DOMINION OF CANADA
DEPARTMENT OF AGRICULTURE
DOMINION EXPERIMENTAL FARMS

EXPERIMENTAL STATION

Ste. Anne de la Pocatiere, Que.

PROGRESS REPORT OF THE SUPERINTENDENT

J. A. STE. MARIE, B.S.A.

FOR THE YEARS 1931-1936

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EXPERIMENTAL STATION—STE. ANNE DE LA POCATIERE, QUE.

OFFICERS

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Emile Petit, B.S.A., *Chief animal husbandman.*

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Report of the Superintendent 1931 to 1936

ANIMAL HUSBANDRY

DAIRY CATTLE

The dairy herd of this station is composed exclusively of Ayrshires, and during the last five years has averaged 55 to 60 pure-bred animals including 20 to 25 milch cows. During the past ten years, the whole herd has been given an annual blood test for contagious abortion, and no reactors have been found. The tuberculosis-free accredited herd certificate issued in 1925 has been renewed yearly. With few exceptions, all the progeny of animals which have proved their worth was raised and the males were sold as breeding sires. Rational feeding was practised with both milch cows and young stock with a view to obtaining the maximum yield and development. The most rigid selection has been practised based upon type standards for the Ayrshire breed and upon milk and butterfat production records. Indicative of the progress made is the fact that the average annual production of the cows, which was 4,125 pounds of milk in 1914, averaged 9,120 pounds of milk testing 4·29 per cent for the last 11 years. In 1922, only one cow qualified for the Record of Performance; to-day, all those that have completed a lactation period have qualified.

OFFICIAL PRODUCTIONS IN THE RECORD OF PERFORMANCE

In the last 11 years, 172 official records in the Record of Performance were made by the Ayrshire herd on this station, including 115 in the 305-day class and 57 in the 365-day class. The average of the 115 records in the 305-day class was 9,242 pounds of milk testing 4·24 per cent or 392 pounds of butterfat. The average of the 57 records in the 365-day class was 10,634 pounds of milk testing 4·29 per cent or 456·3 pounds of butterfat.

In the last 11 years, seven cows have obtained certificates for meritorious productions, five in the class of 50,000 pounds of milk or more and two in the class of 75,000 pounds or more. These certificates are awarded by the Canadian Ayrshire Breeders' Association for cows which have made official records which total 50,000 pounds of milk or more, 75,000 pounds or more and 100,000 pounds or more.

During this 11-year period, four silver cups offered by the Canadian Ayrshire Breeders' Association were awarded to this station in recognition of outstanding achievements in the Record of Performance, namely: the highest record in 1932 in the three-year-old class with 13,735 pounds of milk and 599 pounds of butterfat; the highest record in 1925 in the three-year-old class with 17,406 pounds of milk and 746 pounds of butterfat; the highest record in 1926 in the four-year-old class with 16,051 pounds of milk and 702 pounds of butterfat;

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the highest record in 1927 in the adult class with 16,009 pounds of milk and 613 pounds of butterfat. Further, in 1925, one cow established a world's record with 22,035 pounds of milk and 979 pounds of fat in 365 days in lactation.

These records were made under conditions similar to those prevailing on a number of farms in this province where pure-bred animals are kept. They demonstrate that this section of the province is just as suitable for dairying as any other district, provided that good feeding and breeding practices are followed.

A registration certificate in the Record of Performance is to-day a guarantee required by the purchasers of pure-bred stock, and breeders should not neglect any opportunity for having their cows tested and sires officially qualified in the Record of Performance. Breeders should take the trouble of having all their pure-bred cows entered in the Record of Performance each year, as experience at this station has shown that this is the best means of applying selection which will result in rapid improvement in the quality of the herd.

IMPROVEMENT OF THE HERD BY THE USE OF SUPERIOR SIRES

During the five-year period, six herd sires have been used, and they were responsible for a substantial improvement in the milk and butterfat production. The list of these herd sires is given below, with some data in connection with the production of the dams and the improvement in the production of the daughters.

Ottawa Lord Kyle—77049—sired by Overton Lord Kyle (imp.) out of Hardcroft Dewdrop 3rd (imp.). The average of the records of his dam was 10,600 pounds of milk testing 4·19 per cent. The eight cows bred to this bull gave an average production of 9,796 pounds of milk testing 4·11 per cent. The average production of his eight daughters was 9,976 pounds of milk testing 4·34 per cent. Therefore, this bull has increased the production by 180 pounds milk and ·23 per cent fat; he has shown the ability of transmitting to his progeny a productive capacity of 10,053 pounds of milk testing 4·69 per cent fat (Mount Hope Bull Index.)

Ottawa Supreme 2nd—89288—sired by Shewalton Mains Supreme (imp.) 83930 (22659) out of Auchlochan Emerald (imp.)—70083—. The average of the records of his dam was 10,366 pounds of milk testing 4·03 per cent. The six cows bred to this bull gave an average production of 8,716 pounds of milk testing 4·28 per cent. The average production of his six daughters was 9,992 pounds of milk testing 4·40 per cent. This bull has increased the production by 1,276 pounds of milk and ·12 per cent fat, transmitting to his progeny a productive capacity of 10,539 pounds of milk testing 4·58 per cent.

Ste. Anne Lord Kyle 12th—97949—, sired by Ottawa Lord Kyle —77049— out of Briery Lass —85707—. The average of his dam's records was 16,134 pounds of milk testing 3·98 per cent. The seven cows bred to this bull gave an average production of 10,328 pounds of milk testing 4·37 per cent. The average production of his seven daughters was 11,538 pounds of milk testing 4·52 per cent. He has increased the production by 1,210 pounds of milk and ·15 per cent fat, transmitting to his progeny a productive capacity of 12,057 pounds of milk testing 4·75 per cent.

Ste. Anne Briery Supreme —105382—, sired by Ottawa Supreme 2nd —89288— out of Briery Lass —85707—. The average of his dam's records was 16,134 pounds of milk testing 3·98 per cent. The seven cows bred to this bull gave an average production of 10,013 pounds of milk testing 4·21 per cent. The average production of his seven daughters was 11,446 pounds of milk testing 4·15 per cent. This bull has increased the production by 1,433 pounds of milk but he was responsible for a reduction of ·06 per cent in the percentage of butterfat. He has shown the ability of transmitting to his progeny a productive capacity of 12,060 pounds of milk testing 4·11 per cent.

Ottawa Supreme 10th —91809—, sired by Shewalton Mains Supreme —83930 (22659) (imp.) out of Auchinbay Mina 5 —70080—. The average of his dam's records was 12,111 pounds of milk testing 4 per cent. The ten cows bred to this bull gave an average production of 11,173 pounds of milk testing 4·32 per cent. The average production of his ten daughters was 11,824 pounds of milk testing 4·21 per cent. This bull has increased the milk production by 651 pounds but was responsible for a decrease of ·11 per cent in the percentage of butterfat. He has shown the ability of transmitting to his progeny a productive capacity of 12,113 pounds of milk testing 4·14 per cent.

Kirkcudbright Legend (imp.) —155136— (30247)—, imported from Scotland and sired by Relief Banker —23874— out of Kirkcudbright Bella 5th —66287—. The six cows bred to this bull gave an average production of 11,209 pounds of milk testing 3·73 per cent. The average production of his six daughters was 12,393 pounds of milk testing 4·29 per cent. This bull has increased the production by 1,183 pounds of milk and 0·53 per cent fat transmitting to his progeny a productive capacity of 12,603 pounds of milk testing 4·97 per cent.

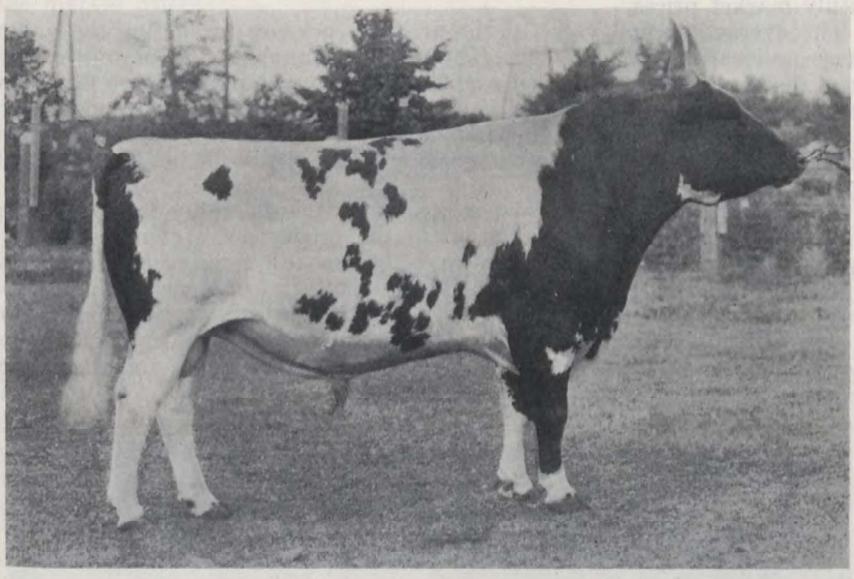

FIG. 1.—Kirkcudbright Legend—155136—(30747). This bull was imported from Scotland and headed the Ayrshire herd at the Ste. Anne Station for several years.

COST OF MILK AND BUTTER PRODUCTION

In order to determine the cost of milk and butter production, a record was kept of all the feed consumed by the dairy cows and of all the milk and butter produced. The home-grown feeds such as hay, roots, silage, and pasture were charged at the cost price on the farm, while other feeds such as meal and beet pulp were charged according to the monthly market price.

Over an 11-year period, including the last five years, with 216 lactations, the average annual production of the cows was 9,120 pounds of milk testing 4·29 per cent or 459·9 pounds of butter. In order to give this production, the annual feed consumption per head was 2,465 pounds of meal, 4,669 pounds of roots, 5,571 pounds of silage, 2,725 pounds of clover or alfalfa hay, 678 pounds

of green fodder hay and 86 pounds of beet pulp, in addition to 3·9 months of pasture. The annual feed cost per cow was $79.04. Thus the feed cost of milk was 87 cents per hundred pounds and of butter 17 cents per pound.

These cost figures may seem rather high, but it must be borne in mind that the cows freshen at all times during the year at this station and that production is as heavy in winter as in summer. The feed cost of milk and butter production is always much lower when the cows are kept on pastures than when they are fed in the stable during the winter. While the cost of production of milk and butter is higher in winter than in summer, on the other hand the selling price is much higher in winter than in summer. In any case, when the cost of production of butter on this farm was 17 cents per pound, as the average during the last 11 years, the selling price on the market during the same period was 29 cents per pound, based upon the winter and summer prices.

PROFIT PER COW AND PER POUND OF BUTTER

The value of the products given by dairy cows was also established in order to determine the profit per cow and per pound of butter. Skim-milk was always valued at 20 cents per 100 pounds, while the value of butter was based upon the monthly market prices.

The average annual value of the products per cow, excluding the value of manure and calves, was $147.10. The average annual value of butter on the market during the 11-year period was 29 cents. In comparing these figures with those of the preceding paragraphs, which give the cost of feed consumed per cow and the cost of production per pound of butter, it will be found that the average annual profit per cow was $68.06 and that the profit per pound of butter was 12 cents.

The profit over cost of feed per cow varied considerably from one animal to another. It was in direct relation to the production of butterfat and the total feed cost. Indeed, it is not always the heaviest milking cow which gives the highest profit, but it is usually the highest butterfat producer. Therefore, the farmer should neglect no opportunity to test the butterfat producing ability of his cows. Thus, in ascertaining the quantity of butterfat which each cow produces, he will know which deserve to be kept and fed properly and which should be sent to the slaughter-house.

FIG. 2.—A group of heifers sired by Kirkcudbright Legend.

FEEDING OF DAIRY COWS

The feeding system followed for dairy cows in the last 11 years has never varied materially and consists in giving the following quantities per head and per day:—

1 pound meal per 3 or 4 pounds milk produced;
1½ pounds clover or alfalfa hay per 100 pounds of the animal's weight;
4 to 4½ pounds roots or silage per 100 pounds of the animal's weight.

During the summer, the cows were placed on good fertilized permanent pastures between June 1 and July 20; from July 20 to the end of September, they were placed on good hay aftermath.

COST OF REARING AYRSHIRE CATTLE

In order to determine the feed cost of rearing cattle, a record was kept of the feed consumed by all the animals reared on this farm during the last 11 years. Such feeds as hay, roots and silage were charged at the cost price on the farm, while others such as meal and whole milk were charged according to the market prices.

Cost of rearing male calves from birth to one year of age.—During the same period, the average quantity of feed consumed per head, from birth to one year of age, by 32 calves reared on this station was as follows: 388 pounds whole milk, 2,204 pounds skim-milk, 1,344 pounds hay, 1,130 pounds meal, 691 pounds roots and 146 pounds silage. The average feed cost was $34.32 per head, and the average weight at one year of age was 760 pounds.

Cost of rearing heifers from birth to one year of age.—For the 11-year period, the average quantity of feed consumed per head, from birth to one year of age, by 68 Ayrshire heifers reared on this station was as follows; 404 pounds whole milk, 1,690 pounds skim-milk, 1,302 pounds hay, 948 pounds meal, 1,076 pounds roots and 252 pounds silage. The average feed cost was $32.86 per head and the average weight at one year of age was 640 pounds.

Cost of rearing heifers from birth to first calving.—During the last 11 years. the average quantity of feed consumed per head, from birth to first calving, by 65 heifers reared on this station was as follows: 403 pounds whole milk, 1,904 pounds skim-milk, 1,385 pounds meal, 3,780 pounds hay, 4,699 pounds roots, 4,319 pounds silage, and in addition they were kept on pasture for nine months. The average feed cost was $76.47 per head. The average age at calving was two years and 234 days. At calving, the average weight was 1,047 pounds.

HEIFER FEEDING

As shown above, the feed cost of rearing Ayrshire heifers does not seem to be very high, if it is considered that these were pure-bred heifers and that they received an abundance of feed in order that they should make a rapid and normal growth and reach their full development at three years of age.

From birth to six months.—For the first five weeks following birth, the heifers receive whole milk; from that age until they reach six months, they receive skim-milk and calf meal. The quantity of whole or skim-milk given per day is equal to one-tenth of the animal's weight; however, this amount never exceeds 15 pounds per day. In addition to the skim-milk and calf meal, each heifer receives dry meal daily at the rate of approximately one pound per 100 pounds of the animal's weight, as well as good clover or alfalfa hay.

From six months to one year.—From the age of six months until they reach one year, the heifers are never turned out to pasture without first receiving meal and they are given the following daily ration per 100 pounds of body weight; one pound mixed meal, four pounds roots or silage and one and one-half pounds good clover or alfalfa hay.

From one year to first calving.—During the summer, the heifers which are a year old or over are turned out to good permanent pastures which have been fertilized and limed, but do not receive any meal ration. During the winter, they receive daily about four pounds roots or silage and one and one-half pounds of good clover or alfalfa hay per head per 100 pounds of live weight. With good pastures in summer and roots and good clover or alfalfa hay during the winter, it is never necessary to give meal to keep heifers which are one year old or over in a very good fleshy condition.

COST OF MAINTENANCE OF A HERD SIRE

Over a two-year period, the average quantity of feed consumed by a mature bull weighing between 1,800 and 2,000 pounds was as follows: 1,515 pounds meal, 9,040 pounds hay and 280 pounds green fodder. The feed cost amounted to $54.28. The maintenance of a herd sire is always fairly costly on small farms since it is inadvisable to turn him out to pasture; hence he should be used for farm work or his services should be shared by two or three neighbours.

FIG. 3.—Ayrshire herd at Ste. Anne on alfalfa aftermath which provided 100 days of pasture per acre for one cow.

CALF-FEEDING EXPERIMENTS

In the last five years, eight methods of calf feeding were tried out in order to ascertain their efficiency in regard to the growth made. However, only the four methods which gave the best results and which proved to be the best under various conditions are outlined in this report.

Full skim-milk ration and substitute.—In this method, whole milk was given until the animals reached four or five weeks. From then on until six months, the calves received a full ration of skim-milk ranging from 8 to 15 pounds per day according to age, to which was added as a substitute for the butterfat a calf meal containing 24 per cent protein. This meal was added in a dry state to the skim-milk at the rate of $\frac{1}{4}$ to $\frac{3}{4}$ pound per day according to the age. In addition, the calves received a home-mixed dry meal mixture and clover or alfalfa hay. The composition of the home-mixed meal was as

follows: 90 pounds ground oats, 60 pounds ground corn, 60 pounds bran, 30 pounds linseed oilcake, 30 pounds ground linseed, 1½ pounds ordinary salt and 3 pounds bone char.

This plan gave very good results and it may be recommended as the best of those that have been tested on this farm. The calves reared in this manner gained an average of 43 pounds during the second month, 59 pounds during the third, 59 pounds during the fourth, 63 pounds during the fifth and 68 pounds during the sixth. The average gain from birth to six months was 318 pounds per head, and the average feed cost $21.63.

Full skim-milk ration without substitute in the milk.—In this method, skim-milk was substituted for whole milk around four or five weeks, but no substitute was added to replace the butterfat removed. From that age until six months, the calves received a full ration of skim-milk ranging from 8 to 15 pounds per day according to age. They received in addition the same home-mixed meal and clover or alfalfa hay.

This system gave fairly good results and in addition it had the advantage of being very simple. The calves reared in this manner made an average gain of 34·5 pounds during the second month, 54 pounds during the third, 48·5 during the fourth, 43·5 during the fifth, and 56·5 during the sixth. The total gain from birth to six months was 263 pounds per head and the average feed cast $20,96.

Minimum quantity of skim-milk and cod liver oil.—In this method, whole milk was fed until four or five weeks. From then until six months, the calves received a minimum amount of skim-milk, four to five pounds per day, mixed with a home-made gruel or porridge composed of 100 pounds ground corn, 100 pounds middlings, 100 pounds oilcake, 100 pounds dried blood meal, one gallon cod liver oil, one per cent bone meal, one per cent ground limestone and one per cent common salt. This was prepared by mixing thoroughly one pound of the dry meal with one pound of cold water, to which nine pounds of boiling water were then added. It was fed at a temperature of approximately 100 degrees F. by mixing it with the skim-milk, and a sufficient quantity of warm water to form the equivalent bulk of a complete ration of skim-milk. In addition, the calves received the same meal mixture and clover or alfalfa hay.

This system gave good results and may be recommended for breeders who are not in a position to give a full ration of skim-milk. The calves reared on this ration made a gain of 45 pounds during the second month, 46 pounds during the third, 44 pounds during the fourth, 68 pounds during the fifth and 54 pounds during the sixth month. The average gain per head from birth to six months was 285 pounds and the average feed cost $18.29.

Without skim-milk.—In this system, whole milk was fed until the calves were five or six weeks old. From then until six months, the calves received a hot gruel prepared with a skim-milk calf meal containing 25 per cent protein. This gruel was prepared by adding eight to ten parts of hot water to one part of meal. The quantity given varied with the age and the weight of the calves, taking as a basis one pound of meal per day per 100 pounds of the animals' weight. Once the weight of 100 pounds was reached, the quantity of meal was increased by one-half pound per day for each additional 100 pounds until the calves reached the age of six months. The gruel was fed at a temperature of approximately 100 degrees F. The whole milk was replaced by gruel gradually. The calves received, in addition, the same meal mixture as mentioned in the three other systems, as well as clover or alfalfa hay.

This system gave good results and may be recommended to those who, for any reason, have no skim-milk available. The calves fed according to this plan made a gain of 40 pounds during the second month, 53 pounds during the third, 59 pounds during the fourth, 65 pounds during the fifth and 51 pounds during the sixth. The average gain per head from birth to six months was 290 pounds and the average cost of feed $24.91.

VALUE OF ROOTS AS A SUBSTITUTE FOR PART OF THE MEAL RATION FOR MILCH COWS

An experiment with the object of ascertaining the value of swedes and beets as a substitute for part of the meal ration of milch cows was carried on for six successive years. The swedes and the beets were fed at the rate of four pounds per 100 pounds of live weight per day, and they were used to replace 40 to 50 per cent of the ordinary meal ration and a small quantity of hay.

The data collected during this experiment show that a ton of swedes replaced 214 pounds of mixed meal and 193 pounds of hay, which were valued at $32.88 and $6.60 per ton, respectively. Therefore, the value of swedes was $4.16 per ton, and if it is considered that the cost of production of swedes on the farm during this six-year period was $3.06, a net profit of $1.10 per ton was made. In this experiment, one ton of beets replaced 202 pounds of mixed meal and 155 pounds of hay, which at the foregoing prices gives beets a value of $3.82 per ton. The cost of production of the beets was $2.88, and the net profit 94 cents per ton.

This shows clearly the value of swedes and beets in the ration of milch cows. Hence, farmers would be well advised to give more attention to these crops and those who can grow roots without hiring additional help may figure that swedes will have a net return value of nearly $4.16 per ton and beets $3.82.

ROOTS VS. SILAGE FOR MILCH COWS

An experiment was carried on during five years in order to compare the value of roots, mixed corn and sunflower silage as succulent feeds for milch cows. In this experiment, silage and roots were not given as substitutes for part of the meal ration as in the previous experiment, but both were fed at the rate of four pounds per 100 pounds of live weight per day. When cows received silage as succulent feed, milk cost 99 cents per 100 pounds and butterfat 20·3 cents per pound; when they received roots instead of silage, the rest of the ration remaining unchanged, milk cost 97 cents per hundred pounds and butterfat 19 cents per pound. This means that in this district, roots are practically equal to silage for the production of milk. However, in cases where home labour is inadequate and where the herd is sufficiently large to warrant the erection of a silo and the purchase of ensiling machines, it might be more profitable to grow a mixture of sunflowers and corn for silage purposes.

HOME-GROWN GRAINS SUPPLEMENTED BY PEAS AND LINSEED OILCAKE FOR MILCH COWS

In an experiment carried on during the winter of 1934, the following meal mixtures were compared as to their feeding value for milch cows:—

300 pounds ground barley	300 pounds ground barley
400 pounds ground oats	400 pounds ground oats
300 pounds 32 per cent protein supplement, including minerals	150 pounds pea meal
	220 pounds linseed oilcake
	6 pounds salt
	5 pounds bone char
	5 pounds ground limestone

These two meal mixtures are identical in regard to the non-nitrogenous part, which is composed of home-grown grains, barley and oats. The nitrogenous portion differs only in the mixtures, the percentage of total crude protein being 18 per cent in each case. In one mixture, nitrogen is supplied by a 32 per cent protein supplement purchased in the trade; in the other, it is supplied by peas grown on the farm and by linseed oil meal. Aside from this difference, the rest of the ration was identical in both cases, namely one pound of meal per 3½ pounds milk produced, 1½ pounds mixed clover and alfalfa hay per 100 pounds of live weight per day and 4 pounds roots per 100 pounds of weight.

When the cows received a meal ration supplemented by peas and linseed oilcake, the quantity of milk and butterfat produced during a given period was practically as high as when they received a meal ration supplemented by a commercial protein supplement. For example in a 14-day period, eight cows produced only 23 pounds more milk and ·9 pound more butterfat when receiving the commercial supplement than when receiving the home mixed one. Further, with the pea and linseed oilcake ration, the cost of production per 100 pounds of milk was 2·7 cents lower and the profits over feed cost 2·4 cents higher per 100 pounds of milk.

As a result of this experiment, it may be said that home-grown peas may profitably replace in part, at least, materials such as linseed oilcake or commercial protein supplement. For this purpose, peas may be grown alone or mixed with oats or even wheat. However, it is recommended that the proportion of peas in the meal mixture should not exceed 15 to 18 per cent; a larger proportion of peas would be detrimental to the palatability of the meal mixture, and the cows may even refuse to eat it.

HOME-GROWN GRAINS BALANCED WITH A PROTEIN SUPPLEMENT VS. HOME-GROWN GRAINS BALANCED WITH BRAN AND LINSEED OILCAKE FOR MILCH COWS

In another experiment carried on during the winter of 1935, the feed value of the following meal mixtures for milch cows was compared:—

500 pounds ground oats	500 pounds ground oats
200 pounds ground barley	200 pounds ground barley
300 pounds 32 per cent protein supplement, including minerals	300 pounds bran
	276 pounds linseed oilcake
	8 pounds salt
	6 pounds bone char
	6 pounds ground limestone

These two meal mixtures are also identical in regard to the non-nitrogenous part, which is composed of home-grown barley and oats. As in the previous experiment, the nitrogenous portion only differs, the percentage of total crude protein remaining at 18 per cent. In one mixture, nitrogen is supplied by a 32 per cent commercial protein supplement and in the other it is supplied by bran and by linseed oilmeal. The remainder of the ration was identical in both cases. The cows received one pound of meal per 3 pounds milk produced, 1½ to 2 pounds clover and alfalfa hay per 100 pounds live weight per day and 4½ pounds beets per 100 pounds live weight.

In this experiment, five cows which received protein supplement in the grain ration gave only 70 pounds more milk than those receiving a meal ration balanced with bran and linseed oilmeal during a 14-day period. The percentage of fat in the milk was identical in both cases, namely, 4·08 per cent. The meal ration containing commercial supplement cost $1.50 per 100 pounds compared with $1.35 for the ration containing bran and linseed oilmeal. The supplement and the linseed oilmeal were charged at the then market prices, $2.35 and $1.90 per hundred pounds, respectively.

In this experiment, when the meal was balanced with supplement, the cost of production of 100 pounds of milk was 81 cents and when it was balanced with bran and linseed oilmeal, the cost of production of 100 pounds of milk was 79 cents.

While the commercial supplement did not prove quite as economical as linseed oilmeal in this experiment, it is worthy of recommendation to the farmer, since it supplies a ready means of balancing home-grown grains; in addition, the supplement includes also minerals.

HOME-GROWN GRAINS BALANCED WITH A PROTEIN SUPPLEMENT ONLY VS. HOME-GROWN GRAINS BALANCED WITH A PROTEIN SUPPLEMENT AND BRAN FOR MILCH COWS

According to casual observations, it was thought that the protein supplement used to balance home-grown grains in the ration for milch cows gave better results when a quantity of bran was added to the meal mixture. In order to ascertain definitely whether this was the case, an experiment was carried on during the winter of 1935-36. In this experiment, the feeding value for milch cows of the two following meal mixtures was compared:—

1. *Balanced with supplement only*	2. *Balanced with supplement and bran*
450 pounds ground oats	450 pounds ground oats
150 pounds ground barley	150 pounds ground barley
100 pounds 32 per cent protein supplement	100 pounds 32 per cent protein supplement
	200 pounds bran

These two mixtures were identical in regard to the non-nitrogenous part. The nitrogenous part only differs, the total percentage of crude protein being practically similar, namely, 15 per cent. In one mixture, the nitrogen was supplied by a 32 per cent protein supplement purchased in the trade; in the other, it was supplied by a 32 per cent protein supplement and bran. The rest of the ration was identical in both cases, and was as follows: one pound of meal per 3 pounds of milk produced, approximately 1½ pounds mixed clover and alfalfa hay and 4½ pounds of roots per 100 pounds live weight per day.

When the cows received meal balanced with protein supplement alone, they gave 1,780 pounds of milk containing 4·39 per cent butterfat or 78·05 pounds of fat. When they received the meal mixture balanced with supplement and bran, the same cows gave during a like period 1,786 pounds of milk testing 4·53 per cent or 80·84 pounds of fat. When the cows received a meal mixture balance with supplement alone, the cost of production of milk was *85 cents* per hundred pounds, and the cost of production of fat *21·2 cents;* when they received a meal mixture balanced with protein supplement and bran, the cost of production of milk was *77 cents* per 100 pounds and that of fat *19·2 cents* per pound. Therefore, the meal ration balanced with supplement and bran was more profitable than meal balanced with supplement alone; the butterfat yield was slightly higher and the cost of milk and butterfat production was substantially lower. A meal mixture composed of 450 pounds of ground oats, 150 pounds of ground barley, 200 pounds of bran and 100 pounds of 32 per cent protein supplement would be a practical, economical and efficient ration for milch cows. This ration was adopted some years ago on this farm, and it has given very good results.

TEST OF VARIOUS LITTER MATERIALS

During the winter of 1934, an experiment was carried on in order to ascertain the comparative value of sawdust, peat, chopped straw, whole straw and granulated superphosphate, used as litter and as liquid manure absorbents. These litter materials were tested under tied-up cows and in stalls.

In this experiment, dry sawdust and dry peat were more satisfactory than straw for absorbing liquid manure. While chopped straw proved no more absorbent than whole straw, it produced a manure which was easier to handle and to spread. Granulated superphosphate used alone in the gutter does not constitute an adequate absorbent. It should be used with a liberal quantity of straw, sawdust or peat in order to absorb all the liquid manure in which superphosphate is dissolved.

The most satisfactory litter in regard to the absorption of liquid manure, the cleanliness of animals and economy was that composed of whole straw and sawdust. Whole straw combined with peat was just as satisfactory as straw

and sawdust, but in many cases peat is too costly to use as litter. It is to be recommended, however, to those who have some on their farms or who are in a position to procure it at low cost. In the absence of sawdust and peat, straw alone constitutes a good litter and a good liquid manure absorbent, but at least five pounds per head per day must be used in order to absorb all the liquid manure and keep the animals clean.

WINTERING HEIFERS IN OPEN BARNS

During the winter of 1932-33, eight two-year-old heifers were wintered loose in a stable the doors of which were left open during the day and were closed at night. Thus, the animals were free to go outside during the day but they spent the night in the stable. Three other heifers were wintered tied up in an ordinary closed barn. A record was kept of the feed consumed, the gain or loss in weight, as well as of the total feed cost, for both groups, in order to determine the efficiency of both methods in regard to the development of the heifers and the cost of feed.

The heifers wintered in the open barn gained 45 pounds per head during the winter, compared with 39 pounds for those wintered inside. The feed cost per head for the period from November 14, 1932, to June 5, 1933, was $22.53 for the heifers wintered in the open barn and $20.17 for those wintered in the closed stable. The monthly gains were about the same in both cases. The heifers wintered in the open barn did not appear to have suffered from the cold; however, the winter of 1932-33 was rather mild. The experiment was repeated during the following winter, which was colder, and the results were similar.

TWO VS. THREE MILKINGS PER DAY

An experiment was undertaken to determine the comparative value of milking two and three times daily. Six cows (group A) in their second lactation period—three in 1931 and three in 1932—were milked three times per day during an average of 165 days from calving. Their milk and butterfat production was compared with that of six other cows (group B) of the same age, of the same milk-producing ability, fed in the same manner, but which were milked twice per day. The average milk production of groups A and B in the first lactation period was 7,518 pounds of milk testing 4·41 per cent or 331·3 pounds of butterfat and 7,633 pounds of milk testing 4·57 per cent or 349 pounds of butterfat respectively.

Over a 165-day lactation period, the cows milked three times per day gave 6,592·6 pounds of milk testing 4·1 per cent fat, or 268·71 pounds of fat, compared with 5,351·6 pounds milk testing 4·41 per cent or 235·98 pounds of fat for the cows milked twice a day during the same period, a difference of 1,211 pounds of milk and 32·73 pounds of fat in favour of the group milked three times per day. In the case of heavy producers, cows which give 50 pounds per day or over, it is advisable to milk three times per day for a time; but, in the light of the results obtained in this experiment, it may be said that for cows which give an ordinary production, three milkings per day would be profitable only under exceptional circumstances.

SWINE

As pig breeding is the complement of dairying which in turn is the major industry in this district, a herd of Yorkhire swine has been maintained for several years on this station, in order to distribute good stock and to carry on experiments on feeding methods.

For several years crosses have been made with Yorkshire boars imported from Scotland and Sweden. An average of 26 boars and 57 sows, all registered and from parents qualified in the Advanced Registry, have been sold annually for breeding purposes throughout the province.

Each year, from 50 to 60 pigs are used for feeding tests. In the last five years, the average number of pigs farrowed per litter was 13·04, and the average number weaned 8·2.

ADVANCED REGISTRY FOR SWINE

Since the establishment of this system of swine registration by the Dominion Live Stock Branch, this station has co-operated in the improvement of the Yorkshire breed. An average of five litters per year has been fed for the slaughter test, enabling the determination of the best strains of sows. The Blanche and Alerte strains have already five and three generations respectively of sows that have qualified in the Advanced Registry.

To date, the average official records for the 24 sows which qualified are as follows: 48·2 points for production (5 points per pig weaned), 110·7 points for the maturity index (100 points being equal to a 200-pound pig in 200 days), and 82·2 points for slaughter test (minimum requirement to qualify 75 points).

In 1935, "Ste. Anne Alexandra"—162952—which had the highest score under the Advanced Registry policy on pigs fed by the breeder, weaned 15 pigs and thus obtained 75 points, which is a Canadian record under the Advanced Registry policy.

MAINTENANCE COST OF BROOD SOWS

In order to ascertain whether pig breeding is profitable, it is necessary to determine the annual maintenance cost of sows. In the last five years, the average annual consumption of feed for 15·3 sows was as follows: 2,394 pounds meal, 1,210 pounds skim-milk, 315 pounds hay and 374 pounds roots. In addition, the sows were on pasture for five months. The average annual cost of maintenance was $34.63.

COST OF RAISING YOUNG PIGS

In sections where few pigs are raised, or in the vicinity of towns, most pigs are sold at weaning time. In order to assist swine breeders in determining the selling price, the cost of a young pig, based upon the annual maintenance cost of the sow and the additional feed cost of the young pigs until eight weeks of age, was established. With an annual average of 15·3 sows, the average cost of a young pig was $2.12 when the dam farrowed two litters, and $4.25 when only one litter was farrowed.

On the other hand, when the feed cost of the sow and the young pigs from birth to weaning time only was considered, the cost was only $1.02 with 15·3 sows giving an average of 1·39 litters per year.

COST OF MAINTENANCE OF A BOAR

The general practice followed in the district is for a club member to keep the boar for which he receives a compensation; thus, it is necessary to ascertain the expenses incurred by the caretaker for the maintenance of this animal. Further, this information is useful in the analysis of the operating costs of a piggery. The average annual maintenance cost of 11 boars kept on this station during the last five years was $37.65. The annual feed consumption was as follows: 2,055 pounds meal, 470 pounds whole oats, 301 pounds hay, and six months' pasture.

COMPARATIVE FEEDING TESTS

The rapid and economical fattening of bacon hogs constitutes a very important and complicated problem. Indeed, our farms are not properly organized to produce pigs with home-grown feeds only and commercial protein

supplemental feeds must be resorted to. A number of experiments have been carried on to determine an economical and profitable system of using these feeds in combination with home-grown ones.

A record was kept of the cost of these rations, their growth-promoting ability, and value for finishing bacon hogs. Slaughter tests were carried on for this purpose.

For two consecutive years, this station co-operated with the Feed Committee of the Advanced Registry Board, and six lots of five pigs each were fed with standard rations from weaning time until they reached the market weight, or 210 pounds.

The following deductions may be made from the analysis of the experimental data:

1. The lot receiving a ration in which barley predominated, with a protein supplement including alfalfa meal, consumed 321·3 pounds of meal at a cost of $4.84 per 100 pounds gain, and obtained 81 points at the slaughter test.

2. A second group receiving the same ration as above, but with a protein supplement which did not contain alfalfa meal, consumed 310·1 pounds of meal at a cost of $4.63 per 100 pounds gain. This lot obtained 87 points at the slaughter test.

3. A third group receiving a ration in which wheat predominated, with a protein supplement with alfalfa meal, consumed 352·4 pounds of meal at a cost of $5.49 per 100 pounds gain, and scored 73 points in the slaughter test.

4. The fourth group receiving the same ration as group 3 but without alfalfa meal in the supplement consumed 300 pounds at a cost of $4.67 per 100 pounds gain and scored 68 points in the slaughter test.

5. The fifth group, which received the same ration as the first, but which was self-fed the dry meal, consumed 393·4 pounds meal at a cost of $5.91 per 100 pounds gain, while scoring the same number of points in the slaughter test.

FEEDING VALUE OF CULL POTATOES

The use of cull potatoes in hog feeding is a common practice during the fall and winter months. In order to ascertain fully the value of this practice for fattening market hogs, experiments were carried on with three identical lots of pigs. The first lot received meal only; the second lot received a certain quantity of the same meal, but the rest was replaced by potatoes at the rate of two pounds of potatoes per pound of meal; the third lot received a certain quantity of meal, but the rest was replaced by potatoes at the rate of four pounds of potatoes per pound of meal.

The results obtained over a three-year period show that the first lot consumed 3·21 pounds of meal at a cost of 5·2 cents per pound of pork produced, that the second lot consumed 1·96 pounds of meal and 2·87 pounds of potatoes at a cost of 4·4 cents per pound of pork, and that the third group consumed 1·57 pounds meal and 4·22 pounds potatoes at a cost of 4·3 cents per pound of pork.

FEEDING VALUE OF SWEDES

For the reasons mentioned above, and to ascertain the proportion in which these roots could be economically fed to pigs, two identical lots of bacon hogs were used. These two lots received the same meal from weaning until they reached 210 pounds in weight. However, one lot received meal exclusively, while the other received half the quantity of meal fed the first lot and the balance was replaced by double this quantity of swedes.

The lot receiving meal alone consumed 3·14 pounds of meal per pound gain, at a cost of 5·4 cents, while the lot receiving part of the ration as swedes consumed 2·74 pounds meal and 1·11 pounds swedes per pound gain, at a cost of 5 cents.

HOME-GROWN VS. COMMERCIAL MEALS

In view of the ever increasing quantity of home-grown meals used, an experiment was carried on with a view to ascertaining if the latter may replace commercial meals from the standpoint of efficiency and economy.

Two identical lots of pigs were fed similarly, except that the feeds used were not the same from weaning until they were ready for marketing. Over a four-year period, the pigs receiving home-grown meals consumed an average of 308 pounds at a cost of $6.13 per 100 pounds gain, while those receiving commercial meals required 283 pounds at a cost of $5.71 per 100 pounds gain. However, when the pigs reached a marketing weight, those which received home-grown meal were in better condition as regards the frame. Home-grown meals, while of a coarse texture, were more suitable for the pigs, as commercial meals alone were too fine and doughy.

SHEEP

In view of the growing demand for wool to be used in the homes for the making of clothes, the breeding of long-wooled sheep is becoming increasingly important. For this reason, and because of the cold winters in this district, the Leicester breed was chosen for the station flock. Its popularity increases yearly, and the number of breeders of pure-bred Leicesters increases accordingly. Rough pastures which cover a large area in this section offer possibilities for economical sheep breeding after they have been improved.

The flock kept on the station has been maintained and improved by the adoption of good breeding principles and by the introduction of high quality animals imported from Scotland. Superior strains were developed, and in the last five years, an average of ten male lambs and five ewe lambs were sold for breeding purposes. Ninety per cent of the breeding lambs sold each year were graded " choice." The average weight of the fleeces of adults was nine pounds, and the long wool was graded " choice quality." In the last five years, the average number of lambs weaned per ewe was 1·5 for 23 ewes. Experiments on feeding methods and on rearing costs of various classes of sheep, have been carried on with this flock since the establishment of the station. The results for the last five years are given for the chief projects only.

COST OF MAINTENANCE OF FLOCK

In order to ascertain the profits which might be made with sheep breeding when modern methods are followed, and to determine the selling and purchase prices of animals, a record was kept of the maintenance cost of the flock for several years. Taking account of all feed, shelter and handling costs, the average maintenance cost of 35·4 adult ewes was $5.64 per head.

COST OF RAISING LAMBS

Because of the need for information on the cost of raising lambs, experiments were undertaken to determine this. For the last five years, the cost of raising a five-month-old market lamb was $3.40 and the cost of an eight-month-old lamb was $3.93. These figures are based upon the annual maintenance cost of the dam and of the young on pasture.

LAMBING AT ONE VS. TWO YEARS OF AGE

The relative merits of first lambing ewes at one or at two years of age arouses numerous discussions among breeders. Some claim that the results with lambs from one-year-old ewes are not as satisfactory and that the development of the ewes themselves suffers. Others claim that lambing at two years of age is costly and unnecessary in this district. An experiment carried on to study this matter gave some very interesting results.

The data recorded in the last three years show that the ewes lambing at one year of age raised 75·5 per cent of their progeny, 48 per cent of which was suitable for breeding purposes, and 50 per cent of the lambs were twins. The price obtained for lambs was $6.25 and the average weight of adult ewes was 156 pounds. The ewes which lambed at two years of age raised 84·9 per cent of their progeny, 83·4 per cent of which was suitable for breeding purposes and 71·4 per cent twins. The average selling price of the lambs was $10.77, and the ewes weighed 165·7 pounds at three years of age.

EARLY VS. LATE LAMBING

While late lambing is a serious disadvantage when the time for official grading comes, too early lambing presents some problems here because of the cold winter and spring. In order to secure information on this matter, an experiment was carried on.

Over a three-year period, the lambs born prior to March 15, and weighing an average of 9·2 pounds at birth, weighed 45·6 pounds when they were turned out on pastures in the spring; 79·9 pounds in mid-summer and 102·3 pounds at grading time. Only one lamb died while on pasture. The percentage of progeny found to be suitable for breeding purposes was 76·8 per cent, and the average value of the animals sold for meat and breeding purposes was $11.31.

On the other hand, those which were born following March 15 weighed an average of 9·2 pounds at birth, 31·9 pounds when turned out on pasture, 70·6 pounds in mid-summer and 92·8 pounds at grading time. Four died while on pasture, 61·6 per cent were suitable for breeding purposes, and the average value of the animals sold for breeding purposes and for meat was $10.13.

HORSES

During the past 20 years, the experimental station at Ste. Anne de la Pocatière has specialized in the breeding of Percheron horses in order to develop and improve this breed in the district. The objective was high quality and in order to attain this end, superior male and female breeding animals were imported and the best breeding, feeding and housing practices were followed. These efforts were not in vain, since the station has to-day one of the best groups of Percheron horses in Eastern Canada, some of the animals raised on this station comparing favourably with the best animals imported from France or the United States.

In addition to promoting the breeding of Percheron horses on the station and in the district, some research work was carried on in this field. The chief experiments dealt with the cost of rearing foals, the feed cost of draft horses used for farm operations, the cost of horse labour, the feed cost of a breeding stallion and the wintering of foals and brood mares in the open.

WINTERING FOALS AND BROOD MARES IN THE OPEN

In the last 11 years, 33 Percheron foals bred on this station were wintered in paddocks, in the open where they had access to open shelters built especially for this purpose. Generally, the foals were born in May or June and

spent their first winter in the stable; however, they spent half the day outside. In the second and third winters, they did not enter the stable at all and spent the whole winter in open shelters of inexpensive construction.

These shelters are single boarded and on the southern wall there is an opening the size of an ordinary door. The upper part is used for the storing of hay and grain. The manure in these shelters is removed only once or twice per month.

Generally, the wintering ration included one pound of clover hay and three-quarters to one pound of grain daily per 100 pounds of weight. The grain mixture fed included four parts by weight of whole or cracked oats, one part of bran and one per cent of mineral matter. The foals did not receive any water after snow covered the ground.

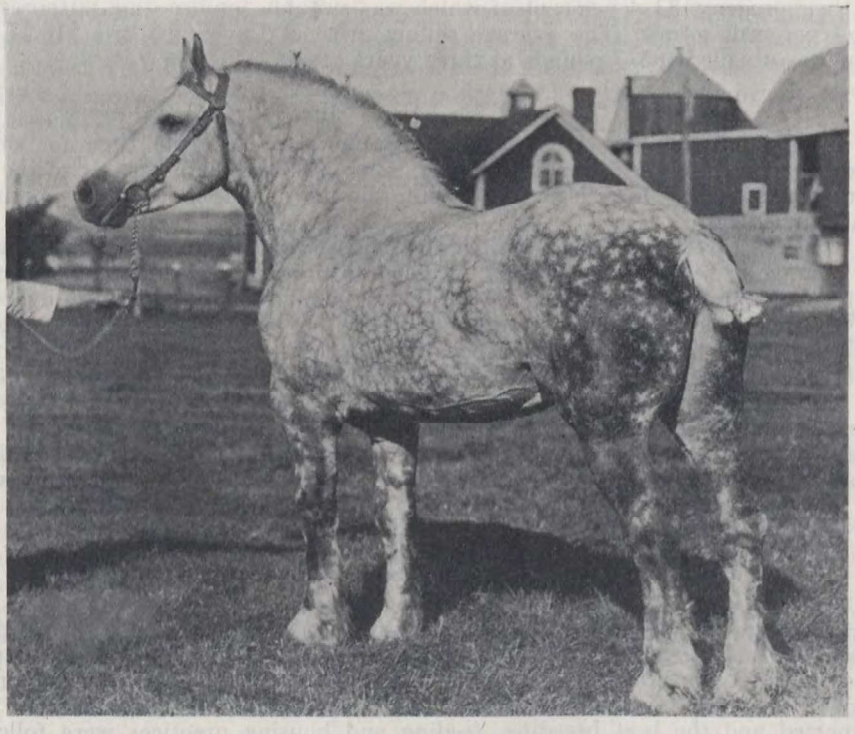

FIG. 4.—Chacal—12951—(165185), Percheron stallion imported from France and used for breeding purposes at the Ste. Anne Station from 1928 to 1931.

This method of wintering foals in the open seems to be very beneficial for the health, strength and quality of the limbs and the normal growth of horses, in addition to effecting considerable saving in labour and shelter cost. Apparently, the animals did not consume any more feed than if they had been wintered in the stable, and did not seem to suffer from the cold. This is explained by the fact that food is better assimilated when the animals breathe pure air and can take plenty of exercise. It is well known also that horses wintered in the open develop a thick coat which protects them against cold.

In the last four years, eight brood mares foaling at the end of April or later were wintered in the open in the same manner as the foals, and the results were very satisfactory. The foals from these mares were born under normal conditions and were very strong and are still making a good development.

These mares received exactly the same ration as the foals wintered in the open; they received each day approximately one pound of hay and two-thirds of a pound of grain per 100 pounds of weight. In addition, they received a teaspoonful of potassium iodide every two weeks.

FEEDING OF FOALS

As this station has been carrying on horse breeding operations on a rather large scale for several years, it might be advisable, in the interests of the readers, to explain the feeding system followed for foals from birth until they are broken in, and to give some of the results in support of the merits of this system.

Nursing period.—During the nursing period, which generally coincides with the pasturing season, the dams are always turned out with their foals, on good limed and fertilized pastures where there is an abundance of clover, but they are not given any grain. At the beginning of August, when permanent pastures have become depleted, they are transferred to good clover aftermath. In this manner, the dams are kept in a good fleshy condition, and the foals make rapid growth until weaning which generally takes place at five months of age.

From weaning to breaking in.—From weaning to breaking, apart from the pasturing season, the foals are almost always placed under the same feeding system; that is they receive clover or alfalfa hay and a grain mixture. The grain mixture fed includes four parts crushed oats, one part bran and one per cent mineral matter. The mineral mixture is composed of two parts finely ground limestone, two parts charcoal, two parts bone char, two parts salt and one-half part of sulphur. However, during the last year, a commercial mineral mixture has been used. In addition, a lump of iodized salt is always available whether the horses are on pasture or in the stable.

From weaning until they reach 1,200 pounds, the foals receive daily about one pound hay and one pound meal per 100 pounds weight. After they have reached 1,200 pounds, the amount of hay is increased to one and a quarter pounds per day per 100 pounds weight; on the other hand, the meal ration remains stationary at 12 pounds per head per day until they are broken in, at approximately two and a half years of age.

During the summer, from the end of May until the end of October, the animals are kept continuously on good permanent pastures, which have been limed and fertilized, but they do not receive any grain ration.

Efficiency of this feeding system.—In order that the reader may judge the value of this plan of feeding, the weights and heights at various ages of all foals reared under this system in the last five years are given in the following table:

GROWTH RECORD OF FOALS RAISED AT STE. ANNE

Age	Weight	Height
	pounds	hands
At birth	154	.....
At six months	773	13¼
At one year	1,031	14¼
At two years	1,490	15¼
At two years and one-half	1,612	.....

FEED COST OF FOALS FROM BIRTH TO ONE YEAR

For the past four years, a record was kept of all the data necessary to establish the feed cost of foals until one year of age, and the feed cost of the dam during the nursing period. A record was kept also during these four years of the maintenance cost and the number of hours worked by brood mares from the date of birth of their foals until the latter reached one year of age, in order to determine whether the feed consumed during the pregnancy and nursing periods is covered by the number of hours of labour.

Over a four-year period, the average feed consumption of 23 brood mares during the nursing period was as follows: 638 pounds hay, 563 pounds oats, 199 pounds bran, and in addition they were 100 days on pasture. The feed cost amounted to $28.80.

During the nursing and pregnancy period, that is during the 12 months following foaling, they consumed per head 3,663 pounds hay, 3,710 pounds oats, 667 pounds bran and were on pastures for 108 days. The total feed cost was $78.62. During this period, the mares worked 947 hours, which, at the standard rate of eight cents per hour, totals $75.76. This amount covers practically the whole feed cost, although the mares have not worked to their full capacity.

From birth to one year of age, the foals consumed per head an average of 1,672 pounds of hay, 1,247 pounds oats, 342 pounds bran and were 13 days on pasture. The feed was valued at $26.92 per head. At six months of age the average weight of the foals was 773 pounds and they measured 13¼ hands at the withers; at one year they weighed 1,031 pounds and measured 14¾ hands.

FEED COST OF FOALS FROM WEANING UNTIL 2½ YEARS OF AGE

In the last 11 years, a record was kept of all feed consumed from weaning until the animals reached two and a half years of age, by most of the foals being reared and kept until breaking in, in order to determine the feed cost. From weaning until two and a half years of age, the average feed consumption of 33 foals was 4,967 pounds hay, 3,525 pounds oats, 855 pounds bran, and in addition, 264 days on pasture.

The total cost of feed per head amounted to $106.20 for foals whose average weight at the age of two and a half years was 1,563 pounds. The bran and oats consumed were charged at the market price, while hay and pastures were charged at the cost price on the farm.

These figures are given in order to show farmers that they can rear horses of better quality and at a lower cost than those which they could purchase on the market.

FEEDING BROOD MARES IN THE STABLE

The brood mares which are wintered in the stable must take exercise daily, and for this purpose they are used for farm operations. Care is taken, however, not to expose them to bad weather and to dangers of abortion. They are given laxative and easily digested feeds.

Before foaling.—They receive approximately one pound of clover hay and two-thirds pound of grain per 100 pounds weight, divided into three feeds daily. The grain mixture used is composed of four parts by weight of whole oats and one part of bran. In addition, two pounds of carrots and a handful of whole linseed or a tablespoonful of molasses are given daily per head. Every two weeks, a teaspoonful of potassium iodide is given. During the two or three months prior to foaling, care must be taken that the ration of hay is not too heavy. Two weeks before foaling, a grain mixture composed of two-thirds whole oats and one-third bran is given, and the quantity fed is cut down daily.

After foaling.—The brood mares still receive clover hay and the same grain mixture as fed during the two weeks previous to foaling, but the quantity fed is increased gradually in order that they may have a plentiful supply of milk without losing weight. In addition, they also receive, as prior to foaling, carrots, linseed or molasses. After foaling, the potassium iodide is discontinued. When the weather permits, the dams and their foals are allowed to take exercise daily to properly develop the foals and keep their legs in good condition.

FIG. 5.—A group of Percheron brood mares bred on the Experimental Station at Ste. Anne.

FEED COST OF A BREEDING STALLION

Over a four-year period, a record was kept of the feed consumed by an adult Percheron stallion, in order to ascertain the yearly maintenance cost.

The information obtained to date shows that the stallion consumed yearly 5,340 pounds hay, 4,608 pounds oats, 604 pounds bran and that the feed cost amounted to $83.93.

FEEDING OF HORSES AND COST OF HORSE LABOUR

During the last 14 years, on this station, a record has been kept of the feed consumed and the number of hours of horse labour worked by all horses regularly employed for the farm operations, in order to establish the cost of horse labour with the Percheron breed. As this work has already covered a reasonably long period, it is felt that the data collected to date should be published and the feeding system followed with these horses during this period described.

Feeding system followed.—The horses regularly employed in the farm operations generally receive each day three-quarters to one pound whole oats and a similar quantity of timothy hay per 100 pounds of weight. During the first ten years of this experiment, approximately two pounds of bran were added to the daily ration of each horse, but in the last three years, this practice was discontinued because bran had a tendency to render horses too soft for heavy work. However, since this change, the grain ration given on Saturday night has been entirely replaced by three pounds of bran to which is added a tablespoonful

of sulphur and a similar quantity of Glauber's salts or saltpetre. The salts are dissolved in hot water and the latter used to dampen the bran and sulphur which had previously been dry mixed.

Thus, the bran, sulphur and salts are given on Saturday nights in order to prevent azoturia, commonly known as paralysis or Monday morning's disease. During the 24 hours following this treatment, horses must be protected from bad weather and must not be subjected to work which might cause them to become overheated. In summer, as an added precaution against this disease, instead of giving the above-mentioned mixture of bran and drugs to the horses, the latter are turned out on pasture on Saturday night and brought back to the stable on Sunday evening only.

In addition to the feeds already mentioned, the horses received daily either one-half cup of molasses or a handful of whole linseed given in the evening with the oats. Generally, the molasses and linseed were given alternately at weekly intervals. Further, a block of rock salt was available at all times in the feed trough of each horse.

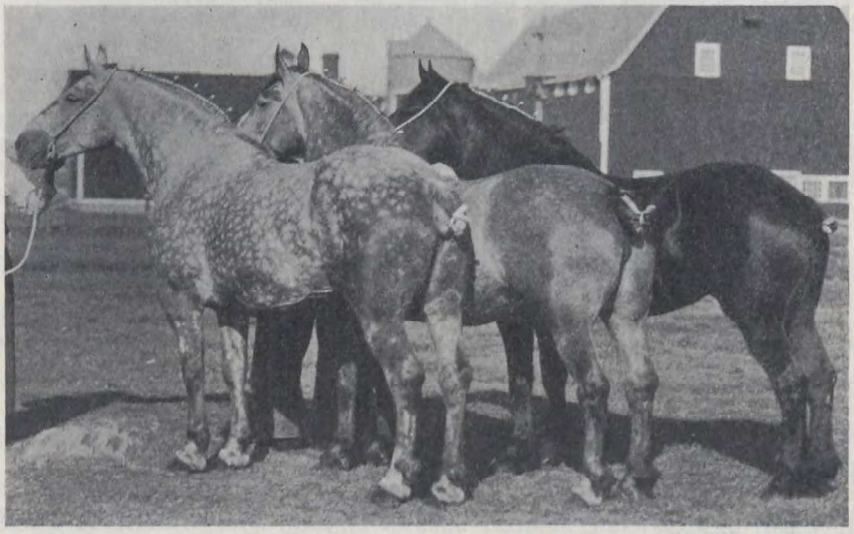

FIG. 6.—Three Percheron fillies sired by Chacal and bred at the Experimental Station, Ste. Anne.

COST OF HORSE LABOUR

In this experiment, which has been carried on for 14 years, the results are based on a yearly average of eight horses. These horses received the above-mentioned ration and were regularly used for the operations of the farm. From a summary of the data collected during this period on the feed consumed and the number of hours of horse labour, it is seen that a Percheron horse weighing an average of 1,665 pounds and used for heavy work throughout the year, consumed 4,960 pounds hay, 5,152 pounds oats and 625 pounds bran, and gave 1,947 hours of labour yearly.

The oats and the bran were charged at the market price, while hay was charged at the cost price on the farm. Since the beginning of this experiment, the average annual cost of feed has been $113.91 per horse, and the cost of horse labour 5·8 cents per hour. It must be borne in mind, however, that these figures cover only the feed cost. Manual labour, rent of buildings, interest on investment, and other similar charges are not included.

In the light of this information, without giving any details regarding the nature of the work accomplished, it is obvious that when a Percheron horse is used at its full capacity, its services are economical. However, in order to realize the accuracy of this statement, a comparison should be made between the amount of work done by a horse of that weight during one hour and the 5·8 cents which it costs. To illustrate this, it should be stated that numerous operations, such as disking with a double harrow, mowing with a six-foot knife, deep ploughing on clay land, etc., were done with two horses only, while three lighter horses would have been required to do the same work as efficiently.

POULTRY

The progress made in breeding and management of poultry in recent years at this station has had a stimulating effect upon the improvement of poultry-keeping not only in the immediate district but also in a few other particular districts of this province, which have been supplied with pedigree stock from this station. In addition to the supervision of the Eastern Quebec Egg Laying Contest, the station has maintained a flock averaging yearly 260 birds in order to furnish good breeding stock to progressive farmers or poultry-keepers and to carry on a few experimental projects on feeding and breeding practices.

Ever since 1921, all birds have been trap-nested and only the best families of layers are used for breeding purposes. The males used for the matings are selected amongst those having good records as to their ancestry and progeny, the latter point being judged on the performance of their daughters through the progeny test.

Influence of Pedigree Breeding on Production

In order to measure this factor, all hens are trap-nested and only the best families are retained for breeding purposes. They are mated with males whose dams and grand dams had a good laying record and where the information is available, whose progeny have produced well enough to indicate the sire to be capable of impressing his good qualities on his progeny.

As a result of this pedigree breeding and of improvement in feeding and management, the average production of the 15 highest birds which was 124 eggs in 1923, increased to 261 eggs for the last five years.

Furthermore, the effect of progeny test and selection was evident over the whole flock, since the average individual production of pullets during the last five years was 208 eggs.

Cost of Feed in Producing Eggs

The object of this experiment is to determine the monthly feed cost of egg production so as to establish the profit or loss which may be realized at the different seasons of the year. Records were kept of the feeds consumed as well as the eggs produced by 12 hens for 28-day periods. During the last five years the average production was 201 eggs, while the feed cost was $1.76 and the cost per dozen of eggs 10·5 cents. The profit over cost of feed amounted to $2.33 per bird.

Best Incubation Date

In order to determine whether hatching gives as good results in March and in April as in May, experiments have been conducted where the percentages of fertility, hatchability and survival of chicks at three weeks were recorded.

Out of a total of 7,448 eggs hatched in March, in seven settings at various intervals, the percentage of fertility was 78 per cent, fertile eggs hatched 65 per

cent and chicks alive at three weeks 93 per cent. In April, out of 12,229 eggs incubated in the same number of settings, the percentages were 76 per cent for fertility, 60 per cent for fertile eggs hatched and 90 per cent for chicks alive at three weeks. In May, out of 4,491 eggs incubated, in six settings at various intervals, the corresponding percentages were 90 per cent for fertility, 54 per cent for fertile eggs hatched and 89 per cent for chicks alive at three weeks.

Cost of Hatching Chicks

In order to determine the incubation cost of a day-old chick, records were kept of the market price of eggs, interest on the amount invested in the incubator, depreciation of machinery and cost of fuel. The machine used was a 1,440-egg Jamesway incubator.

With a yearly average of 2,330 eggs set in the incubator, 1,319 chicks were hatched at the total cost of $123.13. Therefore, the mean cost of hatching a day-old chick was nine cents.

Comparison of Eggs from Hens and Pullets for Hatching

In order to obtain some information on the breeding qualities of these two classes of poultry, an experiment was conducted over a six-year period with a large number of eggs from hens and from pullets to test their respective value as to fertility and hatchability.

With 7,087 eggs from hens divided into six incubation periods, the percentage for fertility was 79 per cent and 63 per cent for fertile eggs hatched. With 12,901 eggs from pullets divided also into six different incubation periods, the respective percentages were 75 and 55 per cent.

Comparison of Pullets vs. Hens for Egg Production

Since a large number of poultry breeders as well as ordinary farmers persist so strongly in retaining old hens for laying purposes, an experiment was carried on to show their comparative inferiority to pullets.

The mean production of the ten best birds for four consecutive years was 242 eggs during their first laying season and 141 during the second.

Barley vs. Corn in Developing Chicks to Six Months

An experiment was conducted on two groups of chicks from birth to six months of age with elaborate and well balanced rations but where the basal grain used was changed with corn in one case and an equivalent amount of barley in the other.

Chicks in both lots were weighed weekly and records were made of feeds consumed and fuel used every week for each lot. The average cost over four years was 47 cents per chick in both lots, when based upon 41 birds in each separate lot. The mean individual gains in weight were 4·94 pounds for the pullets receiving a corn ration and 4·81 for those receiving a barley ration.

Barley vs. Corn in Producing Eggs

Since barley may be grown at home in this district, while corn has to be purchased commercially, the object of this experiment was to ascertain whether barley may profitably take the place of corn in the meal ration. For this purpose, two lots of pullets were fed on a comparative basis, one receiving a meal mixture containing corn while the other received the meal mixture with an equivalent amount of barley substituted for the corn. Averaged for the three years, the total annual production of ten birds receiving corn ration was 2,082 eggs which cost $18.19 and had a commercial value of $42.13, giving a profit

over cost of feeds of $23.93. On the other hand the total annual production for ten birds which received a barley ration was 1,996 eggs at the cost of $16.69 while the commercial value was $40.42 and the profit over cost of feed $23.73.

The total cost of production of a dozen of eggs was 10·4 cents with the corn-fed lot and 10·0 cents with the barley-fed lot.

Home-Grown vs. Commercial Meal Mixtures

The object of this experiment was to ascertain whether the home-grown grains give as good results as commercial feeds. For this purpose two lots of 12 pullets of equal breeding value and development were selected. Records were kept of the number of eggs laid in each group and the quantity of feed consumed in order to compare the cost of eggs per dozen and the profit over cost of feed.

After a test of four years covering a period of six months each, the birds receiving the home-grown feeds gave an average production of 1,097 eggs valued at $23.90 against 1,057 eggs valued at $23.73 for the lot receiving commercial feeds.

The cost of a dozen of eggs was 11 cents and the profit over cost of feed $13.56 for the lot receiving home-grown meal mixture, while for the other lot fed with commercial meal the respective cost and profit were 14 cents per dozen and $11.26.

Source of Animal Protein

The object of this experiment is to compare various sources of animal protein such as horse meat, raw liver, commercial meat meal and skim-milk in the ration of birds. Four equal lots of pullets received the same grain and meal rations with the only difference that the animal protein was supplied from different sources.

Over a five-year test covering a six-month period each year, from November to April inclusive, the 12 birds receiving horse meat produced 1,211 eggs and gave a profit over cost of feeding of $24.78; those receiving skim-milk produced 1,192 eggs with a profit of $23.63; those with raw liver produced 1,173 eggs with a profit of $17.72 while the fourth lot with meat meal gave 1,144 eggs and $21.80 as profit.

Comparison of Green Feeds for Egg Production

The object of this experiment was to ascertain the value of beets, sprouted oats, clover and chopped alfalfa as green feeds for egg production. Three equal lots of pullets were fed in the same manner, except that one lot received beets, another sprouted oats and a third clover or alfalfa.

Over a five-year period, the best average results were given by the lot receiving alfalfa, followed by beets and sprouted oats. From November to April inclusive, the 12 birds receiving alfalfa produced 1,271 eggs, those receiving beets 1,166 and those receiving sprouted oats 1,144. The profit over cost of feeds amounted to $28.25 with alfalfa, $22.89 with beets and $20.44 with sprouted oats.

Eastern Quebec Egg Laying Contest

The Egg Laying Contest for Eastern Quebec has been in operation for 14 consecutive years. During this period the number of birds under test ranged annually from 100 to 200. In perusing the results, it is found that the average production which was 112 eggs per bird in 1923 had steadily increased to 201·0 eggs in 1935. In addition to the improvement brought about in production, the percentage of registered birds has also increased considerably, so much so that it was 39·2 per cent as an average for the last five years.

FIELD HUSBANDRY

Field husbandry is the most important line of work on this station, since it includes the production of all the crops used in the feeding of the various classes of live stock kept. The production of field crops is organized in order to fill as much as possible the needs of dairy cattle, horses, swine, sheep, and poultry. The field crops grown are timothy hay, clover hay, mixed clover and alfalfa hay, green fodder hay, corn and sunflowers for silage, swedes, mangels, horse carrots, potatoes, wheat, peas, barley, and oats; in addition, a certain area of the farm is used for permanent pastures during the summer. The area of the station comprises 360 acres of arable land, about half of which is a compact clay which is difficult to work but very fertile; the other half is sandy or gravelly and is very poor. These two types are fairly representative of the soils in this district.

The good yields obtained with most field crops on this station are due to soil drainage, good cultural practices, control of weeds, rotations and the rational use of farm manure and chemical fertilizers.

In addition to producing the necessary crops for feeding live stock, this stations is conducting numerous experiments with the various problems in field husbandry. The object of these experiments is to obtain from the land the maximum yield and to ascertain the crops which may be grown on a large scale in the district, taking into consideration the soil and climatic conditions. They deal chiefly with the cost of production of crops, rotations, soil drainage, control of weeds, improvement of pastures, and the value of farm manure and chemical fertilizers for various crops and various types of soils.

Yield and Cost of Producing Hay

In the last five years, the average yields per acre were 2·76 tons of clover with 72 per cent dry matter; 5·15 tons of mixed clover and alfalfa hay with 70 per cent dry matter; 3·02 tons of timothy with 73 per cent dry matter, and 2·77 tons of green fodder hay with 75 per cent dry matter. The cost of production per ton was $6.35 for clover, $5.30 for the mixed clover and alfalfa, $5.16 for timothy and $8.52 for the green fodder (oats and peas).

Over the last 12 years, the average yield per acre was 2·99 tons of clover, 4·59 tons of the mixed clover and alfalfa, 2·81 tons of timothy, and 3·15 tons of oats and pea hay. The cost of production per ton was as follows: $7.28 for clover, $5.42 for the clover and alfalfa mixture, $6.74 for timothy, and $9.25 for the green fodder hay.

The above high yields of clover and timothy were obtained on three-, four-, and five-year rotations, seeded with 20 pounds per acre of a mixture composed of 10 pounds timothy, 8 pounds red clover, and 2 pounds alsike clover.

The mixed clover and alfalfa hay which gave an exceptionally high yield and correspondingly low cost per ton, was produced on a four-year rotation including a hoed crop in the first year, cereals in the second, mixed clover and alfalfa hay in the third and almost pure alfalfa hay in the fourth. The seed mixture used included 8 pounds of timothy, 5 pounds of red clover, 2 pounds of alsike clover and 6 pounds of alfalfa per acre. The yield of hay was almost doubled by the addition of a few pounds of alfalfa to the ordinary grass mixture. This practice of adding a small quantity of alfalfa to the seed mixture should be followed by all farmers engaged in dairying, where the soil is well drained and not too deficient in lime.

While the cost of production of green fodder hay per ton is higher than that of the other crops, it is advisable to sow each year a few acres of a mixture of peas, vetches and oats, to be used as green feed. This crop offers many advantages for dairy farms; if pastures are inadequate, it may be cut

green and fed to the cows during the summer; if the supply of legume hay is inadequate for the winter, it may be cut for hay; if it is not needed for other purposes, it may be placed in the silo or cut for grain which will contain a high proportion of nitrogenous matter suitable for cows and swine.

Yield and Cost of Producing Hoed Crops

Over the past five years, the average yields of green matter per acre given by hoed crops were as follows: corn silage, 14·19 tons; sunflower silage, 17·22 tons; corn and sunflower mixture, 19·29 tons; swedes, 19·82 tons; mangels, 23·56 tons. The cost per ton of green matter was as follows: corn silage, $2.92, sunflower silage, $2.62, corn and sunflower mixture, $2.57, swedes, $2.98, mangels, $2.64. The percentages of dry matter were as follows: corn, 15·44, sunflowers, 15·95, corn and sunflower mixture, 14·46, swedes, 12·17, and mangels, 12·55. The yield of dry matter per acre, based upon the percentage of dry matter was as follows: corn, 2·19 tons, sunflowers, 2·75 tons, corn and sunflower mixture, 2·79 tons, swedes, 2·41 tons, and mangels, 2·92 tons. The cost of production per ton of dry matter was as follows: corn, $19.07, sunflowers, $16.35, corn and sunflower mixture,. $17.80, swedes, $24.54, and mangels, $21.04.

In the last 12 years, the average yields per acre were as follows: corn, 13·44 tons, sunflowers, 17·13 tons, corn and sunflower mixture, 16·51 tons, swedes, 19·75 tons, and mangels, 24·24 tons. The cost per ton of green matter was as follows: corn, $3.69, sunflowers, $3.03, corn and sunflower mixture, $3.16, swedes, $3.03, and mangels, $2.73. The dry matter content was as follows: corn, 15·40 per cent, sunflowers, 15·34 per cent, corn and sunflower mixture, 14·38 per cent, swedes, 11·17 per cent, and mangels 12·78 per cent. The yield of dry matter per acre ranged from 2·07 to 3·10 tons, as follows: corn, 2·07 tons, sunflowers, 2·67 tons, corn and sunflower mixture, 2·37 tons, swedes, 2·21 tons, and mangels 3·10 tons. The cost of production per ton of dry matter was as follows: corn, $23.57, sunflowers, $19.29, corn and sunflower mixture, $21.19, swedes, $26.67, and mangels, $21.19.

The choice of a hoed crop on dairy farms depends to a certain extent on the economic conditions on each farm. Thus on specialized dairy farms where the herd is large enough to justify the purchase of ensiling machinery and the construction of a silo, the corn and sunflower mixture may be as worthy of recommendation as roots. But on the average farms of the district where the number of cows is limited and where the growing of hoed crops does not involve any additional labour, roots are always more economical. Indeed, with roots, if no expenditures are incurred for labour, the cost of production per ton is always very low and may range from $1 to $1.25, provided that the yield per acre is satisfactory. The growing of sunflowers alone is not to be recommended because the silage is not very palatable for dairy cows; the growing of corn alone for silage is not recommended in this district either because the yield per acre is too low. However, corn growing might be profitable if the crop is fed green during September. Following several experiments conducted on this station with the dairy herd, it may be said that swedes, mangels, and corn and sunflower mixture appear to have practically the same feeding value for dairy cows.

Yield and Cost of Producing Grains

In the last five years, the average yield per acre of field grain crops was as follows: oats, 82 bushels, wheat, 36 bushels, barley, 45 bushels, and peas 45 bushels. The cost per bushel was as follows: oats, 37 cents, wheat, 83 cents, barley, 64 cents, and peas, 83 cents.

Average yields per acre for the past 12 years were as follows: oats, 77 bushels, wheat, 33 bushels, barley, 41 bushels, and peas 42 bushels. The cost per bushel was as follows: oats, 39 cents, wheat, 94 cents, barley, 73 cents, and peas, $1.02.

With oats the varieties used were Banner and Cartier. In the last five years, a field of 3·5 acres of Banner oats gave an average yield per acre of 85 bushels. This same field of Banner oats yielded 92 bushels per acre in 1933 and 97·5 bushels in 1934. A half acre field of Cartier oats yielded 73 bushels per acre in 1933 and 93 bushels in 1934. Cartier is a new early variety which ripens in 90 days on this station.

In the case of wheat, the varieties grown were Huron (spring wheat) and Kharkov (fall wheat). Reward, which is an early variety, yielded 25 bushels per acre as a five-year average. Kharkov fall wheat ripens generally around August 10, while Reward ripens 10 to 15 days earlier than Huron. The highest yields of wheat per acre obtained to date on this station are as follows: Huron, 44·5 bushels, Kharkov fall wheat 43 bushels, and Reward 31·5 bushels.

The varieties of barley grown were O.A.C. 21 and Mensury. Two years ago, the Mensury variety replaced the O.A.C. 21 entirely. On this station, the highest yields per acre obtained with barley were 52·5 bushels for the Mensury variety and 56·5 bushels for the O.A.C. 21. The average yield per acre over a nine-year period, of O.A.C. 21 was 41 bushels, and the average yield per acre over a three-year period of Mensury was 44 bushels. These two varieties ripen in exactly the same time as Cartier oats and may be sown in mixture with the latter. This practice is highly recommended, especially in districts where the growing season is short.

With peas, the varieties grown were Arthur and Mackay. However, during the past five years, the Arthur variety has completely replaced Mackay. On this station, the highest yields obtained per acre were 73 bushels for the Mackay variety and 68 bushels for Arthur. Over a nine-year period, the average yield per acre of Arthur peas was 43 bushels, and the average yield of the Mackay peas, over a five-year period, was 44 bushels. Arthur peas are quite suitable for soups, while Mackay peas are more suitable for feeding purposes and for green feed. According to the results obtained on this station, soup peas may be considered as a very profitable cash crop, and they should be grown on most farms.

Yield and Cost of Producing Potatoes

In the last four years, the average yield per acre was 381 bushels, the cost of production per acre $75.55, and the cost per bushel 19·6 cents. Disregarding the cost of labour, but taking into consideration all other expenses, the cost of production per bushel was 9·9 cents.

These yields and production costs were determined with the Green Mountain variety grown in a sandy and rather poor soil, in a three-year rotation as follows: first year, potatoes; second year, oats, and third year, clover. In the third year of the rotation, the second growth of clover was usually ploughed under in the fall. The fertilizers applied to the potato crop were as follows: 10 tons farm manure and 600 pounds of 3-8-8 fertilizer per acre. In 1935, the 3-8-8 was replaced by 450 pounds of 4-8-10. Certified seed from tuber unit selection was used each year. Six or seven applications of 4-4-40 Bordeaux mixture were made regularly each year at the proper time to prevent blight, and this disease has never caused any damage.

Crop Rotations

Of all the rotations tested on this station in the last 12 years, that which gave the best results is a four-year rotation including a corn and sunflower mixture in the first year, a part in wheat and a part in oats in the second year, two cuttings of mixed alfalfa and clover hay in the third year, and one or two cuttings of alfalfa hay, followed by pasture, in the fourth year. In this rotation, the fertilizers are applied in the first year of the rotation only, that is to the sunflower and corn crop, and include 12 tons of farm manure and 400 pounds

acid phosphate (20 per cent) per acre. The grass mixture used per acre in this rotation includes 8 pounds timothy, 5 pounds red clover, 2 pounds alsike clover, 1 pound white clover, 6 pounds alfalfa, 2 pounds Kentucky blue grass, and 1 pound tall oat grass.

In the last five years, the average yields per acre obtained in this rotation were as follows: corn and sunflower mixture, 19·20 tons; Banner oats, 85 bushels; Huron wheat, 42 bushels; mixed clover and alfalfa hay, 5·10 tons, and 3 tons of almost pure alfalfa hay, followed by 75 days of pasture for one cow in the last year of the rotation. The cost of production was as follows: silage, $2.47 per ton, oats, 34 cents per bushel, wheat, 66 cents per bushel, first year hay, $4.35 per ton, and second year hay, $5.59 per ton. The highest yields obtained to date in this rotation were as follows: 21·50 tons of silage in 1931, 97·5 bushels of Banner oats in 1934, 45 bushels of Huron wheat in 1934, and 6·13 tons of clover and alfalfa hay in 1934.

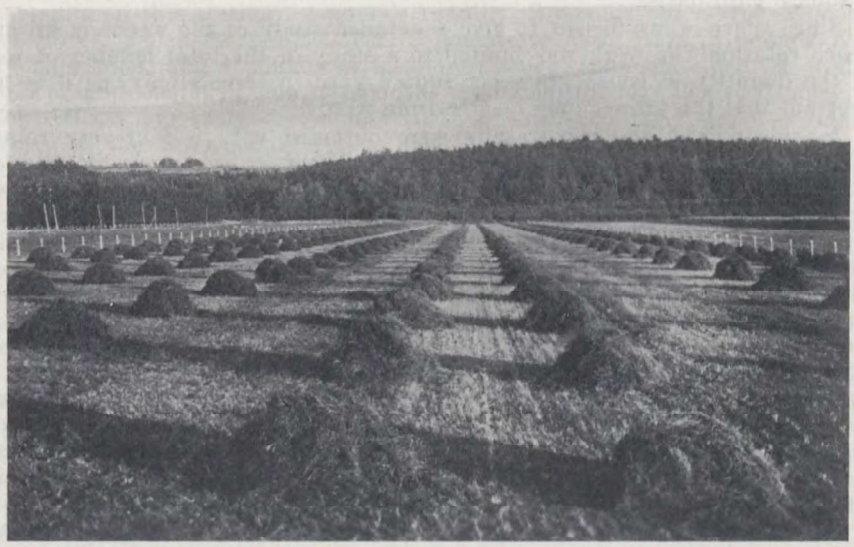

FIG. 7.—A heavy crop of alfalfa hay in the coil.

This type of rotation may be modified according to the conditions on each farm without impairing its efficiency. Thus, the corn and sunflower mixture may be partially or totally replaced either by swedes, mangels, or greenfeed. In the second year of the rotation, the land may be seeded to wheat, oats, barley or mixed grains. After the first cutting of hay in the fourth year of the rotation, the aftermath may be used as an additional pasture or a second cutting of hay may be made, or, if necessary, a partial fallow may be used to control weeds.

DRAINED VS. UNDRAINED LAND

In order to compare under-drainage and open drainage on clay land, two similar four-year rotations have been under way for 12 years, one on under-drained land and the other not. The results obtained to date in this experiment show that drainage was especially effective for hoed crops and cereals. The yields of hay were almost as heavy in the undrained rotation as in the drained one. The average yearly difference in yield in favour of drainage, over a 12-year period, was as follows: swedes, 2·78 tons; corn, 1·32 ton; sunflowers, 0·88 ton; wheat, 7·9 bushels; clover hay, 0·28 ton; and timothy, 0·08 ton.

This experiment shows that the drainage of the soil is a very important factor in growing roots and cereals. This does not imply, however, that drainage is always profitable in all types of soils. Generally speaking, it is only practical in soils which suffer considerably from an excess of moisture, or on parts of fields which cannot be drained by open ditches.

Weed Control

Six years ago, an experiment was undertaken in regard to weed control. The object of this study was to ascertain whether the length of the rotation, the arrangement of crops, the farming practices, and the drainage exerted an influence upon the quantity of weeds. Up to three years ago, a record was taken at six different spots on each field in crop, except on that bearing a hoed crop, with all the rotations; at each of these spots, the approximate number of weeds in $\frac{1}{20}$th acre was ascertained, but in the last three years counts were made on the square yard basis.

Since space is insufficient to give a detailed study of the weeds in all crops in each rotation, the work was limited to a study of the total number of weeds and the quantity of couch grass per square yard in cereals only, as it is most important that this crop should be free from weeds.

In this regard, the best results were obtained with a four-year rotation including corn and sunflower mixture in the first year, wheat and oats in the second year, clover and alfalfa in the third year, and alfalfa without after harvest cultivation in the fourth year. Indeed, only five weeds per square yard were found in the oats and in the wheat. Next came a four-year rotation on sandy soil with green fodder hay in the first year, oats in the second year, clover and alfalfa in the third year, and timothy and alfalfa in the fourth year, followed by after harvest cultivation and a spring ploughing, with a total of six weeds per square yard in the oats. In a three-year rotation including corn and sunflower mixture in the first year, wheat in the second year, and clover and alfalfa in the third year, with after harvest cultivation, seven weeds were found per square yard. In two four-year rotations, one drained and the other undrained, including swedes, sunflowers and corn in the first year, wheat in the second year, clover in the third year and timothy in the fourth year, followed by after harvest cultivation, there were eight and nine weeds per square yard, respectively.

In all the above-mentioned rotations, the cereal crop was entirely free from couch grass and practically free from all the other principal weeds of the district, such as Canada thistle, sow thistle, mustard, horsetail, etc. In view of these results, it is logical to conclude that the rotation which includes a hoed crop, preceded by after harvest cultivation, is a very efficient means of controlling all kinds of weeds.

Establishment of Permanent Pastures

The establishment of permanent pastures may be done in several ways. Several methods in regard to the cultural treatments, fertilizers and seed mixtures have been tried at this station. The results obtained in the last ten years show that the establishment of permanent pastures may be done easily, economically, and efficiently by harrowing, applying ground limestone and acid phosphate, and by seeding down to a good grass mixture.

Ground limestone.—Ground limestone is applied at the rate of two tons per acre in the fall. In the case of pastures, perhaps more than for any other crop, it must be ground very fine and must contain a high percentage of lime carbonate. The application must be made evenly and preferably with a lime spreader. In districts where there are marl deposits, the latter may profitably replace limestone.

Harrowing.—In the spring following the application of limestone, as soon as the snow has melted and while the land is still water-soaked and subject to frost action, the pasture should be harrowed with a heavy stiff-tooth harrow. Harrowing is done both ways until the hard sod is well broken up. On clay soils, disking gives better results than harrowing.

Acid phosphate.—As soon as the danger of washouts has disappeared, that is eight to ten days after harrowing, 400 pounds of acid phosphate containing 20 per cent of available phosphoric acid, or 500 pounds if it contains only 16 per cent of phosphoric acid, should be applied. As in the case of limestone, acid phosphate must be applied evenly. In some cases, the 2-12-6 fertilizer mixture may profitably replace acid phosphate. On clay soils, Thomas phosphate applied at the rate of 500 to 600 pounds per acre seems to be more beneficial than limestone and acid phosphate or the 2-12-16 mixture.

Seeding Down.—Immediately after the application of acid phosphate, 20 pounds of a grass mixture should be seeded. The following mixture gave very good results on this station: 4 pounds timothy, 2 pounds red clover, 2 pounds alsike clover, 2 pounds white clover, 2 pounds orchard grass, 2 pounds Kentucky blue grass, and 4 pounds of meadow fescue. Immediately after seeding down, the land should be lightly harrowed and then rolled. The seed must not be sown either too early or too late; if it is sown too early, there is danger of frost; on the other hand, if it is sown too late, the plants cannot emerge through lack of moisture. The proper time is from April 25 to May 10, according to the lateness of the spring.

Pastures thus established are ready for grazing at the beginning of June of the same year, provided the animals have access to other pastures. The fact that the pastures may be used the first year of the treatment is one of the important factors of success. The grazing of animals at that time, far from destroying the young grass, seems to stimulate the growth. Care should be taken, however, not to keep the pastures too closely grazed in September.

Since 1927, the station has renovated by this system 30 acres of old pastures which were quite unproductive. Invariably on all fields, and in each year, there was in the first year of treatment a good growth of grass, composed chiefly of white clover, of which the animals were very fond. Further, it is found that this growth of grass is becoming thicker from year to year. It is hoped that these pastures will remain in good condition indefinitely without the necessity of further harrowing and seeding down; it should be sufficient to repeat the fertilizer treatment every two or three years. In order to maintain the productivity of improved pastures and to establish permanent pastures, farm manure at the rate of 10 tons per acre, applied in September, also gives very good results, especially on high ground which drys up rapidly when rains are infrequent.

Permanent pastures thus established and maintained will supply an abundance of grass for nearly two 1,000-pound head of live stock per acre, at least during the plentiful period from May 20 to July 15. Productivity decreases after July 15, but unless there is a protracted drought they can still carry one animal per acre until fall. In order to make up the deficiency of pastures which arises around July 15, it is necessary to provide aftermath which is done by cutting a field of hay very early, that is around June 20 or 25. This aftermath should be used for dairy cows.

Fertilized vs. Unfertilized Pastures. Pastures Grazed Alternately vs Grazed Continuously

An old eight-acre pasture located on sandy and gravelly land, producing only a small quantity of wild hay and overrun with raspberry bushes, was ploughed in the spring of 1928 and seeded to green fodder; six to eight tons of farm manure were applied per acre. In 1929, this field was seeded to

oats and no fertilizers were applied, but it was seeded down with a grass mixture with a view to making a permanent pasture. In 1930, this field was divided into five practically equal sections by permanent fences. Since 1930 each of these five sections has been grazed by Ayrshire heifers. One section was limed, fertilized, and pastured continuously, another was not fertilized or limed, and was pastured continuously as in the previous case. The three other sections were fertilized and limed and pastured alternately, the heifers being transferred from one section to another every week.

In this experiment, a careful record was kept of the number of days of grazing provided per acre, of the weight of the heifers and of the gains made per acre. Further, the feed supplied by these various pastures was figured out on the basis of the quantity of digestive nutrients required for the maintenance and the fattening of the heifers which pastured upon them. In addition to keeping a record of the results obtained with the heifers, grass clippings were made in small plots and under cages. By means of these clippings, the yields per acre of green and dry matter produced by these fields were determined.

On a six-year average, the fertilized pasture produced more than twice as much as the unfertilized one. The best basis for comparison is undoubtedly the quantity of digestible nutrients produced per acre. The fertilized pasture provided per year an average of 1,454 pounds of digestible nutrients per acre, compared with 677 pounds for the unfertilized one. The annual value of the pastures, after deducting the cost of fertilizers, provides also a fair basis for comparison. This value was $9.42 per acre for the unfertilized pasture, compared with $14.15 for the fertilized one. The average cost of treatment per acre was $6.09 per year. The alternately pastured fields gave slightly better results than those continuously pastured. Thus, the alternately pastured fields provided, per acre and per year, 1,504 pounds of digestible nutrients compared with 1,403 pounds for the continuously pastured ones. The annual value of the pasture, after deducting the cost of fertilizers, was $14.74 per acre for the alternately pastured fields and $13.55 for those continuously pastured.

The yields per acre of the clippings substantially confirm the results obtained with the heifers. On the plots, the average annual yield of dry matter, over a six-year period, was 1,451 pounds for the unfertilized pastures, compared with 2,784 pounds for the combined fertilized ones. In the case of the continuously pastured field, it was 2,772 pounds compared with 2,796 pounds for the alternately pastured one. Under the cages, the average annual yield of dry matter per acre, over a three-year period, was 2,486 pounds for the continuously pastured and fertilized field, 759 pounds for the unfertilized one, and 3,000 pounds for the alternately pastured and fertilized fields.

The most striking feature of this experiment is that chemical fertilizers applied to permanent pastures have produced an increased yield almost sufficient to cover twice the cost of treatment. It should be borne in mind also that in view of the results of this experiment, alternately pastured fields cannot be recommended in preference to continuously pastured ones, especially if it is considered that in several cases additional costs are incurred for fences or watering facilities which are not likely to be covered by the surplus of yield obtained.

Commercial Fertilizers vs. Farm Manure for Hay and Grain, on Clay Land

The object of this experiment is to determine the value of chemical fertilizers and farm manure for hay and grain on clay land. It was carried on with a five-year rotation, including green feed hay in the first year, oats in the second, clover in the third and timothy in the fourth and fifth years. The various treatments were applied to the hay crop, but the results were determined for each of the crops. Each field of the rotation was divided into three plots, one of which received farm manure, one chemical fertilizers, and a third left unfertilized.

The manured plot received 16 tons of manure per acre, half of which was applied as top dressing on the oat stubble for the clover hay, and half for the second year timothy.

The plot receiving chemical fertilizers was fertilized as follows: the two first years of the rotation were left unfertilized; in the third year, 200 pounds of acid phosphate, 100 pounds nitrate of soda and 75 pounds of muriate of potash were applied per acre; in the fourth year, 200 pounds of acid phosphate and 100 pounds of nitrate of soda were applied; in the fifth year, 100 pounds of nitrate of soda were applied.

The check plot received neither manure nor chemical fertilizers.

Over eleven years, on clay land, the plots fertilized with commercial fertilizers or with farm manure gave a higher yield of hay and grain than the plot which was left unfertilized. Commercial fertilizers gave a slightly higher yield than farm manure. The value of the crops, after deducting the cost of fertilizers, was higher on plots receiving commercial fertilizers than on the unfertilized plots, and practically the same on unfertilized plots as on the manured plots.

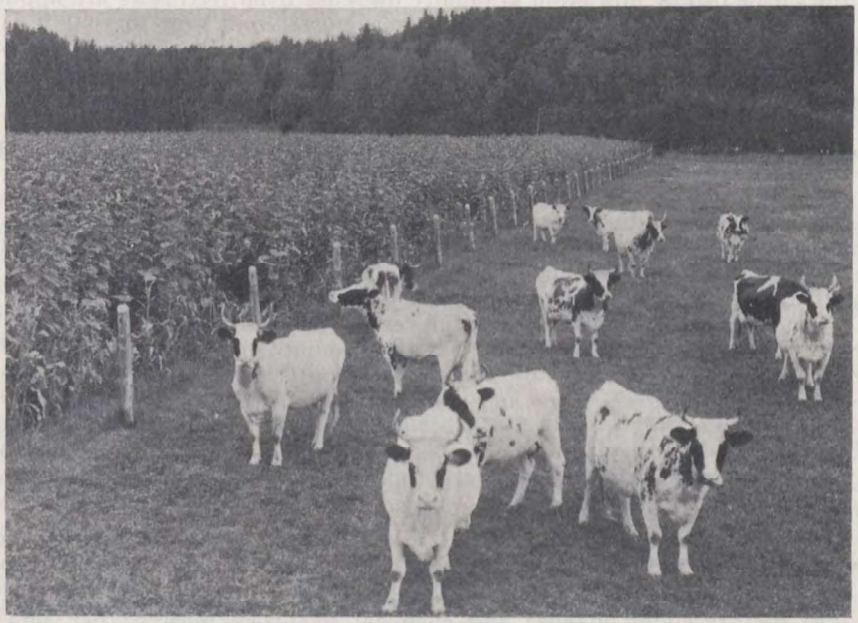

FIG. 8.—Mixed corn and sunflowers grown for ensilage purposes and yielding 21½ tons per acre.

With farm manure, the average yields of hay per acre, over an 11-year period were as follows: pea and oat hay, 2·68 tons; clover hay, 2·72 tons; first year timothy, 2·81 tons; second year timothy, 2·92 tons. The value of the crops per acre, after deducting the cost of manure, was $24.41 for the pea and oat hay, $23.81 for the clover hay, $28.94 for the first year timothy and $26.22 for the second year timothy. The yield of oats per acre was 59 bushels and the value of the crop per acre, after deducting the cost of fertilizers, was $33.09.

With commercial fertilizers, the average yields of hay per acre, over an 11-year period, were as follows: pea and oat hay, 2·77 tons; clover hay, 2·76 tons; first year timothy, 2·96 tons; second year timothy, 2·86 tons. The value

of the crops per acre, after deducting the cost of fertilizers, was $27.82 for the pea and oat hay, $27.04 for the clover hay, $30.12 for the first year timothy, and $29.52 for the second year timothy. The yield of oats per acre was 61 bushels and the value of the crop, after deducting the cost of fertilizers, was $36.34.

Without manure or commercial fertilizers, the average yields of hay per acre, over an 11-year period, were as follows: pea and oat hay, 2·37 tons; clover hay, 2·26 tons; first year timothy, 2·42 tons; second year timothy, 2·39 tons. The value of the crops per acre was as follows: $25.33 for the pea and oat hay, $24.55 for the clover hay, $27.61 for the first year timothy, and $27.53 for the second year timothy. The yield of oats per acre was 56 bushels and the value of the crop per acre was $33.61.

If the difference in the yield of hay and grain was not large between the fertilized and unfertilized plots, this is due entirely to the fact that this experiment was carried on on a good clay soil, well taken care of, where it was possible to secure good crops for a number of years without making any applications of fertilizers. However, experience has shown that even on a good clay soil, the yields of hay and grain gradually decrease if no fertilizers are applied; on the other hand, they have a tendency to increase from year to year if farm manure or commercial fertilizers are periodically applied. Experience has shown also that chemical fertilizers are preferable to farm manure for the economical production of hay and grain on clay soils.

Commercial Fertilizers and Farm Manure for the Production of Hay and Grain on Sandy Soil

The object of this experiment was to compare the fertilizing value of manure alone, manure and commercial fertilizers, and commercial fertilizers alone on infertile gravelly and sandy soil for the growing of grain and hay. It was carried on with a four-year rotation, including pea and oat hay in the first year, oats in the second year, clover in the third, and timothy in the fourth. Each field in the rotation was divided into five plots, one of which received nitrophoska, one manure alone, one manure and commercial fertilizers, one commercial fertilizers alone and one was left unfertilized.

The plot receiving nitrophoska received, per acre, 700 pounds nitrophoska (15-30-15), of which 300 pounds were applied to the first year crop, 150 pounds to the second year crop, 150 pounds to the third year and 100 pounds to the fourth year crop.

The plot receiving manure alone received 20 tons of manure per acre, of which 12 tons were applied to the first year crop and 8 tons on oat stubble the following year.

The plot receiving manure and chemical fertilizers received per acre 10 tons of manure and 500 pounds of chemical fertilizers. Six tons of manure and 100 pounds acid phosphate, 100 pounds nitrate of soda and 40 pounds muriate of potash were applied to the crop of the first year of the rotation; 100 pounds acid phosphate, 50 pounds nitrate of soda, and 10 pounds muriate of potash were applied to the second year crop; 4 tons of manure, 50 pounds acid phosphate and 25 pounds nitrate of soda were applied to the third year crop, and 25 pounds nitrate of soda were applied to the fourth year crop.

The plot receiving chemical fertilizers alone received 1,000 pounds of chemical fertilizers per acre. Two hundred pounds acid phosphate, 200 pounds nitrate of soda, and 75 pounds muriate of potash were applied to the first year crop; 200 pounds acid phosphate, 50 pounds nitrate of soda and 25 pounds muriate of potash were applied to the second year crop; 100 pounds of acid phosphate and 75 pounds nitrate of soda were applied to the third year crop, and 75 pounds nitrate of soda were applied to the fourth year crop.

The unfertilized plot received neither manure nor chemical fertilizers and was used as check.

Over a ten-year period, on sandy land, the fertilized plots gave, for the combined treatments, three times more hay and grain than the unfertilized plots. Both in regard to the yield and value of the crops, after deducting the cost of the fertilizers, the nitrophoska (15-30-15) plots headed the list. Next came the plots receiving manure and chemical fertilizers. It should be borne in mind that the plots fertilized with manure alone or chemical fertilizers alone also gave very good results.

With nitrophoska, the average yields of hay per acre, over a five-year period, were as follows: pea and oat hay, 2·73 tons; clover hay, over a two-year period, 2·13 tons. The average annual value of crops per acre, after deducting the cost of treatment, was $20.93 for the pea and oat hay, $17.39 for the clover hay, and $16.90 for the timothy hay. Over a four-year period, the average yield of oats per acre was 56 bushels, and the annual value of the crop per acre, after deducting the cost of chemical fertilizers, was $17.60.

With chemical fertilizers and manure, the average yields of hay per acre over a ten-year period were as follows: pea and oat hay 2·07 tons, clover hay 1·90 tons, timothy hay 1·12 tons. The average annual value of crops per acre, after deducting the cost of treatment, was as follows: $12.66 for the pea and oat hay, $13.58 for the clover hay and $14.01 for timothy hay. The yield of oats per acre was 40 bushels and the value of the crop per acre, after deducting the cost of fertilizers, was $17.49.

With manure alone, the average yields of hay per acre, over a ten-year period, were as follows: pea and oat hay 2·06 tons, clover hay 1·93 tons and timothy hay 1·82 tons. The value of the crops per acre, after deducting the cost of treatment, was $11.60 for the pea and oat hay, $10.42 for the clover hay, and $13.99 for the timothy hay. The yield of oats per acre was 39 bushels and the value of the crop per acre, after deducting the cost of manure, was $16.78.

With chemical fertilizers alone, the average yields of hay per acre, over a ten-year period, were as follows: pea and oat hay, 1·88 tons, clover hay, 1·56 tons and timothy hay 1·38 tons. The average annual value of crops per acre, after deducting the cost of treatment, was $12.96 for the pea and oat hay, $12.76 for the clover hay and $13.49 for the timothy hay. The yield of oats per acre was 36 bushels, and the value of the crop, after deducting the cost of chemical fertilizers, was $16.89.

Without any fertilizers, the average yields of hay per acre, over a ten-year period, were as follows: pea and oat hay 0·74 ton, clover hay 0·53 ton, and timothy hay 0·61 ton. The average annual value of the crops per acre was $7.98 for the pea and oat hay, $5.41 for the clover hay, and $6.35 for the timothy hay. The yield of oats per acre was 18 bushels and the value of the crop per acre was $12.44.

This experiment, conducted on sandy land, was carried on in conjunction with another similar experiment on clay land in order to determine and compare the value of chemical fertilizers or farm manure for the hay and grain crops on rich clay soil and on poor sandy soil. Unlike the results obtained on clay soils, the chemical fertilizers and the farm manure applied on sandy soil have increased almost three fold the hay and grain yields.

This experiment, which has been under way for ten years, has shown that unlike clay soils, sandy soils quickly lose their productivity if they are cropped without applying any fertilizers; on the other hand, very good yields, increasing from year to year, may be secured if farm manure or chemical fertilizers, or preferably mixed manure and chemical fertilizer are applied periodically.

Chemical Fertilizers for Potatoes

An experiment has been under way for seven years in order to determine the most suitable chemical fertilizer formulae, rates and systems of application for potatoes. Nine groups of plots are included in this experiment, as follows: a check group, a group receiving manure alone, one receiving manure and chemical fertilizers, one with a minimum and a maximum quantity of nitrogen, one with a minimum and a maximum quantity of potash, one with a minimum and a maximum quantity of phosphoric acid, one with various quantities of 3-8-8 (400 to 1,600 pounds), one with various commercial formulae and one with various systems of application, either in rows or broadcast. All fertilizers were applied entirely for the potato crop.

For the purpose of this experiment, a three-year rotation on light soil, including potatoes in the first year, oats in the second, and clover in the third year, was followed. The yields of oats and clover are also recorded in order to determine the residual effects of the fertilizers upon these crops. The various treatments as well as the results obtained with potatoes in the last seven years and with oats in the last five years are given in detail in the following table. The yields of clover are not given because they only cover a two-year period.

CHEMICAL FERTILIZERS FOR POTATOES

Treatments per acre	Potatoes 7-year average		Oats 5-year average	
	Yield per acre	Value of crop per acre, after deducting cost of fertilizers	Yield per acre	Value of crop per acre, after deducting cost of fertilizers
	bush.	$ cts.	bush.	$ cts.
Check group—				
No manure or chemical fertilizers	279·5	109 82	41·0	20 65
Manure group—				
15 tons manure	356·5	127 53	52·5	19 74
Manure and chemical fertilizer group—				
6 tons manure and 400 lb. 3–10–6 fertilizer mixture	351·0	127 88	40·6	19 15
6 tons manure and 700 lb. 3–10–6 fertilizer mixture	355·8	129 32	45·7	18 90
Minimum and maximum nitrogen group—				
500 lb. 0–8–8 fertilizer mixture	310·2	117 60	44·4	21 54
500 lb. 3–8–8 " "	330·0	126 69	45·1	21 22
500 lb. 6–8–8 " "	355·7	133 59	43·9	20 12
Minimum and maximum phosphoric acid group—				
500 lb. 4–0–8 fertilizer mixture	320·5	122 17	41·5	19 61
500 lb. 4–6–8 " "	334·5	128 80	43·7	20 64
500 lb. 4–12–8 " "	332·9	130 43	44·5	22 27
Various rates of chemical fertilizer group—				
400 lb. 3–8–8 fertilizer mixture	345·3	133 92	42·9	20 60
800 lb. 3–8–8 " "	358·8	133 88	42·5	19 15
1,200 lb. 3–8–8 " "	390·0	144 16	43·3	18 19
1,600 lb. 3–8–8 " "	396·6	144 98	48·5	19 70
Commercial formulae group—				
250 lb. 6–20–16 fertilizer mixture	334·1	125 40	49·5	22 90
250 lb. 15–30–15 " "	350·8	125 44	44·6	18 97
500 lb. 15–30–15 " "	376·1	126 57	43·5	15 38
Application system group—				
800 lb. chemical fertilizers 3–8–8 broadcast	358·8	133 88	42·5	19 15
400 lb. 3–8–8 chemical fertilizers broadcast and 440 lb. in the rows	368·3	140 55	40·6	18 03
800 lb. 3–8–8 chemical fertilizers in the rows	375·7	146 84	43·4	19 46

It is shown by the above table that nitrogen was the most useful plant food for the potato crop, increasing the yield in proportion to the quantity of this element in the various mixtures. Thus, the 0-8-8 mixture gave a yield of 310·2 bushels per acre, the 3-8-8 a yield of 330 bushels and the 6-8-8 a yield of 355·7 bushels per acre, an increase of 45·5 bushels in favour of the mixture containing six per cent of nitrogen. The potash and phosphoric acid groups did not produce any increase by the addition of numerous units of these plant food elements.

Application of the chemical fertilizers at rates of 400, 800, 1,200, to 1,600 pounds per acre showed that the most economical rates were 1,200 and 1,600 pounds of 3-8-8 per acre. As is shown by the table, application in the rows is preferable to the broadcast application. Of the 22 treatments tried in this experiment, the one which proved most economical for the potato crop was the application of 800 pounds of 3-8-8 in the rows. It produced a yield of 375·7 bushels per acre compared with 279·5 bushels for the unfertilized plots.

In regard to the residual effects of the various fertilizers on the oat crop following the potatoes, the table shows that there are no substantial differences in the yield given by the various treatments; this means that the most important thing to do is to select the fertilizers which will give the highest yield of potatoes.

Chemical Fertilizers for Swedes on Clay Soil

An experiment was carried on for eight years in order to determine the value of farm manure, chemical fertilizers, and lime for swedes on clay soil. This experiment was conducted on a four-year rotation including swedes in the first year, barley in the second, clover in the third, and timothy in the fourth. In this experiment, 13 various treatments were tested, and while all fertilizers or amendments tried were applied for the swede crop, not only was a record kept of the yield of the swedes but also of all the other crops in the rotation in order to establish, at the same time, the residual effects of the various treatments upon the subsequent crops.

The treatments tested in this experiment were as follows:

1. Ground limestone	2	tons	per	acre
2. Marco phosphate	350	pounds	"	"
3. Burnt lime	2,240	"	"	"
4. Thomas phosphate	750	"	"	"
5. Acid phosphate	750	"	"	"
6. Manure	20	tons	"	"
7. Ground limestone	2	"	"	"
Manure	20	"	"	"
8. Acid phosphate	500	pounds	"	"
Ground limestone	1	ton	"	"
9. Manure	10	tons	"	"
Nitrate of soda	100	pounds	"	"
Sulphate of ammonia	75	"	"	"
Acid phosphate	400	"	"	"
Muriate of potash	100	"	"	"
10. Nitrate of soda	100	"	"	"
Sulphate of ammonia	75	"	"	"
Acid phosphate	400	"	"	"
Muriate of potash	100	"	"	"
11. Nitrate of soda	100	"	"	"
Sulphate of ammonia	75	"	"	"
Acid phosphate	100	"	"	"
12. Nitrate of soda	100	"	"	"
Sulphate of ammonia	75	"	"	"
Muriate of potash	100	"	"	"
13. Acid phosphate	400	"	"	"
Muriate of potash	100	"	"	"
14. Check (no fertilizers).				

As space does not permit giving the results obtained with each of the treatments tested in this experiment, only those which gave the highest average yields over an eight-year period, compared with the check plot, will be given.

The application of 20 tons of farm manure and two tons ground limestone gave a yield per acre of 24·69 tons of swedes, 48 bushels of barley, 2·71 tons of clover hay and 3·06 tons of timothy hay.

The application of 20 tons of manure alone gave per acre 23·63 tons of swedes, 47 bushels barley, 2·52 tons clover hay and 3·08 tons timothy hay.

The application of 10 tons of farm manure supplemented by 675 pounds chemical fertilizers composed of 100 pounds of nitrate of soda, 75 pounds of sulphate of ammonia, 400 pounds acid phosphate and 100 pounds muriate of potash, gave a yield per acre of 22·81 tons of swedes, 40 bushels barely, 2·57 tons clover hay and 2·82 tons timothy hay.

The application of 750 pounds acid phosphate alone gave a yield per acre of 21·31 tons of swedes, 43 bushels of barley, 2·56 tons clover hay and 2·89 tons timothy hay.

The check plot, which had been left unfertilized, gave a yield per acre of 16·07 tons of swedes, 39 bushels barley, 2·65 tons clover hay and 2·36 tons timothy hay.

However, the most economical yields were not always the highest ones. Thus, the treatments which gave the highest profit for the whole of the four crops in the rotation, after deducting the cost of fertilizers, were as follows:—

1. The mixture of 400 pounds acid phosphate and 100 pounds muriate of potash, which left a profit of $182.71 for the four crops of the rotation, with a yield per acre of 20·85 tons swedes, 43 bushels barley, 2·64 tons clover hay, and 2·83 tons timothy hay.

2. The acid phosphate alone at the rate of 750 pounds, which left a profit of $181.96 with a yield per acre of 21·31 tons swedes, 43 bushels barley, 2·56 tons clover hay, and 2·93 tons timothy hay.

3. The mixture of 675 pounds of chemical fertilizers composed of 100 pounds of nitrate of soda, 75 pounds sulphate of ammonia, 400 pounds acid phosphate, and 100 pounds muriate of potash, which left a profit of $174.65 with a yield per acre of 22·27 tons swedes, 40 bushels barley, 2·50 tons clover hay, and 2·78 tons timothy hay.

Chemical Fertilizers for Swedes on Sandy Soil

A second experiment identical with the preceding one, on the value of manure, chemical fertilizers and lime, was undertaken four years ago on sandy soil, in order to determine whether the results on light soils would be similar to those obtained on heavy soils. However, the rotation followed was somewhat different inasmuch as oats replaced barley as the grain crop in the second year of the rotation.

In this experiment, the best results to date have been obtained from the following treatments:

1. An application of 10 tons manure supplemented by 650 pounds of chemical fertilizers composed of 100 pounds nitrate of soda, 75 pounds sulphate of ammonia, 400 pounds acid phosphate, and 100 pounds muriate of potash gave a yield per acre of 23·56 tons swedes, 53 bushels oats, 2·85 tons clover hay, and 2·18 tons timothy hay. With this treatment, the value of the four crops in the rotation, after deducting the cost of the fertilizers applied, was $138.95.

2. An application of 20 tons manure and 2 tons ground limestone gave a yield per acre of 21·05 tons swedes, 60 bushels oats, 3·47 tons clover hay, and 2·54 tons timothy hay. With this treatment, the value of the four crops in the rotation, after deducting the cost of the fertilizers applied, was $131.92.

3. An application of 20 tons manure alone gave a yield per acre of 20·74 tons swedes, 53·5 bushels oats, 3·22 tons clover hay, and 2·57 tons timothy hay. With this treatment, the value of the four crops of the rotation was $131.95.

4. An application of 675 pounds of chemical fertilizers composed of 100 pounds of nitrate of soda, 75 pounds sulphate of ammonia, 400 pounds acid

phosphate, and 100 pounds muriate of potash gave a yield per acre of 20·21 tons swedes, 39 bushels oats, 2·26 tons clover hay and 1·45 tons timothy hay. With this treatment, the value of the four crops of the rotation, after deducting the cost of fertilizers, was $121.77.

The check plot, which was left unfertilized, gave a yield per acre of 10·91 tons swedes, 41 bushels oats, 1·77 tons clover hay, and 1·33 tons timothy hay. The value of the four crops of the rotation was $93.77.

It is seen from the foregoing that there is a substantial difference when the average yields of the plots which did not receive any fertilizers are compared with the average yields of those which received fertilizers suitable for the soil and the crops produced.

HORTICULTURE

In the last few years, the horticultural work at this station has been confined to the maintenance of an experimental orchard, shrubbery tests and a demonstration vegetable garden as well as the upkeep of lawns and flower beds for ornamental purposes.

The Experimental Orchard

The orchard work is carried on with a view to selecting the most suitable varieties of apples for the district and measuring the favourable effects of modern methods of handling an apple orchard under local conditions. In addition, the station co-operates with the local plant pathology laboratory in some spraying studies.

The orchard, which has been run for 23 years, is not located under ideal conditions because it was established on a flat piece of clay soil and has never been manured, although it is satisfactorily underdrained and well protected against prevailing winds. So far the results have been encouraging and in fact for the last five years, the average annual yield per bearing tree was four bushels of fruit of very fine quality.

The shelter belt which protects the fruit trees consists of Lombardy poplars and a hedge of spruce and cedar trees about 300 feet from the first row of apple trees. This shelter belt prevents the premature dropping of fruits and protects the trees against snow drifts, which otherwise would break the branches. Mulching with hay is regularly practised, spreading it twice a year in order to supply more humus over the roots so as to retain more moisture at the foot of trees. In addition various chemical manuring treatments have been applied on a few trees to increase the soil fertility. The best results have been obtained from sulphate of ammonia applied in August at the rate of five pounds per bearing tree.

Furthermore, the base of each tree has been wrapped with metal, with metal screens and in a few cases with roofing paper to protect it against rodents. Apparently the metal screens are more profitable as they last longer although the protective value of the treatments is about equal. Whenever roofing or tar paper is used, it must be removed early in the spring in order to avoid scorching the bark by sun heat which is absorbed by the paper.

Modern practices of pruning are employed involving the removal of thin wood from the outside of the tree and all dried, diseased and misshaped branches affecting the normal condition and shape of the tree. By thinning the outside of the tree where fruits are borne, sunlight, air and spray materials reach all parts of the tree uniformly and more particularly the fruits. Regular sprayings with sulphur solution containing lead arsenate are applied to fight common apple diseases and insects.

Thinning of fruits, around the middle of July, on overloaded branches has given very profitable results, not by increasing the gross yield but by permitting a more uniform growth and ripening of fruits and thus improving the quality and

commercial value of the whole crop. In picking the fruits, care is taken to protect them against spotting or bruising. Fruits are immediately placed in the cool cellar at the average temperature which ranges from 35 to 38°F. and where notes are taken on the keeping qualities of the most important varieties.

Of the 119 varieties or seedlings under observation the following are highly recommended for the district: Crimson Beauty, Melba and Duchess as summer varieties; Wealthy for the fall; McIntosh for early winter and Lobo, Bethel and Rosalie for the later winter. Varieties of the two last groups have the best keeping qualities and also excel in the matter of size, shape and colour of fruit.

FIG. 9.—A Melba apple tree well loaded with fruit.

THE DEMONSTRATION VEGETABLE GARDEN

Even though experiments on vegetables have been discontinued for several years, a medium-size garden is still maintained for educational purposes. A few varieties of each vegetable which is commonly grown in the district are tested. From the records collected, the following varieties are recommended in order of earliness:

Carrot: Nantes Half Long, Chantenay;
Cabbage: Summer—Golden Acre, Copenhagen Market; Winter—Drumhead, Danish Roundhead;
Corn: Pickaninny, Banting, Early Malcolm, Dorinny, Golden Bantam, Golden Giant;
Beet: Detroit Dark Red;
Onion: Southport White Globe, Red Wethersfield, Yellow Globe Danvers;
Cauliflower: Snowball;
Cucumber: White Spine;
Pumpkin: Sweet or Sugar;
Bean: Golden Wax, Peerless;
Pea: Alaska, Thomas Laxton and Lincoln;
Radish: Scarlet Turnip White-Tip;
Lettuce: Grand Rapids, Iceberg, Big Boston;
Tomato: Alacrity, Abel, Earliana, Bonny Best.

Trials of Annual Flowers

The general practice has been to start in a hot bed those varieties requiring a long period of growth before reaching blooming and in the open other varieties which are early blooming. Of the 200 varieties or hybrids of annual flowers grown on the station, nearly every one could profitably be sown in the open provided seeding is done early and on a well prepared seed bed. Whenever earliness or an extended blooming season is desired seeding in hot beds or in flats is required.

From the observations made for several consecutive seasons on the respective characters of annuals, the following are recommended as the best:

RESULTS OF EXPERIMENTS WITH ANNUAL FLOWERS

Varieties or hybrids	Way of planting	Date of seeding	Height of growth	Blooming season
			inches	
Asperula	Open air	May 10	15	July 1 to September
Acroclinium	"	"	20	July 3 to October
Brachycome	"	"	12	July 5 to September.
Calendula	"	"	32	July 11 to October
Chrysanthemum	"	"	19	July 12 to September
Iberis	"	"	13	July 3 to Mid- "
Clarkia	"	"	33	July 12 to Mid- "
Dimorphotheca	"	"	25	July 10 to Mid- "
Leptosyne Stillmani	"	"	20	July 3 to Mid- "
Linaria	"	"	14	July 1 to Mid- "
Linum	"	"	18	July 12 to September
Marigold	"	"	40	July 12 to September
Nigella	"	"	20	July 15 to Mid- "
Nemesia	"	"	14	July 14 to Mid- "
Schizanthus	"	"	6	July 14 to Mid- "
Balsam	Hot beds	April 14	20	July 20 to October
Cosmos	"	"	62	July 20 to frosts
Stocks	"	"	20	July 10 to frosts
Antirrhinum	"	"	23	July 15 to frosts
Marvel of Peru	"	"	24	July 12 to frosts
Aster	"	"	22	July 8 to frosts
Zinnia	"	"	30	July 10 to frosts

Comparison of Shrub Hedges

Each of the eight shrub hedges is made up of a single row approximately 60 feet long with the individual plants spaced 18 inches apart. This seems to be the proper spacing to ensure a quick establishment and a sufficiently thick interlacement. As the seasonal growth of shrubs is about completed in the district at the beginning of July, at least for the eight species actually under observation, the hedges are pruned at this time and no further pruning is required to retain their good appearance and appropriate shape.

The eight hedges were planted in 1924 and in the light of present information they are placed in order of merit with height and width measurements as follows:

Varieties	Height	Width at base
	inches	inches
Caragana arborescens	68	44
Thuja occidentalis	32	32
Salix pentandra	70	40
Picea glauca	35	30
Berberis Thunbergii	31	25
Viburnum Lantana	40	32
Ligustrum amurense	39	26
Syringa villosa	49	35

All of these varieties have shown excellent resistance to the severe winters of the district.

BEEKEEPING

Honey Production

During the past five years, the average production of honey per colony in the station apiary has been 27 pounds in 1932, 38 pounds in 1933, 99·13 pounds in 1934, 103·12 pounds in 1935 and 85 pounds in 1936. These results show that three years were favourable for honey production and two years were unfavourable. This was due to poor weather conditions in 1932 and 1933.

Control of Swarming by Dequeening and Requeening

At the first appearance of larvae in the queen cells, the queen was taken from the hive and all queen cells were destroyed. Nine days later, the queen cells were again destroyed and a young fertilized queen was introduced or a queen cell was left.

Over the last ten years, out of a total of 39 colonies thus treated, only 2·6 per cent of swarming occurred after treatment.

Control of Swarming by Separating the Queen From the Brood

In this method all the queen cells were destroyed at the first appearance of larvae in the queen cells. The frames containing brood were placed in a super, the brood chamber was filled with drawn combs and the queen was left in this new brood chamber. Then a queen-excluder was placed over the latter above which the supers of honey and the supers containing the brood were placed. Nine days later, the super containing brood was again inspected and all the queen cells were destroyed.

During the last five years, out of a total of 34 colonies thus treated, 35·3 per cent made preparations for swarming after treatment.

Wintering in Cellar

A total of 377 colonies were wintered in the cellar during the last five years. The average temperature of the cellar was 47·9 degrees F. The average length of the wintering period was 151 days and the average quantity of food consumed per colony was 16·5 pounds. Losses amounted to 3·9 per cent.

Wintering in Cases

Three types of cases have been used; those containing four, two and one colonies. In all types, shavings were used for insulating purposes, four inches thick on the bottom and around the hives and eight inches on top. The hives were placed in the cases during the first week of October and were taken out in the last week of May.

The results obtained were as follows:

Wintering in four-colony cases: out of a total of 36 colonies, the losses amounted to 13·9 per cent.

Wintering in three-colony cases: out of a total of 18 colonies, the losses amounted to 11·1 per cent.

Wintering in single colony cases: out of a total of 10 colonies, the losses amounted to 20 per cent.

It must be pointed out that most of these losses were suffered during the very cold winter of 1933-34.

How to Prevent Swarming By Giving More Space

In order to give more laying space to the queen, an additional hive body or a half-super was added to five colonies at the beginning of June. When the main flow is about half over, the queen is placed in the lower brood chamber.

Out of a total of 118 colonies thus treated in the last five years, 57·6 per cent made preparations for swarming.

Spring Protection of the Brood Chamber

Two groups of colonies totalling 29 colonies in each group over the past five years, were included in this experiment. One group was protected by means of an outside case from the time it was taken out of the cellar until the beginning of June. No protection was given to the other group.

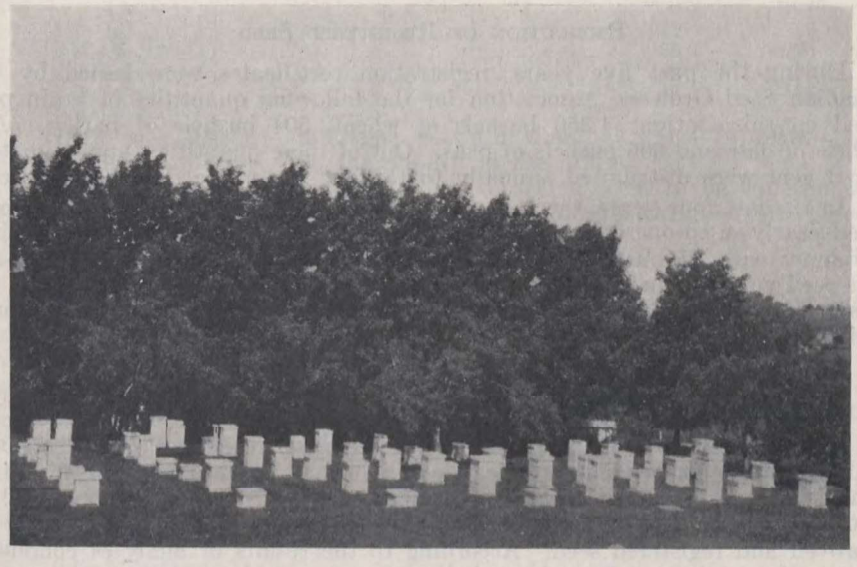

Fig. 10.—The apiary at the Ste. Anne Experimental Station.

The average production per colony was 83·9 pounds for the protected group and 77·9 pounds for the unprotected one.

It must be pointed out that the station apiary is very well protected from the wind by natural shelters. Spring protection would, therefore, be very much more efficient in an apiary exposed to the wind.

A number of other experiments were also carried on during the period under review, as follows: control of swarming by means of artificial swarming for comb honey production; study of minor sources of honey; study of the honey flow; queen rearing; production of comb and extracted honey; comparison of various methods of increase; comparison of two and three-pound packages of bees and wintered colonies.

Each year, the station has distributed several hundred circulars giving timely hints on the work to be done in the apiary at various periods during the season.

CEREALS

The experimental work conducted on this station in the last few years has contributed considerably to the improvement of seed grain in the immediate district, and indirectly in the whole province of Quebec, through the distribution of varieties selected for the quality of the grain, high yield and early ripening. This select seed was first distributed in small quantities to farmers specializing in the production of registered grain, and the latter, in turn, distributed this seed in their respective localities.

In the last few years, substantial progress was made through the introduction of new varieties which were first tested experimentally on this station and later distributed to farmers for commercial purposes or for their own use. The experimental work with cereals has also dealt with the production of mixed grain, and in this field investigations were made in order to ascertain the best seeding rates and the best kinds of grain to sow in mixtures.

Production of Registered Seed

During the past five years, registration certificates were issued by the Canadian Seed Growers' Association for the following quantities of grain produced on this station: 1,350 bushels of wheat, 504 bushels of barley, 7,068 bushels of oats and 606 bushels of peas. Out of these quantities, approximately 80 per cent were distributed annually to farmers to replace degenerated seed.

In the last four years, the following quantities of Elite stock seed were produced yearly in co-operation with the above-mentioned association: 250 bushels of Banner oats, 75 bushels of Mensury barley and 40 bushels of Arthur peas. This seed was sent in small lots to the operators of illustration stations in the district in order that the latter might bring it to the attention of the farmers in their vicinity.

Selected Seed vs. Non-Selected Seed

In order to obtain definite information on the respective value of selected and non-selected seed, in regard to yield, earliness, resistance to lodging and quality of grain, experiments were carried on during two successive seasons. Sixty samples of oats obtained from the farmers of the district and representative of the seed still used to a large extent, were compared with ten samples of improved and registered seed. According to the results of analyses conducted by the Dominion Seed Branch, the quantity of seed necessary to sow an acre of oats contained the following average numbers of weed seeds: 1337 primary weed seeds, 6,982 secondary weed seeds and 28,141 foreign but useful seeds. Out of 60 samples of oats submitted for analysis, 37 per cent were rejected as being unfit for seeding purposes.

In regard to earliness, germinating ability and resistance to lodging, there was a slight difference in favour of the selected samples. In addition, the latter produced 22·7 per cent more per acre and yielded a grain of a much higher commercial and feeding value.

Variety Test of Spring Wheat

In order to determine the baking quality, the productive capacity and the adaptability to local climatic conditions, as well as other minor agronomic factors, several varieties of wheat were tested on this station. As a result of these tests, the following varieties which are given with their average production in the last five years, may be recommended: Huron, 37 bushels per acre, Garnet, 36 bushels, Marquis, 34 bushels and Reward, 32 bushels.

The respective number of days to ripen for each of these varieties in the above order is as follows: 104, 99, 106 and 97 days. In regard to the baking quality, these varieties come in the following order of merit: Reward, Marquis, Garnet and Huron.

During the last three years, new varieties or strains were tested with a view to improved yield or resistance to rust. According to the observations noted to date, the most promising are Reliance, Red Fife M.C. 3308, Brock and Canus.

Barley—Variety Test

Several varieties of barley, some very old and others new, were tested in order to determine the relative productiveness, earliness, resistance to shattering and lodging and those which produce the best grain under local soil and climatic conditions. The average results in the last five years for the varieties which seem to be the most worthy of recommendation to date are as follows:

	Bushels per acre	Days to ripen
Trebi	71	89
Bearer 475	68	90
Himalayan	49	82
O.A.C. 21	49	87

There is a distinct difference between these varieties in regard to the malt-producing qualities and the quality of the grain.

Among the new introductions, some of which seem to be superior to the old varieties, the York, Byng, Sanalta and Nobarb varieties are especially promising.

Oats—Variety Test

Oats are grown more extensively than any other grain crop in this district and they form the basic feed for farm animals. Two types are required, a very early type for sections where the growing season is short, and a later and more productive type for sections located farther south.

The following are the results obtained during the last five years from the varieties which seem to be the most worthy of recommendation:

	Bushels per acre	Days to ripen
Late oats—		
Victory	90	102
Banner 0·49	89	101
Early oats—		
Cartier	75	95

Some new varieties, such as Legacy 83, Lanark, Gopher and Eagle, have shown themselves to be very productive and it is possible that in a few years they will replace the above-mentioned varieties.

Peas—Variety Test

The varieties of peas may be divided into two classes according to whether they are grown for grain or for green fodder. In the selection of a soup variety, the quality of the grain, the yield and the duration of the growth are considered; while for green fodder, a variety which produces a large quantity of foliage and a heavy yield of large pods is desirable.

Among the soup varieties, the recommended sorts, together with the average yield per acre for the last five years are as follows: Arthur, 52 bushels; Chancellor, 49 bushels; Early Blue, 45 bushels. These varieties ripen in 99, 99 and 96 days respectively.

The most satisfactory varieties for the production of green fodder are Mackay and Canadian Beauty.

Flax for Seed—Variety Test

Four varieties of flax especially suited for seed production have been tested for two years only. Flax seed may be used for live stock feeding or for industrial purposes. The results of this test were as follows:

Diadem	24·8	bushels per acre,	98	days to ripen
Redwing	24·8	"	96	"
N.D.R. 52	24·6	"	95	"
Novelty	24·5	"	103	"

Beans—Variety Test

In this district, beans are grown for domestic consumption exclusively. The choice of varieties is based upon the yield, the earliness and the resistance to anthracnose. Four varieties gave the following results in a two-year period:—

Genessee	21·4	bushels per acre,	111	days to ripen
Burbank	20·7	"	94	"
Gohn's Rainy River	20·5	"	94	"
Navy	17	"	100	"

Vetch—Variety Test

The use of vetches for the production of green fodder is a very old practice which is popular in this district. Experiments on the comparison of varieties, rates of seeding, seeding alone or in mixture, were carried on at this station for over five years. Experience indicates that the best procedure for the production of seed is to sow the vetches at the rate of 60 pounds per acre, in combination with 40 pounds of oats, in rows seven inches apart. This crop is easily separated with an ordinary sieve and during the growing period, the oats support the foliage of the vetches, thus preventing them from lodging and rotting in the field, by allowing a freer circulation of air and light through the rows.

Of the varieties tested, four native selections yielded better than an improved selection from the Oregon State College.

Blanche de Déry	48·1	bushels per acre,	118	days to ripen
Dionne	46·8	"	121	"
J. B. St. Pierre	45·6	"	122	"
Noire de Déry	44·9	"	119	"
Oregon 18134	44·0	"	113	"

Production of Mixed Grains

While not very extensively practiced, the growing of mixed grains for feeding purposes is becoming increasingly important, as the advantages derived from this system become more widely known. For best results it is necessary to ascertain the most profitable kinds for seeding in mixtures and the most satisfactory rates of seeding from the standpoint of yield and even maturity of the various kinds of crops in the mixture.

Experiments were undertaken in order to solve these problems, and the following recommendations are based upon five years' work:—

Pea and Oat Mixture

For an early crop, Chancellor peas, sown at the rate of 1¼ bushels per acre, and Alaska oats, at the rate of 1 bushel, yielded 4,229 pounds of straw and 3,440 pounds of grain containing 673 pounds protein per acre.

With the same kinds, a late mixture composed of Mackay peas, at the rate of 1¼ bushels per acre, and Banner oats, at the rate of 1 bushel, yielded 4,950 pounds straw and 4,100 pounds grain containing 613 pounds protein per acre.

Apparently an increase in the rate of seeding of the peas beyond 1¼ bushels per acre does not increase the yield of grain or protein.

The early mixture yielded considerably less than the late mixture; on the other hand, it was ready for cutting 10 days earlier.

BARLEY AND OAT MIXTURE

For early ripening, the mixture of Gold Rain oats, at the rate of 1 bushel per acre and O.A.C. 21 barley, at the rate of 1½ bushels, yielded 4,760 pounds straw and 4,020 pounds grain containing 492 pounds protein per acre.

With the same kinds and the same rates of seeding, a late mixture composed of Banner oats and Bearer barley yielded 4,370 pounds straw and 4,340 pounds grain containing 539 pounds protein per acre.

Barley and oats grow very well in mixture and neither predominates very much over the other.

MIXTURE OF OATS, BARLEY AND WHEAT

An early mixture composed of Alaska oats, 1 bushel per acre; Star barley, 1 bushel per acre; Reward wheat, ½ bushel per acre, yielded 4,590 pounds straw per acre and 3,501 pounds grain containing 463 pounds protein.

A late mixture composed of Banner oats, Charlottetown barley and Huron wheat, at the same rates of seeding, yielded 5,360 pounds straw and 3,860 pounds grain containing 496 pounds protein per acre.

Oats seem to predominate over the other components of the mixture, and for this reason should not be sown at a rate exceeding 1¼ bushels per acre.

MIXTURE OF OATS, BARLEY AND PEAS

Early mixture.—Alaska oats at the rate of 1 bushel per acre, Star barley at the rate of 1 bushel and Chancellor peas at the rate of ½ bushel yielded 4,660 pounds straw and 3,680 pounds grain containing 436 pounds protein per acre.

Late mixture.—Banner oats, Charlottetown barley and Mackay peas, at the same rates of seeding as the former mixture yielded 5,400 pounds straw and 3,980 pounds grain containing 521 pounds protein per acre.

The late mixture yielded substantially more than the early one. Apparently in this mixture containing three kinds of crops, the quantity of peas per acre should not exceed ½ bushel; further it seems inadvisable to seed peas with more than one other kind of crop in mixture.

MIXTURE OF OATS, PEAS AND WHEAT

A very early mixture composed of Alaska oats seeded at the rate of ½ bushel per acre, Chancellor peas at the rate of 1¼ bushels and Reward wheat at the rate of ½ bushel yielded 4,260 pounds straw and 3,380 pounds grain containing 704 pounds protein per acre.

At the same rates of seeding, a late mixture including Banner oats, Mackay peas and Huron wheat yielded 5,440 pounds straw and 3,980 pounds grain containing 636 pounds protein per acre.

The predominance of oats over the peas is much more pronounced with three kinds of cereals than with two only. There is no advantage in increasing the rate of seeding of the peas beyond ½ bushel per acre.

PEA AND WHEAT MIXTURE

A very early mixture including Chancellor peas, at the rate of 1¾ bushels per acre, and Reward wheat, at the rate of 1 bushel per acre, yielded 3,600 pounds straw and 3,041 pounds grain containing 671 pounds protein per acre.

These two crops seeded at the same rates, but using Arthur peas and Huron wheat, ripened about seven days later and yielded 5,150 pounds straw and 3,020 pounds grain containing 564 pounds protein per acre.

Of all the mixtures tested, the wheat and pea mixture yielded the highest percentage of protein. Here also, wheat readily predominates over peas and for this reason should not be sown at too high a rate.

OAT AND WHEAT MIXTURE

Of all the mixtures, the earliest is that composed of Alaska oats at the rate of $1\frac{3}{4}$ bushels per acre and Reward wheat, at the rate of $\frac{3}{4}$ bushel. This mixture yielded 4,590 pounds straw and 3,040 pounds grain containing 455 pounds protein per acre.

Another mixture sown at the same rates, but using Marquis wheat and Banner oats yielded 6,070 pounds straw and 4,100 pounds grain containing 537 pounds protein per acre. This latter mixture, while giving a higher yield, ripens ten days later than the previous one.

In these mixtures neither crop has a tendency to predominate.

FORAGE CROPS

It has been recognized for a long time that dairying is and must remain the basis of farming operations in the province of Quebec. Thus, the experiments which contribute to the improvement of pastures, to the increasing of yields of hay, green fodder and roots are of direct benefit to this industry.

Several interesting experiments have to date given results which are sufficiently conclusive to justify practical deductions. On the other hand, new experiments which have been started recently, especially in regard to the renovation and improvement of pastures do not yet justify definite recommendations.

Mangels—Variety Test

During the winter months, mangels are quite suitable to supply succulent feed in the ration of dairy cattle, in particular, and of swine and sheep, to a lesser extent.

In the choice of a variety, the chief factors which should be considered are yield, ease of pulling and keeping quality.

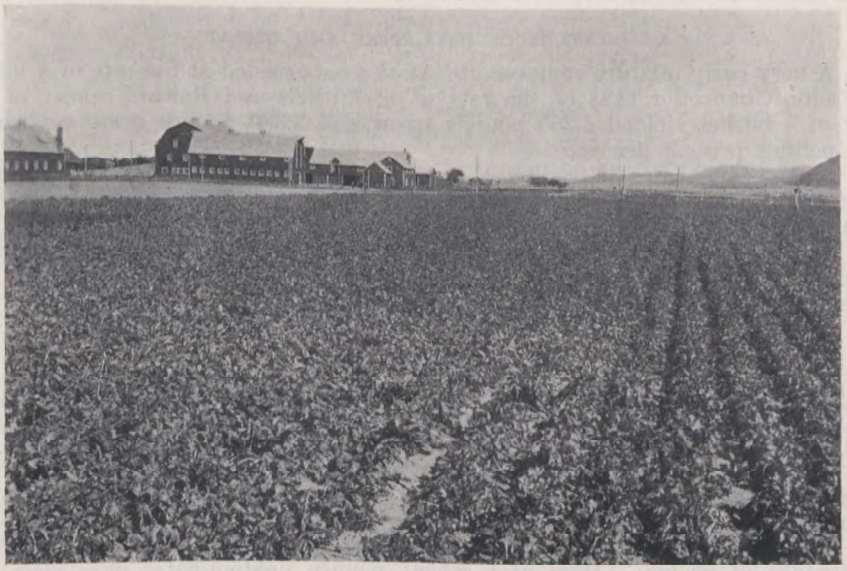

Fig. 11.—A field of mangels which produced 26 tons per acre.

In regard to green matter per acre, the varieties tested for the past five years have yielded as follows:—

Variety	Tons
Yellow Globe	26·01
Danish Sludstrup	25·41
Half Sugar White	23·67
Yellow Tankard	23·19
Long Red	22·32
Yellow Intermediate	21·71

If the yield of dry matter per acre is considered, the order is a little different:—

Variety	Tons
Yellow Intermediate	2·81
Danish Sludstrup	2·81
Half Sugar White	2·60
Long Red	2·59
Yellow Globe	2·40
Yellow Tankard	2·27

The Yellow Tankard and Yellow Globe varieties are the easiest to pull, while the Long Red and Half Sugar White, on account of the length of their roots, have the serious drawback of being very difficult to pull. All of the varieties keep well.

Swedes—Variety Test

Swedes are grown for the same purpose as mangels, that is for the feeding of dairy cattle during the winter months. This crop deserves much more attention in the lower St. Lawrence section in view of the fact that the growing of corn for silage seldom succeeds.

For the past five years the chief commercial varieties have been tested for yield, susceptibility to the brown-heart disease and quality of the roots.

The varieties stand in the following order in regard to the yield of green matter per acre:—

Variety	Tons
Purple Top	29·18
Ditmars	26·50
Corning Green Top	23·55
Hall Westbury	23·40
Bangholm Resistant	20·05

With respect to the yield of dry matter per acre, the varieties rank as follows:—

Variety	Tons
Purple Top	3·15
Corning Green Top	2·93
Ditmars	2·80
Bangholm Resistant	2·60
Hall Westbury	2·59

While giving the best yield, the texture of the Purple Top and Ditmars varieties is inclined to be somewhat woody. The Corning Green Top has shown the greatest resistance to brown-heart.

Annual Hay Crops—Variety Test

Two groups of annual crops, one of which may be sown very early and the other at the beginning of the summer, were compared to determine yields and their ability to replace crops which may have been destroyed by frost in the spring.

The crops listed below may be sown early and converted into green fodder. The table records the results of the tests.

Crop	Variety	Rate of seeding per acre	Yield per acre	
			Dry matter	Dried hay containing 15 per cent moisture
		bushel	pound	pound
Oats	Banner	3	6,982	8,214
Oats	Banner	2	6,032	7,097
Peas	Mackay	1	.....	.....
Oats	Banner	2	.....	.....
Peas	Mackay	½	5,834	6,863
Vetches	.....	½	.....	.....

The crops which are suitable for use as hay on a field where seeding was delayed or to replace a crop sown the previous year and which has been destroyed by frost or drought, are listed in the following table along with the yields obtained.

Crop	Variety	Rate of seeding per acre	Yield per acre	
			Dry matter	Dried hay containing 15 per cent moisture
		pound	pound	pound
Sorghum	.....	25	4,948	5,821
Millets	Japanese	25	4,930	5,800
Soybean	Wis. Black	90	3,621	4,260
Sudan grass	.....	25	3,481	4,075

Vetch and Soybean Variety Tests

While not very important as yet as hay crops, some varieties of vetches and soybeans have been tested. Their productivity is proportional to the length of the growing season. In this district, however, the semi-early varieties, while yielding less, are the most desirable. They are the St. Pierre and Déry native varieties of vetches, and the Wisconsin Black and Manitoba Brown varieties of soybeans.

Alfalfa Variety Test

This crop is one of the main hay crops on account of its high yield as well as of its comparatively high percentage of protein. Alfalfa aftermath is also

very useful for pasturing purposes. This is the reason why, in the comparison of varieties, the productivity, the hardiness and the rapidity with which a good aftermath is secured are taken into consideration.

The varieties tested have given the following average yields over a five-year period:—

Variety	Yield per acre	
	Dry matter	Dried hay containing 15 per cent moisture
	tons	tons
Ontario Variegated	7·01	8·30
Grimm	6·70	7·85
Ste. Anne	6·55	7·67
Ladak	6·30	7·45

Two cuttings per year were made for each of the varieties. All varieties withstood the cold winter quite well. Ontario Variegated, Grimm and Ste. Anne produced the best aftermath.

Red Clover Variety Test

Red clover is the chief legume used for the production of hay and pastures in this district. The factors to be considered in the choice of a variety are essentially the same as for alfalfa. Five varieties (four of which are of Quebec origin) have given the following results in a two-year test:—

RED CLOVER—RESULTS OF VARIETY TEST

Variety	Yield per acre	
	Dry matter	Dried hay containing 15 per cent moisture
	tons	tons
Ottawa	3·50	4·10
Dollard	3·33	3·90
Yamaska	3·27	3·85
Soulanges	3·06	3·60
Temiskaming	2·90	3·43

The Dollard and Ottawa varieties have given the best aftermaths. The varieties which have suffered the least from frost were Dollard and Temiskaming.

Timothy Variety Test

Timothy is the main hay crop. It is used for meadows and pastures. It is perfectly adapted to the climate and succeeds wonderfully well on clay soils and even on sandy soils.

As shown by the following figures, the improved varieties have given a higher yield than the native varieties:—

TIMOTHY—RESULTS OF VARIETY TEST

Variety	Yield per acre	
	Dry matter	Dried hay containing 15 per cent moisture
	tons	tons
Svalof M.C.	3·63	4·26
Cornell M.C.	3·49	4·09
Huron	3·46	4·06
Cornell 1777	3·43	4·04
Swallow	3·40	3·99
Yamaska	3·14	3·69
Vaudreuil	2·99	3·52
Boon	2·03	2·39

Test of Hay and Pasture Mixtures

During ten successive years 28 mixtures of grasses and legumes were tested on duplicate $\frac{1}{50}$ acre plots. The mixtures which seem to be the most worthy of recommendation are as follows:—

Alfalfa	3 pounds	15 pounds per acre
Timothy	6 pounds	
Red clover	5 pounds	
White clover	1 pound	
Timothy	6 pounds	21 pounds per acre
Orchard grass	2 pounds	
Meadow fescue	2 pounds	
Red clover	8 pounds	
Alsike clover	2 pounds	
White clover	1 pound	

Soybeans—Variety Test

The soybean varieties which are most suitable for this district are those which mature early such as Wisconsin Black, which yielded 27 bushels per acre, and Manitoba Brown, which yielded 22 bushels per acre.

FIBRE PLANTS

There has been a renewal of interest in the home spinning industry in the last few years. For this reason the station has investigated the growing of flax for fibre from the standpoint of cultural treatments and varieties.

Flax for Fibre—Variety Test

High yield of fibre and resistance to lodging are the two principal factors which must be taken into consideration in the selection of a variety. Three varieties tested for two years only had given the following results:—

Cirrus	582 pounds of fibre per acre
J.W.S.	530 " " "
Gossamer	432 " " "

Another group of three varieties, tested for seven years, gave the following yields:—

Saginaw	366 pounds of fibre per acre
Longstem	347 " " "
Riga Blue	334 " " "

Methods of Seeding

During a five-year period, a comparison was made of seeding in rows seven inches apart and seeding broadcast. The results are definitely in favour of seeding broadcast which has given an average yield of 399 pounds of fibre per acre, compared with 292 pounds when seeded in rows. Further, lodging was 30 per cent greater in the crop seeded in rows and this is detrimental to the quality of the fibre.

Seeding Flax at Different Dates

Seeding tests made at one-week intervals show that the seeding made around the middle of May is the most suitable, as indicated by the following figures:—

Seeding on May 9, 326 pounds of fibre per acre; seeding on May 17, 325 pounds of fibre per acre; seeding on May 23, 340 pounds of fibre; seeding on May 30, 311 pounds of fibre.

It must be borne in mind that it is very important to seed flax early for another reason, that is in order that the flax may be retted before the snow flies.

Rates of Seeding Flax

During a five-year period, the following yields of flax per acre were secured: With a rate of 84 pounds of seed per acre, 337 pounds of fibre; with 98 pounds of seed per acre, 342 pounds of fibre; with 112 pounds of seed per acre, 358 pounds of fibre.

Chemical Fertilizers for Flax

The following deductions may be made from the results of a five-year test:—

Chemical fertilizers have little effect on the quality and the yield per acre.

An increase in the quantity of nitrogen, alone or in combination, is actually followed by a decrease in the yield of fibre.

Superphosphate and muriate of potash slightly increase the yield of fibre, but in practice this increase is insufficient to cover the cost of the fertilizers.

The land where this experiment was carried on is a rich and well-drained clay soil.

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