had when using regular farm loads. A second tractor was used for loads being pulled in various gears against compression.

All tests in this experiment were conducted on a level field of stubble and ploughed summer-fallow, each footing type being recorded separately.

Conclusions drawn from these tests after an analysis of the information obtained were:—

1. That weight on the traction tires increases the tractive efficiency.
2. That tractive efficiency of rubber increases as the air pressure in the traction tires decreases.
3. That the increase in tractive efficiency from added weight and decreased air pressure is especially marked on loose footing conditions.
4. That rubber tire equipment, in common with other types of traction equipment for wheel tractors, is more efficient on solid footing than on loose footing.
5. That the average tractive efficiency of rubber is 80 to 90 per cent that of steel for the two footing conditions tested.
6. That the margin of safe operating air pressure for traction tires may be increased with each addition of wheel weights to maintain a given tractive efficiency.
7. That air pressures between 7 and 12 pounds are the most desirable for all average farm loads and footings.
8. That no rim-creep resulted from the use of pressures below 7 pounds.
9. That wheel weights attached firmly to the traction wheel greatly aid the efficiency of rubber on uneven ground and reduce the bouncing effect common to rubber-tired tractors having weights on the platform.
10. That maximum drawbar horsepower under field conditions, as outlined in the 1931 report of Tractor Tests at Swift Current, can be developed with rubber tire equipment provided the correct combination of tire air pressure and wheel weights are used.
11. That greatest tractive efficiency may be secured with rubbed equipment at highest speeds.
12. That due to the test tires being of the shallow tread (1933) type a much greater efficiency may be obtained when the deep tread (new) type tires are used.
13. That due to the fact that the test tractor was originally designed for use with steel wheel equipment suitable speeds for greatest rubber tire equipment efficiency were not available. This fact was particularly noticeable whenever a heavy load was encountered, the motor having more than sufficient power to spin the drive wheels under any footing conditions. A more suitable range of speeds to utilize the power of the motor on rubber-tired equipment would greatly increase the efficiency of rubber as well as the suitability under a greater variety of operations.

Rubber Tires on Farm Implements

The use of rubber tires on some of the common farm implements is being studied. Considerable progress has been made in this regard during the past two years. Farmers' wagons used for road work have been largely replaced by converted automobile chassis and much reduced draft results. Rubber tired combines aid greatly in reducing the power necessary for pulling this heavy harvesting device. Many other farm implements such as the mower, separator, binder, and others have proved to be successful on rubber in many areas, and indications are that other implements will be used on rubber as soon as a standard, interchangeable wheel and tire size has been adapted with hubs to fit several different machines.

Tillage Machinery

Tillage machinery investigations have been practically confined to the study of soil drifting and trash cover implements. No new implements of major importance for tillage work have been developed during the past six years. A few changes have been made on existing machinery for better surface work.

ONE-WAY DISK

The rapid increase in the use of the one-way disk and the seeding attachment for this machine has been due to the relatively low cost of working land with this equipment. Work with the one-way disk began at this station in 1927 as a tillage machine. It has proved to be one of the most effective implements for the first operation and weed killing on stubble land. Its action for second operations on stubble land or first operation on over-wintered summerfallow may cause serious soil drifting by the pulverizing effect on the soil, unless a heavy trash cover is present.

The type of tillage work done with the one-way disk depends largely upon the type of land, whether rolling, rough or smooth, the amount of stubble or trash on the surface, the diameter, concavity and spacing of disks and the speed at which the machine is pulled. From this work at Swift Current it has been found that no general recommendations may be made since all these factors have a tendency to alter the results. As a general rule, however, the higher the disks and wider the spacing the better will be the trash clearance. The higher and wider the disks the greater will be the depth of working for any effective cut, therefore the greater the draught. Shallow concavity disks tend to anchor trash rather than throw it on the surface as do the deeper concavities.

Speed of travel depends upon the type of disk and amount of trash present as well as the work desired. A heavy trash generally will allow greater disk speed for a given job than will lighter trash. The shallower the disk concavity the greater the disk speed may be for a given job.

Individual problems should first be considered before selecting a one-way disk to fit these conditions. Size of unit, power and speeds available and general trash and soil conditions influence the disk selection. A wide range of selection is available for the convenience of the buyer in most one-way disks, and this makes it possible to fit individual needs.

ONE-WAY DISK SEEDER

The seeding attachment for the one-way disk has been studied at this station since 1929. An experiment to compare the work of the seeding attachment for the one-way disk with other methods has been in progress. Six years' results show that the one-way disk seeding attachment has produced less yield per acre than the standard seed drill following the one-way disk. In poor crop years the combination one-way disk seeder showed considerably poorer yields

than the seed drill following the one-way disk. Weed infestation was greater in the one-way disk seeded plots than in those of the standard seed drill, thus creating extra harvesting problems where the straight combine was used.

Frequent tests have proved that it is necessary to increase the rate of seeding by one-half bushel per acre when using the one-way disk seeder over the standard double-disk drill in order to secure a uniform stand and control weed growth.

The chief merit in the use of the combination one-way disk seeder is the apparent increased acreage covered per day and the reduced cost. However, this is not as real as it would seem, due to the fact that draught tests conducted with the one-way disk, the one-way disk with seeder attachment, and a double-disk drill of disk width showed only 100 pounds difference in favour of the attachment. This would go to show that no particular advantage in draught is present. With the factors of germination, weed control, yield and harvesting in mind the double disk drill following the one-way disk has decided advantages over the combination one-way disk seeder.

In light soil areas the combination one-way disk seeder gives much poorer results than in the medium soil types, especially in dry years where the firmness of the seed bed is particularly important. In light soils it is essential to use a good packer following the one-way disk seeder while the action of a double-disk drill is such that the packer is not necessary in most cases.

Heavy soil types have given good yields with the one-way disk seeder in both good and poor years, but where the packer is used the danger of soil drifting and "baking" often offsets the increase. The relative absence of severe Russian thistle growth in crops on heavy land partially overcomes the harvesting objection to this type of seeding equipment but other weeds might so interfere as to make it an important problem even on this soil type.

CULTIVATOR TESTS

Several types of cultivators have recently been tested to study their possibilities for first work on stubble land, to retain a good trash cover for wind protection, and still destroy all weed growth for soil moisture preservation.

Six types of cultivators were studied: first, the standard stiff shank release cultivator; second, the standard stiff shank (non-release); third, the three-row I.H.C. Cady cultivator; fourth, the Dempster culitvator; fifth, the four-row, stiff-shank Ronald's cultivator; and sixth, the Kemp lister share cultivator. The last mentioned cultivator was also fitted with a blade in place of the lister shares. The object was to cut under the crown roots of the stubble, killing deep-rooted weeds, disturbing surface weeds and leaving the stubble in an upright, anchored position for wind protection.

All cultivators were satisfactory in short, clean binder stubble, killing all weed growth and leaving a very desirable protective cover. Where long, clean stubble was encountered in an upright position the resulting work was not very satisfactory. The stubble fell over, making subsequent work very difficult with frequent plugging up and dragging of stubble. Wherever weed growth was present in high, thick stubble all cultivators plugged, some going further than others, depending upon the amount of clearance between shovel point and frame.

The Dempster machine was the most satisfactory, since the packer wheels tended to pull out the accumulated trash, clearing the rear row of teeth. The Cady cultivator cleared better than the standard two-row cultivators but in Russian thistle undergrowth it plugged readily, due to the accumulation of weeds on the shanks. The Ronald's cultivator would only work in clean, untangled stubble since the large number of shanks accumulated trash, causing frequent stops to clear the teeth. The standard cultivators worked as well as any in good conditions but acted as the others where Russian thistles plugged the shanks. The Kemp cultivator with blade was not satisfactory, it being necessary to

operate at such depth that weed growth was virtually undisturbed. Hard spots caused the blade to lift out of the ground where trash accumulated on the knife edge, preventing re-entry until cleared off by hand. Weeds accumulated on the blade shanks in the same manner as on the cultivators, causing plugging and delay as well as missed areas. With shovels the Kemp cultivator acted in much the same manner as the standard machines, except for additional clearance from ground to frame allowing it go further before plugging. When the coulters were used ahead of the individual shares (lister shares) less success was had than without coulters. These devices were designed to cut ahead of the share point, dividing the trash and preventing the accumulation on the shank. However, the coulter did not cut after several rounds, only tending to push the trash into the ground, running over it and helping to lift the machine out of the ground.

In this same experiment the one-way disk was used as a check and proved that for adverse conditions it was the most satisfactory trash cover implement.

THE PACKER

Various types of packers have been under observation for some years. During the past six years the use of the one-way disk seeder has brought out much work with packers which will pack the loose ground around the broadcast seed and still retain the protective trash cover. The cultipacker and surface packer have proved very unsatisfactory for this purpose since the whole surface was packed, tramping in and smoothing down whatever lumps or protective stubble may have been on the surface to prevent wind erosion.

Three types of packers have proved to have merit for this purpose: first, the large narrow cast wheel built with a wedge shaped rim and spaced to travel at 4-, 6- or 8-inch intervals; second, the press wheel packers with narrow rims; and third, the home-made packer constructed from worn-out disks from double disk drills and placed on a shaft at 3- to 6-inch intervals running straight in line with the direction of travel.

All types tend to firm the soil below the surface, filling in air spaces created by trash around the seed, without disturbing more than a minimum surface area, thus enabling a protective cover created by tillage to prevent soil drifting.

Harvesting Machinery

Harvesting machinery investigations have mainly been confined to the development of methods which will recover a maximum of sawfly- or weed-infested crops without an excessive cost. In four of the six years it has been necessary, due to drought, to harvest every possible kernel in order to help pay the costs. In good years crops such as have been the general rule during the past six years would have been left uncut since binder and combine costs would be too high to recover them.

THE HEADER-BARGE

The header-barge, reported on in the station reports of 1928, '29 and '30, has been the method generally used to supplement the binder and combine in short crop years. A general increase in the use of this method has taken place since 1930. The outstanding feature of this situation is the fact that practically 99 per cent of the barges used are home-made from old discarded machinery and buildings. Many hundreds of different designs are being used but in the main the designs developed through nine years of barge experience at Swift Current are most popular. Alterations to fit individual conditions are the rule rather than the exception.

The barge developed at Swift Current is the result of four barges constructed for trial during the past nine years on the station plus the observed experiences of individual builders. It is a design which contains the features most generally accepted as practical by the users of this method.

The tilting bottom, pivoted on the rear wheel axle, with rigid sides and frame and a rear gate lifting up to clear the discharged stack and operated by the action of the self dumping bottom is the type in use.

Push headers, converted binders and swathers, special cutting devices and elevators have been used with this barge. The mounting of the barge on the swather frame and the extension of the side delivery elevator gained favour in 1936.

Very short grain may be picked up at binder cutting stage regardless of weed growth and saved in the stack where proper curing takes place. Combines or separators are used to thresh these stacks.

Stacks are generally dropped in rows to facilitate threshing but in some cases they are dumped whenever the barge is full and buck or sweep rakes move them into the central location for threshing.

The building of the barge stack has been given considerable study since a great deal of loss has resulted from wet weather causing spoilage in many of these stacks. It has been found that stacks made by merely elevating the loose grain into the barge then dumping when full have resulted in highest damage from rains. The next highest damage is in the stacks which have been thoroughly tramped from the bottom to the top, forming a solid, compact stack when dumped from the barge. These stacks generally settle with the moisture running into the centre rather than shedding away from the centre. The most successful type of barge stack to withstand wet weather is made by tramping only the centre of the stack, keeping the sides level as the barge fills up. By tramping only 12 to 18 inches of the centre and topping all stacks before they leave the barge they will settle with the centre high, thus shedding rain.

Stacks over eight feet in width do not allow sufficient circulation of air in the middle of the stack to cure the grain or green weeds; thus damage by moulds and heating will result. If the green kernels and weeds are not properly cured loss of grade or high dockage will result. Length and height of stack are governed by the size of barge possible to pull and the height to which it is possible to elevate the cut grain. The higher the stack the more grain will be protected by a single top.

SIDE HILL ATTACHMENT FOR COMBINE

In 1931 an experiment was conducted to determine the efficiency of the "Side Hill Attachment" for the combine. A great deal of combine threshing loss was thought to occur, due to the separating mechanism being often forced to operate on a side hill or off-level position due to rolling land, thereby throwing the grain and straw to one side of the machine, overloading it and causing loss of grain over the "tail end." In order to determine the amount thus lost for different side hill conditions a standard "Prairie type" combine was secured with a special attachment which would allow the threshing and separating body of the combine to be moved into a level position regardless of the ground being travelled over.

A field of 50 acres on very rolling ground was cut with this machine, alternate rounds being used for comparison between keeping the combine always level or in the regular undisturbed position. No difference in yield or grain saved could be found. Straw and chaff, or "tail end" discharge, was collected and hand threshed, no difference being noticed.

A second field one mile long on level ground was selected for another thorough trial. One round was made in the level position and the next at a definite angle off-level to right, then left. Angles from 5 per cent grade to 25 per cent grade were used with no variation in "tail end" loss. It was concluded that for areas where the grade was less than 10 per cent and not constant, no need was seen for any special levelling device, the standard combine giving perfect satisfaction under these conditions.

Sharp uphill or downhill grades affect the "tail end" loss but no device has been used to correct this beyond the type of threshing devices, sieves and straw carriers used which are quite effective for most types of prairie wheat land.

HORTICULTURE

Horticulture has become an important part of prairie agriculture. Interest has been aroused not only by economic considerations but has also been developed by the desire to beautify prairie farm homes. Climatic conditions are such that results are not obtained without considerable effort, but generally speaking prairie horticulture is a worth while undertaking.

In all phases of gardening it is necessary to conserve and make as much use of the available moisture as is possible. Consideration should be given to this fact when choosing a site for the farm garden. In many cases it is possible to choose a site which will receive run-off water from adjoining land. Temporary dikes and small dams may be used to hold back the run-off water which would otherwise be lost. Rain water from the eaves of barns and machine sheds has been used with very good results. Many ingenious methods have been used to apply water to small garden areas, including the pumping of water from dugouts and shallow farm wells and the diverting of water from natural springs. All of these methods of water conservation have resulted in good garden crops in spite of dry years.

The Shelterbelt

A permanent shelterbelt is an asset to the prairie farm home. The growing of fruits, vegetables and ornamental shrubbery is a much less hazardous undertaking when protection is provided by a windbreak. Other advantages include protection from the hot, drying winds of summer and the cold winds of winter, protection to man and to live stock, and the increased sale value of the farm.

To be fully effective the protective influence of the tree belt should extend to all sides of the farmstead. In planning the windbreak, sufficient space should be enclosed to provide for a wide fallow strip between it and the fruit and vegetable gardens. The roots of trees such as poplar have been known to extend for over forty feet into garden areas when this was not done.

Past results indicate that young trees are more easily established on fallowed land. Most windbreak trees require little or no pruning after the first year. Caragana for shelterbelt purposes should be cut back to within an inch or two of the ground level at planting time and lesser amounts should be trimmed off for each of the next few years. This encourages low branching which is desirable.

Ash, elm, box elder, caragana and a limited quantity of poplar and cottonwood are the recommended broadleaved trees. The evergreens. such as white spruce, lodgepole pine and Scotch pine, make very effective shelterbelts. They are difficult to establish without protection.

Trees for windbreak purposes are obtainable from the Dominion Forest Nursery Station, Indian Head, Sask.

Vegetable Gardening

The vegetable garden is usually considered to be the most valuable phase of prairie horticulture. Fresh greens throughout the summer, a few shelves of canned vegetables, and a bin or two of roots provide welcome additions to the diet, especially when returns from grain crops are low and the purchase of green foods is impossible.

When the vegetable garden is not placed within the main windbreak sufficient protection can usually be provided by a single or double row of caragana.

Experience at Swift Current has shown that to be reasonably sure of success with the vegetable garden, under dry land conditions, it should be placed on fallowed land each year. This necessitates a garden area twice the size of that required for one year's garden. A dressing of well-rotted manure during the fallow year is advisable.

SEEDING

In preparing the plan of the garden, consideration should be given to the succession of crops and to ease of maintenance during the summer.

The dates of seeding some of the vegetables are important. The crops sown around May 1 include carrots, parsnips, onions, peas, lettuce, kale, spinach and chard. Well-hardened early cabbage plants may be set out soon after this date. Sweet corn, beans, pumpkin, squash, melons, cucumbers and beets for storage purposes are usually sown between May 15 and May 20. Main crop beets, if sown earlier than this date, yield too large a percentage of large, coarse roots. When a succession of crops is required, seedings can be made at weekly intervals throughout May and early June. Tomatoes, egg plants and peppers are not set out until after June 1.

Spring cultural work is reduced to a minimum and is done just prior to seeding in order to avoid the loss of soil moisture. Wide spacing of the vegetable rows is essential under dry land conditions so that there will be no competition for the available moisture. A slight depression along the rows after they have been seeded aids germination by acting as a storage for additional rain water. Only sufficient cultural work to control weeds is necessary. The modern single and double wheel hoes are splendid labour-saving implements.

KINDS AND VARIETIES OF VEGETABLES

The following lists of vegetable varieties are based on tests conducted at Swift Current:—

Beets.—The variety Detroit Dark Red is recommended for general purpose use. Early Flat Egyptian has also shown some merit, especially for early use. This variety should not be allowed to grow larger than 2 or 2½ inches in diameter at it becomes coarse.

Beans.—With the exception of 1936, bean varieties as a rule have given fair to good yields during the past six years. The following varieties have shown superiority not only in their ability of yield but in table quality:—

Green Podded—Stringless Green Pod.

Wax Podded—Round Pod Kidney Wax.

Celery.—Golden Self Blanching and Golden Plume are both good varieties. This vegetable requires an abundance of moisture and should be planted where it can be watered. The young plants are started indoors and set out soon after the middle of May.

Cabbage.—Cabbage plants have, as a rule, given a fair yield of good heads and occasionally good yields are secured. Experience at this station would indicate that it is advisable to start all cabbage plants indoors or in a hotbed. Under favourable conditions it is possible to get good yields of late cabbage from seed sown in the open in May. Cabbage seed is usually sown indoors in

early April. The seedlings are transplanted once and are then planted out from four to six weeks after seeding. Varieties recommended are:—

Early—Golden Acre, Copenhagen Market.
Midseason—Glory of Enkhuizen.
Late—Danish Ballhead.

If only one variety is grown Copenhagen Market is the most useful.

Cauliflower.—Cauliflower can usually be relied upon to form small but very good quality heads. During seasons of extreme drought, such as 1936, cauliflower suffers severely. The flower heads that do emerge are often discoloured from the intense heat. Early Snowball is the best general purpose variety. Seed is usually sown at the same time as cabbage seed.

Carrots.—For general use the variety Chanteney is superior to other varieties tested. Scarlet Nantes is of excellent quality but has not the storage qualities of the former.

Corn.—Recent introductions of early maturing varieties of good quality have greatly added to corn growing possibilities in the West. Recommended varieties are:—

Early—Golden Gem.
Mid-season—Dorinny.
Late—Golden Sixty Day and Golden Bantam.

Late-maturing varieties are not always a success because of the extremely hot weather of late summer.

Lettuce.—Grand Rapids is the leading variety of leaf lettuce. New York No. 12, Iceberg, and Salamander have given best results in the head lettuce group. New York No. 12 is the earliest and usually the heaviest yielder. For best results head lettuce should be given the same treatment as early cabbage. Plants started indoors in early April can be set out a month later.

Onions.—The growing of onions from seed sown in the open ground has not always proved a successful method under Swift Current conditions. The use of setts is a more reliable method of raising a small crop. From limited trials at this station the use of onion transplants would appear to be a worthwhile method of raising an onion crop. Seed is sown thinly in a seed box in early April and the seedlings planted out about a month later. Varieties: For transplants—Prizetaker. For the open ground—Mountain Danvers.

Parsnips.—Parsnips are not always a successful crop under dry land conditions. The roots are frequently small and much branched. Varieties: Half Long—Guernsey. Long—Hollow Crown.

Peas.—Seeding of peas for the early crop should be done as soon as possible after the ground warms up. Tests at this station have shown that peas with the dwarfer type of vines are much better suited to our conditions than the taller growing kinds. Varieties: Early—Alaska, Thos. Laxton. Main Crop—Lincoln (Homesteader). Late—Stratagem.

Radish.—Saxa is the most popular turnip type of radish, while White Icicle is the most popular long type tested at Swift Current.

Spinach.—The New Zealand type of spinach is much better adapted to the hot summers of southwestern Saskatchewan than the true spinach because it can be used over a much longer period.

Tomatoes.—By the use of staking and pruning, fair yields of ripe fruit have been harvested from the varieties Abel and Bestal. If the plants are not to be staked and pruned Bison is the variety recommended.

Vines—With few exceptions, pumpkins and squash have produced good yields of mature fruit. The smaller pie type of pumpkins is preferable to the field type. Varieties:—

Pumpkin—Pie type—Sweet or Sugar.
Field type—Connecticut Field.
Vegetable Marrow—Long White Bush.
Squash—Buttercup.

Potatoes.—Irish Cobbler and Early Ohio still hold the lead as the most popular varieties of potatoes. The "Q" strain of Gold Nugget and the new variety Warba are, however, giving promise of being worthy of more general planting.

The need for constant attention to the quality of seed potatoes cannot be over-emphasized. The growing of a small seed plot from the best seed each year is recommended. This plot should be thoroughly rogued of all unhealthy plants throughout the summer.

PERENNIAL VEGETABLES

Asparagus.—The results of tests at Swift Current show that asparagus is well suited to the conditions found here. Good yields of tips have been harvested from a five-year plantation of the variety Martha Washington.

Rhubarb.—This vegetable should be located where it will receive run-off water if possible. Deep and thorough cultivation with a liberal application of well-rotted manure should be the rule before planting is done. Frequent division of the roots is also beneficial. Macdonald and Ruby are the leading varieties.

Ornamental Gardening

TREES AND SHRUBS

Within the shelter of the windbreak, trees and shrubs have become an important part of the grounds of the Experimental Station at Swift Current. If care is exercised in the choice of well-adapted varieties and attention is given to a few important rules in care and management, ornamental shrubbery can be grown successfully.

Spring planting on fallowed land is recommended. Wide spacing of the young bushes is advisable to allow for proper development and to avoid future competition for moisture. Specimen trees are benefited by having a saucer-shaped circle of fallow maintained about them to aid in holding rain water.

The following is a brief list of trees and shrubs which have proved adaptable:—

Trees.—Green Ash, American Elm, Box Elder, White Spruce and Blue Spruce.

Shrubs.—Siberian Crab, Russian Olive, Buffalo berry, Common Caragana, Pin Cherry, Honeysuckle, Russian Sandthorn, Native Hawthorn, Common Lilac, Cotoneaster, Spiraea media, Siberian Almond, Dwarf Burning Bush and Froebel's Spiraea. The shrubs listed above are in order of their height at maturity.

FLOWER GROWING

The growing of flowers in southwestern Saskatchewan will, in most years, repay the efforts of the gardener who is seeking to improve the home surroundings. Flowers will show a greater response to additional moisture than most horticultural crops and this factor should be given careful attention when choosing a site for the flower garden.

Photo taken in 1929.

Photo taken in 1931.

Photo taken in 1936.

The above photographs show Scotch pine and lodgepole pine in the background, white spruce in the foreground. All were planted in 1923 and 1924. Photos show growth development up to 1936.

ANNUAL FLOWERS

Annuals are divided into two main groups, those that can be successfully sown out-of-doors, i.e., hardy annuals, and those which require to be started indoors or in a hotbed, i.e., half-hardy annuals. The following is a list from each group which have proved most successful under dry land conditions:—

Hardy Annuals.—Anchusa, Bartonia, Baby's Breath, African Daisy, California Poppy, Lavatera, Shirley Poppy, Sweet Sultan, Nigella, Larkspur and Sweet Peas.

Half-hardy Annuals.—Asters, Ageratum, Alyssum, Coreopsis, Pinks, Pansies, Petunias, Stocks, Snapdragons and Zinnia.

PERENNIAL FLOWERS

Perennials, besides including some of the most popular flowers, are valuable because of their permanency. Experience has shown that if given reasonably good conditions and ordinary care there are many worth while perennials which can be grown successfully in this area. A number of the native plants are worthy of a place in the flower border.

One of the greatest drawbacks to the successful growing of perennials is the alternate freezing and thawing to which they are subjected during the early spring months. To overcome this, it is suggested that the flower border be placed where it will receive a good blanket of snow. A few boughs will often prevent this snow blanket from melting too soon in the spring.

The following is a list of some of the best of the hardy perennials which can be recommended for general planting: Anchusa, Baby's Breath, Blue Flax, Scarlet Lychnis, Sweet Rocket, Peony, Iris, Beardtongue, Tiger Lily, Tulips, Ox-eye Daisy, Gaillardia, Grass Pink, Columbine and Bellflower. Many others are worthy of a trial.

Fruit Growing

Fruits have been grown on the Dominion Experimental Station at Swift Current for the past ten years with encouraging results. It has been demonstrated that fruits for domestic purposes can be grown during most years. In common with all other horticultural crops a suitable site, adequate protection and proper care are essential for success.

The site for the fruit plantation should have a northerly slope where possible to avoid sunscald injury.

All fruit trees and bushes are more successfully planted in early spring. If they must be moved in the autumn they should be heeled-in over winter and planted in the spring. One or two year old bushes are much more easily established than those of a greater age. Trees of apple, crabapple and plum should be cut back to within a foot or eighteen inches of the ground when planting is done. This encourages low branching which is desirable. Subsequent pruning should consist of the removal of dead wood and only enough new growth to keep the tree in a symmetrical open form.

Currants and gooseberries are best cut back almost to ground level at planting time. Annual pruning thereafter consists of the removal of old wood as well as the weaker new growth. Cuts are made as near ground level as possible. All pruning is best done during the autumn or early winter.

Varieties:—

Apples—Heyer Seedling No. 12.
Crabapples—Osman, Dolgo, Florence, Rosilda.
Tree Plums—Assiniboine, Cheney, Mordena.
Bush Plums—Tom Thumb, Opata, Sapa, Oka.
Black Currants—Kerry.

Red Currants—London Market, Fay's Prolific.
Raspberries—Sunbeam.
Gooseberries—Houghton and Downing. Pixwell, Perry and Abundance are recommended for trial.

Rabbits are a great menace to fruit plantations. When present in small numbers shooting, snaring, poisoning and a good dog are all of value in keeping them in check. A permanent rabbit fence is advisable but is an expensive undertaking. Extreme care should be exercised in using poisons.

Garden Insect Control

Insects which attack gardens and shade trees are divided into two main groups according to the type and method of injury.

Leaf eating insects are those which actually eat the leaves of the plants. Injury is first evidenced by the shot-holes in the leaves and later by complete defoliation of the plants. Insects of this type can be controlled by the application of a *lead arsenate* spray. Two pounds of lead arsenate per forty gallons of water or two to three tablespoons per gallon are proportions to use. Exception to this should be taken in the case of cabbage worm as sprays will not adhere to the leaves of the cabbage plant. They should be dusted with a mixture of one part lead arsenate to ten parts powdered lime when the leaves are damp. Paris green is not generally recommended because of the tendency to burn the leaves of plants other than those of potatoes.

Sucking insects are those which pierce the leaves and suck the plant juices. Examples are the currant aphids and the green flies or aphids on house plants. This type of insect can be controlled by the application of a contact spray such as *Black Leaf 40* or some other form of nicotine sulphate. One teaspoonful per gallon of water is the amount to use. This spray must be applied so that it strikes the under side of the leaves where these insects are usually found.

POULTRY

The climate of southwestern Saskatchewan is suitable for poultry production. The standard of poultry raised in this district could be given more consideration. During the drought years properly managed flocks have aided the farmer in minimizing the farm losses.

The average annual production of all birds in Canada is only 90 eggs per bird. This is a very low average and appears even lower when it is considered that many flocks average over 150 eggs per bird. Experience has shown that when more attention has been given to the farm flock the average production can be raised considerably above this figure.

While experimental work has not been the major activity, a flock of Barred Plymouth Rocks has been maintained since the inception of the station to study flock improvement methods. This study involves an analysis of individual birds as to their body weight, plumage colour, age at first egg, egg weight, broodiness and many other factors. Each bird used for breeding is analysed as to the fertility and hatchability of the eggs used in the hatching season. The progeny of each dam and each sire are analysed collectively according to the above mentioned factors. From a consideration of these factors superior families can be selected and from them the best individuals for breeding purposes.

In the past three years good males have been secured to assist in grading up the flock. As a result, the standard of the flock has been gradually raised and in 1936 the fertility of all eggs set was 85·7 per cent, the hatchability of all eggs set was 55·5 per cent and the average production of the 155 pullets

which completed their first year during 1936 was 176 eggs. The above figures demonstrate clearly the value of a flock improvement policy such as is outlined above.

Since 1930 the flock has been periodically blood tested for pullorum disease (bacillary white diarrhoea). In 1930 there were thirty-seven reactors which had to be removed from the flock, in 1933 there were only two reactors and in 1936 the flock tested pullorum free. The practical elimination of this disease from the flock in this manner has no doubt had considerable to do with the present standard of the flock.

Observations have been made regarding methods of feeding. No attempt has been made to mix feeds for baby chicks, but commercial feeds are bought and fed until the age of about six or eight weeks. At that time the birds are gradually shifted to a rearing ration composed as follows:—

Ground wheat	250 pounds
Ground oats	75 "
Ground barley	100 "
Meat scrap	50 "
Alfalfa meal	15 "
Bone meal	10 "
Salt	2½ "

The above quantity of mash will feed twenty pullets from the age of six weeks to maturity. It is fed dry in open hoppers and as available to the birds at all times. Grain, charcoal, grit and oyster shell (this fed later in the summer) are also supplied in open hoppers.

Economy is the main consideration in this system of feeding growing birds, and the ingredients mentioned which must be purchased are absolutely essential to the proper development of the birds and will more than repay their cost.

A succulent pasture is essential for the birds to range on and if pasture is not available one gallon of cod liver oil should be added to the above mash. The seeding of one drill width of mixed grains at regular intervals of one week and working out from the house is excellent pasture management. In this way there is always a supply of green feed at the correct stage.

Carrots are a good feed for growing poultry and if available should be chopped and fed daily as much as the birds will eat in twenty minutes.

When the birds are placed in laying pens in the fall the following mash is fed:—

Ground wheat	200 pounds
Ground oats	200 "
Ground barley	200 "
Bran	100 "
Shorts	100 "
Meat scrap	100 "
Charcoal	20 "
Bonemeal	15 "
Alfalfa meal	15 "
Salt	5 "
Cod liver oil	1 gallon

One hundred birds will eat from 14 to 16 pounds of the above mash per day. It is also fed in open hoppers and scratch grain of three parts wheat to two parts barley is fed about one hour before roosting at the rate of 16 pounds per 100 birds. The method of scattering the grain in the litter to provide the birds with exercise is being discarded as unnecessary, especially with pullets, and the grain can be fed in troughs.

For four months during 1936 a preliminary experiment was conducted on the "Feeding of Rye for Egg Production." Results of this experiment would indicate that rye can be fed in the scratch grain and is best in combination

with barley. The scratch grain should be fed sparingly until the birds become accustomed to the feed and no great alarm should be attached to the occurrence of loose droppings when rye is fed even in small quantities.

A clean, fresh supply of water should be kept before the birds at all times. Too much importance cannot be laid on this. If available, milk can be substituted for the water to advantage, and if this is done consistently, the amount of meat scrap can be reduced. Milk is particularly valuable prior to and during the breeding season as it has a beneficial effect on hatchability.

PUBLICATIONS FOR DISTRIBUTION FROM SWIFT CURRENT EXPERIMENTAL STATION

Mimeographed Circulars

Nine Years' Experience with the One-way Disk.
Coarse Grains and Other Cereals for Southwestern Saskatchewan.
Forage Crops for Southwestern Saskatchewan.
Cereal Crops for Southwestern Saskatchewan.
Hardy Fruits for Southwestern Saskatchewan.
Weed Control in Southwestern Saskatchewan.
Skeleton Weed, a Dry Land Plant.
The Bur-weed, Marsh Elder, a Menace to Health.
The Veined Dock, a Potential Weed of the Lighter Soils.
Russian Thistle for Hay.
Automatic Grain Duster.
Pneumatic Rubber Tires for Tractors.
Header-Barge.
"V" Belt Nursery Seeder.

Bulletins Obtainable from the Publicity and Extension Branch, Department of Agriculture, Ottawa

Swift Current Station Reports, 1922-30 inclusive.
The combined Reaper Thresher in Western Canada. N.S. Pam. 83.
Departmental Directory and List of Publications. Pub. 526.