DOMINION OF CANADA
DEPARTMENT OF AGRICULTURE
DOMINION EXPERIMENTAL FARMS

Dominion Experimental Station

Fredericton, N.B.

RESULTS OF EXPERIMENTS

1931-1936 INCLUSIVE

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Superintendent

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REPORT OF THE DOMINION EXPERIMENTAL STATION, FREDERICTON, N.B., 1931 TO 1936

INTRODUCTION

This report deals with the work of the Dominion Experimental Station, Fredericton, N.B., for the years 1931-36 inclusive.

The experimental work at this station naturally covers a great variety of problems, being at the service of the whole province of New Brunswick. From 1920 until 1930, an annual report of the work of this station was published and distributed each year among the farmers of the province. These reports dealt with a large number of major and minor problems, and judging from the inquiries received for reports during the interim, they were serving a useful purpose in many farmers' homes. In the present report an attempt has been made to give information on a number of the most important farm problems being dealt with at this station during the past six years. Some major problems and a great many minor problems under investigation cannot be included here, owing to lack of space.

This summary report differs from former annual reports in that an effort has been made to set forth information in a more readable style; more attention has also been given to the use of illustrations such as charts and photographs which have direct application to the subjects under discussion. Any readers requiring information not given in this report are invited to correspond with the Superintendent of the Dominion Experimental Station, Fredericton, N.B.

LIVE STOCK

Experimental work and cost of production records form an important part of the work with live stock, but this station has also endeavoured to supply breeding stock of high quality to interested breeders. The demand has usually exceeded the supply. Animals that are not considered suitable for breeding are sold for meat. A questionnaire concerning the animals sold during the period 1931-5 was sent to the purchasers and replies indicate that practically all of the animals proved satisfactory.

HORSES

Breeding work was carried on with Clydesdales prior to 1935, but a majority of the farmers interested in horse breeding in the province favoured Percherons as a draught breed, so it was decided to establish a Percheron breeding centre at Fredericton. The Clydesdale mares were transferred to the Experimental Farm at Nappan, N.S., where Clydesdale breeding is being carried on somewhat extensively, and four pure-bred Percheron mares in foal were obtained from the Experimental Station at Ste. Anne de la Pocatiere, Quebec. The Percheron stallion Laeteen (14825) 210908 was purchased by the Dominion

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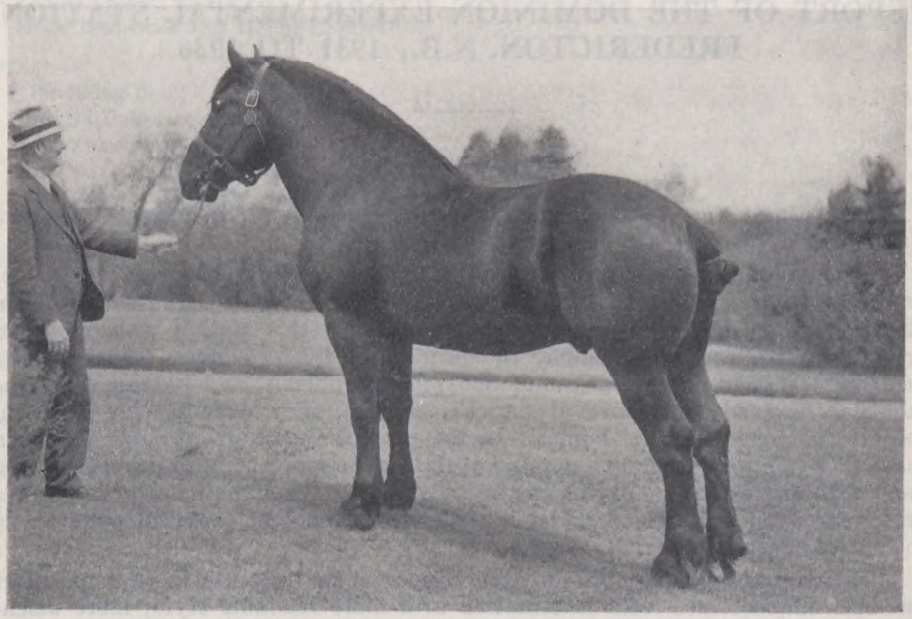
Live Stock Branch and stands for service at this station under the Dominion Premium Mare Policy. All mares presented for service are inspected and must pass a certain standard to be eligible for breeding.



Percheron stallion, Laeteen [14825] 210908, head of the Percheron breeding stud at the Dominion Experimental Station, Fredericton, N.B. Born, May 17, 1933; weight about 2,000 pounds.

CATTLE

Two breeds of cattle, Holstein and Ayrshire, have been kept at Fredericton, but the Ayrshire herd was dispersed in the fall of 1936, leaving only Holsteins. This step had been under consideration for some time, because the Ayrshire breed is represented in the Maritimes, in so far as the Dominion Experimental Farms are concerned, at Charlottetown. Holsteins are not kept at any other Dominion Experimental Farm in the Maritimes and it is felt that more attention can be given to one breed at this station than to two breeds. The fire which destroyed the dairy barn in 1936 forced the complete dispersion of the Ayrshire herd before the animals were placed in winter quarters. These Ayrshires were not lost to the experimental farms, however, as sixteen of the most valuable animals were transferred to a new station in Quebec.

Cost of Production of Milk

The feed cost of milk and butterfat production for the whole herd, including dry cows, has been calculated for each month since 1932. Pasture was charged at the rate of $1.50 per cow per month up to and including 1934 and at the rate of $2 per cow per month for the years 1935 and 1936. The prices charged for hay, roots and oats were the cost of production figures of these feeds at this station. Mill feeds were charged at prevailing local prices.

The cows are fed with the object of keeping them in thrifty condition and keeping milk production at a reasonable level without feeding large amounts of concentrates to produce high records. During the period of stable feeding, mixed hay is largely used for roughage and when timothy is the main roughage,

an effort is made to use timothy which was cut early and which is therefore more nutritious. The meal mixture varies at times owing to the nature of the feed on hand, but the one now being used consists of 200 pounds of ground oats, 200 pounds of oil meal and 100 pounds each of ground barley, bran and gluten feed, and 14 pounds of minerals. The mineral mixture is made up of equal parts of ground limestone, bone char and salt.

Table 1 shows the average monthly feed cost of milk production for the years 1932-5 inclusive. This table shows clearly that the feed cost of milk production is much lower during the summer months than during the period of stable feeding. For the four years under consideration, only a small amount of pasture was available in May and the milch cows were placed on winter rations shortly after October 1. A small amount of grain was fed during the summer months, except during part of the month of June and it is interesting to note that cost of production in June is lower than in any other month.

TABLE 1.—FEED COST OF MILK PRODUCTION 1932-35

Month	Cost of feed per cow	Feed cost per 100 lb. milk	Feed cost per lb. butterfat
	$ c.	$ c.	$ c.
January	7 47	1 18	30
February	6 82	1 15	31
March	7 42	1 15	31
April	7 32	1 03	26
May	6 87	79	21
June	2 88	30	08
July	3 89	45	13
August	4 22	59	16
September	4 50	79	23
October	5 56	1 01	28
November	6 81	1 11	30
December	7 25	1 15	31

In 1936 the cows were turned to pasture during the daytime from May 12 until May 18, when they were turned to pasture night and day. No grain or other supplementary feed was fed from May 20 until September 1, but good pasture was provided throughout the summer. The cost of milk production for May, June, July, and August was 54 cents, 22 cents, 25 cents, and 33 cents per 100 pounds respectively, and the cost of butterfat production for the same months was 15 cents, 7 cents, 7 cents, and 8 cents per pound. These figures show that costs were reduced by providing good pasture and thus eliminating the necessity of feeding grain.

Rearing Dairy Heifers

The aim in feeding dairy calves at Fredericton is to keep them growing and to avoid a set-back. Calves are fed whole milk until they are three to four weeks of age, and then gradually changed to skim-milk. A fat substitute, composed of one part ground flax seed and four parts ground oats, is added to the skim-milk. This fat substitute is scalded and allowed to stand for twelve to twenty-four hours before feeding. Each calf is fed from one-quarter to one pound of this fat substitute per day, the amount depending on the age and condition of the calf. The calves are also fed hay, roots, and grain as soon as they will eat them. The calves are provided with a night paddock during their first summer and turned to pasture the following summer. The dry meal mixture is made up for the most part of two parts crushed oats, two parts bran, and one part oil meal. The same mineral mixture as used for the cows is fed

at the rate of 2 per cent of the meal mixture. No meal is fed to the heifers from the time they are a year old until a few weeks before calving, except in some special cases.

Feeding Experiments with Dairy Cattle

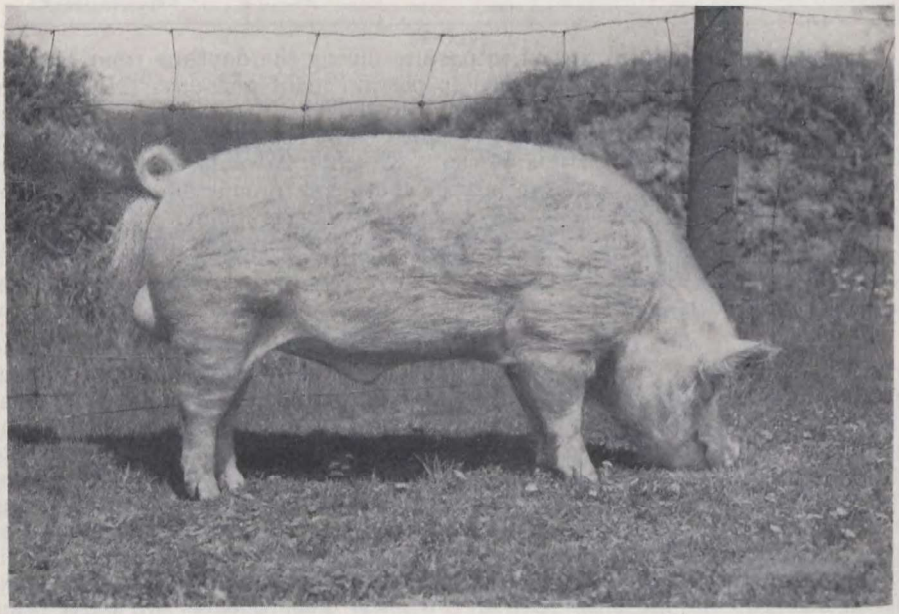
Boutflour System.—An experiment was carried on in 1932 and in 1933 to determine the merits of the Boutflour system of feeding cattle, under which no roots are fed; grain and chopped hay mixed together is the only feed used. The total amount fed is determined by the weight of the cow. The proportion of meal to hay is determined by the amount of milk produced. The results of these experiments indicate that production and costs are practically the same under the Boutflour system as under the regular system of feeding where roots are included in the ration. The experiment, however, did not determine the effect, if any, of prolonged feeding without succulent feed, on the general health of the animals.

Mangels versus Potatoes

Another experiment was conducted in 1935 to determine the relative value of potatoes and mangels as succulent feed for dairy cows. The rate of feeding was 40 pounds of pulped mangels per cow per day to one group, and 20 pounds of pulped potatoes per cow to another group. Grain and hay were fed in the usual amounts. There was no evidence of scouring in any of the animals and they all came through the test in good condition. The results of this experiment would indicate that when potatoes are fed at the rate of 20 pounds per cow per day, they may replace mangels satisfactorily in the ration.

SWINE

Breeding work with swine has been carried on with a herd of Yorkshires, numbering usually from ten to twelve sows. Every effort has been made to use only boars of good quality, and breeding stock from this station has been much



Yorkshire boar, Wille of Stava—179612—imported in 1934 from Sweden. Senior herd sire at the Dominion Experimental Station, Fredericton, N.B.

in demand. The senior herd sire at present (1937) is a boar imported from Sweden with a shipment in 1934. This boar is bred from many generations of advanced registry swine and his progeny have given satisfactory results in feeding trials.

All of the sows are entered in advanced registry with their first litter and only those which qualify in the test are retained for breeders. This station has been active in advanced registry work from the time the policy was first put into effect. For the first few years, the feeding tests for advanced registry were carried on at the breeders' farms. A pig testing station was established at Aulac, N.B., in 1934 and all tests are now carried on at that station under the direction of the Nova Scotia and New Brunswick Swine Breeders' Associations, co-operating with the Dominion Live Stock Branch.

Feeding Experiments with Hogs

Feeding experiments with bacon hogs have been carried on since 1933 with rations made up largely of home-grown feeds. Potatoes, which are an important crop in this province, have been included in various forms in several rations. Fish meal, which is also a Maritime product, has been compared with skim-milk as a protein supplement.

In these experiments, the basal grain mixture, up until the pigs weighed about 100 pounds each, consisted usually of equal parts of ground oats. ground barley and middlings. After the pigs weighed about 100 pounds each, one extra part of barley was added to the mixture. When skim-milk was used as the protein supplement, it was fed at the rate of 2 pounds of milk to 1 pound of grain at the beginning, and gradually reduced to 1 pound of milk to 1 pound of grain during the finishing period. When white fish-meal was used as the protein supplement, it was fed at the rate of 9 per cent of the grain mixture at the beginning and gradually reduced to 5 per cent of the mixture during the finishing period. In 1935 and 1936, all rations included 2 per cent of a mineral mixture. The mineral mixture being used at present is made up of 40 pounds ground limestone, 40 pounds bone char and 20 pounds salt.

When potatoes were included in the ration, one part of barley was omitted from the mixture and they were fed at the rate of 4 pounds raw weight, to 1 pound of grain. The proportions of protein supplement and minerals in the grain mixture were doubled so that the percentage of these ingredients in the dry matter of the ration remained practically the same in all rations.

The results indicate that there is little difference in rate of gain or in the cost of production of pork when either fish meal or milk is used as the protein supplement with grain. In 1935, the average daily gain per hog was 1·4 pounds for the fish meal lots and 1·3 pounds for the skim-milk fed hogs. Rations including potatoes, which were valued at 30 cents per barrel, produced the cheapest gains. Fish meal seems to be superior to skim-milk as a protein supplement when potatoes are included in the ration, although the difference was slight in 1936.

In the experiment conducted in 1935, cooked potatoes were worth 68 cents per barrel for hog feed, based on the prevailing local prices of grain, when fish meal was the protein supplement; potatoes were worth 40 cents per barrel when skim-milk was the protein supplement.

In 1935 and 1936, one pen of hogs received oily fish meal as the protein supplement. In these tests there was no significant difference in rate of gain between lots receiving either oily or white-fish meal. There is some difference of opinion in regard to the flavour of pork from hogs fed oily fish meal, hence further cooking tests are necessary to determine the effect of this product on the quality of pork.

There was no significant difference in the grading results of carcasses from properly finished hogs from any of the experimental pens.

Results of feeding raw potatoes to bacon hogs would indicate that potatoes may be fed raw during the fattening period with fair success, although rate of gain is likely to be somewhat slower than when the potatoes are cooked. Young pigs did not relish raw potatoes, and gains in the early stages were unsatisfactory. It is therefore suggested that if raw potatoes are fed at all, they should not be fed until the pigs weigh about 100 pounds each.

Cooked potatoes were fed at the rate of 4 pounds, raw weight, to 1 pound of grain to one pen in 1936 until the hogs averaged about 100 pounds in weight and then at the rate of 8 pounds of potatoes to 1 pound of grain. Fish meal was the protein supplement. The hogs averaged 1·22 pounds gain per day compared to a gain of 1·33 pounds for the hogs fed potatoes at the rate of 4 pounds to 1 pound of grain throughout the test. If cull potatoes are available at 30 cents per barrel, the cost of pork production will be greatly reduced with this ration.

Potatoes were also fed in 1936 in the form of ground dried potatoes, raw potato silage and cooked potato silage in combination with grain and fish meal. The cooked potato silage was made by cooking potatoes with steam in puncheons and packing them in a trench silo. The raw potato silage was made by mixing 5 per cent of moist fermented corn meal with raw sliced potatoes and packing in a trench silo. Both lots of silage kept in good condition during the experiment; the pits were closed again when about two-thirds of the silage had been fed, and will be opened for feeding trials in the summer of 1937 to see if potatoes can be stored in this manner for a year or more. Young pigs apparently relished the cooked potato silage as well as the ordinary cooked potatoes. The raw potato silage and the ground dried potatoes were unpalatable and unsatisfactory for young pigs, but gave fair results when fed to pigs weighing over 100 pounds.

Cost of Rearing Litters

Feed consumption and farrowing records are kept for each sow. Feed is charged at prevailing local prices and boar service is charged at one dollar per sow. The average cost of producing pigs to weaning age of six weeks for the five year period 1931-5 was $3.81 per pig when one litter per year was raised. The average number of pigs weaned was 8·69 pigs per litter. This cost is somewhat higher than would be expected under farm conditions where a considerable amount of feed which has no market value is available. The cost per pig weaned would also be lower if two litters per year were produced.

FIELD HUSBANDRY

WEATHER RECORDS

The climate of New Brunswick is well suited for the production of crops requiring a rather heavy precipitation with a relatively low temperature. These conditions favour the production of crops for the feeding of live stock, and the growing of specialties, such as potatoes. The mean average temperature for a 22-year period for June, July and August has been 60·62, 66·48 and 64·18 degrees Fahrenheit respectively. The average precipitation per year for a 22-year period was 38·40 inches, this being fairly evenly distributed throughout the year.

CROP ROTATIONS

The 6-year rotation seems to be well suited for mixed farming, but in most cases it should be used in combination with a 3- or 4-year rotation, which could be used to produce special crops and additional hay and grain. This short rotation should be located on fields specially suited for certain crops, such as potatoes and mangels.

The weed problem has been no more serious on the 5- and 6-year rotations including a hoed crop, or the 4-year rotation of grain and hay only, than on the

3-year rotations of grain, hay, and potatoes or corn. In fact, these 3-year rotations which have not received lime, are heavily infested with corn spurrey and sheep sorrel, and yields of hay and grain are low.

The fertilizer and manure treatment of the 6-year rotation consists of an application of 16 tons of barnyard manure and 800 pounds of 2-12-6 fertilizer per acre for swede turnips, corn and O.P.V., or 1,200 pounds 4-8-10 fertilizer for mangels. Each grain crop is fertilized with 200 to 300 pounds of superphosphate per acre, and the third-year hay crop receives a top dressing of 8 to 9 tons of barnyard manure per acre after the previous hay crop has been removed. With this treatment, the third-year hay is almost invariably the heaviest hay crop in the rotation.

A 4-year rotation of one crop of grain and three crops of hay, where manure or fertilizer is applied as a top dressing to the hay crops, has given good results. Where manure is used in the rotation, the first- and third-year hay crops are top dressed with 8 tons of manure per acre the previous fall. Where fertilizer is used, all hay crops are top dressed in the spring with 100 pounds of nitrate of soda, 350 pounds of 16 per cent superphosphate or the equivalent, and 25 pounds of muriate of potash per acre. Evidently the fertility of the soil can be maintained with this rotation and weeds have not been a serious problem.

With the exception of rotations in which potatoes are included, most of the soil in this district is greatly improved by an application of about 2 tons of ground limestone per acre on the grain crop which is seeded down. The beneficial results are especially apparent on the first-year hay where in some cases yields have been increased over 100 per cent.

COST OF PRODUCTION OF FIELD CROPS

Cost of production records have been kept for all crops in the regular six-year farm rotation of grain, hay, hay, hay, grain and roots, as well as in three, four, five and six year rotations in one-third acre plots. Rental for the use of land and buildings is placed at $3 per acre, and $2.85 per acre is charged against each crop for the use of machinery. A share of the manure and fertilizer is charged against each crop, and labour, seed, etc., are charged at prevailing prices.

Hay

The average yield of hay in the 6-year rotation at this station for the 5-year period 1931-5 was 2·60 tons per acre and the cost of production was $6.36 per ton. The first-year hay crop is largely clover and the percentage of clover in the second-year hay varies with the different seasons. The third-year hay is usually largely timothy. This rotation produces a high proportion of timothy hay which is inferior to clover for dairy cattle, sheep, and young stock. This objection is overcome to some extent by cutting the clover and as much of the timothy as may be required for the cattle, early, that is before the timothy comes in bloom. Timothy, when cut early gives a somewhat lower yield of dry matter than when cut late, but it contains a higher percentage of digestible nutrients, especially protein, and is therefore more suitable for feeding dairy cattle.

The seed mixture used at Fredericton consists of 10 pounds of timothy, 6 pounds of red clover, 4 pounds of alsike and 2 pounds of alfalfa per acre. The alfalfa is omitted where the land is low and wet. The mixture is seeded with the grass seed attachment on the grain drill at the time of seeding the grain.

Oats

Cost of production records have been kept for Victory oats following both hoed crop and third-year hay in the rotation. For the 5-year period 1931-5, oats gave an average yield of 63·6 bushels per acre following hoed crop, and 55·5 bushels per acre following third-year hay; the average cost was 46 cents and

43 cents per bushel respectively. The slightly lower cost per bushel obtained from the oats following third-year hay, even though a lower yield per acre was obtained, was due largely to a smaller share of the manure and fertilizer applied to the rotation being charged to this crop than to the oats following hoed crop.

The usual rate of seeding Victory oats at this station is 3½ bushels per acre, as this rate gave the highest yield in rates of seeding experiments. Generally speaking, early sowing is preferable to late sowing, but if the land is worked while it is still wet in the spring, and if the oats are sown before the land has become warm enough to induce quick germination, weeds often become more prevalent than if seeding has been delayed.

The price of oats seldom goes below the cost of production, and it would seem advisable for farmers to grow as much grain for stock feeding as possible rather than leave the land for long periods in hay without proper fertilization, and hence yielding unprofitable crops. When oats can be produced at or near a cost approximating the market value, they should be considered a profitable crop, because such factors as rent of land and machinery are included in overhead expenses, whether the land is producing or not. Most of the labour charged against the oat crop, however, does not represent any additional cash outlay on most farms.

Swede Turnips

Swede turnips are grown as the main hoed crop for live stock feed on most farms in New Brunswick. This crop is better adapted to a long rotation because there is less danger of club root than in a short one. Only part of the cultivated portion of the rotation is sown to turnips, however, because one-sixth of the rotation in turnips would be difficult to handle and is unnecessary. This crop requires a considerable amount of labour and should be grown only on land that is comparatively free of couch grass or other troublesome weeds.

The average yield of turnips for the 6-year period 1930-35 was 23·09 tons green weight and 2·46 tons dry matter. The average cost per ton was $2.93 green weight and $26.71 per ton dry matter. These yields and costs compare favourably with other farm crops.

Turnips are grown in drills 30 inches apart, the rate of seeding being 2 to 3 pounds of seed per acre. The plants are thinned to a distance of 12 inches apart when they are from 2 to 3 inches high. Good results have been obtained with Hall's Westbury, which is a purple top variety, and with Ditmars, which is a bronze top globe variety.

In 1936, the land on which the swede turnips were grown was treated with 25 pounds of powdered borax per acre. This material was mixed with 65 pounds of superphosphate and applied broadcast. It is desirable to apply borax about 5 days before the seed is sown, although in actual practice wet weather may prevent seeding for several days later. As a result of this treatment, the turnips were almost free of brown heart. In recent years, over 80 per cent of the turnips grown under field conditions on land not treated with borax were seriously affected with brown heart.

Mangels

Mangels are becoming more popular as a succulent crop for pigs and poultry, and to some extent cows, especially on farms which are heavily infested with club root. This crop requires fertile ground which can be worked early in the spring, because early seeding is necessary for good results. For this reason, mangels do not fit well in most farm rotations and they should be grown only on clean land specially suited to them. The seed-bed should be carefully prepared and the drills should be rolled both before and after seeding, in order to induce quick germination. If grown on suitable soil, the yield and cost will compare favourably with swede turnips. The average yield of mangels in the 6-year

rotation for the 5-year period 1931-35 was 19·46 tons green weight per acre. Besides their suitability for certain classes of stock, they have the advantage of keeping somewhat longer in storage than turnips.

A variety such as Yellow Intermediate is probably most satisfactory when yield and ease of pulling are considered. At this station mangels are grown in drills 30 inches apart and the plants are thinned to 8 or 10 inches in the drill.

Oats, Peas and Vetches

This crop is grown on part of the hoed crop section of the rotation. The chief advantages of this crop are the small amount of labour required in the production of a high-quality crop that can be used for green feed, silage, hay, or grain. The chief disadvantage of the crop is the high cost of the seed mixture. This objection can be overcome to some extent by eliminating vetches from the mixture, and by growing enough peas to supply seed requirements. In many cases, the yield will be as high if only oats and peas are sown, but where vetches thrive, it is advisable to include them in the mixture.

The rate of seeding used at Fredericton is 2 bushels of oats, 1 bushel of peas, and ½ bushel of vetches per acre. The varieties used are Victory oats, Chancellor or Golden Vine peas, and common vetches. Late-maturing, long-strawed varieties of oats and peas should be used in order to get the maximum yield.

If the crop is cut when the oats are in the milk stage, the dry matter content will average about 20 per cent. The average yield for the 6-year period 1930-35 was 7·76 tons green weight and 1·60 ton dry matter per acre. This was equivalent to about 1·88 ton of hay equal in feeding value to good clover hay. The average cost of production was $5.53 per ton green weight.

Corn

Corn is not grown extensively in New Brunswick and very few silos have been built. Generally speaking, the climate is not considered favourable for corn, although yields of nearly 20 tons green weight per acre have been secured at this station. Germination is sometimes poor due to cold wet weather after seeding, and considerable damage is caused in many districts by crows digging up the young plants.

Longfellow is one of the best varieties to grow for forage purposes. The kernels in this variety have been in the milk to dough stage every year since it has been under test. Although both Northwestern Dent and Twitchell's Pride are earlier maturing, Longfellow is recommended as a forage corn as it will produce a much larger yield of both green and dry weight.

HORTICULTURE

During recent years the horticultural work at this station has undergone drastic changes. Many minor projects, including variety tests of vegetables, have been discontinued, and effort is being concentrated on a relatively small number of problems of vital importance to the horticultural industry of New Brunswick. From time to time, the program is modified in response to requests from vegetable gardeners and fruit-growers to include the investigation of new problems as they arise. In this report details are purposely avoided, and information of an economic and practical nature only is presented.

CORKY CORE OF APPLES

A type of physiological disorder of apples, termed corky core, has been present in isolated trees in the Gagetown district for approximately ten years. This condition is characterized by the presence of small brown corky areas (Figure 1) in the flesh of the fruit. It varies considerably in form according to

variety. In the variety Fameuse, in severe cases, the fruit is badly deformed, the spots being scattered throughout the flesh of the apple, and not strictly confined to the core area. In the varieties McIntosh, Wolf River, and Bishop Pippin, the spots are definitely confined to the interior, no external evidence of the disorder ever having been noted.

In 1933, a serious outbreak of corky core occurred in several orchards in this district. A preliminary survey of the situation was made that fall, and in 1934 a more extensive survey was undertaken with the view of determining the distribution of this trouble as well as the occurrence of any foliage symptoms suspected as being due to a nutritional disorder.

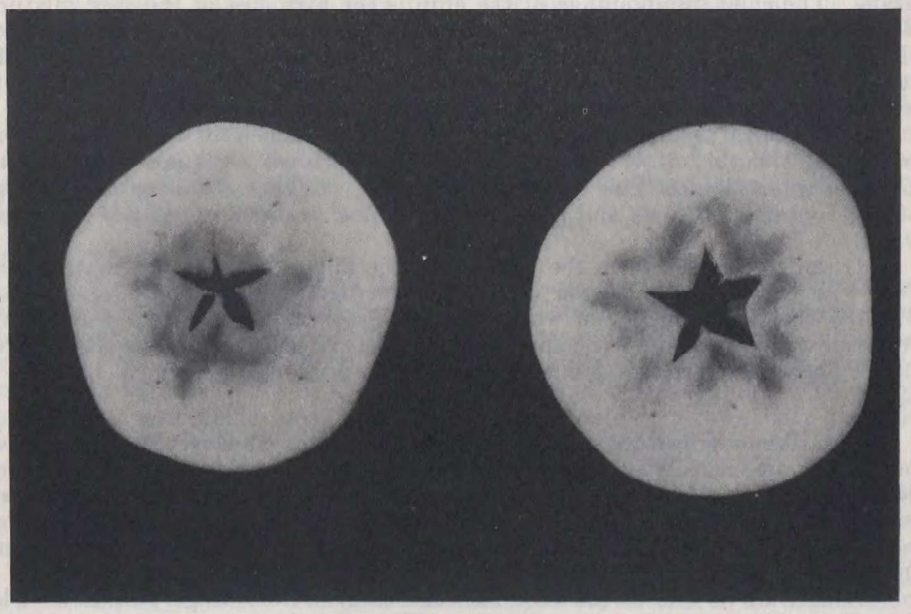


FIG. 1.—Corky Core in McIntosh Apple. (J. L. Howatt)

Corky core and disorders of a like nature have been the subject of critical investigation over a long period of years in many parts of the world. Various theories have been advanced explaining their cause, but control measures of a really definite character were lacking. The survey referred to above indicated that corky core existed in orchards receiving a wide range of fertilizer treatments. In fact, it was found in trees growing almost in the wild, in trees that had not received any commercial fertilizer during the past 16 years, in trees fertilized with barnyard manure and in trees receiving various combinations of commercial fertilizers. For these reasons, it was felt that in this area at least the most profitable line of attack would be an investigation of soil and root conditions and a study of the effect of a few of the rarer elements, including boron, magnesium, and zinc.

Although these investigations have not yet been completed, it is possible to draw certain general conclusions. The application of boron either in the form of a wet or dry injection exercises a controlling effect upon corky core in apples. Additional weight is attached to these conclusions owing to the report of concurrent findings in British Columbia, New Zealand and Ontario.

The boring of holes in trees in both wet and dry injection methods is undesirable in commercial practice. Evidence is available suggesting that boron in

the form of a spray is equally effective. Considerable work has also been done with soil applications of boron. Soil applications of borax, in both wet and dry form, at rates up to 4 pounds per 20-year-old tree, have failed to produce visible injury to the trees during the year of application. Although definite control by this method has not yet been recorded, the results to date would indicate that the apple is fairly tolerant of boron and would suggest that a soil application would probably eventually prove to be the most satisfactory means of applying boron to apple trees.

A study of root distribution, as based on the examination of the root systems of fourteen trees, has indicated a tendency for a concentration of the larger roots at greater depths in non-affected areas than in areas in which corky core is prevalent. It is possible that the application of boron as a preventive measure on soils in which the apple trees are inclined to be shallow rooted will finally prove to be a good policy.

The chemical analysis of the soil at the various horizons down to a depth of 3½ and 4 feet indicated a wide variation in the chemical composition of the different samples, with no definite correlation between any particular factor and the incidence of cork. Unfortunately, data concerning the boron content of the soils are not available.

Definite instructions for the control of corky core are not included in this report, as final recommendations have not yet been compiled. Orchardists generally will be glad to learn that a control measure for a hitherto incurable disorder has been discovered, and owners of orchards affected with corky core, which is believed to be more widely distributed than at first anticipated, are asked to write to this station for recommended measures of control.

BITTER PIT OF APPLES

Bitter pit is another of the so-called physiological disorders. There has not been any satisfactory explanation for the occurrence of bitter pit apart from the fact that it is due to disturbed water relations. During very recent years the opinion has sometimes been expressed that corky core, bitter pit and similar disorders are merely expressions of the same trouble, but differing according to the variety upon which they occur.

In its advanced stage, bitter pit is characterized by small, dark sunken spots, which are more numerous near the calyx end of the apple. Internally, cork spots may be found directly beneath the external sunken spots and also scattered through the flesh in the outer portion of the apple.

This disease is widespread and affects many varieties. In the Saint John River Valley, it has caused very heavy losses in the Baxter variety during recent years, and has been the subject of special investigation by the laboratory of plant pathology in 1935 and by this station in 1936. During the past season, some 140 barrels of apples were examined in these tests. The results indicate that the application of boron will not control bitter pit, thus suggesting that corky core and bitter pit are apparently distinct disorders and not merely varietal expressions of the same trouble.

APPLE VARIETIES

During the past few years, the recommended planting list has been narrowed down to a very few varieties. Contrary to expectations, the severe winter of 1933-4 had little effect in changing these recommendations. In fact it emphasized the wisdom of previous recommendations. Northern Spy and Bishop Pippin are definitely removed from the list, especially in the Fredericton district. On the same basis, Fameuse should not be further planted. The relative hardiness of new varieties must be carefully considered before they are recommended for general planting.

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Factors other than winter-hardiness have combined to remove a number of old standard varieties from the list. Duchess is now over-planted. Premature break-down in storage of Fameuse, combined with its lack of hardiness have rendered future plantings unwarranted. Changes in marketing systems and trends have been responsible for the removal of three other varieties, Dudley, Alexander and Wolf River, there being comparatively little demand for these at the present time. Wealthy also has fallen into disrepute upon the market. Although these varieties can frequently be marketed profitably, it is believed that their production should not be increased. It is the opinion of this station that Dudley could be popularized by an advertising campaign in this province, and the demand for it greatly increased. It is an excellent cooking apple, being in a class by itself in its season. Although its commercial season extends only to early November, it will keep in ordinary storage in fit condition for home use until the first of December.

Plantings in the immediate future should consist largely of McIntosh with a few other varieties added for pollination purposes. Melba may be added in sufficient quantity to supply the local market. Plantings to date of this variety, totalling some 1,850 trees,* are nearly sufficient to do this.

Lobo is being seriously considered as a variety to replace Wealthy, but does not appear to be altogether satisfactory in that it comes into season little, if any, earlier than McIntosh. The tree is very vigorous, hardy and a good cropper. The fruit is of good quality and of excellent appearance, but it too nearly approximates McIntosh in season. There have been 1,597 Lobo trees planted in the province during the period 1927-36 inclusive. As many of these are already bearing, the exact place of this variety in commercial orcharding in New Brunswick should be determined in the near future.

Cortland is being planted fairly extensively, there being a recorded planting of 6,491 trees. As grown at this station, the trees are hardy and vigorous. The fruit is attractive and of good quality, although not equal to McIntosh. The season is two weeks later than McIntosh. It is definitely not a late winter variety. It comes into bearing early and is an annual bearer. Its bearing habit, as mature trees, is yet to be determined. The opinion has been expressed in certain quarters in Ontario that Cortland will not produce more than one-third to one-half the yield of McIntosh. A comparison of the early yield of these two varieties is interesting. Ten Cortland trees were planted in 1924. One of these trees died in 1934, hence yield figures after that date are on the basis of nine trees. The average yield per tree, expressed in pecks, is as follows: 1930—1·2; 1931—2·3; 1932—4·6; 1933—3·4; 1934—5·9; 1935—2·0; 1936—3·3.

These yield records may be compared with those of thirteen McIntosh trees, planted in the Fertilizer Orchard in 1923. The records for these trees are as follows: 1929—0·2; 1930—0·8; 1931—1·4; 1932—5·3; 1933—8·8; 1934—3·0; 1935—8·0; 1936—1·8.

Summarizing these records, for the first twelve years after planting, Cortland produced an average annual yield per tree of 3·2 pecks as compared with 3·9 pecks of McIntosh. During the first three years after the trees came into bearing, Cortland outyielded McIntosh. During the past four years the tendency has been reversed, the average annual yield per tree for McIntosh for the period 1933-6 inclusive being 5·4 pecks as compared with only 3·6 pecks for Cortland. These results, although being far from conclusive, would indicate the possibility of Cortland eventually proving to be a lighter yielding variety than McIntosh. In spite of this drawback, Cortland will probably be more extensively planted than any other variety, with the exception of McIntosh, until such time as a superior variety is located.

*All records in this report dealing with the recorded planting of different varieties in the province have been supplied through the courtesy of Mr. A. G. Turney, Provincial Horticulturist, and are based on the records of the New Brunswick Fruit Growers' Association.

In the matter of winter varieties, definite and unqualified recommendations cannot yet be made. The variety Sandow, long regarded as being very promising, is still the nearest approach to the ideal winter variety for New Brunswick. It is a high yielding variety, having given an average annual yield per tree of 18·6 pecks for the period 1925-33 inclusive. This was the highest yield of any variety in the orchard, although the varieties Northwestern Greening, Wolf River and McIntosh followed closely with yields of 17·9, 17·7 and 17·2 pecks respectively. The season is January to March inclusive, the quality is excellent and the appearance good to excellent, depending on the locality in which it is grown. Its hardiness however, is not all that can be desired. The two old trees in the station orchard were very severely injured in 1933-4. Neither tree was killed outright, although one tree is now in very poor condition and will probably die during the coming year. The other tree is in medium condition, having produced a crop of 12·3 pecks in 1935 and 13·0 pecks in 1936. There are certain factors which made these trees more susceptible to winter injury than they normally would have been. Both trees had been stripped of scion wood for a number of years, owing to the excessive demand for this variety from growers all over the province and also from nurseries for propagation purposes. In addition, both trees bore exceptionally heavy crops of fruit during the summer preceding the severe winter, the yields in 1933 being 52·5 and 48·6 pecks respectively. Experience with other varieties has proven that this condition is very conducive to winter injury. Even with a variety such as Wealthy, trees which bore heavily preceding the severe winter were severely injured, whereas trees which bore lightly were not injured visibly. One must not, therefore, draw too hasty conclusions regarding the hardiness of Sandow, as based on the performance of these two trees only. Bearing-grafts of Sandow on Alexander and Yellow Transparent, although injured considerably, have recovered strongly, and are now in good condition. Moreover, grafts in at least one other orchard in this district and in two orchards in Westmorland County came through with little, if any, injury. Although it is impossible to draw definite conclusions from information of this character, it is believed that Sandow is definitely more hardy than Northern Spy, and will eventually prove to be intermediate in hardiness between Fameuse and McIntosh.

Unfortunately, there are no Sandow trees of any age elsewhere in the province. During the period 1928-36, Sandow scions have been distributed to 68 growers for test purposes. In 1934, 226 Sandow trees were distributed by this station in co-operation with the Fruit Growers' Association, to 22 orchardists in eight counties in the province. In addition, trees handled by the association have numbered 24 in 1934, 126 in 1935, and 225 in 1936. There is now a recorded planting of some 601 trees in the province. It will naturally be some time before definite information can be gathered from these plantings.

Bethel, a variety which formerly was recommended as a winter apple, has proved to be a shy bearer, with an average annual yield per tree for the period 1925-36 inclusive of only 8·5 pecks as compared with 16·4 for McIntosh. It is also only fair in quality, and is not worthy of further planting, except in isolated cases where the variety colours better than usual and a brisk local demand exists for it.

There are several new varieties which are proving worthy of careful consideration. Among these may be listed Lawfam, Linda, and Lawseed, all originations of the Central Experimental Farm, Ottawa.

The variety Lawfam has not been considered particularly promising at this station, but in view of its performance in Quebec, it should be planted on an experimental scale in this province. As grown here, the apples are a little on the small side. They are very highly coloured, but inclined to be somewhat dark and dull, which detracts from their appearance. In season it is an early-winter and not a late-winter variety as reported in Quebec. In hardiness it

appears intermediate between Fameuse and McIntosh. These observations are based on the performance of two trees only, and it is to be hoped that growers throughout the province will plant a few trees of this variety immediately in order to gain more detailed information. If this variety should eventually prove to be as reported in Quebec, it would most certainly have an important place in New Brunswick orchards.

Linda is a winter variety of exceptionally high quality. In fact, it is probably the best variety from the standpoint of quality of any apple ever grown at this station. In addition, it is very highly coloured and attractive in appearance. Its season, under common storage, is from the middle of November to the end of January. As the trees grow older, the season will undoubtedly prove to be later. The question of hardiness is the main factor restraining its recommendation for extensive future planting. Of a total of ten trees planted in 1928, 1929, and 1930, six trees died in 1935 and one in 1936, as a result of winter injury. Only three trees out of the original ten remain, and these appear to be in good condition. As young trees are usually more hardy than older trees, it is doubtful if this variety will prove sufficiently hardy for local conditions. In view of the other outstanding qualities, it is, however, being recommended for trial planting.

The variety Lawseed first attracted attention as possessing real promise in 1935. The two trees of this variety were planted in 1927. One tree came into bearing in 1933 and the other in 1934, and both trees have borne annual crops since. No signs of winter injury could be detected in either tree in 1934. A portion of one tree has shown considerable injury in 1935 and 1936. Whether or not this is due to winter injury in the 1933-34 season cannot definitely be stated. The fruit is of good size and attractive. The colour, although not deep, is distributed over the entire surface of the apple. The entire crop is uniform, there being a very low percentage of cull apples. The quality is only medium, the flesh being somewhat coarse and pulpy. The flavour, although not strong, is pleasant, and is retained under common storage conditions until late March. In cooking tests at Ottawa the quality was found to be good. This variety is worthy of an extensive test. It is now being propagated in co-operation with the New Brunswick Fruit Growers' Association, and it is hoped that a limited number of trees will be available for distribution in the spring of 1938.

Space permits mentioning only a few of the most promising of the newer varieties of apples. Progress in evaluating these varieties will be slow, unless the fruit-growers co-operate fully with the governmental agencies interested. Some 155 varieties are being grown at this station, and it is impossible to have more than a very few trees of any one variety. Growers are therefore urged to plant a few trees of the more promising varieties in their own orchards in order that a considerable number of trees will be available for observation, and rapid progress will consequently be made.

APPLE BREEDING

Future progress in orcharding in New Brunswick depends largely upon the production and introduction of new varieties of apples combining hardiness with desirable commercial characteristics. At the present time, only one variety, namely McIntosh, can be generally recommended for future planting. New varieties, later in season than McIntosh, are urgently needed.

The breeding work with apples is of comparatively recent origin, having been commenced in 1926. Both open and controlled methods of pollination have been employed in the production of seedlings, with the McIntosh variety being used very extensively as a parent. Of the 5,200 seedling trees in the test orchards, only 823 have produced fruit to date. Of these, approximately 500 have been discarded as possessing no commercial promise. The others have been retained for future observations.

A number of promising types have fruited, but none of these have been considered as particularly outstanding. In general, exceptional colour and attractive appearance have been combined with only mediocre quality.

THE YIELDING ABILITY OF SOME APPLE VARIETIES

The yielding ability of a given variety is a very important factor in determining its possibilities as a revenue producer. Moreover, it is a factor that is not very easily determined by the average grower. The commercial orchard at the experimental station was set out in 1914, and consisted of eighteen varieties. Yield records have varied greatly according to variety. The average yield in pecks per tree, according to variety, for the 12-year period 1925-36 inclusive, is as follows:

YIELD OF APPLES FOR 12-YEAR PERIOD 1925-36

Variety	No. of trees	Average yield in pecks per tree	Variety	No. of trees	Average yield in pecks per tree
Canada Baldwin	4	17·8	Fameuse	22	12·2
Crimson Beauty	27	17·6	Wealthy	23	11·9
Wolf River	14	17·5	Golden Russet	5	10·3
McIntosh	10	16·4	Duchess	32	10·0
Northwestern Greening	4	16·3	Salome	3	9·0
Dudley	23	15·6	Bethel	17	8·5
Milwaukee	27	15·4	Red Astrachan	2	8·4
Alexander	21	15·3	Yellow Bellflower	2	4·0

With Red Astrachan, the yield is for an 11-year period as both trees died in 1935-6 due to the severe injury suffered during the winter of 1933-4.

In considering the above figures it should be borne in mind that various fertilizer tests are being conducted in this orchard. This, to say the least, introduces an undesirable factor. Then again, with certain varieties, the number of trees under test is not sufficient to give accurate proof of their yielding ability. Minor differences must therefore be overlooked and only major differences emphasized.

WINTER VARIETY ORCHARD

In response to a request by the New Brunswick Fruit Growers' Association, an orchard consisting of winter varieties only was set out in 1935. This orchard consists of the following varieties: Bancroft, Cortland, Edgar, Kendall, Lawfam, Lawseed, Linda, Macoun, Macwood, Medina, McIntosh, Orleans, Red Spy, Red Rome Beauty, Secor and Sandow.

A number of Anis trees, a hardy Russian variety, have also been included. As soon as these trees develop a suitable framework, they will be top-worked to some of the above mentioned varieties. Even a variety such as McIntosh suffers considerable trunk and crotch injury in a normal winter. It is expected that by top-working a variety such as this on a hardy framework, this damage will be largely avoided. The merits of such a system will be tested out in this orchard.

APPLE STORAGE STUDIES

Detailed apple storage studies have been carried on, commencing with the 1933-4 season. These have included date of picking tests with Fameuse and McIntosh and fertilizer tests with Dudley, Wealthy, Alexander, Fameuse, McIntosh, Milwaukee and Golden Russet.

At the time of picking, records are kept of such factors as colour, as determined by a colour chart, amount of red colour, firmness of flesh as deter-

mined by a pressure tester, starch content as determined by the iodine test, size of fruit, and general attractiveness of sample. The apples are placed in common storage and examined at intervals of one month throughout the storage season. At these examinations, factors such as flavour, texture, shrinkage, development of storage disorders, and length of storage life are noted.

Date of picking tests with Fameuse and McIntosh have indicated that both varieties should be picked as late as possible, consistent with commercial practice. The apples picked at the later dates are characterized by greatly improved colour, increased size, better keeping quality and better general appearance. The improvement in colour is very marked, especially with that type of McIntosh which does not colour solidly over the entire surface. In early October, poorly coloured McIntosh and Fameuse apples may be expected to increase in red colouring at a rate of approximately 2 per cent per day. This figure has been determined by tagging individual apples on several trees and recording the colour percentage on different dates. Thirty-seven apples on a McIntosh tree showed an average reading of 29·2 per cent red colour on October 2. By October 17, this reading had increased to 70·8 per cent representing an increase of 41·6 per cent over a 2-week period, This is possibly somewhat exceptional, but it does serve to illustrate the point that apples colour very rapidly at this time of the year.

With varieties such as McIntosh and Fameuse, the date of picking is largely a matter for the individual grower to decide for himself. These varieties will not become over-mature on the trees. Picking should be delayed as late as possible without encountering the danger of excessive losses by dropping. The advisability of making two pickings is suggested.

Fertilizer tests are conducted with a number of the common commercial varieties, comparing nitrogen, phosphorus and potash alone and in varying combinations. There is no conclusive evidence as to the outstanding value of any particular fertilizer treatment. Experience in other investigations has demonstrated the advisability of applying a complete fertilizer to apple trees, instead of relying upon nitrogen only. Fameuse trees, receiving a complete fertilizer containing nitrogen, phosphorus and potash, suffered much less winter injury during the 1933-4 season than trees receiving nitrogen only. The addition of phosphorus to low nitrogen (three pounds of nitrate of soda per tree) failed to increase hardiness. On the other hand, the addition of phosphorus alone or phosphorus and potash in combination, to high nitrogen (nine pounds of nitrate of soda per tree) definitely increased the hardiness. This coincides with the findings of cold storage investigations conducted in the Horticultural Division, Central Experimental Farm, Ottawa with Fameuse apples from Fredericton. Keeping quality was affected similarly as was hardiness. It was lowered by the addition of phosphorus to low nitrogen, and improved by the addition of phosphorus alone or phosphorus and potash in combination to high nitrogen. The standard fertilizer application at Fredericton is 5 pounds of nitrate of soda, 2 pounds of acid phosphate and 1 pound of potash per tree. This is equivalent approximately to a fertilizer of a 9-5-7 analysis. The rate per tree should be adjusted to promote normal growth.

Various tests have been employed to determine the correct stage of maturity at which different varieties should be picked. These have included the colour chart, the mechanical pressure tester and the iodine test for starch. All are valuable from the standpoint of experimental work. It is very doubtful if any of them have any practical value in New Brunswick orcharding.

The laboratory of plant pathology is co-operating with the station in these investigations, and is responsible for the identification of all rots occurring in storage.

During the storage season of 1935-6, a new apple disease causing a destructive rot in many of the standard apple varieties appeared after the fruit was

about 65 days in storage. The disease showed on the fruit in the form of smooth, brown, circular areas of rotted tissue, which later became wrinkled and covered with the white fruiting structures of the causal fungus.

The disease was studied by the officials of the Fredericton Plant Pathological Laboratory with the assistance of Dr. John Dearness, of London, Ontario. The fungus responsible for the rot was identified as *Dasycarpoma allantoideum* (Peck.) Dearness. Laboratory studies showed that the organism could only cause a rot when introduced into healthy apples by wounding the skin. A total of 10,700 apples representing the varieties Dudley, Wealthy, McIntosh, Fameuse, Milwaukee and Golden Russet was examined, of which 6·0 per cent were affected with the rot. The varieties Fameuse and McIntosh were the most susceptible, 18·1 per cent of the former and 4·1 per cent of the latter being affected by the rot. Fruit from trees receiving high nitrate applications was most susceptible to the disease.

APPLE POLLINATION

Apple-pollination studies have been conducted largely with the McIntosh variety, since, owing to the nature of plantings in New Brunswick, few pollination problems exist with other varieties. Experiments have proven that McIntosh will not produce a commercial set of fruit when pollinated with its own pollen. What little fruit is produced is likely to be deformed and with an abnormally low seed content. On a caged McIntosh tree, with a colony of bees enclosed to ensure pollination, 182 apples were produced. Most of these apples were deformed and possessed the low seed content of 2·1 seeds per fruit. It is believed that these apples were produced as a result of pollination with McIntosh pollen, although the number of apples formed was abnormally high. When McIntosh pollen is applied by hand, it is a very rare occurrence to obtain a single fruit. As compared with this, 210 apples on individual branches of this tree, pollinated by hand with suitable varieties, were normal in shape and averaged 6·6 seeds per fruit. Provision must therefore be made for the adequate pollination of this variety by interplanting with suitable varieties. Fortunately, practically all our common varieties will readily cross-fertilize one another, provided their bloom-periods overlap sufficiently.

The difference in blooming dates of different varieties complicates the problem somewhat, although not to the extent that is commonly thought by growers. Blooming dates, including date of commencement of bloom, date of full bloom, and date of bloom fallen, are kept of every tree in the station orchards. The average dates of blooming for the five-year period 1932-6 are presented in chart form in Figure 2. Taking Crimson Beauty as an example, this chart should be interpreted as follows: date of commencement of bloom, May 24; date of full bloom, May 27; date of bloom fallen, June 4. The varieties Melba, Lobo, Cortland and Sandow are located in a separate orchard, and possibly on a slightly earlier exposure. It is probable that the dates for these varieties are one day later than they appear on this chart.

For ease of consideration, these varieties may be grouped as follows:—

Very early blooming—Crimson Beauty.
Early blooming—Duchess, Melba, Dudley, Milwaukee.
Mid-season blooming—Wealthy, Golden Russet, Fameuse and McIntosh.
Late blooming—Alexander, Wolf River, Lobo, Canada Baldwin, Cortland and Bishop Pippin.
Very late blooming—Bethel, Sandow, Salome and Northwestern Greening.

With the possible exception of the very early and the very late blooming varieties, there is sufficient overlapping of the bloom periods to ensure a commercial set. The extensive planting of the late-blooming Cortland, combined with the removal and grafting over of such varieties as Dudley, Fameuse, Alex-

ander and Wolf River, may accentuate the McIntosh pollination problem, especially during unfavourable seasons. Growers are advised, therefore, not to overlook this aspect of the subject.

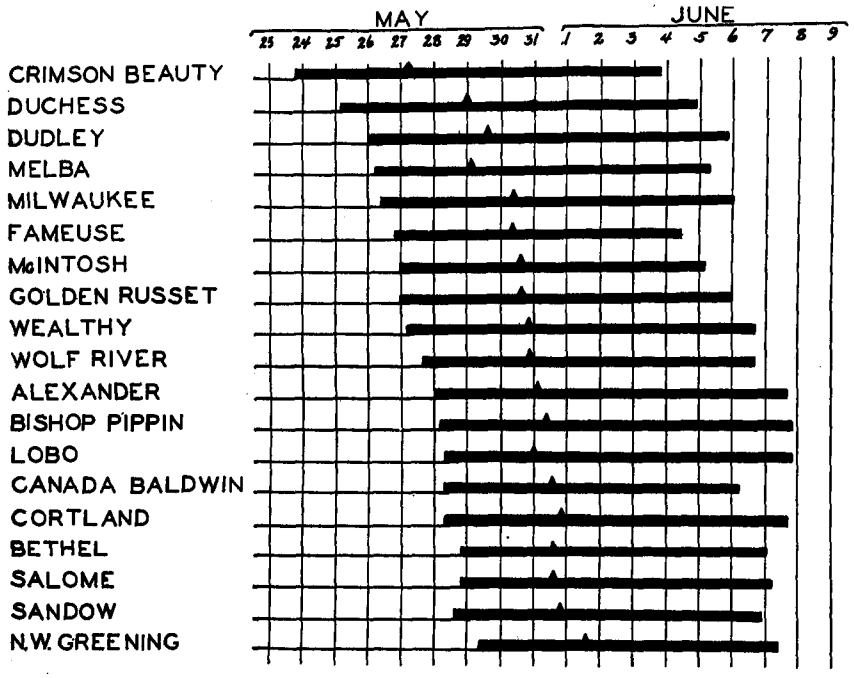


FIG. 2.—Chart showing average blossoming period of different varieties (1932-6). (Original)

Opinions differ as to the number of trees that are necessary for pollination purposes. With a variety such as McIntosh it is probable that every third row in the orchard should consist of pollinating varieties. With the information now available, growers can determine for themselves the type of interplanting of varieties best adapted to their individual conditions.

STRAWBERRY VARIETIES

The strawberry is one of the most important horticultural crops in the province. The variety Senator Dunlap is grown very widely and constitutes the bulk of the crop. It is not an ideal berry, as it drops off in size and yield toward the end of the season. Moreover, it has been fairly severely criticized on several of the large markets in Quebec and Ontario during the past two or three seasons on account of its colour.

At the present time the New Brunswick crop comes on the market just after the peak of the Ontario and United States crop is reached. This gives local growers a certain advantage, which, however, would be greatly increased if a satisfactory variety could be introduced which would lengthen our present season by at least several days. The production of such a variety was the object of a breeding program initiated in 1929. Although this project, in so far as the production of new seedlings is concerned, has been discontinued owing to the necessity of concentrating on other lines of work, a number of promising productions are still under observation.

In addition, some 30 new varieties developed in the Horticultural Division, Central Experimental Farm, Ottawa, are being grown. Some of these are promising from the standpoint of firmness of flesh and season, many of them being much later than Senator Dunlap. The variety Claribel is very promising. The fruit is uniform and attractive, very firm and very late in season. Other promising varieties are Lavergne, Laurier, Edward and Henry.

THE ROLE OF INDIVIDUAL NUTRIENT ELEMENTS IN PLANT GROWTH

Until recent years, general fertility practices with many horticultural crops have consisted mainly of the application of barnyard manure as the chief source of humus and plant food with commercial fertilizers being added in a supplementary rôle. In the case of orchards and potatoes, commercial fertilizers have been used extensively and in many cases, exclusively. Three elements, nitrogen, phosphorus and potash, were considered essential to the production of satisfactory crops, and were accordingly applied. Other elements were known to be essential to plant growth, but were thought to be present in sufficient quantities in ordinary soil. During recent years, revolutionary changes have taken place in our ideas of fertilizer practice. The existence of deficiency diseases in the province, such as magnesium deficiency of potatoes, brown heart of turnips, and corky core of apples, has proven conclusively that certain of the so-called minor elements (that is, elements other than nitrogen, phosphorus and potash) must be added if normal growth is to be obtained and satisfactory yields secured. In such cases, it is not enough to apply barnyard manure or an ordinary commercial fertilizer. Even very heavy applications of this type will fail to correct the trouble. This can only be done by the application of the particular element which is deficient.

The question of *balance* between the three common essential elements, nitrogen, phosphorus and potash, which has been emphasized in many nutritional experiments in sand and water cultures, has also been found to have practical significance in field work. Cases of lack of balance are more likely to exist in instances where the same crop is grown year after year on the same piece of land. In such instances, the essential elements may be present in sufficient quantities for all plant requirements, but the proper balance or proportion is not maintained between the different elements. Growth processes are consequently interfered with and various abnormalities may occur.

In view of the fact that cases of deficiency and cases of lack of balance of the nutrient elements under field conditions have already been noted, and inasmuch as similar conditions are apt to occur in the future with increasing frequency, a few instances are herewith presented in an attempt to impress upon readers the necessity of more careful fertilization of crops.

Magnesium for Potatoes

Magnesium deficiency is now too well known to necessitate further description. It is characterized by dwarfing of the plants, by a definite leaf symptom, and by greatly reduced yields. Increased applications of common fertilizers fail to remedy the situation. The application of magnesium readily controls the trouble and restores normal growth, as has been amply demonstrated by other workers in various parts of the province. In order to determine the effect of magnesium on soils which are not known to be deficient in magnesium, an experiment has been conducted to determine if the application of magnesium will increase the yield of potatoes under normal conditions. The results of this experiment, over a three-year period, have shown no significant increase in yield resulting from the application of magnesium.

Boron for Potatoes

The potato is generally considered as being a crop relatively sensitive to boron. This idea has been fostered largely by the numerous cases of boron injury reported in Maine a number of years ago. This injury was due to the borax content of the potash fertilizer which was used at that time. Growers to-day are skeptical regarding the use of a fertilizer containing borax for fear of possible injury. To gain some light on this subject, an experiment was conducted in 1936, utilizing plots that had been in potatoes during the preceding two years. Four fertilizer treatments were employed, these treatments being identical with those of the preceding two years. The borax was applied in the drill, three days previous to planting, at the rate of fifteen pounds per acre. Results may be summarized briefly as follows: Borax applied to plots which have not received any fertilizer over a three-year period failed to affect yield. Borax applied to plots that have been fertilized annually for three years, resulted in a 11·6 per cent increase in yield. Borax applied to plots that have received both fertilizer and also magnesium at the rate of 120 pounds of epsom salts per acre, resulted in a 17·1 per cent increase in yield. Borax applied to plots that have received both fertilizer and also magnesium at the rate of 240 pounds of epsom salts per acre, resulted in a 9·0 per cent increase in yield.

It is probable that on most New Brunswick soils, an application of borax at the rate of 15 pounds per acre in the drill will not prove injurious to potatoes. These results would indicate that under certain conditions, possibly where potatoes are grown continuously on the same piece of ground, the application of borax will actually increase the yield.

Boron for Turnips

In a series of experiments in which swede turnips were grown in sand, and fed entirely on nutrient solutions of known constitution, boron was found to be essential to the growth of the turnip plant. This fact has been reported previously from different quarters. Plants fed a complete solution made normal growth and produced turnips that were free of brown heart. Plants fed a solution lacking boron but sprayed with a solution containing boron made normal growth, indicating that boron was taken in through the leaves. Most of the turnips, however, were affected with brown heart.

A definite leaf symptom was noted in the boron deficient plants. A distinct marginal yellowing was followed by the development of definite purplish colorations which worked fairly well into the main portion of the leaf. A splitting of the leaf stems along the upper surface was noticed in severe cases. In non-treated fields, the presence of such colorations usually indicated a turnip which was found to be affected with brown heart. In fields that had been treated with borax, plants with similar symptoms were found, but usually these were not affected with brown heart.

Boron for Apples

The results of the experiments, suggesting that an application of boron will control corky core of apples, have been presented previously in this report.

Nitrogen and Potash for Tomatoes

Market-gardeners, who fertilize heavily and frequently use the same area of land year after year should be extremely careful regarding their fertilizer applications. Lack of care will result in the failure to reap maximum benefits for the expenditure, and occasionally will adversely affect the growth of the crop to a marked degree. The latter point was strikingly emphasized by a large field of tomatoes which was under observation during the past season.

Small, dead spots, varying in size from $\frac{1}{16}$ to $\frac{1}{8}$ inch, appeared on the leaves and stems about the middle of June. These increased rapidly in size and number so that by the end of June, all the leaves on the lower one-third of the plant were

dead. The plants then began to recover, and by mid-summer were vigorous again.

This was thought to be a case of lack of balance between nitrogen and potash. In sand-cultures in the greenhouse, it has been found possible to reproduce these symptoms (Figures 3 and 4) on both tomato and potato plants, merely by increasing the nitrogen content of the nutrient solutions to two or three times the

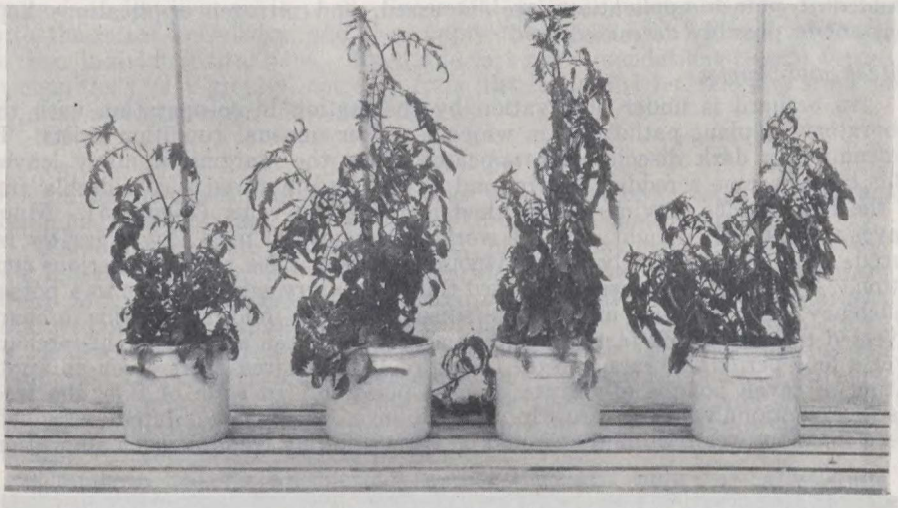


FIG. 3.—Tomato plants grown in pure sand and fed artificial nutrient solutions. The plant at left received a standard solution containing a definite amount of nitrogen. Plants 2, 3 and 4 received amounts of nitrogen which were increased progressively from plant to plant. Lesions on leaves and stems of plants 2, 3 and 4 not evident in photo. (Original)

FIG. 4.—Tomato plants fed same solutions as those in Figure 3 with the exception that the potash fed to plants 2, 3 and 4 was increased at the same rate as was nitrogen. Note the increased size of plants, luxuriant foliage and absence of leaf and stem lesions as compared with corresponding plants in Figure 3. (Original)

normal. These symptoms failed to appear on plants fed a solution in which the potash content was increased in step with the nitrogen content, thus indicating that there is a certain definite ratio between nitrogen and potash essential to the normal growth of these plants.

An enquiry into the fertilizer practices of this grower showed that heavy nitrogen and low potash applications had been made, not only that year, but also in previous years. It is believed that further trouble in this field will be avoided if potash applications are increased, and nitrogen applications kept constant or possibly decreased.

Potash and Apples

An orchard is under observation by the station in co-operation with the laboratory of plant pathology, in which a rather unusual condition exists. In midsummer a dark discoloration appeared along the margins of many leaves. This later became a reddish brown, and by fall had involved a considerble area of the leaf surface, having also worked in along the veins (Figure 5). Many leaves were killed outright, and the working capacity of most leaves greatly reduced. The trees generally lacked vigour and many trees were in a serious condition. A preliminary survey suggested that this injury might be due to a potash deficiency. An enquiry into the fertilizer practice followed in this orchard revealed the interesting fact that nitrogen only had been applied to this orchard over a long period of years. In the spring of 1936, all trees were given an application of seven pounds of nitrate of soda per tree. In spite of this, the trees made exceptionally weak growth. The foliage, where not injured, was light green in colour, resembling that found on trees suffering from nitrogen starvation.

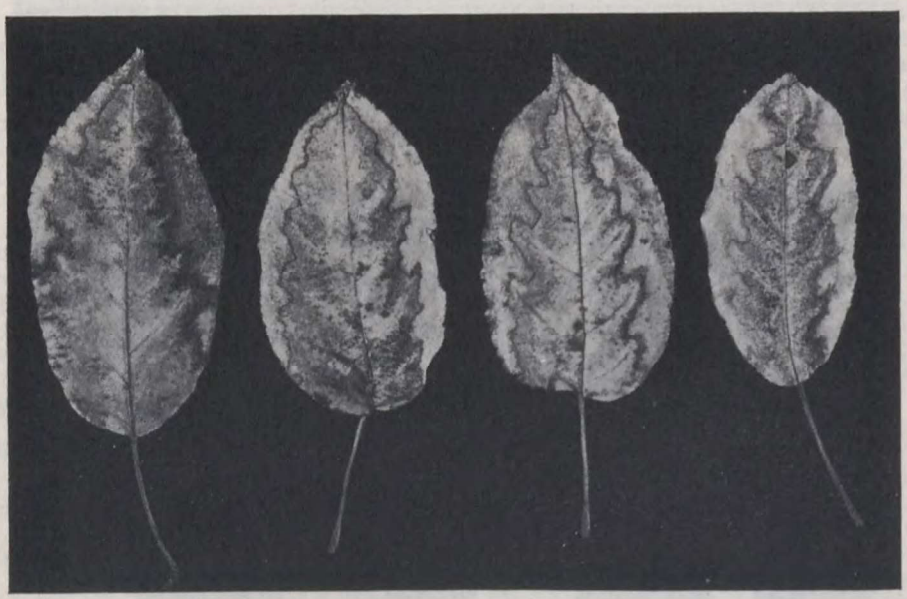


FIG. 5.—Injury to leaves from McIntosh trees suspected to be suffering from potash deficiency. (J. L. Howatt)

Samples of leaves and soils from affected and non-affected trees were collected for the purpose of chemical analysis. The analysis of several samples of leaves has been completed. The only significant feature noted to date in the analysis is the fact that the potash content of the leaves from the non-affected

trees is approximately six times greater than that of the leaves from the affected trees, thus adding weight to the supposition that this disorder is due to a potash deficiency. Experiments will be conducted to determine if this condition can be corrected.

Summary

This information is presented to show that the day of the old method of fertilization is past. Successful growers must acquaint themselves with the latest knowledge, and then apply these scientific findings intelligently to their individual situations. Hard and fast recommendations cannot be made, as conditions vary greatly, not only from district to district, but also from farm to farm, and even upon individual farms.

NEW POTATO VARIETIES

Among the newer varieties of potatoes which have been tested at this station, Katahdin, Chippewa and Warba appear to have the most promise.

Katahdin is a late maturing variety of excellent type. It is resistant to mild mosaic but not to leaf roll. It is not nearly as heavy yielding a variety as Green Mountain. In 1935, Katahdin produced 126·6 barrels of marketable potatoes per acre as compared with 167·7 barrels for Green Mountain. In 1936, its yield was 110 barrels per acre as compared with 143·5 barrels for Green Mountain. This variety may be criticized in that the tubers have a pronounced tendency to grow too large. This may be partially overcome by reducing fertilizer applications, by planting small whole potatoes instead of sets, and by planting the sets closer together.

Chippewa matures considerably earlier than Katahdin. It is resistant to mild mosiac but not to leaf roll. The tubers are of excellent type. The yield in 1935 was much below that of Katahdin. In 1936, with a new supply of seed from Presque Isle, the yield of marketable potatoes was 13·9 barrels per acre below that of Katahdin, whereas the total yield was 3·1 barrels per acre above. In many places in the United States, Chippewa has proven to be a higher yielding variety than Katahdin.

Warba is an early variety, maturing approximately one week earlier than Irish Cobbler. It is claimed to be slightly resistant to mild mosaic. In type, it is similar to Irish Cobbler, being deep-eyed and rough. In the two years under test, it has outyielded Irish Cobbler by a considerable margin. In 1935, the Irish Cobbler plants appeared to lack somewhat in vigour, and it was thought the yield was for that reason below normal. In 1936, with a new supply of seed, the difference in yield was not so great, the margin in yield of marketable potatoes however, still being 20 barrels per acre in favour of Warba.

The yield records, as reduced to barrels per acre, for these varieties for the two seasons 1935 and 1936 are given below. With each variety, the first figure indicates the yield in barrels per acre of marketable potatoes, the figure following denoting the total yield per acre: Green Mountain—155·6 (170·2); Warba—120·4 (144·5); Katahdin—118·3 (128·8); Chippewa—84·8 (107·9); Irish Cobbler—84·1 (113·9).

Although it is impossible to draw definite conclusions from a 2-year test, it is believed that these varieties are worthy of further trial. The variety Warba appears to be very promising, and should be given an extended trial throughout the province. It is to be hoped that Katahdin and Chippewa will also be grown in several districts in order to definitely determine their yielding ability as compared with Green Mountain.

POTATO BREEDING

The potato-breeding project which is being carried on co-operatively with the laboratory of plant pathology is the major horticultural activity at this station. The breeding phases of the investigation are conducted by the experi-

mental station, whereas the laboratory of plant pathology is responsible for the testing of all sorts for resistance to disease. This project was commenced in 1933, and is of necessity a long time investigation since the work is laborious and progress slow.

The ultimate object is the production of new varieties of potatoes combining resistance to the common potato diseases with desirable commercial characters. Since the potato-breeding work for the entire Dominion is being concentrated at Fredericton, breeding for frost resistance has also been included in the program, in response to a request from British Columbia.

From the standpoint of disease, investigations have centred around two diseases, mild mosaic and late blight. During this period, some 5,700 controlled pollinations have been made and 31,760 seedling potatoes produced. Of these, 2,863 seedlings are still under observation.

Breeding for resistance to mild mosaic has been confined to crosses between named varieties of the common potato. Considerable progress has been made in this aspect of the investigation, as many of the seedlings are highly resistant to mosaic, and at the same time, possess desirable commercial characters.

In breeding for resistance to late blight, one of the parents in all original crosses has been a wild potato. Some of these wild potatoes are immune to late blight. They, however, possess many undersirable qualities, such as character of top growth, small tubers, some of them being no larger than peanuts, and long stolons, the tubers being borne four and five feet away from the main stalk. In order to get rid of these undesirable characters, it is necessary to back-cross several times to a cultivated variety. The third back-cross has been performed in many cases. A large percentage of these are still highly resistant to late blight, and many of them are approaching the cultivated potato in type.

Definite progress has been made in the collection from various parts of the world of varieties and species of the potato, possessing value as parents. Potatoes from the United States, Mexico, South America, Great Britain, Norway, Germany and Holland are now included in the collection.

POTATOES CONTINUOUSLY VERSUS POTATOES IN ROTATION

Potatoes are selective in their soil requirements, requiring a definite type of soil for their optimum development; for this reason, many farms are not suited to their cultivation. On most farms, however, there is usually a small field in which the soil is fairly well adapted to potatoes, and the practice has sometimes been to grow them continuously on such fields, year after year.

In order to gain information on this subject an experiment was commenced in 1931, comparing potatoes grown continuously on plots receiving five different fertilizer treatments, with potatoes grown in a fertilized and an unfertilized 3-year rotation. The fertilizer treatments on the continuqus plots are as follows: (1) 2,000 pounds of 4-8-10 fertilizer per acre; (2) 1,000 pounds of 4-8-10 fertilizer; (3) Check; (4) 16 tons of barnyard manure; (5) 8 tons of barnyard manure plus 1,000 pounds 4-8-10 fertilizer. Two 3-year rotations are included. In one rotation, the potato crop receives 2,000 pounds of a 4-8-10 fertilizer per acre. In the other rotation, no fertilizer or manure is applied at any time during the rotation. This experiment has been in progress for six years, and certain trends are indicated.

The ploughing under of even a poor sod is beneficial to the potato crop. The plot in the fertilized rotation has been consistently the highest yielding plot in the entire series.

The yields on all continuous plots, with the possible exception of the one receiving the combined manure and fertilizer treatment, have shown a gradual decrease from year to year. The plot receiving the combined manure and fertilizer treatment, has shown the smallest decrease. Moreover, this plot has always produced the highest yield of any treatment in the continuous section.

The plot receiving a ton of fertilizer per acre decreased gradually in yield until 1936, when for some unexplainable reason, the yield dropped suddenly, being only 76 per cent that of the plot receiving half a ton of fertilizer per acre, and 49 per cent that of the plot receiving the combined fertilizer and manure.

The plots receiving 1,000 pounds of fertilizer and 16 tons of manure per acre respectively have decreased in yields at the same rate, and have always approximated each other in yield.

The results to date indicate that it is not advisable to grow potatoes continuously on the same piece of ground. If such a practice must be followed, a combined manure and commercial fertilizer treatment is advisable. On farms where a small area only is suitable for potatoes, the establishment of a small, short rotation within the main farm rotation, is good practice.

VARIETY TESTS OF VEGETABLES

Although variety tests of vegetables in general have been discontinued, an effort is made to test promising new varieties of vegetables, as they appear. New Brunswick growers are reluctant to try out the newer introductions, and cling tenaciously to the old standard varieties. The following information will therefore be of interest. Additional information regarding variety tests with many other vegetables, over a long period of years, is available upon application.

Corn.—Two Ottawa introductions, Banting and Dorinny, are considered to be promising.

Banting is a very early variety, being 9-12 days earlier than Golden Bantam. It may be criticized on account of its shortness of ear and its poor quality. In districts where it is impossible to grow other varieties, because of early fall frosts, this variety should have a distinct place.

Dorinny is from 4-7 days earlier than Golden Bantam. In quality, it is equal, and possibly superior in some respects, to this variety. The length of ear is intermediate between Banting and Golden Bantam. It is worthy of a place in New Brunswick gardens.

Golden Sunshine is another variety that is gaining some popularity among market-gardeners. It has not been tested to any extent at this station. It is, however, very variable in type, and growers are advised to test it along with Dorinny, before deciding upon any change in variety.

Onions.—Considerable work has been done with onions during the past 2 years. This has included a test of varieties and a comparison of seeding direct in the field as contrasted with seeding in hot-beds and later transplanting into the field. Transplanting has resulted in increased maturity and also in greatly increased yields. In 1935, the increase in yield was approximately 50 per cent, whereas in 1936, a gain of almost 300 per cent was secured. In 1935, the 2-week period following transplanting was hot and very dry. The seedlings finally became nicely established, and were beginning to make satisfactory growth, when a very severe hail storm occurred. Many of the plants were cut off at the ground level, and thus received a second severe set-back. In a normal season, it is believed that transplanting will double the yield of marketable onions.

In this system, the seed is sown thickly in rows, two inches apart, in hot-beds in late March. The seedlings are not pricked off, as is the case with other vegetables that are commonly started in hot-beds, but are transplanted directly from the seedling rows to the field as soon as outside conditions are favourable.

Peas.—As a result of investigations at this Station, the Director pea, originated at the Dominion Experimental Station, Invermere, B.C., was found to be very promising under local conditions. A number of growers were en-

couraged to test it, with the result that the variety is now being grown fairly extensively, and is held in high regard by market-gardeners in the Fredericton district.

Tomatoes.—Three new varieties, Abel, Herald and Bestal, developed in the Horticultural Division, Central Experimental Farm, Ottawa, are promising both from the standpoint of earliness and total yield of ripe fruit.

CEREALS

Cereal crops have produced more wealth each year since 1930 than any other field crop except hay. Even in the period of greatest production there was not enough of any cereal crop grown to supply the home market. Therefore the production of all classes of cereals could well be increased with profit not only to the farmers but also to the province as a whole.

For this reason, this station devotes considerable effort to testing the suitability of varieties and advising farmers which varieties are best adapted to New Brunswick conditions.

WHEAT

The Dominion Bureau of Statistics estimates that the wheat acreage for New Brunswick was over 133 per cent greater in 1935 than in 1931. In this period the total yield increased from 142,000 to 314,000 bushels. Notwithstanding this increase, the total crop would not supply the requirements for the poultry industry that year. Bearing in mind that some of this wheat was reserved for seed, and some of it was manufactured into flour, it is evident that there is need for an even greater production. The most profitable way to increase production is to sow clean seed of varieties with high yielding ability.

Huron, Ottawa 3, which has been included in the variety test at this station each year since 1915, continues to be one of the best yielding varieties on test. It has given the highest average yield of any bread wheat for the last 6 years. The strength of straw is good and, while not resistant to stem rust, it has produced fair yields even in 1935 when stem rust was especially severe. This wheat is bearded and has brown chaff. It is a late variety, having matured in an average of 106 days during the last 6 years.

White Russian is a beardless wheat and for that reason is preferred in some districts to Huron. It is slightly later maturing than Huron and has averaged 1 bushel less grain per acre the last 6 years. As it is also rather susceptible to glume spot, it is not as suitable a late maturing variety for this district.

Garnet, Ottawa 652, is well adapted to those districts which require an earlier maturing variety. In the last 6 years Garnet has ripened 10 days earlier than Huron. It has yielded 28·82 bushels per acre as compared with 32·48 bushels per acre for Huron. Because it is early it is usually harvested before broken weather sets in and the grain is usually better quality than Huron. While it has very little resistance to stem rust, its early maturity often allows it to escape severe infection. It is beardless.

Marquis, which ripens about 2 days earlier than Huron, and Reward, which ripens 2-3 days later than Garnet, have both given low yields and the grain has been rather poor quality.

During the last 4 years tests have been conducted with a number of rust resistant hybrids from the Rust Laboratory at Winnipeg. One of these hybrids, Pentad × Marquis 1005, has given the highest yield of any bread wheat tested during this period. Pentad × Marquis 729 and 1000 are also promising. These new wheats have produced good quality grain even in 1935 when nearly all the wheat grown at the station was of inferior quality. This was largely due to their being able to resist the severe stem rust infection.

Thatcher, which has given good results in the Prairie Provinces has given rather low yields here, and has not proven as resistant to stem rust as the Pentad × Marquis crosses.

The two Durum wheats, Goose and Mindum, in the order named, have given the highest average yields of any wheat grown the last 6 years. Although Goose has averaged 2·63 and Mindum, 1·98 more bushels per acre than Huron, they do not appear to be well adapted to this district, as the straw is weak and they are even later maturing than Huron. They have shown considerable resistance to stem rust in the 5-year period from 1931 to 1935 inclusive, but stem rust was severe on these wheats in 1936.

OATS

Of the 284,400 acres devoted to cereal crops in 1935 in New Brunswick, 215,100 acres were sown to oats. Oats occupies the third place in value of the field crops in New Brunswick, being only surpassed by hay and potatoes. For this reason, it is important that high yielding varieties which are adapted to New Brunswick conditions, should be grown. In spite of the importance of the crop a large percentage of the grain grown is of low yielding ability. This was strikingly illustrated in 1935 when grain was secured from 104 farms and only six of these gave as large yields as Victory oats.

The variety tests at this station indicate that Victory and Banner can still be recommended as good late maturing varieties. There is comparatively little difference between these varieties in their yielding ability. In the last 6 years Banner has given an average of three pounds per acre higher yield than Victory, but Victory has given a slightly higher average yield for the 22 years that these two varieties have been grown. In the last 6 years Victory has ripened in an average of 101 days, as compared with 100 days for Banner. Although the strength of straw and resistance to disease may vary from year to year, they were approximately the same over that period. Victory is a plumper oat and for that reason has a more attractive appearance, but there has been no appreciable difference in the percentage hull of Victory and Banner. Although the station grows Victory as a main crop, it would seem that a choice between these two varieties is largely a matter of personal preference.

There are some sections in the province where an earlier maturing variety is desirable. Late maturing varieties have given higher yields than earlier maturing varieties over a long period, although during the last 6 years the reverse has been true in some cases. During this period Legacy (Ottawa 678) has given slightly over ½ bushel higher yield per acre than either Victory or Banner and has ripened 6 days earlier. Legacy is a thinner oat and is not as attractive in appearance as either Victory or Banner, but the percentage hull is only slightly higher. This oat is suitable for districts where a slightly earlier maturing variety is desirable.

There are some districts which require an even earlier maturing variety. Gopher, Alaska or Cartier are recommended for these districts, as they ripen 3 to 4 days earlier than Legacy. Of these three, Gopher has given the highest yield, giving slightly higher yields than Legacy in the last 6 years. It has good strength of straw but the straw is short. This has not been a disadvantage at this station, but it might be on less fertile land.

Alaska has given slightly over 7 bushels lower average yield per acre than Victory the last 6 years. It has a lower percentage hull than either Victory or Banner but as it is a thin oat, it does not look as attractive.

Cartier, a new variety developed at MacDonald College, has given approximately the same yield as Alaska. It has a slightly higher percentage hull than Alaska but not as high as either Victory or Banner. It is a plump, rather attractive oat.

Laurel, a hulless oat, has given excellent yields at this station. It matures about 2 days earlier than Victory, has good strength of straw, and does not shatter readily. It can be recommended to those desiring this type of oats.

OATS AND PEAS IN COMBINATION FOR GRAIN

Practically all the rough grain crops grown in New Brunswick have a relatively low percentage of protein. When these grains are used in a feed mixture the amount of protein must be increased by the purchase of imported high-protein feeds. In order to ascertain whether it was possible to grow higher protein grain economically in New Brunswick, mixtures of oats and peas have been compared in field trials with the same varieties of oats and peas sown alone each year since 1931.

The mixtures were sown at the rate of 1 bushel of oats and $1\frac{3}{4}$ bushels peas per acre in 1931 and 1932. In 1933 the amount of peas in the mixtures was increased to $2\frac{1}{4}$ bushels per acre. The oats remained unchanged.

Laurel, a hulless variety of oats, was sown alone at the rate of 2 bushels per acre. The other varieties of oats and the peas were sown alone at the rate of 3 bushels per acre.

The varieties of peas grown in mixtures included Early Blue, Ottawa 21, Chancellor, and O.A.C. 181, and the varieties of oats included Alaska, Gopher, Gold Rain, and Laurel.

The mixtures of oats and peas have not shown any definite advantage in yield over the same varieties sown alone, but some of the mixtures have been more easily harvested and have assisted in the control of weeds. Thus Early Blue peas and Gopher oats can be more easily cut than Early Blue peas alone. Early Blue peas have short vines, and when these peas were sown alone the ground became very weedy. The weeds were not as serious a problem in a mixture of Gopher oats and Early Blue peas. Gopher oats, 1 bushel, and Early Blue peas, $2\frac{1}{4}$ bushels per acre, has been the most productive mixture each year since it was first grown in 1933.

BARLEY

While the barley acreage in New Brunswick is small when compared with oats, barley merits increased attention. It can be used for feeding all classes of live stock, and especially in swine and poultry feeding where it can be used as a substitute for corn (an imported feed) in feed mixtures. While more exacting in its soil requirements than oats, in recent years the more productive barleys have yielded more grain per acre than any variety of oats grown on similar land at this station. It has also been superior to oats as a nurse crop.

Trebi has been the productive barley since it was first grown in 1928. It has not been definitely recommended because in most years it is rather susceptible to disease (especially *Helminthosporium*), has only fair strength of straw, and when grown on poor land the straw is extremely short. At this station it invariably has a poor appearance and a high yield.

Two old established varieties, viz: O.A.C. 21, a six-rowed and Charlottetown No. 80, a two-rowed barley, have been recommended for a number of years. Charlottetown No. 80 has produced more grain per acre and the grain is usually better quality. It has, however, less strength of straw and therefore a greater tendency to lodge and smother out grass and clover when used as a nurse crop on wet years.

Although smooth awned barleys have been grown at this Station since 1927, their value was not fully realized until a number of outstanding new varieties were introduced in 1934. A number of these have outyielded O.A.C. 21 and Charlottetown No. 80. The average yield per acre for the last three years of the most promising smooth awned varieties, expressed in bushels, is: Byng—63·9; Nobarb—59·4; Sanalta—58·7; Regal—58·4, and Wisconsin Pedigree—57·1, as compared with Charlottetown No. 80—53·2 and O.A.C. 21—52·7, the two rough awned varieties. Trebi produced an average of 65·1 bushels per acre in this same period, but as already stated, it is rather susceptible to disease and

the straw is short. No serious weakness has been found in these smooth awned varieties in the short time they have been tested, and plans are being made to extend the tests to local districts.

PEAS

The field pea acreage in New Brunswick is small, probably due to the difficulty of procuring satisfactory yields. Aphis infest the crop each year, and although this infestation may vary in severity, it makes peas an uncertain crop. It is often difficult to harvest the crop satisfactorily as wet weather in the autumn delays ripening, causes shelling and lowers the quality of the crop. In spite of these handicaps more peas could be profitably grown in New Brunswick. They always command a good price, and farmers should grow at least enough to supply their seed for oats and peas mixtures, and also for mixtures of oats, peas and vetches, as peas are always the most expensive item in these seed mixtures. These mixtures are grown by dairy farmers in all sections of the province; therefore any surplus seed could be easily disposed of, and peas not suitable for seed are excellent high protein food.

Early Blue peas have given the largest yield each year since they were first grown in 1930. The average yield for the last 6 years was 37·4 bushels per acre. O.A.C. 181, which gave the next highest yield averaged only 28·1 bushels per acre in the same period. The average length of time from seeding to ripening of Early Blue for these 6 years was 93 days. Chancellor, the next earliest pea, required 99 days to ripen. Owing to its early maturity, the yields of Early Blue have not been as seriously affected by aphis as the other varieties.

Although Early Blue peas have given the largest yield in the variety test, they have not given good yields under field conditions on weedy land. The vines are not sufficiently luxuriant to control weeds, which smother the crop during the time the peas are ripening. O.A.C. 181 and Chancellor are more effective in suppressing weeds. They are more vigorous growers, will produce more tonnage, and are therefore more suitable for sowing in forage mixtures.

BEANS

Only 17,600 bushels of beans were grown in New Brunswick in 1935. A much larger acreage could be grown to advantage as this is not nearly enough to supply the home market, and the results at the Fredericton station indicate that New Brunswick is well adapted to the growing of beans.

The late maturing varieties of beans have given the largest yields. In the last four years N. S. Marrow, which has matured in an average of 118 days, has given an average yield of 47·95 bushels per acre. Navy Ottawa 711 and Gohn's Rainy River, which have matured in an average of 110 days, have given average yields of 46·95 bushels and 44·89 bushels per acre respectively. N. S. Marrow is a large white bean. Navy is a medium white bean, and Gohn's Rainy River is a small white bean. These varieties have been the most productive in their respective classes. They are all susceptible to anthracnose, and this disease has been rather severe in patches on the Navy bean. It has not however seriously affected the quality of the beans in recent years.

N. S. Marrow cannot be ripened satisfactorily at this Station unless it is sown soon after danger of frost is over. Districts with a shorter growing season would probably obtain better results with either Navy or Gohn's Rainy River. For districts with an even shorter growing season, or when seeding is delayed, either Yellow Eye or Soldier are recommended, as they require an even shorter maturing period. These varieties have not given as large yields as the first three mentioned. Yellow Eye gave an average yield of 35·64 bushels and Soldier a yield of 35·23 bushels per acre in the last 4 years.

BUCKWHEAT

Buckwheat is the most important grain crop grown in New Brunswick, except oats, both as regards the total acreage grown and value of the crop. This crop enables farmers to make use of land which would not grow any other cereal profitably.

In the variety tests at this station, for the last 6 years, Japanese, Silverhull, Tartarian and Rye buckwheat have yielded in the order named, but there has been no outstanding difference in the yielding ability of any of these for this period. Conditions seem to favour one or the other of these in different years.

In recent years there has been considerable decrease in yield at this station due to false blossoms. Investigations in co-operation with the Dominion Laboratory of Plant Pathology, Fredericton, seem to show that this condition is due to a virus.

FORAGE

SWEDES

Although all sections of New Brunswick are adapted to the growth of swedes, the acreage does not increase very rapidly. This is unfortunate, because in New Brunswick this crop is the most reliable source of succulent feed for winter feeding of live stock.

The varieties which gave the highest average yields at Fredericton during the last 4 years, in order of merit, were: Ditmar, Acadia and Hall's Westbury. Acadia has been grown for only 4 years. The other two maintained the same order of yield over a 6-year period. Under normal conditions all these varieties produce good sized roots suitable for either table use or for stock feeding, but they are all susceptible to the club-root disease of turnips and should not be grown on land infested with this organism.

Ditmar, which has given the highest average yield both green and dry weight per acre of any swede which has been grown continuously for a long period, is a bronze-top globe and fairly uniform in size and shape. It has been very susceptible to brown-heart.

Acadia has been surpassed only by Ditmar the four years it has been grown. It is a purple-top globe and is uniform in size and shape. This is a new variety developed by the Central Experimental Farm, Ottawa, and recently made eligible for registration by the Canadian Seed Growers' Association.

Hall's Westbury is also a purple top, a good yielder and fairly uniform in shape and size.

Club-Root Resistant Swedes.—

There are many sections in the province which are badly infested with club-root. While the ordinary varieties of swedes will not produce satisfactory crops on this land, there are some varieties which have a special resistance to this disease.

Trials of club-root resistant swedes both at the Fredericton station and adjacent districts, indicate that the club-root organism in the Saint John River valley is particularly virulent, and that no variety or strain of swedes tested will produce a profitable crop when the infestation is severe. Nevertheless, a number of varieties have shown some resistance to this disease.

Wilhelmsburger, a green-top globe, and Bangholm Herning, a purple globe, have shown the most resistance in the order named. While neither of these varieties has given as large a yield as Ditmar, they are recommended for land slightly infested with this organism, where they may either prove resistant to club-root or the injury may be slight and confined to the small rootlets. When only the small rootlets are affected, the roots are usually of good quality when trimmed.

While these varieties are recommended because they have shown resistance to club-root, farmers should endeavour to rid their land of this disease. When clean land is available, swedes, turnips and related crops should not be grown on club-root land, as manure from cows fed slightly diseased roots may help to spread this trouble. Even when club-root is slight, it is advisable either to grow swedes with fertilizer or to use manure produced when the cows are not fed either swedes or turnips. When club-root is severe, it may be best to depend on mangels for succulent feed.

BROWN HEART

This disease has undoubtedly been in the province for a long time, but it first became serious at this Station in 1929, when it was found in all varieties of swedes. The disease was so severe in 1930 as to seriously threaten the shipping of table stock to the New England States. It did not apparently destroy the keeping qualities of the swedes, but it undoubtedly lowered their value for live stock feeding.

In 1931 a concerted effort was made to find either a resistant variety or a control for this trouble. The Dominion Laboratory of Plant Pathology co-operated in the work, the station growing the roots and the staff of the laboratory making the brown heart readings. In 1933 all the experimental work was placed under the direction of a Maritime Committee composed of the staffs of the various experimental stations and the Dominion laboratories of plant pathology in the Maritime Provinces, assisted by the staff of the Forage Division, Central Experimental Farm, Ottawa.

Variety Test.—A variety test of swedes was begun in 1931 in order to ascertain if any variety or strain of swedes had any specific resistance to brown heart. This test was carried on for 3 years. The number of varieties and strains grown during these years was 140 in 1931, 122 in 1932 and 180 in 1933. In addition, 34 varieties or strains of turnips were grown in 1932. While there was some difference in the extent of injury in the different varieties, none of the swedes or turnips grown showed any specific resistance to brown heart. This experiment was discontinued in 1933 when it became apparent that brown heart could be largely prevented by applying borax to the soil.

In 1931 and 1932 the effect of manure, lime and various fertilizer formulae on the occurrence of brown heart in a swede crop was studied. The effect of early, medium and late seeding in each treatment was also studied. None of the treatments had any specific effect on the severity of brown heart. Early, medium and late seeding of swedes were also ineffective, although brown heart was not as severe on the last seeding.

Effect of Boron on Brown Heart.—

The fertilizer formulae experiment was discontinued in 1933 because the experimental work of the two previous years had clearly shown that neither heavy, nor medium applications or the omission of either nitrogen, phosphorous or potash in commercial fertilizers had any specific effect on the amount of brown heart in a swede crop.

The 1933 tests were more comprehensive and included trials of the effect of various rarer elements, and excessive manure applications on acid and alkaline soils artificially induced by employing sulphur and lime respectively. The effect of early and late seeding was also studied on these combinations. The treatments indicated that applications of sulphur reduced the severity of the disease and that borax applied in the drill at the rate of 10 pounds per acre appeared to definitely control brown heart. Brown heart was not as prevalent on late as on early seeding. The beneficial effect of borax was confirmed in the experimental work at the other Maritime experimental farms and at various illustration stations.

Borax was tested in both wet and dry form in 1934. It was applied with various carriers which included commercial fertilizer broadcast at a maximum of 30 pounds per acre and in drills at 10 pounds per acre. Tests were also conducted on the depth of placement, the depth ranging from ½ to 5 inches.

The trial of methods of application demonstrated that borax could be applied successfully in fertilizer, either broadcast or directly in the drill. Applications in the wet form before seeding and after germination were successful. Deep placement of borax in the drill (2-5 inches) was more effective than shallow application (½ to 1 inch).

The medium and deep placements caused some yellowing of the foliage, which disappeared however, after a period of about 2 weeks. Such yellow plants were slightly retarded in growth early in the season but they made good recovery. The results obtained at Fredericton were confirmed at other points where these trials were being carried on.

Experiments with borax were continued in 1935. It was established without a doubt that borax added to fertilizer or manure is effective in controlling brown heart. Manure was slightly superior to fertilizer, or fertilizer plus manure, in controlling brown heart. Wheat, oats and barley sown on plots treated with borax the previous year did not show any injury from the borax residue.

In 1936 borax applied broadcast at rates ranging from 10 to 60 pounds per acre had no harmful effect on swedes, mangels, potatoes, oats, wheat and barley grown in plots. This was also true of corn, sugar beets, rape, kale, oats, peas, vetch and millet grown on land to which an application of 30 pounds of borax per acre was applied broadcast in the superphosphate a week or more before seeding.

Third-year hay showed no harmful effect from 30- and 60-pound applications of borax per acre applied on May 1.

As a result of these trials, this station recommends either 15 pounds of borax per acre in the drills, or 30 pounds per acre broadcast, for the control of brown heart in swedes. For the swedes in the variety test in 1936 the broadcast application was made by mixing 30 pounds of borax with 70 pounds of superphosphate. This was put on with a fertilizer spreader at least a week before the crop was sown.

While no harmful effects have been noticed this year on any of the crops to which borax was applied, the rains were timely this summer and it is possible that results might not be the same in a dry year.

MANGELS

In some sections of the province part of the swede crop is being replaced by mangels, the reason for the change being that mangels have better keeping qualities, are not affected by diseases such as club-root, and are more suitable for swine feeding. Mangels require a well prepared seed-bed and a soil that is both fertile and well drained. This has been clearly shown at this station both when mangels were grown as a field crop and when they were grown in a variety test. When soil conditions were good, the long, half-long, intermediate and tankard types have all given good yields, although results favour the half-long and intermediate types.

Half Sugar White has given the highest average yield of dry matter in the last 4 years. It has a high percentage of dry matter. It is a half-long root and is usually harder to pull and more rooty than the intermediate type.

Yellow Intermediate and Danish Sludstrup have given the next highest yields with no appreciable difference between the two. They are intermediate types and are easily harvested as they are free from roots and readily pulled. They have a fairly high percentage of dry matter. (Yellow Intermediate from the Central Experimental Farm, Ottawa, has had the highest average percentage dry matter in the variety tests for the last 4 years.)

Long Red, as its name suggests, is a long type and is both hard to pull and rooty. It has given lower yields of dry matter than either the half-long or intermediate types. Considerable ground adheres to the roots especially in wet weather. Although this makes them harder to handle, it does not appear to spoil the keeping quality which is usually good. At this station the seed of the Long Red type has usually germinated better than the other types.

Variety tests of mangels at the Dominion Experimental Station, Fredericton, N.B. The Danish Sludstrup, an intermediate type in the centre of picture, produced 55·68 tons of mangels per acre in 1932.

Yellow Tankard is both easy to pull and free from roots. It has, however, a lower average percentage dry matter than the long, half-long and intermediate types.

Yellow Globe is easy to pull and free from roots, but it has given lower average yields per acre both green and dry weight than the other types. It also has the lowest per cent dry matter.

CORN

Nearly all the forage corn grown in New Brunswick is used for fall feeding, only a few favoured sections being adapted to growing corn for silage.

It is doubtful if the Fredericton station is particularly adapted to the growth of corn. Nevertheless, good yields have been obtained most years. The largest average yields of both green and dry matter have been obtained from the later maturing varieties. In the last 4 years Burr Leaming, the latest maturing variety grown, gave an average yield of 4·11 tons dry matter per acre as compared with 3·91 tons for Longfellow, the next highest yielder. Burr Leaming has been a consistent high yielding variety, but as already stated, it is late maturing. Although conditions were favourable for corn 3 of the last 4 years, the kernels were in the watery stage each year.

While Longfellow gave slightly less yield, it was more mature, the kernels being from milk to dough stage each year. Results both in the variety tests and in the field indicate that this is one of the best varieties of corn to grow for forage in this district and it is recommended by this station.

Compton's Early, Wisconsin No. 7 and Iroquois all gave lower yields of dry matter. Compton's Early and Wisconsin No. 7 were in approximately the same stage of maturity. Iroquois was slightly more mature.

Twitchell's Pride, the earliest variety tested for forage, was glazed in 1933, 1934 and 1935, but only a small percentage was glazed in 1936. Northwestern Dent had begun to glaze in 1933 and 1935 and was in the dough stage in 1934 and 1936. Although both Twitchell's Pride and Northwestern Dent are earlier maturing than Longfellow, they are not recommended as both green and dry matter yields are much lower, Twitchell's Pride giving an average yield of 3·14 tons and Northwestern Dent 3·15 tons dry matter per acre for the last 4 years.

While Twitchell's Pride is not suitable for a forage crop, because of its low yield, it has possibilities as a husking corn. This variety was obtained from G. M. Twitchell, Nonawick, Maine, eighteen years ago and has ripened satisfactorily at this station every year except two. Twitchell's Pride grown at this station was awarded first prize for corn ripening in less than 110 days, at the World's Grain Exhibition in Regina in 1933.

FLESHY ANNUALS—RAPE AND KALE

Rape and kale do not require as much hand labour as either swedes or mangels. For this reason it is sometimes advisable to grow these crops for fall feeding although the average yields of both green and dry weight per acre are usually lower. This has been especially true in dry years.

During the last 4 years Purple Marrow Stem kale has given the highest average yield of both green and dry matter, followed by 1000 Headed kale and Dwarf Essex rape in the order named. Green Marrow Stem kale, which has been grown only the last 3 years, has given the highest average yield for that period.

Dwarf Essex rape has been grown for a number of years for fall pasture. It has been found especially satisfactory for weaning lambs and for flushing ewes. Kale has been grown only in the variety tests.

ANNUAL HAYS

In recent years there has been considerable interest shown in annual hays. In order to provide reliable data on the value of these hays, a comparative test was begun in 1934. The mixtures and single species sown, the rate of seeding and the average hay yield per acre for the last 3 years were as follows:—

	Tons
Oats, 2 bushels; peas, ¾ bushel; Vetch, ¼ bushel	3·36
Oats, 3 bushels	3·28
Oats, 2 bushels; peas, 1 bushel	3·23
Japanese Millet, 25 pounds	3·08
Oats, 2 bushels; fall rye, 1 bushel	2·62
Siberian Millet, 25 pounds	2·33
Soybeans (Mandarin), 90 pounds	2·02
Soybeans (Wisconsin Black), 90 pounds	2·01
Early Amber Cane Sorghum, 25 pounds	1·76
Sudan Grass, 25 pounds	1·57

There was comparatively little difference in the yields obtained from oats, peas and vetch, oats alone and oats and peas. Oats, peas and vetch, and the oats and peas, however, produced a hay which was superior to oats alone, both in protein content and in palatability. Adding fall rye to oats decreased the yield. The fall rye has been so short at harvest each year that a large per-

centage of it could not be gathered. The oats and oat mixtures have been cut each year when the oats were in milk.

The first 2 years all the annual hays were sown late in May. In 1936, however, the oats and oat mixtures were sown on May 27, soybeans were sown on June 2 and the millets, Early Amber Cane Sorghum and Sudan Grass were not sown until June 15. This later seeding seemed to favour the millets, especially Japanese Millet, which produced 4·48 tons hay per acre as compared with 3·85 tons for oats, sown as a check on the same date, and 3·94 tons for oats sown on May 27. These hay yields were derived by figuring 85 pounds dry matter as equal to 100 pounds hay containing 15 per cent moisture. Japanese Millet sown in this trial on June 15 produced 3·81 tons dry matter per acre. When labour costs are taken into consideration, this yield compares favourably with the yields of any variety of corn, swede, mangel or fleshy annual grown that year. They were all grown on similar land and the fertilization of all these crops was exactly the same. Japanese Millet is suitable for seeding on fertile land. It will produce a heavy soiling crop. It can also be made into hay, although owing to its late maturity it is not easy to cure if the fall is wet. For hay, Siberian Millet, which matures earlier, may be preferable in districts with short growing seasons, although it has a considerably lower yield.

Soybean yields were reduced by poor germination in 1934 and again by hail injury on June 12, 1935. However, when due allowance is made for these conditions, the yields were not as large as those from either oats alone, the oat mixtures or the millets. The hay, however, was of superior quality, as it had a high percentage of protein. By using straddles, this crop was readily made into hay.

Early Amber Cane Sorghum and Sudan grass are not adapted to this district.

Oats, oat mixtures and soybeans were sown with an ordinary grain drill; millet, cane sorghum and Sudan grass were broadcast.

SOYBEAN

While the widespread interest shown by farmers in New Brunswick in the soybean is largely due to the good results obtained in other provinces of Canada, and the United States, where the growing season is longer, results obtained at this station indicate that fair yields can be obtained in this section of New Brunswick. When the high percentage of protein in the soybeans is taken into consideration, the possibilities of this crop seem well worthy of consideration.

Early maturing soybeans have ripened satisfactorily every year. Medium early varieties usually ripen seed and they have produced the largest yields in favourable seasons. When the season is backward, however, they will not ripen satisfactorily. The late maturing varieties such as Manchu, Disco and O.A.C. 211 have not been suitable as a seed crop even in favourable years.

For the three years 1933, 1934 and 1935, Manchu (Hudson) and Mandarin, two medium early varieties, yielded an average of 26·61 and 26·6 bushels seed per acre respectively. In the same period Wisconsin Black and Manitoba Brown, two early varieties, yielded 24·69 and 23·11 bushels per acre respectively. In 1936, however, Wisconsin Black and Manitoba Brown were the only varieties which ripened satisfactorily in the variety test. This was partly due to the test being located on late land, because Mandarin gave a good yield under field conditions on early land.

Manitoba Brown, which is the earliest variety tested, required 117 days to mature in 1933 and 1934, and 130 days in 1935. Wisconsin Black required 126, 127 and 137 days to mature in 1933, 1934 and 1935 respectively. Notwithstanding their late maturity as compared with most other crops, excellent quality soybeans have been grown. They are not affected by the slight frosts

which occur in May, September and early October. Also, as the crop ripens it sheds its leaves and the beans will ripen on the stalks. At the Fredericton station soybeans are not harvested until the beans are hard enough to thresh. This crop has been remarkably free from insect pests and disease.

Strain Test.—A number of early-maturing strains of soybeans were grown in 1935 and 1936. Some of these new strains show superior yielding ability to either Manitoba Brown or Wisconsin Black and have produced beans of excellent quality and are sufficiently early to ripen seed every season. These strains of soybeans produce yellow beans; this colour is preferred to either brown beans like Manitoba Brown or a black bean like Wisconsin Black.

Seed yields of Mandarin soybeans were definitely increased by inoculation in 1933 and 1934. Culture for this purpose may be obtained from the Bacteriological Division, Central Experimental Farm, Ottawa.

Effect of Superphosphate on Maturity.—The application of 100, 200 and 400 pounds superphosphate in the rows had no apparent effect in hastening maturity of Mandarin soybeans in 1933, 1934 or 1935.

Soybeans for Hay.—Late and medium early maturing varieties of soybeans for hay were compared in 1933 and 1936. O.A.C. 211, a late variety, gave a larger yield both years than Mandarin, a medium early variety. Even the earlier maturing variety was not ready to cut for hay until September on either occasion. It is difficult to cure soybeans that late in the season unless they are put on straddles. O.A.C. 211 cured satisfactorily on straddles in 1936. In 1936 these soybeans were sown in drills 30 inches apart and weeds were easily controlled with a cultivator. Seed was sown at the rate of 50 pounds per acre in order to prevent the stalks from being coarse. In 1933, when they were sown with a grain drill in rows 7 inches apart, the soybeans were not effective in controlling weeds as they start slowly in the spring. This was also noticed in the soybeans which were sown with the grain drill in the annual hays the last three years.

MILLETS

While the acreage of millets grown in New Brunswick is small, this crop is favoured as a soiling crop in some sections and the acreage is increasing. For this reason tests have been carried on the last 3 years with a number of strains developed at the Central Experimental Farm. Some of these strains are especially promising, giving almost as large yields as Japanese millet and being much earlier they can be cut for hay in good season.

The grain yielding ability of these millets has also been investigated. Results in 1935 and 1936 indicate that they are much inferior to both oats and barley as a grain crop.

PASTURES

The pastures on the average farm in New Brunswick are less fertile than when the land was first cleared. Plant food is being continually removed from them to produce milk, meat, bone, etc. Available plant food is also being removed each fall and spring by leaching. This would not be so important if these pastures were originally located on fertile land, but the reverse is more often true. On many farms the pastures consist of the most broken, rocky and least fertile fields, the more desirable land being used to grow hay, grain or hoed crops.

The best pastures at this station in 1922 were very little better than the average pasture in the district. The growth was largely bent grass (brown top) with a mixture of other grasses, weeds and moss. Wild White clover was present but the plants were so small that they had very little value. In order to maintain the milk flow, it was necessary to feed milch cows grain all summer and either green feed or silage, except for a short time during the flush period.

The rough pastures were even poorer. Twenty-one growing heifers lost an average of 28 pounds per head while at pasture in 1922

EARLY PASTURE IMPROVEMENT STUDIES

Basic slag was the first fertilizer used on the pastures at Fredericton. It was used because of the excellent results secured from basic slag on British pastures. In the spring of 1923 a 22-acre field was top dressed with 400 pounds basic slag per acre. This field was not fertilized again for 5 years, and pasture was not noticeably improved in that time.

A small area in this field was reserved for fertilizer trials on mowed plots. These trials were also begun in 1923. Basic slag was used at rates ranging from 250 to 1,000 pounds per acre. The equivalent of 500 pounds of basic slag per acre in the form of superphosphate was also tested both alone and with 1,000 and 2,000 pounds of ground limestone per acre. Ground limestone alone at the rates of one and two tons per acre was also tested. These treatments were repeated in 1926 and again in 1929. Nitrate of soda was applied alone in 1923, 1926, 1928 and 1929 at the rates of 100 and 200 pounds per acre. All fertilizer was applied as a top dressing in the spring.

All treatments gave slight increases but none of them gave a profitable increase. The best results were obtained from superphosphate. Both alone and when used in combination with ground limestone it gave a larger average increase in yields than the other treatments.

LATER PASTURE IMPROVEMENT STUDIES

The first definite pasture improvement was made in 1928. That spring four 3⅓-acre fields were taken from the field which was top dressed with 400 pounds of basic slag in 1923. On April 28 these fields were given a broadcast application of 50 pounds of sulphate of ammonia, 350 pounds of 16 per cent superphosphate and 100 pounds of muriate of potash per acre. Three of these fields were top dressed with 125 pounds of nitrate of soda per acre in May and with an additional 100 pounds later in the season. The remaining field did not receive any more fertilizer after April 28.

These fields were rotationally grazed. The improvement in the pastures was striking. The fields carried an average of 1·13 cows per acre from May 26 to October 8, inclusive. The cows maintained their milk flow better than in previous years although they were fed less grain and were not fed any roughage until October.

The three fields receiving the two applications of nitrate of soda later in the season were better than the field given only the initial application of fertilizer on April 28, but they were not enough better to justify the additional 225 pounds nitrate of soda per acre which they had received, so when the experiment was revised the next year, a smaller amount of nitrogenous fertilizer was used.

The grazing and fertilization experiment in 1928 had been conducted in order to study the effect of a pasture fertilization system, which consisted of a liberal application of superphosphate and muriate of potash, successive applications of nitrogen, and rotational grazing.

In 1929 the experiment was revised and enlarged so as to compare the system of rotational grazing with continuous grazing when the same amount of fertilizer was used in both cases. Continuous grazing with applications of fertilizer was also compared with continuous grazing on unfertilized pasture.

Twelve and one-half acres of the 13⅓ acres fertilized the previous year were divided into five fields of 2·5 acres each. Four of these fields were rotationally grazed, the remaining field was continuously grazed. These five fields were all given complete fertilizer treatment. An adjoining 2·5-acre field on similar land was continuously grazed but was not fertilized.

This experiment was carried on with only minor changes until the fall of 1935. The fertilizer treatment on the five fertilized fields consisted of 350

pounds of 16 per cent superphosphate or the equivalent of 20 per cent superphosphate, and 100 pounds of muriate of potash every two years, and 150 pounds of either nitrate of soda or nitro-chalk each year.

While the amount of fertilizer used remained the same throughout the experiment, the time of application was changed in order to reduce labour costs. During the early years each field was given two applications of either nitrate of soda or nitro-chalk, 100 pounds per acre being applied in the spring at commencement of growth and the remaining 50 pounds being applied a month to six weeks later. Beginning 1932, all nitrogen fertilizer was applied at commencement of growth, viz., the last of April or early in May. The superphosphate and muriate of potash for the 1929, 1931 and 1933 grazing seasons were applied the previous fall, either late in October or early in November. In 1935 they were applied with the nitrogen fertilizer at commencement of growth.

The average grazing results per year for the seven-year period 1929-35 are shown in the following table:—

GRAZING RESULTS—AVERAGE 7 YEARS—1929-35

Plot treatment	Number of days in pasture season	Carrying capacity		Yield per acre dry matter, average 3 years
		Cow days per acre for season	Cows per acre per day	
				lb.
Continuously grazed and fertilized	137	195·84	1·43	7,183
Rotationally grazed and fertilized	137	205·57	1·50	7,283
Continuously grazed and unfertilized	137	121·24	0·89	3,096

Milch cows were used most of the time for grazing, and carrying capacity is expressed in cow days. The yield of dry matter was obtained from caged areas on four representative places in each field. The herbage under these cages was cut three or four times in the season and the cages were moved to new areas after each cutting, in order to have the yields taken under more natural grazing conditions.

PASTURE MANAGEMENT

While fertilized pasture has much surpassed unfertilized pasture, the difference between continuous and rotational grazing has been slight. For the 7-year period 1929-35 inclusive, the continuously grazed fertilized field had an average carrying capacity of 195·8 cow days per acre as compared with 121·2 cow days per acre for the continuously grazed and unfertilized field, an increase in carrying capacity of 61·5 per cent due to fertilization. In that same period, the rotationally grazed fields had an average carrying capacity of 205·6 cow days per acre or an increase of 69·6 per cent over the continuously grazed unfertilized field.

Continuous grazing as now practised at this station includes many of the better features of rotational grazing. The pastures do not carry the same number of cows throughout the grazing season and all the cows are taken off the pastures whenever it is thought advisable to do so. In order to keep the pastures under proper control, it is necessary to start grazing as early as possible in the spring and graze heavily during the entire period of rapid growth. This prevents much of the grass from heading out and encourages the growth of white clover.

In 1936, the cows were turned to pasture during the day on May 12. They were turned to pasture night and day on May 18. Grain feeding was discon-

Grazing scene at the Dominion Experimental Station, Fredericton, N.B., showing pasture where the grass has been kept under proper control throughout the grazing season.

This pasture illustrates the ill effects of under-grazing.

tinued May 20 and no grain, silage, green feed or hay was fed until September 1, when a small grain allowance was given to animals which had freshened recently or were approaching calving. After the fertilized pastures had been grazed short early in the season, the cows were turned to the unimproved pastures to take advantage of the natural June flush and to permit the fertilized pastures to recover. The fertilized pastures were rested whenever it was thought advisable, and advantage was taken of aftermath on hay fields, green oats sown for this purpose, and unimproved pasture.

While close grazing, especially early in the season, is recommended, it is generally considered advisable to avoid grazing the herbage very short late in the fall. If the cows are removed from the pastures a few weeks before the ground freezes, the plants have a chance to recover. This may result in less winter killing and earlier and more vigorous growth in the spring.

The fertilized pastures were mowed on June 15 in order to control buttercups which have become prevalent. During this operation some grass was also cut but it was readily eaten by the cows when it was partially dried. When pastures are mowed early in the season when growth is rapid, they do not get a set-back and conditions are made more favourable for the growth of wild white clover. In previous years, when mowing was done later in the season, even as early as the first week in July, the pastures were given a severe set-back.

The fertilized pastures are harrowed both ways each fall after the grazing season with a chain harrow. This harrowing spreads droppings and helps to prevent rank growth around droppings the next summer. Pastures have not been harrowed during the grazing season in recent years because the grass becomes soiled with manure and this increases the amount of grass that the cows will not eat.

SUPPLEMENTARY PASTURES

No system of pasture fertilization has been discovered that will enable a New Brunswick pasture to carry as many cows in August and September as in June and early July. If only the number of cows which a pasture will carry in midsummer are kept on a pasture early in the season, the grass will be insufficiently grazed and a large percentage of it will head out, thus lowering the feeding value of the grass and hindering the growth of white clover. If a sufficient number of cows to control the growth in June are kept on the fields in August and September, the pasture will be overgrazed and it will be necessary to provide supplementary feed in the form of green feed, hay or grain.

In order to provide supplementary pasture in late summer, two fields of 2·5 acres each were laid out in 1931 with the object of cutting the hay early and using the aftermath for grazing. These fields had been seeded with the regular hay mixture in 1929. The usual practice has been to cut the hay on these fields during the last week in June and graze only the aftermath, although one field has been grazed occasionally before being cut for hay. The fertilizer treatment for the most part has consisted of an application of 280 pounds of superphosphate (20 per cent) or the equivalent, and 100 pounds of muriate of potash per acre every two years. Nitrate of soda has been applied at the rate of 100 pounds per acre in the spring and 100 pounds when the hay is removed.

For the last 5 years, these fields have given an average yield of 1·55 tons of good quality hay and provided grazing for 68·64 cow days per acre. This method of providing supplementary pasture would seem to have considerable merit where conditions favour the setting aside of a certain field for this purpose. In any event, aftermath from hay fields where the hay has been cut early will usually provide a considerable amount of grazing in August and September.

Oats have been grown as an annual supplementary pasture. Cattle were turned to pasture in the oats just before they started to come in head. Oats must be sown two or three weeks later than for the main grain crop in order to provide

pasture late in the season. In 1936, oats provided 75 four-hour grazing periods per acre. After the cows were removed from the oats each day, they grazed on ordinary grass pasture and production remained satisfactory.

In 1936, New Zealand orchard grass was seeded with the oats with the object of providing early pasture next spring, and supplementary pasture later in the summer. New Zealand orchard grass has persisted well in a plot seeded in 1932, and it commences growth earlier in the spring than native grasses. This plot was grazed along with plots of other grasses on May 14, 1936. The orchard grass had developed considerably more growth than the others and the cows grazed it in preference to most other grasses.

COST OF FERTILIZER AND RETURNS

The average annual cost of the fertilizer applied to the pastures in the 7-year period 1929-35 was $6 per acre. With milk worth 91 cents per hundred pounds the average value of the milk produced per acre over the cost of supplementary feed and fertilizer is $28·41 for the fertilized fields and $21·18 for the unfertilized field. In other words, the fertilized pastures produced enough extra milk to pay for the fertilizer and supplementary feed and still return a profit of $7.23 per acre more than the unfertilized field. The increased yield of dry matter from the fertilized fields over the unfertilized field, determined from caged areas is 4,137 pounds. This is equivalent to 2·43 tons of hay. This increased yield alone is worth more than the cost of the fertilizer applied and the fertilized pastures have a much thicker turf made up of more desirable grasses and white clover than the unfertilized pasture, which still contains a considerable amount of moss and weeds. Once a pasture has been improved and a good sod established, it is quite possible that the nitrogen fertilizer can be greatly reduced or even eliminated and thus reduce the cost of the fertilizer. An experiment is under way at the present time to determine if this assumption is correct.

Further evidence of the value of good pasture is contained in the cost of production records at this station. The average feed cost of milk and butterfat production for the four years 1932-5 in January was $1.18 per hundred pounds milk and 30 cents per pound butterfat, while in June the feed cost was 30 cents per hundred pounds milk and 8 cents per pound of butterfat. On May 11, 1936, under barn feeding conditions, the production from the 23 cows comprising the milking herd was 683 pounds. Production increased steadily after the cows went to pasture and grain feeding was discontinued after May 20. One month later, when the cows were much further advanced in their lactation periods, these same 23 cows produced 756 pounds of milk. Even though 1936 was a favourable year for pastures, it is perhaps safe to say that without improved pastures these cows would have had to be barn fed for two weeks longer and production would have been lower. It is reasonable to assume that under some conditions, this extra pasture in the spring alone would pay for the fertilizer applied to the pastures.

PASTURE FERTILIZER ON SMALL PLOTS

Live stock grazing on pasture return a large percentage of the nitrogen, phosphorous and potash in the grass they eat to the pasture in urine and manure, but when the grass on pasture plots is mowed and weighed, all the plant food in the cut grass is removed from the plot. Therefore, although small mowed plots are used to secure additional information on the various problems of pasture fertilization, this information is at best only indicative.

The standard mineral treatment for pasture plots consists of 350 pounds of 16 per cent or 280 pounds of 20 per cent superphosphate, and 100 pounds of muriate of potash per acre. The standard nitrogen treatment is 100 pounds of nitrate of soda per acre. The two treatments represent 800 pounds of 2-7-6

fertilizer per acre. The mineral treatment has been applied both in the fall and spring, but in recent years it is applied in the spring at commencement of growth. The nitrogen treatment has always been applied at the commencement of growth. Unless otherwise stated, both treatments are applied as a top dressing.

Results indicate that a pasture can be improved profitably by the mineral treatment alone. Minerals have been applied each year, every two years and every six years. The largest increase in yields has been obtained when minerals were applied each year, but a cheaper increase in yields was secured when they were applied every two years. When applied every six years they were only slightly effective the third year and did not noticeably increase yields the fourth, fifth or sixth year.

Pastures can be improved more quickly and profitably, however, by using also the nitrogen treatment, at least in the early years of pasture improvement; but nitrate of soda is not effective unless the mineral treatment is fairly liberal. One hundred pounds of nitrate of soda gave good increases in yields when minerals were applied each year and every 2 years. When the mineral treatment was applied every 6 years, nearly all the increase in yield due to nitrate of soda was secured the first 2 years after applying the mineral. Two later applications of nitrate of soda of 50 pounds each per acre at 4- to 6-week intervals both increased yields when minerals were applied each year, but when minerals were applied every 2 and every 6 years, the second and third applications of nitrate of soda gave very low average returns. The effectiveness of these later applications of nitrate of soda is largely dependent on weather conditions, and as they greatly increase the cost of applying pasture fertilizer, they are not recommended by this station.

With one exception, minerals have helped to distribute increase in yield over the entire grazing season. The year minerals were applied fair increases in yields have been secured at each cutting. The year minerals were not applied, the increase due to nitrate of soda has nearly all been obtained in the flush period, that is, in June and early July.

Nitrate of soda has given slightly higher yields than either nitro-chalk, cyanamide or sulphate of ammonia. The latter has given the smallest increase, but the differences were not striking. The nitrogen treatment in this test was the equivalent of 160 pounds nitrate of soda from each source. The plots were top dressed every two years with either 300 pounds of 16 per cent or 240 pounds of 20 per cent superphosphate and 75 pounds of muriate of potash per acre.

Potash used in combination with nitrate of soda and superphosphate has always increased yields at this station. It has also increased yields when used with superphosphate. One hundred pounds of muriate of potash per acre have given larger returns than smaller applications, but definite recommendations cannot be made as to the most profitable amount to apply. This subject is being further investigated.

LIME

Lime has been used in pasture improvement at the Fredericton station with varying results. Two tons of ground limestone per acre, harrowed into the soil before seeding, definitely increased yields of both grasses and clovers in the only experiment in which this method of applying ground limestone was used.

Top dressing with one and two tons of ground limestone per acre has been fairly effective on pastures fertilized with a complete fertilizer, for some years previous to applying the ground limestone.

Top dressing unimproved pastures with ground limestone has always slightly increased yields but not enough to justify the expenditure. This has been the case on both new seeded and on permanent pasture.

The pH of the untreated soil of the field on which ground limestone was harrowed into the soil, was 5·4, and on the field to which ground limestone was applied as a top dressing, ranges from 5·2 to 5·6. This indicates that both fields were medium acid.

RESEEDING PASTURES

While most of the pasture improvement work at this station has been conducted on permanent pastures, the behaviour of reseeded pastures is also being investigated.

The first work was begun in 1929; that spring a piece of pasture land which had been ploughed the previous August was seeded with a seed mixture recommended by the Forage Division, Central Experimental Farm, Ottawa. Basic slag, superphosphate and ground limestone singly, and superphosphate and ground limestone in combination, were applied to this new seeded pasture as a top dressing. This area is located in the same field as the fertilized permanent pastures and was alongside the plots laid out in 1923. The test was designed to find out if the fertilizers used would give better results on new seeded pastures than they had previously given on permanent pastures. The result was the same in both cases, all the fertilizers giving slight increases in yield, but none giving a profitable increase. When one-third of the plots were top dressed in the spring of 1932, with 100 pounds of nitrate of soda, 350 pounds of 16 per cent superphosphate and 100 pounds muriate of potash per acre, yields were increased 80 per cent, showing that this new seeded pasture would also respond to a complete fertilizer.

Reseeding may be advisable when pastures are weedy and rough. An acre which was seeded in 1932 is located on similar land and in the same field as the fertilized permanent pasture. This acre has been given about the same fertilizer treatment as the permanent pasture, and the stock carrying capacity is about the same. This indicates that equally good results can be obtained when pastures are broken up and reseeded.

Trials at this station have shown that the seed mixture sown is not as important as liberal pasture fertilization and good management. When pastures were well fertilized, volunteer grasses and native white clover quickly formed an excellent turf. None of the single pasture species or mixtures sown provided good grazing on unfertilized pastures. When the land was well fertilized, however, plots sown with various grasses and clover mixtures, plots sown with single grasses such as timothy, Kentucky Blue grass and New Zealand orchard grass, and plots which were not seeded with either grass or clover, have all become excellent pastures. Timothy, red clover (Canadian grown) and alsike furnished good grazing the first year, after which volunteer grasses and native white clover have provided excellent pasture. This seed mixture is recommended by this station because the seed is comparatively cheap and can be purchased from any seed dealer. The money saved by not buying a more expensive pasture seed mixture can be profitably used to purchase pasture fertilizer.

Observations at this station show that timothy persists fairly well on fertilized pasture and that it is relished by all classes of live stock. The volunteer bent grass (brown top), fescues, Canadian Blue grass, etc., which gradually thicken the stand on new seeded pasture, are all readily eaten on well fertilized, closely grazed pastures. Red clover and alsike are not persistent, but when pastures are liberally fertilized and closely grazed, native wild white clover quickly replaces them.

On unfertilized pastures, wild white clover plants are usually small and lack in vigour. Although wild white clover was fairly abundant on unfertilized pasture in 1936, it has very little value most years. This clover is present in all pastures at this station. If this were not so, it would be good practice to sow a pound of wild white clover in the seed mixture used in reseeding pastures.

Neither Dutch nor mammoth white clover can be recommended for a pasture seed mixture. They largely disappear from the pastures the third year and wild white clover does not seem to thrive while they are present.

Rough-stalked meadow grass has possibilities as pasture grass. This grass produces a very low yield in pure stands, but its presence in pasture plots has promoted the growth of wild white clover.

Perennial rye grass has persisted for three winters when seeded with English wild white clover. When sown alone, 90 per cent winter-killed the second year.

New Zealand orchard grass is especially promising. This is a leafy grass and provides early grazing as it starts early in the spring. It also provides grazing through the summer as it starts quickly after being grazed and is apparently persistent and winter hardy. It has come through four winters at this station without winter-killing. Cows turned on this grass early in May preferred it to either timothy, Kentucky blue, red top or the various mixtures of grasses and clovers. This was not true when the pasture was not grazed early in the season.

POULTRY

BREEDING

The poultry flock consists entirely of Barred Plymouth Rocks. This breed continues to be the most popular one in the province and it is admirably suited as a general purpose breed for the average mixed farm. New Brunswick Barred Plymouth Rocks are unexcelled for egg production and they are well suited for the production of roasters of the heavy class.

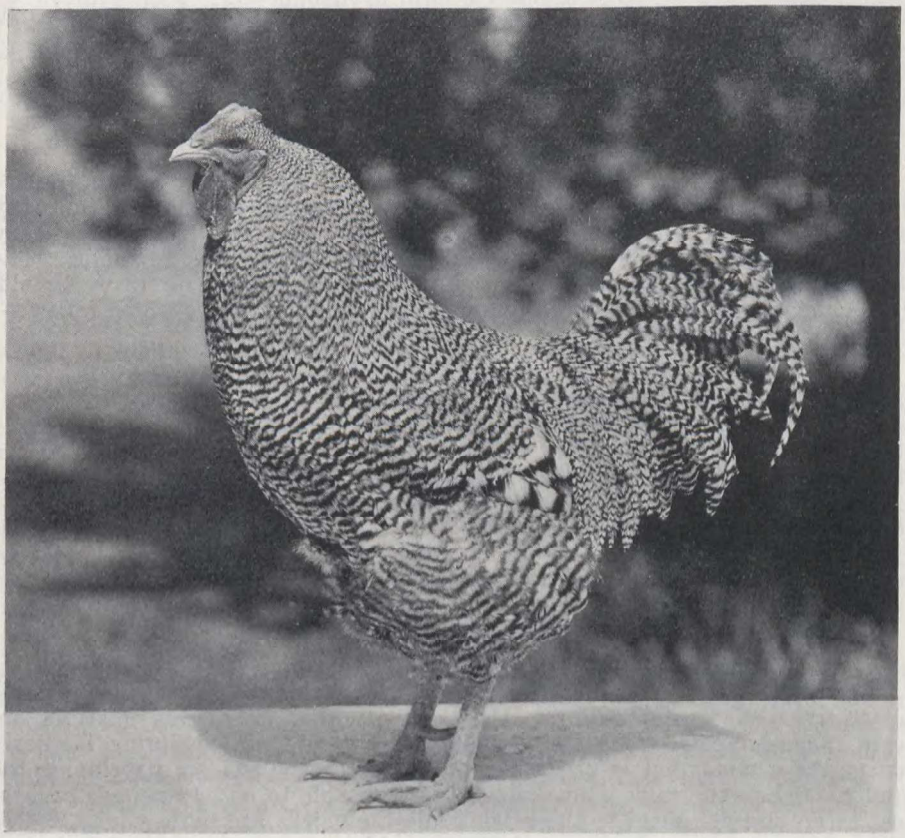
Poultry registration is featured in the breeding work and a sufficient number of chicks are hatched from registered matings each year to provide the station's requirements of pedigree pullets. The males of exceptional quality and breeding are registered and sold largely to leading breeders in the province. One hundred and eighty-seven pullets are entered in R.O.P. this year and R.O.P. cockerels have been much in demand.

Progeny records are kept for each male producing at least four pullets from at least four dams. These records include body weights, egg weights, hatching results, egg production, mortality and other information which may be useful in selecting the more desirable families for breeding purposes. These records show that males differ in their ability to transmit production, vigour and other characteristics to their progeny. Good males may be used several seasons. One registered Barred Plymouth Rock male, Fredericton 33L —14714— has been used three seasons and he is still in a vigorous condition. In one year, he had 86 daughters banded, with a mortality of 6·98 per cent. His daughters produced an average of 197·28 eggs, weighing an average of 24·4 ounces per dozen. Another male, the same year, had 26 daughters banded from hens of similar breeding. There was a mortality of 23·08 per cent in this group and the average production was only 164·48 eggs weighing an average of 24·1 ounces per dozen. Records show that even high producers from males of this kind are likely to be poor breeders and the entire family should be discarded. If breeding stock is selected only from matings which give consistently high producers, much greater progress will be made.

FEEDING AND MANAGEMENT

Production and the health of the flock have been very satisfactory. With the exception of respiratory diseases in the fall of the year, which appear to be presenting a problem, there have been no outbreaks of contagious disease. A few changes in feeding and management have been made as a result of experimental work.

The feed mixture during the hatching season has been changed, with the result that hatchability from pedigree matings has increased from about 40 per cent to over 50 per cent of the total eggs set. The breeding ration has also been changed in order to include a higher proportion of feeds produced in Canada.



Registered Barred Plymouth Rock male, Fredericton 33L-14714. In one year he had 86 daughters banded with a mortality of only 6·98 per cent. His daughters produced an average of 197·28 eggs, weighing an average of 24·4 ounces per dozen.

The system of moving the brooder houses each year to clean clover sod is followed, and the chicks are given a yard as soon as weather permits. The cockerels are separated from the pullets when about 9 weeks of age and they are all moved to clean clover or grass range when they are about 12 weeks of age. The brooder houses and laying houses are thoroughly scrubbed and disinfected before the chicks or pullets are placed in them. These practices, along with blood testing for pullorum and reasonable cleanliness in all operations, as well as the immediate disposal of birds suspected of having contagious disease, have no doubt been responsible for the maintenance of a healthy flock.

The following feed mixtures have given satisfactory results at this Station and are being used at present:—

Starting Mash Mixture—

100 pounds shorts.
100 pounds middlings.
100 pounds corn meal.
100 pounds ground oat groats or ground oats with hulls sifted out.
16 pounds meat scrap
16 pounds fish meal.
16 pounds milk powder.
14 pounds bone meal.
10 pounds cod liver oil.

Feeding Directions.—Liquid milk is not required with this starting mash. The chicks are given water to drink when they are about 48 hours old and they are given their first feed on heavy wrapping paper about one hour later. They receive 2 feeds the first day and 4 to 6 feeds daily for the next few days. The mash is then fed in open hoppers until the chicks are from 8 to 12 weeks old, when a change is made to the growing mash and grain mixtures which follow:—

Growing Mash Mixture—

100 pounds corn meal.
100 pounds middlings.
100 pounds ground oats.
50 pounds bran.
15 pounds bone meal.
5 pounds charcoal.
4 pounds fine salt.

Growing Grain Mixture—

200 pounds wheat.
100 pounds cracked corn.
100 pounds whole oats.
100 pounds barley.

Feeding Directions.—The chicks are placed on range as soon as possible and receive their green feed from that source. Mash and grain mixtures are fed in range hoppers. A limited amount of skim-milk is fed during the early part of the summer but is discontinued later if the pullets are developing too rapidly. If no skim-milk is available, it is advisable to add 15 pounds each of meat scrap and fish meal to the mash while the chicks are quite young and to reduce this amount gradually as they grow older.

Laying Mash Mixture—

100 pounds ground oats.
100 pounds corn meal.
100 pounds middlings.
100 pounds bran.
25 pounds fish meal.
25 pounds meat scrap.
15 pounds bone meal.
5 pounds charcoal.
5 pounds salt.
10 pounds cod liver oil.

Laying Grain Mixture—

200 pounds wheat.
100 pounds cracked corn.
100 pounds barley.
100 pounds oats.

Feeding Directions.—For best results the birds should receive skim-milk at the rate of one quart for each 10 birds, or 15 to 25 pounds of milk powder may be added to the mash mixture. The grain is fed in the litter night and morning and the mash is fed dry in open hoppers. The cod liver oil is omitted during the summer months when the hens have access to a yard.

The following changes in the mash mixture are made about January 1 with the breeding flock. The amount of bran is reduced to 50 pounds, and 50 pounds of alfalfa leaf meal is added. Fish meal and meat scrap are eliminated and 75 pounds of milk powder replaces them. No green feed or liquid milk is given, although where a continuous supply of liquid milk is available, it could be used to replace part or all of the powdered milk and thus reduce the cost of the ration.

FEEDING EXPERIMENTS WITH POULTRY

Feeds for Fertility and Hatchability

Experiments have been carried on to determine the effect of various feeds on fertility and hatchability. In comparing the value of alfalfa leaf meal with mangels as a source of green feed, a difference of 3·2 per cent in fertility and 6·5 per cent in hatchability was obtained in favour of alfalfa leaf meal, although variability for these factors is so great that an insufficient number of individuals were used to demonstrate such differences to be significant.

In comparing the value of milk with a combination of fish meal and meat scrap in the ration for breeding hens, a difference of 7·4 per cent in fertility and 18·6 per cent in hatchability was obtained in favour of milk. In this test, milk powder was used in the mash, although liquid milk to drink may be equally valuable. The amount of milk necessary in the ration for best results was not determined in this test but there can be little doubt as to the value of milk in the ration for breeding hens. The mash containing milk powder in this experiment is used for the main breeding flock and is listed with the rations used at this station.

Brooding and Rearing

An experiment has been carried on testing the merits of three different starting and rearing rations. Feeds under test included the starting mash mixture as used with the main flock, a cafteria starter mash produced by a commercial firm and a starter mash made up of 70 pounds of corn meal, 20 pounds of middlings, 3 pounds of bone meal, ½ pound of salt and one pint of cod liver oil. Oyster shell and grit were supplied in separate hoppers and skim-milk and water were provided in separate fountains. When the chicks were 9 weeks old, the cockerels were removed from the pens and the feed was changed to the growing ration for the pullets. The chicks started on cafeteria chick mash were given the cafeteria growing mash. Those started on the standard chick starter were given the standard scratch and growing mash. The corn meal mash was used for both starting and growing mash for pullets which were started on this feed. All lots were given the standard laying ration in the fall.

In these tests, there was little difference at 9 weeks of age in the chicks receiving the cafeteria mash and those receiving the standard mash. The chicks in both these lots were heavier than those receiving the corn meal mash although these chicks were heavily pigmented and presented an attractive appearance. These chicks practically equalled those on the standard ration in weight at the commencement of egg production. The pullets fed the cafeteria mash were heavier than either of the other lots at the comencement of egg production and they appeared to be developing sexually earlier although there was little difference in date of laying first egg or in fall and winter production. The pullets reared on the standard ration were not given any animal feed during the growing period and this no doubt accounts for their somewhat slower development.

The rations used as standard for the main flock and listed elsewhere in this report are recommended partly as a result of these experiments. The corn meal mash would appear to merit consideration where skim-milk is available and where home-grown feeds are not readily available at prices comparable to corn meal.

Grass Ash and Grass Tea in Brooding and Rearing Rations

Standard brooding and rearing rations were supplemented with ash made by burning dried grass and with tea made by soaking grass clippings. These supplements did not appear to have any value with the rations used.

Feeding Cockerels for the British Market

In co-operation with other experimental farms and the Dominion Live Stock Branch, a trial shipment of roasters was sent to the British market in 1935. At this station 179 cockerels were fed, and killed and packed at Saint John. The average dressed (undrawn) weight of these birds was 5·54 pounds each.

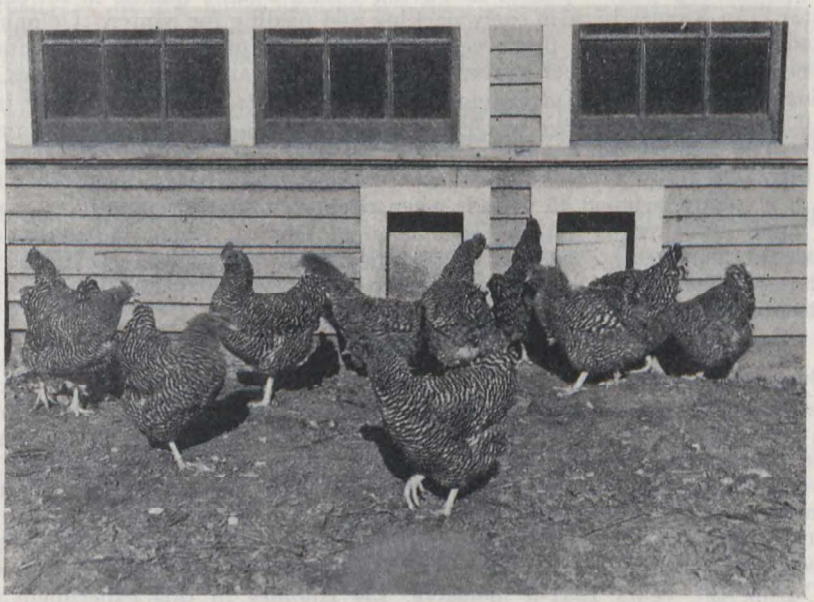
The results of these trial shipments indicate that a market exists in Great Britain for Canadian chicken. The average net price at the farm realized for chicken in this shipment from the Maritime Provinces, was 20·5 cents per pound dressed (undrawn) or 17·3 cents per pound alive. The prices obtained were disappointing, but it must be considered that the removal of poultry from Canadian markets has without doubt a stabilizing effect upon Canadian prices.

Comment on these shipments stressed the necessity of uniform grading and packing. Apparently a market for roasters of the heavy class exists but is distinctly limited, whereas roasters weighing 3½ to 4 pounds are much in demand. In regard to the portion of the shipment which was chilled rather than frozen, it is suggested that the idea of developing a trade in chilled chickens be dropped as the risk is too great, and it is only at Christmas time that there is any opportunity for their sale, and even then it is more or less of an off chance. These trial shipments however, have demonstrated the possibility of putting up suitable quality chickens for the export market at various centres in Canada and such a project should be very helpful to the poultry industry.

NEW BRUNSWICK EGG LAYING CONTEST

Poultry registration is carried on through the medium of Egg Laying Contests and Registration Progeny Tests. This policy became popular in New Brunswick shortly after the egg laying contests were started and many applications were transferred to contests being operated by Dominion experimental stations located at Charlottetown, P.E.I., Nappan, N.S. and Kentville, N.S. The accommodation was increased at Fredericton, however, in 1931 from 20 pens to 30 pens. New Brunswick poultry, especially Barred Plymouth Rocks, quickly established a world-wide reputation, and registered males have been sold to many points throughout Canada and other countries.

Some excellent records have been made in the New Brunswick contest and in 3 of the past 6 years, the leading pen was the highest in any contest east of the Rocky Mountains. White Leghorns led once and Barred Rocks led twice. The leading pen in the 1933-4 contest was Barred Plymouth Rocks, and they produced the highest score for a pen of that breed in any Canadian contest. It is also interesting to note that the leading pen in all four contests conducted by experimental stations in the Maritime Provinces that year were owned by New Brunswick breeders. The 1934-5 contest was led by a pen of Barred Plymouth Rocks with an average production per bird of 252·1 eggs and 293·14 points. This was the highest point production for a pen of any breed in any official laying contest in Canada for that contest year.



Winning pen in the New Brunswick Egg Laying Contest conducted at the Dominion Experimental Station, Fredericton, N.B., and leading pen in all official contests in Canada in 1934-5.

APIARY

Investigations in beekeeping have been largely of a practical nature The following information, which is a summary of the more important findings, should be of especial interest to all beekeepers in the province.

WINTERING BEES

Wintering bees has for many years been one of the beekeeper's major problems, and experiments comparing wintering bees in quadruple, double and single cases, have been conducted with interesting results.

Investigations in past years at this station have shown wintering bees in outside cases to be superior to cellar wintering. Bees packed in outside cases came out stronger in the spring and built up much faster for the honey flow. Some of the disadvantages of cellar wintering were irregularities of cellar temperatures, excess humidity, improper ventilation and inability of bees to take cleansing flights.

Dark cellars maintaining a fairly uniform temperature of 45°, which do not contain excess humidity, are best suited for wintering bees. Wintering in quadruple cases has proven the most economical method of outside wintering.

During normal winters the bees consumed less stores and came out stronger in the spring than those wintered in double and single cases.

Exceptions to the rule were experienced at this station during the winters of 1933 and 1934 owing to more than average protection given by snow, at which time the cases were buried for a considerable length of time. It was thought the bees in the quadruple cases were kept too warm, resulting in increased activity of the bees and increased consumption of stores.

Excellent wintering results have been obtained at this station, as out of a total of 244 colonies wintered during the past 5 years, only one colony has been

lost. Special emphasis is placed on having young prolific queens in all colonies not later than August 15, also early packing and feeding for winter. Colonies are weighed not later than the first week in October and packed in cases containing at least four inches of planer shavings on the bottom and around the sides.

Sugar syrup made by dissolving 2 parts of white granulated sugar in one part of boiling water (either weight or volume) is used to supplement natural stores. The number of pounds of sugar required for a colony is ascertained by subtracting the weight of the colony (without metal cover) from 75 pounds. Thus, if a colony weighed 45 pounds when packed, it would require 30 pounds of sugar made into syrup. At the conclusion of feeding, which is usually about October 15, the metal covers of all colonies are removed and sacks of planer shavings 8 inches in thickness are placed over every colony and the packing is then completed.

SWARM DETECTION

Swarm detection, like wintering of bees, has been another major problem to beekeepers. Experiments have been conducted with the use of the shallow brood chamber or extracting super for increasing the size of the brood chamber and for aiding swarm detection. The results obtained in this experiment show quite conclusively that if the shallow supers are given before the brood chambers become congested, preparations for swarming may be detected by tipping the shallow super every nine or ten days during the swarming period, and observing if queen cells containing larvae are present along the bottom bars of the combs.

During the years 1931-5 inclusive, 134 colonies in this experiment made preparations for swarming. In 130 of these, preparations for swarming were detected merely by raising the shallow super. In 4 colonies only, queen cells containing larvae were found in the lower full depth brood chamber without any evidence of preparation for swarming being evident in the shallow super.

This experiment is an important one from a labour-saving standpoint as it necessitates only the tipping of the shallow super, whereas the old method of examining all combs in the brood chamber resulted in the expenditure of a large amount of time, and also in the unnecessary disturbance of the bees.

TWO QUEEN SYSTEM

Beekeepers in the fall quite often find several colonies in their apiaries too weak to winter, yet headed by young prolific queens. An experiment whereby these queens may be saved for spring use, to replace winter losses or unprofitable queens, has been conducted. This project is called the two queen system. Colonies having enough bees to cover approximately five Langstroth combs are brought together in one hive, having a tight division board between and separate entrances. They are then packed and fed in the usual manner. This method of wintering surplus queens has proven very satisfactory. During the years 1931-5 inclusive, four double colonies were used in this experiment, and all eight queens successfully wintered.

STUDY OF THE HONEY FLOW

The study of the honey flow is another project worthy of note. As soon as colonies are removed from their winter cases, one colony of average strength is placed on scales and left there during the entire season. This colony is weighed every morning and records kept of gain or loss, weather conditions and duration of honey flow.

Deductions from this project from 1931-6 inclusive, indicate that at Fredericton there are:—

(1) Two major honey flows—one from June 16 to July 15, and the other from August 16 to September 15.

(2) Colonies do not store any surplus during fruit and dandelion bloom, as practically all of this honey is used for brood rearing. This flow occurs when most colonies are short of stores.

(3) The greatest gains have been made during the clover flow or period between June 16-July 15.

(4) A honey dearth exists between August 1 and August 15.

(5) The heaviest producing period in the late honey flow is from September 1-15. This flow is principally from goldenrod and wild asters.

RELATION OF STRENGTH OF COLONY IN BEES AND BROOD TO THE HONEY CROP

An experiment to ascertain the relation of strength of colony in bees and brood to the honey crop has been conducted. Results from 1931-5 inclusive indicate quite clearly that the strongest colonies at first spring examination produce the most honey, also that colonies should have at least enough bees at that time to cover four Langstroth combs.

SWARM CONTROL

During the years 1931-5 inclusive only one project on swarm control was conducted, namely, control of swarming by combination of de-queening and re-queening and raising the brood. Eighty-six colonies were used in this experiment and thirty-five colonies made further preparations for swarming. This method of swarm control has not proven satisfactory, as the above figures indicate.

Previous to 1931 another method of swarm control was tested with very satisfactory results. This method was as follows: colonies were de-queened and all queen cells containing larvae were destroyed. Nine days later the queen cells were again destroyed and a young laying queen introduced.

PACKAGE BEES

During recent years package bees have been a great boon to western beekeepers for establishing colonies. It is thought that the purchase of package bees may prove to be sound investment for beekeepers in New Brunswick, even if the honey flow is somewhat earlier than in the western provinces. At this station about 40 pounds of stores, at a cost of approximately $2 per colony, are required for wintering. When consideration is made of the cost involved for packing and feeding, winter cases and possible winter losses, it is questionable if it pays to winter colonies when one can secure in the spring a 2-pound package with queen delivered for $3.50.

Investigations with package bees were conducted at this station previous to 1931 with results indicating that bees should be installed not later than May 10 if a honey surplus is expected. Bees installed the last week in April gave the highest yields.

In 1935 an experiment with package bees was conducted with the following objects in view:—

(1) To ascertain package bee possibilities as a means of starting colonies.

(2) To compare results of package bees established on drawn combs versus comb, foundation, also comb foundation with an extra pound of bees given approximately two weeks after installation.

(3) To ascertain most suitable date for installation of package bees.

Eighteen 2-pound packages with queens and three 2-pound packages without queens, were used in this experiment. Groups of six 2-pound packages each were installed on April 19, April 27, and May 7. Two packages in each group were installed on comb foundation, two on comb foundation with an additional pound of bees given approximately two weeks after installation, and two on

drawn combs. Three 2-pound packages without queens were used to supply an extra pound of bees for two colonies established on comb foundation in each group. These were given on May 2, May 13 and May 22.

A comparison of yields was not made, as after the honey flow commenced a number of the package bee colonies were removed to an out-apiary. Deductions from this experiment for 1935 were:—

(1) Two-pound packages of bees installed on foundation did not build up as rapidly as colonies in which an extra pound of bees was given approximately two weeks after installation and those installed on drawn combs.

(2) Drawn combs seemed especially beneficial to packages installed April 19.

(3) Colonies installed April 27 were stronger at the beginning of the honey flow than those installed April 19 and May 7.

(4) An extra pound of bees given approximately two weeks after installation to packages established on comb foundation and drawn combs did not prove beneficial to packages installed on April 27 and May 7.

(5) Bees installed on April 19 and April 27 required more stores than those installed on May 7.

(6) Less stores were required for bees installed on drawn combs than those installed on comb foundation.

During 1936 a comparison in yields between over-wintered versus package bees was made in an out-apiary at Oromocto. The average yield for the over-wintered colonies was 92·8 pounds of extracted honey as compared with 108·4 pounds for the package bee colonies.

Experiments with package bees promise to be a major project for 1937, as it is thought that further investigations should be made before conclusions are drawn.

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