DOMINION OF CANADA
DEPARTMENT OF AGRICULTURE
DOMINION EXPERIMENTAL FARMS

EXPERIMENTAL STATION

SCOTT, SASK.

RESULTS OF EXPERIMENTS

1931-1936 INCLUSIVE

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SUPERINTENDENT

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REPORT OF THE DOMINION EXPERIMENTAL STATION SCOTT, SASK., 1931 TO 1936

INTRODUCTION

Annual reports of the Dominion Experimental Station, Scott, Saskatchewan, have not been published since 1930. An attempt has been made in this five-year report, to cover the work that was in progress and any that was concluded, during the years 1931 to 1936.

Drought characterized the period covered, particularly the past four years. This meant that soil drifting was frequent in many of the prairie areas under crop production. Precipitation has been often ineffective because the total per month frequently represented a number of small showers. Careful records have been kept covering precipitation, temperatures, evaporation, wind and sunshine. A noticeable feature of the weather data has been the number of new records established during recent years.

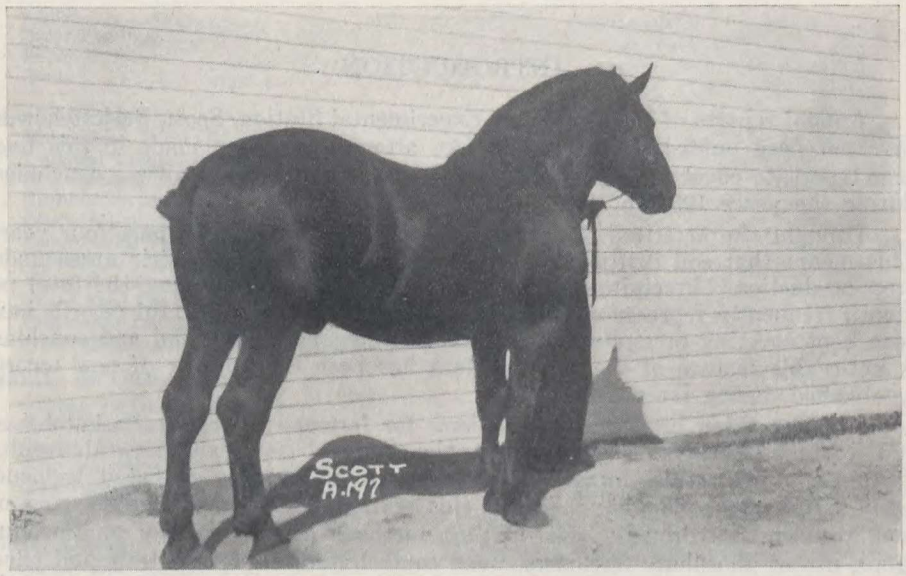
This condition brought new problems for farmers in western Saskatchewan and eastern Alberta. Consequently the demand for experimental results, particularly in cereals, forage crops and field husbandry, increased tremendously. New demands were made on this station and attacks were started on such problems as drought, soil drifting, methods of seeding hay and pasture crops, use of phosphate fertilizers, weed control studies, pasture tests and effect of frost on dates of seeding wheat. Farmers have shown a readiness to apply results which have a bearing on their problems. There has been a tendency for farmers to lower production costs, adopt ploughless instead of ploughed fallow, to seed certain grasses in late fall, to use phosphate fertilizer where favourable responses are obtained, to practise more timely tillage for weed control and generally to use practices which give best results in dry seasons. It is hoped that publication of these experimental findings will fill the continuous demand for unpublished reports of this station.

ANIMAL HUSBANDRY

During the five-year period ending December 31, 1936, from 20 to 25 horses have been kept on the Scott station, mainly as a source of farm power. Most of these have been pure-bred Percherons.

Early in the year of 1932, a grey, pure-bred Percheron stallion, Chacal (Imp.) [12951] (165185) was transferred to the Scott station from the station at Ste. Anne de la Pocatière, Quebec. Colts left by this stallion give promise of being a credit to him. In December, 1934, this stallion was replaced by a black two-year-old Percheron, Mel Laet 2nd [14498] 210068, which was placed second in a large class at the Toronto Royal a few weeks before. This stallion stood for service at special rates for pure-bred mares and as a result, some excellent mares were brought in from great distances for service. Mel Laet 2nd weighed 1,900 when three years old and is of the close-coupled, deep-bodied, easy-keeping type, with good legs and feet, that is very popular among farmers. The first lot of colts by this stallion, born 1936, show considerable size and quality and the several owners have expressed their satisfaction in the appearance of these colts.

This stallion stood for service at the Scott station during the seasons of 1935 and 1936 under the Premium Mare Policy laid down by the Dominion Department of Agriculture, which gave special consideration to high-class pure-bred mares, and extra allowance was made for those from a distance.



Mel Lact 2nd [14498] 210068. Three-year-old, weight 1950 pounds.

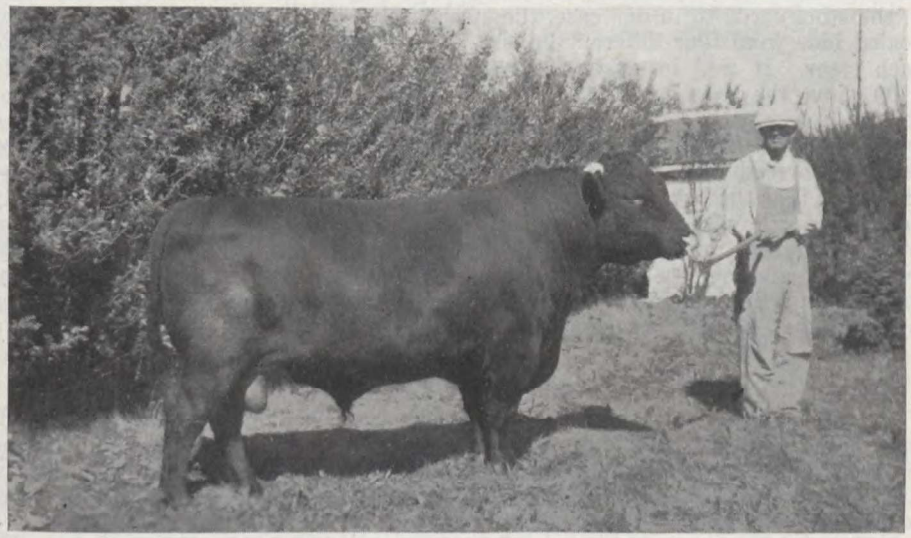
CATTLE

The Dual-Purpose Shorthorn herd has been maintained at approximately 40 head during the five-year period just past. The object in mind has been to maintain a good beef type and constantly select for reasonable milk production. Some of the highest milk records at the Scott station have been made by the largest, most blocky cows. Some examples are: Scott Prairie Red Rose 26A, with a milk record of 7,339 pounds and a body weight of 1,640 pounds; Scott Prairie Rose weighing 1,635 pounds and having a milk record of 8,470 pounds. In seven lactation periods, her total yield was 52,109 pounds of milk, averaging four per cent fat, a total of 2,084 pounds of butter fat. An example of persistence in milking is provided by Prairie Red Rose 32 which milked 740 days and produced 9,709 pounds of milk. Her R.O.P. record of 365 days is 6,164 pounds. These cows are of a good beef conformation and a credit to any Shorthorn herd.

The average milk flow for the entire herd (including the lowest records) was 5,821 pounds of milk and the profit over feed and pasture averaged $14.53 per cow annually, deducting cost of labour and value of calves. This includes all records completed in the years 1931-36 inclusive. Probably from five to eight thousand pounds of milk per year, according to age, is sufficient to expect from the average cow of beef conformation. It should be mentioned that the records at the Scott station have been made under normal conditions and although some oat chop has been fed to milch cows during the summer months, for the most part, pastures have been short and dry, and at no time has a cow been given special rations to produce an absolute maximum milk flow. During the winter the chop mixture has been usually made up of two parts oat chop, two parts bran

and one part of linseed meal, with one to three per cent bone meal. This mixture is fed to the milch cows at the rate of approximately ten pounds per head daily with 20 pounds of sunflower silage and 15 pounds of cut oat straw.

The bulls used during the past five years were Neralcam Star —171592— and Neralcam Gallant Prince —196886— both bred by Alex Maclaren of Buckingham, Que., and latterly an imported bull from the north of Ireland, Aughlish Captain —221136— (261570). His sire was Colonel (249863) and his dam, Apple Blossom (68906), with a record of 10,209 pounds of milk in 315 days. This imported bull was the only herd sire on hand at the end of 1936. He is a red, low-set animal with excellent conformation and will probably prove to be an outstanding sire. Calves by this bull are still young but show superior qualities as compared with some other young calves on hand, sired by other bulls.



Aughlish Captain—221136—(261570), three years old—weight 1,850 pounds.

During the years 1931-1936 inclusive, 24 females have been disposed of for breeding purposes and 32 bull calves. The demand has been consistently greater than the supply. A questionnaire was sent out in 1936 to purchasers of breeding stock and the forms returned indicated that the greater number of these cattle had been highly satisfactory to their owners. A number of the bulls had changed hands but most of them were still in use.

STEER FEEDING

Each autumn for three years, 25 head of "long yearling" steers were purchased and divided into five lots of five steers each. Great care was taken to get the lots as even as possible in size, conformation and temperament. Individual weights were taken monthly during the tests.

The same test was conducted each year to establish a reliable average result. The feeds under test were, wheat, oats, barley and rye. The fifth lot was fed equal parts of each and was used as a basis of comparison. All grains were ground and fed alone to the respective lots twice a day and the roughage used was oat straw. It was observed that the steers would eat more chop when it was rather coarsely ground, particularly in the case of rye, although the same was true of the other grains to a lesser degree. It was found difficult to obtain

rye which was reasonably free from ergot, and the feeding quality of each grain varied from year to year, depending upon the season. However, by using representative samples of each grain annually for three seasons, the result should be fairly reliable.

The average gain per head for an average period of 138 days was as follows: mixed grain 209 pounds, wheat, 202 pounds, barley, 189 pounds, rye, 185 pounds, and oats, 181 pounds. The lowest chop requirement per 100 pounds of gain was 606 pounds in the mixed grain lot with the other grains ranking in the following order: wheat, 627 pounds, barley, 662 pounds, rye, 704 pounds, and oats 715 pounds.

Several methods of selling have been followed. As in the case of experimental feeding, it is desirable to have an accurate valuation on each lot, or better still, on each steer. It is possible, but not always easy to get this satisfactorily done in the stockyards so in one case, the steers were sold at the station after getting sealed bids from four different buyers. Each buyer showed a separate price for each steer. It was interesting to note that the highest total bid was nearly $100 above the lowest and $55 above the next highest for the 25 steers, also that the average of the four bids on each lot showed the highest price for the lot which received the mixed grain—the same lot which made the highest gains on the lowest feed requirement. The other lots were priced in the same order excepting that the barley and wheat lots were reversed for second place with only one cent per hundred between the two lots. The average prices offered per lot were as follows: mixed grain lot, $3.46 per hundred, barley, $3.40, wheat, $3.39, rye, $3.28 and oats, $3.27. These figures indicate the comparative finish as measured by the judgment of four experienced buyers. Each steer was identified by a number on his neck strap.

SHEEP

The breeding flock during recent years has been maintained at approximately 60 females with the necessary changes of sires. Both Rambouillets and Shropshires have been included until, in 1936, the Shropshires were disposed of and, on account of a shortage of feed and pasture, the breeding Rambouillet females were reduced to 30 head.

The comparative wool clip for an average of five years was 8·9 pounds per head from Shropshires and 12·7 pounds from Rambouillets. The wool from the Rambouillets has consistently sold at higher prices and provided more adequate protection for the animals during the winter weather because of the greater density of finer fibres. The lambing percentage averaged for the period was: 146 per cent for Shropshires and 140 per cent for Rambouillets. Cross-bred lambs reached market weight sooner than either of the two pure breeds.

Feeding Tests.—The female lambs selected for breeding purposes and held over winter were used for a comparative test of frozen wheat versus oats for a wintering ration. The average gain per head, in three tests averaging 90 days each, was 11 pounds in the frozen wheat lot and 17 pounds in the oat lot. The gains represent comparative growth rather than condition as no attempt was made to fatten these lambs. The only roughage was oat straw and the grain was fed whole.

Following these tests a similar one was made to compare oats and barley for a maintenance ration for lambs with oat straw as the roughage. The grain was fed whole at the rate of approximately one pound per head daily. The average gains for three tests were the same for both lots (12½ pounds), indicating that there is little to choose between oats and barley for wintering lambs, but that the price per pound should be the deciding factor.

In an attempt to determine the value of rape pasture for lambs, a lot was placed on rape pasture at weaning time without grain, another lot was placed

on rape pasture and given mixed whole grain while a third lot was confined to a dry yard and fed mixed grain and hay. There were 20 head in each lot and the test continued until the pasture became depleted at the end of 19 days. Both lots getting rape pasture made the same gains with or without grain, which was 8·3 pounds per head, while the lambs in the dry yard getting mixed grain and hay gained only 5·8 pounds each. This was only a single test and should be repeated when conditions permit, but it is interesting to note that the grain was of no value when rape pasture was available.

Control of Goitre.—As a means of controlling goitre in lambs, potassium iodide is fed to the ewes during the gestation period. Symptoms of goitre are weak lambs sometimes without wool, and they may or may not have an enlarged thyroid gland (or lump in the throat). The method of feeding the iodide is to dissolve an ounce of the crystals in a teacupful of warm water and sprinkle this solution on 20 pounds of dry salt which is kept before the ewes.

SWINE

During the past five years, only Yorkshires have been kept at this station and the number of litters raised each year has been approximately 20 in the spring and 6 in the fall.

Several sires have been used but the most important have been: (1) Ivanhoe Y39 —139602—sire of the grand champion barrow at the Toronto Royal, 1930, and grand champion himself at Saskatoon and Regina the same year; (2) Evergreen Lad 24 —142428— bred by Alex. McPhail of Brandon, Man., and grand champion at Saskatoon and Regina in 1931; (3) Lacombe Duke 27 —164005—, a boar of Advanced Registry breeding transferred from the Dominion Experimental Station, Lacombe, Alta.; (4) Viking of Svalof (Imp.) —179613— (8106), a Swedish Yorkshire bred by Peter Bondesson's Agricultural Company, Svalof, Sweden.

From feed records over a ten-year period, it has been calculated that an average of 1,087 pounds of mixed feed was required to raise a pig from birth to market weight when one litter per year was produced, averaging seven pigs per litter. The feed for the brood sow for 12 months was included and when two litters per year were produced, the average feed per pig was reduced to 918 pounds. The feed requirement is given rather than the actual cost on account of the constant variation in grain and feed prices. The limited amount of pasture used and cost of labour have not been considered.

Feeding Value of Barley Varieties Compared.—In response to inquiries concerning the comparative feeding value of different varieties of barley, a test was made comparing O.A.C.21, Hannchen and Trebi. A fourth lot was fed a common mixture of oats and barley. In the first test there were ten pigs in each lot and in the second, eight. In both cases the difference in gain was too small to warrant the recommendation of any variety tested over another. In both tests the three lots getting barley chop alone made slightly higher gains than the lot getting part oat chop.

The comparative yields of the varieties under test for a six-year average are as follows: Trebi, 53·5 bushels, Hannchen, 47·1 bushels, and O.A.C. 21, 40·1 bushels per acre. Hannchen was slightly weaker in the straw than either of the other two varieties and Trebi was strongest.

Comparative Value of Different Feeds for Hogs.—In a feeding test of 92 days' duration, barley chop was compared with shorts, each fed with oats, while a third lot of pigs was fed oat chop alone. Five per cent tankage was included in the chop in each case and a mineral mixture was self-fed to each lot. The total gain of 128 lb. per pig in the barley lot and 126 lb. in the shorts lot, indicate that there is practically no difference in value of the two feeds by

weight but the price might be a factor in deciding which to use. The lot getting oat chop alone gained only 103 lb. each, 24 lb. less than the average of the other two lots and the chop eaten per 100 lb. of gain was 83 lb. more in the oat lot than the average requirement of the other two lots.

A similar test was made comparing wheat chop, barley chop and oat chop, each fed alone, together with mixed oat and barley chop. In 92 days the average gain per pig was 103 lb. in the oat lot, 113 lb. in the wheat lot, 107 lb. in the barley lot, and 128 lb. in the lot getting a mixture of oats and barley.

In 1933 a test was made comparing wheat and barley alone, while a third lot was fed a mixture of oats and barley. In 71 days the gain per pig was 114 lb. in the wheat lot, 101 lb. in the barley lot and 92 lb. in the lot getting the mixture. The general results show that oat chop fed alone, even with tankage as a protein supplement, does not produce very satisfactory gains and while a mixture of oats and barley gave a marked increase in gains in one case, in another trial it was slightly below barley or wheat fed alone. It is evident, however, that wheat or barley may be fed alone with tankage, with satisfactory results. Of course, all grain should be finely ground for feeding swine. When a mixture of oats and barley is fed, a common practice is to begin with three parts oat chop to one of barley and increase the proportion of barley gradually until the proportions are reversed, near the end of the feeding period.

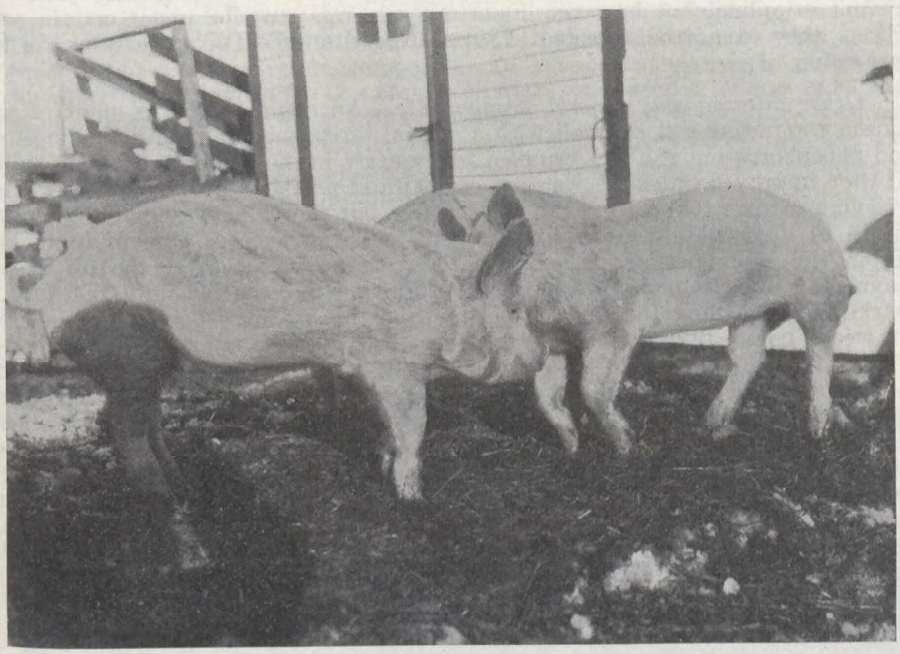
Tests comparing buttermilk and tankage have supported previous tests, showing buttermilk to be superior to tankage for this purpose.

Mineral supplements in the feeding ration.—A single test to determine the value of two per cent of salt in the chop revealed no extra gains in 102 days with pigs on a limited pasture. One observation was that the pigs getting salt did much more rooting than the other lot. Mineral mixtures have not produced important gains when tankage or buttermilk are fed, but in 1934 a lot of pigs which received neither tankage nor minerals gained only 98 lb. per head in 122 days while two lots each getting the same feed with minerals and tankage added, made an average gain of 149 lb. per pig. Two mineral mixtures which have been used extensively at the Scott station are made up as follows:—

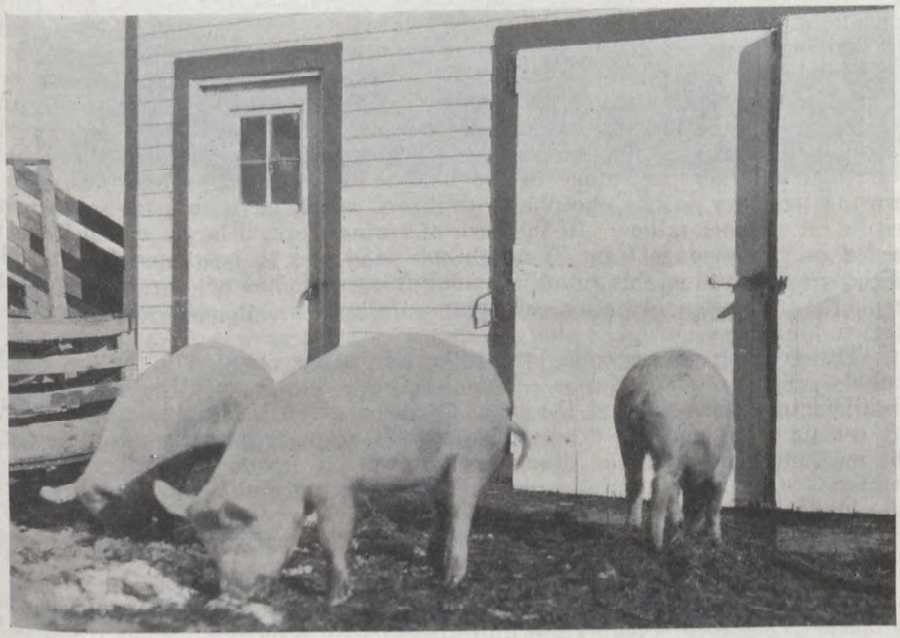
(1) Sulphur, two pounds, ground limestone or hydrated lime, five pounds, salt, 20 pounds, soft fine coal, 50 pounds. Self-fed.
(2) Ground limestone, 50 pounds, bone meal, 50 pounds, salt, 25 pounds. This mixture is combined in the chop at the rate of two per cent.

For brood sows during the winter the salt in either mixture may be iodized by dissolving two ounces of potassium iodide in a teacupful of warm water and mixing thoroughly in 25 lb. of dry salt used.

Fish oils as vitamin sources.—Cod liver oil and pilchard oil have been compared and several tests have consistently indicated that these oils are practically equal in value as sources of vitamin "D." The oil may be fed in the chop during the winter as a preventive for crippling but when fed at the rate of one ounce per pig daily, *it left a very objectionable fishy taste in the pork.* However, this was overcome by discontinuing the feeding of oil about six weeks before marketing the pigs or killing for pork. Pigs have been denied direct sunlight from birth and given no green feed of any kind, yet excellent gains were produced during the winter by use of one of the oils mentioned. For comparative purposes some of these pigs were given the same feed and care except for the oil, and crippling developed in severe form early in the winter. Some of these crippled pigs which were unable to walk to the trough were later saved by the use of oil. It is possible that one ounce per pig daily is more than is necessary to prevent rickets or crippling. Pigs which have had an opportunity to run out in the sunshine for two months or more before winter starts, seldom show signs of crippling before spring, even without oil.



Fall pigs not fed cod liver oil during winter nor given direct sunlight from birth.



Fall pigs fed cod liver oil during winter, no access to direct sunlight from birth.

Limestone and other minerals are sometimes fed during the winter to prevent crippling, but however important minerals may be under certain conditions, they cannot be expected to supply the vitamin " D " so necessary in the prevention of rickets.

Other vitamin and mineral supplements.—An actual trial was made at this station comparing cod liver oil with a special product containing both limestone and phosphorus but the pigs crippled badly early in the winter and upon feeding oil they improved quickly. Ten per cent alfalfa meal fed in the chop prevented crippling of pigs taken from the same litters but the gains were only 42 lb. per pig in 61 days while the cod liver oil lot made an average gain of 61 lb. per pig in the same period. The alfalfa has an advantage over the oil of not leaving an objectionable flavour in the pork and may be fed until the date of marketing or killing the pig for pork, while the oil must be discontinued for six weeks before killing to ensure that the taste of oil is out of the meat.

In 1935, a test was made comparing the two home-made mineral mixtures mentioned in detail before, with a commercial product known as monocalcium phosphate. The test was continued for a period of 92 days, during the summer-feeding period. There were eight pigs in each lot and a fourth lot was given the same feed with the exception of the minerals. Tankage and linseed meal were both fed to all lots at the rate of five per cent of the meal mixture. Practically identical gains in each lot indicated, as in previous tests, that minerals were of little value when tankage was fed. Another condition worthy of note is that all pigs received milk until the test started, at which time the average weight of the pigs was 50 lb.

FIELD HUSBANDRY

ROTATIONS

During the past five years drought and soil drifting have been major considerations in field crop practices. Therefore there is a tendency to measure the value of crop rotations from these standpoints. The cropping system of grain and fallow has grown in popularity. Such a system has been the best form of crop insurance the farmer has had at his disposal. It gives some straw or crop residue to form a trash cover to resist wind action. This system fits in well with strip farming practices. Cheaper methods and less tillage have permitted a larger percentage of the land to be fallowed. There has been a growing tendency to use phosphate fertilizers, which have only been producing results on summer-fallow. In the rush of spring work, a larger acreage can be seeded on the average farm, if no stubble land was to be prepared. In spite of the growing use of this rotation among farmers, it has not excelled the profit from the three-year rotation of summer-fallow, wheat and wheat, on this station.

The growing of a second crop after fallow has resulted in failure of the stubble crops on many farms. This has been due frequently to the use of unsatisfactory methods and the little attention given to stubble crops. There are certain areas and soil types where stubble crops are usually unsatisfactory. On medium loam soils the practice of growing a second crop after fallow is common. On this station the method of preparing stubble in the three-year rotation is to spring plough. During the past six years, wheat, in a rotation of alternate grain and fallow, has averaged 14 bushels and the second crop, 12 bushels per acre.

Grass in the Rotation.—Rotations containing grass have not fared so well in recent dry years. Seeding down of grasses with a nurse crop has resulted in failure or their stands have become thickly populated with weeds. Hay has been of poor quality and yields have amounted to one-third to one-half a ton.

thereby giving less returns than grain crops. Wireworm damage has been prevalent in grain following grass sod. The grain crops following grass (and fallow) have yielded several bushels less than after fallow in a grain rotation, when the past six years are compared. In a series of six years (1926-1930), when moisture was good for this area, the fallow grain crop after grass yielded five bushels more than the same variety of grain on fallow in the three year grain rotation. Farmers in the territory served by this station have, in many cases, discontinued rotations containing grass crops. A definite cycle with grass in a rotation does not seem to fit into prairie agriculture. The use of grass is now confined to special areas on the farm with a definite purpose in view, such as weed control, pasture or to control drifting from a knoll in the field. Utilizing grass for such definite purposes, together with improved methods of obtaining stands, has resulted in a greatly increased use of grass, particularly crested wheat grass, in prairie areas.

Western rye, left—poor sod. Crested wheat grass, right—excellent sod.

Cost of production has been lowered during recent years. Less work is required to summer-fallow in dry years. Cultivating only, instead of ploughing, has resulted in economy. Ploughing costs almost as much as three cultivations. In recent years the work done on summer-fallow has often been limited to two cultivations. Tillage has been reduced to a minimum to avoid soil drifting, thus reducing cost. Harvesting and threshing have not only been expensive but involved a cash outlay. Efforts have been made to reduce this cost, mainly by the use of home-made headers and header-barges.

CULTURAL TREATMENTS

The investigational work discussed under this heading involves the study of various tillage methods and the use of manure in the production of field crops. These include: treatment of summer-fallow, cover crops, stubble treatment, depth of ploughing, soil packers, summer-fallow substitutes, manure and straw mulch. A three-year rotation is used for all experiments and most of them have been in progress long enough to make fairly definite statements on the results of the various treatments.

Methods of Summer-Fallowing.—Regardless of any disadvantages it may have, the practice of summer-fallowing in some form is an essential part of any cropping system under prairie agriculture. A number of summer-fallow treatments have been tested for 21 years at Scott. There was little difference in yields obtained from ploughing summer-fallow, four, six or eight inches deep, but the results favoured the four-inch ploughing. Ploughing twice, namely, in June and backsetting in September, did not give sufficient yield increases over ploughing once to pay for the extra cost of the second ploughing. In summer-fallow ploughed on May 15, June 15 and July 15, the results were definitely in favour of the early date. Yields of wheat produced on fallow ploughed May 15 gave an average increase of five and one-half bushels per acre, over the crop grown on fallow ploughed on July 15. In this test, no cultivation was given previous to ploughing. There was practically no weed growth at the time of the first ploughing but by July 15, there was heavy weed growth. These results illustrate the losses in yield that may be expected by allowing weeds to grow on the land during the summer-fallow year.

Spreading straw to control soil drifting on knolls.

Seeding a half bushel of oats on the fallow after ploughing in June and pasturing off, reduced yields to the same extent as when ploughing was delayed until the middle of July. Unlike a cover crop, this plot was cultivated after pasturing and no growth was left to catch snow, which would have replenished in part the moisture used by the oats. A series of plots were used to test the value of tillage treatments before ploughing the summer-fallow, in which all plots were ploughed in June. Spring cultivation gave better results than either cultivating or ploughing the previous fall. When the experiment was started, ploughing in some form was thought necessary for summer-fallow. With the introduction of the ploughless or cultivated fallow, this method was included in the test. Results from 12 years' work show that yields on ploughless fallow are equal to yields obtained after ploughed treatments, and that the ploughless fallow is less expensive. From the standpoint of moisture conservation, results show that any method of summer-fallowing which keeps the land free of weeds and other growth, accomplishes the desired purpose. Timely cultivation with

sharp implements gave better control of weeds, and usually reduced the number of cultivations. Ploughless fallow, with stubble incorporated on the surface, has been observed to resist wind action where ploughed fallow was drifting.

Value of Cover Crops.—An experiment was begun in 1935 to test the value of cover crops. Seedings were made at different dates in the summer-fallow year. Soil moisture samples were taken at the time of seeding the cover crop, both at the end of the growing season and again the following spring, just before seeding the crop. The soil moisture figures, taken at the end of the growing season, showed that the cover crops used moisture and the amount used increased with the earlier dates of seeding. Moisture determinations taken the following spring before seeding showed practically the same percentage of moisture for all treatments in the first foot of soil, including the check plots, where no cover crop was used. It should be mentioned that there was a heavy snowfall on the plots and because there was no frost in the ground, most of the moisture from the snow was absorbed into the soil. This may explain why there was practically no difference in the 1936 yields from different dates of seeding cover crops.

A problem with cover crops in dry years is the difficulty of obtaining a stand and the danger from grasshopper damage when a stand is obtained. A new method included in this test was mowing the weeds during the summer-fallow year instead of tillage. Where the stand of weeds was uniformly thick, two cuttings checked their growth but where they were thin, the tendency was for the weeds to spread out along the ground and set seed. This treatment produced lower yields, shorter straw, had more biennial weeds than the others, and was equally expensive.

Depth of Ploughing.—Reports appear from time to time of increased yields obtained from deep ploughing. It is claimed that deep ploughing creates a reservoir for holding the moisture. Depths of ploughing for summer-fallow were tested at three, four, five, six, seven and eight inches deep. Another set of plots was ploughed at five, six, seven and eight inches deep, in which each plot was sub-soiled four inches below the furrow. Thus, the soil was moved from three to twelve inches deep. This experiment was conducted for 17 years. There was little difference in yield for the various depths, but results favoured the four-inch ploughing. These findings substantiate results from varying depths of ploughing in other tests. In addition to giving equally high yields, shallow ploughing gives better control of wireworms and certain annual weeds.

Wheat, oats and barley were tested in two and three row groups in addition to single rows of sunflowers, corn and potatoes, as summer-fallow substitutes. Wheat, following these crops, was compared with wheat on fallow and continuous wheat. Triple rows gave higher yields than three double rows for the three classes of grain used, but the difference in yields of wheat following grain in double or triple rows, was small. Sunflowers yielded over three times the tonnage of corn, and the yield of wheat following was about the same as continuous wheat. The yield of wheat following corn, was equal to wheat on bare fallow, but the three drill rows of grain proved the most profitable fallow substitute. Some of the disadvantages of using grain in rows as fallow substitutes are: uneven maturity, volunteer grain in the subsequent crops, and the rapid increase of weed growth.

SOIL PACKING EXPERIMENTS

The value of using soil packers for wheat has been tested for 20 years at Scott. In the first eight years of the test, three types of packers were used, namely: surface, subsurface and combination packer. At the end of this period, results showed that the time of packing and the condition of the soil when the packing was done, were important considerations. The experiment was com-

pletely revised in 1922 and involved a comparison of the surface packer, culti-packer with an extra stroke of the harrow on summer-fallow, spring ploughing and fall ploughing.

In order to test the best time to pack, the three implements were used in the preparation of the summer-fallow at five different stages. These were: after ploughing the summer-fallow, just before seeding the crop the next spring, immediately after seeding, both before and after seeding the crop and both after ploughing the summer-fallow and after seeding. The best result from an extra stroke of the harrow was when it was done in the spring, just before seeding. The only stage where packing gave an increased yield over harrowing was after ploughing the land in the summer-fallow year, in which case the increase was about two bushels. This increase, however, was not equal to an extra stroke of the harrow before seeding. In none of the other treatments was there any consistent difference in favour of packing over harrowing. In the case of spring ploughed stubble, these implements were used before seeding, after seeding, and both before and after seeding. The double operation of packing and harrowing did not increase the yield over the single operations for any of the implements used. Results were in favour of the culti-packer used after seeding, but the yield differences were small.

The packers and harrow were compared at four different stages in the preparation of the fall ploughed stubble, namely: in the fall after ploughing, the next spring before seeding, after seeding, and both before and after seeding. Two operations were no better than one and there was no material difference from packing in any stage. The results favoured an extra harrowing when given just before seeding. The average results from 12 years work did not show any consistent difference in favour of packing over harrowing, for the different stages of soil preparation in which they were used. The packing of the land for the sake of harvest implements may be considered worthwhile by some farmers.

STUBBLE TREATMENTS

Several tillage methods have been tested in the preparation of stubble land for grain crops. Spring ploughing of the stubble land has consistently out-yielded fall ploughing for both wheat and oats, at this station. The average increase was approximately two and one-half bushels per acre for wheat and five bushels for oats. In the case of oats, spring cultivation was next, with fall ploughing giving the lowest yield. Stubble, disked in the fall, gave about the same yield as fall ploughing and the cost was much less. Early fall disking before fall ploughing did not materially influence the yield, but fall disking reduced the yield of spring ploughing by about a bushel per acre. The fall disking treatments called for in this project were done fairly deeply and left little stubble to hold snow. A study of results indicates that any fall treatment which destroys the stubble reduces the yield of the succeeding crop. Where fall disking is done for weed control, it is advisable to do it early and very shallow, just deep enough to move the soil but not to destroy the stubble. In another part of this experiment, deep fall cultivation only, spring cultivation and no cultivation when seeding wheat on stubble, were compared. For the past eight years, results have averaged as follows: spring ploughing, 11·5; spring cultivation, 9·5; deep fall cultivation, 8·9; shallow fall cultivation, 7·9, and no cultivation before or after seeding stubble, 1·5 bushels per acre. These results forcibly illustrate the necessity of some form of tillage of stubble before seeding the grain crop, as shown by the abnormally low yield where no tillage was given.

Barnyard Manure.—The value of fresh and rotted manure on summer-fallow and stubble crops of wheat, oats and barley has been tested for 20 years. All manure was applied at the rate of 12 tons per acre. With wheat, applications of fresh and rotted manure, ploughed under in the fallow year, gave

similar increases of two and a half bushels per acre. There was no residual effect from the fresh manure, but the rotted manure showed about a bushel increase in the second crop. Spreading fresh manure on first year's stubble in winter, gave no yield increase in the following crop. No increase in yield was obtained by using manure in the form of top dressing, after seeding on spring-ploughed stubble, but residual increase of over two and one-half bushels per acre was received in the fallow crop following. Rotted manure applied on first year's stubble and ploughed under in the fall, gave an increase of three and one-half bushels per acre. Spreading rotted manure in the spring and ploughing it under before seeding, gave the highest yield increase, which was over five bushels per acre.

In the case of oats on fallow, fresh manure gave better results than rotted manure. Where manure was applied to oats in the second crop after fallow, the increase from fresh manure was about five bushels per acre. A similar increase was obtained from ploughing under rotted manure in the fall. The lowest increase was from using rotted manure as a top dressing and the highest from applying the manure in the spring and ploughing it under before seeding. Results from the use of fresh and rotted manure for barley grown on fallow were about a bushel per acre in favour of rotted manure. The use of manure for barley, when grown as a second crop after fallow, was also tested. The highest increase was obtained when the manure was applied in spring and ploughed down before seeding, but the application of fresh manure spread in the winter and ploughed under in the spring gave practically the same increase. Using rotted manure as a top dressing after seeding gave the lowest increases.

In general, results from fresh and rotted manure were about equal when used on wheat, oats and barley, grown on summer-fallow. Where the manure was applied to affect the second crop after fallow, rotted manure applied in the spring and ploughed under before seeding gave best results, except in the case of barley, with which crop fresh manure was equally as good.

The use of fresh and rotted manure has been tested for sunflowers grown on fall and spring ploughed stubble. The average increase in yield from manured plots was about a ton per acre. A heavy application of rotted manure did not materially increase the yield over a light one. The results favoured the use of rotted manure with spring ploughing, and eight tons per acre was the most economical rate. Yields of six to seven tons per acre may be considered satisfactory for this crop, when grown on ploughed stubble, under conditions at this station.

STRAW MULCH FOR WHEAT

The value of spreading straw on the wheat crop after seeding has been tested at Scott for ten years. Results from this experiment are important at present because of the increasing use of straw in some form, as an aid in controlling soil drifting. Straw was spread immediately after seeding, at the rate of a ton and a half per acre, on both summer-fallow and spring-ploughed plots and compared with similar treatments which received no straw mulch. Spreading straw on the summer-fallow crop did not increase the yield, but the residual effect from it gave an increase of three bushels per acre in the following crop on spring-ploughed stubble. Applying straw on the spring-ploughed crop gave an increase of two and one-half bushels per acre, in the following crop on summer-fallow. The results show that some increase in yield may be expected from this practice. The information is valuable in connection with soil drifting. While it is not always practical to spread straw on large areas, more of the straw than usual can be left on the land in the form of stubble. Some volunteer grain was observed in the plots receiving straw mulch and they were usually a few days later in ripening.

Green Manure Crops.—The use of green manure, in the form of leguminous crops, ploughed under in the summer-fallow year, has been tested in a three-

year rotation. Plots of peas were drilled into the stubble in early spring and ploughed under in early and late bloom. Other plots were seeded to sweet clover and the clover ploughed down in July. The height of the sweet clover when ploughed, depended on the rate of growth. Another plot, summer-fallowed in the ordinary way, received an application of 12 tons of rotted manure per acre. Ploughing down sweet clover and peas in the summer-fallow year reduced yields two bushels per acre in the subsequent wheat crop, compared with the ordinary summer-fallow, while the manure plot yielded six and one-half bushels more than the usual fallow. The results show that the use of moisture by any form of growth in the summer-fallow year, reduces the yield of the succeeding crops. The green crops occupy the land most of the months of May and June and use the moisture received in this period. The loss of this amount of moisture under conditions similar to those at Scott, more than offsets any value derived from the green crops ploughed under during the summer-fallow year.

COMMERCIAL FERTILIZERS

Perhaps no phase of field crop production in northwestern Saskatchewan has attracted more attention in the past five years than the use of commercial fertilizers. Some 20 years ago, tests with commercial fertilizers were commenced on this station. Unfortunately, the different classes of fertilizers were applied to corn once in four years in a rotation of wheat, oats, hay and corn. It was not until 1927 when three crops of wheat had been grown on the land that the effect on wheat was discovered. Nitrate of soda had a slightly depressing effect on the yield of wheat. Potash gave a yield practically the same as an untreated plot. An increase of six bushels per acre was obtained where phosphate fertilizer was used alone. Influences on the wheat crop were also obtained where phosphate fertilizer was used in combination with other forms of commercial fertilizers. Where phosphate fertilizer was applied, early growth of wheat was more vigorous, the appearance of the plots was more uniform, time of ripening was advanced and yields were increased. This was followed by field tests with phosphate fertilizer on wheat, drilled in with wheat, and which served to confirm the plot tests. Some six years ago, a fairly comprehensive study of the practices to be used in applying phosphate fertilizer, was commenced, using phosphate alone and phosphate with nitrogen in the form of ammonium phosphate.

The foremost question was the rate to use with triple superphosphate (43 per cent) and ammonium phosphate (10-48) which were being sold to farmers in the Prairie Provinces. The rates used, yields obtained and profit from different rates, are shown in the following table.

PROJECT F. 511

RATES OF APPLYING PHOSPHATE FERTILIZER WITH WHEAT SOWN ON SUMMER-FALLOW

6-Year Average—1931-1936

Rate of Application per Acre	Yield Six-Year Average	Six-Year Average Increase	Value of Increases	Cost of Fertilizer	Profit
	Bush.	Bush.	$	$	$
Triple Superphosphate 20 lb.	16·5	1·8	1.01	0.48	0.53
" 30 "	16·8	2·1	1.18	0.72	0.46
" 40 "	17·5	2·8	1.57	0.96	0.61
" 50 "	18·2	3·5	1.96	1.20	0.76
" 60 "	18·5	3·8	2.13	1.44	0.69
" 80 "	18·6	3·9	2.18	1.92	0.26
CHECK—No Fertilizer	14·7				
Ammonium phosphate 18 lb.	18·4	3·7	2.07	0.54	1.53
" 27 "	18·2	3·5	1.96	0.81	1.15
" 36 "	18·9	4·2	2.35	1.08	1.27
" 45 "	20·0	5·3	2.97	1.35	1.62
" 54 "	20·5	5·8	3.25	1.62	1.63
" 72 "	20·7	6·0	3.36	2.16	1.20

The results show much higher increases for ammonium phosphate when compared with corresponding rates of triple superphosphate, on a basis of phosphate content. An 18-pound rate of ammonium phosphate costs six cents more than a 20-pound rate of triple superphosphate, but the former produced almost three times as much profit. In field appearance, there was not much difference between the rates used, but all showed more uniform and vigorous growth than the untreated plots used for comparison. The difference with high rates was that the kernels were smaller in dry years, even though good increases were obtained. The reaction of farmers viewing these plots was to use a low rate because it involved less cash outlay, yet with all the advantages desired.

Rates of Seeding Wheat with Phosphate Fertilizer.—Because of the more vigorous growth when phosphate was used with wheat, an attempt was made to study the rate of sowing the grain per acre. Rates of $\frac{3}{4}$ bushel, 1 bushel, $1\frac{1}{4}$ bushels and $1\frac{1}{2}$ bushels of wheat were each sown without and with ammonium phosphate, at a rate of 36 pounds per acre. The respective increases in yield for these rates were: 3·9, 5·5, 4·2 and 5·2 bushels per acre in favour of the fertilized crop. At this station the practice is to use $1\frac{1}{4}$ bushels of wheat on fallow and these results indicate that a peck less seed per acre may be used when drilling in ammonium phosphate fertilizer with wheat on summer-fallow.

Note earlier and more even heading of wheat produced by phosphate fertilizer.

Dates of Seeding Wheat with Phosphate Fertilizer.—Many farmers were of the opinion that, because of the advanced maturity obtained, phosphate fertilizer could best be used on late-sown crops to help avoid frost damage. A project was designed to find an answer to this question. Plots were sown with and without phosphate fertilizer, commencing as soon as possible in the spring and continuing at weekly intervals until six sowings were made. The first date usually falls in the third week of April and the sixth, the last week in May. Six years' work has served to establish that the last two dates gave the lowest yields and the poorest sample of grain. From a practical point of view, the best date was the second, or as soon as wheat seeding becomes general. Wheat sown with phosphate fertilizer three weeks later than the earliest seeding without fertilizer, usually matured at the same time, but later seedings with this fertilizer would be more subject to frost.

Drilling versus Broadcasting Phosphate Fertilizers.—In this series of experiments where results are quoted, the phosphate fertilizer was drilled in with the seed. A series of plots was devoted to the question of broadcasting versus drilling. Two to three times as much increase was obtained by drilling-in the fertilizer with the seed, as compared with broadcasting at the same rate before seeding. This experiment also served to confirm the results already mentioned, that ammonium phosphate produced larger increases than triple superphosphate.

Manure versus Phosphate.—Perhaps the most common form of fertilizer used is barnyard manure. A test was designed to compare: barnyard manure alone, phosphate alone and manure plus phosphate drilled in with wheat. In six years, the average results with wheat on summer-fallow, have been: no fertilizer, 14·8 bushels per acre; phosphate fertilizer alone, 18·8; barnyard manure alone, 20·0; and barnyard manure plus phosphate, 23·0. The increase of 8·2 bushels per acre for a combination of manure and phosphate, is the largest increase in this series of experiments. While this combination is not practical in prairie agriculture, it has a place for multiplying pure seed or other special crops.

Size of Fertilizer Particles.—Some difficulty was experienced because of lack of uniformity in size of particles in fertilizers sold. Special screenings were made therefore to determine drillability and response of wheat when different sized particles were used. There was practically no difference in effect from phosphate fertilizer screened to four different sizes, except that a convenient drillable size of free-running fertilizer had the advantage. This difficulty has been overcome for the user, by a convenient granular form being sold on the market.

Phosphate with Different Percentages of Nitrogen.—When detailed work on phosphate fertilizers was started at this station some six years ago, there was one mixture of ammonium phosphate fertilizer sold on the market in the ratio of about one of nitrogen to five of phosphate. The question arose as to whether this was the right combination, if nitrogen was necessary. Special mixtures of nitrogen and phosphate were therefore tested in the ratios of: 1 to 5, 1 to 2¼, 3 to 4½ and also at three different rates using the same proportion of nitrogen and phosphate. The results, after six years work, indicate that all combinations gave yield increases over untreated plots and that the increase was larger as the percentage of nitrogen was increased while the phosphate percentage remained constant. In other words, the largest increase was obtained when the amounts of nitrogen and phosphate were even. The question of rate to apply per acre with wheat on summer-fallow, when nitrogen and phosphate are in the same proportion, has not been determined yet.

Response of Wheat Varieties to Phosphate.—Some discussion arose as to whether the response from phosphate fertilizers would be the same with different varieties of wheat. Marquis, Garnet, Reward and Reliance have been tested with and without ammonium phosphate. The early varieties (Garnet and Reward) have only given half the increase from phosphate that was obtained when Marquis was used. Reliance, although maturing about the same time as Marquis, gave practically the same low increase as Reward, although, without fertilizer, Reliance yields some ten per cent higher than Marquis.

ADDITIONAL FERTILIZER FINDINGS

To supplement the tests with phosphate fertilizers that are conducted on small plots, this work has also been carried on under field conditions to give a more practical aspect from the farmers' viewpoint. After seven years of applying ammonium phosphate on summer-fallow under field conditions, it has been

found that a five-bushel increase per acre has resulted and that wheat has ripened five days earlier, when Marquis was used. The yield increases reported from applications of phosphate fertilizers have been obtained by applying phosphate drilled in with wheat on summer-fallow. No increases have been obtained by direct application to wheat on stubble. Increases in yield have not been obtained on stubble where phosphate was applied only the previous year to the crop grown on fallow. Moderate applications have given no increase on hay crops. The assertion frequently made by farmers, that once fertilizer is used on the land its use must be continued, has not been found true with reference to phosphate fertilizers and this fallacy has no experimental evidence as proof when applied to phosphate fertilizers.

Results from tests at this station with phosphate fertilizer, on the lessening of damage caused by wireworms and certain root diseases in wheat, has prompted investigators of these crop hazards to make more detailed studies of these subjects. The pronounced lessening of damage caused by weeds on grain crops, is no doubt a factor which contributes to the increased yields obtained, and is discussed in the weed section of this report.

Before a farmer uses phosphate fertilizer on a large scale, he should first establish by making a small field test, the profitability of its use on his farm. After that, its use should be continued every year, rather than only in those seasons which are supposed to turn out to be wet years. Even when a soil reacts to the use of phosphate fertilizer, the results are definitely related to supply of soil moisure.

WEED EXPERIMENTS

Weed counts have been made for several years on a number of tillage experiment and crop rotation plots. The object of making these weed counts is to determine the effect of certain cultural treatments and crop rotations on weed control. A rotation of two grain crops and summer-fallow was used for all cultural experiments. The rotations included cropping systems of grain crops alone and grain crops with grasses and clovers. The weed counts were made on a number of areas of one square yard each. The number of counts was increased according to the size of the plot. The rotations containing grasses and clover had many more kinds of weeds present than did the straight grain rotations, but the infestation of most of the weeds was light. Except for lamb's-quarters, the infestation of all kinds of weeds found on the cultural experiments was also light. In the case of many of the weeds, there were not enough to test the control value of the different tillage treatments used. For this reason, only their effect on the most prevalent weeds will be discussed.

Lamb's-Quarters.—This was the most prevalent of the weeds found and was present on 95 per cent of the plots. Ploughing summer-fallow late—the middle of July—gave better control than the other summer-fallow practices used. In the case of the second crop after summer-fallow, where the land had received fall ploughing or fall tillage, there were fewer weeds than on land that had been spring ploughed. In the packing experiments an extra stroke of the harrow gave better control than packing. The use of fertilizer drilled in with the grain greatly reduced the amount and vigour of growth of lamb's-quarters in the summer-fallow crop. In rotations including grass and clover crops, there were fewer weeds in the hay crops than in the grain crops.

Wild Buckwheat.—This plant ranked second in degree of infestation. The infestation was heavy on the grain rotations, but comparatively light in the cultural experiments and rotations containing grass and clover. Ploughing twice in the fallow year appeared to give a little better control than one ploughing, but the infestation was light on this project. There was less weed growth following spring ploughing than with fall ploughing or cultivation. A heavy

infestation on rotation " C " (summer-fallow, wheat, wheat) showed no material difference in the number of weeds on summer-fallow and spring-ploughed crops, but the weeds were definitely smaller on the spring-ploughed crop and therefore used much less moisture. The use of phosphate fertilizer drilled in with wheat on fallow did not appreciably reduce the number of weeds, but the plants were so small and backward in growth on the fertilized crop that many of them did not mature seed. This may explain why the following crop on spring ploughing had less weeds than where no fertilizer was used on the previous summer-fallow crop. Where applications of rotted manure were made, the infestation was somewhat less than where no manure was used, and the first crop following the manure benefited most in this respect.

Stinkweed.—Only a very light infestation of stinkweed occurred in the cultural experiments. Late ploughing of the summer-fallow, on July 15, without previous cultivation gave quite a heavy growth, while the other summer-fallow treatments had none to less than one plant per square yard. Stinkweed is an annual and winter annual and unless destroyed, many of the seeds ripen by the middle of July. Where comparisons could be made, oats appeared to give a little better control than wheat. In the three-year grain rotation there were more weeds in the summer-fallow crop than in the second crop on spring-ploughed stubble.

Peppergrass.—Ploughing twice gave best control of this weed in the summer-fallow treatments and ploughing the summer-fallow late with no previous cultivation, the poorest control. Crops grown on spring ploughing had a lighter infestation than on fall ploughing or on summer-fallow land. The use of fertilizer on the crop sown on summer-fallow reduced the number of weeds as compared with that where no fertilizer was used. In rotations containing grass and clover, the infestation was definitely heavier in the grass and clover crops than in the grain crops of the same rotations.

Spearleaf Goosefoot.—All summer-fallow treatment gave good control of this weed except where the fallow was ploughed late. Control in the second crop after fallow favoured fall tillage. Crops grown on summer-fallow had a lighter infestation than the second crop after fallow.

WEED SEED GERMINATION STUDIES

An experiment was designed in 1933 to test the effect of rotting manure on the germination of certain weed seeds and, if possible, the length of time required to kill them. Several collections of weed seeds were buried in a manure pile and their germination tested at definite periods.

Twenty-five species of weed seeds in lots of 100 each were prepared in quadruplicate and placed in a gradually increasing pile of manure. The weed seeds were: ball mustard, blue burr, Canada thistle, cow cockle, common false flax, false ragweed, hare's-ear mustard, lamb's-quarters, night-flowering catchfly, field peppergrass, purslane, quack grass, red root pigweed, Russian pigweed, Russian thistle, shepherd's purse, perennial sow thistle, stinkweed, sweet clover, green tansy mustard, wild buckwheat, wild oats, wormweed and tumbling mustard. When samples of each were removed and tested at the end of three and six months, not a single seed germinated.

Seven weed seeds (blue burr, lamb's-quarters, quack grass, Russian pigweed, stinkweed, tansy mustard and wild oats), placed separately in fresh horse and cow manure as received from the barns, inside folded fine screening of monel metal, failed to germinate at the end of one month.

Another group of 14 weed seeds were wrapped in monel metal and placed in a corner of the manure pile which was watered every three or four days. At the

end of one month, not a single seed germinated. Another group of weed seeds were handled similarly except that the monel metal was not used but the weed seeds were wrapped in cardboard or thin wooden containers. Again no weed seeds germinated at the end of one month. This indicated that slight decomposition of the monel metal noted where it was used in another phase of this project, was not responsible for destroying germination.

In view of the fact that the germination power of all weed seeds tested in manure was destroyed at the end of one month, it was decided to obtain more definite information on the time required to destroy their vitality. Lamb's quarters, wild buckwheat, stinkweed, wild oats, peppergrass, red root pigweed, blue burr, tansy mustard, shepherd's purse, and tumbling mustard were used in the test. The seeds of each variety were removed at periods of 3, 7, 14, 21, 30 and 60 days and tested for germination. Unfortunately the heating of the manure pile was not as uniform as the previous year. For this reason, the germination results for the first few periods are rather inconsistent. However, none of the seeds removed at the end of the 30-day period germinated, which corroborates the findings of the previous year.

CONTROL OF LAMB'S-QUARTERS

An experiment was begun in 1934 to determine the value of various methods of controlling lamb's-quarters. This project is conducted in eight different parts, but has not been in progress long enough to appraise the value of the various methods used.

Part 1 consists of ten different summer-fallow treatments. Ploughless fallow, cultivated only when weeds were four inches high, gave somewhat better control than the other treatments used. Three treatments in this part of the experiment were: harrowing grain just before it emerged, harrowing when weeds had reached the two-leaf stage, harrowing both before grain emerged and when weeds had reached the two-leaf stage. Three years' results show no difference in yields from any of the harrowed plots as compared with those not harrowed. Harrowing reduced weeds, but also thinned the stand of grain. This was more pronounced in the plots twice harrowed. Weeds that remained after harrowing grew larger than on the unharrowed plots. With a good supply of early summer moisture in 1934, harrowing grain when leaves had reached the two-leaf stage, increased yields. During 1935 and 1936, with a comparatively light weed infestation, but with crops suffering from drought, harrowing did not increase yield and, in some cases, reduced it.

In part 2, three different rates of wheat, oats and barley were sown on both summer-fallow and spring-ploughed stubble: (1) with phosphate fertilizer drilled in with the seed; (2) with phosphate fertilizer broadcast before seeding; (3) with no fertilizer. The rates seeded per acre were: wheat—1, 1½ and 2 bushels; oats—1½, 2½ and 3½ bushels; barley—1, 2 and 3 bushels. Results showed that when phosphate fertilizer was drilled in with the seed on summer-fallow land, fair yield increases were obtained, which decreased with the higher rates of seeding. Where fertilizer was broadcast before seeding the grain, yields were not materially influenced, as compared with plots receiving no fertilizer. The use of fertilizer on spring-ploughed stubble crops had a tendency to decrease, rather than increase, yields. In general, the yields of all crops decreased with increased rates of seeding, both with and without fertilizer. In addition, higher rates of seeding grain were associated with shorter crops and slightly advanced maturity. Weeds were noticeably reduced in size for all crops with increasing rates of seeding, but this reduction in size was more pronounced in the fertilized crops. A reduction was also shown in the number of weeds, in the case of oats and barley, but not appreciably so with wheat. Barley (Hannchen) gave the best control of weeds, and oats were somewhat better than wheat in this respect.

Part 3 is designed to test the effect of dates of seeding wheat on the development of lamb's-quarters. Seedings are made on April 25, May 10 and May 25 at the rate of 1½ bushels per acre on summer-fallow and spring-ploughed stubble. In 1934, with comparatively good moisture conditions, the later seedings had smaller and fewer weeds. Under dry conditions in 1935, weed control and stands of grain were better in the early seeding. Similar results were obtained in the extremely dry season of 1936. Crops on spring ploughed stubble had fewer weeds than on summer-fallow.

Part 4 deals with the effect of weeds on wheat yields. This part of the experiment was conducted on large rotation fields instead of on small plots. Five areas were selected on which the crop was kept free of weeds during the growing season. Five areas of equal size, representing a light to medium weed infestation, were picked. A similar group was selected, having a heavy infestation. Compared with areas which were kept weed free, the light to moderate infestation reduced wheat yields by 25 per cent and the heavy infestation by approximately 50 per cent. These yield reductions illustrate the losses that may be caused by weeds and emphasize the necessity of practising the most efficient methods of weed control.

Part 5 is designed to test the viability of buried seeds of lamb's-quarters. Twenty bottles, each containing 200 seeds of lamb's-quarters, mixed with weed-free soil, were buried at a depth of six inches in 1934. In June, 1935, at the end of one year, two bottles were dug up. The germination was 58·9 per cent in sterile soil and 94 per cent on blotters. At the end of two years, in 1936, two more bottles were dug up. This time the seeds gave a germination of 67 per cent in sterile soil and 25 per cent on blotters. While the results are not consistent, they do indicate that the germinating power of lamb's-quarters buried in the soil, was reduced at the end of two years.

OBSERVATIONS ON WEED CONTROL

It has been observed that timely and efficient tillage methods greatly reduce the damage caused by annual weeds on this station. Weeds on summer-fallow cannot be destroyed unless the work is started before the weeds become too large. Any tillage method on a summer-fallow should kill the annual growing weeds in one operation. The sharpness and set of cultivator shovels are most important in weed control. Summer-fallow tillage should only be done when there are weeds to destroy. When there are a few large weeds scattered over the summer-fallow in the fall, it is often more economical and safer to hand-pull and remove them, rather than to work the whole field. A light growth of annual weeds in the fall, on summer-fallow, that would be destroyed by frost, can often be left advantageously as an aid against soil drifting, rather than giving the land an extra working. In the spring, all land to be sown to grain should be given some form of spring tillage and should be seeded as soon as possible after the land is worked, both for weed and soil drifting control. Using clean seed which contains no weeds is the first step in producing clean crops. Grain crops should be given the maximum opportunity for development, particularly in the early stages. This involves vigorous seed, careful smut treatment (preferably with a mercury dust compound) and uniform seeding. A drill which seeds unevenly, or misses, results in bare spaces where weeds grow and ripen before the grain is harvested. Application of these principles of weed control resulted in cleaning up a farm leased by this station, which was infested with annual weeds (mainly wild oats) even before the use of phosphate fertilizer which is a great help in weed control when combined with the other practices outlined.

CEREALS OR GRAIN CROPS

During the past five years, yields of grain crops have shown wide variation. In fact, since the last report of this station was published in 1930, from the standpoint of yield, there have been two paying crops, two were about half the average yield and two were almost in the failure class. The seasons of 1931 and 1932 produced good wheat yields, averaging approximately 20 bushels per acre; 1933 and 1936 crops were both about four bushels per acre, while in 1934 and 1935 they were slightly over ten bushels per acre, under field conditions. Oats gave approximately twice the bushel yield of wheat, and barley about midway between, which means these classes of grain produced about the same number of pounds per acre.

These years represent somewhat worse than average conditions at this station. They are definitely on the dry side. The results of variety tests in these years represent a reasonably good index of their performance in west-central Saskatchewan over types of seasons that may be expected. Rust did not affect yields of wheat these stations during these years.

WHEAT VARIETIES

At the close of 1936, Apex was a much discussed variety because rust was prevalent in eastern Saskatchewan during the previous year. It is one of the new varieties resistant to stem rust. In appearance it is similar to Marquis and matures about the same time. During the past three years, it has definitely outyielded Marquis at this station and the sample of grain has been good.

Testing of grain varieties requires accurate work and careful study.

Garnet has given a good performance in northern areas. It starts growth rapidly in early spring and is little affected by browning disease which attacks wheat plants in the seedling stage. Straw is slightly shorter and not so strong as Marquis. Few varieties thresh easier. During wet falls it has been observed to sprout readily in the stook. Unfortunately, this early variety is not equal in baking strength and flour colour to Marquis. Because Garnet falls off in

yield, with lean kernels under dry conditions, its production is confined to the park areas north of the prairie where earliness is essential to help escape frost. During the past five years (1932-1936), the weight per bushel of Garnet has been two pounds less than Marquis.

Few varieties have the general adaptation of Marquis and none is more widely grown in western Saskatchewan. In yield it is close to the top among varieties tested. Under dry conditions it holds its colour and plumpness of kernels perhaps better than any other variety tested. Its general performance in the field combined with high milling and baking qualities makes it a standard by which to compare other varieties. Its chief disadvantages are its lateness for areas subject to late summer frosts and its susceptibility to stem rust. Where these hazards exist, more suitable varieties are gradually replacing it.

Mindum is regarded as the standard of macaroni quality for the durums. Mindum is bearded, longer and much weaker in the straw than Marquis and usually matures a day or so later. In the past six years it has yielded almost 25 per cent less than Marquis. There is a tendency among farmers to grow a durum variety when the price is higher than common spring wheat. It has happened that when the crop is ready to be marketed the price spread is lower for durum. The grower then loses with lower yield as well as price. In switching back to Marquis or another hard red spring wheat on the same farm, a mixture of these invariably results which seriously reduces grade and market price.

Red Bobs has performed consistently well at the station and during the past six years has maintained its high position for yield. Under field conditions it is usually quite attractive with its erect heads and complete absence of awns. The stem is slightly shorter than Marquis. This variety threshes easily. Its distribution is confined to north and west of this station and it was eliminated east of this point in 1927 because of damage from rust. It is usually about four days earlier than Marquis and this contributes to its popularity in the north. In park areas it has a strong tendency to produce a piebald sample and in wet harvest weather Red Bobs bleaches readily. Similar sister sorts are Early Triumph, Supreme and Red Bobs 222.

Red Fife is now rarely found in large fields in pure form. It has been eliminated mainly because it is late in maturing, usually lower in yield and shatters readily. Occasionally it is grown as a stubble crop because of longer straw than Marquis. Frequently, it is confused with Early Red Fife which is a few days earlier but distinctly different. During recent dry years many farmers have claimed yields would have been better had they still been growing the old Red Fife, but its performance at this station during that period disproves such claims.

Reliance is a relatively new wheat and is one of the few bearded varieties of red spring wheat found growing in this part of Saskatchewan. An outstanding merit of this variety is its greater resistance to spring frosts after the crop has emerged, compared with other commonly grown varieties. At this station, it has usually outyielded Marquis. The sample of grain usually weighs the same as Marquis but is not so attractive in colour of kernel.

Reward, although low in yield at this station, has some merits worth mentioning. It is early, produces an attractive sample and ranks very high in flour quality. On the other hand, it suffers badly from spring frosts, is susceptible to browning disease, is a poor weed fighter and has a ragged-looking field appearance. Because of these qualities it is not a good wheat for general use in western Saskatchewan. In the north, it usually makes a highly attractive sample of grain and yields comparatively better. Because of its larger kernels, it is advisable to sow it a peck more per acre than Marquis.

Thatcher is a new rust resistant wheat that is about four days earlier than Marquis. It has definitely outyielded Marquis at this station. Straw is strong but considerably shorter than Marquis. In recent dry years the sample of

grain, compared with Marquis, under the same conditions, has been definitely lower in weight per bushel, gave a leaner sample and was a paler colour. Present indications are that Thatcher is better adapted to more moist areas where rust is liable to occur.

OAT VARIETIES

Over a long period of years at this station, oats have averaged double the yield of wheat (or about the same number of pounds per acre) and this position has been well maintained in recent dry years where the oat crop has been given the same treatment. During the past few dry years oats sown on stubble late and with little attention, have frequently been not worth harvesting. Under extremely dry conditions, wheat shows more drought resistance than oats. Under conditions similar to those at this station where oats are required for feed, a good policy is to sow part of the oat crop early on well-prepared fallow that will not drift or be exposed to drifting soil. In oats, consideration should also be given to variety.

Anthony is a new rust resistant oat that has been given some publicity based on its performance in the eastern part of the Prairie Provinces. Its performance at this station has been disappointing. In field appearance and maturity it is similar to Banner. Under prevailing dry conditions during the past four years, it has yielded at Scott, 16 per cent less than Banner.

Few varieties equal Banner at this station over a period of years. This indicates that it is well adapted to the spread of moisture conditions prevailing in western Saskatchewan. In the past four years, which were decidedly dry, it has been the tallest oat and has given more bushels per acre than any oat commonly grown. It frequently falls below most varieties in weight per bushel but in percentage of kernel it ranks well.

Gopher is the best available early oat based on performance at this station. In maturity it is about a week earlier than Banner. The straw is finer and shorter than Banner. In the past five years it has yielded ten per cent less than Banner. The sample is usually uniformly white, kernels are smaller than Banner but equal in weight per bushel. This is a suitable variety where a short straw is desired or where late summer frosts are prevalent.

Where a grower desires a hulless oat for special purposes, Laurel is the best available. It usually yields about 25 per cent less, which means that its yield is equally as good as a hulled variety when allowance is made for the hulls. Laurel, like other hulless oats, has a distinctive appearance in the field. It has no commercial importance, mainly because there is always a small percentage of kernels with hulls on them. It is only grown as a special feed for poultry or young pigs. This variety should never be treated with formalin but always given a dust treatment because of injury to germination by formalin.

Vanguard is a new rust resistant oat that has performed better at this station than Anthony and almost equalled Banner in yield. It is a few days earlier than Banner but has about the same amount of straw. Tests at this station during the past three years show a lean sample and a low weight per measured bushel. For west-central Saskatchewan, this variety does not possess any special merit.

Victory performs about the same as Banner at this station in good seasons but in recent dry years it has been definitely below Banner, being shorter in straw and lower in yield. In spite of somewhat lower yields in dry years, it produces a sample which is higher in weight per bushel than Banner. Because of its shorter, plumper kernel, it is usually more saleable than Banner and has even grown in popularity in recent dry years.

BARLEY VARIETIES

As conditions become drier, the acreage of barley gradually diminishes so that in west-central Saskatchewan there is little grown. In recent dry years it has practically disappeared. Under conditions similar to those prevailing at this station, there is little live stock produced and even where barley is grown it is unsuitable for malting. In the park areas of northwestern Saskatchewan, barley occupies a relatively higher acreage. Even where barley should be grown as part of the grain crop, the variety is usually more important than in other classes of grain. Barley varieties may range as much as two weeks in time of ripening and 50 per cent in yield. There is also a wide range in type and field characters. A short review of these varieties, based on their performance at this station, is presented.

O.A.C.21 is a six-rowed, nodding, rough-awned variety with greenish-blue kernels and is the standard of malting quality for barley in Canada. It is a low yielder at Scott, and of medium maturity, with rather weak straw of medium length. The neck strength is poor, which results in many of the heads breaking off at the time of maturity. It is not equal to Hannchen in competing with weed growth and ranks low in weight of kernel and weight per bushel. The threshed grain usually contains some awns but is not considered bad in this respect. There is often a strong demand for high quality malting barley and O.A.C.21 is the best variety available for supplying this requirement. Because of its low yield and the poor quality of malt obtained under dry conditions, this variety is not recommended for the drier prairie areas. Its production should therefore be confined to the northern park or wooded areas where the yield is reasonably good and satisfactory malting barley may be produced.

Hannchen is a nodding two-rowed, rough-awned variety with yellowish-white coloured seed. It is shorter and slightly weaker in the straw than O.A.C.21 and matures about four days later, at Scott. In weight per bushel and kernel weight, this variety ranks high, has good neck strength and is quite resistant to shattering. It has a tendency to partly shed its awns when ripe and threshes a nice sample of grain practically free of awns. While not early it has proved to be one of the best barleys for competing with weed growth. Hannchen is a high-yielding variety producing about 40 per cent more grain than O.A.C.21 at Scott. It does well under dry conditions but may prove a little short in the straw when grown as the second or third crop after fallow. Where more moisture is available in the northern areas, this variety has a tendency to lodge because of its straw weakness. This variety is accepted in the two-rowed malting grades.

Trebi is a six-rowed, semi-nodding, rough-awned variety with greenish-blue coloured kernels. The straw is short, moderately strong and matures about the same time as O.A.C.21. It has large kernels, good neck strength and is quite resistant to shattering. In threshing, the awns do not separate readily from the kernels. The threshed grain usually contains quite a few awns and consequently has a low weight per bushel. Trebi is adapted to a wide range of growing conditions, is a good feed barley and gives a high yield of grain. The chief disadvantages of this variety are its shortness of straw, especially when grown as a stubble crop, and the presence of awns in the grain. The awns make the grain less pleasant to handle and often obstruct seeding through the grain drill. Trebi is not a malting barley.

Regal is a nodding, six-rowed barley with smooth awns and white seed. It is slightly more resistant to shattering, has much stronger neck strength, has stronger and slightly longer straw, and matures about two days later than O.A.C.21. It has a medium-sized kernel, good weight per bushel but the sample of threshed grain contains quite a few awns attached to the kernels. In yield performance, it is satisfactory but not equal to Hannchen at Scott. Regal

possesses a number of advantages over other commonly grown sorts. Its comparatively strong straw of good length makes it easy to cut and bind. The smooth awn character makes it more pleasant for harvest operations. It is more satisfactory for feeding live stock than rough-awned varieties when fed either as straw or in the sheaf. Regal is not classed as a malting barley.

Colsess is a medium-early, six-rowed, hooded variety with yellowish-white, medium-sized kernels. On account of its distinctive hooded character, this variety presents a pleasing appearance in the field. It has stronger and slightly shorter straw than O.A.C.21 and matures about three days earlier. Unlike other hooded sorts, this variety has a high degree of resistance to shattering, is strong in the neck and ranks high in yield. Because many of the hoods adhere to the kernel after threshing, the weight per bushel is usually much lower than in other varieties and the sample of threshed grain has a rather poor appearance. It is not considered a good market barley and is very susceptible to both loose and covered smut. On the other hand, Colsess produces a high yield of feed barley but the crushed grain usually has a high percentage of fibre. This variety has other merits. Its relatively high yield of hay, combined with leafiness and absence of awns, makes it a valuable sheaf feed. Because of its rapid early spring growth and early maturity, it is useful also in combating weed growth.

Olli is a six-rowed, rough-awned, early-maturing variety with straw of medium height and strength. At Scott it ripened ten days earlier and yielded 22 per cent higher than O.A.C.21 but was lower in kernel and bushel weight. Because of its earliness and satisfactory yield performance, this variety has possibilities as a weed control crop, and is worthy of further testing in this direction. A preliminary test made in 1936 on a badly infested field of wild oats proved most promising in fulfilling this desired need.

Smooth-awned Types.—With the discovery of a number of promising smooth-awned types, a plan of testing was introduced by the Cereal Division, Central Experimental Farm, Ottawa, in 1934, to give information on the comparative value of these types in the shortest possible time. This test was conducted at all institutions carrying on work with barley. The Western Canada test contained 13 smooth-awned sorts with three rough-awned varieties included for purposes of comparison. A rough-awned group of 16 varieties was also tested which included for purposes of comparison the same three rough-awned varieties used in the smooth-awned group. Both the smooth- and rough-awned groups were tested separately in 1935, but the two groups were merged in 1936 with some of the least promising sorts dropped from the test. Some interesting results have accrued from this investigation in the three years it has been carried on. A number of smooth-awned sorts have proved equal in yield and other desired characters to some of the best rough-awned varieties, in addition to having the advantage of being smooth-awned. Sanalta, a two-rowed sort, is a strong-strawed variety, high in weight of kernel and weight per bushel, but has not been a high yielder and is rather late in maturing at Scott. Byng was tested for the first time in 1936 and gave a good yield. More tests are required to establish the malting value of these two varieties.

Most of the barley produced is used for feeding live stock. Because it is grown largely as a cleaning crop, the yields are comparatively low and the grain usually contains a lot of weed seeds. Both yield and grades of barley could be materially improved by seeding the crop earlier and on better prepared land. The returns from barley have not been encouraging in west-central Saskatchewan and its production is confined mainly to the more moist areas in the northern part. Tests have shown that only an inferior quality of wheat can be grown in certain parts of northern Saskatchewan and that these areas are quite well suited to the production of malting barley.

With the frequent premium paid for malting barley, it would appear that many farmers in these areas could profitably grow malting barley. Those desiring to grow barley with a view to having it sold for malting purposes must follow certain practices, if the premium is to be obtained. Use only good seed of a variety that is accepted in the malting grades. The seed should be free of weed seeds and other cultivated grains, it should have good germination and be treated for control of smut. To obtain best results, it is essential to seed early on clean, well-prepared land. The crop should not be cut until the entire field is fully ripe as immature kernels are detrimental. In threshing every precaution must be taken to have the lowest possible number of broken or peeled kernels. The machine should be run as slowly as possible with teeth set well apart and the minimum number of concaves used. Make sure there is no end play in the cylinder and adjust the separator to ensure the minimum amount of grain returned for rethreshing. Since the kernels are less brittle when the humidity of the air is high, threshing should be done on cloudy days or in the morning when less damage to the grain is likely to occur. Farmers desiring to grow malting barley should obtain special literature on this subject from their nearest experimental farm.

FLAX VARIETIES

The type of soil at Scott is not productive of high yields of flax, nor has there been much difference in yield, height and strength of straw between the varieties tested. Several varieties have been tested on summer-fallow land over a long period of years with comparatively low yields. Crown and Premost, two commonly grown sorts, have yielded an average of only 10·6 and 9·5 bushels per acre respectively in the past ten years. For the same period the average yield of Marquis wheat was 26·3, Hannchen barley 40·3, and Banner oats 53·8 bushels per acre. Higher yields are produced under prairie conditions on the heavy clay soils. Results from a limited amount of testing done in the northern regions where more moisture is available, indicate that higher yields and better quality of oil were obtained than under prairie conditions. Redwing, because of its earliness, is the most suitable variety yet available for the north.

Flax has a shallow root system and competes less successfully with weeds than do other cereal crops. It should be sown reasonably early on clean, well-prepared land. The rate of seeding varies from 28 pounds in the drier areas to 40 pounds per acre in the northern areas where more moisture is available. Flax seed is smaller than the common cereals and does not require to be sown as deeply. The depth will vary according to the nearness of moisture to the surface, ranging from one to one and a half inches, as required to place the seed in moist soil. It is important to use wilt-resistant varieties. A brief discussion of available flax varieties is presented.

Bison is a wilt-resistant variety which is distinctive in having dark blue blossoms and large seeds. Its distribution in the province commenced in 1930 and it is now accepted for registration. In maturity it is medium and has straw of average height and strength. This variety showed considerable damage from heat canker at Scott in 1933. Bison gives a comparatively good yield of grain which is high in oil content but only fair in quality.

Buda is resistant to wilt, has medium blue coloured flowers and small seeds. It gives a comparatively good yield, matures about a day earlier than Bison and has average length and strength of straw. Buda showed slight damage from heat canker at this station in 1933. It is not particularly high in oil content but the quality is good.

Redwing is a medium-early, small-seeded variety. It has blue blossoms and ripens four to five days earlier than Bison at Scott. It gives a comparatively good yield and is satisfactory in length and strength of straw. Redwing is a

wilt-resistant variety and is also partially resistant to rust. Because of its earliness, this variety will be found more suitable in the northern areas than some of the later maturing sorts. Redwing has been accepted for registration.

PEA VARIETIES

Several varieties of peas have been tested at Scott for a sufficient length of time to determine their comparative yields. When grown on clean summer-fallow land, satisfactory yields have been obtained, but the difference between varieties was not great. As a crop, peas rank low in competing with weeds. Where there is considerable weed growth in the crop, yields are materially reduced. Peas are not usually damaged by spring frosts and may be sown early. They can be sown with the ordinary grain drill, the rate of seeding depending on the size of the seed—ranging from one and one-half to three bushels per acre. Extension guards should be used on the mower when cutting and the crop handled carefully to avoid shattering. In order to reduce the damage from splitting, peas should be threshed on a cloudy day or in the morning. A small-seeded variety such as Chancellor is less likely to split than a large-seeded sort like Arthur. The pea crop is not of commercial importance in the area served by this station. Some farmers like to grow a small acreage for their live stock and the merits of varieties tested are reviewed.

Arthur is a medium-maturing variety with white flowers and good length of vine. The flowers and pods are borne in a cluster at the tip of the vine. The seeds have a smooth surface, are medium-sized and have a creamy white colour. It gives a good yield of grain.

Chancellor is an early-maturing variety which produces a small creamy white coloured pea with a smooth surface. Compared with Arthur, it is an inch or so shorter in the vine and yields about a bushel less, but ripens a week earlier. Because of its smaller seeds this variety requires less seed for seeding and there is less damage from splitting when threshing than with the larger seeded sorts.

Early Blue matures a couple of days earlier than Chancellor and gives a high yield of grain. It is distinctly short in the vine, being only about 60 per cent of Arthur in length. The kernels are medium in size, wrinkled and have a pale greenish-blue colour.

Mackay is a medium-late maturing variety, with white flowers and long vines. The peas have a smooth surface. Creamy white colour, with a black eye, easily identifies them. This variety is about seven inches longer in the vine, matures four to five days later, and yields approximately the same as Arthur. Because of its vigorous growth, Mackay gives a good yield of hay.

FIELD BEANS

There has been a revived interest in the growing of beans within the last few years. The trend has been more along lines of production for home consumption rather than for market purposes.

Beans are a warm climate crop and are very susceptible to frost damage. For successful production they require a frost-free period equal to the time required for the crop to grow and ripen. The preparation of the land and available moisture should be such as to ensure rapid germination and good growth from the start. A few varieties of beans have been tested on the station for a number of years with little success. In 1934, it was decided to make a more intensive test of beans in order to establish their value as a field crop in north-western Saskatchewan. Accordingly, eight varieties were tested with yields varying from only one to two bushels that year. All varieties showed some frost damage with early sorts least affected. The 1935 test was completely killed by five degrees of frost on August 16 and the plants made no further growth after

that date. While the 1936 test was sown during the last week in May on well-prepared fallow, the crop did not emerge until three weeks later. Growth was very slow and short with only two varieties out of eight maturing seed. The average frost-free period for 25 years at Scott has been 87 days with June 7 average date of last spring frost and August 31 date of first fall frost. With such a short growing season, only early varieties should be grown. Norwegian, Ottawa 710, Beauty Ottawa 712 and C.D. 831 No. 2 were the most promising sorts tested. Observations show that beans emerge slowly, are short and backward in growth during the entire season at Scott. Under favourable conditions, early varieties mature seed but yields are low. Results to date indicate that beans cannot be recommended as a field crop under conditions similar to those at Scott, but an early variety like Norwegian might be grown in a limited way for domestic use in the vegetable garden where it can be given special attention.

FORAGE CROPS

The term forage crops is used to describe crops which have all the edible parts used for food, whereas, in cereals, only the grain is of commercial importance for food. Forage includes the leaves and fleshy growths which do well under favourable growing conditions. Consequently the past five years, which were so dry, provided a rigid test for forage crops at this station.

Among the annuals, there are: corn, sunflowers, roots and certain grains used for hay. Biennials feature sweet clover. Grasses are the main perennials for adaptation under dry prairie conditions.

SILAGE AND ROOTS

Over a period of years, corn has not been a forage of economic importance at Scott. Growth has been too slow and yields too low. The yield per acre in tons is only about one-third of what may be expected from sheaf oats. When corn is grown for grain at this station, even the earliest varieties rarely reach maturity. In spite of this, there are farmers who like to grow some corn and others who have lighter land to which the crop is better suited. There are some who keep planting it, hoping for a favourable year because the crop can be fed and stored in several ways. It has provided feed in years when grasshoppers have severely damaged other feed crops.

It has been found that corn yields can be improved by sowing as soon as the soil is warm enough to germinate the seed which is usually the early part of May, rather than waiting till the third week in May. The crop recovers from light spring frosts. During the past two years yields of corn have been more than doubled by growing it on the same land year after year.

Sunflowers have produced at this station about the same yield as sheaf oats when measured on a dry matter basis. When compared for green weight the tonnage of sunflowers is about twice that of sheaf oats. Unfortunately the average farmer is not equipped to handle sunflowers preserved in the form of ensilage. For the dairy farmer it provides succulent feed which can be preserved over a period of years. The popular opinion that wheat yields are low after sunflowers has not been borne out by yields at this station. Among varieties, Mammoth Russian or Giant Russian may be expected to give the best tonnage, averaging about nine tons green weight on summer-fallow over a period of years. Sunflowers in rows are fairly drought resistant and will stand light frost without material damage.

Silage on the Canadian prairies is usually frozen in the winter so that it is difficult to remove for feeding purposes. Removal may be facilitated by distributing cut straw evenly in layers at intervals when filling. During the winter, frozen blocks will separate readily at the layers of straw. These blocks can be

placed in a warm part of the barn to thaw out before feeding. Following a series of poor years, sunflower silage several years old was fed during the winter of 1936-37.

Root crops were tested up until 1932, when as many as 71 varieties were under test in a single season. Mangels, sugar beets, carrots, fall turnips and swede turnips were included in the tests. Carrots were always low in tonnage and a favourite food for jack rabbits. Mangels and sugar beets rarely produced good stands and yields were too small to be of economic importance. Turnips did comparatively well with the swede turnips producing approximately 20 tons per acre in a good year.

The prairie farmer depends upon oats in sheaf form for the bulk of his forage. Some experimental results with annual hay crops are worthy of review.

ANNUAL HAY CROPS

A number of grain crops are suitable for annual hay. Oats alone or with peas leads in yield when a medium-late variety such as Banner or Victory is used. Early varieties of oats yield considerably less. Hooded barley or smooth-awned barley, although not quite equal in tonnage, is well relished by stock. Spring rye does well on lighter soils but is relatively poor in quality and is best cut for hay shortly after heading. Field peas produce a fair yield of high quality hay but require clean land with long-vined varieties such as Mackay or Arthur for best results. Millets, which are annuals, produced less hay than grain crops, and in addition are not as acceptable a feed as sheaf grain for horses. Soybeans were in the failure class for hay or seed production. Marquis wheat produced about the same yield of sheaf feed as Banner oats.

Since the last report was published, a test to determine the best stage of maturity at which to cut oats for hay has been concluded. Nine varieties were included in this test. These varieties were cut in the bloom, milk and dough stages. Highest yields of both cured hay and dry matter were obtained by cutting oats in the dough stage. Yields were lessened with earlier stage of cutting but protein value increased. The total food value was greatest when cut in the dough stage and least in the bloom stage. It was also noted that early and hulless sorts yielded less than later-maturing varieties such as Banner and Victory. The practical recommendation from this work is that oats for sheaf feed should be cut when beginning to turn yellow to obtain maximum yield and food value, in addition to having all of the plant relished by stock.

The opinion was general some years ago and still persists, that oats for hay could be seeded any time up until the end of June with a good crop resulting. Even in fairly good seasons this did not hold true as results show that over a period of years the yield from early sowing was more than twice as high as late seeding. In dry seasons early sowing of oats (for grain or hay) gave a fair crop but late seedings were a failure.

GRASSES AND CLOVERS

Grasses and clovers have grown in popularity in west-central Saskatchewan but acreage has not increased because of the many failures to obtain good stands. Partial stands of these crops grow up to weeds and the crop usually results in failure. Consequently, in recent years work with grasses and clovers at this station has been concentrated on methods of securing good stands or catches.

There are four essential requirements for securing good stands from spring seedings under the varying seasonable conditions at this station, namely: early seeding, firm seed bed, shallow seeding and a location where the seedlings will not be destroyed by soil drifting. Early seeding means early in May (or before

wheat is sown) for grasses, but sweet clover seedlings are destroyed by frost and seeding should be delayed a couple of weeks in northern areas. Firm seed bed means heavy packing when the surface soil is moist, immediately after spring tillage is done, because packing after sowing has not proved effective. By shallow seeding is meant just having the seed well covered, usually not more than half an inch deep on medium and heavy soils. Releasing the pressure springs on the drill disks aids in shallow seeding and chains provide sufficient covering. It is useless to sow grass or clover on land which is in a condition to drift or is exposed to drifting soil.

Fall seeding.—Fall seeding is a new development that is worthy of review in the light of information to date. Fall seedings have been made in September, October and November. September seedings (first and fifteenth day) have only been moderately successful at Scott when there was sufficient rain not only to moisten the surface soil but to penetrate deeper so that roots could be established before cold weather. From the farmer's point of view, September seeding comes at the height of threshing activities and usually would not be done even if it were satisfactory. Results with October seedings have not been dependable; where plants start they do not have much vitality in succeeding years for some reason not clearly understood. Early November seedings have produced good stands the next spring, being somewhat better than early seedings made the following spring. Late fall seedings have been made at scattered points as demonstrations to supplement tests made on this station. Of fall seeding dates, early November or just before freezeup has given best results. Such seedings should be made shallow but covered and in stubble or adequate weed cover where the soil will not drift.

Late fall seedings are made in dry top soil and no germination is required or expected until the following spring. Such seed is in the soil ready to take maximum advantage of spring moisture which is an all important consideration in semi-arid prairie. This late seeding can be done without interfering with any major farm activity. It has been found that in districts where late fall seeding has been demonstrated, farmers have been quick to recognize its advantages.

GRASSES—TEST OF VARIETIES OR STRAINS, 1933-35

Variety	1933			1934			1935			3-Yr. Average 1933-1935		
	Per-cent Stand	Height of Plant	Cured Hay	Per-cent Stand	Height of Plant	Cured Hay	Per-cent Stand	Height of Plant	Cured Hay	Per-cent Stand	Height of Plant	Cured Hay
	%	Inches	Tons	%	Inches	Tons	%	Inches	Tons	%	Inches	Tons
Crested Wheat Grass Fairway	90·3	16·2	·59	92·0	17·6	·55	77·5	12·9	·71	86·6	15·6	·62
Crest Wheat Grass Forage	96·8	17·0	·55	98·0	19·1	·59	91·3	14·1	·67	95·4	16·7	·60
Crest Wheat Grass Commercial	91·8	18·8	·51	92·0	20·4	·60	80·0	18·2	·83	87·9	19·1	·65
Brome	92·8	21·5	·43	93·3	24·1	·54	82·5	22·8	·76	89·5	22·8	·58
Western Rye Grass Grazier	97·0	17·5	·37	94·3	23·9	·88	55·0	12·3	·10	82·1	17·9	·45
Western Rye Grass Mecca	93·8	17·5	·36	86·8	23·8	·75	34·5	12·3	F	71·7	17·9	·37
Western Rye Grass 77	91·8	20·5	·55	86·8	27·6	·93	47·5	16·1	·45	75·4	21·4	·64
Crested Wheat 10 lb. Alfalfa 8	93·8	18·4	·34	93·0	20·5	·58	80·0	16·9	·72	88·9	18·6	·55
Crested Wheat 10 lb. Sweet Clover 8 lb	92·0	17·5	·41	92·5	20·6	·59	77·0	18·0	·74	87·2	18·7	·58
Western Rye 10 lb. Sweet Clover 8 lb	99·0	14·5	·29	98·8	22·1	·97	82·8	12·5	·31	93·5	16·4	·52
Western Rye 10 lb. Alfalfa 8	97·3	14·1	·31	98·3	23·3	1·02	85·0	13·5	·38	93·5	17·0	·57

NOTE.—F.—Failure.
(In the above table the differences in yield between the strains of crested wheat grass are not significant. This is evident from the fact that the order of yield in the second crop year is just the reverse of that in the first crop year, and the third year differs from the other two.)

GRASSES ADAPTED TO DRY CONDITIONS

Under prairie conditions, high yields of grasses are rare. Grasses, under farm conditions, occupy a place which cannot be filled by any other crop. In utilizing cultivated grasses, successful methods of obtaining a stand must be given first consideration because this has been a frequent cause of failure. The most essential consideration is using a grass which thrives under comparatively dry conditions. At Scott these grasses are, crested wheat, brome and western rye.

At the end of three years the production of crested wheat and brome was best in the third crop for the seasons experienced, but western rye fell off markedly in yield and stand in the third year. The three strains of western rye showed considerable difference in the third year when Mecca was a failure, Grazier practically a failure and No. 77 with half a stand, was considerably less than crested wheat or brome. A slight improvement in the third year was obtained for Grazier western rye where it was sown with a legume. The type of sod produced by these grasses was observed when these were broken up after three crops. The western rye was little better than a good grain stubble, the brome gave a fair sod but not enough fibrous roots to hold the sod together while the crested wheat gave a heavy matted sod which may be described as better than the original prairie breaking.

Legumes.—In addition to the grasses for hay production, some mention should be made of results with legumes which include alfalfa and sweet clover. In recent dry years it has been shown definitely that sweet clover has more drought resistance and greatly outyields alfalfa. In dry areas the forage problem is to obtain quantity rather than quality of feed. In the dry year of 1933 alfalfa was not long enough to cut with a mower whereas sweet clover produced half a ton of hay per acre. Alpha, a fine-stemmed sweet clover, has yielded as much in recent dry years as the common coarser varieties such as Arctic and Common White sweet clover.

Seedings of grasses and legumes already mentioned refer to sowing without a nurse crop. Some recent work has been done on these when seeding with a nurse crop in the spring.

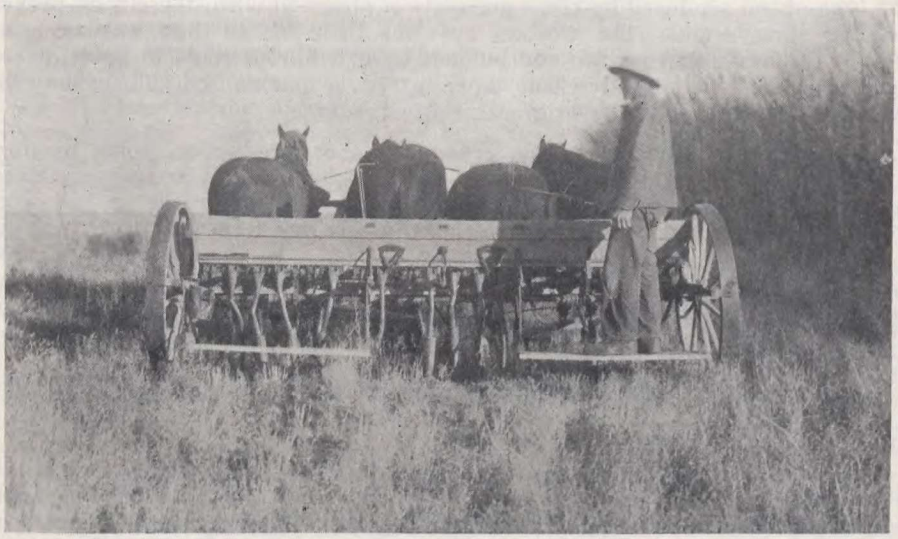
Sowing this forage in the row with the grain at the same time has given unsatisfactory results in recent dry years. Not only are stands poor but the plants the next season make comparatively little growth. Better results have been secured by sowing crested wheat grass and western rye grass in early spring, ten days before seeding the nurse crop of grain, but results by this method with sweet clover have not been consistently good. Cross-seeding of the grass and clover in the opposite direction of seeding the grain has given promising indications. Results at this station indicate that seedings made without a nurse crop are always better than where a nurse crop was used.

SOWING GRASSES FOR SEED PRODUCTION

There is a growing need for information on the sowing of grasses, sweet clover and alfalfa in rows for seed production. Good stands can only be expected by early shallow seeding on a firm seed bed, and where the land will not drift or be exposed to drifting. By early seeding is meant as soon as possible in the spring after the land is workable. It is advisable to seed crested wheat grass before seeding wheat. Shallow seeding for this crop means not deeper than half an inch. Shallow seeding is only possible on a firm seed bed which invariably means packing, releasing the pressure springs for the disks but leaving the chains on. Use of a double disk drill for this purpose is recommended.

Clean summer-fallow land is preferred. The small area required should be cultivated, cross-harrowed and packed in quick succession. The packer should be weighted heavily and all operations done while the soil is moist. On medium (chocolate) loam soils, stubble land may be used by spring ploughing early, harrowing and packing while the land is moist and the forage seed sown immediately. Choose a few acres where the seed plot will have the best possible chance, but the location should not be close to the farm shelter belt nor where damage from spring freshets is liable to occur.

Make sure the drill cups are thoroughly cleaned to permit free-running of the small seed. All moving parts of the drill should be in good working order before drilling. The drill cups should be seeding evenly and as accurately as possible for the rate required, using shims or thin washers, where possible, to make the runs uniform. Each run used for seeding in rows should be partitioned off snugly with heavy cardboard or beaver board on both sides of the cups used.



Seeding crested wheat grass among weeds on abandoned land in late fall has produced excellent stands.

Crested wheat grass when well cleaned flows freely alone through most grain drills, but it is advisable to make sure it is always running during seeding. To seed three pounds of crested wheat grass per acre in rows, three feet apart, the average grain drill should be set at three quarters of a bushel for wheat. In the case of brome, sweet clover and alfalfa, seeding can be delayed, but not later than the middle of May. For seeding the amount required of these crops through the grain drill, another heavier suitable material must be mixed with the seed to make it flow properly. For this purpose, cracked wheat is most suitable. The wheat should be coarsely crushed and the fine material removed with a fanning mill using only wheat cracked in about four parts. In the case of sweet clover and alfalfa, it is mixed in the proportion of three parts of cracked wheat by weight to one part of seed, and the drill set at one and a quarter bushels for wheat. Brome is mixed in the proportion of five parts of cracked wheat by weight to one part of brome, and the drill set at two bushels for wheat. These drill settings should sow these forage crops at the rate of three pounds per acre in rows three feet apart but further adjustment may be necessary depending

on the condition of the drill. For seeding a small area in rows a hand garden seeder can be used to excellent advantage, when no cracked wheat will be required. No matter which method of drilling is used, every effort should be made to sow the rows as straight as possible to aid in future cultivations.

Nurse Crops to Prevent Soil Drifting.—On land worked in the spring where drifting is liable to occur, wheat (or oats for brome) may be sown in between the rows in the same operation, by placing grain in the portion of the drill not partitioned off for grass seed. When this method is used, each forage seed is prepared as already mentioned and drill settings outlined above must be used. This nurse crop should be cut for green feed before ripening. Where the only possible selection is light sandy land, it is not advisable to work the soil, because of danger from soil drifting. Choose stubble land not exposed to possible drifting from a knoll or nearby summer-fallow. Do not disturb the covering of stubble or weeds which should be present. Drill the seed shallow directly into the stubble with no tillage before or after seeding. Under such conditions, do not cultivate between the rows the first year but merely clip the weeds with a mower. Under all methods of growing, during the first year, if weeds grow in the row with the forage plants, do not pull them as this will destroy seedlings. Clipping or mowing the weeds is safe and will not damage the young forage plants or the seed crop for next year.

The average grower often finds difficulty in using an ordinary grain drill to sow rows three feet apart and in knowing where to drive when having to turn either direction. The following diagrams will be found helpful for this purpose.

In the diagrams illustrated the letter O represents unused runs and the letter X, the runs used for seeding. It is assumed that the drill runs are six inches apart and the centre of the wheel nine inches from the end drill run. Illustrations and directions for turning are shown for three widths of drills to sow single rows spaced three feet apart.

Twenty-Run Drill:

O O O X O O O O O X O O O O O X O O O O

When turning right, drive wheel between fourth and fifth run.
When turning left, drive wheel between second and third runs.

Twenty-four-Run Drill:

O O X O O O O O X O O O O O X O O O O O X O O O

When turning right, drive wheel between second and third drill runs.
When turning left, drive wheel midway between last drill run and wheel mark.

Twenty-eight-Run Drill:

O X O O O O O X O O O O O X O O O O O X O O O O O X O O

When turning right, drive wheel midway between last drill run and wheel mark.
When turning left, drive wheel just outside last wheel mark.

The above diagrams are worked out when looking forward from the back of the drill. The directions for seeding after turning can be greatly simplified by dragging a chain behind the drill attached to the foot board on the line where the wheel is to be driven after turning.

Permanent Hay Meadows.—Many prairie farmers have low spots in their fields of considerable size which are not alkaline and which retain snow water until June. It is often desired to have these permanently into hay production. This problem has been solved on this station by using reed canary grass. Seed is scarce and relatively expensive. For this reason, four to five pounds per acre

may be used and the plants allowed to thicken up. Seeding can be done in early summer when the land becomes dry enough for working, but it is often better done when the land is dry in late fall. It is scarcely possible to lay down a detailed procedure to suit all conditions and interested farmers are invited to send details about their particular problem in this respect.

Soybeans.—Some four years ago, considerable publicity was given to soybeans in the Prairie Provinces. In spite of the fact that a previous test had shown them to be low in yield and unadapted for prevailing conditions, a new test was started of early varieties, incorporating inoculation and phosphate fertilizer.

The results obtained after three years confirm previous findings. Inoculation and fertilizer did not materially influence the yield from an economic standpoint. The growth is too short to handle with common harvesting implements. The crop is ruined with a slight frost. Seed production appears impossible. The crop may be useful on account of its high quality even when low yields are obtained, for special purposes such as feeding fur-producing rabbits.

PASTURE EXPERIMENTS

During recent years there has been an increasing need for suitable pasture for prairie farmers. Consequently the carrying capacity of different grasses has been tested. Thirty acres were divided into four fields which were seeded in 1933 to crested wheat grass, brome grass, western rye grass and, the fourth field, to a mixture of the three grasses. Ammonium phosphate (16-20) was applied in early spring each year to half of these plots. Sheep were used to determine the carrying capacity of the grasses.

PASTURE EXPERIMENT

Project AG. 267

Crop	1934		1935		1936		3-Yr. Average 1934–1936	
	Sheep Days	Per cent	Sheep Days	Per cent	Sheep Days	Per cent	Sheep Days	Per cent
Crested Wheat Grass	2,693	25·8	1,618	32·9	884	37·1	1,732	31·9
Mixture: Brome, W.R., C.W.	2,693	25·8	1,219	24·8	952	40·0	1,621	30·2
Brome Grass	2,464	23·6	1,246	25·3	544	22·9	1,418	23·9
Western Rye Grass	2,597	24·9	840	17·1	None	0	1,146	14·0

In the first pasture year the amount of pasture from each field was practically the same. In the second year crested wheat gave the most pasture with western rye taking a definite drop. In the third year, 1936, western rye produced no pasture, brome gave less than half the pasture of the previous year, crested wheat excelled all the grasses sown singly. The third pasture season was exceedingly dry and the figures indicate a good showing for the mixture but this should be discounted because a portion of the field was flooded in early spring. Judging by the figures presented and observations made, crested wheat grass has demonstrated its superiority for quantity of pasture produced under dry conditions.

Near the finish of the third pasture season which was abnormally dry, the fields were examined and the following observations were made: Surface and subsoil were dry. Native prairie sod on edges of sown fields had been eaten close to the ground. Crested wheat grass showed good evidence of green growth in low spots and traces of green growth on higher ground. Brome showed traces of purplish-green growth in low spots, but on higher land there

was no growth and plants were dry and appeared to be dying with small sage creeping in. In the mixture of the three grasses, a low area had some green growth but practically no evidence of growth on higher land with sage much in evidence. The western rye grass appeared to be dead in low spots and was all dead on the upland and sage had taken possession of the field.

HORTICULTURE

VEGETABLES

Much has been learned during the past five successive dry years regarding the growth of annual vegetables and notably the advantage of ample spacing. With the surface moisture gone by the end of June and subsoil moisture seriously depleted, it has been necessary to deviate from the usual procedure in vegetable growing. It has been the practice in the past to allow 30 inches between the rows of staple vegetables but it was found during the past five years that size and quality can only be maintained if this space is doubled or even trebled. There is generally considerable surface moisture following the melted snow. This supplemented with early summer showers, gives sufficient moisture to promote growth of all vegetables until the end of June. Then, assisted by ample spacing and surface cultivation, the crop is carried through to maturity.

It has been discovered that onions can be raised from seed far better than from sets. The work of planting was therefore reduced. Success was obtained by early seeding, thinning, and removing the soil from around the bulbs.

The long hours of sunshine during the prairie summer makes possible the growing of cabbage and cauliflower sown in the open ground in advance of those transplanted from the greenhouse. Here again the benefit of spacing is much in evidence.

Damage to vine crops from winds is almost nil if earth is drawn up around the lower six or eight inches of stem in the early stages of growth.

The only perennial vegetables grown at Scott are asparagus and rhubarb. It is preferable to grow these in a block entirely by themselves so as not to interfere with the general garden. Asparagus is an early vegetable, while rhubarb is always in demand. It has been found desirable to leave these plantations undisturbed for a number of years, applying liberal dressings of well-rotted manure from time to time.

SUGGESTED LIST OF VEGETABLES

PERENNIALS:

Asparagus—Argenteuil, Colossal, Mary Washington.
Rhubarb—Victoria, Ruby, McDonald.

ANNUALS:

Beans—Wardwell's Kidney, Masterpiece, White Wax, Stringless Green Pod.
Beets—Detroit Dark Red, Egyptian.
Cabbage—*Early:* Copenhagen Market, Golden Acre.
Main Crop: Danish Ballhead, Flat Dutch.
Carrots—Oxheart, Chantenay, Improved Half-Long.
Cauliflower—Early Snowball, Dwarf Erfurt.
Celery—Golden Self-Blanching, Winter King, Giant Pascal.
Citron—Colorado, Red-Seeded.
Corn—Banting, Golden Gem, Pickaninny.
Cucumber—Davis Perfect, Early Fortune, Long Green, Early Russian, White Spine.
Egg Plant—Extra Early Dwarf.
Lettuce—*Leaf:* Grand Rapids, Curled Simpson.
Head: New York, Big Boston, Iceberg.

SUGGESTED LIST OF VEGETABLES—*Concluded*

ANNUALS—*Concluded*

Marrow—English Vegetable, White Bush.
Onions—Ailsa Craig, Yellow Danvers, Flat Red, Southport Yellow Globe, Denia, Prizetaker.
Parsnips—Hollow Crown, Guernsey.
Peas—Thomas Laxton, Homesteader, Telephone, English Wonder.
Potatoes—*Pink:* Early Ohio, Early Six Weeks, Bovee.
White: Irish Cobbler, Gold Nugget.
Peppers—Harris Earliest.
Pumpkins—King of Mammoths, Connecticut Field.
Radish—Saxa, White Icicle, Twenty-Day.
Spinach—Bloomsdale, Princess Juliana, Viroflay.
Squash—Golden Hubbard, Green Hubbard.
Swiss Chard—Fordhook Giant, Lucullus.
Tomatoes—Alacrity, Bonny Best, Chalks' Early Jewel, Sunrise, Grand Rapids.
Turnips—*Summer:* White Stone, Orange Jelly
Winter: Purple Top, Bangholm, Ditmars.

FLOWERS

Five consecutive years of drought brings home forcibly the value of the perennial border. Its early growth, its many shades of green and its dependability of producing some bloom no matter how obdurate the season, make such a border indispensable for ornamental purposes.

Siberian or Russian Almond (Prunus nana)—a hardy shrub with pink blossoms which blooms early.

Keeping this in mind it has been the practice for the past few years to introduce for trial about a dozen new varieties of perennials each year until the perennial borders have become a regular source of information for the surrounding district.

A large number of varieties of peonies furnished the grounds with colour in their period of bloom. Some of the beds have stood for over 20 years, yielding their bloom every season. Even during the past seasons of drought they have continued to bloom, although with the moisture greatly reduced in the root area, naturally the blooms did not attain their normal size.

Of all the gems of the flower border, none surpasses the lily for gorgeous colouring, stately habit of growth and prolonged season of bloom. The past five years have seen many new introductions in the lily garden. In most cases lilies have proved extremely hardy and are given no other covering but the snow. No hesitation is felt in recommending the following lilies for north-western Saskatchewan: *tigrinum, umbellatum, tenuifolium, elegans, Willmottiae, concolor, Wallacei* and Maxwill.

Recent additions to the flower border include: *Aconitum, Anthemis, Armeria, Bidens, Incarvillea* and *Inula.*

ANNUALS

A great deal of work has been done also with both hardy and half-hardy annuals. Summarizing the work of the past five years it has been determined that hardy annuals sown in the open in the early spring are to be preferred for farm use rather than half hardy annuals which of necessity must be raised inside or in the hot bed.

Generally speaking, there is ample moisture in the spring to bring the hardy annuals to maturity. Great assistance has been given to farmers in the district served by this station by supplying information on flowers to enable them to get their flower border started.

Based on results in the station flower borders a list of flowers with some supplementary notes, is given for the guidance of intending purchasers.

FLOWERS FOR OUTDOOR BLOOM

ANNUAL FLOWERS SOWN DIRECTLY OUT-OF-DOORS

Name	Variety	Colour of Bloom	Approximate Height
Asperula	azurea setosa	pale blue	1 ft.
Alyssum	Little Dorrit	white	4 inches.
Arctotis	hybrida	mixed	1 ft.
Bartonia	aurea	yellow	1–1½ ft.
Brachycome	Swan River Daisy	bright blue	6 inches.
Calendula	Sensation	orange	1 ft. 3 in.
Candytuft	Hyacinth Flowered	white	9 inches.
Centaura	cyanus	mixed	1 ft. 2 in.
Clarkia	Salmon Queen	salmon	2 ft.
Cosmos	Mammoth	crimson	3 ft.
Coreopsis	Crimson King	reddish maroon	1 ft.
Dimorphotheca	African Daisy	mixed	1 ft.
Godetia	Azalea Flowered	mixed	1 ft.
Gypsophila	elegans	white	1 ft. 3 in.
Larkspur	Rosy Scarlet	rosy scarlet	2 ft.
Lavatera	Loveliness	rosy pink	2 ft. 6 in.
Linaria	mixed	mixed	1 ft.
Malope	mixed	mixed	2 ft.
Mathiola	bicornis	mixed	1 ft. 3 in.
Mignonette	Giant Red	reddish buff	9 inches.
Nasturtium	Golden Gleam	yellow	1 ft.
Nigella	Miss Jekyll	blue	1 ft. 3 in.
Phacelia	Campanularia	blue	6 inches.
Rhodanthe	Manglesii	pink and white	10 inches.
Virginian Stock	mixed	mixed	9 inches.

List of Annual Flowers Sown Indoors

Name	Variety	Colour of Bloom	Approximate Height
Antirrhinum	bedding	mixed	1 ft. 6 in.
Aster	Ostrich Plume	"	1 ft. 6 in.
Anagallis	grandiflora	"	6 inches.
Anthemis	tictoria	gold	2 ft.
Carnation	marguerite	mixed	2 ft.
Daisy	double English	"	6 inches.
Gallardia	double	"	1 ft. 6 in.
Heliotrope	Regale	blue	1 ft. 6 in.
Hollyhock	double	mixed	6 ft.
Lobelia	tenuir	cobalt blue	7 inches.
Malva	moschata	rose pink	2 ft.
Marigold	African	orange	2 ft.
Nemesia	grandiflora	mixed	1 ft.
Nicotiana	Crimson Bedder	deep crimson	1 ft. 3 in.
Phlox Drummondii	mixed	mixed	1 ft.
Petunia	Giant Fringed	"	1 ft. 3 in.
Schizanthus	hybridus	"	1 ft. 3 in.
Salpiglossis	Orchid Flowered	"	2 ft.
Stock	Ten Weeks	"	1 ft. 3 in.
Verbena	Giant Hybrids	"	1 ft.
Zinnia	Giant Mixed	"	1 ft. 6 in.

Perennial Flowers Grown From Seed, Sown Outside

Aquilegia	Long Spurred	mixed	2 ft. 6 in.
Aconitum	Wilsoni	pale blue	4 ft.
Anchusa	italica	blue	4 ft.
Aubrietia	purpurea	purple	6 inches.
Agrostemma	coronaria	mixed	1 ft.
Arabis	alpina	white	6 inches.
Campanula	bedding	mixed	1 ft. 6 in.
Cephalaria	alpina	yellow	3 ft.
Cerastium	tomentosum	white	5 inches.
Dianthus	barbatus	mixed	10 inches.
Delphinium	Wrexham	Oxford blue	5 ft.
Helenium	Riverton Gem	lemon yellow	2 ft. 6 in.
Heuchera	sanguinea	coral crimson	1 ft.
Liatris	Blazing Star	purple	3 ft.
Lychnis	Arkwrightii	scarlet	2 ft.
Linaria	Maroccana Excelsior	yellow	2 ft. 6 in.
Myosotis	Royal Blue	blue	5 inches.
Polemonium	coeruleum	purple blue	2 ft.
Poppy	oriental	scarlet	3 ft. 6 in.
Scabiosa	caucasica	blue	2 ft. 6 in.
Sedum	kamtschaticum	yellow	9 inches.
Veronica	prostrata	blue	4 inches.

List of Perennials Which are not Dependable at Scott Station

Name	Variety	Name	Variety
Armeria	maritima.	Iberis	sempervirens.
Campanula	turbinata.	Lupinus	polyphyllus.
"	Telham Beauty.	Lathyrus	latifolius.
"	persicifolia.	Oriental Poppy	Mrs. Perry.
"	Moerheimi.	Pentstemon	ovatus.
Chrysanthemum	King Edward VII.	Pentstemon	glaber.
Dianthus	brevicaulis.	Salvia	pratensis.
"	Allwoodii.	Symphytum	asperum.
"	plumarius.	Trollius	Ledebouri.
Digitalis	Giant Shirley.	Viola	cornuta.
Geum	Mrs. Bradshaw.	Yucca	angustifolia.

Among hardy perennial flowers not listed above are peonies and irises which are propagated by root division and certain hardy lilies which are propagated by bulbs. No attempt has been made to list flowers especially suited for rock gardens.

TREES AND SHRUBS

Information is constantly being requested regarding ornamental trees and shrubs and to supply this demand the arboretum is made one of the main horticultural projects at this station. It contains over 200 trees and new ones are being added regularly. For the convenience of visitors interested in this work, a guide to the arboretum has been compiled listing specimens of each variety grown. A simple method of cataloging is used by which any tree or shrub in the arboretum can be found with comparative ease.

Although the past few dry seasons have greatly retarded growth of most trees and shrubs, some notable exceptions are especially worthy of mention. Amongst these are the green ash which, contrary to public opinion, is a strong grower when established. It has proved particularly suitable for dry regions because it sheds its leaves early in the dry season and does not exhaust itself. The American elm also is a leader among long-lived trees, every specimen having held its own under the adverse conditions of the past few years. Most conifers have stood remarkably well and special mention must be made of the white spruce and the Swiss stone pine—both of which have maintained a vivid green throughout the heat of summer, drifting soil, burning winds and severe winters.

Flowering shrubs provide one of the main sources of attraction to visitors, hundreds of whom pass through the rows of lilacs during the flowering season. Although many bushes have felt the effect of drought, not a single lilac has been lost and all continue to bloom. Another excellent shrub in growth, in decorative effect both in blossom and berry, and in resistance to drought and wind, is the *Lonicera* or honeysuckle, of which there are 15 different species represented in the arboretum.

The last five years afforded ample opportunity for observations on the drought resistance of different varieties. Furthermore numerous inquiries have been received along these lines and for this purpose a classification of trees and shrubs which were in the arboretum in 1932 is presented, showing their condition in the fall of 1936. The classification resulted as follows:—

96 classed Excellent
31 classed Good
26 classed Fair
29 classed Poor
23 have died in the meantime.

Condition of Trees and Shrubs After Five Years of Drought.—(The following classification, recorded in fall of 1936, is based on specimens of trees and shrubs in the arboretum in 1932 and does not record those which died previous to the period covered. Following a dry period and other natural hazards, their condition has been described as: EXCELLENT, GOOD, FAIR, POOR, OR DEAD.)

EXCELLENT

Botanical Name	*Common Name or Variety*
Aesculus hippocastanum	horse chestnut
Amelanchier alnifolia	saskatoon
Amelanchier vulgaris	juneberry
Betula papyrifera	canoe birch
Berberis vernae	verna barberry

EXCELLENT—*Continued*

Botanical Name	*Common Name or Variety*
Caragana arborescens	Siberian pea tree
Caragana arborescens pendula	weeping caragana
Caragana chamlagu	caragana
Caragana tragacanthoides	caragana
Caragana frutex	woody caragana
Caragana grandiflora	large-flowered caragana
Caragana microphylla	caragana
Caragana mollisglabra	caragana
Caragana pygmaea aurantiaca	dwarf caragana
Cornus stolonifera	red-osier dogwood
Cotoneaster angustifolia	cotoneaster
Cotoneaster frigida	cotoneaster
Cotoneaster lucida	cotoneaster
Cotoneaster tomentosa	cotoneaster
Crataegus rotundifolia	thicket hawthorn
Eleagnus angustifolia	Russian olive
Eleagnus	dwarf olive
Euonymus Hamiltoniana	Chinese spindle tree
Fraxinus pennsylvanica lanceolata	green ash
Halimodendron halodendron	salt tree
Juniperus horizontalis	creeping juniper
Juniperus sabina	Savin juniper
Ligustrum amurense	Amur river privet
Lonicera Morrowii	white honeysuckle
Lonicera canadensis	wild honeysuckle
Lonicera chrysantha	honeysuckle
Lonicera chrysantha longipes	honeysuckle
Lonicera notha alba	honeysuckle
Lonicera tatarica sibirica	Siberian honeysuckle
Lonicera spinosa Alberti	Albert regal honeysuckle
Lonicera tatarica	Tatarian honeysuckle
Lonicera tatarica	Brooks No. 1 Tatarian honeysuckle
Lonicera tatarica grandiflora	Tatarian honeysuckle
Lonicera tatarica rosea	Tatarian honeysuckle (pink)
Lonicera tatarica rubra	Tatarian honeysuckle (red)
Lonicera tatarica sempalatinsk	Tatarian honeysuckle
Lonicera tatarica virginales alba	Tatarian honeysuckle
Malus baccata	Siberian crabapple
Malus Namew	ornamental crabapple
Philadelphus grandiflorus	large-flowered mock orange
Philadelphus satsumi	Japanese mock orange
Picea glauca	white spruce
Pinus Cembra	Swiss stone pine
Pinus sylvestris	Scotch pine
Potentilla fruticosa	shrubby cinquefoil
Prunus Maackii	Amur cherry
Prunus nana	Russian almond
Prunus nigra	native plum
Prunus pennsylvanica	pincherry
Prunus triloba	flowering plum
Prinsepia sinensis	Prinsepia
Rhamnus cathartica	common buckthorn
Rhus glabra	sumach
Ribes americanum	native black currant
Ribes aureum	Missouri currant
Ribes diacantha	flowering currant
Ribes rubrum	red currant (native)
Ribes alpinum sterile	alpine currant
Rosa acicularis	prairie rose (single)
Rosa canina	rose

EXCELLENT—*Concluded*

Botanical Name	*Common Name or Variety*
Shepherdia argentea	silver buffalo berry
Shepherdia canadensis	russet buffalo berry
Spiraea media	spiraea
Spiraea oblongifolia	spiraea
Spiraea Billiardii	spiraea
Sorbaria sorbifolia	ash-leaved spiraea
Symphoricarpos occidentalis	snowberry
Syringa amurensis	Amur lilac
Syringa chinensis	Rouen lilac
Syringa pekinensis	Pekin lilac
Syringa villosa	Chinese lilac
Syringa vulgaris	Alba grandiflora
Syringa vulgaris	Bulgarnia lilac
Syringa vulgaris	Charles X
Syringa vulgaris	Congo
Syringa vulgaris	Doyen Keteleer
Syringa vulgaris	Georges Bellair
Syringa vulgaris	Grand Duc
Syringa vulgaris	La Tour d'Auvergne
Syringa vulgaris	Leon Simon
Syringa vulgaris	Linne
Syringa vulgaris	Marie Legrave
Syringa vulgaris	Michel Buchner
Syringa vulgaris	Pierre Joigneaux
Syringa vulgaris	President Carnot
Syringa vulgaris	Souvenir de L Spath
Thuja occidentalis	American arborvitae
Ulmus americana	American elm
Ulmus parvifolia	Chinese elm
Viburnum Lentago	Sheepberry

GOOD

Acer tataricum rubrum	Tatarian maple
Caragana frutex var macrantha	caragana
Caragana sophoralfolia	caragana
Celtis occidentalis	hackberry
Cornus alba sibirica	Siberian dogwood
Corylus americana	hazelnut
Crataegus crus-galli	cockspur thorn
Gleditsia triacanthos	flowering locust
Hippophae rhamnoides	Russian sand thorn
Lonicera Ruprechtiana	Manchurian honeysuckle
Lonicera tatarica	Brooks No. 2 Tatarian honeysuckle
Malus Babine	ornamental crab apple
Picea pungens Kosteriana	Koster blue spruce
Pinus Banksiana	jack pine
Pinus contorta latifolia	lodge-pole pine
Populus	northwest poplar
Populus alba	snowy white poplar
Quercus cathartica	Native oak
Ribes crandel	flowering currant
Ribes oxyacanthoides	northern gooseberry
Rosa Cree	
Rosa rubiginosa	sweet brier rose
Rosa rugosa	Japanese rose
Rosa	double native

GOOD—*Concluded*

Botanical Name	*Common Name or Variety*
Salix alba vitellina	golden willow
Sambucus canadensis	American elder
Sambucus racemosa	red elder
Sorbus americana	American mountain ash
Sorbus aucuparia	European mountain ash
Spiraea cantoniensis	spiraea
Syringa Josikea	Hungarian lilac

FAIR

Abies balsamea	balsam fir
Acer Negundo	Manitoba maple
Acer tataricum aidzuense	Tatarian maple
Cotoneaster integerrima	European cotoneaster
Eleagnus argentea	Wolfe willow
Euonymus Sieboldianus	Japanese spindle tree
Larix decidua	European larch
Larix laricina	American larch or tamarack
Lonicera deflexicalyx	honeysuckle
Physocarpus opulifolius	ninebark
Pinus montana mughus	dwarf mountain pine
Populus nigra	black poplar
Populus Petrowskyana	Russian poplar
Prunus virginiana	choke cherry
Rhamnus utilis	buckthorn
Rhamnus saxatilis	buckthorn
Rosa Hansa	Hansa rose
Rosa rubrifolia	redleaf rose
Salix Batavia	willow
Salix vitellina flava	yellow willow
Sambucus canadensis laciniata	cutleaf elder
Spiraea arguta	garland spiraea
Spiraea fontenaysii alba	spiraea
Spiraea fontenaysii rosea	spiraea
Spiraea trichocarpa	spiraea
Viburnum Lantana	wayfaring tree

POOR

Acer saccharinum	silver maple
Acer spicatum	mountain maple
Acer saccharum	sugar maple
Acer ginnala	ginnalian maple
Cornus Baileyi	dogwood
Euonymus atropurpureus	burning bush
Juglans	walnut
Malus Timiskaming	ornamental crabapple
Malus ussuriensis	Siberian pear
Phellodendron amurense	Amur cork tree
Prunus Grayana	European bird cherry
Prunus saliciana	Japanese plum

POOR—*Concluded*

Botanical Name	*Common Name or Variety*
Rosa chinensis	Chinese rose
Rosa davurica	rose
Rosa villosa	rose
Rubus occidentalis	wild raspberry
Salix	native willow
Salix alba vitellina var chermesina	red-barked willow
Salix fragilis bullata	willow
Salix dasyclados	willow
Salix purpurea	purple willow
Salix alba sericea	white willow
Salix roefemuide	willow
Salix ural	willow
Salix purpurea gracilis	willow
Spiraea salicifolia alba	spiraea
Spiraea semperflorens	spiraea
Spiraea Vanhoutei	Van Houtte spiraea
Viburnum trilobum	high bush cranberry

DEAD

Betula excelsa	yellow birch
Caragana Maximowicziana	caragana
Cornus amomum	dogwood
Cornus sibirica variegata	variegated dogwood
Cornus coronata	dogwood
Cornus paniculata	dogwood
Euonymus alata	winged spindle tree
Fraxinus mandschurica	Manchurian ash
Malus Athabasca	ornamental crab
Malus Muskoka	ornamental crab
Malus Nipissing	ornamental crab
Malus Slocan	ornamental crab
Populus alba var Balleana	white poplar
Populus berolinensis	Columnar poplar
Populus charkoviensis	Lombardy black poplar
Rhamnus davurica	Dahurian buckthorn
Rhamnus Pallasii	buckthorn
Rosa Huron	rose
Rosa rubrosa	rose
Salix blanda	Wisconsin weeping willow
Spiraea cruxosa	spiraea
Ulmus pumila	Chinese elm
Viburnum opulus	snowball

TREE FRUITS

In recent years, distinct advances have been made in fruit growing at this station, despite the unfavourable moisture conditions. Many hybrids and seedling selections have been grown. After ruthless culling and a steady process of elimination, five distinct varieties of crabapples have been selected and named.

One of these, known as *Rescue*, is especially in favour in this locality. This is a seedling selected from Blushed Calville, and a little apple resembling a miniature Spy, red in colour, early, prolific and hardy. The flesh is firm and juicy.

Diameter averages 1¼ inches when grown at Scott. *Recover* is a larger size than Rescue, is yellow in colour, and is also a seedling of Blushed Calville. The other new varieties named are: *Marilyn*—light yellow splashed with red; *Earl*—a stippled effect of red and russet; and *Jesim*—yellow and red, streaked. The last mentioned is a medium-sized apple of excellent quality, and is a cross between Jewel and Simbirsk.

Seven selections from the native plums have also been made and selected for their superior quality. These vary in colour from bright yellow to deep purple. A large quantity of both crab and plum seed was planted last year. In the fall of 1936, about 1,000 young stocks were secured from outside sources, upon which it is proposed to graft during the present winter and plant into nursery rows in the spring.

In some ways the drought of the past few years, has been a distinct advantage, in that it has shown up those varieties which are particularly suited to prairie conditions. This gives a selection of kinds with which to go forward on a larger scale.

LIST OF TREE FRUITS RECOMMENDED

Variety	Average Diameter of Fruit	Colour of Skin	Flesh	Time of Maturity
	Inches			
CRABAPPLES—				
Osman	1½	Red and yellow streaks.	Cream-yellow and mealy	Aug. 20–Sept. 8
Florence	1⅝	Yellow, splashed with red.	Streaky red, crisp texture.	Sept. 1–7
Transcendent	2	Bright yellow	Medium yellow and firm	End of Aug.
Rescue	1¼	Red	Firm and juicy	Sept. 1–10
Recover	1½	Yellow	Light yellow and mealy.	Sept. 1–12
Jesim	1¾	Yellow and red streaked	Light yellow, juicy, even-textured.	Sept. 2– 8
Earl	1⅜	Stippled red with russet.	Very light, sweet and firm.	Early Sept.
Marilyn	1¾	Yellow, splashed with red.	Cream-yellow, med. texture.	Sept. 8–18
PLUM—				
Assiniboine	1	Bright red	Green, firm and sweet. Large pit.	Mid-September.
CHERRY—				
Champa	⅝	Blue	Green and firm, small pit.	Early Sept.
PLUM X SANDCHERRY HYBRIDS—				
Sapa	1	Purplish red	Purple with small pit	Early Sept.
Opata	1⅛	Dark purple with blue bloom.	Green and firm, small pit	Early Sept.
Zumbra	¾	Dark purple	Green, medium pit	Late August
Oka	⅞	Purplish red	Wine red, small pit	Late August
Tom Thumb	¾	Purplish red	Dark purple, medium pit.	Early Sept.

The above list of tree fruits is recommended as the most outstanding from a large number of varieties tested at Scott, selected for hardiness, quality and fruiting habits. All named varieties of apples, crabapples, plums and cherries are, for all practical purposes, self-sterile and plants of any one variety planted alone will be unproductive. Plants of two varieties at least of the same kind of fruit are necessary for fruitfulness and plants of three or four varieties are preferable.

The use of several plants of one variety will not result in fruitfulness any more than will the use of one plant of that variety because all plants of a given variety, where increase is made by vegetative methods, are identical. One kind of fruit is not inter-fertile with another kind, as the apple with the plum, but crabapples and apples are inter-fertile as are also the sand-cherries mentioned and the plum x sand-cherry hybrids as Sapa and Opata, Tom Thumb and Oka.

SMALL FRUITS

During the past five years, there has been little change in varieties of small fruits but there has been demonstrated the need for greater space between rows under prairie conditions.

Suitable varieties of small fruits are:

Strawberries.—Senator Dunlap, Dakota, and Dr. Burrill.

Raspberries.—Herbert, Sunbeam, Latham and Newman.

Gooseberries.—*Green*—Oregon, Champion.

Red or Pink—Houghton, Pixwell.

White Currants.—Large White and White Grape.

Red Currants.—Red Dutch, Stewart, Red Grape and London Market.

Black Currants.—Saunders and Climax.

Under prairie conditions the rows of small fruits should be wider than commonly grown. Suggested distances are: for strawberries, six to eight feet, for raspberries, eight to sixteen feet, and for currants, eight to ten feet. Small fruit plantations can be greatly aided in production by proper pruning, suggestions for which will be gladly supplied on request. In laying out plantations, care should be taken not to plant them close to vigorous-rooted trees.

POULTRY

The poultry flocks at the Scott station during the five-year period just past, have consisted of from 250 to 300 Barred Plymouth Rocks as a breeding flock, and 10 or 12 Mammoth Bronze turkeys. From 1,000 to 2,000 chicks and from 50 to 75 turkey poults have been raised and brooded artificially each year. In 1936, 1,300 young chicks were supplied to Illustration Stations supervised from Scott. No difficulty has been experienced with pullorum (white diarrhoea) in young chicks since annual blood tests were first made about ten years ago. Records are kept of the ancestry of each bird. This is made possible by trap nesting and the hatching of eggs in special wire baskets in the incubator. By referring to the records of production of the ancestors, it is possible to intelligently select the most promising individuals for breeding purposes. During the last five years, several birds have laid approximately 300 eggs in their first laying period and some have exceeded that number.

FEED FOR LAYING STOCK

The following plan of feeding has given good production for many years at the Scott station: Dry mash (kept before the birds winter and summer): equal parts by weight of oat chop, barley chop, bran, shorts and beef scrap. To each 100 pounds of the mixture, one quarter of a pound of salt and two and one-half pounds of fine charcoal are added. The beef scrap may be omitted if milk can be kept before the birds in place of water, (either skim milk or buttermilk).

In comparatively recent years, the value of cod liver oil during winter has been realized. At Scott, two pounds of this oil is mixed with sufficient bran to make the mixture fairly dry and this is then stirred thoroughly into enough dry mash to make up 100 pounds. Fed to the chicks, it has improved their vitality

to a noticeable extent, and in an average of four trials has increased egg production by five per cent and hatchability of eggs by 30 per cent. Pilchard oil has been equally effective and is usually slightly cheaper.

Scratch Grain.—This is made up of four parts of low-grade wheat, one part oats and one part barley. It is fed in the litter on the floor about half an hour before roosting time, at the rate of 16 pounds per 100 birds.

Green Feed.—When fresh green feed is not available, rape leaves, a mangel or a cabbage may be tied to the wall of the house until freezing weather. During the cold weather green feed may be supplied by feeding sprouted oats in the litter about noon, at the rate of ten pounds per 100 birds.

The following is a simple method of sprouting oats, used at the Scott station. Six containers, each large enough to hold one day's feed, are required, and in the bottom of each, holes must be provided for drainage. Sufficient oats for one day's feed are soaked in water for 24 hours, then placed in the first container, from which the water will drain. Each day a new lot of oats is placed in water to soak, and each of the other lots is moved from one container into the next. The oats are sprinkled as necessary to keep moist. At the end of a six-day period, the six containers are filled, and the oats in the sixth box are sprouted and ready to feed. A reasonably warm room is necessary to promote germination.

If alfalfa is available in a well-cured form, bunches may be fastened to the wall so that the birds may pick the leaves. Commercial alfalfa leaf or blossom meal may be used to advantage in the laying mash. However, no tests have been made at Scott to compare the value of alfalfa to that of sprouted oats, for green feed.

FEEDING OF YOUNG CHICKS

Many poultrymen have their own mixtures and methods of feeding young chicks and there are many good "chick starters" on the market, but the following homemade mixtures and methods of feeding have given good results at the Scott station, and they are presented for the benefit of those who are in need of such information.

From the time the chicks are removed from the incubators on the 23rd day of incubation, a dry mash is kept before them in feeders, made up of equal parts of bran, shorts, cornmeal and oat chop (hulls sifted out), with six per cent of fine meat scrap, one-half of one per cent of fine salt and two per cent of each of the following: fish meal, skim-milk powder, bone meal and cod liver oil. If milk can be kept before the chicks the meat meal, fish meal and milk powder may be omitted, or ten per cent of meat meal or meat scrap may be fed in place of the fish meal and milk powder. It would be a mistake to omit the cod liver oil, particularly for early chicks not running outside.

After the chicks are about ten days old, cracked grain is fed twice daily, at first on a sheet of brown paper, and in the litter after the chicks are more active. Green feed is supplied in the form of sprouted oats until the chicks can get outside to pick their own green feed. After the chicks are well started, whole grain is fed morning and evening and the following dry mash is kept before them in a self-feeder: bran, 100 lb., shorts, 150 lb., oat chop, 150 lb., beef scrap, 50 lb., and fine salt, 2 lb.

CRATE FEEDING

Several tests were made in crate feeding cockerels for a special market. Each test covered a period of 20 days and the average weight of the cockerels was about five pounds at the beginning of the test. Different grain mixtures were used with all grain finely ground and moistened with sour buttermilk and

stirred thoroughly, adding milk until the mixture was just thin enough to pour slowly. The birds were given nothing else to eat or drink. The mixtures tested were:—

(1) Wheat, oats, barley and boiled potatoes, equal parts.
(2) Wheat chop alone.
(3) Wheat, oats, barley, equal parts.
(4) Same as No. 3, but confined to a small pen in place of the standard fattening crate.

The average gain per bird was approximately one and one-half pounds. The greatest difference was in the case of the lot getting the boiled potatoes mixed with the batter, which reduced the gains slightly. The birds fed in the pen in the same building made practically the same gains, but after killing, the difference in finish was easily detected as the crate-fed birds carried a layer of fat beneath the skin while the pen-fed birds appeared to have grown more than fattened. Records were tabulated of similar birds at the beginning of the test which were left running on the range, receiving the regular whole grain twice daily and dry mash in the self-feeder, but the gains were less than half as much as the crate-fed birds.

Further details of crate feeding may be obtained from pamphlet No. 125, New Series, which is free upon application to the Publicity and Extension Branch, Department of Agriculture, Ottawa, Ontario. (No stamp required on letter.)

WAX PLUCKING

The National Research Council of Canada and the Dominion Department of Agriculture have developed a method of removing pin feathers, hairs, etc., from dry picked birds by the use of a specially prepared wax. It has been demonstrated at this station, but the scheme is considered to be more practical in cases where a large number of birds are to be plucked and where there is a good means of controlling temperatures, both of the wax and of the room where the wax cools on the birds.

Full details of wax plucking may be obtained from the special pamphlet known as "The Use of Wax in the Plucking of Poultry," free upon application to the Publicity and Extension Branch, Department of Agriculture, Ottawa, Ontario.

MANAGEMENT OF LAYING BIRDS

A four-year test was made comparing the standard laying mash given on the first page of the Poultry section of this report, with the same mash in which the bran and shorts were replaced with an equal weight of wheat chop. The test was carried on approximately six months each year during the winter and the average egg production showed four eggs per bird more per year in favour of the mash containing the wheat chop. However, the hatchability was remarkably low in this pen each year, which would indicate that the wheat chop should not be used where the eggs were to be used for hatching.

Milk powder was compared with beef scrap as a protein supplement for laying pullets. A four-year average shows that beef scrap produced ten eggs per bird more for a six-month winter period, than the milk powder. Perhaps the difference may be accounted for, at least in part, by the fact that the milk powder, having a lower protein content, increased the bulk of the mash to an extent that less of the other feeds could be consumed.

Value of Artificial Heat.—Artificial heat for egg production was tested for four consecutive winters. Although severe weather usually reduced egg production in the unheated pen, it was found that after the weather moderated, the birds made up the difference, so at the end of the test there was practically

no difference in total egg production. There was therefore nothing to show for the fuel used, the extra labour, and the danger of fire in having a stove near the straw and the litter necessary in the house.

In order to ascertain the value of cornmeal in the ration for laying pullets, 20 per cent corn was added to the standard ration. The average egg production per bird for a six-month period, taken each winter for three years, was 95 eggs from each bird getting the standard ration and 92 eggs per bird from those getting the cornmeal in their ration.

Sources of Protein.—A special test was made in order to determine if protein, as supplied by 20 per cent beef scrap in the dry mash, is as effective in egg production as supplying the same net quantity of protein from several sources. One lot of pullets received the standard ration containing 20 per cent beef scrap, while the other pen received an equal quantity of total protein from four separate protein feeds. Those used were: tankage, fish meal, beef scrap and milk powder, and the proportions used were in accordance with the protein content of each, in order that each would supply an equal amount of the total net protein. Three tests were made, each covering a six-month period from November 1 to May 1, and the average egg production per bird per test was 80 for the beef scrap, and 81 for the mixed protein, which does not justify the extra trouble.

A test was made to compare common gravel, sifted from sand, with commercial grit. Each was kept before the laying pullets during the winter, for three tests. The average egg production per bird per season, was 79 for the gravel and 76 for the commercial grit. Contrary to the idea of some feeders, both grit and oyster shell are necessary for best results.

Fish Oils.—It is well known among most poultrymen that cod liver oil will stimulate egg production as well as increase hatchability and strength of chicks. Pilchard oil is on the market for the same purpose and a test was made covering four winter periods of six months each. In the average of four tests the total weight of eggs laid per bird was 7·5 pounds in the check lot getting no oil, 11·3 pounds in the cod liver oil lot, and 12·2 pounds in the pilchard oil lot. A rating in percentage, based on the weight of eggs produced per pound of feed consumed, was: 100 per cent for pilchard oil, 94 per cent for cod liver oil and 70 per cent for the lot getting the same feeds without oil. The oil was fed at the rate of two per cent in the dry mash in the self-feeder by mixing it with a small quantity of chop, then adding the mixture to the mash and mixing it well before placing in the self-feeder.

Further details concerning the use of cod liver oil may be obtained from Technical Bulletin No. 475, free upon application to the Publicity and Extension Branch, Department of Agriculture, Ottawa, Ontario.

Feed Value of Low Grade Wheat.—During the winter of 1935-36, a test was made comparing low grade wheat with a good grade of wheat for use in the feed of laying pullets, both in the mash and scratch grain. The wheat chop made up two-fifths of the laying mash by replacing the bran and shorts used in the regular mash, previously referred to. In the scratch grain, made up of two-thirds wheat, the respective samples were used as allotted. For the low grade wheat, the sample was classed as " feed " and weighed 54 pounds per bushel, and was purchased at 35½ cents per bushel. The other sample was No. 2 Northern, weighing 59½ pounds per bushel and the price was 71½ cents. The returns over cost of feed were in favour of the feed wheat, but the total weight of eggs laid was three-quarters of a pound per bird in favour of the No. 2 wheat, during the test of six and a half months. The count of eggs was in favour of the pen getting the low grade wheat.

In the final analysis, there was 22 cents per bird in favour of the feed wheat by reason of the spread in price of the two samples. The lot getting No. 2 wheat produced 19 pounds of eggs per 100 pounds of feed eaten, while the feed wheat produced only 17 pounds of eggs per 100 pounds of feed.

TURKEYS

During the past five years the turkey flock has consisted mostly of grade "A" females and always a grade "A" male has been used.

The turkeys are moved each year to fresh land where turkeys have not been for several years and where chickens have never run. The turkeys are confined to a yard from one and one-half to two acres in area, where oats and rape are grown for green feed. The poults are hatched in the incubator and brooded artificially. From 50 to 75 poults are usually raised each year. The inferior birds are used for table purposes early in the fall and the remainder of the flock is graded by a representative of the Provincial Government and the surplus of the best stock is sold for breeding purposes according to grade.

Feeding.—No hard and fast rule can be laid down for feeding and handling young poults. Any person who has been successful with a method of his own should not be hasty in adopting another, but some modifications may be desirable to improve the balance of the ration. The beginner may prefer to use some commercial starter, of which there are many good ones on the market, but they are usually much more expensive than a home-made preparation. Poults are quite similar to chicks and may be treated much the same way, except that they are more indifferent to food when young and if allowed to go too long before feeding, the difficulty may be increased. This is true particularly of the poult hatched in the incubator and artificially brooded. When first placed in the brooder it is well to dip the beak in the water, and, of course, water should be kept within easy reach. There is danger of a poult over-eating, and if indigestion results, the poult may not eat again for a time and will then have to learn over again. Frequent feeding in small quantities will help to avoid such a difficulty. Four or five times per day is suggested at first. Hard-boiled eggs with shells included, together with shorts and cut green dandelion leaves, makes a satisfactory starter. The dandelion leaves may be replaced by six per cent alfalfa leaf meal if desired, and used in the feed until the poults can pick their own greens outside. If milk is available, it may well be used to moisten the shorts to a crumbly condition, every second feeding in place of the boiled eggs. Fine grit and oyster shell should be provided in a pan or small feeder. When the poults are about two weeks old, there should be a gradual change to a dry mash. Some of the poults may be slow to eat the dry mash and sufficient of the moist feed should be continued for a time to prevent such poults from suffering from hunger. At this station the green feed is fed separately after the second week. The dry mash may be made up of equal parts of bran, corn meal, shorts and oat chop (hulls sifted out), with ten per cent fine meat scrap, two per cent bone meal and one-half of one per cent fine salt. This mash may be kept in the self-feeder before the poults and after they are eating well, the moist mash may be reduced gradually and finally discontinued. Sour milk should be kept before them from the first if possible, and scratch grain may be fed daily from the time they are four weeks old, beginning with cracked wheat and gradually changing to whole grain as the poults develop. This may be fed twice daily in such a quantity as will be eaten at once.

If it is desired to hasten growth or put on a special finish, a moist mash made up of shorts and sour milk, with five per cent bone meal, may be fed in a trough once per day. Any feed not eaten at once should be removed as souring or moulding of feed may cause digestive troubles.

APICULTURE

The end of the year 1936 marks a change in the apiculture work at this station. Due to the semi-arid climate at Scott and the resulting shortage of nectar, it has been considered wise to operate only a demonstration apiary here. The number of colonies, therefore, has been reduced from 20 to half that number. In this way, demonstrations may still be made in different phases of management, and information will be available for beekeepers writing in or visiting the station, and who live in areas of the territory served by the Scott station but where conditions are more favourable for beekeeping. The most common inquiries in the past have concerned methods of swarm control, wintering, feeding, and the handling of package bees.

From eight to twelve packages of bees have been imported from the United States annually for some time. They were used for conducting experiments in strengthening of weak colonies and for comparing with overwintered colonies.

No colonies have been destroyed in the fall with a view to replacing them in the spring, as it has been considered more advisable to winter all colonies. Any weak colonies in the fall are united with others to reduce the hazards and costs of wintering. The honey is removed and sugar syrup is fed until the hive weighs 75 pounds without cover. Some reasons for preferring to winter bees are as follows: (1) Overwintered colonies have consistently given a higher production of honey than package bees, which helps to offset the cost of wintering. (2) Too large a percentage of beekeepers destroying all bees in the fall and depending upon packages in the spring would make it impossible for everyone to get prompt deliveries, and late packages are unprofitable. (3) Overwintered colonies have young brood well advanced before packages are shipped. (4) Queens received with packages frequently have to be replaced before the end of the honey flow. (5) Very little difficulty has been experienced in wintering bees at Scott.

A pamphlet giving complete instructions as to the installation of package bees may be obtained free upon application to the Publicity and Extension Branch, Department of Agriculture, Ottawa, Ontario.

WINTERING BEES

The wintering trials at this station have proved that bees can be successfully wintered either in a cellar or in wintering cases. For cellar wintering, the tempertature of the cellar should be maintained at about 45 degrees F. if possible. The location in the cellar, for the best results, would be in a corner or against a wall, with curtains to prevent the light from reaching the hives. The hives should not be in the same room as vegetables are stored.

The cases for wintering bees outside are prepared so that the hives may be packed on all sides with insulation. Insulation material used has included mill shavings, sawdust and cut straw, with equal success. These insulations were satisfactory at six, eight- and ten-inch thicknesses. A tunnel is provided to enable the bees to get out on mild days and the cases allow for inspection of bees from the top of the case. This method of wintering has the advantage of giving protection from changeable weather in both spring and fall, and the bees always have the opportunity for a cleansing flight in mild weather. The cellar-wintered bees sometimes require protection from rough weather after being placed outside in the spring.

More complete information concerning wintering may be obtained from Bulletin No. 74, "Wintering Bees in Canada," which is free upon application to the Publicity and Extension Branch, Department of Agriculture, Ottawa, Ontario.

SWARM CONTROL

Swarming is seldom permitted in the modern apiary and a number of methods of control have been tried at Scott. A double brood chamber has been useful in detecting the preparation for swarming. The top super is tipped from the back, just sufficiently to allow a view of the bottom bars of the frames, in the upper super. If no queen cells are evident, there is no danger of swarming. This saves a great deal of time as compared with the old plan of looking for queen cells by removing one frame at a time in the single brood chamber.

Swarming may be caused by overcrowding of bees, brood or stores. When there is no congested condition in the hive and a swarming tendency is noticed, the treatment preferred at Scott is to destroy the old queen and all queen cells and introduce a young laying queen at once by use of a "push-in" cage. The plan followed is to raise all of the brood to the upper super before the new queen is introduced, except from one frame which is emerging. Ten days later all queen cells must be again destroyed.

QUEEN RAISING

Although it is generally considered that a warmer climate is more satisfactory for the fertilization of queens, no difficulty has been experienced at Scott in this regard, where queens have been raised annually for some time. However, for the apiarist who has but a few colonies, it is hardly worth while to raise queens but in the large apiary it is an important saving.

General information concerning beekeeping may be obtained from Bulletin No. 169, "Bees and How to Keep Them," which is free upon application to the Publicity and Extension Branch, Department of Agriculture, Ottawa, Ontario. (No stamp required on letter.)

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