DOMINION OF CANADA
DEPARTMENT OF AGRICULTURE
DOMINION EXPERIMENTAL FARMS

DIVISION OF HORTICULTURE

PROGRESS REPORT OF THE DOMINION HORTICULTURIST

M. B. DAVIS

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PERSONNEL, HORTICULTURAL SERVICE, EXPERIMENTAL FARMS SYSTEM

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Report of the Division of Horticulture

INTRODUCTION

As the last annual report of the Division of Horticulture was published in 1930, the present report attempts to summarize the results of work for the three years from 1931 to 1933 inclusive.

The report is not intended to contain complete or detailed articles; these have been and will continue to be published from time to time, either in the form of technical articles or in the form of popular bulletins. A list of the technical articles already published has been appended to this report, and a list of available popular bulletins is also attached.

In the past it has been customary for the various branch farms conducting horticultural work to publish their material in their annual reports. This policy having been suspended, all the horticultural work of the Experimental Farms System is now included under one cover for the purpose of a progress or summary report. The report has been divided into various sections, and under each section the results of each farm are dealt with separately. While it has not been possible to acknowledge authorships, it should be understood that these are to be attributed to the personnel of the station concerned.

Since the appearance of our last report in 1930, Dr. W. T. Macoun, who was then Dominion Horticulturist, has passed away. As his death occurred in August, 1933, practically all the work reported in this summary was completed under his direction.

COLD STORAGE INVESTIGATIONS

General

Since the publication of the last (1930) annual report of the Division of Horticulture, three cold storage plants have been erected by the Experimental Farms Branch for the purpose of studying the storage conditions of fruits and vegetables. The three plants are located at the Experimental Station, Kentville, N.S., the Central Experimental Farm, Ottawa, and the Experimental Station, Summerland, B.C. In addition, common storage experiments with apples are being conducted at the Experimental Station, Fredericton, N.B.

OTTAWA—EQUIPMENT AVAILABLE.—The cold storage plant at the Central Experimental Farm consists of five chambers 10 by 10 feet square, cooled by brine circulation, each room having a separate brine pump under thermostatic control. With this arrangement, temperatures may be controlled to within about ¾° F., for temperatures above 36°, and to within ½° F. for temperatures below that.

For the purpose of obtaining temperature controls within ⅛° F., each room is equipped, in addition to the above, with a very sensitive thermostat, which, operating through a thermionic relay in conjunction with a small heating coil and revolving fan, acts as a balance against the brine and maintains a very accurate temperature range. Any room may, therefore, be operated on either basis of control. When operating with the thermionic relay, the brine pump operates continuously instead of cutting in and out automatically.

Temperatures are recorded by thermographs, accurate and graduated to $\frac{1}{5}$° F., which makes possible the detection of slight variation in temperatures both in time and in space. In addition, one freezer room capable of below-zero temperatures is operated on direct expansion.

EXPERIMENTAL WORK CONDUCTED.—The work with apples conducted to date falls under the following headings:—

(1) A study of the relation between fertilizer treatment and the storage quality of Fameuse and McIntosh apples.
(2) A study of the maturity of apples in relation to keeping quality.
(3) A test of various methods which may be employed as an index of proper picking maturity.
(4) A determination of the possible variation which may exist within a population extracted from a single unit.
(5) A study of temperature effect on the life of various varieties of apples.
(6) A determination of the types of spoilage under various temperature conditions.
(7) In co-operation with the Division of Chemistry, a study of the chemistry of apples produced under different conditions in an endeavour to correlate chemical data and ultimate keeping quality.

Determination of the Types of Spoilage

Accurate data on the types of spoilage occurring are being obtained. In co-operation with the Division of Botany, determination of the types of rot and their classification has been studied. The occurrence of various forms of breakdown and physiological disorders has been studied, and photographs and coloured drawings illustrating these have been accumulated. While various forms of rot and breakdown have occurred, the greatest loss is due to the development of a form of internal breakdown termed core flush, because it progresses from the core outwards, showing at first as a joint browning of the cells in the immediate vicinity of the carpels. Some interesting data on the effect of temperature in the development of both rots and disorders will be available from this study.

Chemical Analysis

In co-operation with the Division of Chemistry, ash analyses have been made on certain samples of fruits from different fertilizer treatments which were known to give different performance records in storage.

In addition, carbohydrate determinations of the fruit at picking, and periodically during the storage life, have been performed.

While considerable data have accumulated there is still little information to date of a positive nature. A few facts stand out, however, such as the higher rate of loss in acidity at 32°F. as compared with 36°F., which is associated with absence of core flush at 32°F. At 36°F., there appeared to be a correlation between acid loss and keeping quality, low rate of acid loss appearing to be associated with high percentage of spoilage.

At 32°F., with the variety Wealthy, there was an increase in total sugars between sampling dates in storage, this apparently, at the expense of materials other than starch. At the higher temperatures, the reverse was the case.

Aside from these points there have not been to date any definite correlations of an important nature.

Apple Storage Studies

EXPERIMENTAL STATION, FREDERICTON, N.B.—Since no cold storage or controlled storage temperatures are available at this station, work has been confined to a common store with modern ventilation equipment and proper insulation. This makes it difficult to control temperatures in the early autumn and fall, but permits of fairly accurate control when outside temperatures are below freezing.

The work consists of:—

(1) Storage tests of apples, mostly Fameuse and McIntosh, grown under various fertilizer treatments for a period of over twelve years.

(2) Picking date tests with Fameuse and McIntosh.

FRUIT BREEDING

The improvement of the existing varieties of some of the more important fruits grown in Canada has been one of the major activities of the Division of Horticulture for some years. In addition to work with the hardier fruits at Ottawa, several of the branch farms have included the same line of breeding work among their endeavours. The Experimental Station at Morden, Manitoba, has devoted much of its energies in that direction and probably has the largest collection of hardy fruits in North America with which to work. The Experimental Station at Kentville, N.S., has a large apple breeding project well under way and the Experimental Station at Summerland, B.C., has paid considerable attention to the improvement of the apple for Okanagan conditions. The Experimental Station at Sidney, B.C., has devoted considerable work to the improvement of the loganberry and the strawberry for Vancouver Island conditions.

Apple Breeding

THE DIVISION OF HORTICULTURE AT THE CENTRAL EXPERIMENTAL FARM, OTTAWA

For many years this division has devoted much attention to the improvement of the apple for Eastern Ontario and Quebec and the more severe fruit districts of Canada. The work divides itself into two main sections:—

(*a*) Improvement of commercial and dessert apples for the fruit districts of Eastern Ontario and Quebec.

(*b*) The continuation of the Saunders' line of breeding with *Pyrus baccata* for the Northwest of Canada and the more severe districts.

New varieties of apples, originated in the Division of Horticulture, are fruiting at Ottawa every year. As soon as it is thought that a variety is sufficiently promising to be named, a name is given to it, and a detailed description published as soon as possible in the annual report. Thus, since 1906, detailed descriptions of varieties that have been named have been published in the annual reports nearly every year. Some of these descriptions have been slightly revised and republished in subsequent reports. For example, in the report for 1927 there were descriptions of some of the most promising varieties of McIntosh and Fameuse types; in the 1928 report, the most promising of the Northern Spy type; in the 1929 report, some of the most promising of other types; and in the 1930 report, descriptions of some of the best varieties of crab apples originated at Ottawa. In the annual report for 1926, there was published a list of all varieties which had been named up to that time and reference made to the annual reports in which they were first described.

The following varieties are described, in this report, for the first time:—

BANCROFT (Forest x McIntosh).—Size medium to above medium; form oblate to roundish conic, ribbed; cavity open, shallow to medium depth, russeted at base; stem medium length, to short, stout; basin shallow to medium depth, medium width, wrinkled; calyx open or partly open; colour yellow well washed with deep crimson; predominant colour deep crimson; seeds medium size, plump, acute; dots moderately numerous, white, distinct; skin moderately thick, moderately tender; flesh dull white or yellowish, crisp, tender, juicy; core medium, open; flavour briskly subacid, little flavour but pleasant; quality good; season probably late December to March or later; no marked resemblance to either parent.

FORESOME (Forest x McIntosh).—Size medium to below medium; form roundish conic; cavity deep, medium width, sometimes shallow and open; stem medium length, stout to moderately stout; basin medium depth and width, wrinkled; calyx open or partly open; colour, yellow, well washed with crimson; predominant colour crimson; seeds medium, plump, acute; dots few, yellow, distinct; skin moderately thick, moderately tough; flesh white, tender, juicy; core small, open; flavour subacid, pleasant; quality good; season late December, probably to April; no marked resemblance to Forest but resembles McIntosh much in colour of skin and in flesh and flavour.

LOWEL (Lowland x Bethel).—Size above medium; form roundish conic, slightly ribbed; cavity narrow, shallow to medium; stem medium length, moderately stout; basin open, medium depth to shallow, wrinkled; calyx partly open; colour greenish yellow well washed with attractive crimson; predominant colour attractive crimson; seeds medium size, acute; dots obscure; skin moderately thick, tender; flesh yellowish with traces of red, tender, breaking, juicy; core medium to small, open; flavour subacid, pleasant, but not high; quality above medium to good; season September. No marked resemblance to Bethel except in shape. Resembles Lowland somewhat in tenderness of flesh and shape of fruit. Handsome in appearance.

MACFOREST (Forest x McIntosh).—Size above medium to medium; form roundish conic, ribbed; cavity open, medium depth, russeted; stem short to medium length, stout; basin medium depth and width to open, wrinkled; calyx partly open or open; colour pale greenish yellow well washed with attractive crimson; predominant colour crimson; seeds medium, acute; dots moderately numerous, yellow, distinct; bloom thin, bluish; skin moderately thick, moderately tough; flesh dull white or yellowish tinged with red, crisp, firm, tender, juicy; core medium size, open; flavour subacid, pleasant; quality good; season probably December to March; no marked resemblance to Forest, but resembles McIntosh somewhat in colour of skin, flesh and flavour.

MACREST (Forest x McIntosh).—Size below medium to medium; form roundish conical; cavity open, medium depth, russeted; stem medium length, stout; basin narrow to medium, medium depth, wrinkled; calyx partly open; colour yellow, well washed with deep crimson; predominant colour deep crimson; seeds large, obtuse; dots numerous, yellow, distinct; bloom moderately pinkish; skin moderately thick, tender; flesh yellowish with traces of red, tender, juicy; core medium size, open; flavour subacid, pleasant, distinct; quality good; season probably late November to April. Resembles McIntosh very much in colour of skin and somewhat in shape and in flavour. No marked resemblance to Forest.

MACFIND (McIntosh Seedling).—Fruit: size medium to below medium; form roundish conical; cavity medium width and depth to deep, russeted; stem medium length, stout; basin shallow, medium width, wrinkled; calyx partly open or

closed; colour yellow, well washed and sometimes slightly splashed with attractive crimson; predominant colour crimson; seeds medium size, acute; dots numerous, small, pale yellow, distinct; bloom thin, pinkish; skin moderately thick, tender, flesh yellowish, tender, juicy; core medium size, open; flavour subacid, pleasant; quality good to very good; season November to January. Resembles McIntosh considerably in colour of skin, in flesh, and in flavour. Attractive in appearance. Sometimes not quite large enough.

MACWOOD (McIntosh x Forest).—Fruit: size above medium; form roundish to oblong, slightly ribbed; cavity narrow, medium depth to shallow; stem short to medium, stout; basin medium width and depth to deep; calyx open; colour yellow, well washed with deep crimson; predominant colour deep crimson; seeds medium size, acute; dots moderately numerous, pale yellow, distinct; skin thick, tough; flesh yellowish with traces of red, moderately juicy; core medium size, open, flavour subacid, pleasant; quality good; season December to March. Attractive in appearance and a good keeper.

SHILOH (Shiawassee Seedling).—Fruit: size medium; form oblate to roundish conic; cavity deep, open, russeted; stem medium length, moderately stout to stout; basin deep, open, wrinkled; calyx open; colour greenish yellow, washed and splashed with deep carmine; predominant colour deep, rather dull carmine; seeds below medium to small, acute; dots few to moderately numerous, yellow, distinct; bloom thin, pinkish; skin moderately thick, tough; flesh white, tender, juicy; core small; flavour mildly subacid, pleasant; quality good; season November to February or later. A nice dessert apple though not quite bright enough in colour.

IMPROVEMENT OF THE APPLE FOR THE GREAT NORTHWEST OF CANADA

In 1887, the late Dr. Wm. Saunders commenced an apple breeding project for the origination of hardy apples for the Canadian Northwest. In 1911 he published Bulletin No. 68, describing his results to that date. Dr. Saunders approached this problem by the use of the extremely hardy *Pyrus baccata,* an apple scarcely larger than a good sized pea. His first generation of hybrids were crosses between this and such apples as Haas, Pewaukee, Yellow Transparent, McIntosh Red, Tetofsky and other commercial sorts. From these first crosses there were produced a number of hybrids, all of crab-like characters, about 1 inch to 1½ inches in diameter. Later, a second dose of commercial apples was introduced from varieties like McIntosh Red, Northern Spy and Ontario. These second crosses were still very crab-like in nature but produced fruits up to 2⅝ inches in diameter. After Dr. Saunders' death, this work was continued by the production of more second crosses and by the introduction of a third dose of commercial fruits from varieties like McIntosh Red.

From among the first crosses produced two successes stand out, Osman and Columbia. These two sorts are without a doubt the hardiest crabs of any commercial size growing in Canada to-day and appear to form a foundation for the future development of Dr. Saunders' aspiration.

From among the second crosses, there were a few outstanding varieties possessing an extraordinary degree of hardiness and very superior quality for crabs; these were Rosilda, Piotosh, Wapella and Printosh. All of these apples have been previously described in the reports of this division.

The third crosses of recent origin have been developed from the use of the best of these second crosses hybridized again with McIntosh, Wealthy and such sorts. During the past few years, over ninety of these have fruited, producing a variable population from among which apples approaching the commercial quality have been grown, exceeding 3 inches in diameter. The selection of the

best of these and their distribution throughout the Canadian prairies for a hardiness test will take place in the next few years. Several hundred more of these third crosses are yet to fruit at Ottawa.

With the advent of commercial size and quality in the third crosses, a new plan of breeding has been adopted in which hybrids between first and third, second and third, and sib crosses between the best of the third crosses are being undertaken, as the future line of attack. These sib crosses have been adopted as the most practical approach to self-fertilization for segregational purposes.

Experimental Station, Kentville, N.S.

At Kentville, N.S., an apple breeding program of considerable dimensions is under way as the result of hybrids made in connection with a six-year apple pollination study conducted at that station.

At present there are growing seedlings from 484 crosses represented by over 16,000 hybrid trees, 11,000 of which are in permanent locations for fruiting. In addition to breeding for ordinary commercial characteristics such as quality, appearance, season, etc., considerable attention is being paid to the possibility of originating varieties resistant to scab, certain croosses having been made with scab resistant parents for that purpose. With the co-operation of the Division of Botany careful notes on the resistance of the resulting hybrids are being acquired.

Seed production from these crosses shows significant differences in the degree of success from different crosses. This is especially true when the varieties are considered with regard to their chromosome number, whether diploid or triploid. A diploid has two groups of 17 chromosomes whereas a triploid has three.

An analysis of the results shows significant differences in the success of crosses made where a triploid or a diploid male is crossed on a diploid female. It would appear that the chances of success when crossing a triploid male on a diploid female are so small as to eliminate this particular cross from any breeding project. On the other hand diploid crossed on diploid gave a high percentage of success.

Where triploids are to be used they make good female parents whether crossed with diploids or triploids. The percentage of success in either case seems high enough to warrant this method being used. Gravenstein seems an exception in that the triploid males have given poor results on this variety.

There would seem to be a significant difference in the number of seeds per apple produced by triploids and diploids. The average number of seeds per apple for a triploid female runs much lower than is the case with a diploid female. Where a triploid has been used as male parent, however, on a diploid, or where the apple has been selfed, the number of seeds per apple drops to the average figure for triploid crosses.

The variety used has a marked influence on the vigour of the seedlings. It would appear from one year's work that the mean vigour of seedlings from diploid females is greater than that of seedlings from triploid females. In the triploid group, however, there are many individual seedlings that have as much vigour as those from the diploid group.

Work with two other varieties, Stark and Blenheim, as females, and twenty-three varieties crossed on each of these is in accordance with the above statements.

Further information on this work is contained in the following publication: "Seed content, seedling production and fruitfulness in apples": W. H. Brittain and C. C. Eidt, Can. Jour. of Research *9:* 307-333, 1933.

EXPERIMENTAL STATION, FREDERICTON, N.B.

Breeding work with apples at this station 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. Approximately 5,200 seedlings are in nurseries and test plots at the present time. The oldest of these seedlings are just now nicely coming into bearing, 250 seedlings having fruited to date. Although none of these has been outstanding a few rather nice apples have been produced. Unfortunately these are fall and early winter in season. Late winter types produced to date are of no promise.

EXPERIMENTAL STATION, MORDEN, MAN.

The Experimental Station at Morden, Manitoba, was established primarily to assist in the development of satisfactory horticultural varieties and methods for the Prairie Provinces of Canada. Fruit breeding has, therefore, been a most important part of its work.

In addition to a very large number of open-pollinated apple seedlings from parents such as Anis, Antonovka, Charlamoff, Blushed Calville and other hardy Russian sorts, a large number of controlled crosses have been made.

As in the work at Ottawa, these controlled crosses may be divided into two groups, those containing *Pyrus baccata* parentage, directly or indirectly, and crosses between hardy commercial sorts and the more superior commercial apples of a lesser degree of hardiness. Some of our well known apples have been employed as parents, viz., Cox Orange, Melba, Duchess, Wealthy and McIntosh and such crabs as Dolga, Whitney, and Martha, with *Pyrus baccata* being introduced through Osman and others of the Saunders' hybrids.

From among several thousands of the open-pollinated seedlings which constitute the bulk of the early work at this station, the following have been introduced for trial throughout the prairies since 1930.

The practice here is to name but few of the promising seedling fruits on hand. However, there is warrant for bestowing names this year on an additional 5 seedling apples and one seedling sandcherry. A further total of 10 promising seedling apples are herewith accorded propagation numbers, under which they will be tested in other districts. It may be that some trees, bearing fruit of but moderate quality, will prove unusually hardy and adapted to trying climatic conditions. Such seedlings will later command names.

Godfrey, 5034-G135, is a Patten (Patten Greening) apple seedling. The tree is strong, vigorous, with stout crotches. Fruit 2¾ inches, yellow, heavily washed with bright red, somewhat striped carrying a light waxy bloom; fine texture, crisp, juicy, aromatic, flavour sweet, sprightly. Season to March; named in deference to Mr. William Godfrey, head gardener, with his approval.

Manitoba, 5027-E163, is a seedling of Duchess (Duchess of Oldenburg). Tree healthy, strong; fruit slightly over 2½ inches; yellow blushed with red; texture smooth, fine; flesh juicy, melting, pleasant sub-acid, aromatic. Season to early January. This variety lacks in red colour but is the best dessert apple grown at the Morden Experimental Station this year.

Manitoba Spy, 5034-G180, is a seedling of Patten. Tree strong, healthy. Fruit well over 3 inches; yellow, washed with dull red, red stripe; texture medium; flesh, juicy, tender, pleasant, mildly acid. Season to January. Resembling Northern Spy considerably in size, shape and colour.

Stevenson, 5034-E400, is a seedling of Patten. Tree, healthy, vigorous, upright-spreading, with strong crotches. Fruit about 3 inches, yellow heavily washed with red, red striped, with prominent dots; deep in basin and cavity;

flesh firm, crisp, juicy; flavour rich, sprightly. An apple pleasing the eye, and good for cooking, acceptable as dessert. Season to March. Name accepted by Mr. Robt. Stevenson, and accorded in honour of the A. P. Stevenson family, Morden, who have done valuable pioneering work in Manitoba fruit culture.

Watts, 5034-H-17, is another seedling of Patten. Tree vigorous. Fruit over 3 inches; yellow, blushed red with some short red stripes; flesh juicy, tender; flavour sweet, resembling Tolman Sweet, superior to that of Repka Kislaga. Season to early March. Named in deference to Mr. Harry Watts, herdsman, who has approved of this variety and of its name.

New Introductions

It has appeared advisable to give a further number of fruit seedlings introduction numbers. These will be more simple to the grower receiving them, and in recording their performance. Those proving merit in a widened test will be described later and named.

The apples, 17 in number, are:

Morden 320: A Tetofsky seedling ripening in 1933 by July 31, (5025-C25).

Morden 321: Blushed Calville seedling of high quality, suggesting McIntosh, but early, (5026-E49).

Morden 322: Blushed Calville seedling, a fall apple that is in high quality to the new year, (5026-I40).

Morden 323: Duchess seedling, a dull red apple; prime in November, (5027-E30).

Morden 324: Charlamoff seedling, mostly yellow; sutured, sweet, (5022-I12).

Morden 325: Wealthy seedling; deeper, sweeter and longer keeper, otherwise resembling to a considerable degree the mother parent; (5002-I9).

Morden 326: Wealthy seedling, resembling Ostrakoff in external characters, but very sweet in flavour, (5002-E23).

Morden 327: Hoadley seedling, bright scarlet on pale yellow, sprightly in flavour; season to mid-winter, (5030-L8).

Morden 328: Tetofsky seedling, a dessert apple, early, (5013-K1).

Morden 329: Tetofsky seedling, very early and productive, (5025-C3).

Morden 330: Tetofsky seedling, small but early, productive and tasty, (5025-F15).

Morden 331: Tetofsky seedling, early dessert to mid-September, (5025-F35).

Morden 332: Ostrakoff seedling, large, general purpose use to the new year, (5016-J1).

Morden 333: Anisim seedling, heavily dark red all over; season to January, (5031-F17).

Morden 334: Anisim seedling, early, red, aromatic dessert, (5019-J4).

Morden 335: Crusoe seedling, resembles the grandmother Wealthy, but flesh is a trifle tough; keeps well, (5021-B27).

Morden 336: Crusoe seedling, an attractive dessert autumn and early winter apple, (5021-B40).

Plum Breeding.—During the last three years a large number of open-pollinated seedlings of Assiniboine, Pembina and Cree plums have fruited. These have been tested for value as dessert products and for culinary use. Of 198 plums thus tested, 22 gave a cooking test equal to, or better than Assiniboine.

Indications are that the hardy plums carrying Chinese apricot plum parentage, such as Hanska, Kaga, Loba and Tokata should present new varieties of unusual value. The apricot flavour and firm flesh are attractive features.

As a result of the above work, fifteen seedlings have been propagated as sufficiently promising for introduction. One Assiniboine seedling has been named Mordel and has already been introduced throughout the prairies.

IMPROVEMENT OF THE SANDCHERRY.—The improvement of this fruit for the prairie offers a most fertile field of endeavour. The early bearing habit and the large number which may be grown in a limited area facilitates rapid improvement by selection. The most outstanding sandcherry available is the variety Brooks No. 1, received from A. Griffin, Brooks, Alberta. This variety is free of astringency and runs as high as 1 inch in diameter. Two Morden introductions, Wanda and Morden, although not as large, produce very fine crops of good quality fruit and are noteworthy adjuncts to the prairie fruit test.

The variety Sioux has proved to be the most valuable mother parent yet encountered. A large number of its progeny, in addition to being high in quality and of good size, have bushes of a distinctly upright habit, this being a decided improvement over their prostrate growing parent.

EXPERIMENTAL STATION, SUMMERLAND, B.C.—As there is need for better varieties of apples to withstand the particular environmental conditions in the apple-producing areas served by this station, and also to meet the present-day exacting conditions of marketing, the improvement of the apple was commenced at this station in 1924.

Crosses have been made, using such varieties as McIntosh, Delicious, Newtown, Grimes Golden, Rome Beauty, and Winesap as both male and female parents. The seed from these controlled crosses, together with a large quantity of open-pollinated seed taken from an orchard where good commercial varieties were growing, was planted in 1924, 1925 and 1926.

METHOD OF PROCEDURE.—A large number of the resulting trees bore fruit in 1933. During the ripening period, systematic weekly examinations were made of all trees fruiting. The most promising seedlings were selected in the orchard at their proper harvesting season, which was determined by skin, flesh and seed colour tests. With many of the seedlings examined, the size, shape, colour and flavour characteristics were such as to justify discarding in the orchard. From each seedling selected for storage trials, two flats of apples were carefully picked and stored, one in common storage and the other in cold storage. Prior to storage, the ground colour, seed colour, over colour, diameter and pressure of each seedling selected for storage test were recorded. During the storage trials, the seedlings were examined each week until they reached the eating ripe stage when their flavour, quality and general storage behaviour were recorded and compared with those of named varieties having similar seasons. The less promising seedlings were then discarded and the more desirable retained for the balance of their storage life. Of those selected at the eating ripe stage as being worthy of further trial, additional data were recorded of pressure, seed colour, core characteristics, storage disorders, if any, and the length of the eating ripe season.

In the improvement of the apple, it is important to know the general characteristics of many named varieties. Accordingly, samples of apples representing sixty-five named varieties which fruited on the station this season were placed in a common and cold storage.

The quality and storage behaviour of these named varieties were observed and recorded and formed a basis of comparison by which to judge the merits of new seedlings. These samples of named varieties were also of assistance in the naming of specimens sent in to the station for identification.

RESULTS.—These crosses produced 1,013 seedling apple trees. Of this number 420, or 41 per cent, fruited in 1933. The number of bearing trees which were tested and rejected in the orchard was 364, or 87 per cent. The number of trees bearing fruits which were considered of sufficient promise to merit storage tests was 58, or 14 per cent. Of this number 44, or 76 per cent were discarded and 14, or 24 per cent rated worthy of further trial.

Of the total number of seedlings fruiting in 1933, only 3·3 per cent were finally selected as being worthy of further trial.

PEACH BREEDING.—The object of this project is to develop superior varieties of peaches for the peach-growing areas of British Columbia. The aim has been to supply the type of peach in greatest demand, of fine quality, and suitable for the district. In 1930 attention was directed toward the production of clingstone peaches, similar to the well known canning peaches of California. Many of the California varieties had already been planted in the test orchard. The variety required was an early ripening, yellow-flesh, clingstone peach, productive and hardy. Consequently, the breeding work of 1931 and 1932 included a clingstone variety in each cross. In the meantime, peaches of this type in the variety orchards had come into production with rather disappointing results. Furthermore, clingstone peaches are suitable for canning only and will not do for the fresh fruit trade. In the peach-breeding work for 1933, all clingstone peaches were discarded and the following varieties used: J. H. Hale, Veteran, Rochester, Vedette, Elberta and No. 4108.

Four crosses were made, with one parent tree enclosed in each of four 12-foot by 12-foot by 12-foot insect proof cages. Bouquets of blossoms from the other parent tree were placed in the cage in tubs of water. When the blossoms began to open, a colony of bees was introduced during the evening and left within the cage until the blossoms were fading. It was found advisable to feed each colony a 10-pound can of syrup on the evening they were moved to the cages. This seemed to hold their attention until they became accustomed to the confinement. By this procedure, nearly two thousand peach seeds of known parentage have been gathered this year, and are being held in cold storage for spring planting.

BUD VARIATION IN THE APPLE.—Attention has been chiefly concentrated, at this station, on the study of colour sports in McIntosh and Delicious, two varieties in which bud variation seems to be especially prevalent.

Proof that there are distinct red and striped strains of McIntosh has been secured from propagation trials. Scions from trees bearing red apples and scions from trees bearing striped apples have been top-grafted on the same framework. The resulting tree produces both red fruits and striped fruits, the branches which have developed from the red strain scions bearing red apples, and the branches which have developed from the striped strain scions bearing striped apples.

The commercial advantage of the red strains lies in the fact that McIntosh apples are graded largely according to the percentage of their surface which is covered with solid red colour, the more highly coloured specimens commanding the higher price. From our results it has been found that over half the crop from the red strain trees qualified for extra fancy, whereas only 27 per cent of the fruit from the striped strain trees developed sufficient red colour to be classed as extra fancy.

What appears to be four distinct red sports of Delicious have been found in British Columbia. Unfortunately, evidence is lacking as to their origin, for they have appeared as individual trees in commercial orchards in the Salmon Arm, Vernon, Oyama and Winfield districts, respectively. However, the appearance and behaviour of these trees indicate that they represent bud variations from the original striped Delicious.

These four Canadian strains of Delicious have been propagated on clonal root-stocks at the Summerland Experimental Station. Accordingly, information will soon be available as to their performance under uniform growing conditions.

In the meantime, harvesting and storage experiments have been carried out with the fruit from the original trees.

Picking date tests with these strains of Delicious have indicated a very low percentage of extra fancy fruit harvested at the first pick from the striped strains, whereas over 80 per cent of the crop from the red strain trees had already developed sufficient colour and quality for the extra fancy grade.

Most growers are well satisfied when half their crop of striped Delicious qualifies as extra fancy. It seems altogether probable, therefore, that growers are likely to pick the red strains at an earlier date than has been customary with the striped Delicious. That such a procedure may react to their disadvantage is indicated by determinations of flesh colour, quality and chemical composition.

As Delicious apples approach maturity on the tree, the flesh colour changes from a distinct green, through an almost white stage, to a creamy yellow. These flesh colours are similar though not identical to those of Pale Chalcedony Yellow, Marguerite Yellow and Napthalene Yellow as shown in Ridgway's colour chart.

To secure information as to flesh colour, twenty apples from each picking from each tree were cut across and graded into three flesh colour classes, designated "green," "white" and "yellow."

From the data thus gathered, it was apparent that a fairly high percentage of the fruit picked on the first date had "green" flesh colour. There were fewer "green" fleshed fruits in the second picking and fewer still in the third picking.

It was further noted that while none of the red coloured fruits from the striped strains showed "green" flesh, a large percentage of the red coloured fruits from the red strains did. In other words, grading for red colour eliminated the "green" fleshed fruit from the extra fancy grade in the case of the striped Delicious but not in the case of the red strains.

This suggests that early picking of the red strains may result in a high percentage of fruit with extra fancy colour requirements but poor dessert quality.

An article dealing with this subject has been published as follows:

"Bud variation in the apple" R. C. Palmer and C. C. Strachan.
Scientific Agriculture *13:* 3. November, 1932.

NUTRITIONAL STUDIES WITH HORTICULTURAL CROP PLANTS

Division of Horticulture, Central Experimental Farm, Ottawa

For some years past the Division of Horticulture has been conducting nutritional studies with certain horticultural plants grown under controlled conditions. The number of species used is gradually being increased and results have been and will be published from time to time. The main object of the work is to determine symptoms in plants which they may show when subjected to excess and deficient treatments.

The procedure with all species is practically the same. The plants are grown from the seedling stage in a pure sand, in pots, either glazed or unglazed, depending upon the accuracy of the particular experiments. Nutrient solutions are fed in the form of C.P. chemicals, and as uniform water conditions as are possible are maintained.

THE TOMATO

In the study of the tomato plant which has covered a period of five years, involving nine different experiments, the plants have been subjected to deficiencies of nitrogen, phosphorus, potassium, calcium and magnesium. A reciprocal series, in which each of the above elements given in excess have been studied, has also been employed.

A study of ratios, particularly between nitrogen and potassium, nitrogen and phosphorus, and phosphorus and potassium has also been conducted:—

Extreme deficiency of potassium has been evidenced by almost complete lack of growth, and by purpling of the under surface of the leaves, with the upper surface muddy green. Older leaves faded to brown purplish green with purple veins and the leaves curled downward to the stem. *Partial deficiency* of the above element, due either to excess nitrogen or actual lack of potassium, was evidenced by a chlorotic condition around the margins of the lower leaves, this chlorosis spreading extensively and being followed by scorching and death of the affected tissue.

Extreme lack of phosphorus produced symptoms somewhat similar to those produced by potassium starvation, with considerably less purpling; the leaves became transparent.

Excess potassium plants presented symptoms more closely allied to lack of nitrogen; light green foliage, slender growth with long internodes.

Excess phosphorus feeding produced plants lacking much in vigour, pale green in colour with patches resembling the work of a leaf skeletonizer. Death resulted in many cases from excess phosphorus feeding, which was only corrected by an adjustment of the phosphorus potassium ratio.

Excess nitrogen concentrations produced a decidedly injurious effect; stunted growth with a characteristic yellow chlorotic streaking of the leaves, the older leaves being the most affected; brown to black streaking on the stems, sometimes extending into the leaf petioles. In the highest concentrations the leaf petioles became necrotic lesions extending into the main rib of the leaf; the petioles drooped and finally dropped off. The injury described resembles, to some extent, the streak disease of tomatoes and it is interesting to note that high streak infection has been reported as associated with high nitrogen feeding.

When each of the other elements, in turn, was increased with the nitrogen, it was found that potassium alone was capable of correcting the symptoms due to excess nitrogen.

In so far as purely vegetative response was concerned, the nitrogen potassium ratio appeared to be all-important.

BLOSSOM-END-ROT.—There was evidence to show the considerable effect of nutrition on the occurrence and severity of blossom-end-rot. There was a positive correlation between this disorder and vegetative vigour. By growing plants of low or medium vigour, it was found possible to avoid the trouble, but, whenever plant growth was forced or highly vigorous, severe blossom-end-rot-infection invariably followed. Although there was no apparent correlation between elemental ratios of the nutrient solution and severity of infection, high vigour was naturally associated with high nitrogen feeding. Too heavy applications of fertilizer, especially nitrogen, bringing about too rapid and luxurious top growth, are considered to be a contributory cause of this disorder.

Positive information was found to show that the feeding program must be regulated according to the time of the year at which the plants are being grown. Plants handled in the same way and fed the same nutrient solution had consistently significant different percentages of infection when grown during different seasons of the year. The percentage of infection was greatly increased when plants were grown during a short day period.

It would seem advisable to conduct investigations with this disorder involving such factors as top to root growth, root carbohydrate levels, temperature, light, humidity and transpiration rates in conjunction with nutrition.

CHEMICAL DATA (IN CO-OPERATION WITH THE DIVISION OF CHEMISTRY).—As the nitrogen was increased in the nutrient solution there was a tendency to increased potassium in the ash, an increase in magnesium and a decrease in sulphur. As nitrogen was decreased the converse was found. When potassium and nitrogen were increased together there was a distinct increase of potassium in the ash, accompanied by a corresponding decrease in calcium, magnesium and phosphorus. Increased phosphorus with increased nitrogen gave a large increase of potassium in the ash, a large decrease of calcium and magnesium, and increased phosphorus. Where potassium is deficient in the solution, potassium is low in the ash, and calcium and magnesium are increased, while sulphur and phosphorus are somewhat lower than normally. When phosphorus is deficient there is a large increase of potassium and magnesium and a large decrease of sulphur and phosphorus.

The total nitrogen content in ripe fruit agreed with the nitrogen concentration in the solution. A consistently higher starch content was found in diseased fruit compared with healthy fruit.

THE STRAWBERRY

Nutritional studies with this plant have been conducted for a period of nine years. In Pamphlet No. 96 of the Dominion Department of Agriculture the effects of nitrogen, potassium and phosphorus starvation in strawberry plants were reported. It was shown that certain rather definite symptoms were exhibited by the plant in the absence of any one of these elements. Later, in the 1928 Report of this Division, a more complete series of experiments in which strawberry plants were subjected to certain periods of starvation for the elements referred to above were dealt with. In this last report it was possible to corroborate some of the points brought out in the earlier publication, particularly as regards foliage tints developed and the effect of phosphorus and potassium on set. Further studies have been conducted in order to deal more fully with the effects of the deficiency of the above elements, and, in addition, to determine the effects of deficient magnesium, calcium and sulphur, and the results obtained from an addition of an excess of any of the elements above mentioned. The results of these studies were published in the April, 1934, Scientific Agriculture *14*: 8.

RESULTS.—Foliage symptoms were obtained which could be correlated with the treatments given and which should prove of value in diagnosis. Lack of hardiness during winter was associated more markedly with deficient potassium than with any other treatment. Yield data indicate the possibility of reduced bud formation due to excess phosphorus and excess calcium feeding.

The complete withdrawal of phosphorus and magnesium markedly affected fruit bud formation, while the complete withdrawal of calcium and sulphur had little, if any, effect. The plants appeared capable of re-utilizing their original potassium to a marked degree. Carbohydrate analyses of the tops (leaves and crowns) indicated the marked influence of potassium in carbohydrate accumulation. Ash analyses of the leaves revealed the marked influence of the various treatments on the composition of ash and dry matter.

All omission treatments were reflected by a reduction of the element concerned in ash and in dry matter. Antagonism between calcium and potassium and phosphorus and potassium was revealed. Lack of low potassium and low phosphorus symptoms of the foliage were noted in the series where calcium, magnesium or sulphur were not fed and this was associated with a high for those two elements found in ash and in dry matter.

Correlation figures show significant correlations as follows: A negative correlation between CaO and K_2O in ash; a positive correlation between MgO and P_2O_5; a negative correlation between K_2O and MgO and a negative correlation between P_2O_5 and K_2O in ash.

In growing this plant considerable trouble is often experienced in maintaining a healthy and normal foliage. Burning and dropping of the lower foliage occurs with a mottling or spotting of the upper leaves. Experience derived from nutritional studies with other plants indicated that these troubles might be due to nutritional deficiencies or lack of balance between nitrogen and the mineral elements.

In the last three years studies have been made of the effect of deficiencies of nitrogen, phosphorus and potassium, and of excesses of these elements as well as ratios between nitrogen and potassium and nitrogen and phosphorus. In addition, plants were grown in beds in river sand with a view to testing the possibility of employing such an artificial soil when the proper nutrients were supplied. The results of these studies were published in Scientific Agriculture.

Deficiency of potassium is characterized by poor vigour, fading and yellow browning of the foliage, together with burning and dying of the foliage to within a short distance from the growing tips. The burning and dying of the foliage from the base up is similar to that brought about by high nitrogen applications when potassium is not increased at the same time.

Deficiency of phosphorus is characterized by a great reduction in vigour, bronzing and reddish-purpling of the leaves. The lower leaves which die are reddish-purple in colour.

Excess nitrogen concentrations produced a decidedly injurious effect which commenced as a yellowing or chlorosis of the leaf margins. The yellowing extends inwards between the veins and the leaves, which finally burn and die. This injury commences at the base of the plant so that the lower leaves may be scorched and burnt or fallen off and the upper foliage have different degrees of yellowing or chlorosis.

When each of the other elements in turn was increased with the nitrogen, it was found that potassium alone was capable of correcting the symptoms due to excess nitrogen.

Definite foliage injuries are associated with a high nitrogen-potassium ratio in the nutrient solution. Chrysanthemums are apparently high potassium feeders and a nitrogen potassium ratio of 1 to 2 in the nutrient solution produces fine vigorous plants.

High phosphorous feeding in the presence of a high nitrogen potassium ratio increases the severity of foliage injuries. Yield data indicate the possibility of reduced flower bud formation and reduction in the size of bloom due to excess phosphorus feeding.

There is some indication that response to nutritional treatments may be qualified in degree and character by variety, and it is suggested that it may be necessary to group varieties according to their nutritional requirements.

Fertilizer treatments have a marked effect upon the production of depth of colour in the bloom. Development of bloom colour is dependent on an adequate potassium supply, not only in total amount, but in relation to the amount of nitrogen or phosphorus available.

Ash analysis of the plant top revealed the marked influence on the composition of ash and dry matter. A negative correlation of the nitrogen potassium ratio on the accumulation of potassium, calcium, magnesium and phosphorus in plant ash was revealed.

Antagonism between potassium and phosphorus was revealed. Foliage troubles and lack of development of bloom colour were associated with low potassium in plant ash, and high calcium, magnesium or phosphorus, brought about by widening the nitrogen-potassium ratio in the nutrient solution or by increasing the concentration of phosphorus.

Plants grown in river sand and fed nutrient solutions compared quite favourably with plants grown in soil and handled in a commercial way.

Fertilizer Experiments With Apples (Storage Studies) at the Experimental Station, Fredericton, N.B.

Studies involving the application of nitrogen alone in varying amounts and of nitrogen, phosphorus and potash in various combinations, have been conducted for a number of years, involving the following varieties of apples: McIntosh, Fameuse, Bethel, Golden Russet, Wealthy, Dudley, Milwaukee, Alexander and Wolf River.

The economic importance of the project may well be illustrated by reference to one variety only, namely, Fameuse. This variety should be second only to McIntosh as a main seller for New Brunswick orchards, but everywhere, commercial growers state that it is one of their hardest varieties to sell. This is due entirely to the fact that New Brunswick Fameuse are breaking down prematurely in storage. Investigations of this breakdown is one of the major objects of this experiment.

In the early years of this experiment, no definite systematic storage records were kept. In 1932, more complete records, including the noting of the incidence of various storage ills, were taken. In 1933, the work was further elaborated into a fairly comprehensive project. In addition to former lines of investigation, the question of the influence of stage of maturity at the time of picking upon the keeping quality of the fruit is receiving special attention. Various tests, including the charting of ground colour by colour chart, the iodine test for starch, and the use of a pressure tester to a limited extent are all being used in this connection.

A date of picking test was conducted with the Fameuse and McIntosh varieties, as a further means of relating maturity with keeping quality.

In all, 141 lots of apples, consisting of from 140 to 170 apples each, and picked according to recognized procedure, were gathered.

As this investigation is still in progress at the time of writing, no attempt is being made in this report to interpret the results secured. This is to be considered merely as a progress report, with a detailed report to be presented at a later date.

Orchard Fertilizer Studies at the Experimental Station, Kentville, N.S.

Fertilizer studies with apple trees have been conducted at this station since 1912, and the original experiment, consisting of fifty-one plots of Gravenstein and Wagener, offers a unique opportunity for an interesting study which is now being conducted. Having been treated with the same fertilizer application for a period of twenty-one years, the results of long-time applications of single elements, two elements, and complete fertilizers are commencing to appear.

From the mass of data accumulated there emerge a few outstanding lessons, when yields and net returns per acre are used as indices of results.

On soils of the type employed at this station it is apparent that the continued use of limestone, in conjunction with either manure or complete fertilizers, has resulted in reduced returns per acre.

The best results appear to have been obtained from the use of a complete fertilizer containing nitrogen, phosphorus and potash and there is evidence to indicate that the nutritional balance of the soil may be upset by the long-time use of single elements or pairs of elements.

Soil Management, and Fertilizers Applied at Different Dates.—This experiment has two objects in view, one to determine the value of different methods of tillage, and the other to determine the best time for applying fertilizers to the orchard. The trees used were McIntosh and Wagener, alternating, spaced 20 feet apart in the row, and the rows 20 feet apart. Up to the spring of 1924, all the trees had received similar treatment and were fertilized alike. The trees were set in 1915, and were given clean cultivation until 1921, when a strip of grass six feet wide under the trees was allowed to remain uncultivated. These strips were clipped in mid-June and again in mid-August, and the clippings allowed to remain as a mulch. The area outside of the strips was cultivated to July 1. By 1924, the grass strip had widened to 8 feet (4 feet at each side of the tree-row). A space of 8 feet on each side of the grass strips was cultivated, and the areas between the cultivated rows were in a three-year rotation of field crops.

In 1924, the cultivated strips on either side of one row of trees were seeded down and have not been cultivated since. Another row was left with the sod strip, and has been cultivated at each side of the strip to July 1. A third was ploughed, and has been kept cultivated close to the tree and for a distance as wide as that with the sod strip cultivation. The grass on the areas in sod was cut twice each season and allowed to remain as a mulch, and, in 1931, a light mulch of hay was evenly scattered over the area.

Under the clean and partial cultivation treatments the trees show a better and more healthy foliage, with better growth conditions and larger fruit than the trees in sod. The trees in sod show the effect of dry weather in a marked degree, as is evidenced during dry summers.

The three rows under the different methods of management were each divided into four plots of five trees each, and the same fertilizer was applied to one plot in each row on April 25, to another three plots on May 17, and to another three plots on June 8, one plot in each row being left unfertilized. The fertilizer used was made up of 150 pounds of nitrate of soda, 300 pounds of superphosphate and 50 pounds of muriate of potash, which is a 4·5-9·6-5 fertilizer. This was used at the rate of 5 pounds per tree in 1924, 1925 and 1926, and 7 pounds per tree in 1927 and 1928. In 1929, the regular orchard fertilizer mixture used on the station orchards, 200 pounds of nitrate of soda, 200 pounds of sulphate of ammonia, 300 pounds of superphosphate and 100 pounds of muriate of potash, was applied at the rate of 8 pounds per tree. The fertilizer was broadcast around each tree to cover the area occupied by the roots of the tree, a distance around and under the tree three feet greater than the spread of the branches.

The early application of fertilizers to the orchard is not advised, as at that time in most orchards it is difficult to move readily because of the ground being soft. The time that suits the best is about the middle of May, and the practice of applying fertilizer from the 10th to the middle of May is satisfactory. The results indicate that the best yields were obtained from the plots fertilized on June 8. This is probably too late, and the mid-May application is advised until further data are secured on this point.

The yields in Table 1 are the average of two trees each of McIntosh and Wagener from each plot, for the nine years since this experiment started. The value of the McIntosh is calculated at $3 and of the Wagener at $2.50 per barrel, tree run. These trees are planted 54 to the acre, so that the yield per acre of each variety is calculated on the basis of 27 trees of the variety per acre.

TABLE 1.—PROJECT H. 26 (3), C. 13 (3)—ORCHARD: SOIL MANAGEMENT, AND FERTILIZERS APPLIED AT DIFFERENT DATES—TOTAL YIELDS PER TREE, ETC., DURING THE NINE-YEAR PERIOD, 1924 TO 1932.

Method of culture	No fertilizer	Fertilizer applied			Average yield per tree	Average annual yield per acre
		April 25	May 17	June 8		
	Bbl.	Bbl.	Bbl.	Bbl.	Bbl.	Bbl.
Grass mulch	14·06	18·45	20·42	24·20	19·28	57·84
Clean cultivation	19·42	15·34	18·67	16·85	17·57	52·71
Sod belt	17·89	22·13	21·00	27·90	22·23	66·69
Average	17·12	18·64	20·03	22·98	.....	.....

Fertilizer Experiments With Apples at the Experimental Station, Lennoxville, P.Q.

CO-OPERATIVE EXPERIMENTS IN COMMERCIAL ORCHARDS.—The co-operative experiments in commercial orchards at Chateauguay Basin, P.Q., and St. Paul d'Abbotsford, P.Q. were continued in 1933.

At Chateauguay Basin, in the orchard owned by Mr. S. R. Jack, the experiments from 1925 to 1930 consisted of a comparison of nitrate of soda and sulphate of ammonia with leguminous and non-leguminous cover crops. At the end of this period, no definite results having been obtained, the entire orchard was seeded down, one-half to a leguminous sod and the other half to a mixture of grasses. On each half, experiments have been started with various fertilizer combinations and mulch. Although in such experiments the results from but three years' work are of little value as a basis from which to form recommendations, it is interesting to note that in the past two years, the yield of fruit from the entire orchard has substantially increased. Marked differences have also occurred with different treatments, which, if continued, should provide interesting and useful information.

Several of the experiments in Mr. A. W. Buzzell's orchard at St. Paul d'Abbotsford have now been conducted for a period of nine years, and the results obtained, where bearing trees have been used, may be considered as fairly conclusive for the conditions under which the experiments were conducted.

NITRATE OF SODA VS. SULPHATE OF AMMONIA

In this experiment, the varieties Wealthy and Fameuse have been used, the plots of Wealthy trees being composed of nine trees each and those of Fameuse, of twelve. In so far as could be determined, the trees of both varieties were twenty-five years old at the beginning of the experiment, and had been in sod for some time previously. The same method of culture has been continued, the grass being cut two or three times each year, as necessary, and allowed to lie where cut. The fertilizers have been applied each spring, when the leaf buds were opening, the material being spread evenly over the ground from about two feet from the trunk to a distance of two to four feet beyond the spread of the branches.

Owing to the difference in the analyses of the two fertilizers, sulphate of ammonia containing 20 per cent of nitrogen in the form of ammonia, and nitrate of soda 15 per cent as nitrate nitrogen, larger amounts of nitrate of soda have been used, so that the amount of nitrogen supplied by each material was approximately the same. From the beginning of the experiment in 1925, until 1930, the Wealthy trees received four pounds of sulphate of ammonia, or five pounds of nitrate of soda annually. On the Fameuse trees, which were somewhat larger,

the annual application was five pounds of sulphate of ammonia, or six and one-half pounds of nitrate of soda. In 1931, the trees having made comparatively heavy growth, and, as a consequence, being somewhat larger than at the beginning of the experiment, all applications of fertilizer were increased by fifty per cent.

Although a record has been kept of all yields from 1925 to 1933, the crop in 1925 was very uneven and of very little value from an experimental standpoint. Accordingly, Table 2 has been compiled from results obtained during the past eight years:—

TABLE 2.—APPLES—NITRATE OF SODA vs. SULPHATE OF AMMONIA AT ABBOTSFORD, P.Q., AVERAGE OF RESULTS, 1926 TO 1931.

Fertilizer application	Variety	Yield per tree								
		1926	1927	1928	1929	1930	1931	1932	1933	Average
		Bush.	Bush.	Bush.	Bush.	Bush.	Bush.	Bush.	Bush.	Bush.
Nitrate of soda	Wealthy	8·60	1·54	6·61	4·56	5·75	2·75	6·72	5·53	5·26
Sulphate of ammonia	"	10·62	0·63	10·11	3·06	7·08	0·56	10·03	6·67	6·09
Nitrate of soda	Fameuse	15·44	0·00	13·12	0·40	14·82	0·00	14·68	0·50	7·37
Sulphate of ammonia	"	16·17	1·46	13·42	1·62	16·58	0·89	12·00	2·50	8·08

Average of two varieties during period:—
Nitrate of soda ..... 6·31 bushels per tree
Sulphate of ammonia ..... 7·08 " "

From the statement in Table 2, it may be noted that although with each fertilizer the trees have remained decidedly biennial in bearing habit, larger yields of apples were obtained where sulphate of ammonia was used. Although this difference in yield may not be sufficient to be considered as significant, it would at least indicate that under the conditions of this experiment the nitrogen in sulphate of ammonia is fully equal to that in nitrate of soda for apple trees.

COMPARISON OF FERTILIZER COMBINATIONS

This experiment consists of a comparison of nitrogen only, with nitrogen and phosphoric acid, and with nitrogen, phosphoric acid and potash, as fertilizers for apple trees. Three varieties have been used, namely, Wealthy, Golden Russet and Fameuse. The plots of Wealthy and Golden Russet consist of nine trees each, and those of Fameuse of twelve. The trees of each variety were about twenty-five years old at the beginning of the experiment. Previous and subsequent treatment, excepting in the ingredients and amounts of the fertilizers applied, was similar to that followed with the trees used in the experiment, "Nitrate of soda vs. Sulphate of ammonia."

From 1925 to 1930, the annual applications of fertilizers per tree were as follows: With the variety Wealthy, the nitrogen application was supplied by using five pounds of nitrate of soda; where the applications contained nitrogen and phosphoric acid, five pounds of nitrate of soda and five pounds of superphosphate were used; the complete fertilizer was made of the same amounts of nitrate of soda and superphosphate, to which was added one pound of muriate of potash; for the Golden Russet and Fameuse trees, the various applications were the same, with the exception of nitrate of soda, which was applied at the rate of six pounds per tree. In 1931, the trees having made a substantial increase in size, all applications were increased fifty per cent.

Table 3 shows the average yields per tree from each application for the years 1926 to 1932.

TABLE 3.—APPLES—COMPARISON OF FERTILIZER COMBINATIONS AT ABBOTSFORD, P.Q.—AVERAGE OF RESULTS, 1926 TO 1933.

Fertilizer application	Variety	Yield per tree								
		1926	1927	1928	1929	1930	1931	1932	1933	Average
		Bush.	Bush.	Bush.	Bush.	Bush.	Bush.	Bush.	Bush.	Bush.
Nitrate of soda	Wealthy	8·60	1·54	6·61	4·56	5·75	2·75	6·72	5·53	5·26
Nitrate of soda and superphosphate	"	6·25	5·07	6·75	9·25	3·94	7·69	4·03	12·56	6·94
Nitrate of soda, superphosphate and muriate of potash	"	9·67	3·31	10·28	9·28	6·17	3·86	10·64	13·53	8·34
Check—no fertilizer	"	5·32	2·63	3·16	3·87	3·31	3·97	2·45	5·84	3·76
Nitrate of soda	Golden Russet	4·17	0·13	1·78	4·17	3·17	4·39	1·98	2·67	2·81
Nitrate of soda and superphosphate	"	4·33	0·75	2·78	4·33	3·44	6·86	4·00	5·33	3·98
Nitrate of soda, superphosphate and muriate of potash	"	5·37	0·50	3·94	4·22	5·06	5·50	6·25	5·83	4·58
Check—no fertilizer	"	3·46	0·29	1·50	2·44	2·83	4·39	2·89	3·39	2·65
Nitrate of soda	Fameuse.	15·44	0·00	13·12	0·40	14·82	0·00	14·63	0·50	7·37
Nitrate of soda and superphosphate	"	13·79	2·33	11·94	3·89	13·89	1·67	9·17	1·50	7·27
Nitrate of soda, superphosphate and muriate of potash	"	16·19	0·02	16·46	1·03	16·92	0·00	14·46	0·54	8·21

Average yield per tree of three varieties:—

Nitrate of soda	5·16 bushels per tree
Nitrate of soda and superphosphate	6·06 " "
Nitrate of soda, superphosphate and muriate of potash	7·04 " "

With the three varieties, very satisfactory results have followed the use of a complete fertilizer. With both Wealthy and Golden Russet, the fertilizer containing nitrogen and phosphoric acid has proved superior to one composed of nitrogen only. With these varieties, nitrogen only has given better results than no fertilizer. Furthermore, with the same varieties there has been a tendency towards annual bearing by the trees receiving a complete fertilizer. This had become fairly well established with Wealthy by 1930, and possibly would have continued had not a severe infection of fire blight occurred in that year. This, with the necessary heavy pruning, may have been the cause of the light crop in 1931. With Golden Russet, the crop has been fairly steady, with all treatments including the check, since 1928. With Fameuse, the biennial bearing habit has continued with all three applications. From the results of this experiment, it would seem reasonable to expect that a satisfactory response would follow the use of a complete fertilizer in sod orchards, under similar conditions, throughout the province of Quebec.

LIGHT VS. HEAVY APPLICATION OF NITROGEN

This experiment has been conducted with the variety Golden Russet, which, in the opinion of many fruit growers, requires high soil fertility to promote bearing crops. The trees used were in the same block and had been handled in the same manner as those used in the foregoing project. During the course of the experiment the general treatment, other than the amount of fertilizer applied, was also the same. Two plots of nine trees each were used, one receiving a comparatively light application of nitrate of soda, and the other double that amount. No other fertilizer ingredients were used in this experiment. From 1925 to 1930, the respective applications were five and ten pounds per tree. In 1931, these were increased to seven and one-half and fifteen pounds per tree. Table 4 shows the results obtained.

TABLE 4.—APPLES—GOLDEN RUSSET—LIGHT vs. HEAVY APPLICATION OF NITROGEN AT ABBOTSFORD, P.Q.—AVERAGE OF RESULTS, 1925 TO 1933.

Application	Yield per tree									
	1925	1926	1927	1928	1929	1930	1931	1932	1933	Average
	Bush.	Bush.	Bush.	Bush.	Bush.	Bush.	Bush.	Bush.	Bush.	Bush.
Light.....	1·35	4·17	0·13	1·78	4·17	3·17	4·39	1·98	2·67	2·65
Heavy.....	1·05	4·05	0·38	3·19	3·69	3·72	4·97	4·77	5·0	3·42

By doubling the application of nitrogen, a slight increase of crop was obtained. This increase, however, was somewhat less than that obtained in the experiment "Comparison of Fertilizer Combinations," where superphosphate was added to nitrate of soda, or where a complete fertilizer was used.

Cultural Methods for Stone Fruit Orchards at the Experimental Station, Summerland, B.C.

Two orchards of stone fruits, adjoining, have been under cover crop for eight years, the one seeded to alfalfa and the other to hairy vetch. Four years ago the alfalfa was ploughed under and for two years the orchard was clean cultivated to free it of all vegetation. It was seeded to vetch in 1932, but a poor catch resulted, and it was seeded to yellow sweet clover in 1933.

The orchard under vetch cover crop had been disked at least once a year and allowed to reseed. In 1930, it was clean cultivated and again seeded to vetch, but because of wild grasses and weeds, a clean cultivation program was carried out in 1932 and 1933, when this orchard also was seeded to yellow sweet clover.

For the first few years after seeding, the alfalfa cover crop orchard suffered from lack of water and serious winter injury resulted. The orchard seeded to hairy vetch required less water and did not suffer from winter injury.

There has been no fertilizer of any kind applied to these two orchards during the twelve years they have been under cover crops. During the first few years (1921-23), while the alfalfa was becoming established, much more water was required than was available and consequently the trees suffered; but in 1929, when the alfalfa was ploughed under, the soil was in splendid condition, rich in humus, and the trees thriving well. It was also noted that irrigation water spread more readily through the soil and was more evenly held. Young trees made rapid growth and produced heavy crops. The vetch cover crop orchard was likewise improved but not to such a marked extent. It did not suffer during the first years of the experiment, but it has not benefited to the same degree during the last few years. However, the vetch has been more simple and economical to handle in all orchard operations, and was conveniently disked under during a shortage of irrigation water. These results indicate that for a long term practice, if sufficient water is assured, alfalfa will do more to build up the soil than will hairy vetch. Hairy vetch, however, is economical to maintain and can be easily disposed of, if necessary. In the event of wild grasses and weeds becoming troublesome, the cover crop may be thoroughly cultivated out, the land cleaned, and the addition of a small amount of seed will soon give a new stand of vetch.

By the use of leguminous cover crops, these two orchards have been materially improved. During the past season however, there have been indications of the need for some further soil improvement. There is evidence that cover crops may well be supplemented with an occasional application of commercial fertilizer and barnyard manure.

FERTILIZERS FOR STONE FRUIT ORCHARDS

This experiment was planned to ascertain the most economical methods of maintaining soil fertility in stone fruit orchards. A three-acre block was planted to apricots and peaches, one acre receiving an annual application of 600 pounds of a complete fertilizer, the second acre being treated with 12 tons of barnyard manure each year, and the third being cover cropped with hairy vetch. The fertilizer and manure blocks have been clean cultivated. These treatments have now been repeated over a period of seven years. Records of tree growth and crop yield together with general observations regarding soil texture and response to irrigation have been kept.

Clean cultivation and chemical fertilizers applied annually at the rate of 300 pounds of superphosphate and 150 pounds each of nitrate of soda and sulphate of potash, per acre, have resulted in satisfactory growth of the trees during the first few years of the trial. In later years the humus has been steadily depleted from the soil and the plot has become difficult to irrigate. The trees have made the least total growth of the three plots and have produced the smallest crops, yielding less than one-third the amount of fruit produced by the trees in the manure block.

The block of trees receiving 12 tons of barnyard manure each year has consistently produced the heaviest crop of peaches and apricots. The trees have grown to large size, and the soil has become well supplied with humus so that irrigation water spreads readily and evenly. Valuing manure at five dollars per ton places a heavy annual cost on this block, which is not entirely compensated by the increased yields.

The vetch cover crop block has been the least expensive to maintain. Tree growth has been satisfactory and yields of fruit more than twice as heavy as on the fertilizer block.

The present condition of these orchards, together with records for the past five years, show certain benefits to be derived from each treatment. From a careful study of these records there is evidence that a combination of the three treatments would be more desirable than any one of them individually. Chemical fertilizer alone, with clean cultivation, leaves a soil depleted of humus; manure is expensive to buy and in many cases is not obtainable; vetch cover crop alone builds up the soil more slowly than is advisable with stone fruits. A procedure designed to eliminate the disadvantages and to maintain the virtues of each treatment with economy commensurate with yield of fruit is suggested. A well established vetch cover crop, which may be disked in to reseed each year, should be supplemented with five to ten tons per acre of barnyard manure, once in four years. In addition to this, 500 pounds per acre of a commercial fertilizer, rich in nitrogen, should be applied each year, or as often as required to maintain an annual terminal growth in the trees of at least eighteen inches. Continuous production of stone fruits of high quality is dependent upon a yearly renewal of fruiting wood.

Pruning Peach and Apricot at the Experimental Station, Summerland, B.C.

Some ten years ago a new type of pruning was being advocated for fruit trees. Advocates of this new system designated it " long-pruning " in contrast to the established method of cutting back or shortening the wood growth, now called " short-pruning." Experimental evidence had already been secured to show that there was much in favour of the new system. Promising results had been obtained from young orchards of stone fruits, and particularly with apricots and peaches.

The profitable life of peach trees is compartively short, and it is, therefore, essential that they be pushed into early and heavy bearing. Apricot trees, while longer-lived, respond quickly to cultural treatment, and may be encouraged to produce fruit at an early age. It had been demonstrated by several investigators that heavy pruning subdued, and light pruning encouraged, total wood growth in young trees. The larger and stronger trees resulting from light pruning produced more fruit and at an earlier age, while the heavy cutting or "short-pruning" gave luxuriant vegetative shoot-growth with late and meagre crops of fruit.

Accordingly, a project was planned in 1925 to ascertain whether the "long" method of pruning apricots and peaches could be used to advantage in the irrigated districts of British Columbia. An intermediate system of pruning, involving light heading back, was introduced, giving three methods for comparison.

An orchard was planted in the spring of 1925, covering three one-acre plots and including the following varieties: Wenatchee Moorpark, Blenheim and Tilton apricots; and Tuscan, J. H. Hale, and Elberta peaches. Each plot has received a different soil cultural treatment but the same pruning program involving a comparison of the three systems mentioned above. A detailed account of the procedure followed in this project has been given in the reports of this station for 1928 and 1929. Records of tree growth and yield of fruit have been kept each year. At the close of the seventh year's growth the following information is available.

Data on total tree growth have been secured by measuring trunk circumference in centimetres at six inches from the ground level. Other investigators have found that a definite correlation exists between trunk circumference and weight of both root and top, thus trunk circumference provides a good indication of the total growth of the tree. The following table shows the influence of the three different methods of pruning on the trunk circumference of three varieties of peaches. There were originally 16 trees of each variety receiving each pruning treatment. Owing to a few deaths and severe breakages, it has not been possible to include all the original trees in calculating average growth, but each figure in Table 5 represents the average of at least 10 trees.

TABLE 5.—INFLUENCE OF PRUNING ON TRUNK CIRCUMFERENCE OF PEACHES.

Variety (trees 7 years old)	Average trunk circumference		
	Short pruned	Medium pruned	Long pruned
	cm.	cm.	cm.
Tuscan	55·1	53·1	55·0
J. H. Hale	43·7	44·1	45·8
Elberta	51·8	55·5	62·5

Growth measurements secured during the first few years of the life of these trees indicated that long-pruning produced larger trees and that heavy cutting-back or short-pruning had a dwarfing influence. The above table indicates that this is still the case with the Elberta, in spite of the fact that long-pruned trees of this variety have produced heavy crops of fruit during the past four years.

Table 6 gives the average yield of peaches per tree for 1931, under each method of pruning.

TABLE 6.—INFLUENCE OF PRUNING ON YIELD OF PEACHES.

Variety	Average yield per tree, 1931		
	Short-pruned	Medium-pruned	Long-pruned
	Lb.	Lb.	Lb.
Tuscan	17·5	88·0	102·0
J. H. Hale	164·3	151·7	182·0
Elberta	197·0	132·5	205·0

It is noticeable that the short-pruned Tuscan trees have not been productive, although measurements show them to be larger in size than most of the other peach trees. Even the medium and long-pruned Tuscan trees have given very low yields in comparison with J. H. Hale and Elberta. The Tuscan, like most other yellow-fleshed clingstone varieties, seems unsuited to British Columbia conditions.

Since coming into bearing, the long-pruned trees of both J. H. Hale and Elberta have, on the average, produced more fruit than the medium and short-pruned trees. The heavy fruiting of the long-pruned trees has been accompanied by less and less terminal growth. With the J. H. Hale, the age may soon be reached where a system of pruning involving some heading-back to stimulate new wood growth will give greater yields of high quality fruit than the long method. The Elbertas, on account of their greater vigour, promise to respond satisfactorily to the long system for several years yet. Breakages have occurred in some of the long-pruned trees, indicating the necessity for careful bracing and propping of the long spreading limbs. With the Elberta, a planting distance of more than 20 feet by 20 feet may be necessary where long-pruning is practised.

APRICOT PRUNING EXPERIMENT

Apricot trees probably demand greater care and attention to pruning during the first five years of their growth than do any others of our orchard fruit trees. The lack of judicious and careful culture during the early stages of growth accounts in no small measure for the total or partial loss of so many apricot trees before they reach full growth, large size and comparative hardiness. The young apricot tree, under favourable soil and moisture conditions, makes rapid twig growth with attending danger of weak crotches and long spindly branches.

Three varieties of apricots were included with the peaches in the experimental orchard planted in 1925. They were placed in three rows alternating with three rows of peaches throughout the entire orchard and so arranged that each variety and each method of treatment would experience any variations of soil and moisture.

Three systems of pruning have been followed, identical with those practised on the peaches. An endeavour has been made to produce a type of tree with a modified leader and well distributed main branches. On the long-pruned trees, no heading or cutting-back has been done, but a thinning-out type of pruning has been practised. These trees have been kept open enough to ensure sunlight reaching the fruit wood well down the main limbs. The short-pruned trees received the same general thinning-out treatment but were headed back each year, about half of each new growth being removed. The medium or intermediate system of pruning involved sufficient thinning out to ensure a well-balanced tree, and moderate heading-back, about a quarter of each new growth being removed.

Growth has been recorded by measuring trunk circumference with a steel tape, six inches from the ground level. The data in Table 7 represent the average tree growth for each variety under each system of pruning, at the end of the seventh year.

TABLE 7.—INFLUENCE OF PRUNING ON TRUNK CIRCUMFERENCE OF APRICOT TREES.

Variety	Average trunk circumference		
	Short-pruned	Medium-pruned	Long-pruned
	cm.	cm.	cm.
Moorpark	50·3	48·5	48·1
Blenheim	57·5	55·1	61·2
Tilton	56·0	52·1	53·9

The results indicate that, after seven years of growth, there was no consistent difference in size between apricot trees receiving long, medium and short-pruning. Measurements made in previous seasons, however, showed that during the first few years of the tree's life, the long and medium-pruned trees made greater total growth than those receiving short-pruning.

Table 8 sets forth the average yield per tree of each variety under each system of pruning.

TABLE 8.—INFLUENCE OF PRUNING ON YIELD OF APRICOT TREES.

Variety	Average yield per tree		
	Short-pruned	Medium-pruned	Long-pruned
	Lb.	Lb.	Lb.
Moorpark	109	100	107
Blenheim	92	117	104
Tilton	94	115	130

The data recorded in Tables 7 and 8, together with observations made in the orchard, indicate the desirability of modifying the pruning treatment to suit the variety and age of the tree. Moorpark seems to respond well to short-pruning after the trees have come into bearing. Blenheim, under the long-pruning system, produces a very straggly type of tree. An intermediate system involving some heading-back to keep the tree within bounds suits this variety well. Although short-pruned Tiltons have developed into large trees, the growth habit is greatly improved by the long system. Short-pruned trees of this variety are very compact in form and the dense growth is not conducive to heavy fruit production.

Pruning is one of the expensive operations in orchard practice. It calls for intelligent work before as well as after the trees begin to bear in order to build and maintain strong well-formed trees, capable of producing maximum yields of high-class fruit.

PRUNE PRUNING EXPERIMENTS

This experiment, commenced in 1925, was designed to give information which should help toward the establishment of a system or method of pruning particularly suitable to prune trees. At the time the experiment was planned, much interest was being shown in various varieties of prunes which might be profitable to grow for dehydration as well as for the fresh fruit trade. Several new varieties were being advertised and rather extravagant claims made for

their quality and productiveness. With this in mind, twelve varieties were selected for a combined variety and pruning trial. The following pruning program was adopted: two trees of each variety to be short-pruned; two trees to be long-pruned, and two trees to be short-pruned one year and long-pruned the next. Records have been kept of the growth and yield. Observations have been made of the various varieties for adaptability to the Okanagan, and their relative value for commercial plantings. The fruit has been tested in the Fruit Product Laboratory for its dehydration value, and the results are included in this report.

The following is a list of varieties of prunes which have been planted in this experimental orchard block:—

Date	Mammoth French	Imperial Epineuse
Silver	Burton	Sugar
Petite	Hungarian	Yakima
Standard	Italian	Saratoga.

Ten of the varieties mentioned were planted in rows containing six trees of each variety. This provided two trees of each variety for each system of pruning mentioned. Other varieties, such as Burton and Saratoga, were fewer in number and were pruned either long or short in alternate years, and a record of their performance obtained. Thus, twelve varieties of prunes have been tested for their suitability to Okanagan conditions and their response to different systems of pruning.

Long-Pruned Trees.—The so-called long system of pruning involved a method, from the time the tree was first planted in the orchard, which called for a careful selection of well placed main branches followed by an annual thinning out to avoid crowding, but no cutting-back or heading-back of terminal growth. The type of tree developed has been the central leader or modified central leader rather than the vase form.

Short-Pruned Trees.—The method of short-pruning followed throughout the experiment consisted of the same careful selection of main branches to build the frame-work of the tree, followed by a regular thinning-out and heading-back of terminal growth or shoots. This system has been in common practice and has usually been followed with the idea of securing stockiness and to promote branching.

Modified Pruning.—A modification of long-pruning was adopted by alternating each year from long to short-pruning. Thus a certain number of trees were long-pruned one year and short-pruned in the following year. This system was devised to offset the tendency of long-pruned trees to slow down in the production of new fruiting wood after a year or two of maximum fruit production. It was hoped that a system of cutting-back in alternate years would stimulate growth of new fruiting wood which in the long-pruned year would set fruit buds of greater vigour.

The Italian Prune and Its Response.—In vigour and growth of tree, and in the production of fruit during the same period in the same orchard, the Italian prune surpassed all others. This variety is more widely planted in the Okanagan than either plums or prunes of any other variety and prune trees outnumber all other plums combined by one hundred per cent. With the importance of the Italian prune in mind, and because of its outstanding performance in this project, the response of this variety to pruning is here given separately.

The long-pruned Italian trees have produced a greater average yield of fruit and, by trunk measurements, the largest trees, but twig growth now shows a decided slowing up in the formation of new fruiting wood. This should be

considered as an indication that a change in the pruning method is required to bring about a better balance between fruit production and new wood growth. A treatment of cutting-back to two-year laterals and spur-pruning would probably give good results. However, this variety has maintained satisfactory growth under all three methods of pruning, and long-pruned trees still carry plenty of healthy vigorous fruiting twigs. A thinning-out of branches should be sufficient at this time, with very little cutting-back.

Response of Other Varieties.—Long-pruning has resulted in trees of greater average size throughout the varieties, and in the first few years of production, more fruit has been harvested from long-pruned trees.

During this period of growth and early production, there appears to be little if any advantage in regularly alternating the system of pruning from short to long. Cutting-back or "heading-in" every other year did not cause an even distribution of new wood, but inclined to force clusters of shoots from terminal branches. A thinning-out of these clusters was required in the following season's pruning. The application of this method has been only partly effective. Results have not been consistent in all varieties, evidently due to varietal habits of growth.

These trees have now come into profitable bearing, and the results of the last two years' production have been totalled and averaged. Eight varieties of prunes enter into this calculation, namely, Italian, Date, Silver, Imperial, Epineuse, Standard, Petite, Hungarian, and Mammoth French.

The long-pruned trees have produced on the average 39·8 per cent more fruit, in the two years above recorded, than have the short-pruned trees. They have made the greatest growth to date as evidenced by the average trunk circumference, but the last season's growth of terminal shoots or new wood has been the smallest, and hardly sufficient to supply an adequate amount of new fruiting wood and leaf surface. Trees that have produced the heaviest yield of fruit have made the least new wood growth required to extend the bearing surface. This has resulted in trees of a dwarfed or stunted appearance covered with clusters of spur-wood. It has been strikingly evident that all varieties of prunes in this experiment respond in this way, and in degree according to the amount of fruit production and variety habit. Furthermore, branches thickly covered with old fruiting spurs have produced prunes of the smaller size, unless carefully thinned. The trees which have been regularly long-pruned have been more productive of fruit and according to measurements of trunk they are at present, on the average, larger trees. However, there has been in the past year very little new extended wood growth on these trees. Such a tree shows heavy fruit-spur development and indications of a stagnant condition of growth. However, the long system of pruning on prunes has proved of advantage in reducing the pruning costs, building a larger tree, and producing more fruit up to seven years of age. But at this stage, with certain variety modifications, the point has been reached, or is quickly approaching, when a drastic change in the pruning method must be made to stimulate growth of new fruiting wood. Anticipating the necessity for such a change should enable a gradual introduction of heading-back. Some varieties, e.g., Silver prune, made so little branch growth with successive heavy crops of fruit, that there are too few fruiting branches. These trees which have been lightly pruned have produced spurs along all lateral branches but have ceased twig growth almost entirely. However, regular and heavy cutting-back is not to be recommended as it seems to confine the new growth to points near where parts were removed. It would appear that heavy cutting as well as too little pruning may result in unsatisfactory tree growth and unsatisfactory fruit production.

In order for the long system of pruning to be established as the more economical method of handling prunes, it would need to reduce labour, encourage early bearing, and result in greater yields of high-class fruit throughout

the life of the tree. These claims have been made by advocates for the long system of pruning, but little consideration has been given to the individual peculiarities of the different varieties of fruit trees. Such variety characteristics are also very often modified or accentuated by cultural conditions of soil, fertilizer and water. It has been established, by ample experimental trial, that severe pruning has a dwarfing effect on a tree or on any part of that tree. It would naturally follow that the less severe the pruning or cutting, the greater would be the tree growth, assuming the production of well-formed trees. This holds true in a general way, as long as the tree is making or producing wood growth only, and as long as growth conditions are favourable.

As soon as fruit production is added to the activities of the plant, this factor effects a dwarfing influence upon tree growth, increased fruit production resulting in decreased wood and twig growth within the tree.

Prunes produce fruit on short crooked shoots known as fruit spurs. The tendency is for these spurs to increase in number at the expense of longer shoot growth and total leaf area. The spurs become less vigorous as the wood becomes older and the decreased leaf surface cannot produce high-quality fruit. Thus, if long-pruning promotes rapid tree growth and early fruit-bearing, a more drastic type of pruning may be necessary to maintain an even balance between fruit production and the development of wood.

With all varieties of prunes included in this experiment, results have indicated that long-pruning may be practised to advantage during the early years of growth. A judicious selection of branches must be made to build a strong well-formed tree, open to sunlight. Individual and variety characteristics must be considered. As fruit production tends to slow down new wood growth, a gradual heading-back should be introduced, accompanied by more or less severe thinning-out of the fruiting spurs.

Apple Thinning Investigations at the Experimental Station, Summerland, B.C.

Thinning, or the removal of a portion of the crop in the early stages of growth, is an orchard operation which calls for the exercise of sound judgment. In order that the grower's judgment may be sound, it must be based on accurate evidence. Much evidence of value can be secured by the grower in his own orchard; in fact, it will always be necessary for him to modify his practice to conform with local conditions. Few growers, however, have the time or inclination to conduct detailed thinning experiments over a period of years. The natural tendency is for the grower to adopt over his whole orchard that practice which, after the first season's trial, seems to promise greatest financial returns. It is only at an experimental institution, where experimental data are accorded first place and financial returns are considered of secondary importance, that it is possible to conduct a systematic series of thinning experiments over a long period. With these facts in mind, the original orchards planted at this station in 1916 were laid out to serve as an extensive test of various thinning practices.

Both distance-of-thinning and time-of-thinning experiments have been conducted, the basis for removing the fruits being to estimate the distance along a branch between the apples intended to remain, and to eliminate the intervening fruits. In no case was more than one apple left to a spur. Over 350 trees have been used in the distance-of-thinning experiments, equal numbers being thinned heavily (9 inches apart), medium (6 inches apart), and lightly (3 inches apart). These treatments were carried out consistently on the same trees year after year in order to provide information concerning the cumulative effect of thinning on tree growth. These experiments have provided a wealth of data, details of which it is impossible to present in this brief report. However, some of the most important results are summarized below.

Summary of Results

1. There is evidence that heavy thinning reduced the yield of Wagener, Duchess and Jonathan, but with the varieties Rome Beauty, Delicious, McIntosh, Cox Orange, Yellow Transparent, Newtown and Grimes Golden, there has been no significant decrease in crop resulting from heavy thinning as contrasted with light thinning.

2. Trees on which 9-inch thinning was practised have grown larger than those on which 3-inch thinning was done. This increase in size of heavily thinned trees has, in large measure, compensated for any reduction in yield per unit of bearing surface caused by heavy thinning.

3. Nine-inch thinning, practised over a period of years, has resulted in the establishment of the annual bearing habit in a greater percentage of trees than has been the case with 6 and 3-inch thinning.

4. Nine-inch thinned trees have set larger numbers of apples per tree than have 6 or 3-inch thinned trees, with a resulting increase in the cost of thinning.

5. Heavy thinning has resulted in larger fruit and greater development of red colour.

6. When costs of thinning and picking are considered there has been a significant decrease in returns from heavily compared to lightly thinned trees of most varieties.

7. Delicious, however, showed a significant increase in returns from heavy thinning.

8. The cost of heavy thinning amounted to approximately $1.40 per tree per year; medium thinning, $1 per tree per year; and light thinning, 60 cents per tree per year.

9. With regard to time of thinning, the most satisfactory results were secured with Duchess and Transparent when these varieties were thinned at the time the fruits had attained a diameter of 1 inch. At this stage of growth, the fruits could be easily removed and the maximum effect on size was secured.

10. With Delicious, Jonathan, Wagener, McIntosh, Newtown and Rome Beauty, thinning was advantageously performed when the fruits were between 1 inch and 1¼ inches in diameter.

11. Total yield per tree and trunk cross-sectional area were found to be closely correlated.

12. Size of fruit was found to be positively correlated with leaf area per apple.

13. McIntosh and Delicious were found to have denser foliage than Newtown and Rome Beauty.

14. Rome Beauty produced a much greater weight of fruit per unit of leaf area than did McIntosh.

Recommendations

The above results suggest the following recommendations which may be of value to the practical fruit grower.

Thinning is essentially a process of apportioning the number of apples to the leaf area of the tree in such a way as to improve the size of the fruit. Accordingly, thinning should be thought of, not as a mechanical procedure of spacing apples 9 inches apart or 3 inches apart, but as a means of distributing the apples over the tree in such a way as to secure the desired effect from the leaf area of the tree in question. The degree of thinning, which should be practised with any particular variety or any one tree of a variety, depends on the leaf area carried by that tree and the size of fruit required. The results

of these experiments indicate that, given adequate water supply and favourable cultural conditions, most varieties of apples can be expected to respond profitably to 3-inch thinning. With the Delicious variety, heavier thinning may be justified, owing to the higher prices received for large highly coloured fruit of this variety.

The actual thinning operation should be performed at the time when the surplus fruits can be economically removed with a minimum loss of food reserves to the tree. The best time to thin Duchess and Yellow Transparent is when the fruits are about an inch in diameter, which is usually about a month after the blossom period. Thinning of later varieties such as McIntosh, Delicious and Yellow Newtown can be performed to advantage when the fruits are between 1 inch and 1¾ inches in diameter.

The leaves play a major rôle in the performance of an apple tree. It is by means of them that the bearing surface increases, the root system extends and the fruit develops. Accordingly, the reason that heavily thinned trees grow larger than lightly thinned trees is probably because a smaller proportion of the food is used for fruit production, leaving a greater surplus available for wood growth. The wise grower will adopt those cultural practices which produce a large healthy leaf surface, thus ensuring desirable size in his fruit with the minimum of thinning.

Raspberry Problems in the Mission Hatzic District, B.C.

A survey to determine the cause or causes of the decreased production from raspberry patches in the above mentioned area was commenced in 1930. This work has been continued during the last three seasons.

From the evidence gathered to date there appear to be several possible factors, including plant diseases, moles, and probably an acute soil condition or nutritional problem. An experimental plot has been established in the Mission Hatzic area for the purpose of conducting detailed studies in nutritional problems, results from which will be reported later.

Variety Trials With Raspberries at the Experimental Farm, Agassiz, B.C.

The earliest variety under test is the St. Regis and the latest is the Latham. The Count and Brighton, for earliness, follow the St. Regis about one week later and both give large yields. The fruit, however, is small, particularly after the first few pickings. All varieties under test proved hardier than Cuthbert and none, except Herbert, and this to a minor extent, manifested the Cuthbert characteristic of fall growth of buds from the current season's growth. The condition of the Viking, after growth commences in the spring, is frequently weak and indicates severe winter injury. It differs in one chief respect from the Cuthbert. In the latter variety many buds are killed outright and from the base of these quite frequently new bud growth develops; usually, however, such growth is too weak to have any fruiting value. With the Viking there are practically no buds killed. Most of them, however, give very weak growth, indicating winter injury. The crop on such weakened buds is very small and, as a consequence, this is the poorest yielding variety.

The Lloyd George is one of the more promising of the newer varieties. The fruit is large, attractive in appearance, of good quality, and the plants yield abundantly. During the last two years, this variety has outyielded all others. The fruit has a tendency to be soft, though in two trial shipments to Calgary

the condition on arrival was satisfactory. As a canning berry it is not viewed favourably by some of the commercial canners, the processed fruit being too pale in colour. As a jam berry it is very promising. Plants are resistant to yellow rust which should prove beneficial in warding off attacks of cane blight. The Newman is also a promising variety, having few of the weaknesses of the Cuthbert, but it is slightly inferior in quality.

Blossom Pruning With Strawberries at the Experimental Farm, Agassiz, B.C.

The method involved in this project consists of removing all blossoms from one series of plots during the first year and allowing fruit to set in the second series. The results here reported are from the first main cropping season. In total yield of fruit from the two treatments, the deblossomed plants gave a slightly larger yield in eight of the ten plots. The normal plants in two plots yielded more than the deblossomed ones. The difference in yield did not prove significant, using "Student's Pairing Method." The deblossomed plants showed slightly more vigour with berries averaging 0·158 ounce as against 0·153 ounce for the normal treatment.

Effect of Manurial and Cultural Treatments on Winter-Killing of Raspberries, Experimental Farm, Agassiz, B.C.

During the winter of 1932-33 very severe winter injury was experienced, in the Fraser River Valley, by growers of raspberries. As high as 90 per cent of the canes of the Cuthbert variety were killed.

Some of the experiments under way at this farm have thrown considerable light on cultural methods which might induce winter injury.

Plots receiving fertilizer and manure were more severely injured than those which had received other treatment. Table 9 sets forth the results from the various treatments.

TABLE 9.—RASPBERRIES—PER CENT OF CANES WINTER-KILLED.

Treatment	Total number of canes	Number of canes living	Number of canes dead	Percentage of dead canes
Rye, cover crop	610	355	255	41·8
Clover, cover crop	617	316	301	48·7
Vetch, cover crop	608	362	246	40·5
Manure	657	109	548	83·4
Fertilizer (complete 5-10-6)	597	144	463	77·6
Clean cultivation	659	216	443	67·2

A count made of the buds actually alive corroborated these figures.

Another condition noted from the manurial treatments was the greater number of branching canes from manure, fertilizer and clean cultivation plots. Branching canes appear to be more susceptible to winter injury. Plots treated with cover crops produced finer branching canes than those receiving the other treatments.

A comparison between plants grown on the hedge row system and those grown on the hill system yielded the following.

NUMBER OF LIVING BUDS ON FIFTY CANES

Hill treatment	12·5 living buds
Hedge row	40·9 " "

This indicates a correlation between a small number of canes and winter injury; in other words, a correlation between high vigour and winter injury. Since the hilled rows produced a larger number of branching canes than the hedge rows, it is further corroboration of the susceptibility of branching canes to injury.

Evidence from the farm experimental plots and from observations in commercial patches indicates that where there is sufficient natural fertility, chemical fertilizers and live stock manure should be applied very sparingly, and that humus may be satisfactorily incorporated into the soil through the medium of spring or fall cover crops and ploughing down green crops in a definitely planned system of rotation.

Mulch Paper Experiments at the Experimental Station, Sidney, B.C.

THE EFFECT OF MULCH PAPER ON THE YIELD OF THE MAGOON VARIETY OF STRAWBERRY

The mulch paper was laid down in strips on each side of the row of plants, the adjacent edges of the paper overlapping. The rows extended across the three areas used in the previous experiment, so that the culminating effect of manure, or fertilizer, plus the mulch paper, could be studied.

The yield of berries from the Keating Plot, expressed as pounds per acre, is shown in Table 10.

TABLE 10.—DEMONSTRATION STRAWBERRY WORK AT KEATING, B.C.

Fertilizer	Paper mulch			Clean cultivation		
	Crate	Jam	Total	Crate	Jam	Total
	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.
Manure	3,357	5,183	8,740	1,186	2,812	3,998
Fertilizer	2,619	4,087	6,706	868	1,988	2,856
Check	2,355	3,874	6,229	865	2,834	3,699

1. The yield with paper is in general double that of clean cultivation; on the manured and fertilized plants it is a little more than double and on the control a little less.

2. The berries on the paper mulched plot were smaller. During the last pickings, the berries almost all went as second class jam berries. The average size was that of a large pea.

3. A large percentage of the berries were dirty on the mulch paper plot, particularly so after the rain, as the paper was held in place by means of soil.

4. If the mulch paper is used, it would have to be renewed yearly as it gets badly torn toward the latter part of the season.

In another experiment conducted at Gordon Head, British Columbia, the following results appeared:

The mulch paper was laid down in strips on each side of a row of plants, the adjacent edges of the paper overlapping.

The rows extended across the three areas used in the previous experiment, so that the cumulative effect of manure, or fertilizer plus the mulch paper, could be studied.

In addition, this plot was watered by overhead irrigation. On this plot it was thought useful to keep a record of a row with mulch paper on only one side. The reason for this was that by covering the adjacent sides of two rows, if the paper should show some effect, it would reduce the amount of paper used, and thus the cost. Also, it wouldn't need to be replaced, as the pickers could pick in the areas between the rows not covered by the paper.

TABLE 11.—DEMONSTRATION STRAWBERRY WORK AT GORDON HEAD, B.C.

Fertilizer	Paper mulch			Clean cultivation		
	Crate	Jam	Total	Crate	Jam	Total
	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.
Manure	3,413	9,233	12,646	1,801	5,887	7,688
Fertilizer	2,848	5,894	8,742	1,579	4,625	6,204
Check	2,735	8,305	11,040	1,001	4,836	5,837

ONE-HALF PAPER MULCH

—	Crate	Jam	Total
	Lb.	Lb.	Lb.
Manure	2,298	8,763	11,061
Fertilizer	1,607	8,502	10,109
Check	1,198	5,950	7,148

1. The berries on the mulch paper plot were on the whole larger than the corresponding ones at Keating.

2. The berries were considerably dirtier than those at Keating. While it rained and while the irrigating system was being used, approximately one-sixth of the entire picking was too dirty for use.

3. On the row which was covered with mulch paper on only one side, the berries were very dirty. In general, however, they were larger than those from the row with mulch paper on both sides.

4. The drop in yield, on the row with mulch paper on both sides and fertilizer used, was due to the fact that June-beetle larvae killed a considerable number of plants.

5. The yield with mulch paper is in general double that of the clean cultivation making allowance for the row damaged by the June-beetle larvae.

6. The yield from the row covered on one side is not quite double that from clean cultivation.

POLLINATION STUDIES

Experimental Station, Kentville, N.S.

Experiments in pollination have been largely a follow-up of phases of the work instituted by the Pollination Committee and reported in Apple Pollination Studies, Dominion Department of Agriculture, Bulletin No. 162, by Dr. W. H. Brittain.

OPEN-BLOSSOM-END STUDIES WITH GRAVENSTEIN

It has previously been reported by W. H. Brittain and C. C. Eidt* that a definite correlation exists between open-calyx condition and the incidence of mouldy core. A definite correlation between seed content and presence of open-calyx condition was found. Low seed content was found to be associated with

* Brittain, Dr. W. H., and Eidt, C. C., National Research Council Bull., Seed content, seedling production and fruitfulness in apples.

this condition. Further, effectively pollinated trees under control conditions were found to be free of this condition. Ineffectively pollinated trees had low seed content, open-calyx condition, and mouldy core. Much late drop occurred from these trees.

A study of this condition was continued during the 1933 season. Two trees, of as nearly equal size as possible, were tented. Each tree was in its heavy-fruiting year and was well covered with fruiting buds. Twelve individual branches on each tree were tagged and the number of blooms counted. The branches were selected at well-distributed points throughout the trees. A check, or open-pollinated tree, was similarly treated.

During the full-bloom period one tented tree was supplied with Wagener bouquets, and a hive of bees was placed in the tent. The other tented tree was supplied with Blenheim bouquets and bees. Wagener has proved to be an effective pollinator for Gravenstein, and Blenheim an ineffective pollinator.

On the tree pollinated by Wagener two limbs were covered with cotton. These were hand-pollinated with Blenheim pollen. On the tree pollinated with Blenheim two limbs were pollinated with Wagener by the same method. On the open-pollinated tree two limbs were treated similarly and pollinated with Wagener pollen, and two with Blenheim pollen.

The results show that Wagener was effective in producing a heavy set on all three trees. Blenheim pollen produced a very small set on all three trees. The effectiveness of pollination of the three trees was, therefore, in the following order: Gravenstein pollinated by Wagener with 16·31 per cent set; the open-pollinated tree with 9·35 per cent set; and the Blenheim-pollinated tree with 1·92 per cent set.

BEE-POLLEN-COATER STUDIES

In the spring of 1933, a study was made of the effectiveness of bee pollen-coaters for distributing pollen, and to find the cost per gram of pollen satisfactory for pollination.

The bee pollen-coater is simply a narrowed extension to the beehive entrance. A well is constructed in this extension to hold pollen for its complete width. The depth, with the pollen in, is just sufficient to allow bees to walk over the pollen to get in and out of the hive.

To test whether or not the bees carried the pollen from the hive, two trees were tented, one Blenheim and one Stark. A hive of bees with a bee pollen-coater front was supplied in each tent, and pollen was supplied in the full-bloom period for three days. Golden Russet, an effective pollen for these two varieties, was used.

Cost of Pollen.—Both hives were strong over-wintered colonies. It was found that they removed approximately 3 grams of pollen during the day.

A check on the time necessary to strip anthers and dry them showed that the cost of pollen (dehisced anthers) was 36 cents per gram. The pollen, therefore, cost $1.08 per hive per day.

Effectiveness.—On each of the two trees ten limbs were marked and the blossoms counted. In addition, four limbs on each tree were bagged so that bees could not work them. Branches on check trees were also counted to ascertain their set. Over two thousand blooms were used on each tree, on which to base the set.

The use of the bee pollen-coater shows that bees did carry pollen from the hive to the blooms, and successful pollination was effected on the trees in the tents. This is especially true of Stark. A much larger set was produced under the tent than in the open-pollinated tree. Unfortunately, the Blenheim tree was not normal after the bloom period. Most of the leaves dropped off the tree, probably due to root injury. This probably accounts for the low set under the tent on the Blenheim tree.

ORCHARD CHECK.—A commercial orchard of five acres was supplied with five hives of bees for three days during the full-bloom period. This orchard is comprised of Blenheims and Rhode Island Greenings only. It is isolated from other orchards and in nine years had produced only very light crops though blooming heavily. The owner set the average crop at ten barrels per acre per year. Pollen was supplied to the hives at the rate of three grams of pollen per day for each of three days, at a cost for pollen of $16.20.

Bee activity was marked throughout the period and bees were found working the trees. The set was good in this orchard. A final crop of 324 barrels of Rhode Island Greenings and 128 barrels of Blenheims was harvested.

This may be taken as an indication that the bee pollen-coater is effective. However, the weather was ideal for pollination during the entire bloom period and more extensive data are necessary before final conclusions are reached.

ORCHARD BEE COUNTS

In the spring of 1933, it became apparent that a small wild-bee population was present in the valley. Counts were taken during the full-bloom period in seventeen orchards well-distributed throughout the valley. In ten orchards, on five ten-minute counts on selected branches, no bees were counted and very few were seen in any orchards.

Set counts showed a light set on orchards where varieties were planted in blocks, except where the varieties were self-fruitful.

Due to the exceptional bloom and very favourable growth conditions, even on light-set trees, comparatively large crops were harvested, as individual fruits developed to a large size.

THE USE OF BEES IN ORCHARDS

In years when wild bees are scarce, advantage from the use of bees should be gained.

In an isolated orchard in the Blomidon district, where a suitable combination of varieties from the pollination standpoint was present, five five-pound packages of bees were placed in the full-bloom period. Bee counts were taken throughout the orchard and a most unusual bee activity was noted. After three days, considerable weight had been gained by the hives, from apple nectar. The counts showed as many as 20 bees visiting a single branch in a ten-minute period.

Set counts were taken in this orchard and in an adjacent orchard under the same management. The results showed a consistent advantage in set for the orchard in which bees had been placed.

DROPS IMMEDIATELY BEFORE HARVEST DATE

The July drop was followed by another drop early in September, immediately before the fruit was ready to harvest. This drop was most severe on the ineffectively-pollinated trees, less severe on the open-pollinated tree, and very light on the effectively-pollinated tree. Many of these fruits were found to have an open-calyx-end and to be mouldy.

The data showed that heavy late drops occurred to a much greater extent on the ineffectively-pollinated tree than on the effectively-pollinated tree. It also showed that this drop was probably due to open-calyx condition. On the ineffectively-pollinated tree, although the crop was very light, a heavy proportional drop occurred. Most of these fruits had an open-calyx-end and were affected with mouldy core. This condition has been observed in commercial orchards. In one solid Crimson Gravenstein block, in the autumns of 1932 and 1933, a very heavy drop occurred and a very large proportion of these fruits were affected with mouldy core.

PICKED FRUIT

Fruit was picked from all the trees, and cut. Approximately one thousand fruits were cut from each of the Wagener-pollinated and the open-pollinated trees. From the ineffectively-pollinated tree all the apples were cut. The crop from this tree was only large enough to provide 259 fruits.

In cutting, the apples were listed according to the calyx condition, and presence or absence of mouldy core. The number of seeds in each fruit was counted. Open-calyx condition and mouldy core were very closely associated.

A low per cent with open-calyx resulted in a low per cent with mouldy core. A high per cent with open-calyx meant a high per cent with mouldy core. Some fruits with open-calyx condition showed no development of mouldy core, whereas others with a closed calyx produced mouldy-core fruit. These percentages were in every case very small, which would indicate that an open-calyx condition usually resulted in infection taking place. Some fruit must have been infected very early in the development of the fruit before calyx closure had taken place.

The number of seeds per apple, which is taken as an index of the effectiveness of pollination, was directly related to the presence of mouldy core. The average number of seeds per apple in each class was determined. An inspection showed that open-calyx fruit had fewer seeds than closed-calyx fruit, except in one case. Wagener and open normal fruits, and Blenheim mouldy, were the only three that gave large populations and in these three cases there was a large population cut. In the other three, small numbers were available, and much greater error is possible.

The Blenheim-pollinated tree had less seeds per apple than the other two, and the amount of open-calyx was directly correlated to this. Wagener, which was most effectively pollinated, produced more seeds per apple and had very little mouldy core (5·2 per cent). The open-pollinated tree had fewer seeds per apple, was less effectively pollinated, and produced 19·5 per cent mouldy core. The ineffectively-pollinated tree had very few seeds per apple and produced 61·6 per cent of mouldy core fruits.

Hockey and Harrison* report size of fruit as an important factor in the production of mouldy core. Large fruits were found to produce a larger per cent of mouldy core than smaller ones. This would still leave pollination as a most important factor, as where insufficient pollination has taken place a few fruits of very large size are produced on the tree. These, according to their findings, would be subject to open-calyx conditions.

SUMMARY

The results of the 1933 season are in line with those of previous years.

The effectiveness of pollination, as measured by set and seeds per apple, has been directly correlated with the production of open-calyx. Effective pollination to ensure large crops has largely controlled this condition.

Experimental Station, Fredericton, N.B.

Hand pollination studies, with the object of determining the relative suitability of some of the common commercial varieties as pollinators for McIntosh, commenced in 1929, have been continued. The varieties under test have been Melba, Dudley, Wealthy, Alexander, Lobo, Fameuse, McIntosh, and Cortland.

The results of the experiment indicate that McIntosh, although not self-sterile, is commercially self-unfruitful and that all of the varieties tested as pollinators, with the possible exception of Dudley, are satisfactory pollinators for McIntosh, providing they fulfil the bloom requirements in so far as time of blossoming is concerned.

* In N.S.F.G. Assn. Report for 1933.

For the past three years, the flowering dates of all these varieties, excepting Lobo, have corresponded sufficiently or have overlapped enough to warrant considering them as satisfactory pollinators for McIntosh. Lobo generally blooms about two days later than McIntosh and it is doubtful, on that account, if it would be entirely satisfactory.

Cherry Pollination Studies at the Experimental Station, Summerland, B.C.

In growing any or all of the three important sweet cherries, i.e., Bing, Lambert and Royal Ann (Napoleon), an extra variety must be included to act as a pollinator. The varieties used as pollinators have, in most cases, been of too low a quality to be acceptable in the regular markets.

Some years ago, this station began a search for pollinators of high commercial value, and endeavoured to find a strain within a variety which would be of known efficiency for the standard varieties. Wood from the tree selected could then be distributed to nurseries for propagation.

From results obtained after four years' testing by controlled methods, and using pollen from several well known pollinators compared with varieties of quality but with unknown pollinating ability, a variety known as Deacon was selected. This variety is a black sweet cherry of good commercial value, and is now being sold by most nurseries in the West as a pollinator for Bing, Lambert, and Royal Ann.

Further tests were made this year using pollen from four varieties of exceptional promise. Pollen was obtained from a highly recommended variety grown in the Fraser valley and known as Carnival. Three other varieties in the station variety orchard were also tested, i.e., Giant, V160140 and V160133. The last mentioned is a new variety, which originated at Vineland, and is a most attractive cherry. If it proves to be a good pollinator, its value will be enhanced to that extent. Pollen of variety V160140 gave a good set on Bing, Lambert, and Royal Ann. V160133 was effective on Royal Ann only, Giant on Lambert only, and Carnival on none. However, it should be mentioned that the Carnival pollen arrived in very poor condition. Furthermore, as weather conditions were unfavourable during the period when pollination was done, it will be advisable to repeat these experiments.

Pollination Studies With Pears and Cherries at the Experimental Station, Sidney, B.C.

The problem of pear pollination has been receiving the attention of this station since 1929. The problem resolved itself into the following phases:

1. To what extent are pear varieties influenced by cross-pollination?
2. If planted alone in commercial orchards, will the set of fruit be sufficient to warrant such plantings?
3. If pears will not produce profitably in the absence of cross-pollination, what varieties should be used as pollinators?
4. If interplanting of varieties is found to increase the yield of fruit, will the increase be sufficient to make the interplanting profitable?
5. When it is found that two varieties pollinate each other the following points should also be considered:
   - (*a*) Value of the pollinator commercially.
   - (*b*) Coincidence of bloom of the pollinator with that of the variety to be pollinated.
   - (*c*) Succession of ripening in varieties for convenience in harvesting.
   - (*d*) Amount of pollen produced by the pollinator.

Some fifty varieties of pears are grown in the station orchard and this has offered an excellent opportunity for the study of the above problems. In conducting the work, the common system of caging, emasculating and hand-pollinating has been employed.

RESULTS.—Increased sets of fruit brought about through cross-pollinations have been very noticeable. In the case of some of the more popular varieties, known crosses have been made over a period of years, to determine suitable pollinators. Anjou, Bartlett, Boussock, Louise Bonne de Jersey, Clairgeau and Bosc have all been used. Clairgeau and Bosc are the best pollinators for Anjou, of those tried. Dr. Jules Guyot and Bosc are best pollinators for Boussock while Bartlett and Bosc are best for Clairgeau. For Louise Bonne de Jersey, Bosc is decidedly the best pollinator. Hence it is seen that Bosc pollen gave best results of any single variety used. In the case of Anjou, greater sets were obtained with Bosc and Clairgeau pollen than under ordinary open-crossing conditions. Emasculation injury is no doubt an important factor in many cases, but this cannot be precisely ascertained. Emasculations have been carried out each year, but perhaps more satisfactory results might be obtained through omitting the operation of emasculating and observing the increase in set, if any, brought about by the use of known pollen.

TABLE 12.—NORMAL SET vs. SELF SET FRUIT.

—	Five Years			Three Years				
	Number of blossoms	Number fruit set	Per cent set	Number of blossoms	Number fruit set	Number fruit harvested	Per cent of blossoms harvested	Per cent of set harvested
Normal	41,546	8,252	19·8	24,839	4,837	1,520	6·1	31·4
Self	40,531	1,644	4·0	24,047	1,124	285	1·1	25·3

The importance of providing for cross-pollinations is amply shown in Table 12. Not only is the set higher with cross-pollinations but the seasonal "drop" is less. "Normal set" is obtained from counts made on uncaged branches and subject to ordinary orchard open-crossing conditions where varieties are interplanted. "Self" sets are from counts made of bloom caged in cotton bags until the stigmas begin to dry off.

In order to determine the influence of hand-pollination versus no hand-pollination, the following small project was carried out. Bloom on trees of all varieties in the orchard was caged and hand-pollinated with its own pollen. This was carried out by the simple method of plucking flower clusters and using them in much the same manner as a brush. This method has been found to be superior to that of using a camelhair brush; an abundance of pollen is supplied to the stigmas concerned with a minimum amount of injury to those delicate flower parts. In the corresponding group of bags nothing was done, the bags simply being removed as soon as bloom was over.

It will be seen that hand-pollinations gave a slightly better set of fruit. The number of blooms involved is sufficient to give a fairly accurate comparison between the two methods.

TABLE 13.—HAND POLLINATION vs. NO POLLINATION.

Method	Number of blossoms counted	Number of fruit set	Per cent set
Hand-pollination	4,603	330	7·1
No pollination	8,762	514	5·8

Some investigational work has been carried out on the effect of shaking caged branches to increase the set of fruit. Hand-pollinations entail considerable time and labour in removing and replacing the bags, providing the pollen, etc. As a substitute for this procedure it was thought worth while to determine the effect on the set of shaking the cages to ensure distribution of pollen within the bag. The results obtained are difficult to interpret in that a lower set was obtained through shaking. In each instance 50 bags were involved, each containing over 80 blossoms. Data have been carefully checked and the amount of fruit set is in favour of the unshaken bags.

TABLE 14.—RESULTS FROM SHAKEN AND UNSHAKEN BAGS.

—	Number of blossoms counted	Number of fruit set	Per cent set
Shaken bags	4,341	210	4·8
Unshaken bags	4,421	304	6·8

Several varieties have shown complete self-sterility for the five-year period. These are: Anjou, Beurre Diel, Madame Baltet, Passe Crassane, Pitmaston Duchess, Princess, Triomphe de Vienne, Virginie Baltet and Winter Nelis.

A few other varieties have given such low sets (and only in one or two of the five years), that they may be considered self-sterile. These are: Barry, Beurre Hardy, Boussock, Crocker Bartlett, Doyenne d'Alencon, Doyenne du Comice, Koonce, Le Lectier, Louise Bonne de Jersey, Madame Ernest Baltet, Pulteney, Royale Vendee, Vicar of Winkfield, and Warden Seckel.

Two varieties, Seckel and President Deviolaine, show a greater set with their own pollen than under ordinary open-crossing conditions. In all other cases self-pollinations gave lower sets and in most cases showed a marked inferiority.

CHERRIES

Much the same plan of pollination studies has been carried out for the cherry as for pears. Sets of fruit under natural, cross, self, and artificial conditions have been recorded. Time of blooming has much to do with the question; e.g. the Lambert, at times, is much too late to be pollinated by some of the earlier varieties, neither can it pollinate these early sorts. Cherries have a comparatively long blooming period, if the entire time from the opening of the first flowers to the shedding of the last blossoms is considered. The average length of the blooming period for most varieties is over three weeks. This period may be a month in certain seasons, hence there is usually sufficient overlapping in most varieties to ensure pollination.

In the cross-pollination, attention has been confined to those varieties which have been found of commercial value in this locality. Without doubt, Bing, Royal Ann and Lambert are among the more popular varieties.

A variety to be used as a pollinator should have considerable merit of itself. This has been kept in mind, and considerable testing of Black Tartarian and Deacon has been carried out.

The summary of the results to date indicates Deacon to be the most effective pollinator, of those tried, for Bing, Royal Ann and Lambert. Next to Deacon, Black Tartarian on the three varieties mentioned gave best results. Emasculations were carried out on all varieties. Owing to the structure of the flower, this operation with cherries results in less injury than with pears.

While Bing and Royal Ann are reported to be intersterile, it might be pointed out that Royal Ann pollen gave a very good set here on Bing during the season of 1932. The Windsor, a variety of considerable merit, has not been as good a pollinator as Black Tartarian or Deacon.

FRUIT VARIETY TESTING AND RECOMMENDATIONS

The testing of varieties of fruits throughout Canada continues to be one of the important lines of work in the Division of Horticulture. The great variations in climate make this a necessary and very useful function of this division. As a result of the many years' records accumulated, recommendations from time to time are possible and some of these are here appended.

Experimental Station, Kentville, N.S.

STRAWBERRIES

For years, the variety Senator Dunlap has been the one important variety in the Annapolis Valley and the greater part of Nova Scotia. During the last few years, however, there has been a growing dissatisfaction with this variety. A large amount of this is no doubt due to the spread of various troubles, such as root-rots, virus diseases and mites.

In an endeavour to locate better varieties than Dunlap, a large collection of strawberries has been grown at this station and to date the following have proved of considerable promise and may be recommended:

Early—Senator Dunlap, Premier and Blakemore. Mid-season—Bliss, Minnehaha and Marvel.

Late—Jessie and Portia.

CURRANTS AND GOOSEBERRIES

While currants and gooseberries are not very important crops commercially, there are considerable quantities grown in the valley for local and home use. The most satisfactory varieties for conditions here are:

Black currants—Black Victoria, Boskoop and Saunders.

Red currants—Fay Prolific and Perfection.

Gooseberries—Downing, Houghton, Mabel and Red Jacket.

Raspberries—Newman No. 23 is an early, hardy, productive variety with large crimson-red berries of good quality. It is firm for shipping but must be picked regularly, as it will drop from the canes if left after it is ripe enough to harvest.

Newman No. 20 is a few days later, producing a slightly larger, more attractive, firmer berry of equal or better quality than No. 23, but it is slightly less productive. These two varieties have at this station proved to be vigorous growers, producing more sturdy upright canes, and yielding better crops than Herbert.

Experimental Station, Charlottetown, P.E.I.

STRAWBERRIES

As a result of the testing of twenty-nine of the well-known and newer varieties of strawberries over a period of years, the following have proved to be of outstanding merit:

SENATOR DUNLAP.—This is a vigorously growing variety doing well in all sections of the province. The fruit is above medium in size, and of good quality. This variety, under normal conditions, can be depended upon to produce a good crop each year.

VALERIA.—This an imperfect variety of vigorous habit. The fruit is only of medium size, but it is much less acid than that of any other variety tested here. With respect to yield it is outstanding. Its chief fault is that it does not hold its size well over the season.

LAVINIA.—This is a very attractive medium late variety. While it is not quite so adaptable as Dunlap, the berries are larger and more attractive in appearance. This variety has done well in most years, and is well worthy of trial.

PORTIA.—A late variety. The plants are extremely vigorous with good foliage. The fruit is attractive, briskly subacid with prominent seeds. It is very attractive and worthy of trial.

CASSANDRA.—A seedling of Bubach. The plants are moderately vigorous and the foliage good. The berries are large but inclined to be soft. In wet seasons it has a tendency to scald. Worthy of trial.

Experimental Farm, Nappan, Nova Scotia

BLACK CURRANTS.—The following appear to be varieties in considerable favour at this farm and may be recommended as suitable to this district: Saunders, Topsy and Climax.

RED CURRANTS.—The following varieties have, during the last three years, given the most outstanding performance: Cherry (red) and Fay's Prolific.

GOOSEBERRIES.—Red Jacket, Silvia and Charles would appear to be the three best sorts for general planting.

Experimental Station, Fredericton, N.B.

APPLE VARIETIES

Of the varieties under test in this orchard, Northwestern Greening, Wolf River and McIntosh have produced the highest yields with average annual yields per tree of bearing age of 17·85, 17·73, and 17·24 pecks, respectively. If the 1929 McIntosh yields had been available, it is probable that this variety would have proved the highest yielding variety under test. This yielding ability of McIntosh, together with its high quality and popularity on the market, ranks it easily as New Brunswick's premier apple.

Crimson Beauty is in fourth position, with an average annual yield of 16·40 pecks. This is the earliest apple grown in New Brunswick, being earlier than Yellow Transparent, and, in addition to being a good bearer, it is perfectly hardy under local conditions and produces a very vigorous and strong tree. It may be criticized somewhat on account of its quality, being quite acid in nature. It also ripens unevenly, necessitating several pickings if a really high grade class of stock is to be put on the market. These drawbacks are more than offset by its extreme earliness and the attractiveness of the fruit, which is well coloured, and for years this variety has proved one of our best sellers. Its planting should be confined, however, to the demands of the local markets.

The variety Fameuse, although in eighth position as regards yield, has been a very popular apple in the past. During recent years, it has been subject to premature breakdown in storage, a factor which has ruined its reputation on the market and greatly decreased its sales value. So serious is this problem, that until such time as a solution is found, it is questionable if additional plantings should be recommended.

Wolf River, Milwaukee, Alexander and Canada Baldwin, although good producing varieties, are not recommended for further planting. The Alexander and Wolf River varieties, although only fair in quality, have proved fairly remunerative in the past. Their ease of growing combined with reduced handling charges, due to ease of picking and grading, have combined to make a fair return to the grower possible. The development of the chain-store system with its subsequent demand for a medium sized apple, suitable for selling in baskets, has virtually ruined the market for large-sized apples such as Alexander and Wolf River. For the past three seasons, it has been almost impossible to sell these varieties in commercial quantities, thus rendering further plantings inadvisable at the present time.

Bethel, a variety which has been strongly recommended as a winter apple for New Brunswick, has proved to be a shy bearer. 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. In fact, the experience of this station has been such that the top-working of existing Bethel trees is under serious consideration.

Duchess and New Brunswick, which are one and the same variety, have proved to be very poor producers. The market for these apples is very limited. In fact, in some seasons it is very difficult to dispose of them at any price. Further plantings are certainly not justified.

In view of these circumstances, it is evident that future commercial plantings of apples in New Brunswick must be confined to a small number of varieties. McIntosh should constitute a large proportion of the total planting. Crimson Beauty may be planted in small quantities only. Golden Russet must be seriously considered as a winter apple. Fameuse may be planted fairly extensively, providing the breakdown problem is solved. Replacing Duchess, the variety Melba may be strongly recommended. Two trees of this variety, in the station variety orchard, have given an average annual yield, for the period 1925 to 1933 inclusive, of 14·55 pecks. The exact commercial status of Melba in New Brunswick has not been determined. It has been found that the apples must be handled carefully, as they are easily bruised. The appearance on the tree is very deceiving, as they do not pack out and look as attractive in the package as one would expect. This variety also requires fairly heavy thinning for best results. On account of its high quality, it would appear to have an important place in any high class trade.

For a winter apple, the variety Sandow is very promising, and its performance to date has been such as to warrant its planting, on a small scale at least, in New Brunswick orchards. For the period, 1925 to 1933, inclusive, this variety has given an average annual yield per tree of 18·59 pecks, thus ranking it as a very heavy producer on the basis of the records of two trees in the variety orchard.

Experimental Station, Ste. Anne de la Pocatière, P.Q.

Apples.—The region surrounding this station is evidently very suited to the production of high class apples, particularly if the orchards are located on the higher and sloping lands. The following varieties have performed excellently and appear to be suitable for general planting: Melba, for an early variety; Lobo, Fameuse and McIntosh.

Plums.—Twenty-eight varieties of plums are contained in the plum orchard, the majority being of the Domestica group; these plums appear to succeed quite satisfactorily at this station. The following appear to be of outstanding value for this district: Lombard, Reine Claude, Green Gage, Gucii, Bradshaw, and Montmorency.

Cherries.—La Cerise de France and La Grosse de Montmorency are the most vigorous and hardiest of all varieties of cherries tried at this station.

Experimental Station, Cap Rouge, P.Q.

FRUITS.—Apples and strawberries are the only fruits of economic importance in Central Quebec at present. Raspberries would be profitable if growers understood the necessity of starting with disease-free canes, but under actual conditions this industry is generally run at a loss. Pears cannot be considered until a sufficiently hardy variety of fair to good quality is found. The market for currants and gooseberries is so limited in the district that farmers are advised not to make any commercial plantations. Plums and cherries generally do well but most varieties which succeed in Central Quebec have not fruit of the size and appearance necessary to come in competition with what comes from outside. The season is too short to grow grapes, unless for the home garden.

APPLES.—Climatic conditions are not as good in Central Quebec, for apple growing, as they are in the southwestern part of the province, in certain valleys of Nova Scotia and British Columbia, in Ontario, or in Oregon and Washington.

APPLE—VARIETY EXPERIMENT.—Some 1,200 trees of more than 200 varieties have been tested since 1911. Careful records have been kept regarding hardiness, productivity, size, colour and quality of fruit. Hardly a dozen of these varieties have shown really outstanding merit such as is required to make them profitable under the conditions of Central Quebec. The outstanding varieties to date from among this collection would be: Yellow Transparent, Melba, Lobo, and McIntosh Red.

CHERRY—VARIETY EXPERIMENT.—During the last 20 years, 174 cherry trees of 19 varieties were tested. As only the sour cherries succeed in the district, the size and quality of their fruit is not such that it can favourably compete with fruit that comes from outside, so that the commercial aspect of cherry growing does not promise much. Vladimir is of the highest quality for the home garden. To the man who can find a market, Montmorency Large is recommended. Early Richmond did well, but was surprising in its lack of hardiness.

PLUM—VARIETY EXPERIMENT.—Since 1911, over 300 plum trees of 48 varieties were tested for hardiness, yield, colour, size, appearance, and quality of fruit. European varieties certainly do best where the humidity is high, that is, in localities near large masses of water, while American varieties succeed in interior districts. At Cap Rouge, near the St. Lawrence river, three European varieties have done best, Bonne Ste-Anne, Montmorency and Quackenboss, with the first mentioned in the lead. The same condition exists here as with cherries, that is, the varieties which succeed well in the district have not fruit of the colour, size, appearance, and quality necessary to compete with fruit from outside. Bonne Ste-Anne is a probable exception.

PEAR—VARIETY EXPERIMENT.—From the 64 pear trees of 9 varieties planted from 1911 to 1923, not one merchantable fruit was produced, though such well known varieties as Clapp Favorite, Winter Nelis, Seckel, and Naine de Doucet were tested. It is thus evident that pear growing cannot be recommended in this district.

GRAPE—VARIETY EXPERIMENT.—None of the 33 varieties of grapes tested during the last 17 years has enough quality and earliness to be recommended for commercial growing. Among the ones which have shown up better, for a long number of years, are: black—Early Daisy; red—Wyoming; and green—Winchell and Portland, the latter, from the Geneva, New York, Station, being the most promising of the varieties recently tried.

Experimental Station, Harrow, Ont.

A number of years ago many of the old apple and peach orchards in Southwestern Ontario were destroyed as a result of the rapidly developing tobacco industry with its high prices. To-day the tide has turned again. At the present time the principal flue-cured tobacco-producing area has moved to the Norfolk district, and many farmers are getting back to horticultural crops on a large scale, especially on the lighter soils in Essex County. More orchards are being planted and truck crops are being grown more extensively to meet the early market. As a result of this trend many requests have been made for more experimental work in horticulture at the Harrow station.

In order to meet the demands for information, a small collection of apples and small fruits has been established at this station for variety testing purposes.

Experimental Station, Kapuskasing, Ontario

Fruit growing at this station has proved to be more precarious than at any of the other regular experimental stations, with the result that only a few trees grown have been found to succeed in the short season and severe winters which prevail.

As yet none of the larger fruited apples have been found satisfactory and of the crabs the following appear to be outstanding: Osman, Columbia, Mecca, with Dolga a possibility, although it has been showing considerable injury in the xylem or wood. Of the standard apples, Hibernal and Patten Greening have produced a few fruits below snow level, so cannot be considered as hardy enough for this climate.

Of the plums, Sapa and Opata if kept well pruned, will produce below the snow line, while Assiniboine is probably the best venture yet of the standard varieties.

Raspberries and currants offer much better possibilities and the following have produced very satisfactorily: London Red, Red Dutch and Simcoe King, among the red currants, while Climax, Topsy, Collins Prolific and Saunders in the blacks are all good. Latham and Herbert raspberries are doing well, and, as they produce high quality fruit with good yields, are worthy of extended trial. Ohta is hardier but not as large or of as good quality.

Experimental Station, Morden, Man.

Apples and Crabs.—A feature of the apple crop was the substantial harvest of Melba. Six boxes or two barrels of this splendid new early variety were taken from root-grafted trees and top-worked Hibernals. Indications are that the Melba is hardy and productive in Southern Manitoba. McIntosh Reds, to approximately 30 pounds, were gathered from top-worked trees. As grown here, the McIntosh possesses remarkably high quality, rich in flavour, crisp and juicy.

Among other varieties prominent this season are: Goodhue, Folwell, Haralson, Minnehaha, Oxbo, Pine Grove Red, Rupert, Anoka, Antonovka, Blushed Calville, Crimson Beauty, Duchess, Green Sweet, Jethro, Linton, New Brunswick, Ostrakoff, Patten, Pedro, Perkin, Pinto, and Wealthy.

The Morden Station enjoys the growing prominence of recent introductions. To the fore were: Godfrey, Manitoba, Manitoba Spy, Mantet, Mortof, and Spangelo.

In crabapples, two varieties are of major importance, Rosilda and Trail. These bear annual crops, are attractive dessert small apples, and can well. The former is not unlike pears when canned. Wapella keeps well towards spring and is useful for sauce. Other sorts bearing profitably include Beauty, Columbia, Dolgo, Elkhorn, Faribault, Gertrude, Gretna, Osman, Piotosh, Prince, Printosh, and Robin.

PEARS.—Pears set a medium to heavy crop of fruit, several bushels being picked. Ussurian, Ovoidea, and Saponsky gave very heavy crops. Tolstoy, Gogal, and Pushkin set a few fruits. Patten No. 2999 and Patten No. 1213, top-worked on Ussurian, set some fine fruit, Patten No. 1213 being the finest pear, measuring over 2 inches. The quality was smooth, melting and pleasant. Patten No. 2999 was fair but coarser and not so large or so good in flavour.

PLUMS.—Several important varieties of plums produced well. Varieties little known on the Canadian prairies include Elliott, Emerald, Goldenrod, Hennepin, Kahinta, La Crescent, Minnesota numbers 17, 60, 63, 69, 76, 79, 101, 117, 126, 128, 197, 225, Monitor, Mound, Omaha, Oziya, Radisson, Red Wing, Tecumseh, Toka, Tonka, Tawena, and Winona (similar to Emerald). Of these, four command special interest and deserve wider attention: Radisson and Red Wing, (Minnesota State Fruit Breeding Farm productions); and Tecumseh and Toka (South Dakota Station). Radisson and Tecumseh are early; all rate highly in dessert and canning quality. Red Wing is the favourite jam product of all local fruits in the exhaustive cooking tests performed by Gertrude Bruce Leslie. All appear hardy at Morden. Some of the above new fruits are not recommended due to their late maturity. Such are Elliott, Emerald, Mound, Tonka, Winona.

Other profitable varieties were the two Morden Station productions, Mordel and Mordena; also Assiniboine, Cheney, Hanska, Kaga, Mammoth, Mankato, Ojibwa, Olson, Orchard No. 1, Pembina, Tokata, Underwood, Valley River, Waneta, Wilson and Winnipeg.

It was an experience new to this territory to pick mellow ripe European plums *(P. domestica)* off trees developed in the out-of-doors plantations. Two varieties, Lunn and Mount Royal, blue plums of the prune type, produced fair crops. The latter appears to be the more fruitful here. Heretofore, most varieties of European plums have been subject to winter injury of bud and young wood.

SANDCHERRIES.—Among the sandcherry-plum hybrids, Tom Thumb and Champa continue to hold first place for general planting. Their hardiness and heavy annual bearing are very desirable. The Morden-named seedling of Compass cherry, Mordena, promises well. It is comparatively free-stone, of good size, excellent colour, fine flavour and texture, and the vigorous tree seems hardier than the parent. The natural hybrid from local sandcherry seed, known temporarily as Morden hybrid, appears hardier than Compass cherry and is mild in flavour but less deep in colour. Sapa and Opata bore heavily and are choice fruits. Oka is esteemed as sweet dessert fruit and hangs on to the bush until dried up if protected from robins and cat-birds, but it is too tough in skin for first-class canned fruit. Other hybrids in fair to heavy bearing include Compass Cherry, Nicollet, St. Anthony, Valley City, Zumbra.

Of sandcherries, Sioux is high in quality. Mannmoor, the Morden seedling named in 1930, bore well, is of strong upright habit of bush, with firm flesh of pleasant quality. A sister plant with sweeter fruit, also large, and earlier maturing is being tested under number.

Several thousands of seedling sandcherries are under test. Populations from Sioux seed have an exceptional proportion with good dessert fruit, most of them being of good size and some ripening in the first week of August. It was noted with pleasure that most of these bushes are stronger and more upright in habit than the rather sprawling Sioux variety.

CHERRIES.—The sour cherry tests at this station are encouraging. A number of named varieties produced fair to well, among them being Early Richmond, Dyehouse, Montmorency, Wragg, Bessarabian, and Vladimir. Seedlings of Shubianka are showing up favourably and three selections appear worthy of introduction.

The Chinese bush cherry *(Prunus japonica var. glandulosa)* is hardy and extremely productive. It has been employed chiefly as an ornamental but the fruits are used for jam. The uncooked fruit is distasteful.

Nanking cherry *(P. tomentosa)* is thriving. Much fruit was gathered. The jelly made from this species is rated higher than any other local jelly, surpassing that of the native pincherry.

GRAPES.—A substantial crop of grapes was cut from nearly every variety in 1932. The types ranged from the native *Vitis vulpina* from the Riding mountains, to the white-fruited Pearl of Csaba, *Vitis vinifera*, from Central Europe. Prominent in bulk of bunches produced were Campbell Early, Moore Early, Alpha, Beta, Suelter, Lindley, and Minnesota No. 194. The Amur grape from Manchuria was a favourite with the grasshoppers and the hundreds of plants were mostly defoliated.

SMALL FRUIT

CURRANTS.—The extreme dry conditions prevalent for the past few years have checked black currants. As a result yields have been low, and drying out followed by winter killing has been severe. A few sorts, such as Collins Prolific, Clipper, and Buddenborg, remain robust. But for the most part drying out has been general, especially in the case of the varieties Merveille de la Gironde, Schwarze Traube, Lee Prolific, Climax, and Black Victoria. The large fruiting currants, Kerry and Boskoop Giant, gave their usual harvest of good quality berries. They are, however, suffering from drought.

Prolonged dry conditions have also checked red currants. Varieties coming through with good yields and vigorous growth include Red Dutch, Red Cross, Red English, Raby Castle, Wilder, Cumberland, and Victoria. The types with small sized fruit, such as Wilder, appear to be the most drought-resistant. The varieties Prince Albert, Simcoe King, Perfection, Moore Seedling, Everybody, and Pomona are showing considerable killing-back. Of the large fruiting sorts, Diploma has, so far, come through best. Fay, another large fruiting, delicious currant deserves mention, as doing well. Two new red currants, Stephens No. 9 and Red Lake (Minnesota 24), have been added to the plantation.

A list of white currants that are standing up under the dry conditions includes White Grape, White Cherry, and Large White. White Imperial, with a medium yield of large, high quality berries, continues to be our best white currant.

GOOSEBERRIES.—A summary of experience obtained with the varieties of gooseberries that have been so far properly tested will be found in the following paragraphs.

Como, a hardy Minnesota variety, bears a medium crop of medium to small berries. This is not a promising gooseberry here. Hansen's South Dakota hybrids, Sunset, Kapoza, Kataga, and Kopa are all growing vigorously. Kataga has no merit. Sunset and Kapoza yield good crops of medium to small fruit. Kopa is a promising variety. Its tall robust branches bear heavy crops of medium-sized, silvery-green, handsome fruit. Carrie, Houghton, Downing, Oregon, and Smith yield good annual crops of small to medium-sized fruit. Pearl, Silvia, and Mabel, while hardy, have not been bearing heavily. For the most part they have medium to small greenish-coloured berries.

Poorman has suffered from winter-killing. Protected bushes have given medium yields of medium large, red-coloured, attractive, superior gooseberries. Industry, Ross, and Careless bear very large fruits. They have many fruits measuring over an inch in length. The hardiness of these three gooseberries is questionable. Either drought or cold weather has been retarding these varieties. Careless has been the most hardy of the three and has promise. Ross

is probably the largest-fruiting gooseberry growing on the plains. So far, at Morden, it has consistently killed-back. Hardy seedlings from Ross have been grown and in some cases these attain a medium large size.

Josselyn and Clark are the two best large fruiting varieties. Josselyn has been grown at the station for many years. Its fruits are reddish-green and medium in size. The young plants are vigorous, but older plants become lower in their annual yield. Clark has very large light-red fruit. For the past six years, Clark has successfully withstood dry summers and cold winters. The yield, so far, has been heavy.

Charles and Spinefree are two Ottawa varieties worth noting. Charles produces fruit that is slightly smaller than that of Josselyn. Over a long period Charles would most likely outyield Josselyn. It is probably hardier than Josselyn and just as vigorous. Spinefree has very few thorns. At this station it has been a consistently shy bearer.

Perry, Pixwell, and Abundance are three new promising introductions from North Dakota. At the Morden station they are growing vigorously, fruiting heavily, and appear to be very hardy. Perry is a tall, strong-growing, upstanding bush. On good soil it will attain a height of over six feet. It has heavy crops of small pink fruit. Pixwell and Abundance have slightly larger fruit. The fruit hangs from long stems and is easily picked. Whitesmith, a large fruiting English variety, has killed-out repeatedly during the past few years. Chautauqua, a variety identical in appearance to Whitesmith, has been recently added to the plantation.

In 1929, gooseberry seed was gathered in Northern Manitoba with the object of obtaining a collection of superior strains of our native gooseberries for fruit-breeding purposes. In 1931, 450 native seedlings were planted out, the plants consisting of the species, *Ribes cynosbati*, and *Ribes oxycanthoides*. This year these seedlings were carefully selected and twenty of the best plants were retained as parents carrying a surplus of hardiness for breeding purposes.

Comparisons of the fruit size of most of the gooseberries mentioned will be found below. The berries were measured to the nearest sixteenth of an inch. The figures given are the average length and width of 25 berries from each variety taken at random. Clark, the largest fruiting variety, will be found at the top of the list. It will be noticed that the average length is almost an inch. The smallest fruiting variety, Houghton, will be found at the bottom of the list. This variety is under one-half inch in length, but is still larger than fruit from the native gooseberry, *Ribes oxyacanthoides*.

Variety	Length	Width
Clark	15·9	12·0
Careless	14·8	11·2
Kopa	12·9	9·3
Josselyn	12·8	11·1
Charles	12·5	11·0
Ross seedling	11·4	8·5
Silvia	10·9	8·8
Spinefree	10·3	8·4
Carrie	10·0	8·2
Mabel	9·9	8·9
Pixwell	9·1	8·5
Kapoza	9·1	7·3
Sunset	8·5	7·8
Smith	8·2	7·7
Como	7·8	7·6
Oregon	7·6	6·9
Houghton	7·3	7·0
Ribes oxycanthoides	5·9	5·7

BRAMBLES.—The fall of 1932 found raspberry plants weakened because of drought and grasshopper injury. This fall weakening, followed by a cold winter, caused most of the raspberry varieties to severely winter-kill. Winter injury was especially noticeable with such sorts as Viking, Latham, Herbert,

Newman, St. Regis, King, Turner, Early June, Brighton, Count, and the white raspberry, Golden Queen. Three of Hansen's South Dakota hybrids, Ohta, Sunbeam and Moonbeam, survived the winter and yielded medium crops. Moonbeam was especially vigorous, although its yield was not high. Twilight, Starlight and Fewthorn, three more Hansen hybrids, were severely checked by cold and dry weather.

Considerable mosaic was experienced. It seriously damaged the varieties Philadelphia, Starlight, Lloyd George, Erskine Park, and Latham.

Chief, a Latham seedling, from the Minnesota State Fruit Breeding Station, has been growing at the Morden station for the past six years. So far Chief has completely resisted mosaic, although it has been found moderately susceptible to leaf curl. This year Chief was one of the few varieties to noticeably escape winter damage. It has not borne heavy crops of fruit, but has given medium yields of medium-large, attractive, firm berries.

The recent New York State station introduction, Newburgh, which has been growing at the Morden station for the past two years, has, so far, not succeeded in establishing itself.

The Blackcap varieties, Conrath, Gregg, and Hilborn gave a medium harvest of small fruit. Hilborn remains the most reliable black raspberry.

Blackberries, for the most part, have not been able to live through the past season. Ward, Agawam, Gainor and Blowers have been completely killed-out. Eldorado still remains our best blackberry followed by Mersereau, Erie and Snyder.

STRAWBERRIES.—The strawberry plantations are being killed-out by dry weather, and an unknown disease which closely resembles yellows. Certain varieties are showing vigour. Dakota, and Dunlap have survived so far, and have given small to medium yields. Dakota is susceptible to yellows, but so far Dunlap has been practically immune to this trouble. Dunlap is probably our best variety. Other varieties still bearing fruit include Glen Mary, Grand Prize and William Belt.

Experimental Farm, Indian Head, Sask.

APPLES.—This farm possesses one of the oldest plantations of the original *Pyrus baccata* hybrids on the prairies, and many of these have done exceptionally well in withstanding the many rigorous seasons. Following is a brief description of some of the most promising of these, under Indian Head conditions.

Tony is a late crab, moderately large, bright red, and of very good quality. The tree is hardy and a strong grower.

Jewel is of good quality, a heavy producer, but if not harvested slightly on the green side will quickly rot while hanging on the tree.

Robin is a good preserving crab, a bountiful producer, and appears to be perfectly at home under prevailing conditions.

Silvia is the earliest maturing variety with medium to large yellow fruit of good quality, but it is of very short season as it soon goes soft and mealy if left on the tree for long. It is generally ready to pick by the middle of August.

All the above varieties have been growing since about 1908. Therefore 25 years of fruit growing prove conclusively that crabapples, at least, can be grown on the prairies with some degree of success. It is advantageous to have some sort of shelter-belt and absolutely necessary to provide protection from rabbits. Fencing with chicken wire seems to be the most effective method yet tried. The trees appear more vigorous and productive under clean cultivation, particularly in the dry years when many trees succumbed under a grass mulch system.

PLUMS.—Ojibwa appears to be a hardy, reliable, fruiting variety, as well as an early producer, and should be included in any plum plantation. Tecumseh lacks somewhat in hardiness but is of excellent quality and an early-maturing variety, being ready for harvesting by mid-August. Hanska is a later-maturing sort and not absolutely hardy but of excellent quality when preserved or made into jam.

Of the older trees in the plantation, Assiniboine, Ojibwa, Cree, Opata and Tom Thumb have produced bountifully and appear to be varieties suitably adapted for prairie culture, as very little winter injury is shown despite the very cold winters experienced. Sapa does not appear to be hardy enough to withstand the average conditions, much winter-killing being experienced. Pembina, while growing for a number of years, has not produced any fruit yet and kills back considerably some winters. As time goes on more definite information regarding each variety will be obtained.

Experimental Station, Rosthern, Sask.

APPLES.—None of the standard varieties of apples have proved hardy at this station. Duchess, Pine Grove Red, Green Sweet, Simbirsk No. 9 and Anoka have borne near the ground but all kill-back to about two feet.

None of the second crosses of the Saunders' hybrids has proved fully hardy, but the following have borne some fruit: Rosilda, Printosh and Piotosh. There are a great many crabapples which have proved perfectly hardy. These may be classed as follows:

Class 1, or crabs which are perfectly hardy, good producers, and of excellent quality, would include: Osman, Olga, Dolgo, Alberta, Sylvia, Garnet, Amur, Elkhorn, Fischer seedlings, Rosthern seedling No. 6, and Rosthern seedling No. 2, class 2, or crabs which are perfectly hardy but not so desirable as those in class 1 in production or quality would include: Jewel, Columbia, Prince, Charles, Rosthern seedling No. 1, Rosthern seedling No. 5, Rosthern seedling No. 3, Pioneer, Mecca, Magnus, Transcendent, Rosthern seedling No. 7, Lyman Crab, and Florence, class 3, or crabs which are mostly hardy but almost too small for economic use would include: Hopa, Robin, Golden, Red Siberian, Sue, and Red Sweet crab.

CHERRIES.—The most satisfactory of the cherries tested, considering quality, hardiness, and productiveness, are Champa, Oka, Tom Thumb, and Zumbra. Other bush forms which have fruited fairly well are: Skuya, Hoja, and Sioux sandcherry. Only two tree forms have been tested, namely, Compass cherry and Morden hybrid. Both have produced good quality fruit but are not very productive at this station. *Prunus tómentosa* and a sour cherry have also been under test for several years but kill back severely every winter and so far have not fruited.

PLUMS.—Numerous plums and plum hybrids are under test at this station. Of the tree plums, Assiniboine is the only one which has proved perfectly hardy and also produces large good-quality fruit. Omaha, Ojibwa, Pembina, and Earliest Minnesota have proved almost entirely hardy but have not yielded well. The following have produced some fruit on the lower branches and usually winter-kill above the snow line: Mammoth, Topa, Cree, Hennepin, Brackett, Emerald, Underwood, Wastesa, Elliot and LaCrescent. Of the hybrids tested, Opata and Sapa are the best. They show a fair amount of hardiness, and the fruit is of excellent quality. The following varieties have fruited at this station, but due to lack of production, hardiness, or quality are inferior to Opata or Sapa: Sansota, Cheresota, Wachampa, Waneta, Etopa, Enopa, Kandesa, Tecumseh, Inkpa, Wakonka, Wastesa, Yuteca, and Tokata.

STRAWBERRIES.—Some twenty-six varieties of strawberries have been tested here, including well-known sorts like Senator Dunlap and South Dakota. It has been found in these trials that Aberdeen is without doubt the hardiest, healthiest, and most productive variety under test. The fresh berries are of excellent dessert quality, but after canning, they fade out somewhat. Rosthern June Bearing fades badly. Harvest King shows considerable promise, and while it does not winter or yield as well as Aberdeen, the canning quality appears to be better.

Experimental Station, Scott, Sask.

A small collection of apples, plums, raspberries, currants, gooseberries and strawberries is being grown at this station and has indicated possibilities under the comparatively severe conditions prevailing.

It has been quite evident that to grow existing varieties of strawberries, artificial watering is required. Red currants appear to succeed very well and Prince Albert, Franco German and Large Knight are especially promising. Among the blacks, Black Grape, Eagle and Saunders are well to the top. In raspberries, Sunbeam and Ohta are hardy and good yielders, but Herbert and Latham are better in quality. Of the apples, the following crabs appear to be able to stand up fairly well under these extreme conditions: Osman, Transcendent, Prince, Florence. Crab apples appear to stand up under the drought much better than plums, which have not performed very satisfactorily during the driest years. The most promising varieties would appear to be Opata, Sapa, Ojibwa and Assiniboine. Among the cherry selections and hybrids, the following have proved of much value: Tom Thumb, Oka; Champa and Sioux.

Experimental Station, Swift Current, Sask.

PLUMS.—Opata plum is an outstanding variety that is recommended for the district, with considerable assurance of success. Sapa is also a very promising variety producing fruit of even better flavour than Opata. Cheney and Mammoth appear to be quite hardy. The fruit of the latter, however, though large, has an objectionable, tough skin.

APPLES.—The apples, which include both the crab and the standard varieties as well as a number of crab hybrids, are as promising as the plums. Osman, Dolgo, Amur, Piotosh, Rosilda, Transcendent, Florence and Pine Grove Red have all borne fruit. Pine Grove Red produced the first standard apple grown on the station. Florence yielded an excellent crop of crabapples of good size. Rosilda is an exceptionally well-flavoured crab which resembles its McIntosh Red parent in appearance and flavour, though not in size.

CURRANTS.—A very good crop was produced from the red variety Fay Prolific. London Red also yielded favourably. Kerry and Magnus, the only two black varieties in the test, produced good yields of very large berries.

GOOSEBERRIES.—Houghton, Carrie and Mabel have been grown since 1926. All winter well, but Houghton is the only variety that has produced even fair yields of fruit.

RASPBERRIES.—The raspberry varieties are very much subject to winter-killing even with a covering of one foot of straw during the winter months. Sunbeam and Herbert show the greatest degree of winter hardiness. These two varieties have grown a fair amount of fruit, which was small, possibly due to hot dry weather during the period when the fruit was in its last stages of development.

Experimental Sub-Station, Beaverlodge, Alta.

This sub-station, located in the Peace River country, represents one of the most severe regions for the growing of fruit, where winter injury to buds and wood is very frequent. Several acres of land are devoted to the testing of fruit and ornamental trees and shrubs.

As a result of this certain recommendations have emerged, as follows:—

GOOSEBERRIES.—Oregon Champion appears to be the outstanding producer and, as it is a satisfactory fruit in other aspects, may be recommended for planting in preference to Houghton in this district. In 1933, 12·57 pounds of fruit per bush were gathered from this variety, a good yield for more favoured regions.

CURRANTS, RED.—As a result of a seventeen-year trial New Red Dutch and Victoria Red appear to be the most reliable producers. Both are satisfactory fruit. It is not as large as Fay Prolific which, however, has consistently produced much less. The seventeen-year average for these two varieties has been, New Red Dutch, 8·19 pounds per bush, and Victoria Red 7·47 pounds per bush.

CURRANTS, WHITE.—In white currants, the outstanding variety for yield has been White Cherry with a sixteen-year average of 5·27 pounds per bush as compared with the next best variety, Large White, which produced an average of 3·69 pounds per bush.

CURRANTS, BLACK.—There are three varieties of black currants that have produced satisfactorily and all of them are of good commercial quality, they are: Eclipse, with an average production of 7·99 pounds per bush for a five-year average; Clipper, with an average production of 5·26 pounds per bush for a five-year average; Saunders, with an average production of 6·43 pounds per bush for a five-year average.

RASPBERRIES.—Only three varieties of raspberries have been reported on, and, of these, the Herbert appears to be outstanding, its yields per five-year period averaging 3,131 pounds per acre, which may be considered highly satisfactory for a berry of this size and quality.

PLUMS.—The only plums reported as fully hardy appear to be a large percentage of the wild plums from Manitoba. Practically 95 per cent of these are hardy to the tips. The Opata and Sapa varieties, although killing to some extent, have been brought to successful bearing. It is evident that the Americana varieties are not suitable, as the season is too short to permit of their maturity. There appear to be considerable possibilities in the future selection of desirable sand-cherries.

APPLES.—None of the varieties of apples appear fully hardy to date, although the following have fruited within the past three years: Hibernal, Blushed Calville, and a number of crabs, such as Osman, Columbia, Florence, Olga and Beauty. Hibernal has proved exceptionally resistant to sunscald, while Osman crab, the hardiest in other severe parts, appears to suffer materially from this trouble.

Experimental Station, Lacombe, Alta.

TREE AND BUSH FRUITS RECOMMENDED FOR CENTRAL ALBERTA

APPLES: Hibernal, Anoka, Duchess of Oldenburg, Patten Greening.

CRABS: Elsa, Antonovka, Siberian.

PLUMS: Best seedlings of Manitoba native plum, and Cheney, Aitkin, Odegard, Assiniboine, Sapa and Opata.

SANDCHERRY PLUM HYBRID:: Tom Thumb, Champa.

SANDCHERRY: Sioux and Select seedlings.

RED CURRANTS: Red Dutch, Perfection, Fay Prolific, Red Grape.

WHITE CURRANTS: White Grape.

BLACK CURRANTS: Kerry, Black Naples, Black Champion.

GOOSEBERRIES: Houghton, Carrie.

RASPBERRIES: St. Regis, Sunbeam, Herbert, and Sarah (late).

STRAWBERRIES: Senator Dunlap, Everbearing Champion, Everbearing Mastodon.

Experimental Station, Lethbridge, Alta.

CURRANTS.—A plantation of several varieties of black and red, and two varieties of white currants was set out in the irrigated garden at this station in the fall of 1923, and all varieties have been producing since 1926. When planted, the bushes were set six feet apart each way to allow ample room for using a horse cultivator, and a liberal dressing of well-rotted manure has been applied each autumn to maintain the high degree of soil productivity needed for the successful production of currants.

The following varieties appear to be outstanding as a result of this test.

Blacks: Topsy and Magnus.

Reds: Red Dutch, Prince Albert, Moores Seedling.

Whites: Large White.

PLUMS.—The native plum of Manitoba has so far proved to be the only plum that is entirely hardy for conditions at this station, and while even this variety has not produced fruit every year, plums of good size, flavour and colour have been produced from carefully selected strains. From 350 plum seedlings set out under irrigation at this station in 1912, three trees have been selected for propagation purposes. All of these selections have proved quite hardy but none of the three strains have so far yielded satisfactorily.

One of these, tree L-608, was selected for earliness. The fruit averages three-quarters of an inch in diameter, the flavour is quite sweet, and the colour is yellow, splotched with red. Tree L-613 produces larger sized plums, averaging about one inch in diameter, while flavour and colour are similar to those of the plums from tree L-608. The largest and best flavoured of the three selections is tree L-588. The fruit of this tree averages one and one-quarter inches in diameter. The plums are red with yellow on the underside and mature usually during the last week in August.

APPLES.—The apple is not considered a commercial crop on the prairies, but fair success has been achieved in growing some of the cross-bred varieties, particularly the Osman, and three of the hardier varieties of standard apples including Hibernal, Patten Greening and Yellow Transparent.

Experimental Station, Summerland, B.C.

The importance of planting the most suitable and profitable varieties of tree fruits in an orchard is well recognized to-day. The value of a bearing orchard is determined largely by the varieties it contains. It costs no more, at planting time, to make a wise selection of variety, but the wrong selection may be expensive for years to come.

Five projects are in progress to obtain information regarding varieties of stone fruits. The same general objective applies to each of the following projects for cherries, peaches, plums, apricots, and prunes, respectively; to ascertain the varieties best suited for the conditions of the interior fruit-growing area of British Columbia.

Old, well-known varieties are tested together with new ones that are considered worthy of trial. Observations and records furnish information useful to the grower, and the trees also provide material for other projects. Obviously, projects of this nature must proceed indefinitely in order to test new varieties and to provide a basis for revision of planting recommendations, as results concerning hardiness, quality and productiveness are obtained.

CHERRIES.—The large, dark, sweet cherries are most in demand and are best represented by Bing and Lambert. There is a real need for other varieties to supplement the two mentioned, to extend the season, to provide against loss by splitting, and to provide a pollinator, dark in colour and high in quality.

Carnival is a new variety now planted for trial. It comes highly recommended from the Pacific coastal region and is said to be free from splitting. Its value as a pollinator is yet to be ascertained as well as its vigour and hardiness of tree.

Deacon is a good dark cherry of market value, and an efficient pollinator. It is being tested for production and hardiness.

Cherry No. 160133 (Vineland) is a large black, sweet cherry of very attractive appearance and flavour. The trees are vigorous and thrifty and have been productive of first-class fruit, ripening about the same time as Bing. The flavour is distinctive, being more sprightly than that of Bing. This variety is worthy of propagation for more extended trial in the Okanagan.

PEACHES.—The special demand has been for peaches to round out the season from the earliest possible date until after the harvest of the Elberta variety. Only the yellow-flesh, free-stone varieties are now of interest in the Okanagan Valley. Yellow St. John and Crawford are no longer recommended for commercial plantings in the district.

Several early yellow-flesh peaches are on trial, the best at present being Mikado. This early yellow peach is of good quality, ripening in July, about six weeks before Elberta. Several varieties originating at the Vineland, Ontario, station have been given extensive trial and two have been found worthy of introduction in British Columbia. Veteran is the most promising. Its trees are vigorous and productive. The fruit is ripe a week or more before that of Elberta and is entirely satisfactory for general market requirements. Vedette has also been proved by this station. It ripens about ten days before Veteran.

PLUMS.—Plums receive too little attention by commercial interests, being generally considered unprofitable to grow. This year, sixty-four varieties of plums were under test. Many of these are old and well-known varieties, but some of them have never been given a fair trial, while others are entirely new. The market for plums may be limited but when well-grown and attractively displayed, in certain seasons, they sell most readily. Some varieties grown in the station orchard have given splendid results and may be recommended for limited planting and special marketing.

APRICOTS.—Fifteen varieties and a number of seedling apricots are under test. The most promising have been included in harvesting and shipping experiments, and also tested for dehydration. Very little has been done in securing new varieties of apricots. There is a need for both earlier and later varieties possessing satisfactory market qualities. Most commercial varieties lack some desirable characteristic.

PRUNES.—Twelve varieties of prunes comprise two types, the sweet prunes produced on a large scale in California, and the "tart-sweet" prunes commonly grown farther north. The Italian prune has again given most satisfactory results and is considered the best variety to plant in the Okanagan at present. All late-ripening prunes may have their quality impaired by cool weather and the resulting check in sugar formation. Accordingly, it would be very desirable to find a prune equal to the Italian but ripening about ten days earlier.

PLANT PROPAGATION

Experimental Station, Morden, Man.

A fruit scion storage test has been carried out at this station for the past two years. This was commenced to determine a practical storage method that would bring fruit scions through the winter in a healthy dormant condition, so that they would be available for top-working trees in early May. Nine different methods were used in the storage of four apple, two crabapple, and six plum varieties. In four of these tests the scions were buried outdoors in boxes on the north side of a hedge in a sheltered yard, and covered with two feet of earth. Three lots were placed in the fruit cellar, one heeled-in in the yard along with nursery stock, and one placed on the floor of a wheat granary.

The nine different storage treatments are:—

1. Scions buried in a box outdoors; scions waxed, the box filled with sand.
2. Scions buried in a box outdoors; scions waxed, the box filled with soil.
3. Scions buried in a box outdoors; scions waxed, the box filled with moss.
4. Scions buried in a box outdoors; scions waxed, the box filled with sawdust.
5. Scions placed in the basement; scions waxed, the box filled with moss.
6. Scions placed in the basement; scions unwaxed, the box filled with moss.
7. Scions placed in the basement; scions waxed, the box filled with sand.
8. Scions heeled-in in soil, in a similar manner to the heeling-in of nursery stock. They were placed on a slant in a foot and a half of soil, their tops being covered with six inches of soil.
9. Scions placed in an unheated granary; scions unwaxed, box filled with soil. On January 19, these scions were removed from the granary and used for root-grafting.

The scions that were waxed and buried outdoors, with the exception of those placed in moss, came through the winter in good condition. Those placed in moss were damp in the spring, and the scions were commencing to rot. Waxed scions heeled-in in the soil in the open came through in good condition, but with a tendency for their buds to burst. Heeling-in waxed scions in soil was found to be practical, but they should be at least half a foot below the surface of the ground.

Scions stored in a basement were both waxed and unwaxed. The waxed scions, especially those placed in sand, remained in good condition.

The box placed on the floor of an unheated granary, containing scions to be used for root-grafting, was found to have the scion wood in perfect condition. This would appear to be a satisfactory method.

During the last two years waxed scions placed out-of-doors in pure sand, and covered with two feet of earth have given the best results. The sand is good storage material as it does not generally allow the wood to become too warm or damp, and the scions are always removed from the box in a clean state. Waxed scions remain in good condition longer than unwaxed ones.

Budding done during the dry summer of 1930 was light in catch. The total growing this spring out of 3,804 was 630. Root-grafting resulted in 3,467 out of 5,887, and crown grafting in 604 out of 1,940. This low percentage is attributed to unfavourable weather.

In the root-grafting, some tests were made in which the scion part of the graft was dipped in parawax of varying temperatures, from 100 to 180°F. Those dipped appear to make an earlier start in the spring and to be somewhat larger by autumn. The evidence is that grafting-wax is preferable to parawax for covering the union of root and scion. The upper part of Hibernal apple grafts, dipped in parawax at 180°F., gave 100 per cent stand and grew well. It is desirable to have the parawax heated to at least 150° so that the dipped wood will not be coated unnecessarily heavily.

Rubber bands, sizes 32 to 64, are satisfactory for budding and more easily applied than raffia. Rubber bands are not suitable for tying crown-grafts, as wax rots the rubber.

In top-working and crown-grafting, the bark-graft has proved preferable to the cleft-graft. The former gives greater cambium surface contact; the latter is a more severe operation. However, the bark-graft scion has weaker union the first year and should be carefully supported until the second year when scion and stock should be strongly banded.

To secure plants on their own roots, sandcherry hybrids were layered in the spring of 1929. By autumn, roots were formed on the layers, but it seemed best to delay transplanting until another season's growth has been added.

Hibernal apples, and Dolgo and Piotosh crabapples were root-grafted to 14-inch scions and planted in a sloping position. After two years' growth, strong roots were developed on the lower portion of the scion.

Experimental Station, Summerland, B.C.

FRUIT TREE ROOTSTOCKS

Rootstocks have an important influence on the behaviour of fruit trees worked on them. Evidence in support of this statement has been secured from several experiments conducted at this station.

Following the severe winter of 1924, a number of trees in a four-acre apple orchard failed to leaf out properly in the spring. Investigations revealed that these winter-injured trees had been secured from commercial nurseries using seedlings of unknown parentage as rootstocks. Uninjured trees growing in the same orchard were found to have been propagated on selected seedlings of hardy parentage raised at Ottawa. This experience suggested that the solution of many so-called physiological troubles prevalent in the Okanagan, which are apparently associated with a diseased or injured condition of the roots, might be revealed by a comprehensive investigation of fruit tree rootstocks, and the part they play in the life processes of the tree.

Furthermore, results secured from experiments conducted at the East Malling Research Station in England indicate that the size, productivity, and general behaviour of healthy trees are all materially influenced by the rootstock on which they are worked. Accordingly, a series of experiments was started, the purpose of which is to devise economical means of propagating hardy, vigorous, disease-resistant trees which can be relied upon to produce heavy crops of high-quality fruit over a long period of years.

For the first few years, attention was devoted to collecting promising rootstocks from various parts of the world, and building up supplies of material for use in comparative trials. Ease of propagation was considered of primary importance, and any stocks which could not be reproduced readily were discarded as being unfit for further trial.

The first comprehensive rootstock trial was started in 1925, when 100 trees of Bartlett, Bosc, Flemish Beauty, Anjou, Howell and Winter Nelis, worked on *P. calleryana, P. ussuriensis,* and *P. communis* roots, were planted out. The object of this experiment was to test the comparative resistance of these stocks to fire-blight. Evidence to date shows that while the oriental stocks are undoubtedly resistant to fire-blight, they have a tendency to induce in the fruit a condition termed "black-end," which is as undesirable as fire-blight itself.

A second extensive rootstock trial was started in the fall of 1928, when 80 trees of Delicious and McIntosh, propagated on their own roots and on seedlings of Anis, were set out. This project was enlarged in 1930 and 1933, another 320 trees of the same two varieties, worked on various other promising stocks, being planted. These trees have been spaced fifteen feet apart each way, and occupy two acres of ground. Careful records are being kept of the growth and cropping performance of these trees, and while they are still very young, evidence has already been secured that the rootstocks are exerting a significant influence on size of tree and yield of fruit.

This year the nursery was practically doubled in size and now covers about three acres. A fresh piece of ground was brought into cultivation and a large section of it set out with vegetatively propagated stocks consisting of apples, cherries, plums and pears secured from the East Malling Research Station.

Three comprehensive propagation experiments were started, the "randomized block" system of plot lay-out being used for the first time on this station, in order to ensure reliability in the results secured. In one experiment the merits of seedling and vegetatively propagated rootstocks are being compared, while the second experiment consists of a comparison of grafted and budded trees. The third involves the storage of rootstocks at various temperatures in an attempt to ascertain their comparative hardiness.

To induce scion-root formation, several varieties were "layer-grafted" on seedling roots, but the results were not very encouraging. Root cuttings made in the fall of 1932 were practically a complete failure, owing, possibly, to the severe winter conditions. Those planted in the spring of 1933 were far more successful.

In September, 1932, 1,200 McIntosh and Bartlett were budded on a large range of seedlings in order to secure information regarding the influence of grade and variety of seedling stocks on the behaviour of the resulting trees. Besides the experiments mentioned above, a number of smaller propagation projects with stool-beds, root-cuttings, etc., were carried on.

For the purpose of studying the response of tree roots to water, fertilizers, etc., a root observation trench is being maintained throughout the summer near a mature McIntosh tree. Records of soil moisture are taken every day and measurement of root and twig growth made twice a week. Root growth was rather poor, but, in general, followed that of the previous year with a maximum in June, succeeded by a gradual decline throughout the summer to a minimum in September.

In general, it may be said that the results secured from these rootstock experiments have been sufficiently encouraging to justify continuance of the work on a larger scale.

FRUIT AND VEGETABLE PRODUCTS RESEARCH

Research work in fruit and vegetable products is being conducted at four centres: The Experimental Station at Kentville, Nova Scotia; Central Experimental Farm, Ottawa; the Experimental Station, Summerland, British Columbia; and the Experimental Station, Sidney, British Columbia. The great bulk of the work has been concentrated on the following problems:—

(1) Dehydration of apples, apricots, plums and loganberries.
(2) Problems in connection with the manufacture of cider from Canadian apples.
(3) Problems in connection with the grading of cherries for canning purposes.
(4) Problems in connection with the canning of fruits and vegetables.
(5) An investigation into the methods for the preparing of candied fruit.
(6) Investigations into methods for the manufacture of concentrated fruit juices.
(7) Investigations into the possibilities of the manufacture of brandy from cider.
(8) Dehydration of walnuts.
(9) The preparation of *Digitalis purpurea* for drug purposes.
(10) Sulphuring and preparation of Royal Ann cherries as maraschino stock.
(11) Preparation of cherry raisins.
(12) Preparation of a strawberry weevil bait from waste pear stock.
(13) Preservation of fruit and vegetables by freezing.
(14) Investigations into the value of apple pomace for stock feed purposes.

DEHYDRATION OF FRUITS

Experimental Station, Kentville, N.S.

In Nova Scotia the evaporation and dehydration of apples has been practised for many years. Until very recently, the bulk of the product was manufactured by the old evaporator system, but at present considerable progress is being made in the construction and use of dehydrators to replace the old type of evaporator.

There are many factors involved in the successful construction and operation of a dehydration plant and an endeavour has been made to investigate the numerous factors concerned.

Much work has been done in connection with the type of equipment to be employed and details concerning the mechanics and physics of this are given in bulletin form.

The following summary sets forth the results of some phases of the work:—

(1) Varieties of apples should be kept separate for dehydration purposes. The varieties making an inferior grade of product should not be used.
(2) Small-sized apples are not suitable for dehydration purposes. All apples less than 2½ inches in diameter cost as much to prepare for dehydration as they will probably sell for.
(3) Wagener, Wellington, Baldwin, Ben Davis, Golden Russet and King make excellent dehydration stock.
(4) Apples should be graded to produce a uniform quality of stock.

(5) Apples below 2½ inches in size do not make suitable dehydration stock.
(6) Grading promotes drying-time efficiency.
(7) The maximum temperature for finishing dried apples should not exceed 170 degrees F. If extreme care is taken in removing the fruit before excess drying has occurred, 175 degrees might possibly be used.
(8) Excess humidity, particularly in the early stages of drying, may cause browning of the inside circle of the rings.
(9) Careful operation, to exhaust only that air which has lost its potential dehydration value, results in lowered operation costs.
(10) All air should be forced to circulate over the fruit.
(11) An even flow of air through all sections of the dehydrator promotes uniform drying.
(12) After-sulphuring may prove to be of value in improving the refreshing quality of dried stock.
(13) Low moisture content in the rings tends to make them brittle and easily broken when reduced below 15 per cent moisture.
(14) A very low finishing temperature is essential to prevent browning where low moisture content is required. A temperature not in excess of 150° F. should be used.
(15) Where resulphuring is not practised, low moisture content retards the rate of discoloration of the rings.
(16) Low temperature storage very materially retards the rate of discoloration.
(17) Direct sunlight produces pink colour, regardless of moisture content, where resulphuring is not practised.
(18) Where resulphuring is done, a high moisture content seems to be essential for the proper absorption of sulphur fumes.
(19) Where resulphuring has been practised, on high moisture content fruit it holds the white colour, whether the rings are exposed to cool or warm storage or to direct sunlight.

Experimental Station, Summerland, B.C.

DEHYDRATION OF APPLES

Methods of improving colour of dried apples have been under investigation at this station for the last three years. The conclusions at the end of 1931 were as follows:—

(1) Apples sulphured and dried to a moisture content of 14, 15 and 16 per cent, and stored in tight containers, maintained a satisfactory white colour. Apples dehydrated to from 23 to 24 per cent moisture content and stored, slowly darkened.
(2) Apples sulphured and dehydrated to a moisture content of from 23 to 24 per cent and resulphured maintained a better colour than those dried to this moisture content and not resulphured.

In 1932, a detailed experiment to further study this question was instituted and as a result the following conclusions have been reached:—

SULPHURING.—Thorough sulphuring of the fruit is easily obtained in 35 minutes, if the fruit is sliced. At least 3 hours is required if the fruit is sulphured whole. In cases where the fruit is sulphured whole and penetration of the gas is obtained, the colour is preserved, but it was observed, in these experi-

ments, that the sulphur often does not penetrate to the centre of the flesh, and thus, during storage, a dark ring develops in the unsulphured area. A resulphuring after dehydrating will not entirely correct a poor sulphuring of the fresh fruit as penetration after the fruit is dried is much slower due to the lower moisture content.

Drying to Low Moisture Contents.—Little danger exists of damaging the fruit by dehydrating to low moisture contents. Samples were dried in the tunnel dehydrator, operated at this station, with a dry bulb temperature as high as 183° F., and continued until the fruit was sufficiently dry and brittle to be ground to a floury powder in a small coffee grinder, without any trace of caramelization of the sugars or browning in the appearance of the fruit. This extreme instance serves to illustrate that operators can dehydrate to from 14 to 16 per cent moisture with absolutely no danger of damaging their fruit. The additional time required in the dehydrator to reduce the moisture content from 22 to 15 per cent approximates one-half an hour in a tunnel dehydrator at a temperature of 150 to 160° F.

Storage of Low Moisture Content Samples.—With small samples, difficulty is encountered in maintaining a low moisture content, as the fruit absorbs water vapour from the air. In large curing bins where little of the fruit is exposed, this difficulty may be less troublesome. It may further be suggested that tight rooms could be constructed in which such samples may be stored.

Resulphuring of Moist Samples versus Dehydrating to Low Moisture Content.—Up to the present stage of this experiment, these two methods have been equally efficient in preserving white colour. The question now to be decided is whether it is preferable to add an extra preservative in the form of sulphur fumes (sulphur dioxide) before storing, or whether it is better to add pure water in the form of steam vapour at the end of storage to bring the moisture content near to the tolerance. From a quality standpoint, it may be suggested that both practices be allowed as long as the moisture and sulphur dioxide content are within the tolerance for these compounds.

Experimental Station, Kentville, N.S.

DEHYDRATION OF PRUNES

At present, prunes for dehydration purposes are not grown in Nova Scotia and considerable work is necessary before encouragement can be given to commercial production.

Considerable variation in the maturity of hand-picked prunes was found in the stock received at the dehydrator. If they were held three or four days to get additional maturity considerable rot appeared. It would seem advisable that either the sod be removed from under the trees and the prunes shaken in the regular way or a canvas sheet made to be placed under each tree as it is shaken.

In addition, brine tanks should be installed, so that the fruits might be graded before they are dehydrated. This would permit immersion of the prunes in different strengths of brine and the low sugar prunes could thus be floated off.

A list of the varieties of prunes at present growing in Nova Scotia shows that those of greatest promise are Italian prune, Giant, Imperial Epineuse and Furst.

Experimental Station, Summerland, B.C.

DEHYDRATION OF PRUNES

Although prune dehydration has been carried on to determine the relative merits of any varieties that can be grown in the Okanagan, the major activity now centres on the dehydration of the Italian variety. Hardiness, heavy bearing habits, good size and flavour are its main desirable qualities, but unfortunately it is the latest prune to mature.

Full maturity is not reached until the latter part of September and early October and at this date the weather is sometimes dull. Seasons of this type tend to prevent the normal sugar development and a larger percentage of the prunes are unsuitable for dehydrating than is found in the crops ripening in bright weather. Thus a prune with the good qualities of the Italian but ripening earlier in the season, when the sunlight can be relied upon, would have a decided advantage. A bud sport of the Italian has been found which reaches full maturity by the end of August. This is being propagated at this station and may be of the desired type. Other factors such as soil, irrigation, shade and general health of the trees also have considerable bearing on the quality of the prunes that are produced.

In order to study the influence of these cultural conditions, two blocks of prunes were selected for experiment in 1930. These may be designated as blocks No. 1 and No. 2. Both orchards were in vetch cover crop and had had similar applications of nitrate of soda. The water supply was quite adequate in each case and the general vigour of the trees was good. The trees in each block were well spaced. No. 1, however, was located on deep heavy clay loam, while block No. 2 was located on a sandy loam with a great deal of gravel in the sub-soil. And, whereas the branches and foliage of the trees on block No. 1 were quite thick, the trees of block No. 2 were well pruned and open.

The fruit on both blocks was allowed to mature until it fell on the ground and was then gathered for dehydrating. One exception occurred in block No. 1, as many prunes were still on the tree as late as October 22. These were shaken off and 69 per cent of this lot was unfit for dehydrating. The fruit on block No. 2 was all harvested by October 9.

The prunes were separated by the flotation method wherein the green fruit floats and the ripe sinks in solutions of calcium chloride of various strengths. This method has already been described in the 1929 annual report of this station. However, the sugar development was not as high as it was last year and it was necessary to use weaker solutions of calcium chloride. The 55° and 40° solutions (Salometer scale) were reduced to 50° and 35° respectively. It was also deemed advisable to use a third solution of 20° which would separate the very greenest grade. The prunes which floated in this solution were not considered sufficiently sweet for dehydrating. The strength of this solution was arbitrarily started at 25° and was reduced one degree at a time until a final strength of 20° gave the separation desired.

No appreciable difference was noted in the drying ratio of the same grades from different sources. The drying ratios may be summarized as follows:

35° "floaters"	4·43:1	moisture	content of	18	per cent
50° "floaters"	4·05:1	"	"	18	"
50° "sinkers"	2·6 :1	"	"	18	"

When packed, 31·25 per cent of the "35° floaters" graded 50 to 60 to the pound and 68·75 per cent were larger and graded 40 to 50 to the pound. The "50° Floaters" and "50° sinkers" all graded 40 to 50 to the pound. This separation of the slightly immature prunes from the fully matured greatly improves the quality of the "pack" in two ways: First, the fruit in each grade is uniformly sweet; and, secondly, the smaller sizes are avoided. The prob-

lem that naturally arises is, "What can be done with the fruit that is unsuitable for dehydrating?" During the past season an attempt was made to use this grade of fruit as a base for prune and apple butter. The product was quite tasty and should find a good market if made commercially. The formula used was as follows:

225 pounds prunes.
75 pounds cull apples.
65 pounds sugar.

The apples were crushed and boiled with the prunes until both fruits were pulpy. This stock was then passed through a finishing machine to remove skins, cores and pits and was returned to the kettle and boiled till it fell in sheets from the mixing paddle. The sugar was then added, and, after a short boil, the product was canned. This is one product from the greener prunes that has possibilities and further investigation will be carried on.

Besides the Italian, the French Petite, Mammoth French, and Date varieties offer the greatest possibilities but unfortunately the trees are frail and the fruit does not attain a sufficiently large size.

DEHYDRATION OF APRICOTS

SUN-DRYING OF APRICOTS VERSUS DEHYDRATION

Sun-drying of apricots was carried on, in 1930, with three specific objects. First, to determine the minimum amount of sulphur necessary to maintain a good colour, secondly, to determine sunlight and colour, and thirdly, to determine the merits of sun-drying of apricots, compared with dehydration. The varieties used were Royals, Moorpark and Blenheim.

PART 1—MINIMUM SULPHUR.—Five equal lots were prepared from each variety. Lot 1 was not sulphured. The rest of the samples were sulphured for 3½ hours at a temperature of 85 to 90° F. Lot 2 was sulphured at the rate of 2 pounds of sulphur per ton of fruit, and lots 3, 4 and 5 at the rate of 4, 6 and 8 pounds of sulphur per ton of fruit, respectively. Half of each sample was sun-dried and half was dehydrated, the average temperature in the dehydrator being 140° F. and the time 16 hours. The sun-dried fruit was dried three days in the direct sunlight and was stacked with the trays staggered. The heat during the drying period averaged 87° F. during the day and 62° at night. After five days in the stack the fruit was dry enough to be taken off the trays. The colour resulting in each sample is shown in Table 15.

TABLE 15.—COLOUR OF DEHYDRATED AND SUN-DRIED FRUIT.

Lot No.	Sulphur per ton	Colour of dehydrated fruit	Colour of sun dried fruit
	Lb.		
1	0	Dark brown	Dark brown
2	2	Brown	Brown
3	4	Light brown	Brownish orange
4	6	Light yellow	Good, rich orange
5	8	Yellow	Good, rich orange

The samples from this experiment will be analysed for sulphur dioxide and further data obtained. It is expected that the dehydrated fruit will show lower sulphur content in each lot than the sun-dried, as much of the sulphur is volatilized during dehydrating by the high temperature. Sulphur dioxide is needed in the fruit to preserve the colour and the vitamin content, but too much is objectionable.

PART 2—LENGTH OF EXPOSURE TO DIRECT SUNLIGHT.—A second lot of apricots of the same varieties were sulphured, using sulphur at the rate of six pounds to the ton, and placed in the sun to dry, the object being to determine the effect of the length of exposure to direct sunlight on the colour of the product. Apricots were exposed 2, 3, 4, 5 and 6 days. The average temperature was 85° F. for the period. Those exposed for 2 and 3 days developed an attractive orange colour, whereas the longer exposures caused "burning" and an undesirable darkening to take place. The sample exposed for six days was exceedingly dark and unattractive. There was little difference between the Royal and Blenheim, the Moorpark being much the darkest of the three.

PART 3.—DEHYDRATION VERSUS SUN DRYING.—The third lot of apricots was sulphured in the same way as those in part 2. These were divided into two batches. One was placed directly in the dehydrator where a temperature of 135 to 140°F. with a relative humidity of 12 to 15 per cent was maintained, while the other batch was started to dry in the sun. After two days this fruit was also placed in the dehydrator, where the drying was completed. The object of this test was to ascertain the improvement in colour with the minimum exposure to the direct sunlight. This latter procedure resulted in a very nicely coloured product, much better in appearance than that which had been dehydrated entirely.

The costs of handling are quite high but this factor is partly offset by the reduction in the dehydrating time. From a colour standpoint the sun-dried apricot has a decided advantage over the dehydrated and, where only relatively small lots of apricots are available for drying, the former appears to be the most practical.

PROCESSING OF ROYAL ANN CHERRIES AS MARASCHINO STOCK

The profitable sale of Royal Ann cherries has been a problem in the Okanagan for several years. The fresh market does not desire this variety as it bruises badly in shipment and has not the fine flavour of the black Bings and Lamberts. Canneries have accepted some Royal Anns under a great deal of protest and with the hope of getting price concessions on later peaches, apricots, pears, etc. The Royal Ann has thus become rather a despised variety of cherry, and some of the trees have already been removed.

For three seasons, experiments have been in progress in the fruit products laboratory to develop by-products into which this fruit could be made. The most promising product was the bleached cherry from which candied and maraschinos are prepared. It was known that the same variety was bleached with varying degrees of success in Oregon and Washington, and that most of the Italian bleached cherries consisted of this variety. Samples of the product from the bleaching experiments had been shipped to William Robinson Limited in Vancouver, manufacturers of candied cherries and other candied fruits. The various processes yielded cherries of as many qualities, and thus, by eliminating the cherries of poorest quality, the best process was determined. Extensive bleaching tests had also been under trial at the Oregon Experiment Station, the results of which, combined with our own, gave a good indication of the best procedure.

With the above background, the fruit products department agreed to supervise a commercial test for the Penticton Co-operative Growers. The A. B. C. Company contracted to take ten tons of the sulphured pitted fruit while other interests offered to take smaller quantities. In all, twenty tons of fresh fruit were bleached and pitted.

The process is really of two distinct steps, e.g. (*a*) the barreling, and (*b*) the pitting. Before commencing the barreling, however, it is necessary to dissolve liquid sulphur dioxide in water for the development of sulphurous acid.

VALUE OF THE INDUSTRY.—This small commercial test involved a turn-over in the Penticton district of approximately $5,000. The growers received $1,400 for the fruit, $1,421 was spent on barrels, miscellaneous material, and labour in barreling; the total cost of pitting was $791, while freight on only part of the shipment cost $226. This amply demonstrates the amount of money that can be put in circulation within the country if manufacturing of raw material is exploited.

Generally speaking, this first commercial production of sulphured pitted cherries has been quite satisfactory. With careful development this processing will no doubt provide an outlet for innumerable tons of Canadian cherries of odd varieties, many of which at present are not even picked.

Since commercial sources of sulphurous acid have proved to be an expensive item in connection with this work, a sulphurous acid generating tower in which to manufacture the bleaching solution has been perfected.

This consists of a sulphur burner cooling coil and an absorption tower. The burner was made from a forty-gallon gasoline barrel. The sulphur is burned and the flue gas drawn through a tubular condenser and cooled with a constant spray of cold water. The gas then enters the absorption tower, made of 2-inch fir planks joined with slip-and-tongue joints to prevent leakage. At every 18-inch interval a rack is placed to hold one-inch coke. The distribution of water over the top of the coke, which is allowed to trickle down, dissolves the sulphur dioxide to produce sulphurous acid. A one per cent acid is thus obtained at a very low unit cost.

A complete outline of the entire method was published in *The Fruit Products Journal*, January, February and March, 1935, Vol. 14, Nos. 5, pp. 136-37; 6, pp. 174-5; 7, pp. 206-208.

CANDYING FRUIT

There is a large market in Western Canada for coloured candied fruits for use in cakes by the bakery trade. The glacéd cherries being manufactured help to supply this market but they are a little too expensive for widespread use. To cope with this situation, two firms in Vancouver have been dyeing and candying pineapple bits which are fairly satisfactory. They are tough, however, and do not take on bright colour.

A sample of red candied apple prepared at this laboratory was given to one of the largest bakers' wholesalers in Vancouver who considered it superior to the pineapple product. Accordingly, at the Summerland Experimental Station, methods of preparing this product in commercial quantities are being studied. This product appears to have good commercial possibilities.

Examination of samples of the commercially candied pineapple indicated that the red dye used was erythrosine 517, and that the green dye was a mixture of yellow and green dyes, most likely tartrazine and light green s. f. yellowish.

DYEING AND CANDYING OF APPLES.—In these experiments two red acid-soluble dyes, i.e., ponceau 3R-56 and amaranth 107 were used. Previous experiments had shown their characteristic of remaining bright if kept in acid condition.

Newtown apples were peeled, cored, and cut crosswise into half-inch slices. These slices later were divided into eighths. Sufficient water to cover the fruit was added and the sample boiled until the pieces of apple became translucent. The water solution covering the fruit was then made up to 35° Balling with cane sugar and dye added to make a one-tenth of one per cent solution (figured on the weight of the original water). The dye used was as follows:—

Sample No. 1—Ponceau.
No. 2—Ponceau and amaranth (2 : 1).
No. 3—Ponceau and amaranth (1 : 1).

The most attractive colour was obtained with sample No. 2.

It was found, however, that even in highly concentrated syrups these dyes continue to leach, and thus, if they are to be used with this product, it must be sold quite dry. On the other hand, if erythrosine is used, the apples can be sold in heavy syrup. An economic point thus develops, whether it is cheaper to use a low-priced dye and sell a dry product or to use an expensive dye and sell a wet product.

This candied apple product has a distinct manufacturing advantage over most fruits as it will take the syrup very rapidly, thus greatly reducing the cost.

Recovering Syrups.—It has been found that syrups boiling in the presence of tinned screening dissolve small quantities of this element. The syrup develops a metallic taste and turns a light brown. An effort was made to discover means whereby affected syrup could be purified. Charcoal appeared to have the best possibilities, and samples were prepared in the laboratory from apple wood. This decolorized to some extent but did not remove the metallic flavour. Various commercial charcoals were used but did not give better results than that made locally. Finally a sample of "Nuchar 00" was obtained which completely removed the colour and flavour. This process promises to reduce materially the cost of candied fruit processing, as syrups frequently need purifying.

Purification of Apple Sugar.—It is possible that the consumption of sugar in the Okanagan, for candying fruit and related products, may approach one hundred tons annually. If this could be manufactured from cull apples it would require approximately twelve hundred tons of fruit. With this in mind, experiments have been carried on to determine the feasibility of the process. The points involved were to remove the acid, colour, pectin and flavour and then to concentrate the juice under reduced atmospheric pressure till the syrup contained 70 per cent sugar. Although numerous obstacles were encountered, the following process has been developed which gives satisfactory results. The juice from the press is heated to 70 to 80°F. to stimulate a rapid fermentation. This brings to the surface the usual amount of solids which are removed and also assists to destroy the jellying quality of the pectin. Fermentation is allowed to proceed until the specific gravity hydrometer shows a two point drop from the reading of the fresh juice. After centrifuging, sufficient calcium carbonate is added to reduce the acidity to about 0·08 per cent, and "Nuchar W" is added to the extent of 5 per cent of the total solids. These ingredients are thoroughly mixed with the juice and the whole mass is brought to a boil and filtered. The resulting juice is colourless and practically tasteless. It may then be concentrated to the desired degree in a vacuum pan.

The simple sugars so obtained have the same commercial uses as glucose but have a better flavour.

APRICOT JUICE

In this experiment, an attempt was made to develop an apricot juice of a type similar to tomato juice. A product of this nature is desirable as it could provide an outlet for soft varieties of apricots, such as Wenatches Moorpark, in case of over-production. Three batches were prepared as follows: Batch No. 1—ripe fruit was pulped and one part of 35°B. syrup added to each two parts of pulp, but the resulting product was too sweet and thick. Batch No. 2—slightly greener fruit was pulped and mixed in equal parts with 17½°B. syrup. This juice was of good flavour and consistency but low in acid. Batch No. 3—twenty-five per cent green fruit and seventy-five per cent thoroughly ripened fruit were mixed together and pulped. This batch was then divided into two portions. To one portion an equal volume of 17½°B. syrup was added and to the other an equal volume of 20°B. syrup. After four months' storage, the juice containing 20° B. syrup was superior to that containing the 17½° B. syrup. The flavour, acid and colour were good but it was still a little thick in consistency. It would serve very well, however, for apricot flavoured sodas or apricot malted milk.

A STUDY OF THE RIPENING OF ROYAL ANN CHERRIES FOR CANNING

As Royal Ann cherries turn red while their sugar content is relatively small, and before a stage is reached that would develop maximum quality in the canned article, an effort has been made to ascertain when the cherries have reached the peak of quality for canning. Tests on the fresh fruit included taking the Balling degree of the extracted juice, and the volume and weight. The experiment was started at the period when growers usually pick their entire crops and was continued until the fruit on the bottom of the tree was considered ripe. Samples were taken every third day at the beginning and end of the season and every day during the peak. Three samples were picked at each time, number 1 from the bottom branches, number 2 from half way up the tree, and number 3 from the top. A check was thus obtained of the relative maturity of the cherries on the tree in these three general positions. Duplicate tests were made on each sample. Three number 1 tall cans were canned from each lot. Forty per cent syrup was used throughout and a uniform process entailing a 5-minute steam exhaust and a cook of 12 minutes. The canned samples were opened after six months storage and examined and the following tests made: Balling degree of syrup, acidity, average volume per cherry, weight of 50 cherries, and the average number of cherries per can.

RESULTS OF HYDROMETER TESTS ON EXTRACTED JUICE.—The results for the three period, July 9 to 14, 15 to 19, and 21 to 29, have been averaged together and are given in Table 16.

TABLE 16.—AVERAGE BALLING DEGREES OF JUICE EXTRACTED FROM ROYAL ANN CHERRIES.

Sample No.	July 9-14	July 15-19	July 21-29
1	12·9° B.	15·26° B.	19·3° B.
2	15·4	17·8	19·5
3	17·4	19·5	19·5

It may be noted in Table 16 that the juice from the fruit on top of the tree had a Balling degree of 17·4 at the comencement of the experiment, while the juice from fruit on the bottom of the tree was only 12·9° Balling. The former, however, increased to 19·5 in the period of July 15 to 19 and did not increase further during the season. The latter increased to 15·26 during July 15 to 19 and to 19·5 during July 21 to 29, thus indicating that if the cherries on the bottom of the tree are left, after the tops are picked, they will develop as much sugar as those on the higher branches. From the quality of the canned samples it would appear that a Balling degree of 17·6 to 18·5 gave the best results, the higher sugar development being associated with a " browning " or breakdown on the skin of the cherries. It is wise to emphasize from these results the necessity of making at least two pickings of Royal Ann cherries, one in which the top fruit is picked and the other about two weeks later to harvest the fruit on the lower branches.

CHERRY RAISINS.—This experiment was in the nature of a " feeler " but has proved quite encouraging. The cherries were pitted, boiled for 1½ minutes in a 50° Balling syrup, and set aside for 12 hours. The object of this step was to sterilize partially the cherries and encourage osmotic action. At the end of 12 hours they were sufficiently shrivelled to stand longer boiling without injury. The syrup strength fell in this period to 38·5° Balling and was raised to 60° Balling. The cherries were added to the boiling syrup and were boiled 7 minutes. The steam was then turned off and the cherries remained in the kettle

until cool. After four days the syrup had fallen to 43° Balling and was raised to 65° Balling. At the end of a further five-day period, the Balling degree was 50 and was subsequently raised to 70. The cherries remained in this one week and were then rinsed and dried.

This product has been found very suitable for use in cakes and other confections in which raisins are normally used.

SEPARATION OF CHERRIES INTO QUALITY GRADES FOR CANNING.—During the 1931 season a method of separating Royal Ann cherries into grades according to their maturity by the flotation method was investigated. The method followed was essentially the same as that used with Italian prunes for dehydration, except that new brine strengths had to be determined.

Brines as low as 12° (Salometer scale) were tried, but after several trials a series was established starting with 17° Salometer, with each succeeding brine 3° S. stronger. Samples of each lot were canned for analytical and demonstrational purposes. The analysis planned will deal with the sugar content in particular.

SUMMARY.—It would appear that this year's flotation method of separation of Royal Ann cherries in order to standardize and improve the canned packs is a very logical method. The test of cutting a few cherries to determine the colour of the pit is also a simple method that growers and fieldmen may employ to determine the maturity of the fruit for canning.

RAMIFICATIONS.—This project may be extended as a test for maturity with other sweet cherries which are now sold on the fresh market. The trial with Lambert cherries illustrates the rising sugar content of cherries separated by the higher brines (Table 17). Incidentally, standards for inspection of several of the fresh fruits may be worked out on this basis.

TABLE 17.—SUGAR CONTENT OF CHERRIES PICKED JULY 14, ANALYSED JULY 15.

Sugar	25°F.	35°F.	38°F.	41°F.	44°F.	44°S.
Invert	14·49	15·15	17·85	18·52	19·41	21·50
Reducing	13·88	14·20	17·25	18·18	19·23	21·27
Sucrose as invert	0·61	0·95	0·60	0·34	0·18	0·23

COMPARISON OF VARIETIES OF PEACHES, APRICOTS AND PEARS FOR CANNING PURPOSES

I. PEACHES

J. H. Hale.—This variety holds its shape well but is inclined to be a little light in colour. The flavour is fair to good and the flesh slightly coarse.

Elberta.—This peach is inclined to mush very quickly after a certain stage of maturity. From a canning standpoint it is the poorest of the varieties tested at this station. The flavour is satisfactory but the appearance of the canned product is not good even with the most carefully handled fruit.

Rochester.—Only a small quantity of this variety was available for canning but it would appear from the samples packed that it is not a good canner.

Vedette, Valiant, Vaughan, Vanity.—This group was originally propagated by the Experimental Station at Vineland, Ontario and has only recently been tried out at Summerland. The flavour, colour and firmness is good in each case. The Vedette, however, has its good qualities, more pronounced than the other members of the group, and appears to be the best suited to the conditions of the Okanagan.

Tuscan Cling.—This is the only cling variety that may offer commercial possibilities. During the last two seasons the young trees on this station have borne crops which have ripened before Elberta and J. H. Hale. When canned, this variety has a bright golden yellow colour and the juice is absolutely clear. It does not have as much flavour, however, as the Vineland varieties.

II. Apricots

Blenheim and Tilton.—Both of these varieties are of very good quality for canning. They ripen evenly, and are of good shape, colour and flavour. When canned they hold together well and are not inclined to mush. From the canning standpoint, the Blenheim, Tilton and Royal varieties are of practically equal quality.

Moorpark.—Apricots of this variety are flat shaped and ripen somewhat unevenly. Unfortunately they have a very soft flesh which mushes easily when canned. Their flavour is attractive and a fairly good canned product can be obtained if the fruit is carefully handled and the process relatively short.

III. Pears

Canning tests showed that Flemish Beauty and Dr. Jules Guyot were positively unsuitable for commercial canning. Both varieties had a flat flavour, poor colour, and a rough fluffy surface. A further objection was caused by their numerous seed cells. The Bartlett, on the other hand, produces a very high quality when canned.

MATURITY OF ITALIAN PRUNES FOR CANNING

This project was outlined to determine the quality of canned prunes resulting from prunes canned at various stages of maturity. The fruit was separated by the flotation method as mentioned in project 730 on prune dehydration. Three grades were canned, (1) those floating in a 20° solution of calcium chloride, (2) those floating in a 35° solution, and (3) those floating in a 50° solution. These may be designated as lots number 1, 2 and 3. All samples were canned in number 2½ plain cans, exhausted in water at 185° F. to 190° F. for 6 to 9 minutes and cooked 13 to 16 minutes. The temperature of the syrup entering the can averaged 150° F. and the temperature at the centre of the can, before capping, was 165° F. No marked difference was noted in the various cooks and exhausts of samples in the same grade, but it would appear that the cook could be reduced for the riper fruit. Probably a 6 minute exhaust and 12 minute cook would be sufficient.

Table 18.—CANNING QUALITY AS DETERMINED BY MATURITY OF PRUNE.

Lot No.	Strength of syrup	Strength of syrup after canning	Colour of syrup	Flavour
	%	°B.		
1	40	23·8	Clear, light purple	Poor
2	40	24·3	Purple	Good
3	40	29·0	Clear, deep purple	Very good

It may be noted in Table 18 that the strength of the syrup after canning, commonly known as the "cut out," increases in strength from 23·8° Balling in Lot 1 to 29° Balling in Lot 3, thus indicating the sugar development as this fruit

matures. At the same time the flavour has developed from "poor" to "very good." It is regrettable that Italian prunes have been widely canned in an immature state throughout the Okanagan, when by allowing this fruit to ripen it becomes of very fine quality. As the Italian prunes are now canned, they are merely red plums of no distinct flavour. When this fruit is at full maturity greater difficulty is encountered from cracking of the individual fruits, which slightly detracts from the appearance. It would be a wise policy to place more emphasis on flavour and sweetness and to pay less attention to keeping the individual fruits absolutely whole.

CIDER INVESTIGATIONS*

The bulk of the work with apple cider has been carried on in Nova Scotia and at the Central Experimental Farm, Ottawa, in co-operation with the Divisions of Bacteriology and Chemistry. The work in Nova Scotia has consisted largely of semi-commercial experiments in co-operation with a commercial plant, while the work at Ottawa has been confined to operations in a small laboratory.

Numerous problems in connection with the manufacture of sweet and fermented ciders have been attacked and a satisfactory method has been evolved, which enables the production of a good quality product that may be stored for long periods after bottling without any appreciable change in flavour or condition.

The following projects have been successfully attacked:—

(1) Sterilization of cider by filtration methods in a practical and reliable manner.
(2) Satisfactory sterilization of bottles and crowns.
(3) Isolation of several satisfactory strains of yeast for fermentation purposes.
(4) A test of a number of varieties of apples for cider purposes.
(5) A study of methods for avoiding deposits in bottled cider, viz.:
    (*a*) enzymic treatment.
    (*b*) enzymic control.
    (*c*) elimination of active oxidizing agents.
(6) Control of darkening in bottled cider.
(7) The perfection of a method for the manufacture of bottled cider in closed cuvee using commercial equipment available without royalty rights attached.

CONCENTRATED FRUIT JUICES

Work with the concentration of apple juice has been conducted in Nova Scotia in a commercial manner. It has been shown that a highly satisfactory concentrate may be made under reduced pressure at very low temperatures. This product has met with a favourable reception on home and foreign markets and is offering an outlet for considerable quantities of cull apples.

The use of such a concentrate for the manufacture of both sweet and fermented cider has been investigated and satisfactory progress is being made in this direction.

*Complete information on the manufacture of cider by the closed cuvee method is contained in the article "The Manufacture of Sweet and Fermented Cider by the Closed Cuvee Method" by M. B. Davis: The Fruit Products Journal, June, 1933, Vol. 12, No. 10, pp. 294-298: 315, separates of which are available upon application to the Horticultural Division, Central Experimental Farm, Ottawa.

While there is considerable opinion abroad that the dessert apples of this country are not suitable for cider purposes, considerable evidence to the contrary has been accumulated. Although our dessert apples are low in tannin content, which has always been considered an essential, several of the varieties, such as Ribston, Golden Russet and Nonpareil, appear to be quite satisfactory. In order, however, to be in a position to supply satisfactory varieties of high tannin content for possible future use in blending, an examination has been made of a large number of crabs and hybrids originated at Ottawa for the great northwest of Canada. From among these, several very promising high-tannin apples have been obtained and are being propagated for future use.

OTHER INVESTIGATIONS

Experimental Station, Sidney, B.C.

DEHYDRATION OF WALNUTS

The drying, or perhaps curing is a better word, of walnuts is a matter demanding special attention. If the temperature is too low, mildews develop, which destroy the nuts outright; if they remain on the ground along with the decaying leaves for any length of time, the shells become coloured with a genuine walnut stain, rendering them unsaleable, for if the stain is removed at all, it is with great difficulty. On the other hand, if dried quickly with too high a temperature the nuts take on a peculiar flavour disliked by many. A temperature of 100 degrees F., with the fans constantly running seems to be about right. This temperature, if the nuts are harvested in early season, gives rise to an attractive and well flavoured product, favourably regarded by the trade.

DIGITALIS PURPUREA

Digitalis purpurea has become one of the most important drugs in Canada in the treatment of dropsy and certain diseases of the heart. In every instance the leaves are imported either from England or the United States. It is not well known that digitalis occurs wild in British Columbia. The suitability of the wild plant has been studied by several with a view to ascertaining its medicinal value. These investigations have revealed the fact that the leaves as grown here are of high medicinal value. There seems, therefore, no reason why the province of British Columbia in general, and Vancouver Island in particular, should not become the cultural source of the digitalis used by manufacturers in Canada. Manufacturers no doubt would hesitate to purchase leaves without the assurance that they had been dried at a uniform and constant temperature of from 55 to 60° Centigrade, as this factor has much to do with the potency of the leaf.

Nearly one-half an acre of digitalis was grown last year. A quantity was dried at a uniform temperature by the aid of a dehydrator; it was exhibited at the Vancouver hotel during the time of the medical convention from June 22 to June 26, 1931, along with the flower spikes, running all the way from the whites, through the mauves to the purples.

Samples of the dried digitalis as prepared here, were submitted to the Department of Pensions and National Health, Ottawa, for analysis. The report follows:—

"The sample of digitalis leaves submitted for analysis by the Assistant Superintendent, Mr. E. R. Hall, on July 18, 1931, was found to contain: 10·56 per cent moisture (dried in vacuo at 55°C. to constant weight) and 2·1 per cent fat.

"The potency of the sample *as received* is equivalent to 92·0 per cent of the International Standard.

"The potency of the *dried* and *defatted* sample is 105 per cent of the International Standard.

"The International Standard is that of the League of Nations Health Commission, prepared in 1925 from representative lots of *Digitalis purpurea* from ten different sources."

STRAWBERRY WEEVIL BAIT

The Sidney Experimental Station has found that dehydrated pears are very attractive to strawberry weevils. Small pears, and pears with scab or other defects are common around all fruit packing sheds. These, when dehydrated, ground up with bran or shorts, and properly poisoned, furnish a bait exceedingly attractive to the mature beetles and one giving 100 per cent control. The value of this bait has been amply demonstrated on the Experimental Station and on the farms of the strawberry growers.

VEGETABLE CROPS

In the following pages will be found a résumé of the various phases of the vegetable crop work carried on at the Dominion Experimental Farms and Stations throughout Canada. The work is dealt with in a summary, covering the unpublished reports for the three years, 1931, 1932, and 1933. The summary includes the recommendations made by the workers at the various farms and stations. Tables of yields are not included, for the sake of brevity.

ARRANGEMENT OF SYNOPSIS

As far as possible, the matter in this synopsis has been arranged according to kinds of crops and varieties. Cultural tests, fertilizing, seed-growing, and other miscellaneous projects are described.

Four regional divisions of the country have been made as a means of grouping the work of the stations. The divisions are: I, Maritime Provinces; II, Quebec and Ontario; III, Prairie Provinces; IV, British Columbia.

Asparagus

I. Maritime Provinces

Kentville, N.S.—Three methods of producing asparagus plants have been tried, using Mary Washington as the variety: Seed sown in the field in 1925 and the crowns set in the permanent plantation in 1926; seed sown in the greenhouse in 1925 and permanently planted in the field in 1926; seed sown in the greenhouse and the crowns set permanently in 1927. Four different distances of planting in the row were employed, as follows: 1·5 feet, 2 feet, 2·5 feet and 3 feet. The rows were all spaced 4 feet apart. Two years elapsed from permanent planting to first cutting. The results show clearly that the field sown with one-year-old crowns produced the best returns from all plantings, no matter what the distance apart in the row. It is also quite evident that the crowns spaced 1·5 feet and 2 feet apart in the row produced the best results in all treatments. One-year-old crowns, carefully selected, are superior to two-year-old crowns.

VARIETIES

II. QUEBEC AND ONTARIO

Harrow, Ont.—Mary Washington is considered the best variety for planting.

III. PRAIRIE PROVINCES

Rosthern, Sask.—Asparagus cannot be considered a successful crop for this locality but plantations, if cared for, will produce some asparagus at a time when other vegetables are scarce. A 30-foot row will produce an average of 7 pounds 12 ounces per cutting season.

Scott, Sask.—Connover Colossal and Argenteuil are varieties that do well.

Lethbridge, Alta.—A twenty-year-old bed is still in good cropping condition demonstrating that this vegetable has great possibilities under irrigation conditions. Mary Washington is a good variety to use.

Lacombe, Alta.—Mary Washington, Palmetto and Reading Giant are all good varieties.

Beaverlodge, Alta.—This crop gives promise of being a success at this sub-station. Palmetto, Giant Washington, Mary Washington and Argenteuil have been planted and are succeeding very well.

Fort Vermilion, Alta.—This hardy perennial vegetable has done well. The only protection it receives is the moderate snowfall of winter.

FERTILIZER EXPERIMENTS WITH ASPARAGUS

The use of commercial fertilizer in connection with asparagus growing has been attracting attention.

II. QUEBEC AND ONTARIO

Harrow, Ont.—Interest has been increasing in the growing of asparagus in Southwestern Ontario on account of an increasing demand for this vegetable for canning. In these experiments all plots have been arranged in triplicate and the fertilizing includes the use of manure with nitrate of soda. Where 10 tons of manure per acre were applied in the spring, with the addition of 60 pounds of nitrogen, in the form of nitrate of soda, better results were obtained than where manure was applied during the summer plus nitrogen at the above rate.

The 6-6-10 fertilizer applied at 1,000 pounds per acre gave the best yield in the young asparagus bed. However, there was an almost equal yield from the plots supplied with a 6-3-10 mixture. Since the plant food requirements are greatest during the period between the last cutting and the autumn, it is reasonable to believe that an application of commercial fertilizer made after the last cutting would stimulate plant growth and aid the plants in storing a reserve for the following season's crop.

Beans

VARIETIES

I. MARITIME PROVINCES

Charlottetown, P.E.I.—Round Pod Kidney Wax and Pencil Pod Black Wax are the two most outstanding varieties.

Kentville, N.S.—From a test of sixteen varieties and strains of bush beans, Hodson Wax, Pencil Pod Black Wax, Sure Crop Wax and Wardwell Kidney Wax are the ones recommended as wax pod varieties. Hodson Wax has shown greater freedom from anthracnose than have the other varieties. Refugee, Stringless Green Pod and Bountiful Green Bush are good green pod varieties.

II. Quebec and Ontario

Cap Rouge, P.Q.—Pencil Pod Kidney Wax and Hodson Long Pod Wax are recommended as wax pod varieties, while Stringless Green Pod and Refugee or 1,000 to 1 are the best of the green pod varieties for the locality.

Lennoxville, P.Q.—Of the thirty-seven varieties of beans under test, Round Pod Kidney Wax is rated as excellent in quality although it is not the heaviest yielding variety. Stringless Green Pod is considered to have the best quality of the green pod varieties.

La Ferme, P.Q.—Princess d'Artois was the earliest-maturing green pod bean under test and out-yielded all other varieties, followed by Yellow Pod Bountiful and Plentiful. Earliness of maturity is a very important feature for the successful growing of beans at this station. Challenge Black Wax, Princess d'Artois and a variety originated at Ottawa, called Interloper Challenge Black Wax, are the varieties recommended.

Kapuskasing, Ont.—Under short-season conditions, the early-maturing varieties are of greatest value. Round Pod Kidney Wax and Stringless Green Pod gave the best returns, while Kentucky Wonder is the most satisfactory climbing bean.

III. Prairie Provinces

Morden, Man.—Owing to very trying conditions, caused by alternating flood and drought, coupled with infestations of insects, bean growing has been made very difficult. The green pod varieties found most outstanding are The Prince, Red Valentine, Bountiful and Stringless Green Pod. The following wax pod varieties were tested but did not do well: Davis White Wax, Black Wax and Round Pod Kidney Wax. The Great Northern, a white-seeded shell bean used for baking, is the best yielder.

Rosthern, Sask.—Unrivalled Wax, Round Pod Kidney Wax and Challenge Black Wax have given the best results.

Indian Head, Sask.—The early-maturing varieties have been giving the best results and include Round Pod Kidney Wax, Davis White Wax, Pencil Pod Black Wax, Early Red Valentine and the Ottawa variety Interloper Challenge Black Wax and Stringless Green Pod. Princess d'Artois is a very good early-maturing white-seeded bean, suitable for baking.

Swift Current, Sask.—Round Pod Kidney Wax, Hodson Long Pod Wax, Princess d'Artois and Interloper Challenge Black Wax produced fair yields. Grasshoppers and bean diseases did considerable damage to this crop.

Lethbridge, Alta.—The following is the order in which six out of fourteen varieties of beans are placed in respect to earliness: Yellow Bountiful, Round Pod Kidney Wax, Princess d'Artois, Satisfaction, Pencil Pod Black Wax and Early Red Valentine.

Lacombe, Alta.—The following are recommended for this locality: Round Pod Kidney Wax, Davis White Wax and Pencil Pod Black Wax. Stringless Green Pod, The Prince, Masterpiece, Peerless and Valentine are good green pod varieties.

Beaverlodge, Alta.—In a quadruplicate plot test the following rating, according to yield, was obtained from the bush varieties: Plentiful, Extra Early Red Valentine, Webber Wax, Bountiful, Masterpiece and Stringless Green Pod.

Fort Vermilion, Alta.—In 1931, the ten varieties tested were planted on May 11 and produced satisfactory returns. The outstanding varieties included in this test were Wardwell Kidney Wax, Golden Wax, Davis White Wax and Early Red Valentine. Seasonal conditions in 1932 and 1933 were unfavourable for beans.

CULTURAL PRACTICES WITH BEANS

The distance apart of the bean plants in the row has been thought to have some bearing on the production of snap pods. In the experiment, Stringless Green Pod and Round Pod Kidney Wax were used, with the seed dropped so as to have the plants stand 2, 4 and 6 inches apart in the row. The distance between the rows was the same in each test, namely, 33 inches.

I. MARITIME PROVINCES

Kentville, N.S.—In each case, the plants two inches apart in the row gave the highest yields of snap pods.

III. PRAIRIE PROVINCES

Lacombe, Alta.—Stringless Green Pod responded best when the plants stood six inches apart in the row. Round Pod Kidney Wax gave better yields when the plants stood two inches apart in the row.

Fort Vermilion, Alta.—It has been found that the two-inch spacing of the plants in the row gives the most satisfactory returns with all varieties.

Broad Bean

The broad bean *(Vicia faba)* has been found difficult of culture in a great many parts owing to seasonal conditions which favour to a large measure such pests as black aphis. If the seed is sown as early in the spring as soil and seasonal conditions will permit, the plants will become established and do better than where late sowing is done.

VARIETIES

I. MARITIME PROVINCES

Kentville, N.S.—The broad bean has not succeeded under conditions in this section. Black aphis, coupled with seasonal conditions, seriously damage the plants so that a crop cannot be obtained.

II. QUEBEC AND ONTARIO

La Ferme, P.Q.—The broad bean has been found to do very well under conditions in this locality. The long pod varieties gave the best results and are listed in order of merit as follows: Conqueror, Aquadulce, Hangdown, Seville and Long Pod Green.

Kapuskasing, Ont.—Two of the many varieties of broad beans tested have done exceptionally well, namely, Johnston Wonder and Masterpiece.

III. PRAIRIE PROVINCES

Rosthern, Sask.—Long Pod Seville has proved the best of the many varieties tested.

Beaverlodge, Alta.—The broad bean does very well under conditions here. Mazagan is the most outstanding variety.

Fort Vermilion, Alta.—The date of planting has been between May 11 and 17. Late frosts do not affect the plants, and very satisfactory dry seed yields are obtained. The height of the plants varies, according to the variety, from 34 to 38 inches and the pods vary from 5 to 10 inches in length. All varieties succeed very well.

Pole Bean

VARIETIES

I. MARITIME PROVINCES

Kentville, N.S.—Of the four varieties grown, Kentucky Wonder Wax gave the best yield. One row, 16·5 feet long with the plants 6 inches apart in the row, yielded 40 pounds 14 ounces of marketable snap pod beans.

III. PRAIRIE PROVINCES

Morden, Man.—Two varieties were used in a test to find the effect of pinching the terminal bud of the leader, when 18 inches high, and forcing the plants to branch out and produce the crop much after the fashion of dwarf beans. This was found very satisfactory. Pole No. 1, an Ottawa variety, and Scarlet Runner were used.

Rosthern, Sask.—Kentucky Wonder has been found to be the best variety.

Indian Head, Sask.—Several varieties have been listed and the most satisfactory ones are Scarlet Emperor, Prizewinner and Painted Lady. A local variety called Wiener was found to be the earliest-maturing and the best yielder. This latter bean is of the Oregon Giant type, and may have some prospect of being useful.

Lacombe, Alta.—Prizewinner, Painted Lady and Best of All have been found to do well.

Lima Bean

The lima bean is very exacting as to soil and soil temperature. The warm soils are best suited to growing this crop, and the early-maturing varieties will be found to do best in most sections of the country.

VARIETIES

II. QUEBEC AND ONTARIO

Harrow, Ont.—During the past three years, the Bush Lima, (Henderson) has proved very satisfactory. Foundation and Elite stock seed of this variety have been produced.

HILL VS. ROW PLANTING OF BEANS

III. PRAIRIE PROVINCES

Morden, Man.—Three varieties have been used in a test to determine the effect of hill and row planting. Beans planted in rows have been found to give the best returns.

Indian Head, Sask.—The results indicate that the row system of planting is to be preferred.

Beets

VARIETIES

After a comprehensive test of the main varieties of beets, the following recommendations may be made:—

I. MARITIME PROVINCES

Charlottetown, P.E.I.—The Flat Egyptian variety has been found to be a good early beet, but it is surpassed in quality by Crosby or Early Wonder. Detroit Dark Red is the best general-purpose variety.

Kentville, N.S.—The Early Wonder and Detroit Dark Red varieties are outstanding for earliness, quality and dark flesh colour.

II. Quebec and Ontario

Cap Rouge, P.Q.—In tests extending from 1911 to the present time, Black Red Ball has proved to be a very satisfactory variety.

Lennoxville, P.Q.—Black Red Ball has been found to be the best variety, followed by Detroit Dark Red and Crosby Egyptian.

La Ferme, P.Q.—Of the many varieties under test, Detroit Dark Red is considered to be the best, followed by Eclipse.

Kapuskasing, Ont.—The Detroit Dark Red beet is considered the best for this locality.

III. Prairie Provinces

Morden, Man.—Out of thirteen types of beets tested, Detroit Dark Red has proved to be the best.

Rosthern, Sask.—Detroit Dark Red is the best beet for this locality.

Scott, Sask.—Detroit Dark Red is considered the best variety.

Indian Head, Sask.—The Detroit Half-Long Blood and Half-Long (Kelway) proved very satisfactory.

Swift Current, Sask.—Half-Long Blood and Improved Dark Red were much better than the turnip-rooted varieties. The latter, some years, produce very desirable roots. Early Flat Egyptian seemed to behave the best under dry conditions.

Lacombe, Alta.—Detroit Dark Red and Early Flat Egyptian are the most suitable varieties to grow.

Beaverlodge, Alta.—Detroit Dark Red, Eclipse, Crimson Globe and Crosby Egyptian are the leading varieties.

Fort Vermilion, Alta.—Crosby Egyptian, Crimson Globe and Detroit Dark Red are the three best varieties.

CULTURAL PRACTICES WITH BEETS

An effort has been made to show that beet seed sown in early spring will produce very coarse beets that will be quite poor in texture by harvest time in late autumn. By sowing seed at intervals of 8 to 10 days, and as late as the middle of June, beets of very fine tender quality can be had throughout the season.

I. Maritime Provinces

Charlottetown, P.E.I.—The earliest seeding produced the first early table beets but the seedings made during the latter part of June gave the most satisfactory beets for mid-season and winter storage.

Kentville, N.S.—Seed of beets for table purposes has been sown in three rows as early as April 30, and at intervals of eight to ten days, for five sowings, until June 12. One-half of these rows was harvested when the beets were ready for use when about 2½ to 4 inches in diameter. Another portion was harvested at a later date and the third portion in October. Beets from successional sowings appear to be more profitable for marketing than those from one or two early sowings.

II. Quebec and Ontario

Lennoxville, P.Q.—The variety Detroit Dark Red has been used in a series of successional sowings. The first seeding was made as early in the spring as the soil and seasonal conditions permitted and other seedings were made at

intervals of two weeks, until the end of June. All the seedings produced very fine beets for bunching and the last seeding produced very fine roots for winter storage.

La Ferme, P.Q.—Successional sowings have been found to produce beets of very desirable quality provided that the last sowing is made prior to the soil becoming dry in early summer.

In the experiment on the distance apart of the plants in the row, it was found that two inches apart gave the best sized roots coupled with quality, and the roots were the most uniform in shape.

III. Prairie Provinces

Scott, Sask.—By making sowings at intervals of ten days, a continuous supply of very fine tender beets can be had throughout the season.

Borecole or Kale

The curled kale is one of the best types to grow and does well in most localities. The seed is sown in the field and the plants thinned to twelve inches apart in the row. The best flavour in these greens is found after the plants have been slightly touched by an autumn frost.

VARIETIES

III. Prairie Provinces

Morden, Man.—Scotch or curly kale grows very well. Tall Green Scotch is the most satisfactory variety.

Swift Current, Sask.—Both the Dwarf Scotch Curled and Tall Scotch Curled varieties have done well. This vegetable is superior to spinach since it does not become bitter due to slow growth, and, being a biennial, it does not bolt to seed during the first year.

Lethbridge, Alta.—The dwarf and tall varieties of borecole or kale do well. The plants are started in a hotbed and transplanted to the field like cabbage. This is a useful vegetable for soups and greens.

Beaverlodge, Alta.—All varieties of borecole grow well. Dwarf Scotch Curled and Tall Scotch are equally satisfactory.

Fort Vermilion, Alta.—Dwarf Green Scotch grew very well and can be considered a useful and hardy type of greens.

Brussels Sprouts

Of all the vegetables grown, this is one of the most exacting as to soil and season. In fact it is very difficult to grow in the interior portions of the country. The dwarf varieties have been found generally to give best results.

VARIETIES

II. Quebec and Ontario

La Ferme, P.Q.—One of the best varieties that has been tested is Long Island Improved.

III. Prairie Provinces

Morden, Man.—This crop is not considered entirely satisfactory for the locality. Long Island is the best variety.

Rosthern, Sask.—Of the many varieties tested, Long Island Improved and Danish Prize, both dwarf in habit of growth, gave the best yields.

Indian Head, Sask.—Long Island Improved was found the best followed by Danish Prize, another of the dwarf types.

Swift Current, Sask.—Long Island Improved, Little Gem and Dwarf Paris Market produced good firm sprouts.

Lacombe, Alta.—Danish Market, Paris Market and Dalkeith have given good returns in some years and are worthy of a place in the garden.

Beaverlodge, Alta.—Of the four varieties grown, Amager Market gave the best yield. The best yield resulted when the foliage was allowed to remain intact until harvest time.

Fort Vermilion, Alta.—A satisfactory crop was harvested in 1931 from the Danish Market variety.

IV. British Columbia

Agassiz, B.C.—This is not a satisfactory crop, on account of seasonal conditions. Early seeding is essential to success.

Cabbage

VARIETIES

The early mid-season and late varieties of cabbage all have an important place in the range of garden crops and are given below in order of earliness and quality.

I. Maritime Provinces

Charlottetown, P.E.I.—Golden Acre, Copenhagen Market and, for late or winter cabbage, Danish Ballhead (short stem), are the most outstanding varieties.

Kentville, N.S.—In order of earliness, Golden Acre is first, Copenhagen Market second, and Enkhuizen Glory is a good mid-season variety. The best late variety is Danish Ballhead (short stem). The seed was sown in the greenhouse on March 24 and the plants set in the field on May 8, in rows 33 feet long with the rows 2·75 feet apart and the plants 1·5 feet apart in the row. Seed sowing in the open field has also been done on April 30 and May 7 and the plants transplanted to the field in mid-June with good results.

II. Quebec and Ontario

Cap Rouge, P.Q.—For very early market, Early Jersey Wakefield is the best, followed by Golden Acre and Copenhagen Market, with Succession as a mid-season variety. For late fall and winter storage, Danish Ballhead of the short stem type is recommended.

Lennoxville, P.Q.—Of the many varieties of cabbage tested during the past three years the following are outstanding: Golden Acre for early, Succession for mid-season and Extra Amager Danish Ballhead for the late crop for winter storage.

La Ferme, P.Q.—Golden Acre is the best of the early varieties, followed by Copenhagen Market. Danish Ballhead is the best winter variety.

Kapuskasing, Ont.—Both Golden Acre and Copenhagen Market are to be preferred for early summer cabbage and Danish Ballhead (short stem) is the best late or winter variety.

III. Prairie Provinces

Morden, Man.—The early and mid-season varieties of cabbage do the best. They include Jersey Wakefield, Golden Acre and Copenhagen Market. The following mid-season varieties were found very satisfactory: Glory of Enkhuizen and Succession. Late maturing varieties have not done well.

Rosthern, Sask.—The early varieties of cabbage that did best are: All Head Early, Winnigstadt, and Golden Acre. For the main crop, Copenhagen Market, All Seasons, Glory of Enkhuizen, Danish Ballhead, Brandon Market, and Succession or Brunswick, Improved American Savoy and Red Drumhead are best.

Scott, Sask.—Golden Acre and Copenhagen Market are the two best early and mid-season varieties, while Danish Ballhead (short stem) and Flat Dutch are good varieties for winter storage.

Indian Head, Sask.—Of the many varieties tested, Express and Golden Acre are the best early sorts. Glory of Enkhuizen, All Head Early, Copenhagen Market and Charleston Wakefield, are good mid-season varieties, but Mid-season Market was the heaviest producer. The late varieties that did best are Improved Brunswick, Cannonball, Late Flat Dutch and Danish Roundhead. Mammoth Red Rock and Haco are good red sorts.

Swift Current, Sask.—Glory of Enkhuizen, Succession, Copenhagen Market and Baby Head are the most outstanding early and mid-season varieties, while Danish Ballhead and Brandon Market are the best of the late sorts.

Lethbridge, Alta.—Savoy cabbage did well at this station. The leading varieties in order of merit are Best of All, Improved American, Chester and Kinver Globe.

Lacombe, Alta.—Jersey Wakefield and Golden Acre are the two earliest-maturing varieties. Copenhagen Market and Northern Favourite are good second-early varieties while Danish Ballhead is the best winter variety. Delicatessa and Danish Stonehead are the best of the red varieties.

Beaverlodge, Alta.—The three best-yielding varieties are Fottler Improved Brunswick, Glory of Enkhuizen and Golden Acre. The latter is a very early-maturing round-headed variety of excellent quality. For winter storage Danish Ballhead (short stem) is one of the best.

Fort Vermilion, Alta.—For the early crop, seed was sown in a hotbed on April 25 and for the late crop seed was sown on the open ground on May 20. Early Jersey Wakefield and Golden Acre are the outstanding early sorts and Danish Ballhead is the best of the late varieties.

CULTURAL PRACTICES WITH CABBAGE

Successional sowings with cabbage have been made to find the optimum date of seeding for storage purposes. An early and a main or late crop were used. Copenhagen Market was used as the early-maturing variety and Extra Amager Danish Ballhead as the late-maturing variety. The dates of seed sowing varied from March 24 to June 15.

I. Maritime Provinces

Kentville, N.S.—The heads of Copenhagen Market cabbage produced by plants that were started between May 7 and May 28 were much heavier than those from the March 24, March 29, April 10, June 4 and June 15 seedings. With Extra Amager Danish Ballhead, exceptionally good weight was produced by the plants from the April 10 sowing.

Storing cabbage, in a root cellar, on slatted shelves, with the heads cut off the shanks was found satisfactory.

II. Quebec and Ontario

Lennoxville, P.Q.—An experiment has been conducted during the past eight years with early and main crop cabbage to find the effect exerted by seed sowing at different dates. The first seedings were made in a hotbed early in April. The second seedings were made in a cold frame. Other sowings were made out-of-doors, when conditions permitted, at intervals of two weeks until mid-July. Seedings to the end of June, using Copenhagen Market, proved satisfactory. Golden Acre, sown as late as mid-July, produced very good heads. Extra Amager Danish Ballhead sown after June 15 failed to produce marketable heads.

III. Prairie Provinces

Indian Head, Sask.—From the May 15 sowing, made in the open garden, Improved Brunswick and Danish Roundhead gave the best yields and proved useful for winter storage.

Swift Current, Sask.—Sowings made in the open garden as early as April 24 and around the first of May have produced small firm heads suitable for winter storage. Dry soil conditions hamper the later sowings very greatly.

IV. British Columbia

Agassiz, B.C.—Sowing seed in a hotbed for the early cabbage crop is the most certain method of getting suitable plants for planting at the same time each season. Outdoors seeding is quite satisfactory for mid-season and winter cabbage production.

Carrots

A great range of types of carrots, all of which are more or less known under variety names that convey some idea of a certain type or form of root, have been tested for horticultural qualities. In each instance, where a certain type is looked for, some particular feature is associated, i.e. earliness, size, quality, shape of root or size of top, the latter being important in carrots for bunching. Too large a top is objectionable while too small a top is equally objectionable, since the large top is bulky and the small top is not sufficiently large to allow proper tying into bunches.

VARIETIES

I. Maritime Provinces

Kentville, N.S.—Of the many varieties of carrots tested, Chantenay and Nantes Half-long or Coreless are the two best. Early sowings are usually damaged by carrot rust-fly maggot. The sowings made between June 14 and 24 usually escape this pest and develop into very fine roots for winter storage.

II. Quebec and Ontario

Cap Rouge, P.Q.—Over a period of years, twenty-five varieties and strains have been compared. The Oxheart carrot is very desirable for an early, forcing variety, and also very suitable for the first early-grown variety as an outdoor crop. Chantenay is a popular variety for general marketing.

Lennoxville, P.Q.—Chantenay has been found to be the most satisfactory variety for early bunching and winter storage. Scarlet Horn and Nantes are also very good.

La Ferme, P.Q.—Chantenay, Nantes and Scarlet Horn are the three best varieties. Pride of Denmark tested for two years has been giving very promising results.

Kapuskasing, Ont.—Over a number of years, Chantenay has proved the best variety to grow from yield and quality standpoints.

III. Prairie Provinces

Morden, Man.—Chantenay carrot is the most outstanding for this locality, followed by Nantes Half-long.

Rosthern, Sask.—Chantenay and Nantes are the two most outstanding varieties.

Indian Head, Sask.—Chantenay, Danvers and Nantes are considered the most outstanding varieties.

Swift Current, Sask.—Danvers Half-long, Oxheart and Nantes have been found to do very well.

Lacombe, Alta.—The earliest maturing varieties are Oxheart and Early French Short Horn. For quality, Chantenay, Danvers and Favourite are the best.

Beaverlodge, Alta.—Chantenay and Danvers have given the most satisfactory returns.

Fort Vermilion, Alta.—Early sowing is desirable for a supply of carrots for early summer but the best roots for winter storage were obtained from the late May sowing. The outstanding varieties are Danvers, Nantes, Amsterdam and Chantenay.

CULTURAL PRACTICES WITH CARROTS

The date of sowing carrot seed has a very profound effect upon the size and quality of carrots produced for market during the summer, and for winter storage. Roots of medium size are much more desirable than those of large size that result from early sowing. Small carrots from early sowings are not at all desirable on account of the coarse stringy texture usually associated with slow growth.

I. Maritime Provinces

Kentville, N.S.—The variety Chantenay was sown at intervals starting on May 6 and continuing to June 15, employing 30-foot rows. Half of each row was harvested on August 5 and the remaining portion on October 2. Rust-fly destroyed the sowings of May 6 and 18. The sowings made on May 28, June 4 and 15 developed well. Very fine roots for winter storage were obtained from the June 15 sowing.

II. Quebec and Ontario

Lennoxville, P.Q.—Sowings of Chantenay carrot seed have been made at intervals of two weeks, starting in the spring as soon as soil and seasonal conditions would permit, until June 15. The early sowings produced early carrots but by autumn the roots were oversized and coarse. The sowings at the intervals mentioned, up to mid-June, produced excellent carrots with the latest sowing producing carrots of a desirable size and quality for winter storage.

La Ferme, P.Q.—It has been found that by sowing the seed when the ground is in good condition, and warm enough to give quick germination, the best results are obtained. Sowings made on June 9 and 16 gave very poor germination. One and one-half inches apart in the row is the best distance.

CARROT HARVESTING AT DIFFERENT DATES FOR STORAGE

Indian Head, Sask.—Late harvesting on October 4 resulted in the roots keeping well through the period of storage.

Cauliflower

That important differences exist between the various varieties of cauliflower is a known fact. Differences also exist between the strains of the different varieties. Earliness and uniformity of maturity coupled with compact heading are important. The large-growing, late-maturing varieties are not well adapted to as wide a range of territory as are the early and mid-season varieties.

VARIETIES

I. MARITIME PROVINCES

Kentville, N.S.—Two sowings of cauliflower seed are made each season, for instance, on March 31 in the greenhouse and on May 8 in the open garden. These sowings succeed well. Later sowing than on these dates is not recommended as the heads produced by these later plants are too small to be of value. Early Dwarf Erfurt and Early Snowball are two good varieties. It was found, where the same strain of cauliflower seed was used for the early and second sowing, that it required fewer days for the first sowing to reach market condition than in the case of the second sowing. In the first case, the March 31 sowing, 86 days were required from sowing to ready for market, while for the second sowing, on May 2, it required 110 days.

II. QUEBEC AND ONTARIO

Cap Rouge, P.Q.—Cauliflower is a difficult crop to grow at this station due to hot dry conditions that prevail, as a rule, and which are not conducive to the successful growing of this crop. Early summer and late fall crops are generally the most successful. Early Dwarf Erfurt and Veitch Autumn Giant are good.

La Ferme, P.Q.—It has been found that Snowball is one of the best varieties.

III. PRAIRIE PROVINCES

Under dry weather conditions cauliflower growing is difficult. Conditions of this kind are found on the prairies and unless a water supply can be relied upon, cauliflower will not do very well.

Morden, Man.—Lack of moisture was the cause of almost a failure with this crop. The Snowball and Erfurt varieties have done very much better than the late-maturing, large-growing varieties. The variety, Danish Perfection, is considered the most promising.

Rosthern, Sask.—Early Dwarf Erfurt and Snowball types are the most satisfactory.

Scott, Sask.—Early Dwarf Erfurt and Snowball are well adapted to prairie gardens.

Indian Head, Sask.—Early Dwarf Erfurt, Snowball, and Danish Perfection proved to be good varieties.

Swift Current, Sask.—Early Snowball and Early Dwarf Erfurt were successfully grown during the past years, particularly when a northern or eastern exposure was provided. During moist seasons Danish Perfection or Veitch Autumn Giant will do fairly well.

Lethbridge, Alta.—The Snowball variety and strains have proved earliest and best.

Lacombe, Alta.—At this station the Snowball strains proved earliest as well as good. Early Dwarf Erfurt and Danish Perfection were also very satisfactory.

Beaverlodge, Alta.—In two years out of three the early strains of Snowball have given the best crops. Danish Perfection is a good late variety.

Fort Vermilion, Alta.—The early-maturing varieties are the most satisfactory. Snowball, Early Dwarf Erfurt and Extra Early Paris were the best.

CULTURAL PRACTICES WITH CAULIFLOWER

The sowing of cauliflower seed at various regular dates has had a definite effect on the extension of the season for this crop.

II. Quebec and Ontario

La Ferme, P.Q.—The first sowing was made on April 7 and others at intervals of seven days, until May 5. All sowings reached remarkable condition and the last sowing was ready by September 12. Snowball was used in this test.

III. Prairie Provinces

Indian Head, Sask.—Seed sown on May 5 in the garden, and thinned, extended the season by another month. Early Dwarf Erfurt and Danish Perfection are two good varieties to use.

IV. British Columbia

Agassiz, B.C.—The results of experiments with seed sown in a hotbed versus sown in the open indicate that February-sown seed or early March-sown seed produces the most certain early crop. When seasonal conditions favour open garden seeding good results may be obtained by that practice.

Celery

Salad crops are important, and, as a consequence, the best varieties of celery must be used, if the popularity of this vegetable is to be maintained. The choice of a good strain of a variety is also imperative.

Both the Golden Self-Blanching type and the green type are of very great importance. The latter should be used to a greater extent than at present.

VARIETIES

I. Maritime Provinces

Charlottetown, P.E.I.—Paris Golden yellow is considered the best early variety, and Winter Queen is a satisfactory green, late variety that will blanch white in storage.

Kentville, N.S.—Many varieties have been tested. Sowing the seed in the greenhouse was done on March 31 and planting in the field carried out on June 4, in double rows, 9 inches apart, with the plants 6 inches apart in the rows. Boards, paper, and earth were used for blanching. The boards and paper gave the cleanest and most attractive product. Bordeaux dust has been used for the control of late blight of celery, but not always with successful results.

Those varieties designated as very good are: Golden Self Blanching, Easy Blanching and Fordhook or Emperor.

II. Quebec and Ontario

Cap Rouge, P.Q.—Of the many varieties tested, White Plume ranks first for quality, Golden Self Blanching next, and Giant Pascal third. The former is an excellent variety for the market or home garden but is not suitable for storage, due to its poor keeping qualities. Green celery is not very popular.

Lennoxville, P.Q.—Easy Blanching has proved to be the best market variety, and White Plume is very desirable for the home garden.

Kapuskasing, Ont.—Over a number of years, Golden Plume celery has given the most satisfactory results.

III. Prairie Provinces

Morden, Man.—There seems to be a place for both the self-blanching and green types of celery. Golden Plume is considered the best early variety, followed by Easy Blanching as a second early variety.

The heaviest-yielding variety of winter or green celery is Evans Triumph. In order of yield the following are recommended as well: Giant Pascal, Winter Queen, Emperor and French Success.

Rosthern, Sask.—Golden Self-Blanching is the best all-round variety but Giant Pascal is an excellent green variety.

Scott, Sask.—Of the twelve varieties tested, Winter King has been the best yielder.

Indian Head, Sask.—The White Plume variety has been found to do well as it suffered least from the heat. Winter Queen and Emperor are two of the best of the later or green varieties.

Lethbridge, Alta.—The value of irrigation in connection with celery growing has been shown by planting celery on the level, and at intervals of ten days, with water allowed to run betwen the rows. A thirty-foot row produced 90 pounds of good celery. Where water was not applied in the early stages of development, the plants bolted to seed.

Lacombe, Alta.—Golden Self-Blanching, Ottawa strain, was considered superior to other strains of Paris Golden Yellow. Paris Red Ribbed was found very satisfactory. The red and pink varieties succeed well but are not as popular as the yellow or white types.

Beaverlodge, Alta.—Four varieties have been tested. Paris Golden Yellow has been found very satisfactory.

Fort Vermilion, Alta.—Golden Self-Blanching was tried and produced very encouraging results.

CULTURAL PRACTICES WITH CELERY

To determine the best date to set out celery plants:—

Indian Head, Sask.—Two varieties were used, White Plume and Winter Queen. The results of this test show that the earlier the plants are set out, with seasonal conditions considered, the better the yield will be.

BLANCHING CELERY

Different methods of blanching celery have been tried for the purpose of finding what type of product will result.

III. Prairie Provinces

Beaverlodge, Alta.—By placing one-inch boards twelve inches wide on each side of the row of plants, a cleaner and much more satisfactory product will be available, that will be from fifty to sixty per cent blanched. Earth-mounding

blanched the celery much better, but the leaf stalks were unsightly owing to the adherence of earth. Trench-grown celery blanched 85 per cent, but the earth got into the hearts and adhered to the leaf stalks, which was very objectionable. The earth mounding produced the best celery, apart from the unsightly condition.

IV. British Columbia

Agassiz, B.C.—Earth-mounding blanched celery much quicker than other methods, but during warm weather was apparently the cause of considerable damage, such as unsightliness and rust. Boards one inch thick by twelve inches wide produced the cleanest blanched product. Both trench and level planting were tested. Significant differences in yield could not be determined between the two methods of growing.

Chard or Swiss Chard

This crop is as easy of culture as are beets. The broad succulent leaves are used in a manner similar to spinach. If greens are desired this is the crop to grow. Sow the seed in rows thirty inches apart and thin the plants to stand twelve inches apart in the row. A few plants will produce a great quantity of leaf stalks. In harvesting, break the leaf-stalks from the crowns, and the crowns will keep on producing leaf-stalks throughout the season. In autumn, lift the plants with the roots attached and place them in a cool cellar, covering the roots with sand or soil, and in this way Swiss chard may be had well into the winter months.

VARIETIES

I. Maritime Provinces

Kentville, N.S.—Swiss chard grows exceptionally well but there is little demand for it. Lucullus is a spendid variety.

II. Quebec and Ontario

La Ferme, P.Q.—Both Lucullus and Silver Leaf have given good crops.

III. Prairie Provinces

Lethbridge, Alta.—Silver Leaf and Lucullus have proved equally good at this station.

Lacombe, Alta.—Only one variety, Lucullus, has been grown, and this one is recommended.

Beaverlodge, Alta.—Swiss chard is one of the finest greens crops for this locality. Lucullus is recommended.

Fort Vermilion, Alta.—The Lucullus variety gave a very satisfactory crop lasting until the late autumn.

Chicory

This plant is used in the making of salads. The blanched, white portions are very tender and tasty. When seed is sown in good garden soil in the spring and given the usual care during the season of growth, roots of good size can be harvested in the autumn, that will be of a desirable size for winter forcing, or for drying, to be ground later on for a coffee substitute.

III. Prairie Provinces

Morden, Man.—Witloof chicory grows very well under conditions at Morden, even when the season is very dry.

Chinese Cabbage

This type of vegetable is becoming better known and more popular. Some difficulty is experienced on account of the early sowings going to seed prematurely. Sowing about July 15 will, as a rule, produce a good fall crop.

VARIETIES

I. Maritime Provinces

Kentville, N.S.—Three varieties of Chinese cabbage have been under test: Chihli, Wong Bok and Pe Tsai. The former is more of the Cos lettuce type of head while the latter two produce larger and more compact heads. The plants may be lifted in the fall and the roots set in soil in a cool, dark cellar where they will keep well into the winter.

III. Prairie Provinces

Fort Vermilion, Alta.—The early sown seed sometimes produces very fair heads.

IV. British Columbia

Agassiz, B.C.—Several methods of producing satisfactory spring crops have been tried. Bolting to seed is the common fault. Seed sown on July 19 has produced very fine heads. New Joy, Pe Tsai, Chihli and Wong Bok all did well. New Joy forms heads somewhat celery-like. Wong Bok produces very fine, large, firm heads of four to five pounds. This crop will stand six to eight degrees of frost without serious damage.

Citron

While it is not used as much as the other vegetables, there is a demand for citron for preserving.

VARIETIES

I. Maritime Provinces

Charlottetown, P.E.I.—The Colorado citron (green-seeded) has been found to give the best returns.

Kentville, N.S.—The citron does fairly well but is not in demand.

II. Quebec and Ontario

Kapuskasing, Ont.—This crop is too tender for successful growing at this station. Successful crops have been obtained only twice in ten years. The Red Seeded variety succeeded best.

III. Prairie Provinces

Morden, Man.—The best yielding variety is Colorado.

Rosthern, Sask.—Both Red Seeded and Colorado Green Seeded have given good returns.

Indian Head, Sask.—Both Red Seeded and Green Seeded give very good crops.

Lacombe, Alta.—The two varieties of citron, namely, Red Seeded and Green Seeded Colorado did equally well and each produced a splendid crop.

Beaverlodge, Alta.—Both the Red Seeded and Green Seeded varieties did fairly well. A protected location is essential to success.

Fort Vermilion, Alta.—The Red Seeded and Green Seeded varieties, when grown under glass, produce fair results. Red Seeded has produced fruit when grown out-of-doors.

Corn

For truck garden, market garden and home garden as well as canning, this crop is of great importance. Of recent years many new and very promising varieties have been introduced.

VARIETIES

I. MARITIME PROVINCES

Charlottetown, P.E.I.—The following varieties have been found very valuable: Pickaninny, Banting, Early Malcolm, Sixty-Day Golden, and Golden Bantam. The new yellow variety, Dorinny, that is 7 to 10 days earlier than Golden Bantam, is very promising. Spanish Gold is also a very early yellow variety.

Kentville, N.S.—Of the many varieties that have been tested during the past three years, Banting, Pickaninny and Early Malcolm are considered outstanding early sorts with Golden Sunshine and Golden Bantam as good main crop varieties. The new variety, Dorinny, tested in 1933, outyielded all other varieties, and, while not quite as early as Banting and Pickaninny, it possesses better quality than Banting and better colour than Pickaninny.

Fredericton, N.B.—Earliness of maturity is an important feature in sweet corn for New Brunswick. The most promising varieties are Banting, Golden Gem, Dorinny, and Golden Bantam.

II. QUEBEC AND ONTARIO

Cap Rouge, P.Q.—Three varieties of sweet corn have been found to give excellent results: Malakoff, a white sweet variety that has yielded at the rate of 24,436 ears per acre and was ready for use in 91 days from planting; Golden Bantam, that was ready 103 days from planting and yielded at the rate of 22,056 ears per acre; and Country Gentleman a 129-day white variety that yielded 14,241 ears per acre. These three varieties, planted on the same day, will supply a succession of green corn throughout the season.

Lennoxville, P.Q.—Banting is a very good early-maturing yellow variety to use for the first early plantings and for successional plantings. Early Malcolm has proved to be the best of the early white varieties.

The Banting variety has been used for seed corn production and does very well.

Central Experimental Farm, Ottawa, Ont.—The early-maturing and mid-season varieties do very well; these are the early varieties. Pickaninny, Banting, Golden Gem and Spanish Gold, followed by the mid-season varieties Dorinny, Sunshine and Golden Bantam. Late-maturing varieties like Golden Giant and Bantam Evergreen are not always satisfactory on account of the difficulty they have to mature properly before the first fall frosts.

La Ferme, P.Q.—The varieties that have been found best suited to conditions here are Pickaninny, followed by Golden Early Market and Golden Bantam.

Kapuskasing, Ont.—The early-maturing varieties are of great value. They include Dorinny, Banting and Pickaninny.

Harrow, Ont.—The yellow varieties of corn are popular at present, therefore, an early-maturing high quality variety is of great value. Dorinny, the new variety originated at Ottawa, has proved of great value and is very promising. Golden Bantam is also popular.

III. Prairie Provinces

For the prairies, the early and mid-season varieties of corn are of greatest importance, although, when moisture conditions are right and the season favourable, some of the later-maturing varieties can be grown.

Morden, Man.—The varieties that have given best results are as follows: Golden Gem, the best early variety; Sunshine, the best second early; followed by Golden Bantam, Golden Coin and Howling Mob.

Dorinny, a Central Experimental Farm yellow sweet corn, was found very promising, is fairly early, and retains its tenderness late into the season.

Rosthern, Sask.—Pickaninny and the early-maturing strains of Golden Bantam are the best as to quality.

Scott, Sask.—The early-maturing varieties of corn are suited for this section of the country. Banting has been found to give the best results. In 1931, a very good crop of Golden Bantam was obtained, due to the prolonged frost-free season.

Indian Head, Sask.—Varieties that mature early are important in this locality. Golden Gem, Banting and Pickaninny did well. Dorinny, an Ottawa origination, and Golden Bantam are two good main-season varieties. In two years out of three, Golden Giant, Howling Mob and Golden Country Gentleman gave very good results.

Swift Current, Sask.—Owing to very dry conditions, sweet corn usually germinates poorly. Sunshine, and Golden Sixty-Day as well as Early Market have given very good results.

Lethbridge, Alta.—Of the six varieties and strains tested, two of the Ottawa varieties top the list for earliness and quality. In order, they are: Banting, Pickaninny, Sunshine, Sixty-Day Golden, Golden Gem and Golden Bantam. The latter is the highest quality corn but matures rather late for this locality.

Lacombe, Alta.—Earliness and quality are very important factors in sweet corn. Banting has been found to be the earliest, followed by Dorinny, Early Market, Improved Early Dakota and Pickaninny. In quality, Banting, Golden Bantam, Banting x Golden Bantam, Dorinny and Sixty-Day Golden stood high.

Beaverlodge, Alta.—Pickaninny, Banting and Early Market were the three most outstanding sweet varieties.

Fort Vermilion, Alta.—The Squaw corn matures very well, also Howes Alberta Flint, Pickaninny, Banting, Double Cross Golden Bantam and Early Market (Sixty Day Make Good).

IV. British Columbia

Agassiz, B.C.—Sixty-Day Golden or Golden Early Market and Golden Bantam are the two outstanding varieties. The former is inferior in quality to the latter but it is very much earlier and produces quite large ears. Gill Early Market is also a very promising variety. For late-maturing varieties, Groff Golden and Golden Giant are very satisfactory.

Pop Corn

It is interesting to record that popcorn of the standard commercial varieties has been grown, with considerable success.

VARIETIES

II. QUEBEC AND ONTARIO

Harrow, Ont.—Four varieties of popcorn were grown in 1932 and matured well, which indicated that under favourable conditions this type of corn can be grown. The variety that yielded best was South American Giant Yellow, requiring 115 days to mature. Spanish Giant gave the second best yield and ripened in 79 days from planting. This so-called variety was found to be a mixture of white pearl and rice types.

III. PRAIRIE PROVINCES

Morden, Man.—Thirteen strains of popcorn were grown to maturity successfully and the product was of the finest quality. The most outstanding varieties are Japanese Hulless and Golden Tom Thumb followed by Iroquois Pop. The latter is a heavy-yielding, early type, of a white rice corn.

Indian Head, Sask.—Two varieties have been tested, both of which matured very well, namely, Tom Thumb, a yellow dwarf variety, and White Rice, a white-seeded corn, with good popping qualities.

CULTURAL PRACTICES WITH CORN

An effort has been made to find what influence would be exerted on the yield of ears by the removal of the suckers from the base of the plants.

I. MARITIME PROVINCES

Kentville, N.S.—Two varieties of sweet corn, Early Malcolm and Golden Bantam were used in this test. It has been found that the removal of the suckers from Early Malcolm corn did not have a beneficial or detrimental effect. With Golden Bantam there was a slight advantage in favour of sucker removal, but it could not be considered a profitable procedure in commercial sweet corn growing.

III. PRAIRIE PROVINCES

Morden, Man.—Where the suckers had been removed from Golden Bantam, a slight difference was recorded in favour of sucker removal, but this difference could not be considered significant.

Lacombe, Alta.—Sucker removal had little effect on the earliness and yield of most of the varieties in this test. One variety, Banting, did respond favourably to sucker removal by being slightly earlier. The heaviest yield was, however, obtained from the plants from which the suckers were not removed. Little is to be gained by interfering with the normal development of the plants.

Beaverlodge, Alta.—The removal of the suckers from three varieties of corn in a triplicate plot test did not give an increase in earliness or yield over the plots that did not have the suckers removed. Pickaninny, Banting and Golden Bantam were used.

HILLS VS. ROWS.—A study of the influence exerted by hill-planting and row-planting of sweet corn has been made for the purpose of finding if there would be any difference in early and total yield.

Scott, Sask.—Hill-planted sweet corn has been found to produce ears ready for use much earlier than the plants grown in rows. The hill-grown corn was ready for use on August 15 whereas the row-grown was not ready for use until September 22, and only a few were ready for use at that late date.

Sowing made on different dates to determine the best dates to give an extended season for corn:—

Indian Head, Sask.—The results show that by making the first planting on May 10 or thereabouts and continuing to make plantings at intervals of ten to fifteen days for six plantings, or until July 6, the season for corn can be extended into the late fall. Banting was the variety used.

Cucumber

Cool, crisp cucumbers are a profitable crop if grown to sell at the proper time. The white and black spine types are used to the greatest extent in Canada. The former are used chiefly for table or slicing cucumbers while the latter are used almost exclusively for pickle making.

VARIETIES

I. Maritime Provinces

Charlottetown, P.E.I.—Of the many varieties tested for slicing purposes, Early Fortune is one of the very best for home or market garden growing.

Kentville, N.S.—Strain differences have a definite influence on the performance of cucumbers from one year to another. Perfection, Early Fortune and Improved Long Green are very productive varieties. Boston Pickling is an excellent variety for pickle production.

Fredericton, N.B.—The White Spine variety suits the locality well but the fruits are not of a desirable shape. Selection work was commenced with a view to improving the shape and retaining the earliness.

II. Quebec and Ontario

Kapuskasing, Ont.—Little difficulty is experienced in producing a fair crop of cucumbers when the early-maturing varieties are used; these are XXX Table or White Spine and Davis Perfect, as well as the black spine pickling sorts of which Snow Pickling is the best.

III. Prairie Provinces

Vine crops are subject to severe injury where exposed to strong winds and very dry, hot weather.

Morden, Man.—Early Russian is the earliest variety, while the heaviest yield was obtained from Long Green. The latter variety withstood the windy conditions best of the twelve varieties tested.

Rosthern, Sask.—The most satisfactory large-fruiting varieties are Green Pack, which is a true White Spine, and Windermoor Wonder. Snow Pickling and Early Russian are good varieties for extremely early cucumbers.

Scott, Sask.—The Early Russian variety is the most satisfactory. Great damage is done to vine crops by the very high winds.

Indian Head, Sask.—Davis Perfect is considered the best table or slicing cucumber and Snow Pickling is the most outstanding of the pickling varieties.

Swift Current, Sask.—Early Russian has been found to be a very early and reliable variety, although King of the Ridge, Long Green and the pickler called Double Yield have produced good yields when conditions were favourable.

Lacombe, Alta.—The White Spine type of cucumber, of which there are a considerable number of varieties, has proved to be very suitable. Davis Perfect, Early White Spine and Early Fortune are among the best of these.

Beaverlodge, Alta.—Early Russian and Snow Pickling produced a large yield of fruit. The large-fruiting White Spine types have not been entirely satisfactory.

Fort Vermilion, Alta.—A few fruits were obtained from the glass-protected plants and from those grown in the open. Davis Perfect, Early Fortune, Long Green, Longfellow and Boston Pickling were all tried.

IV. British Columbia

Summerland, B.C.—Some progress has been made with the variety Davis Perfect, but, on account of the long fruits not fitting the crates well, shippers have criticized this variety. An attempt is being made to produce a more suitable cucumber.

Cultural Practices with Cucumbers

III. Prairie Provinces

Morden, Man.—The row system has been found superior to the hill system. Plants grown in rows produce the better crops and are not damaged by the strong winds, on account of the plants forming into a solid mat on the ground. The rows are spaced six feet apart with the plants thinned to one foot apart.

Egg Plant

While not so well known as many other vegetables, the egg plant is a very important vegetable that should be used to a much greater extent on account of its food value.

varieties

I. Maritime Provinces

Charlottetown, P.E.I.—Out of four varieties grown, the Blackie variety, originated at the Central Experimental Farm, proved the best adapted from the standpoints of earliness, yield and size of fruit.

Kentville, N.S.—Five varieties have been tested, of which two gave good results in 1933. Blackie, which was ready on August 14, produced forty marketable fruits weighing 20 pounds 12 ounces, and Black Beauty, ready on September 8, produced fourteen fruits that weighed 9 pounds 12 ounces.

II. Quebec and Ontario

Central Experimental Farm, Ottawa, Ont.—A great many varieties have been grown over a period of years, but very little success was achieved until the Ottawa origination called Blackie was developed.

III. Prairie Provinces

Morden, Man.—The small-fruited varieties, which include Purple Earliest Dwarf and Purple Long of Naples, have done best.

Rosthern, Sask.—Black Dwarf Nagasaki has been found very satisfactory.

Indian Head, Sask.—Blackie, the new Ottawa variety, proved to be the best-yielding variety and was early-maturing.

Beaverlodge, Alta.—Although a perfect stand of plants has been obtained the fruits have not set.

Kohl Rabi

A crop of this vegetable is as easy to grow as turnips. The globe-like portion that is the edible part should be used when three to four inches in diameter. At this stage it possesses the best quality, and is tender and sweet.

VARIETIES

I. MARITIME PROVINCES

Kentville, N.S.—Kohl Rabi grows readily but there is no demand for it in this locality.

II. QUEBEC AND ONTARIO

La Ferme, Que.—White Vienna is the best-yielding variety.

III. PRAIRIE PROVINCES

Morden, Man.—This vegetable grows well. Purple Giant Vienna is the best variety.

Rosthern, Sask.—Earliest Frame outyielded Early White Vienna.

Indian Head, Sask.—Early White Vienna is the earliest maturing and best variety.

Lacombe, Alta.—It has been realized by many that Kohl Rabi is an excellent vegetable. White Vienna is considered the best variety.

Beaverlodge, Alta.—White Vienna has been doing well and producing good crops.

Fort Vermilion, Alta.—White Vienna is a very satisfactory early-maturing variety.

Leek

To get leeks of a large size, the seed should be sown in a hotbed or greenhouse in early March and transplanted to the field. Out-of-door sowings produce small plants.

VARIETIES

II. QUEBEC AND ONTARIO

La Ferme, P.Q.—The Musselburg type of leek has been found to be very satisfactory.

Kapuskasing, Ont.—Musselburg and Giant Carentan do equally well.

III. PRAIRIE PROVINCES

Rosthern, Sask.—Monstrous Carentan has been found to be the best variety.

Lacombe, Alta.—Any of the varieties will do well. The seed is sown in the greenhouse on March 7 and the plants transplanted in the field about June 2. Giant Carentan is a very good variety.

Lettuce

VARIETIES

I. MARITIME PROVINCES

Kentville, N.S.—The loose-leaf types of lettuce do well as spring and fall crops. Grand Rapids and Black Seeded Simpson are considered good. Among the heading varieties, Iceberg, All Heart and Crisp as Ice are about the best. Cos Paris White is quite satisfactory. For frame growing, Paris Market does well, but when the seed is sown in the field, the plants quickly bolt to seed without forming heads.

II. Quebec and Ontario

Lennoxville, P.Q.—The lettuce crop, as a rule, is very satisfactory in this section. The loose-leaf varieties, such as Grand Rapids, do well. Big Boston and Iceberg do well as a transplanted crop. Early spring and early summer sowings made directly in the garden produced very good lettuce.

La Ferme, Que.—Grand Rapids is the best of the loose-leaf sorts and Big Boston and New York are recommended as heading varieties.

Kapuskasing, Ont.—All varieties of lettuce, both heading and loose-leaf, do well in this locality. The varieties that did best, however, are the following: Cos Paris White, New York and Black Seeded Simpson.

III. Prairie Provinces

Morden, Man.—The Wayahead type of lettuce is the best, followed by All Heart or Iceberg. The best loose-leaf variety is Grand Rapids.

Rosthern, Sask.—For early, leaf lettuce, Grand Rapids and Curled Simpson are the best, while May King, Iceberg and New York are good heading varieties. Cos Paris White is the best of its type.

Scott, Sask.—After years of trials, the Cos and other heading lettuce have been found to be the most satisfactory for this locality.

Indian Head, Sask.—Grand Rapids is the best of the loose-leaf varieties. Crisp as Ice, a red-tinged lettuce, All Heart or Iceberg and Salamander headed well but bolted to seed quickly, due to the very high temperature.

Swift Current, Sask.—Grand Rapids and Black Seeded Simpson have been found to give excellent results when sown in a shady place or where there is a slight northern slope. The heading varieties do not develop well, but, when seasonal conditions are favourable, Iceberg and Salamander are the best.

Lacombe, Alta.—On account of the very hot weather experienced early in the season, lettuce should be sown early in the spring to obtain best results. All Seasons, Big Boston, Simpson, Grand Rapids and Hanson are all good varieties suitable for the locality.

Beaverlodge, Alta.—Grand Rapids is reported to be a good variety. Among the heading types, Iceberg and New York gave fairly good results.

Fort Vermilion, Alta.—All varieties, both heading and loose-leaf, do well in this locality.

CULTURAL PRACTICES WITH LETTUCE

To determine how late seed may be sown for profitable head lettuce production:—

Indian Head, Sask.—The variety Iceberg was used. Five sowings were made at intervals of ten to fifteen days, starting on May 4 and concluding on June 20. Seed sown after the middle of May has failed to produce a profitable crop.

The results of head lettuce growing, under irrigation and fertilizer treatments, have yielded some information on what may be expected from such treatments in the foothills in Southwestern Alberta.

Lethbridge, Alta.—Head lettuce requires a low average temperature, with freedom from periods of excessive heat, particularly after heading begins. The best variety and strain is New York No. 12 which produced heads weighing thirty-five ounces while May King produced heads weighing eighteen ounces. Big Boston was unsuitable on account of tipburn, and Iceberg headed slowly. Raised and level beds were used. The raised beds afforded easy irrigation and drainage. Good heads were harvested in the late season from the level planting. Sowing seed direct in the field, and thinning, proved as satisfactory as trans-

planting. Commercial fertilizers are useful in connection with lettuce growing. Ammonium phosphate applied at seeding time increased the firmness of the heads and advanced maturity. Tipburn was present on all varieties and greatly reduced the market value. Early summer and late fall crops should be easily marketed without serious loss.

IV. British Columbia

Agassiz, B.C.—Seeding in hotbeds versus seeding in the open: Best results have been obtained by sowing the seed under glass early in February, with the plants ready to set out in the first fine period in May. Plants produced from January-sown seed will, as a rule, not make satisfactory growth until after March 15, indicating that mid-winter-sown seed is not satisfactory.

A planting of New York lettuce was made on July 15 and was ready for use by November 2. The bulk of the crop was destroyed by frost.

Seedings between May 15 and July 14 did not produce marketable lettuce.

Muskmelon or Cantaloupe and Watermelon

To grow melons successfully the varieties best suited to the particular locality and market should be selected. Being a tender crop, a great deal depends upon the care given the plants during the early part of the growing season and up to ripening of the fruits.

VARIETIES

II. Quebec and Ontario

Harrow, Ont.—Crop improvement with the Osage variety of muskmelon was commenced for the purpose of establishing by selection a uniform strain that would rank high in the class of Foundation Seed. Several segregations have been obtained that are very promising.

III. Prairie Provinces

Morden, Man.—Golden Champlain (Chipman) was found to be the earliest good melon. The best high-quality and flavoured melon is Bender Surprise.

Rosthern, Sask.—Page Early has given the best yields of muskmelons.

Scott, Sask.—The Scott selection or strain of muskmelon has proved most satisfactory.

Indian Head, Sask.—The Scott selection of muskmelon was the earliest to mature but its quality is very much against it. Early Knight was ready by August 28 and Golden Champlain was ready by September 8. These are good varieties with unsurpassed quality.

Beaverlodge, Alta.—Muskmelons have not proved a success, even those of Polish origin.

MUSKMELON OR CANTALOUPE IRRIGATION

The purpose of this investigation was to find what effect different rates of water application would have on the development of the melon crop.

IV. British Columbia

Summerland, B.C.—Water was delivered through a special apparatus that enabled the flow to be accurately measured in gallons and converted into cubic feet and acre-inches. The highest yield of fruit, best grade and best vine growth, was obtained from plots that received three-quarters of an inch of water per week, followed closely by the plot that received one-half an inch per week. Root growth was better in these plots than where heavier applications of water were given.

BRIX SUGAR TEST ON CANTALOUPES

Summerland, B.C.—An effort has been made to find some more satisfactory means of determining when a cantaloupe is ready for use than by the " half-slip" and " full-slip " method, as cantaloupes show a wide variation in sugar content. It is suggested that nine and one-half degrees Brix is low enough and very little hardship would be caused by setting the minimum of ten degrees. Contrary to expectations, the sugar content did not drop after the occurrence of cold nights late in the season. Volatile flavours are responsible for lack of palatability which is not due to lack of sugar.

WATERMELON

There is always a demand for information about watermelons, and, while they cannot be looked upon as an important crop, a few are grown, particularly those that mature early.

III. Prairie Provinces

Morden, Man.—The early-maturing varieties are grown in Southern Manitoba to a considerable extent. These varieties include Kleckley Sweet, Arikara, Golden Anniversary, Sugar and Muscatine. Kleckley Sweet is the best quality melon.

Indian Head, Sask.—Four varieties did well in 1933 on account of favourable seasonal conditions; these were Yukon, Hungarian Honey, Kleckley Sweet and Early Canada.

Beaverlodge, Alta.—Even the earliest-maturing varieties produced only very small fruits.

Fort Vermilion, Alta.—By protecting the plants with sash during the late spring and early autumn nights, Cole Early and Harris Earliest can be grown to small size and ripened indoors.

Okra

This vegetable is important as an ingredient in soups and thrives well under warm season conditions.

III. Prairie Provinces

Morden, Man.—Dwarf Green has been found to do best in this locality.

Onion

VARIETIES

Many varieties have been tested over a great many years to determine their earliness, yield and quality. Local market demands play an important part in the choice of varieties.

I. Maritime Provinces

Charlottetown, P.E.I.—The demand seems to be for a red onion that will mature early and produce a large return per acre. Early Flat Red and Large Red Wethersfield are the two most outstanding varieties.

Kentville, N.S.—To grow onions successfully in this locality it is advised that the seed be sown indoors at the end of February or on the first of March, and transplanted once or twice before planting out in the field in May. By this

method good strong plants can be grown that can withstand the attack of onion root maggot. Onions receiving such treatment will mature well for winter storing. Seed may be sown in the field but there is the danger of serious loss from maggots. Cranston Excelsior, for early summer onions, will grow to good size; Yellow Globe Danvers is the best yellow onion. Red Globe and Red Wethersfield are both good red varieties. Barletta is an excellent white variety for picklers. Thick seeding is essential to get bulbs ¾ of an inch in diameter. Thinning the plants in the row should not be done.

Extra Early Flat Red, Kentville strain, has proved to be a good yielder. In the keeping tests of varieties, Extra Early Flat Red of the March 21 sowing gave 85 per cent good bulbs on March 7 in the following spring. Of the varieties sown on April 30, Yellow Globe Danvers gave 77 per cent good bulbs on March 7 in the following spring. Choice of varieties, and early maturity, influence the keeping qualities to a large extent.

Multiplier is a valuable home garden onion.

II. Quebec and Ontario

Cap Rouge, P.Q.—Of the many varieties of onions tested, Prizetaker is one of the best for growing as transplants. Large Red Wethersfield is a very desirable variety, due to its unexcelled keeping qualities. Planting of onion sets is recommended for onions for early market.

Lennoxville, P.Q.—Nine varieties of onions have been tested during the past few years. Red onions are in greatest demand and the Large Red Wethersfield variety has proved to be very satisfactory. A few yellow onions are grown, including Yellow Globe Danvers and Ailsa Craig. These latter varieties are grown chiefly in the home gardens.

Kapuskasing, Ont.—The yellow varieties of onions are in demand and do very well here. Yellow Globe Danvers and Ailsa Craig are recommended.

III. Prairie Provinces

Morden, Man.—Onions grown from sets developed much better for market than those grown from seed sown in the open ground. Transplanted onion seedlings gave excellent results. Australian Brown followed by Ailsa Craig did best from seed sown in the open ground. Sweet Spanish produced the largest-sized onions when grown from sets, and, when grown by transplanting seedlings, gave the largest and best onions.

Rosthern, Sask.—The Prizetaker variety of onion has given the most satisfactory results. Onion sets can be grown reasonably well, using Giant Prizetaker, Yellow Globe Danvers, Early Flat Red and Large Red Wethersfield.

Indian Head, Sask.—Giant Yellow Prizetaker, Ailsa Craig, Yellow Globe and Large Red Wethersfield all yielded well.

Swift Current, Sask.—Ailsa Craig, Yellow Danvers, Yellow Prizetaker and Southport Yellow Globe have given very good results. The first named variety is, however, recommended as the most outstanding.

Lacombe, Alta.—Nine varieties were tested, and Ailsa Craig, Australian Brown, Giant Yellow Prizetaker, and Cranston Excelsior gave good results. White Barletta is the best variety for pickling.

Beaverlodge, Alta.—Of the thirteen varieties tested, Ailsa Craig, Cranston Excelsior, Yellow Globe Danvers, Giant Yellow Prizetaker and Large Red Wethersfield were the leading ones. In 1933, Giant Yellow Prizetaker gave the best yield.

Fort Vermilion, Alta.—Early seed sowing is important. The Ottawa grown seed gave good yields of Large Red Wethersfield and Yellow Globe Danvers. Extra Early Flat Red, Yellow Prizetaker and Ailsa Craig and other varieties did well. Barletta is a satisfactory pickler type.

Multiplier has proved to be a useful onion for planting to produce early green onions. If an additional planting is made, onions of remarkably good size can be had for winter use.

CULTURAL PRACTICES WITH ONIONS

Tests of the influence of distance apart of transplanted onions in the row upon the yield have given some interesting results.

I. Maritime Provinces

Kentville, N.S.—Four distances apart for transplanting onions have been observed: 4, 6, 9 and 12 inches. Four inches apart in a 16·5-foot row gave 46 onions weighing 49 pounds; 6 inches apart, 33 onions weighing 38 pounds; 9 inches apart, 22 onions weighing 26 pounds; and 12 inches apart, 17 onions weighing 28 pounds 8 ounces. Cranston Excelsior was the variety used and the seed was sown on February 23.

III. Prairie Provinces

Morden, Man.—Onion plants, started from seed and grown in a hotbed, then transplanted to the field, yielded better results than where seed was sown in the open field at the same time. The yield from onion sets planted out was inferior to that from the onion plant method. Dry weather retarded the onions grown from seed sown in the open field.

Beaverlodge, Alta.—This test has shown that sets planted in the spring will mature earlier and give a bigger yield per acre than seed sown in the ground at the same time. Transplanted onions gave the largest yield, but the bulbs were not as well-matured as the onions produced from sets.

Fort Vermilion, Alta.—Both red and yellow sets performed well.

Garlic

The garlic crop finds ready sale in most of the large city markets.

Fort Vermilion, Alta.—Garlic was grown in 1932 and produced a very fair yield.

Parsley

The quickest results with parsley can be obtained by sowing the seed indoors and transplanting the plants to the field.

VARIETIES

I. Maritime Provinces

Kentville, N.S.—The Moss or Double Curled varieties are good. Plants grown from field-sown seed are usually attacked by carrot rust-fly maggot.

II. Quebec and Ontario

La Ferme, P.Q.—Triple Curled is considered one of the best of the Moss Curled varieties.

Kapuskasing, Ont.—Moss Curled is one of the best varieties for this locality.

III. Prairie Provinces

Indian Head, Sask.—Triple Curled is the most satisfactory variety.

Beaverlodge, Alta.—Both Champion Moss Curled and Triple Curled did well.

Fort Vermilion, Alta.—Moss Curled and Perfecta made good growth.

Parsnip

Three types of parsnips are commonly known: Hollow Crown, Guernsey or Student and the Turnip, a flat variety little grown. Seed should be sown in the spring, as early as weather and soil conditions will permit. Roots left in the ground undisturbed during winter will be found, when dug in the spring, to have excellent flavour. Roots that have started with growth are not poisonous.

VARIETIES

I. Maritime Provinces

Kentville, N.S.—The Hollow Crown variety is one of the best to use.

II. Quebec and Ontario

Kapuskasing, Ont.—Hollow Crown has given the best results.

III. Prairie Provinces

Rosthern, Sask.—Guernsey or Student, a half-long parsnip, which is of the Hollow Crown type, gave the best results.

Indian Head, Sask.—Guernsey or Student gave the best yield and is recommended for this locality.

Swift Current, Sask.—Guernsey or Student is recommended as the most satisfactory variety on account of the heavy yield and ease of digging.

Lacombe, Alta.—To obtain maximum yields, the use of the half-long variety, Guernsey or Student, is recommended. Hollow Crown is the best variety for exhibition purposes.

Beaverlodge, Alta.—Cooper Champion Hollow Crown has been found to be the best-yielding variety.

Fort Vermilion, Alta.—The Hollow Crown variety has produced excellent results.

CULTURAL PRACTICES WITH PARSNIPS

The proper spacing of the plants in the row will have a very definite effect on the yield of marketable roots.

I. Maritime Provinces

Kentville, N.S.—From the five sowings made at intervals of ten to twelve days, the best date, judging from yield of marketable roots and pounds per plot, is shown to be May 20.

II. Quebec and Ontario

La Ferme, P.Q.—In experiments extending over a period of five years, it has been found that by thinning the plants to two inches apart the best yield of marketable roots can be obtained. Seeds of parsnips should be sown as early in the spring as the soil is dry and warm enough to give uniform strong germination.

By successional sowings an effort has been made to find the best date to sow parsnip seed.

Pepper

The test of varieties has shown that early maturity is an important factor in pepper growing in most localities.

VARIETIES

I. MARITIME PROVINCES

Kentville, N.S.—The Harris Earliest variety has proved to be a good sort for the Annapolis Valley.

II. QUEBEC AND ONTARIO

Ottawa, Ont.—Harris Earliest is a very good, early, sweet variety, followed by Early Giant (Harris), California Wonder and Neapolitan. In the hot type of peppers, Hamilton Market and Long Red Cayenne are good.

III. PRAIRIE PROVINCES

Morden, Man.—In the hot pepper class, Long Red Cayenne ripened a large crop and in the sweet type, Sunnybrook, sometimes called Squash or Tomato pepper, has been found to do well. The Sunnybrook variety is reported as being quite free from blossom-end-rot.

Rosthern, Sask.—Harris Earliest, Hamilton Market, Early Giant and Golden Dawn have all done very well.

Scott, Sask.—The best variety for this locality is Harris Earliest.

Indian Head, Sask.—Harris Earliest was the earliest and heaviest yielder of green fruits, followed by Long Red Sweet, Golden Queen and Chinese Giant.

Lethbridge, Alta.—Harris Earliest, Bullnose, Long Red Cayenne, Chinese Giant and Neapolitan all did well. This crop requires warm conditions.

Beaverlodge, Alta.—Neapolitan and Harris Earliest each produced a few small fruits. The results were not satisfactory.

Fort Vermilion, Alta.—Harris Earliest and Neapolitan produced a small amount of fruit. The former was the most satisfactory.

Peas

VARIETIES

A great many varieties of garden peas have been under test for early, mid-season and late crops as well as for the purpose of rating them for quality and suitability for home and market garden purposes.

I. MARITIME PROVINCES

Charlottetown, P.E.I.—Several varieties are considered to be important, but the most outstanding variety, though low in yield, coupled with high quality, is Thomas Laxton followed by Badger, Bruce, Kootenay, Director, Lincoln and Phenomenon.

Kentville, N.S.—Alaska, smooth seeded, Fenland Wonder, wrinkled seeded semi-dwarf in height, are good early varieties. Laxtonian and Laxton Progress are good mid-season varieties. Bruce, Director, Lincoln and Dwarf Telephone are good late varieties.

Fredericton, N.B.—The variety Director, originated at the Dominion Experimental Station, Windermere, B.C., is one of the best, followed by Thomas Laxton x English Wonder, a hybrid originated at the Central Experimental Farm, Ottawa.

II. Quebec and Ontario

Cap Rouge, P.Q.—Of early peas, Gregory Surprise has given the best results over a period of nine years, Excelsior (Sutton) is next in earliness and yield, with Juno and Stratagem as good main crop varieties.

Lennoxville, P.Q.—The tall variety, Telephone, is recommended for the home garden where cost of production is not a factor. The most promising of the intermediate-growing varieties are Blue Bantam, Gradus and Stratagem. Of the Dominion Experimental Farm productions the following are recommended: Bruce, Kootenay, Director and Gregory Surprise x English Wonder.

La Ferme, P.Q.—The best varieties are Thomas Laxton x English Wonder, Director and Lincoln. The former is one of the Ottawa originations and Director was originated at the Dominion Experimental Station, Windermere, B.C.

Kapuskasing, Ont.—The best varieties are as follows: early, Thomas Laxton, American Wonder; medium, Bruce and Kootenay. The last two are originations of the Dominion Experimental Station, Windermere, B.C.; Stratagem is a good late variety.

III. Prairie Provinces

Morden, Man.—The best results have been obtained from the early-maturing varieties, Gregory Surprise, Alaska and Laxton Progress. The taller-growing, late varieties have not produced as good crops as the varieties mentioned. Edible podded peas did well. The best variety is Dwarf White Sugar.

Rosthern, Sask.—Of the fifty-seven varieties tested, Extra Early Pedigree or Alaska was the earliest, followed by British Lion, Invicta, Horsford Market Garden and Invermere No. 6.

Scott, Sask.—This being an important western garden crop, twenty-six varieties were tested. Those that are recommended are Early Morn and Thomas Laxton. Stratagem is an excellent late variety.

Indian Head, Sask.—The varieties that survived root-damage or rot are given in order of yield: Lincoln, Bruce, Director and Laxton Progress x Earliest of All. Alaska and Gradus were the earliest to be ready for use, followed by Hundredfold, Pioneer and Laxton Progress x Earliest of All.

Swift Current, Sask.—Early sowing of the seed is necessary to ensure successful germination. Pedigree Extra Early or Alaska is the best first early variety. Lincoln, English Wonder, English Wonder x Laxton Progress, an Ottawa origination, Windermere No. 42, and Director are all good producers.

Lacombe, Alta.—Early sowing on April 1 is important for success. The early varieties are Thomas Laxton, Early Morn, American Wonder and Laxtonian. For later sowing Stratagem, Lincoln and Alderman are recommended.

Beaverlodge, Alta.—Gregory Surprise has proved to be the earliest variety. Laxton Progress x Earliest of All and Thomas Laxton x English Wonder outyielded all other varieties; these are Ottawa varieties. Laxtonian, American Wonder, Director and Lincoln all produced representative crops.

Fort Vermilion, Alta.—Alaska is the earliest variety followed by Thomas Laxton, Early Morn, Pioneer, Little Marvel and English Wonder.

IV. British Columbia

Windermere, B.C.—In the variety test, the results show that Alaska and the other smooth and dimpled varieties are the earliest to mature. Bruce and Kootenay, originations of this station, have been consistently heavy-yielding varieties. Thomas Laxton and Gradus are very high quality varieties but are

not prolific croppers. Lincoln is a very satisfactory, heavy yielding variety that fits in between the Thomas Laxton season and the season of the tall late varieties of the Telephone type. The Ottawa selection, Thomas Laxton x English Wonder, proved to be a good yielder.

Agassiz, B.C.—A test of some of the known later maturing varieties has been made to find those best suited for the late crop. Supreme, Bruce, an origination of the Dominion Experimental Station at Windermere, and McTavish have all produced very fair results.

CULTURAL PRACTICES WITH PEAS

A test with peas was started to find the effect that various distances of seeding in the row and different depths of planting would have on the crop of pods.

I. Maritime Provinces

Kentville, N.S.—Three varieties were used, Thomas Laxton, American Wonder and English Wonder. The seed was dropped in the drill, one, two and three inches apart. In every case the one-inch-apart sowing produced the best and most profitable crop of pods.

II. Quebec and Ontario

La Ferme, P.Q.—Of the three distances of planting peas in the row, one-inch spacing gave the best yield over a period of five years.

III. Prairie Provinces

Rosthern, Sask.—The best depth to plant peas in the soil in this locality is two inches. Deeper or shallower planting is not as satisfactory.

Swift Current, Sask.—The one-inch-apart spacing in the row produced the best yield of pods from all three varieties used, namely, Thomas Laxton, English Wonder and Stratagem.

PEAS FOR CANNING

Being an important crop in the canned vegetable industry, peas have been given considerable attention. Uniformity of maturity is one of the important factors in the production of a high-quality pack. In addition, it is necessary to have heavy-yielding, disease-resisting stocks if the maximum returns are to be obtained.

II. Quebec and Ontario

Harrow, Ont.—During the two years this work has been under way, three of the Ottawa hybrid peas have proved to be good yielders, and have developed quite early in the season. The Kentville, Nova Scotia, stock seed, originated from selected stocks, proved to be very satisfactory.

III. Prairie Provinces

Lacombe, Alta.—The Ottawa origination, Tiny, a small-sized canning pea, produced a very good crop of small pods that were well filled with minute seeds. It is considered that this would be a valuable variety for canning, where vining machinery is available to remove the peas from the pods.

Potatoes

The suitability of potato varieties to the requirements is greatly influenced by the market and the purpose for which they are to be grown. Where the crop is grown for local marketing, the varieties recognized in that locality can be grown and disposed of readily. On the other hand, in the specialized potato growing sections, the fact that potatoes of a certain kind are required for the distant markets will bring about the large scale production of such potatoes to the exclusion of locally known sorts.

VARIETIES

II. Quebec and Ontario

Cap Rouge, P.Q.—Irish Cobbler as an early white variety is very much in demand, while, for the main or late crop Green Mountain is one of the best.

Kapuskasing, Ont.—Irish Cobbler is the best variety, on account of earliness of maturity.

III. Prairie Provinces

Rosthern, Sask.—The varieties found to yield well are Irish Cobbler and Early Ohio, as the early varieties, and Carmen No. 1 and Green Mountain, as main crop sorts.

Scott, Sask.—The varieties that have done well are Irish Cobbler, Gold Nugget, Early Ohio, Bliss Triumph, and Russet Burbank or Netted Gem. The former three are recommended for Northern Saskatchewan.

Certified seed of the above varieties is being produced.

Indian Head, Sask.—A variety test that included eighty-five varieties and strains has been conducted with plots in duplicate. The varieties are arranged in order of yield with Columbia Russet, from Windermere, B.C. in first place, Peachblow in fourth place, Gold Coin in twelfth place and Early Ohio, twenty-fourth in the list.

Swift Current, Sask.—In order of yield, six of the varieties are given: Wee MacGregor, Epicure, Irish Cobbler, Early Favourite, Bovee and Gold Nugget. Russet Queen and Columbia Russet are two of the best of the russet types of potatoes but do not yield as well as the white or red skinned sorts.

Lethbridge, Alta.—Early Eureka or Irish Cobbler, Katahdin, Columbia Russet, Rural Russet and Russet Burbank are arranged in order of earliness. Columbia Russet outyielded all other varieties.

Lacombe, Alta.—The variety test is carried on as a means of checking up the yielding ability of the certified seed produced. Certified seed of the following varieties is produced, and they are given in order of earliness: *Early Ohio, Early Vermont, *Bliss Triumph, Early Eureka or Irish Cobbler, and Netted Gem.

Beaverlodge, Alta.—Carmen No. 1, Great Scott, Columbia Russet, Wee MacGregor (Green Mountain), Gold Coin, Early Ohio and Irish Cobbler are among the best-yielding varieties.

Fort Vermilion, Alta.—The varieties that gave the best results are King Edward, Gold Coin and Carmen No. 1.

*Red or pink skin.

IV. British Columbia

Windermere, B.C.—A very extensive variety and strain test of ten of the classified groups of potatoes was conducted. This test also included three of the unclassified groups dealing with the early and late-maturing as well as the blue varieties. Certain strains of the early varieties, Irish Cobbler, Rose and Hebron groups yielded well. Green Mountain and Up-to-Date strains seemed more promising than the Netted Gem types. Ashcroft and Bella Coola Nugget were the best of the Green Mountain types and produced better yields than any of the Up-to-Date group, of which Queensborough was the best. Blue Snyder was the heaviest yielder of the blue varieties.

Agassiz, B.C.—Several varieties of potatoes have been grown at this station since 1890 without deteriorating. The early-maturing varieties seem to be more susceptible to disease than the others. Those affected most severely by blight were Early Ohio, Houlton Rose, Delaware, Columbia Russet, White Ohio, Manistee and Bovee. Those least affected were Jones White, May Queen, Burbank, Epicure, Vick Early and Dalmeny Beauty.

CULTURAL PRACTICES WITH POTATOES

Various methods have been tested, in connection with the production of potatoes, to find which treatments would produce potatoes for early market and also to find what influence these treatments would have on the yield per acre at the normal harvest time.

Disease-free seed production has also been carried on with a view to providing a source of stock seed supply for growers that are interested.

I. Maritime Provinces

Nappan, N.S.—In the date-of-planting test, the Irish Cobbler variety was used. Three plantings were made at intervals of seven days. Over a period of seven years the first or early planting produced the largest yield.

Another test was conducted to find the effect produced by three different treatments of the seed previous to planting: (*a*) seed potatoes exposed to subdued light at a temperature of 40 to 50 degrees F., for four weeks; (*b*) tubers kept dormant all spring in a special cool room; and (*c*) tubers taken from the general bin. Planting was carried out as near as possible to June 13 each year. Digging was done each season as near as possible to September 22. The rows were spaced 33 inches apart. Over a period of eight years, the best yields were produced from the seed tubers kept dormant in a special cool room until planting. Bin-run of seed, kept under conditions quite as good as the former seed, produced a crop slightly inferior in yield. The seed exposed to subdued light gave the lowest yield.

The tuber-unit method of multiplying the best stocks of selected strains of Irish Cobbler potatoes has been used. Five tubers of each unit stock were cut into four sets each and planted in rows 33 inches apart and spaced 16 inches apart in the row. Frequent inspections, with diseased plants rogued out, resulted in a very fine lot of clean seed.

Kentville, N.S.—The experiment, sprouted versus unsprouted seed potatoes, was carried on. Irish Cobbler tubers placed in the greenhouse on April 9 and allowed to sprout in full light were compared with other tubers of the same variety planted in the field on April 9, direct from the cellar. Another lot was planted on April 30. Six diggings were made from each treatment and seven hills were dug each time. The sprouted potatoes gave the greatest number of marketable tubers on July 11 and up to August 14, followed by the planting of April 30. The

total yield of marketable tubers produced from the sprouted seed was 366, weighing 47 pounds 12 ounces. Potatoes planted direct from the cellar on April 9 produced 310 tubers, weighing 54 pounds 8 ounces. Those planted direct from the cellar on April 30 yielded 365 tubers, weighing 58 pounds 8 ounces. Sprouting had a beneficial effect on early yield but the weight was considerably less. The influence of planting at the proper time is shown by the number of tubers and weight.

Fredericton, N.B.—Potato improvement by means of the tuber-index and tuber-unit methods of disease elimination has been carried on. The elimination of mosaic from the strains of experimental station stock has made definite progress.

Breeding new varieties of potatoes with disease-resistance coupled with superior qualities has also been definitely started. With Irish Cobbler, Green Mountain, and three resistant productions of the United States Department of Agriculture, Katahdin, Chippawa and an unnamed seedling S-45075; approximately 1,000 hand pollinations were made, and 900 open pollinated seed balls of Katahdin were collected. Foundation seed production is also being carried on.

II. Quebec and Ontario

La Ferme, P.Q.—The best average date for planting potatoes has been found to be May 29. Earlier planting is not recommended, on account of unfavourable soil temperatures. Sets with two or three eyes have given the best returns.

Irish Cobbler potatoes give the best yield when planted 12 inches apart in the row, while Green Mountain yielded better over a six-year period when planted 14 inches apart in the row.

Seed tubers that had been kept dormant and firm until planting time gave better yields than potatoes that had been allowed to become sprouted.

Ottawa, Ont.—It has been shown that early yield with potatoes can be brought about by sprouting the tubers, either whole or as cut seed, for four weeks in moist river sand in hotbed flats. The sets will be found to be firm at planting time and have well developed sprouts and roots. Hand planting is, however, necessary.

III. Prairie Provinces

Rosthern, Sask.—An eight-year test with different sizes and types of sets produced interesting and valuable information. Medium-sized whole potatoes produced the best yields. Whole, small potatoes produced the next best yields, while seed cut to two or three eyes gave the third best results. On account of the danger of diseases being present in small potatoes they should not be used for planting. Four inches deep is the best depth for planting. Planting potatoes during the last week of May or first two weeks of June has given greater yields than earlier or later planting.

To determine the best date of planting to obtain the greatest yield is an important problem.

Indian Head, Sask.—Three early-maturing varieties were used, Irish Cobbler, Bliss Triumph and Early Ohio. The dates of planting were April 28, May 8, May 18, May 28, and June 8. The May 18 plantings gave the best yields.

IV. British Columbia

Agassiz, B.C.—Different dates of planting seed potatoes showed that seed from the late plantings, on June 2 and June 16, of potatoes of the previous year, produced the best per cent of germination and yield per acre.

Different dates of digging.—This experiment was conducted to find the best time at which to dig potatoes to obtain the best returns from the early crop.

Agassiz, B.C.—The first marketable-sized tubers are formed at approximately the time of full bloom. The amount of bloom is a very good indicator of the time to dig to obtain profitable returns. As a rule the most profitable time to dig early potatoes, as regards yield, is two weeks after full bloom, at which time practically all the flowers have withered.

Coated vs. uncoated seed.—This test is being conducted to find what effect coating the cut surface of seed pieces with land plaster will have on the stand of plants and crop, with seed cut and planted directly after cutting, as against seed held for three to nine days and then planted. Seed cut, coated with land plaster and held for three to nine days prior to planting gave the best per cent of germination, but the best yield of tubers was obtained from the seed cut, coated with land plaster and planted at once. Cut, coated seed should be kept in sacks.

Different sizes of whole sets.—To determine if two, four or six ounce sets will give returns corresponding to the set size.

Agassiz, B.C.—The whole sets were sprouted previous to planting. The six ounce sets, while requiring more seed per acre, yielded better returns both in acre yields and cash returns than the two and four ounce sets, during three years out of a four-year period.

Pumpkin

VARIETIES

There are a great many varieties of pumpkins, each having an important place in vegetable gardening and for canning purposes. The small sugar or pie pumpkins are desirable for piemaking or as baked vegetables, while the larger varieties are used for canning.

I. MARITIME PROVINCES

Kentville, N.S.—The recommended varieties are Connecticut Field and Small Sugar.

II. QUEBEC AND ONTARIO

Kapuskasing, Ont.—King of the Mammoth and Pie or Sweet or Sugar, are two of the best varieties.

III. PRAIRIE PROVINCES

Morden, Man.—For prairie conditions, the variety, Fort Berthold, that was grown by the Indians, has been found to be a very good cropping small fruited variety. Pie and Sugar varieties ranked second, while Connecticut Field is the best of the large fruiting varieties.

Rosthern, Sask.—Of the eight varieties tested, Pie or Sugar pumpkin produced the most fruits. This variety is the best for quality. Connecticut Field and King of the Mammoth are two very satisfactory field varieties.

Indian Head, Sask.—Pie or Sugar is the best quality pumpkin. Etampes produced the biggest yield but is inferior in quality.

Swift Current, Sask.—Mammoth or Jumbo is the best yielding variety, while Sweet or Sugar is considered the best quality variety.

Lacombe, Alta.—The Sweet or Sugar variety, grown from Ottawa grown seed, gave the best yield. Winter Luxury was second in yield. Both are good varieties.

Beaverlodge, Alta.—Sugar pumpkin has given good results but has been exceeded in yield by Connecticut Field.

Fort Vermilion, Alta.—King of the Mammoth, Connecticut Field and Small Sugar all produced some very acceptable fruit.

Radish

Radish being a hardy type of plant, the seed may be sown very early in the spring. The early sowings will escape root-maggot.

VARIETIES

I. Maritime Provinces

Kentville, N.S.—All varieties of radish do well. Sowings made in early May are only slightly injured by root-maggots.

II. Quebec and Ontario

La Ferme, P.Q.—Radish of all varieties do well at this station but the best ones are Saxa for an early variety, and Scarlet Oval and French Breakfast for general use.

Kapuskasing, Ont.—Of the many varieties tested, Long White Icicle is the best.

III. Prairie Provinces

Morden, Man.—The best varieties for this locality are Scarlet Globe and White Icicle. The Icicle variety will withstand the effect of drying winds much better than any other variety.

Rosthern, Sask.—Winter radish do very well. Seed sown on May 19 produced a very fair crop. Long Black Spanish was the best. Owing to dry, hot soil conditions the ordinary varieties do not develop satisfactory roots.

Scott, Sask.—Most of the round varieties do well but Icicle is the most satisfactory owing to its remaining in crisp condition over a long period.

Indian Head, Sask.—Giant Butter, White Icicle and Scarlet Turnip White Tip gave an extended season for radish.

Swift Current, Sask.—White Icicle is recommended on account of its remaining in condition longer than most varieties.

Lacombe, Alta.—The early maturing crimson variety, Saxa, is considered a splendid variety for all purposes.

Beaverlodge, Alta.—Early Scarlet Globe, Saxa, French Breakfast and Icicle are the best varieties.

Fort Vermilion, Alta.—Early Scarlet Globe, Scarlet Turnip White Tip, French Breakfast and White Icicle are very satisfactory varieties.

Rhubarb

That there is a difference in rhubarb varieties can be quite readily discovered if one has the opportunity to compare the old but well-known, green-skinned, large, coarse-leaf-stalked, very sour rhubarb with the varieties of recent origin.

VARIETIES

II. QUEBEC AND ONTARIO

Cap Rouge, P.Q.—St. Martin has been a consistently heavy cropping variety but it is not as high-quality a rhubarb as are Ruby or MacDonald.

III. PRAIRIE PROVINCES

Scott, Sask.—Both Ruby and MacDonald do very well.

Beaverlodge, Alta.—Both Ruby and MacDonald are doing very well.

Fort Vermilion, Alta.—Ruby and Victoria are under test. The Ruby variety is preferred.

CULTURAL PRACTICES WITH RHUBARB

The winter forcing of rhubarb is quite profitable, as a home project, or for commercial marketing. The roots should be dug in the fall and allowed to remain exposed in the open until the earth and roots are frozen through. Bring the frozen mass into a dark cellar where a temperature of 50° to 55° F. can be maintained; place the roots on the floor and place sand, cinders or soil around them to hold moisture; apply water as required to keep the sand or soil moist.

Kentville, N.S.—Roots of various ages were forced, under the bench, in a greenhouse, with the space curtained off to exclude light. Roots brought in on January 12 gave the first pulling on February 13 and continued to produce leaf-stalks until March 24. The age of the roots does not influence the earliness of the crop. The older crowns gave the larger crop.

Rutabaga

The swede turnip is a very good vegetable when the seed is sown during mid-June and grown rapidly to maturity. Quickly grown roots are tender, sweet, and have fine texture.

VARIETIES

III. PRAIRIE PROVINCES

Morden, Man.—Of the many varieties the following have been found to be the best for table use: Canadian Gem, Perfect Model and Masterpiece.

Scott, Sask.—The best variety of purple top swede for growing in this locality is Canadian Gem.

Salsify

This is not a very popular crop but there is always some offered for sale on the large markets. The best roots are produced in very friable loam soils or muck land.

VARIETIES

I. MARITIME PROVINCES

Kentville, N.S.—Salsify does very well but there is no demand for it. The roots are, as a rule, quite prongy.

II. QUEBEC AND ONTARIO

La Ferme, P.Q.—Mammoth Sandwich Island does well.

Kapuskasing, Ont.—Mammoth Sandwich Island has done better than other sorts.

III. PRAIRIE PROVINCES

Beaverlodge, Alta.—Mammoth Sandwich Island outyielded Long Black Scorzonera.

Spinach

During the past few years spinach has become more popular both as a garden and canning crop. It being a cool season crop, early sowings, made as soon as soil and weather conditions will permit, will produce large succulent plants that go to seed slowly. With the rows 15 inches apart and the plants 6 inches apart in the row a large quantity can be harvested. Muck soil grown spinach is as a rule free from grit.

VARIETIES

I. Maritime Provinces

Kentville, N.S.—Several varieties have been under test. Long Standing Bloomsdale, Broad Flanders, Viroflay or Giant Noble, King of Denmark and New Zealand all did well. The latter variety does not bolt to seed but will do well under dry hot-weather conditions.

II. Quebec and Ontario

La Ferme, P.Q.—The best yielding early varieties are Giant Leaved or Viroflay and King of Denmark. New Zealand is an excellent all-season type of greens that is commonly grouped as spinach and produces a very large crop.

Kapuskasing, Ont.—All varieties do well, but the following are the most outstanding: Giant Leaved or Viroflay, Broad Flanders and Bloomsdale.

III. Prairie Provinces

Morden, Man.—The Bloomsdale Long Standing variety has been found to withstand the effect of the drying winds better than the other varieties, remaining in a more attractive condition and not bolting to seed quickly.

Rosthern, Sask.—Bloomsdale, Giant Noble and King of Denmark produced the best returns and remained in marketable condition over a longer period than other varieties. New Zealand remained in good condition throughout the summer, until killing frosts occurred in the autumn.

Indian Head, Sask.—The best varieties are given in order of merit: Bloomsdale, King of Denmark and Princess Juliana. These all did well, and, in addition, the New Zealand spinach yielded well throughout the season until cut down by frost. The latter is recommended for more extensive planting.

Swift Current, Sask.—New Zealand (*Tetra gonia expansa*) is the best to grow, since it thrives under hot conditions. The true spinach bolts to seed rapidly when the soil and season is dry and hot.

Lethbridge, Alta.—Fall-sown spinach is far superior to the spring-sown. The seed should be sown just before the ground freezes in the fall.

Lacombe, Alta.—With growing interest in this crop, such heavy-yielding varieties as Big Crop, King of Denmark and Princess Juliana should be used by gardeners. The old Victoria variety has been found to stand hot weather well. New Zealand is an excellent variety to grow as it thrives under hot conditions.

Beaverlodge, Alta.—Victoria and Viroflay were found to bolt to seed early while New Zealand was found quite satisfactory.

Fort Vermilion, Alta.—Bloomsdale, Victoria and King of Denmark were sown on May 3 and gave good returns.

IV. British Columbia

Agassiz, B.C.—Two varieties, Prickly Seeded and King of Denmark, have been used in a seeding test. The December 31 seeding of Prickly Seeded was ready by May 14. The February 2 seeding was ready for harvest on May 23. Later seedings did not produce satisfactory returns. Mulch paper, put down, did not produce any earlier results than the crop grown without mulch paper, but the mulched crop was just double the yield.

Squash

Squash can be grown either as a field crop or as a companion crop interplanted with corn. Well grown fruits carefully handled and stored in a dry room at a room temperature of 50° to 55° F. will keep throughout the winter.

VARIETIES

I. Maritime Provinces

Charlottetown, P.E.I.—The following varieties of squash have been found most satisfactory: Warted Hubbard, Delicious, Golden Hubbard and White Bush Marrow.

Kentville, N.S.—Those varieties of squash that have been found most satisfactory are Hubbard, Boston Marrow, Golden Hubbard, Table Queen, White Bush Marrow and English Vegetable Marrow.

II. Quebec and Ontario

Kapuskasing, Ont.—English Vegetable Marrow is preferred for earliness, yield and quality. Delicious is one of the best true squash.

III. Prairie Provinces

Morden, Man.—Table Queen or Des Moines, and Buttercup, are two very good squash that do exceedingly well. Early Mandan does well under drought conditions but the quality is not as good as that of the former two varieties.

Delicious, the earliest of the larger-sized squash has deep delicious orange flesh. Hubbard is the best mid-season variety. Winnibago is the best of the large-sized late varieties. Early White Bush vegetable marrow is the best of its type.

Rosthern, Sask.—Boston Marrow produced the largest number of fruits and the greatest total weight, of the fifteen varieties tested. Giant Summer Crookneck, Arikara, English vegetable marrow and Early Mandan all did well. The latter variety matured the largest number of fruits.

Scott, Sask.—The marrow types such as English vegetable marrow and Bush marrow are considered very satisfactory for summer use, while Table Queen and Delicious will be found very satisfactory for winter use.

Indian Head, Sask.—The Navel or Turban squash gave the best yield followed by Green Hubbard and Golden Hubbard.

Swift Current, Sask.—With protection supplied, squash will become established and produce fruit. Golden Hubbard, Table Queen and Bush Marrow are recommended.

Beaverlodge, Alta.—Golden Hubbard and Arikara have been consistently satisfactory, while Long White Bush and English Vegetable Marrow have proved very satisfactory.

Fort Vermilion, Alta.—Golden Hubbard, Cocoselle and Long White Bush marrow did well.

Turnip

The summer varieties of turnip are quite valuable early summer vegetables. The roots are most desirable for table use when they are grown two to three inches in diameter. Large roots are coarse and bitter, as a rule.

VARIETIES

I. MARITIME PROVINCES

Kentville, N.S.—The best time to sow turnip seed is on June 24. Late sowings escape root-maggot. White Milan and Purple Top Strap Leaf are good varieties.

II. QUEBEC AND ONTARIO

Cap Rouge, P.Q.—Turnips of the Early Milan type are very satisfactory and are easily disposed of.

La Ferme, P.Q.—Early White Milan is one of the best of the early varieties.

Kapuskasing, Ont.—Purple Top Milan is considered the best summer table turnip.

III. PRAIRIE PROVINCES

Rosthern, Sask.—The varieties of summer turnips found to have the best quality and yielding ability are Early White Flat Dutch and Early White Milan.

Indian Head, Sask.—Purple Top Milan, Purple Top Strap Leaf and Early Snowball are all good varieties.

Fort Vermilion, Alta.—Four varieties have been grown and all of them found very satisfactory: Early Purple Top Milan, Early Snowball, Golden Ball and Purple Top White Globe.

Tomato

VARIETIES

I. MARITIME PROVINCES

Charlottetown, P.E.I.—Earliness of maturity coupled with yield and good quality are the chief features considered. Abel, Alacrity, Bestal, Herald, Canadian, Viking, Sunnybrook and L.G. x B.B. have all been found very satisfactory.

Kentville, N.S.—During the past three years the following varieties have given best results where ripe fruit is required: Abel, Alacrity and Herald. Bonny Best gives the best yield of green fruit. Pink No. 2 has given the best returns of ripe and green fruit.

Fredericton, N.B.—Earliness is an important feature in varieties of tomatoes for New Brunswick. The recommendations made in 1931 include Abel, Abb 01811, an Ottawa hybrid, Pink No. 2, an Ottawa hybrid, Penn. State Earliana, Bonny Best and Break O'Day as late tomatoes.

II. QUEBEC AND ONTARIO

Cap Rouge, P.Q.—The variety Capeana, an Earliana selection, has been found to produce good crops. Danish Export is a very good cropping variety of the medium-sized fruited kinds. Alacrity is earlier-maturing. Prosperity is a late heavy-cropping variety.

Lennoxville, P.Q.—Of the many varieties tested, Alacrity and Bonny Best have been the most satisfactory.

La Ferme, P.Q.—Those varieties that did best in order of earliness were Alacrity, Earliana, Bonny Best and Herald.

Ottawa, Ont.—The variety test indicates that, for early yield, Abel, Alacrity, Herald and Earliana lead in the production of ripe fruit, followed by Bestal, John Baer, Chalk Early Jewel and Bonny Best.

The varieties originated at the North Dakota Agricultural College, Fargo, N.D., under the names of Progress and Bison, have been found to produce heavy, early crops. These are of the determinate type and are not suited to staking.

Many of the new varieties have been tested, and, while they possess desirable features, are not as early maturing as the above, and cannot be recommended. Break O'Day matures with Bonny Best while Pritchard or Scarlet Topper and Marglobe mature later than Bonny Best. Late tomatoes are unprofitable in this locality.

Kapuskasing, Ont.—Earliness is important if tomatoes are to be grown successfully in this locality. Alacrity, one of the Ottawa originations, has been found to give the best results.

Harrow, Ont.—The Ottawa early-maturing varieties have been found to yield well and lead all early varieties. Abel, in the past three years, has been found to be a leader for early yield. Herald and Alacrity hold second and third places. Penn. State Earliana is a good commercial variety and is used extensively in the locality.

III. Prairie Provinces

Morden, Man.—Of the many varieties tested, Fargo and Red River are the two that continue to be the best early sorts. Heterosis displayed drought-resistance, but produced small fruits. Abel and Bestal are two Ottawa productions that are interesting.

Rosthern, Sask.—Australian Dwarf was found to be very promising. Grand Rapids, Best of All, Paris Market, Langportiana, Open Air, Earliest of All, Essex Wonder and Beauty of Lorain were among the best yielders.

Scott, Sask.—The tomato is difficult to grow during some years, due to heavy winds and cool conditions. The Ottawa variety, Alacrity, has been found very useful, giving some ripe fruit. Bonny Best is recommended for green fruit production. Pruning had a very marked effect on the crop produced.

Indian Head, Sask.—The Ottawa variety, Abel, produced 50 per cent of its ripe fruit in the first two weeks of the season, which makes it very useful for prairie conditions. Beauty of Lorain, however, was the heaviest producer of fruit for the whole season. Blossom-end-rot was present in three varieties, Break O'Day, Pink No. 2, and Golden Queen.

Swift Current, Sask.—The Ottawa varieties, Abel, Pink No. 1 and Alacrity x Bonny Best, produced the first ripe fruits by August 10 and a few days later ripe fruit was obtained from Bonny Best and I.X.L. From the standpoint of quality, Burbank, Earliana, I.X.L., Alacrity, Abel and Wayahead are the best.

Lacombe, Alta.—It has been found that the tomato plants grown from seed produced at Lacombe give better results than plants grown from seed from outside sources. The best varieties are as follows: Earliest of All, Herald, L.G. x B.B., Langportiana, Open Air x Canadian, which were grown from Lacombe grown seed, and the Ottawa varieties, Abel and Bestal.

Beaverlodge, Alta.—In 1931, the Ottawa variety,[1] L.G. x B.B.., led in the production of early fruit, followed by Bonny Best and Earliana. In 1932, the Ottawa varieties were again at the top of the list for early ripe fruit:[2] A. x B.B. (O.5371) and Alacrity, C.E.F. The 1933 crop was harvested green.

Fort Vermilion, Alta.—The Ottawa variety, Alacrity, produced a very fair amount of ripe fruit. Abel was also quite promising.

IV. British Columbia

Agassiz, B.C.—The two most desirable tomatoes for this locality are Abel and the unnamed hybrid,[1] L.G. x B.B. Both of these are Ottawa varieties. Break O'Day does well, and possesses quality, but is no earlier than Bonny Best. Bonny Best is a good variety for stake culture.

CULTURAL PRACTICES WITH TOMATOES

Training tomatoes to single stems, and staking, has been done quite widely and has resulted in the production of very fine early ripe fruit.

I. Maritime Provinces

Kentville, N.S.—Two varieties have been used, Alacrity and Bonny Best. Twenty plants of each variety were employed in each of the following tests. One lot of plants was cut off above the second truss of fruit and a similar lot was cut off above the third and fourth trusses, with a fourth lot allowed to grow full length. For comparison, the same varieties and number of plants were planted and grown on the ground without training, and occupied the same ground space as those trained to stakes. The full-grown, trained plants produced almost twice the yield of those grown on the ground. The more thorough the pruning the greater the yield of ripe fruit in the first two weeks of the tomato season, but the total yield of ripe and green fruit for the season was greatly reduced.

Fredericton, N.B.—The staking of tomatoes, using Break O'Day and Bonny Best, had a definite influence on the production of marketable early fruit.

Tomato plants, grown in pots prior to planting in the field, gave superior plants, and better yields than did plants grown in flats.

II. Quebec and Ontario

Ottawa, Ont.—Staking tomatoes for early yield has shown that profitable returns can be obtained during the first two weeks of the tomato season, but, owing to the cost of extra plants for close planting and the time required for pruning and tying, the latter part of the season's crop will be produced at a loss due to the rapidly falling prices. Ground-grown tomatoes will produce a larger total yield of ripe and green fruit during mid-season and late season.

Kapuskasing, Ont.—Close planting of tomatoes in the row, training the plants to one stem, and stopping the plants above the first truss of fruit, gave the largest yield of ripe fruit. Plants not stopped at all produced the largest yield of green fruit.

III. Prairie Provinces

Morden, Man.—Staked and pruned tomato plants produced the earliest fruit. Plants allowed to grow on the ground, unpruned, produced the largest total yield, most of which was green fruit; but more of the fruit from the untrained plants was marketable.

[1] Livingston Globe x Bonny Best.

[2] Alacrity x Bonny Best.

Sowing tomato seed out-of-doors and thinning the plants to one every three feet in the row has not been a success.

Truss pruning, or removal of the weak terminal flowers from the trusses, leaving six flowers to produce fruit, has resulted in an improved crop.

Rosthern, Sask.—The pruning test showed that plants that were not checked by removing the terminal growth out-yielded those stopped at one truss, two trusses and three trusses.

Beaverlodge, Alta.—Pruning to two stems and allowing two trusses of fruit, produced the largest yields.

IV. British Columbia

Agassiz, B.C.—Pruning the vines to two and three trusses shows that the most satisfactory returns are obtained from three trusses. Pruning to two stems has produced the highest yields in six years out of seven.

Pruning tomato plants to four, six, eight and ten trusses has shown that severe heading-back hastens maturity. Maturity is hastened by allowing plants to develop beyond the point to which they are to be pruned; earliest and highest production is obtained by allowing the plants to develop for twenty-eight days after they have reached the point to which they are to be pruned, and at the end of this time the plants should be cut back to from three to six trusses.

Cutural Practices

Autumn vs. Spring Sowing.—The practice of sowing vegetable seed, in the fall before the freeze-up, was undertaken to find what influence would be exerted on the earliness of growth and stand of plants.

Scott, Sask.—Nine kinds of vegetables were used in the fall and spring-sowing tests, including beet, cabbage, carrot, lettuce, onion, parsnip, radish, turnip and spinach. Those that did well, when sown in the autumn, were carrot, lettuce, parsnip and spinach. Spring-sown seeds of all varieties did much better than the fall-sowings.

Beaverlodge, Alta.—Fall-sowing had no appreciable advantage over spring-sowing. In fact spring-sowing is recommended.

Mulch Paper

The use of mulch paper as a means of hastening the growth of vegetable crops, increasing yields, conserving moisture, reducing cultivation and increasing soil temperature was tested over a period of three years to find if the claims made for this material could be borne out in experimental tests. Two types of Gator-hide, the light and heavy, were tested, as well as the Hallna Fertilized Protective Paper. The mulch paper plots and check plots were in duplicate.

I. Maritime Provinces

Fredericton, N.B.—The test with mulch paper was continued in 1931, but, in view of the fact that in the previous two years' experiments a number of garden vegetables had definitely shown little or no response to the use of mulch paper, the work was confined to only those kinds that showed promise under such treatment. Response was recorded with cucumber, muskmelon, corn, tomato, spinach and lettuce. With the exception of with cucumber this experiment was broadened to include the Hallna Fertilized Protective Paper.

While increased yields were obtained from the above crops, and slightly higher temperatures recorded under the paper during July, the cost of papering land on an acre basis, using fresh paper each year, is rather high. It is felt that mulch paper may have possibilities greater than the experimental tests have shown, particularly with the above special crops.

II. Quebec and Ontario

La Ferme, P.Q.—The tests with mulch paper indicate that, with the heat loving crops, there is some difference in its favour. The cost of mulch paper for an acre, at present prices, makes its use rather expensive.

Ottawa, Ont.—The use of mulch paper was found to be quite costly, when calculated on the acre basis, since new paper had to be purchased each year. Warm season crops did well under this method of growing. The soil temperature was decidedly higher under mulch paper during July and August. There is possibly a place for mulch paper in the home garden or with special crops.

III. Prairie Provinces

Morden, Man.—The response to the use of mulch paper was not at all consistent from year to year. For instance, during moist seasons the differences between the plots were not noticeable enough to be considered significant.

Scott, Sask.—During the three years this experiment was conducted, two seasons were very dry, and no information of value could be obtained. The cost of the paper on an acre basis is quite high.

IV. British Columbia

Summerland, B.C.—The use of three-foot-wide strips of mulch paper, with the plants set through holes cut in the paper, has proved satisfactory with the heat loving plants. Peppers, eggplants and melons have responded to this treatment best.

Sidney, B.C.—A mulch paper called Thermogene has been tested over a period of years and it has been shown that the heat loving plants do well under such treatment. In 1931, a study of the bacterial population of the soil was made. It has been shown that on various culture media the bacterial population under mulch paper is higher than that in the soil in the unmulched or check plots.

Cucumbers produced 2,602 fruits on the mulch paper plot, while the unmulched plots produced 1,527 fruits. Muskmelons produced 505 fruits on the mulch paper plot, while the check or unmulched plot produced 129 fruits. The pepper plant was found to respond favourably to the use of mulch paper.

Powdered clam shell, being white, was spread over the black surface of a portion of a plot in an effort to find what effect a white surface would have on the soil temperature. The powdered shell lowered the temperature below that of the soil under the black surfaced paper.

Black mulch paper was found to increase the soil temperature above that of the unmulched plots.

Plant Breeding

II. Quebec and Ontario

Central Experimental Farm, Ottawa, Ont.—By employing plant breeding in connection with the improvement of vegetable crops, many new varieties, that are decided improvements on the present well-known varieties, have been produced and made available to the public. This work has been done in the Division of Horticulture, Central Experimental Farm, Ottawa. The various productions are mentioned in the following paragraphs.

BEAN

The production of improved varieties of beans that are free from disease, possess quality, and are suitable for canning or garden purposes, is the objective of this undertaking. A number of the late-maturing varieties have been used in combination with the early varieties in an endeavour to obtain the desired improvements.

CABBAGE

It has been found that there is a considerable range of variation in cabbage, particularly in the Golden Acre variety. This variety is in reality a very early selection of the Copenhagen Market, but, while it resembles the latter variety, it is so much earlier that it is deserving of some improvement. Two distinct strains have been isolated. One is a pale-green, high-heading, coarse, but early-maturing type. The second is a low-heading, flatter type, quite dark-green, but early-maturing. This latter strain is finer in texture and possesses much better flavour than the other.

CORN

Dorinny, the new yellow sweet corn that resulted from a cross between Golden Bantam and Pickaninny, has proved to be a very desirable high-quality variety that matures ahead of Golden Bantam.

EGGPLANT

BLACKIE.—For many years growers have been looking for an early-maturing eggplant that would produce a reasonable crop of medium-sized fruits. The well-known small-fruited early varieties produced fruits of inferior size; therefore, to meet this demand, hybridizing was employed and from this resulted the present new variety, Blackie, which matures earlier than Black Beauty.

MUSKMELON

Improvement of muskmelons has been undertaken with a view to producing an early-maturing, high-quality melon with good shipping qualities. This work is progressing well.

TOMATO

ABEL.—In many sections, where the season is too short for such standard varieties as Earliana and Bonny Best to ripen, the need of a suitable variety was realized. To meet this, the two varieties, Alacrity and Earlibell, were crossed, and after many generations had been grown, the segregation now known as Abel was secured, and has proved to be one of the earliest-ripening, medium-sized, red-fruited varieties.

BESTAL.—An effort has been made to combine the round-fruit shape and quality of Bonny Best with the early-ripening qualities of the earliest-maturing varieties. In this regard, Bestal has combined in it these qualities. Reports have shown that this tomato is earlier than Bonny Best and of quite equal quality.

Tomato breeding is being proceeded with in an endeavour to obtain varieties superior to those already secured.

ONIONS

Improved early-maturing varieties of onions are required for the short-season sections of Canada, and, with this in mind, a project of onion breeding was undertaken to develop an early-maturing, high-quality, mild-flavoured, long-keeping onion. Some very promising material has been obtained.

PEAS

Two phases of breeding work have been undertaken that are aiming in two definite directions for the production of improved varieties of garden peas. In the first place, large-seeded, large-podded, medium-height vines coupled with hardiness of plant and high quality of peas, are wanted: In the second place, a small-seeded, prolific-podded, high-quality, wrinkled pea has been sought after.

There has been a number of very promising large-seeded, large-podded segregations obtained that have not been named yet. After these have been tested sufficiently to be sure of their value, the most promising ones will be named and made available for distribution.

TINY.—This small-seeded variety of recent origin was propagated in sufficient quantity to make it available for a canning test. This variety is the smallest-seeded wrinkled variety now available. Preliminary canning tests proved that this variety cans well and possesses quality superior to the imported " number one " or " petit pois " of foreign origin.

IV. BRITISH COLUMBIA

Windermere, B.C.—Pea-breeding for the production of improved varieties suitable for garden and canning purposes has been carried on and has resulted in the production of such varieties as Director, Bruce and Kootenay. These varieties have been found to yield well, and the variety Bruce is finding favour with the canners, due to the splendid quality of the peas as well as to their large size and yield per acre. Many very interesting and valuable segregations that have been originated by crossing at this station are being tested.

TOMATO BREEDING, FOR DUAL PURPOSE TYPES

Summerland, B.C.—The extensive tomato-breeding project undertaken in 1925 has resulted in an early-maturing heavy-yielding strain of Earliana, S-6896, suitable for both canning and the semi-ripe trade. This strain was included in the Verification Test with the Canadian Seed Growers' Association and found to be a very satisfactory strain that ranked high in production. In the Summerland district this strain is very satisfactory.

Other Work With Vegetables

TOMATO POLLINATION STUDIES

Summerland, B.C.—All Earliana tomato plants used were from individual plant selections. Imperfect pollination is evidently responsible for quite a large proportion of rough fruits, but smooth tomatoes were found which had certain locules without seeds. Variation in length of pistil as compared with length of stamens occurs within the Earliana variety. This variation is not constant, but changes rapidly under certain weather conditions, the exact relation of which has yet to be determined. Length of pistil and weather conditions influence pollination and eventually the shape of the fruit by poorly developed locules. Blossoms with an irregular number of stamens, and in fours, also produce irregular fruits. The effect of available plant food on the plant does not seem to be a factor. Further tests are necessary to determine the influence of temperature and nutrition on the development of smooth and rough fruit. The per cent of drop of blossoms was greater with the outdoor varieties than with the greenhouse varieties. Earliana required 47 days from pollination to ripening.

FOUNDATION AND ELITE STOCK SEED

The establishment of Foundation and Elite Stock seed of assigned varieties of vegetable crops has been proceeded with as rapidly as possible to make stock seed available to prospective seed growers in Canada.

II. QUEBEC AND ONTARIO

Central Experimental Farm, Ottawa, Ont.—The following kinds and varieties already have been registered as Elite Stock seed with the Canadian Seed Growers' Association: Lettuce, Grand Rapids; onion, Yellow Globe Danvers and Large Red Wethersfield; pumpkin, Sweet or Sugar; and squash, Golden and Green Hubbard.

The onion stocks have been in the hands of commercial onion-seed growers for two years and have proved very satisfactory.

The following are pure stocks that have not as yet been registered. Peas have been worked with, starting with individual plant selections. Thomas Laxton, Prince of Wales and Onward are the commercial varieties used. All of the pea stocks originating from hybridizing are comparable to Foundation and Elite Stock seed.

Pumpkin and Squash: Both of these crops have been selected and include Sweet or Sugar pumpkin, and Golden Hubbard and Green Hubbard squash.

Vegetable Seed Growing

III. PRAIRIE PROVINCES

Morden, Man.—Foundation Stock and Elite Stock seed of assigned vegetables have been carried on to maintain pure line strains of vegetable seed that may be used for registered seed production. The kinds and varieties are as follows: Beans—Round Pod Kidney Wax, Stringless Green Pod; marrow, White Bush; onion, Early Flat Red; parsnip, Guernsey; peas, Blue Bantam, Horal; radish, Early Scarlet Globe; spinach, King of Denmark; squash, Boston Marrow.

Rosthern, Sask.—Seed of the Green Trailing vegetable marrow was produced that would be classed as Elite Stock seed.

IV. BRITISH COLUMBIA

Windermere, B.C.—The production of Foundation Stock and Elite seed of Lincoln and Telephone peas was undertaken and to date satisfactory stocks have been made available.

Summerland, B.C.—Foundation Stock and Elite seed of the following crops are being produced: Bean, Round Pod Kidney Wax; corn, Golden Bantam; cucumber, Davis Perfect; eggplant, Blackie; onion, Ebenezer and Yellow Globe Danvers; pepper, Harris Earliest; radish, Scarlet Globe.

Agassiz, B.C.—Foundation Stock and Elite seed of Copenhagen Market cabbage, Daisy or Dwarf Telephone pea, Green Trailing vegetable marrow, Masterpiece bean, and New York Lettuce were produced. This work is being carried out in accordance with the regulations of the Canadian Seed Growers' Association.

PURITY OF VARIETY

Central Experimental Farm, Ottawa, Ont.—Varieties of vegetable seeds are tested for the purpose of finding how reliable the vegetable seed brought into Canada, from foreign countries, actually is. The seed samples are collected,

at the various ports of entry, by the seed inspectors, and transferred to the Division of Horticulture, Central Experimental Farm, for a growing test. During the past three years the number of samples has varied. In 1931, 1,010 samples, in 1932, 209 samples and in 1933, 930 samples were collected. This work requires the keeping of very detailed records.

LICENSE OF VARIETY

Central Experimental Farm, Ottawa, Ont.—All varieties claimed to be new, and distinct from the present commercial varieties, have to be tested and carefully checked with the standard varieties, to find if they are different from and equal to or superior to the known varieties of the particular season in which they are claimed to mature. One hundred and sixty-two samples were tested and reported on to the Seed Branch, Dominion Department of Agriculture.

VERIFICATION TEST OF VEGETABLE SEEDS

In co-operation with the Canadian Seed Growers' Association, all samples of vegetable seed that are intended to be registered with the Association as Elite Stock seed have to be tested by actually growing the crops and determining if the stocks are true to variety and type.

II. Quebec and Ontario

Central Experimental Farm, Ottawa, Ont.—During the past three years samples of vegetable seeds have been submitted for verification, or a field growing test. Quite a number of the stocks of Canadian origin have been found very true to type and variety.

IV. British Columbia

Agassiz, B.C.—The tests conducted at the Central Experimental Farm, Ottawa, for the verification of vegetable seed stocks of the Elite Stocks produced in Canada, are carried out at this station in a similar way. This is done in co-operation with the Canadian Seed Growers' Association.

PLANT PROTECTORS

A cheap means of protecting young melon seedlings during the nighttime, and directly after germination, has been tested.

IV. British Columbia

Summerland, B.C.—Brown, waxed Kraft paper three feet wide, used over wire arches placed three feet apart, produced a very satisfactory type of protector. This type of protector allows a better air space for the plants. Strips of paper 50 feet long can be used for these tests. More tests will be necessary before definite recommendations can be made.

"Windolite" was compared with glass for cucumber and cantaloupe growing. Glass was superior.

Hot Kaps are useful for providing needed protection for cantaloupe plants in the early seedling stages.

SOIL TEMPERATURES

IV. British Columbia

Summerland, B.C.—Temperatures at 12, 18, 24 and 36 inches have been taken. At 12 inches in the ground the temperatures are very unreliable as indicators of the time to plant various crops, especially the heat-loving crops

such as cantaloupes, peppers, etc. At 24 inches the daily change is seldom more than one degree Fahrenheit. Temperatures at this depth are a fairly reliable guide. The temperature at 24 inches follows the air temperature by about 24 hours. At 36 inches the "lag" behind air temperature, is about 72 hours. Soil temperatures change very slowly as the distance from the surface increases.

ETHYLENE GAS EXPERIMENTS

A great deal has been said about ripening of tomatoes and peppers and abbreviating the dormant period of potatoes by the use of ethylene gas.

I. MARITIME PROVINCES

Fredericton, N.B.—For the purpose of experimenting with ethylene gas, an air tight chamber, 6 by 8 feet, was constructed with Ten Test insulation. This chamber was fitted with tiers of sliding trays, about 2 feet square. A temperature of 70°F. was maintained by means of an automatically controlled electric apparatus, and the air circulation in the chamber was regulated by means of an electric fan that worked in conjunction with the electric heater. Humidity was maintained by keeping damp sawdust on the floor of the chamber.

In all the experiments a concentration of one part of ethylene gas to 1,000 parts of air was used, with a uniform temperature of 70°F. The chamber was opened once each day and thorough ventilation given and a fresh charge of ethylene gas introduced.

Two varieties of tomatoes were used, Bonny Best and Break O'Day. Staked and unstaked plants were used as well as pot and flat grown plants.

Only sound, well-grown fruits should be used for ethylene ripening. The stage of maturity at which the fruits are picked for artificial ripening will have a very important influence upon the amount of early fruit made available for market. Fully-matured green fruits will ripen best. Great care must be exercised, in choosing the fruit, to get it at the right stage of development so as to get the best product. Good quality was found in the ethylene-ripened fruit. During the latter part of the season ethylene-ripened fruit was superior to naturally ripened fruit. The gas-ripened fruit had a brighter and more attractive colour than the shed-ripened fruit.

Peppers ripened exceptionally well with ethylene gas treatment. Green peppers ripened thoroughly in from four to fourteen days, without withering. The check sample under the ordinary method had only begun to ripen at the end of two weeks and was beginning to wither.

POTATO AWAKENING EXPERIMENT

A study of the effect produced upon potato tubers by ethylene gas at a concentration of one part of gas to 1,000 parts of air was undertaken to find what effect this treatment would have on abbreviating the normal rest period.

I. MARITIME PROVINCES

Fredericton, N.B.—Six lots of Bliss Triumph, consisting of 50 tubers each, were treated as follows: Lot 1 check, lot 2, treated 48 hours; lot 3, treated 96 hours; lot 4, treated 144 hours; lot 5, treated 192 hours; lot 6, treated 255 hours. The first lot was placed in the chamber on August 28, and the other lots at definite intervals. All lots were removed on September 8, and placed. Sprouting was carried out on a greenhouse bench. The check lot sprouted fully as quickly as the lot treated 255 hours with ethylene gas.

FERTILIZER FOR EARLY TOMATOES

Available fertility at the right time and the required amount for proper plant growth is essential to the production of profitable yields of early tomatoes.

II. QUEBEC AND ONTARIO

Harrow, Ont.—Experiments were started in 1931 to study the fertilizer needs of the early tomato. The experiments consisted of six different series of quantitative applications of nitrogen, phosphoric acid and potash, and nitrogen and potash from various sources were used. Only one element at a time was varied in the basal formula so that the effects of each element in the complete fertilizer might be considered. Different rates of application of the basal formula were also compared.

It is shown that where nitrogen has been used in quantities in excess of 30 pounds per acre, lower returns were received. Nitrate of soda, as a single source of nitrogen, gave better results in a three-year test.

Phosphoric acid has had a very definite effect upon the grade and finish of the fruit obtained.

In 1932, the best returns per acre were obtained from the formula 3-12-6, but it seems possible that a greater response to the use of potash would be obtained on less fertile fields. Sulphate of potash gave somewhat higher returns per acre in a three-year average. Three rates of application of the basal formula, 250, 500 and 750 pounds per acre of a 3-12-4 mixture, were used. Between 500 and 750 pounds per acre gave the best results.

NITRATE OF SODA FOR VEGETABLE GROWING

The object of this experiment was to find what effect would be made upon the various vegetable crops when nitrate of soda was applied as side-dressings. It was planned to use 300 pounds per acre. One hundred pounds were applied per acre in each of three applications. Farmyard manure was applied to the whole area at the rate of 15 tons per acre.

II. QUEBEC AND ONTARIO

La Ferme, P.Q.—Nitrate of soda side-dressings were found beneficial with the following vegetables: Beets, cabbage, carrot, cauliflower, parsnip, peas and Swiss chard. Beans and potatoes did better where only manure had been used.

Kapuskasing, Ont.—Nitrate of soda, at the rate of 300 pounds per acre, as three side-dressings of 100 pounds each per acre, was found to give significant results with beet, cabbage, carrot, cauliflower, kohl rabi, lettuce, parsnip, salsify and garden turnip.

PHOSPHATIC FERTILIZERS FOR VEGETABLES

The value of phosphoric acid in connection with vegetable crop production has not been fully realized by the growers.

III. PRAIRIE PROVINCES

Scott, Sask.—During the past three years, ammonium phosphate has been applied to the land in a portion of the vegetable area. Beet and carrot responded to the extent of a 40 per cent, parsnip a 25 per cent and onion a 15 per cent increase in yield over the check plots. Best results were obtained when the fertilizer was applied in a band along each side of the seed rows, but not in contact with the seed. For beans and peas, the results seemed better when the fertilizer was placed close to the seed.

IV. British Columbia

Summerland, B.C.—The same plots were used for four years in succession with the same fertilizer treatments. The soil is light sandy loam overlying sand or gravel. Barnyard manure gave good results. Commercial fertilizer alone did not give high yields where the humus was depleted. A vetch crop restored the humus. A complete fertilizer with barnyard manure gave increased yields but delayed maturity. Superphosphate, when applied alone, brought about earlier ripening. Muriate of potash alone gave larger total yields and later maturity.

POTATO—FERTILIZER TEST

To determine the value of commercial fertilizer in connection with potato production:—

IV. British Columbia

Agassiz, B.C.—Two fertilizer mixtures were tested, a 4-10-6 and a 4-10-10, each applied at 750 and 1,500 pounds per acre immediately after the potatoes had been planted.

Any one of the fertilizer plots outyielded the check plots by nearly 50 per cent or more. The 4-10-6 formula, at a smaller cost, gave a higher yield than the 4-10-10. Applications of 750 pounds per acre gave more economical returns than 1,500 pounds per acre, in the ratio of six to four.

SOAKING TEST WITH VEGETABLE SEEDS

This test is being conducted to find if soaking seed for one, two or three days prior to sowing, would have a beneficial or detrimental effect upon the germination of the seeds.

III. Prairie Provinces

Beaverlodge, Alta.—One and two-day-soaking did not impair the germination. The three-day-soaking was found injurious in some cases.

THE FARMER'S VEGETABLE GARDEN

Swift Current, Sask.—To demonstrate the growing of staple and other vegetable crops for the farm home use, a garden has been laid out and operated in a two-year rotation. The vegetables are always grown on summer-fallow to take advantage of available moisture and freedom from weeds. Manure is applied in the autumn after the vegetables have been harvested and in the following season the land is treated as summer-fallow. The area occupied consists of sixteen rows 200 feet long with the rows 3 feet apart except in the case of the vine crops that are spaced 6 feet apart. This allows horse cultivation to be done. The cost of such a garden is estimated at $25.84. The yield of vegetables amounted to 1,364 pounds and, at 0·02 cent a pound, the total value amounted to $27.24. From the food value standpoint these vegetables are worth considerably more than the money value stated.

WINDOWLITE VS. GLASS

III. Prairie Provinces

Morden, Man.—Muskmelons and cucumbers were grown under windolite and glass-glazed sash. It was found that there was not difference enough between the results obtained with windolite and glass to warrant the cost of changing from glass. The actual weight of the crop from under glass was more than that of the crop harvested from under windolite.

ORNAMENTAL GARDENING

Annual Flowers

A large number of annual flowers are grown at the experimental farms and stations each year and demonstrate to the visitors how much beauty can be added to the home grounds with a limited amount of care and expense. Notes are taken of the blooming dates, hardiness and desirability of the different varieties grown.

I. Maritime Provinces

Charlottetown.—This station is carrying on extensive tests of sweet pea varieties and careful notes are kept of height of plant, strength of stem, foliage, number of blooms on stem, strength of flower stem and size and colour of flower. The following are listed as the best: All Bright, Ascot, Avalanche, Boy Blue, Beatall, Crimson King, Damask Rose, Gleneagles, Huntsman, Laddie, 2 L.O., Magnet, Matchless, Mrs. A. Searles, Olympia, Pinkie, Ruffled Rose, Ruffled Orchid, Reflection, Sunkist, Satin Mauve, Sybil Henshaw, The Fawn, The Sultan, Brilliant Rose, Capt. Blood, Chieftain, Flamingo, Fire, Idyl, Model and Supreme.

II. Ontario and Quebec

Cap Rouge.—Hundreds of varieties of annuals have been under test at this station since 1911 and the following are recommended: *Ageratum* as a border plant; snapdragon, aster, ten week stocks, mignonette, cornflower, *Didiscus*, larkspur and poppy for long stemmed flowers; African Golden daisy, *Petunia* and nasturtium for garden display, balsam, cosmos, *Kochia* and *Zinnia* for bedding; *Nicotiana* for fragrance; *Helichrysum, Helipterum* and *Limonium* (*Statice*) for winter bouquets.

Some 250 varieties of sweet peas have been tested since 1911. The six that are recommended are: King White, Matchless, cream; Daisy Bird, light pink; Sapphire, blue; Royal Scot, light red; Fordhook Orange, orange.

Kapuskasing.—Many varieties of annual flowers were tested and bloomed profusely. The following are recommended: *Ageratum, Antirrhinum,* aster, balsam, carnation, *Chrysanthemum,* cosmos, *Dimorphotheca, Helichrysum,* marigold, *Nemesia, Nicotiana, Petunia, Phlox Drummondii,* stocks ten weeks, *Verbena* and *Zinnia.* The best for outdoor sowing are: *Alyssum, Calendula,* candytuft, *Clarkia, Coreopsis, Eschscholtzia,* larkspur, mignonette, nasturtium, *Portulaca,* poppy, sweet sultan, *Tagetes,* Virginian stock and sweet peas.

Harrow.—A large number of hardy and half hardy annuals have been tested during the past two seasons. Many of them will not stand the continued heat in this section.

The following appear to withstand the hot weather better than the others: *Petunia, Zinnia,* cosmos, *Ricinus, Alyssum, Browallia, Nicotiana* and *Statice. Gypsophila* does well but is short lived.

III. Prairie Provinces

Morden.—The past few seasons have not been at all favourable for annual flowers. Many varieties have been tested and the following were the most outstanding: *Zinnia,* Fireball; *Dianthus chinensis; Chrysanthemum Nivelli; Antirrhinum,* Orange King; Sweet Wivelsfield; cornflower; *Rudbeckia,* Golden Sunset; *Antirrhinum,* Cherry Rose; *Lavatera; Gaillardia; Antirrhinum,* Victory; and *Asclepias cuirassavica.*

The *Antirrhinums* are specially noted for their uniformity of type.

Indian Head.—The seasons have been rather adverse for annual flowers; seed sown out-of-doors often germinates poorly because of drought and the presence of a super-abundance of flea beetles which destroy the little seedlings as they emerge. The hardy annuals that have done well under these conditions are: *Calendula, Centaurea, Dimorphotheca, Eschscholtzia, Gaillardia, Godetia, Gilia capitata, Gypsophila, Lavatera, Linum rubrum,* mignonette, *Mirabilis, Nemophila, Nigella* var. Miss Jekyll, *Phacelia, Saponaria, Scabiosa* and sweet pea.

The following half hardy varieties started in the greenhouse and planted out about the middle of June gave a good display: *Antirrhinum, Ageratum, Arctotis grandis, Celosia, Chrysanthemum, Linaria,* marigold, *Lobelia, Matricaria, Nemesia,* pansy, *Petunia, Phlox Drummondii, Salpiglossis,* stocks, *Verbena* and *Zinnia,* many carrying blooms after the first frosts had been experienced.

The annual climbers were tried on a trellis, and the best results were obtained from *Convolvulus major* and *Cobaea scandens.* Kenilworth ivy did well and is a good subject for the rockery and window box. Climbing nasturtiums, Kudzu vine and Cardinal climber did not flourish.

Sweet peas sown in April on fall trenched ground were slow in coming into growth owing to weather conditions. The varieties which bloomed profusely are: Olympia, Gleneagles, Mrs. Tom Jones, Crimson King, Matchless, Pinkie, Charming, Ruffled Rose and Avalanche. The variety Cupid growing about six inches high is very useful for edgings or window boxes.

Swift Current.—Results obtained with annual flowers during the past three years would indicate that those started in the greenhouse and planted out in June gave better results than when the seed was sown directly outside and thinned.

Varieties that made the best showing were: stocks, *Antirrhinum, Portulaca, Alyssum, Nicotiana, Petunia, Phlox Drummondii* and *Verbena.*

Sixty-one varieties of sweet peas were grown, the following varieties being recommended: Olympia, Ascot, Helio, Boy Blue, Warrior, Chieftain, Ruffled Beauty, Fluffy Ruffles and Brilliant Rose.

Lacombe.—The following hardy annuals have proved their worth under Lacombe conditions: *Calendula,* mignonette, *Linaria, Gypsophila, Chrysanthemum tricolor,* candytuft, cornflower, and *Dimorphotheca.* Among the half hardy kinds planted out just before the June rains the following were the best: aster, Snow Queen; stocks perpetual and ten weeks; *Nemesia; Salpiglossis; Antirrhinum* and *Linaria.*

As a result of the last few years' work, the following are recommended for the annual flower border. Low growing for front of border: *Asperula azurea setosa, Linaria,* mignonette, *Anthemis arabica,* candytuft, nasturtium, *Eschscholtzia, Portulaca* and Swan River daisy. Tall growing for background: *Bartonia aurea, Clarkia, Gypsophila, Coreopsis, Calendula,* cornflower, larkspur, *Lavatera, Chrysanthemum,* poppy, *Scabiosa* and sweet pea. Sweet peas do well if sown in prepared soil deeply trenched and enriched with well rotted manure the previous fall. The seed is sown as soon as the ground can be worked in the spring and the plants should be well watered in dry weather.

Beaverlodge.—Variety experiments with annual flowers have been continued as usual at this station and while not being a thorough success during the past three years, many kinds have done well, particularly *Linaria, Clarkia, Phacelia campanularia,* candytuft, larkspur, mignonette, sweet sultan, *Nigella, Calendula, Kochia, Dimorphotheca,* poppy, *Chrysanthemum* mixed, cornflower, *Viscaria* and *Bartonia aurea.*

Fort Vermilion.—Annual flowers started in hotbeds and planted out in June at this station will usually bloom profusely from July until cut down by frost.

The following are some of the best: aster, *Antirrhinum,* cosmos, *Phlox,* stocks, candytuft, *Calendula* and sweet pea.

IV. British Columbia

Windermere.—The following annuals do exceptionally well here: *Ageratum, Nemesia,* African and French marigold, *Salpiglossis, Alyssum* var. Little Dorrit, *Lobelia, Petunia, Godetia, Cacalia coccinea, Zinnia, Antirrhinum* and aster. The latter show little sign of virus disease and produce thousands of very fine blooms. Among the best varieties are: American Beauty, Black Prince, Scarlet King, Amethyst, Sutton's Bedding, Sutton's Victoria and Sutton's Pompon.

Greenhouse Flowers

Ottawa.—The greenhouses were used mainly to continue experiments started in previous years including breeding of new chrysanthemums, test of varieties of sweet peas, *Antirrhinums,* geraniums, *Schizanthus* and *Cineraria.*

From the records taken, the following are the best sweet peas in each colour section. The figure after the name represents the average number of blooms per plant during the whole season.

Deep pink: Rose Queen Improved	64
Cream pink: Spring Song	57
Salmon pink: Mrs. Calvin Coolidge	45
Salmon cerise: Cheerful	39
Orange: Orange King Improved	50
Rose: Of the two varieties in this section, Penrose gave more bloom during the first four weeks, but during the whole cutting season, Chevalier was more productive	34 40
Cerise: Of the two varieties in this section, Fire King gave more bloom during the first four weeks, but during the whole season, Illumination was more productive	39 41
Orange scarlet: Grenadier	52
Crimson: Early King	48
Blue: Mrs. Warren G. Harding, the earliest of all	56
Lavender: Lavender King	53

In the following sections there was only one variety tested:—

White: Snowstorm Improved—particularly free flowering early in the season	65
Salmon: Mrs. Kerr	14
Mauve: Mauve Beauty	33
Purple: Glorious	44
Dark Blue: Blue Jacket	57
Primrose: Jean Burpee	29
Bicolor: Gilda Gray	75
Maroon: Maroon Prince	44

New varieties of chrysanthemums originated at the Central Experimental Farm: Seed was saved from open pollinated flowers of a number of good varieties and 2,200 plants were grown. Of these, 298 were marked for further testing and the following were named:—

Constance McKee, seedling of Phillip Ricci; flower large semi-double, dull vermilion orange, attractive.

Dorothy Craig, seedling of Ethel M. Johnston; flower large, single, light lilac, white at base of petals; a fine variety.

Mrs. F. C. Elford, seedling of Susan Liesching; flower large, single, pale lilac pink; one of the best of this year's seedlings.

Grace Marshall, seedling of E. S. Archibald; flower single, pale sulphur yellow; a good yellow.

Isabella Preston, seedling of Chestnut; flower single, coppery old rose, sulphur yellow at base of petals, attractive.

Katharine McElroy, seedling of Portia; flower large, single, violet rose; a good seedling of 1930.

Lillian Cummings, seedling of E. S. Archibald; flower single, bronzy old rose suffused with yellow with large primrose yellow centre; a striking variety.

Mary McKee, seedling of Ethel M. Johnson; flower single, dull buff, vermilion orange; a striking variety.

Norah Wilson, seedling of Ethel M. Johnston; flower large, single, morocco red; a striking variety.

Dorothy Johnston, seedling of Ivy Chamberlain; large single, deep dull carmine lake, yellow anthers.

Caroline Grisdale, seedling of Ethel M. Johnson; white, single or semi-double, some petals quilled, yellow anthers and good substance.

Patricia Macoun, seedling of Puritan; anemone flowered, large anemone centre, sulphur yellow, outer petals pale pink.

E. S. Archibald (2), seedling of Mrs. W. E. Chipman; single deep ochre red, distinct and effective yellow base to petals, giving the effect of a ring of yellow at base.

Herbaceous Perennials

A collection of perennials is grown at all the experimental stations and variety tests of irises and peonies are carried on at several of them. The reports made during the years 1931 to 1933 are given here.

I. Maritime Provinces

Nappan.—The following list will be found very satisfactory for this district: *Iris, Phlox, Campanula, Hemerocallis,* Sweet William, *Thermopsis,* peonies and hollyhocks.

Kentville.—The following herbaceous perennials have done well at this station and do not require any winter protection: *Aquilegia, Aubretia, Vinca, Primula, Iris, Dicentra, Papaver, Erigeron, Hesperis, Thermopsis, Cerastium, Paeonia, Lupinus, Chrysanthemum, Dianthus, Helenium, Dictamnus, Polemonium, Gaillardia, Digitalis, Campanula, Heliopsis, Achillea, Althea, Lychnis, Hosta (Funkia), Coreopsis, Filipendula, Helianthus, Rudbeckia, Platycodon, Gypsophila, Phlox, Hibiscus, Aster,* and *Boltonia.*

II. Quebec and Ontario

Cap Rouge.—The following perennials should give bloom from April to November: *Crocus,* pansy, *Narcissus,* tulip, *Iris, Paeonia, Delphinium, Digitalis,* hollyhock, *Phlox* and *Aster.*

Kapuskasing.—Uniform test plots of various kinds of perennial flowers are still being carried on and the following sorts are still proving hardy at this station: *Anemone, Aquilegia, Campanula, Chrysanthemum, Coreopsis, Delphinium, Dianthus, Iris, Gaillardia, Papaver, Paeonia, Platycodon, Rudbeckia* and *Spiraea.* Most of these bloom profusely all summer.

III. Prairie Provinces

The seasons of 1931 to 1933 were extremely difficult in the Prairie Provinces and plants suffered severely from drought and insect pests.

Morden.—Perennial flowers suffered severely from drought during the seasons of 1931 to 1933. The following appeared to be the best under these conditions: *Veronica incana, Agrostemma coronaria, Stachys lanata. Verbascum,* Harkness varieties are especially drought resistant.

Peonies planted out of reach of the flood water blossomed well. Some of the best varieties that came under notice are: Brand's Magnificent, Sister Annie, Phoebe Carey, Archie Brand, Moses Hull, Ella Wheeler Wilcox, Faribault, Mrs. A. G. Ruggles, Desire, Henry Avery, Helen Wolaver, Winnifred Domme, Grover Cleveland, Jeanne Gaudichau, Splendida and Marie Stuart.

Indian Head.—Testing the hardiness and suitability of herbaceous perennial flowers for this part of Saskatchewan has been carried on during the past few years and from observations made from time to time the following are recommended: *Aconitum, Chrysanthemum Leucanthemum, Pyrethrum, Anthemis Kelwayi, Iberis sempervirens, Pentstemon grandiflorus* and coral gem, *Dianthus deltoides, Viola, Linaria macedonica, Veronica spicata, Dictamnus albus, Gaillardia, Clematis recta, C. integrifolia, Linum perenne, Aquilegia, Helenium autumnale, Saponaria ocymoides, Platycodon Mariesi* and *Myosotis.*

Iris.—Ambassadeur, Camelot, Celeste, Dream, Deuil de Valerie Mayet, Lohengrin, Mme. Chereau, Mrs. H. Darwin, Monsignor, Opera, Perfection, Prosper Laugier, Parc de Neuilly, Rodney, Rose Unique and Sweet Lavender.

Swift Current.—Borders of herbaceous perennials are recommended for western prairie gardens and particularly for the farm home.

Once hardy varieties have become established very little time or labour is required to obtain good results.

The following is a list of perennials which winter well at this station: *Gypsophila paniculata, Delphinium,* Tall Blue, and *chinensis, Lychnis chalcedonica, Aquilegia, Cerastium tomentosum,* pinks, *Achillea,* The Pearl, *Pentstemon glaber, Linum sibiricum, Eryngium alpinum, Paeonia* mixed, *Tanacetum vulgare, Hemerocallis, Sedum kamtschaticum, Chrysanthemum Leucanthemum, Aster amellus, Linaria macedonica, Phalaris arundinacea, Tunica Saxifraga,* and *Lilium tigrinum.*

Lacombe.—From results obtained over a period of years of testing at this station, the following perennials have wintered well most years: *Aquilegia, Aconitum Napellus, Anchusa, Arabis alpina, Delphinium, Dianthus, Dicentra spectabilis, Eryngium planum, Gaillardia, Gypsophila paniculata, Helianthus multiflorus, Hemerocallis, Iris, Lilium tigrinum, Lychnis chalcedonica, Paeonia, Papaver nudicaule, Phlox paniculata, Rudbeckia, Thalictrum adiantifolium* and *Veronica spicata.*

Beaverlodge.—Among the perennials which are recommended for this district are Iceland poppy, columbine, *Iris, Paeonia, Dianthus, Pyrethrum, Lavatera, Hesperis matronalis, Delphinium* and *Phlox.*

Rosthern.—The perennial flowers came through the winter in good condition and made a fine display from the latter part of May until late fall frosts. Those considered most desirable for northern conditions are listed in the 1930 annual report of this station.

IV. British Columbia

Summerland.—Special attention has been devoted to variety trials of *Iris, Gladiolus, Lilium, Chrysanthemum* and *Aster,* all of which thrive exceptionally well under Okanagan conditions.

Some of the best are: *Iris*—Souvenir de Mme. Gaudichau, Lent A. Williamson, Ambassadeur, Edouard Michel, Lord of June, Coquette, Seminole, Dominion, Argynnis and Lord Lambourne; hardy chrysanthemums—Sanctity, Carrie, Goacher's Crimson, Buttercup Bronze, Mrs. McFayden and Horace Martin; asters —Amellus varieties, King George, Rudolphe Goethe and General Pershing and *Aster Frikartii.*

Spring Flowering Bulbs

A number of spring flowering bulbs are grown at the different stations and collections of tulips have been grown for a number of years. They seem to do well all over Canada.

I. Quebec and Ontario

Cap Rouge.—An experiment conducted during five years has shown that the *Narcissus* can be grown profitably for commerce. The doubles have practically no value. Of the single large trumpets, the following are the best: Emperor yellow and Victoria bicolor.

II. Prairie Provinces

Indian Head.—The early tulips were not satisfactory owing to weather conditions. The Darwins, which bloom much later, did better. Prince of Wales, Margaret, City of Haarlem, Madame Krelage and Farncombe Sanders were some of the best.

Swift Current.—Experiments with tulips treated as annuals and perennials are being conducted at this station.

Among the best treated as annuals are: Pride of Haarlem, Madame Krelage, Dream, Farncombe Sanders, La Candeur, Bartigon, King Harold, Suzon, Golden Crown and Picotee.

The following treated as perennials were outstanding: Pride of Haarlem, Madame Krelage, Europe, Baronne de la Tonnaye, Dream, Bartigon, Yellow Prince and Cottage Maid.

The *Narcissus* is also proving suitable for prairie gardens. Emperor and Golden Spur do particularly well.

Dahlia

Beaverlodge.—Dahlias were more satisfactory than usual, probably due to the fact that the tubers were sprouted before planting. The bedding variety, Coltness Gem, gives a much longer season of bloom than the larger flowering kinds. Hybrids from this variety are very strongly recommended.

Gladiolus

Kentville.—In recent years the gladiolus has justly become very popular throughout this district. The best ten large varieties are as follows: Prince of Wales, Red Emperor, E. J. Shaylor, Purple Glory, Rose Ash, Crimson Glow, Golden Measure, Schwaben, American Beauty, Anna Eberius.

The best ten primulinus varieties are: Maiden's Blush, White Butterfly, Rose Luisante, Eula Terry, Scarlano, Orange Queen, Lilywhite, Alice Tiplady, Salmon Beauty and Herada.

Indian Head.—The gladiolus is one type of flower which is receiving much attention and becoming more popular in the Prairie Provinces. From the large numbers of varieties tested at this station, the following are a few of the best: Dr. Van Fleet, Break-O-Day, Phaenomen, Emile Aubrun, Pfitzer's Triumph, Marmora, Crimson Ruffles, Dr. F. E. Bennett, Scarlano, Mrs. Van Kenyenburg and Dr. Moody.

A small project was conducted to ascertain what effects, if any, were to be obtained by sprouting the corms before planting. Several varieties were tried

and it was found that the sprouted corms came into bloom a week or ten days earlier than the unsprouted, with no apparent difference in the quality of the flowers. This would indicate that by sprouting late flowering varieties they could be brought into bloom before severe frost.

Summerland.—All varieties of gladiolus thrive under Okanagan conditions and extensive trials are carried out at this station. The following are a few of the best: Picardy, Emile Aubrun, Gloriana, Coryphee, Golden Dream, Minuet, Veilchenblau, Pfitzer's Triumph and La Paloma.

Lilium

Ottawa.—The collection of *Lilium* at the Central Experimental Farm is being increased as rapidly as possible and it is hoped that in time all species that will grow in the district will be found here. Nearly eighty species have been tried with varying success. The following fourteen are recommended for general garden conditions: *Lilium amabile, L. candidum, L. concolor, L. croceum* and hybrids, *L. Davidi, L. dauricum, L. elegans, L. Hansonii, L. Henryi, L. Martagon, L. regale, L. superbum, L. tenuifolium, L. tigrinum* and *L. Willmottiae.*

A large number of lilium crosses and seedlings of crosses have been grown and some new forms have been segregated and are being grown for further test.

Morden.—During the past three seasons experiments have been carried on with *Lilium* with the object of determining the hardiness and suitability of the regale and other varieties at this station. While nothing definite can be said, yet, the following grew well and had considerable blooms: *L. sulphurgale, L. Sargentiae* x *L. regale, L. cernuum, L. Hansonii, L. Henryi, L. tenuifolium, L. Leichtlinii* var., *Maximowiczii, L. amabile, L. Martagon,* and *L.* x *davmottiae.* The last named had three stems with over fifty blooms on two of them.

Indian Head.—After several seasons of trial, several species of *Lilium* appear to be becoming acclimatized. The following arranged in order of blooming have done well: *L. monadelphum, L. tenuifolium, L. philadelphicum, L. Thunbergianum* var. *alutaceum, L. dauricum, L. concolor, L. elegans, L. regale, L. Willmottiae, L. cernuum, L.* x *maxwill, L. Leichtlinii* var. *Maximowiczii* and *L. tigrinum.* It is interesting to note that in 1933, *L. regale* still survives without any protective covering and, although replanted early in May, it came into bloom about the middle of July.

Swift Current.—*L. tenuifolium* and *L. tigrinum* are grown successfully at this station and are mulched with six inches of straw or hay during the winter.

Lacombe.—*L. tigrinum* is proving very hardy at this station.

Beaverlodge.—The following lilies are doing well at this station: *L. croceum, L. canadense, L. Willmottiae, L.* x *umbellatum, L. concolor, L. tigrinum* and *L. tenuifolium.*

Fort Vermilion.—*L. tigrinum* is recommended for this district.

Summerland.—The following lilies have proved hardy at this station: *L. regale, L. Davidi, L. Henryi, L. Willmottiae, L. tenuifolium, L. concolor* and *L.* x *umbellatum.*

Roses

Fredericton.—Methods of wintering roses—Two methods of wintering were used in this experiment, namely, outdoor wintering or mounding, and trenching. In trenching, the bush is taken up in the fall, after the wood has ripened, and buried in a trench about two feet deep in a sandy well-drained soil. In outdoor wintering, the bush is left in its permanent location and the soil is mounded up around it to a height of eight or twelve inches.

Through several years of experimenting the outdoor wintering method has shown to advantage, mortality being considerably lower, than with the trenching method and subsequent blooming throughout the whole course of the experiment has been much earlier and more profuse.

Ottawa.—Methods of protecting roses for winter—twelve varieties of bush roses were used in this experiment and four methods of covering employed. None was very satisfactory.

AVERAGE HARDINESS OF ROSES UNDER DIFFERENT METHODS OF WINTERING—PERFECTLY HARDY: 10.

Variety	Laid down, covered with soil	Laid down, covered with leaves	Laid down, covered with long manure	Left upright and banked with soil
Lady Pirrie	4·89	3·16	3·60	2·88
Lady Ashtown	6·62	7·50	4·66	3·75
Souvenir de Claudius Pernet	4·12	5·58	3·73	3·58
General MacArthur	1·28	4·44	2·83	2·72
Mme. Edouard Herriot	1·66	5·42	3·27	2·50
Mme. Caroline Testout	2·30	2·91	2·50	1·52
General Jacqueminot	4·69	7·00	7·00	3·38
Frau Karl Druschki	4·91	5·66	3·83	2·61
Mrs. John Laing	5·33	7·33	6·50	3·95
Ulrich Brunner	5·66	6·27	3·55	4·19
Hugh Dickson	6·50	6·39	5·00	2·61
Gruss an Teplitz*	.....	6·27	3·22	2·73
	4·36	5·66	4·14	3·03

*Gruss an Teplitz:—Laid down and covered with an inverted V-shaped trough, covered with dry straw and left open at both ends—7·94.

From these records it would seem that the inverted V-shaped trough is the best method tried, and that laying down and covering with leaves is the second best.

Morden.—During the past three years, experiments were carried on in budding roses on the thorny multiflora rose. The method consists of selecting long shoots of the current year's growth and inserting the buds of the desired variety at such distances apart as to allow two or three nodes on the intervals between the buds. The swelling takes place rapidly and the branch can be cut off in about three weeks' time. The cuttings are easily rooted but no satisfactory method of keeping them over the winter has been found.

Rose breeding has been carried on extensively at this station for five years. The main object is to breed new varieties, with superior blooms, that will be hardy enough to withstand the prairie winter. Crosses between hardy species and Hybrid Perpetuals or Hybrid Teas show a great dominance of the factor of tenderness. Incompatibility of species and varieties and the paucity of seeds secured from crosses make it impossible to obtain a large population from which to make selections.

Of the seedlings that have flowered, the following are considered worthy of special attention, either because of the evidence of inherited characters, or because of their intrinsic merit individually. The name of the seed parent is placed first:—

1.24.34 Ross x Tausendschon
H1.10 Ross x Schneezwerg
1.54.37 Schneezwerg x Ross
1.48.3 Schneezwerg x Capt. Hayward
1.37.1 Ross x Dr. W. van Fleet
J.32.4 Ross x Excelsa
G.14.4 Sunburst x Rev. F. Page Roberts
H.93.1 Mme. Edouard Herriot x Türkes Sämling
H.85.5 Ophelia x Türkes Sämling.

Indian Head.—Some crosses were made on the Ross rose, using pollen of hardy rugosa varieties. Many hips were harvested and the seed was sown and the seedlings made good growth the following years.

The characteristics of the Ross rose appeared to be dominant in all seedlings in which it was one of the parents. The breeding work is being continued.

Beaverlodge.—Variety and hardiness experiments with roses have been continued at this station during the past three seasons.

The following are proving useful for this district: *Rosa spinosissima*, Betty Bland, Agnes, Hansa and many of the Hybrid Perpetuals. Also the following climbers: Dorothy Perkins, Crimson Rambler and Dr. van Fleet.

Roses are protected during the winter by mounding soil around the bush to the depth of several inches. If the bush is rather big the longer branches are bent down and the walls of a box help confine the soil. The box should be covered and surrounded with some litter to catch and hold the snow.

Most of the roses did well but several showed more winter-killing than usual. Particular mention is made of Harison's Yellow which had not been injured before. Hansa is considered one of the best varieties at this station.

Trees and Shrubs

Nappan.—Most of the ornamental trees planted at this Experimental Farm came through the winter in good condition and have made good growth since the date of planting. The following are a few of the leading ornamental trees grown: Sugar, Norway and Schwedler's maples; American elm; English, Scarlet and Japanese oaks; linden; white ash; walnut; Douglas, Norway, Black and Rocky Mountain spruce, and Swiss Stone pine.

Charlottetown.—During the last twenty-two years a large number of trees, shrubs and woody climbers have been tested at Charlottetown. From the information obtained, it is now possible to make recommendations as to the suitability of the majority of these.

Deciduous Trees

Acer platanoides Schwedleri (Schwedler's maple) has purplish foliage in spring. It is slightly tender in Prince Edward Island and should be grown in a sheltered position.

Acer saccharum (Sugar maple), one of the best trees for street or large lawn.

Betula alba laciniata (cut leaf weeping birch), hardy and effective.

Betula populifolia (white birch), one of the best native trees.

Catalpa, the two species tested proved to be unsuited to the province.

Cladrastis amurensis (yellow wood), undesirable.

Crataegus oxyacanthus, Paul's double scarlet thorn does exceptionally well at Charlottetown.

Fraxinus pennsylvanica lanceolata (green ash) is not of much value for planting.

Prunus Grayana maxima is hardy and ornamental but suckers badly.

Syringa japonica (Japanese tree lilac) is a very satisfactory small tree.

Ulmus americana (American elm) is one of the very best large ornamental trees. They should be planted 60 feet apart.

Tilia americana (American linden) and

Tilia europaea (European linden) are both excellent long-lived and clean shade trees for streets and large grounds.

Quercus rubra (red oak) is one the best large ornamental trees.

Ornamental Evergreen Trees and Shrubs

Abies concolor (white or silver fir) is the most satisfactory *Abies* tested at Charlottetown.

Juniperus communis var. *suecica* (Swedish juniper) is quite hardy, apparently.

Picea Abies (excelsa) (Norway spruce).—The Norway spruce and its varieties have not proved entirely satisfactory. They are not so ornamental as our common white spruce.

Picea pungens (Colorada spruce). This species is quite hardy and attractive. The variety *Kosteriana* is one of the best.

Picea Engelmanni (Engelmann's spruce) is not so ornamental as *P. pungens* var. *Kosteriana*.

Pinus Cembra (Swiss stone pine) is one of the most desirable evergreens. It is ideal for locations where a tree with a slow growing evergreen pyramidal habit is required.

Pinus montana (Swiss mountain pine) has not done well.

Pinus nigra var. *austriaca* (Austrian pine) is the best tall-growing pine tested at Charlottetown and can be highly recommended for planting.

Pinus flexilis (limber pine) is not so attractive as others and has been damaged by blister rust.

Pinus ponderosa (bull pine) is of little value as grown in this province.

Pinus strobus (white pine) cannot be recommended because of its susceptibility to blister rust.

Pseudotsuga Douglasii (Douglas fir) is a very attractive and desirable tree.

Retinospora pisifera (Sawara retinospora)—Cypresses, as these plants are often called, are hardy at Charlottetown, and are very ornamental. The best variety is *filifera*.

Thuja occidentalis (American arborvitae) is commonly called white cedar. Most winters the tips of the arborvitaes are injured.

Ornamental Deciduous Shrubs

Amelanchier vulgaris (service berry) is quite hardy and attractive and one of the first to bloom.

A. canadensis is also very ornamental.

Berberis Thunbergii (Japanese barberry) does well even in exposed positions.

Caragana (Siberian pea tree) *C. arborescens* and *C. cuneifolia* have been tested and both are hardy and suitable for exposed positions.

Chionanthus virginica (fringe tree) is of little value at Charlottetown.

Cornus (dogwood). Three species have been grown but none is very ornamental.

Cotoneaster. Four varieties have been tested. *C. frigida, C. integerrima, C. tomentosa* and *C. laxiflora.* The last named is the most desirable.

Deutzia gracilis should be planted in a well sheltered position only.

Euonymus (spindle-tree) does not bear enough fruit at Charlottetown to be worth growing.

Forsythia europaea (golden bell) is the only variety tested. While apparently hardy it has not been attractive.

Hydrangea paniculata var. *grandiflora* is one of the most attractive shrubs and blooms from August to October. It will grow in sun or half shade.

Lonicera (honeysuckle) is hardy and will thrive under adverse conditions. Many species have been tested and the best are *L. tatarica* var. *grandiflora rubra* and *L. Morrowii.*

Mahonia Aquifolium (hollyleaved barberry) is an attractive but tender evergreen shrub. It browns considerably in winter but new growths soon hide the injured foliage.

Philadelphus coronarius (mock orange) is an excellent shrub for planting in shady locations. Other species and varieties are also good hardy flowering shrubs. The golden leaved variety is recommended for the colour of the foliage.

Potentilla fruticosa (shrubby cinquefoil) succeeds well but is only moderately attractive.

Prunus maritima (beach plum) is not highly ornamental. Another species *P. cerasifera* has not proved of great value.

Ptelea trifoliata (golden hoptree) is not attractive enough for general planting.

Rosa rugosa and varieties *alba* and *rubro-plena* bloom over a long season. *R. rubrifolia* (red leaved rose) has attractive foliage all season. *R. Wichuriana* and *R. multiflora* have not proved very desirable.

Rhamnus Frangula (alder buckthorn) is the most attractive of the species grown.

Sambucus nigra aurea (golden-leaved elder) is hardy and has attractive yellow foliage.

Spiraea does best when planted in a sheltered position. Of the species tested the following three are considered the best: *S. arguta, S. Vanhouttei* and *S. sorbifolia* var. *Aitchesonii.*

Symphoricarpos racemosus (snowberry) is hardy and does well in partial shade.

Syringa (lilac). The following are considered the most desirable of those tested: *S. vulgaris* varieties Madame Lemoine and Congo, *S. chinensis* (rothomagensis) *S. villosa* (Chinese lilac) and *S. Josikaea* (Hungarian lilac).

Viburnum Opulus roseum (sterile) (snowball) is the most attractive of the *Viburnums* tested.

Diervilla hybrida (weigelia) is slightly tender at Charlottetown and needs to be grown in a sheltered position. The variety Eva Rathke is one of the best. The variety *D. nana variegata* is one of the best variegated leaved shrubs. *Aralia chinensis* var. *mandschurica* is not sufficiently ornamental to be desirable.

PERENNIAL CLIMBING PLANTS

Ampelopsis quinquefolia hirsuta (self-fastening Virginia creeper) is hardy and attractive.

Aristolochia sipho (Dutchman's pipe) is one of the best hardy climbers.

Clematis Jackmani needs a well-sheltered position.

Celastrus scandens (American bittersweet) is a rapid grower and excellent for covering verandahs.

I. QUEBEC AND ONTARIO

Cap Rouge, 1932.—Trees recommended at this station are Colorado blue spruce and pyramidal arborvitae, cut-leaved maple, rose acacia and white birch. Ornamental shrubs that do well are Tartarian honeysuckle, *Hydrangea paniculata*, lilac var. Michel Buchner, mock orange, *Viburnum Lantana*, *Potentilla fruticosa* and *Spiraea Vanhouttei.*

II. PRAIRIE PROVINCES

Morden, 1931.—Among the shrubs being tested at this station which appear to be worth growing are the following:—

Amorpha macrophylla (fragrant false indigo) is a native shrub that blooms in June.

Crabapple.—Red Tip and Hopa.

Crataegus succulenta (fleshy hawthorn) is a native of Northern Ontario and is one of the finest ornamentals both in flower and fruit.

Elaeagnus angustifolia (Russian olive) has fragrant flowers and silver berries in winter.

Halimodendron halodendron (salt tree) is suitable for dry prairie districts.

Lonicera Korolkowii var. *floribunda* bears an enormous number of pink flowers. Other species that seem promising are *L. amoena* var. *alba* and *L. Ruprechtiana.*

Lycium chinense (The Chinese matrimony vine) grown from Western China seed appears to be superior to common matrimony vine and is quite hardy.

Prunus nana (dwarf Russian almond) and varieties were very attractive.

Rosa spinosissima var. *altaica* is the most attractive shrubbery rose at the station. It is seven feet high and full of bloom for two weeks in June. Its dark purple fruits are also very ornamental.

R. nitida (bristly rose) is desirable for the brilliant colour of the leaves in autumn.

Spiraea trichocarpa and *S. transiens* are two new species which appear to be better adapted to the district than *S. Vanhouttei* and to be equally attractive.

Syringa chinensis (Rouen lilac) is probably the most generally useful of the 200 varieties of lilacs under test. Many of the named varieties of *S. vulgaris* are very satisfactory also. Other species recommended are *S. velutina* (Korean lilac) and *S. amurensis* var. *japonica* (Japanese tree lilac).

Viburnum Opulus var. *roseum (sterile)* (snowball) blooms heavily at this station.

Indian Head.—Most of the ornamental shrubs flowered at this station, especially the *Caragana*, *Halimodendron halodendron (argenteum)*, *Cytisus*, *Crataegus*, *Prunus tomentosa* and mountain ash.

Swift Current.—Most of the trees and shrubs are doing exceptionally well at this station. Russian poplars suffered severely from drought, disease and insects and many of them were removed. Spruce, pine, elm, and ash are continuing to grow and are gradually replacing the temporary trees of poplar and maple. Koster's and Colorado blue spruce and white spruce were planted in the shelter belts and about the grounds. Scotch pine did not transplant successfully.

Lacombe.—Ornamental shrubs recommended for Central Alberta are: *Berberis Thunbergii, Caragana* in variety, *Cotoneaster* in variety, *Crataegus pio mollis, Lonicera tatarica, Lonicera chrysantha, Spiraea* in variety, *Rosa spinosissima* var. *altaica* and *R. rubrifolia.*

NATIVE SHRUBS

Amelanchier alnifolia, Elaeagnus argentea, Rhamnus catharticus, Potentilla fruticosa, Shepherdia argentea, mountain ash and *Viburnum Opulus.*

DECIDUOUS TREES

Acer Negundo, Betula alba, Populus in variety and *Ulmus americana.*

EVERGREEN TREES

Picea in variety and *Pinus* also in variety.

Beaverlodge.—The following list includes some of the hardy varieties recommended for planting:

HARDY EVERGREENS

Picea canadensis, Pinus Banksiana, P. contorta latifolia, P. sylvestris.

SHRUBS

Amelanchier alnifolia, Amorpha fruticosa, Betula species, *Caragana* in variety, *Cornus, Cotoneaster acutifolia, Halimodendron halodendron, Lonicera tatarica* and native species, *Potentilla fruticosa, Prunus padus commutata, P. pennsylvanica, P. virginiana, Rosa rugosa* (Japanese rose) Hansa and *F. J. Grootendorst, Rosa rubrifolia, R. spinosissima, Sambucus racemosa, Shepherdia argentea, Sorbus* native sp., *Spiraea arguta, Spiraea media, Syringa vulgaris, S. villosa.*

DECIDUOUS TREES

Fraxinus lanceolata, Larix laricina, Populus balsamifera, Salix acutifolia.

CLIMBERS

Ampelopis quinquefolia, and *Clematis* native species.

Scott.—Work with ornamental trees and shrubs has been carried on for a great many years at this station and many data have been collected. Information with regard to hardiness and suitability of species to the district can be obtained by addressing the Superintendent, Experimental Station, Scott, Sask.

Summerland.—The following shrubs have proved well adapted to this district: Lilac, *Forsythia, Spiraea, Viburnum, Deutzia, Ribes, Rhus, Tamarix* and *Berberis.*

Sidney.—Rhododendrons are seldom propagated in Canada. The majority of the plants that are sold are imported. These, as a rule, are grafted on *R. catawbiense* or *R. maximum.* About eight years ago it was decided to try to raise these shrubs from seed. Seeds were gathered from the best plants

growing at the station and several hundred plants were raised. The seedlings were transplanted to nursery rows and later planted in a permanent location. They have been cared for over the whole period but none bloomed until last season when six or more produced their first flower. From the appearance of the plants a large number will bloom next season.

For best results seeds should be sown under glass between January 1 and March 15 in soil one half peat and one half pure fine sand. The seeds are very small and need no covering, the usual watering after sowing being sufficient. A thin layer of sphagnum laid over the surface of the seed-pan is good protection from the sun and keeps the soil evenly moist. It should be removed when germination begins. The seedlings must be pricked off as soon as they are large enough to handle as they are likely to damp-off if left in the seed pots too long. Plant out in peaty soil and shade with lath screens. Never let them suffer from dryness.

Any open well drained soil, which does not contain lime or heavy clay and has a moist and fresh sub-soil, is suitable. A position sheltered from drying winds and hot sun should be chosen.

Rhododendrons in a country like Vancouver Island should occupy a larger space in all garden work for they are equally effective as single specimens or massed in large groups.

This report continues the summary of the behaviour of deciduous trees that was started in the report for 1930.

Prunus is a genus which contains many plants of great ornamental value including forms with double flowers, variegated or coloured leaves and drooping habit. Nearly fifty varieties have been grown and for the most part they are of easy culture, spring flowering and hardy.

Prunus Pissardii Carr.—The purple leaved plum is one of the best of all small purple leaved trees and holds its colour well throughout the summer. The best colour is secured from strong young growth which can be encouraged by frequent pruning.

Prunus pseudo-cerasus.—The Japanese flowering cherries are very attractive and should be grown more in gardens. A number of varieties obtained from Japan are grown and have proved hardy at this station.

Pyrus.—Amongst the *Pyrus* can be found the Asiatic crabapples. They are profuse bloomers and very ornamental. Some hold their berry-like fruit into the winter season. They are of the easiest culture on well drained soil but must be sprayed from time to time to control disease. Twenty-eight different species have been tested.

Quercus.—As ornamentals the oaks are trees of noble and majestic habit and are as beautiful when grown singly as when grouped together, forming groves or woods. Generally the oaks grow best in moderately moist rich soil including heavy clay. The black and red oak and especially the pin oak are transplanted easily and large trees can be moved successfully but the white oaks are more particular and only young nursery grown trees should be transplanted. Fifteen species have been grown at this station but six have died.

Rhamnus.—The buckthorns are handsome shrubs with large bright green leaves and inconspicuous greenish flowers. They are useful for growing in shrubberies and do well in moist soil in shaded or partially shaded positions. Five species are grown.

Robinia.—The locusts are very handsome trees with graceful foliage and showy flowers. In some species the pods are also attractive. They are not particular as to soil and will do well even in light sand. They stand transplanting well and make rapid growth when young. Four species are being grown.

Saphora japonica.—The Japan pagoda tree has done fairly well but does not grow very rapidly. It is particularly valuable for its late blooming. It has large panicles of white flowers and graceful dark green foliage.

Tilia.—The lindens or basswoods are very desirable trees of rapid growth. The flowers are very fragrant. The trees are not particular as to soil and will thrive in a very dry location. Seven species are growing at this station.

Ulmus.—The elms are useful shade trees for park and street planting. They transplant without difficulty and large trees can be moved if carefully done. In some seasons and districts insects are troublesome. Elms do well in deep, rich, moist soil. Eight species have been planted at this station but two did not grow.

SHRUBS

When the arboretum was established in 1914 a great variety of shrubs was planted for test purposes. Most of them are five feet apart in the row with the rows ten feet apart. Much variation exists in soil on the experimental station and when planting it was not always possible to select the most suitable conditions for certain plants.

Abelia grandiflora is a bushy shrub with small pinkish white flowers. It blooms from May to November and is very desirable.

Actinidia kolomikta is the one of the three species tested to survive.

Akebia quinata has not done well.

Albizzia julibrissin is perhaps more correctly classified as a tree. It has graceful feathery foliage and pinkish flowers.

Amelanchier.—Five species are grown.

Amorpha.—Two species are grown.

Andromeda.—Two species have been tested and do fairly well.

Ardisia japonica blooms in early May and has white berries later. It is quite hardy at this station.

Aristolochia macrophylla (*A. sipho*).—The Dutchman's pipe vine is excellent for porches.

Azalea.—These are among the best flowering shrubs at this station. They grow best in peaty or porous loamy soil which does not contain lime. Plenty of water is essential and a partially shaded position is desirable. Five out of the six species planted are doing well and four out of six varieties of *Azalea pontica* also have proved satisfactory.

Bacharis halimifolia.—The groundsel tree is quite hardy at this station and thrives well on any well drained soil in a sunny position and is useful for growing on dry slopes. Two other species have also grown well.

Bambusa.—The bamboos require deep rich loam and respond readily to good treatment. The best results are secured by planting on sloping banks above pools and against a dark green background. Seven species are being grown at this station.

Berberis.—The barberries are excellent decorative shrubs which are particularly noticeable when in fruit. They prefer well drained light loam. Ten species have been tested at this station, two of which died.

Berchemia racemosa is a climbing shrub that is useful for growing on a trellis.

Bignonia.—Twelve varieties of Trumpet vine have been grown. They are not particular as to soil and are useful for covering rock, walls and trellis work.

Buddleia.—These shrubs grow well in a sunny location in well drained soil and are easily propagated from self sown seed. They should be pruned back hard each year to induce new growth. Seven varieties are grown at this station.

Camellia.—These shrubs do not do well at this station. Twelve varieties were planted in 1914 but very few have survived.

Caragana.—Eight species of this useful hardy shrub are growing well.

Callicarpa failed to grow.

Carpenteria californica is an ornamental evergreen shrub with white fragrant flowers.

Caryopteris Mastacanthus died owing to unsuitable soil conditions.

Ceanothus.—Seven varieties were planted in 1913 but owing to slight winter injury and too dry soil conditions they gradually died out.

Cercis Siliquastrum rubrum.—The Judas tree is well adapted for shrubberies or as specimen trees and does best in rich moist loam.

Choisya ternata is a good ornamental shrub and is sometimes called Mexican orange.

Clerodendron trichotomum is hardy at this station and has attractive bright blue flowers.

Cleyera japonica is not hardy so far north.

Coronilla Emerus.—Scorpian senna is an early blooming shrub of compact growth.

Corylopsis spicata is not hardy at this station.

Colutea.—Two species are growing and doing well.

Cotoneaster.—These shrubs do best in well-drained soil in a sunny position. The fruits are very decorative in autumn and winter. Eight species have been tested, two of which died.

Cydonia japonica.—The Japanese quinces are hardy at this station. Six varieties are growing.

Cytisus.—The brooms will adapt themselves very quickly to dry gravelly soil where few other plants will grow. Seven species are being tested.

Daphne.—Four species have been tested but have not proved satisfactory.

Daphniphyllum glaucescens is not very attractive.

Deutzia.—The deutzias are amongst the most popular and ornamental shrubs at this station. Twenty-two varieties are being grown.

Edgeworthia papyrifera is not hardy.

Elaeagnus.—Four species are being grown.

Enkianthus japonicus blooms in May and has attractive coloured foliage in autumn.

Eurya japonica did not grow.

Euonymus.—Eighteen varieties of spindle tree have been tested. The flowers in most species are inconspicuous but the foliage and fruit are attractive. Six varieties have died.

Escallonia.—Four species planted but all died.

Fatsia japonica.—This is a half-hardy shrub but is doing well at this station.

Forsythia.—Golden bell is an early-flowering shrub that will grow in almost any kind of garden soil and is suitable for shrubbery planting or for covering walls and fences. Five varieties have been grown and all have done well.

Garrya Thuretii is an evergreen shrub which has done well at this station though it is probably not hardy in any other part of Canada.

Genista.—These low-growing shrubs do well in dry climates and are useful for covering sandy banks and rocky slopes. Seven varieties are growing and doing well.

Halimodendron halodendron (argenteum).—The salt tree will thrive in saline and alkaline soils.

Hamamelis japonica.—Witch hazel blooms early and has bright yellow foliage in fall. *H. virginiana* is reported to be hardy in the north but died out at this station.

Hedysarum multijugum died out after a few years, apparently from drought.

Helwingia rusciflora died, probably from drought.

Hibiscus.—Forty-four varieties were planted in 1914 and most of them have proved very satisfactory under a variety of soil conditions. They bloom in August, September and October.

Hydrangea.—The Hydrangeas do best in moist rich soil in a partially shaded location. Eleven species and fourteen varieties of *H. hortensis* have been grown.

Hypericum.—The St. John's wort thrives in good loamy soil which is sufficiently moist. Four species have been tested, one of which died.

Indigofera dosua.—Indigo has proved quite hardy at this station.

Jasminum nudiflorum.—The winter flowering jasmine blooms from December to April. *J. revolutum* is also hardy at this station.

Kalmia angustifolia.—The sheep laurel although a very hardy plant does not do well at this station and after suffering much from dying back finally died. *K. latifolia* has done better than the other species but also dies back in some seasons.

Kerria japonica and var. *flore plena* are excellent shrubs.

Lavendula vera.—Lavender is quite hardy.

Laurus.—Twenty varieties of laurel were planted in 1914 and for the most part these have all done well. *L. nobilis* is the laurel of history and the leaves of this species are sometimes injured by winter storms.

Lycesteria formosa is quite hardy at this station and blooms in August.

Ligustrum.—Eleven varieties of privet have been grown and all do well.

Lindera sericeum and *L. triloba* lived four years and then died.

Lonicera.—Honeysuckle is one of the most valuable shrubs as it has fragrant flowers, a graceful habit, and grows well in many situations. Twenty-seven species have been tested, three of which died.

Lycium—Four species of matrimony vine have been grown and are useful for covering walls and fences. *L. chinense* is particularly attractive late in the season with its bright red fruit.

Nandina domestica was planted in 1925 and has made satisfactory progress, although reported to be rather tender.

Oleander (*Nerium oleander*) died out the year it was planted.

Olearia Haastii—The tree aster has grown well. It makes a good hedge.

Osmanthus aquifolium and *O. fragrans* died in a few years.

Philadelphus—The mock orange is well adapted for planting in shrubberies. The different varieties vary greatly in height, some being three and others fourteen feet.

Photinia glabra rubrum is doing well.

Potentilla Veitchii has white flowers and is growing well.

Raphiolepsis japonica never became thrifty and died in 1920.

Rhododendron—A very extensive list of varieties has been grown for many years and many of them are completely covered with flowers in the spring.

Rhus—The sumac is particularly attractive in autumn when the foliage is very brilliant. Five other species died a few years after planting.

Ribes sanguineum is indigenous to British Columbia and is a very desirable shrub for gardens in districts where it is hardy. Six other species grown have not been very successful.

Robinia rosea is doing well.

Rubus—The seven species planted in the arboretum have all passed out.

Sambucus nigra folius luteus will grow to a height of fifteen feet where plenty of moisture is available. A native species died after a few years.

Schizophragma hydrangeoides—Sometimes called climbing hydrangea, has made satisfactory growth.

Shepherdia canadensis, a native of British Columbia, is particularly well adapted for planting on dry rocky sterile banks.

Skimmia japonica and two other species are not considered hardy enough for this district.

Spiraea—Twenty species have been tested and all but two have done well.

Staphylea—Four species of bladder nut have grown well. The bladder-like fruits as well as the flowers are interesting.

Stephanandra flexuosa and *S. Tanakae* somewhat like *Spiraea* are very showy and valuable for use in borders.

Syringa—The lilacs are amongst the most popular flowering shrubs and are suitable for large parks or small gardens. Lilacs do well under a variety of soil conditions but should not be planted in exposed situations. Fifty-five varieties have been grown of which eight have died.

Tamarix—The tamarisks are graceful shrubs that bloom late in the summer. Twelve species have been tested, three of which have died. *T. parvifolia* is considered the best at this station.

Ternstroemia japonica failed at this station.

Ulex europaeus commonly known as gorse, blooms profusely in April and May.

Vaccinium—Two species were tested but failed.

Veronica—Four species were tested but only *V. Traversii* grew.

Viburnum.—Ten varieties have been tested, four of which died. The evergreen species, *Viburnum Tinus* often called Laurustinus is covered with bloom in late winter.

Vinca major elegantissima is a useful trailing plant for dry shaded locations.

Vitex agnus-castus is quite hardy at this station.

Vitis—Six species of grapes are grown as ornamentals at this station. They are easily propagated from cuttings.

Weigelia now classified under *Diervilla* grows as tall as twelve feet at this station. Forty varieties are grown and are doing well.

Wisteria—Six species are being grown and are attractive ornamental twining plants suitable for covering porches, arbours and trellises. They do well in most locations and will live in rather dry sandy soils. The roots are difficult to transplant.

Zanthoxylum.—Three species have been grown but all died.

Propagating Shrubs

Morden.—Studies were continued on rooting greenwood cuttings of shrubs and it is evident that material from plants with strong growth is necessary. The date for taking cuttings seems to be very important for a number of genera and much more study is necessary before detailed instructions can be given. Pure sand is generally advocated as the best medium to use but at this station a mixture of peat and sand seems to give better results. Propagation was also tried under heat controlled conditions, with the electric hotbed, but results so far have been disappointing.

Beaverlodge.—Propagation experiments with shrubs from greenwood cuttings have been conducted at this station but with very little success as yet.

Hedges

Cap Rouge.—Of the eighteen kinds of trees and shrubs tested for hedges for more than fifteen years, *Thuya occidentalis* and *Picea Abies (excelsa)* among the conifers and *Caragana* and *Berberis Thunbergii* of the deciduous varieties are the hardiest and most attractive.

Kapuskasing.—The varieties of plants recommended for hedges are white spruce, laurel-leaved willow, Russian poplar and *Caragana.*

Swift Current.—The specimen hedges were started in 1930 and those which are proving satisfactory are *Salix, Elaeagnus angustifolia, Syringa vulgaris* and *Lonicera tatarica. Ligustrum,* Russian poplar and *Artemisia abrotanum* are not satisfactory.

Lacombe.—Hedges recommended for Central Alberta are *Acer ginnala, Caragana arborescens* and *pygmaea, Elaeagnus argentea, Picea glauca (canadensis) Rhamnus cathartica, Salix pentandra, Shepherdia argentea, Syringa villosa.*

Beaverlodge.—Hedge plants recommended for the Peace river country are: *Caragana arborescens* and *pygmaea, Amelanchier alnifolia, Picea glauca, Symphoricarpus albus* and *Elaeagnus argentea.*

Windermere.—The following hedges are well established and suitable to the locality: Russian olive, *Caragana,* willow and lilac.

Chemical Weed Killers

Agassiz.—Atlacide applied in solution (1 pound to 1 gallon of water per 100 square feet) chiefly on couch and June grass at the base of apple and nut trees proved quite satisfactory, although additional spraying would be required for a thorough clean up.

Tests made on couch grass, Canada thistles, plantain, dandelion and annual weeds, at the same rate as above, would lead one to believe that a 100 per cent control will not be attained, because examination of the root systems showed a large percentage killed but a sufficient number living to give plants a start the following year.

An application of dust, 1 pound to 100 square feet, appeared as effective as a liquid spray. Such an application would be simpler but owing to the quick absorption of moisture by the chemical it is hard to keep the shaker duster in good operation and, therefore, the coverage obtained is not as good as with a sprayer.

Windermere.—Atlacide used on the driveway proved more effective when used as a dust than as a spray and was also more economical. Two applications in one season will control the weeds for at least two seasons.

Plant Breeding

Ottawa.—The work of selecting the best seedlings of the new hybrids is being continued as rapidly as possible.

Pyrus Malus.—The name Rosybloom crabapples was given by the late Dr. Macoun to the group of flowering crabapples most of which were described in the Report of the Dominion Horticulturist for 1928; others are given here:—

Athabasca (P.21.08.03) *P. Malus* var. *Niedzwetzkyana* (female) x *P. baccata* (male).—Foliage dark cress green overlaid with mars brown. Flowers in clusters on long spurs; colour in bud rosolane purple; expanded rose pink. Fruit medium sized crab; colour bright red and yellow, drops early.

Makamik (parentage lost).—Foliage dark greenish olive. Flowers in clusters of five or six; colour in bud amaranth purple; expanded rose colour with deeper veins. Fruit small dark red crab.

Namew (P.21.08.08) *P. Malus pumila* var. *Niedzwetzkyana* (female) x P. *baccata* (male).—Foliage hellebore green. Flowers thickly clustered around the stem; petals narrow; colour in bud amaranth purple fading lighter; expanded spinel pink. Fruit bright red and yellow crab.

Wabiskaw (P.20.05.06) *P. malus pumila* var. *Niedzwetzkyana* (female) x *P. baccata* var. *jenensis* (Arboretum No. 2776) (male).—Foliage calla green and claret brown in spring and summer, bright red in autumn. Flowers in bud pomegranate purple; expanded rose colour. Fruit medium size crab, colour bright dark red. The habit of this variety is distinct from the other seedlings as the branches all grow upright.

Syringa.—In 1922, crosses were made between *Syringa vulgaris* var. Negro and *S. hyacinthiflora* var. Lamartine and some open fertilized seeds were also sown. Five seedlings have been named.

Maureen (S.22.01.03) Negro (Female) x Lamartine (male).—Foliage of the *S. vulgaris* type. Flowers single in large loose panicles; colour in bud vernonia purple, expanded Bishop's purple fading to deep lavender.

Muriel (S.22.04.09) Negro (female) x Lamartine (male).—Good dark single.

Norah (S.22.04.16) Negro (female) x Lamartine (male).—This plant is very floriferous and makes a compact round bush completely covered with flowers. It was chosen for this reason and not for the bloom which resembles other varieties in colour.

Patricia (S.22.17.13) Lamartine open fertilized.—Flowers, semi-double in large panicles; colour in bud Hay's lilac; expanded bluish lilac to Hay's lilac fading to pale analine lilac. This variety has a distinct bluish tinge.

Peggy (S.22.17.07) Lamartine open fertilized.—Flowers single in large loose panicles; colour in bud laelia pink, expanded Argyle purple fading to laelia pink. This is a very attractive pale variety.

Iris.—A large number of seedlings of the second generation of the *I. sibirica* var. *maxima* x *I. orientalis* var. Snow Queen varieties were grown and some promising white forms have been kept for further test. The variety, Gatineau, with large blue flowers, was given Honourable Mention and rated 94 by the American Iris Society.

Roses.—Amy Hedrick (R.24.17.04) *R. Harisonii* open fertilized.—Bush resembling *R. Harisonii* with large, semi-double cream flowers.

U. P. Hedrick (R.26.08.01) *R. spinosissima* var. *altaica* open fertilized.—Bush vigorous, hardy, foliage abundant, dark green. Stem reddish brown. Flower single, large, rosolane pink to pale rosolane pink. Blooms for two weeks in June. This plant has some resemblance to *R. blanda* and it is possibly a natural hybrid between *R. spinosissima* var. *altaica* and Betty Bland which was growing nearby. Betty Bland is a hybrid rose raised by Mr. F. L. Skinner and had *Rosa blanda* for one parent.

Lilium.—A large number of lilium crosses and seedlings of crosses have been grown and some new forms have been segregated and are being grown for further test.

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These publications may be obtained from the Publicity and Extension Branch, Department of Agriculture, Ottawa.

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