DOMINION OF CANADA
DEPARTMENT OF AGRICULTURE
DOMINION EXPERIMENTAL FARMS

DIVISION OF HORTICULTURE

REPORT
OF THE DOMINION HORTICULTURIST

W. T. MACOUN

FOR THE YEAR 1922

Japanese Tree Lilac. (*Syringa japonica*)

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REPORT OF THE DIVISION OF HORTICULTURE

W. T. MACOUN, DOMINION HORTICULTURIST

The report which follows is the thirty-sixth annual report of the Division of Horticulture, and since 1887, when the first report was published, a vast amount of horticultural information has been made available to the public in these reports based on the results of the experimental work conducted in this division. These reports make an excellent reference library, and, no doubt, are used by many for this purpose.

In the following report the effort has been made to give fairly full information in regard to the results from a relatively few of the experiments conducted during the year, and for longer periods, and not to attempt to touch on all the very many experiments in progress. Most of that part of the report dealing with pomology has been prepared by the Chief Assistant of the Division, Mr. M. B. Davis, B.S.A.; the section on vegetable gardening by Mr. T. F. Ritchie, B.S.A., Assistant in Vegetable Gardening; and that on ornamental gardening by the Dominion Horticulturist. Other members of the staff in charge of various parts of the work are: Miss F. Fyles, B.A., Artist Botanist; Mr. Jas. McKee, Greenhouse Specialist; and Miss I. Preston, Specialist in Ornamental Horticulture. These, with the office staff and foremen, make a very efficient force, which makes possible the carrying out of the experiments and publication of the results.

THE SEASON

The growing season of 1922 was a favourable one on the whole, as there were no protracted droughts, the rain being well distributed. April was rather cool, although the temperature reached 72·4° on the 10th, on which date it may be said that digging outside was generally possible. This is one day earlier than the average for the past twenty-five years, which is April 11th. The month of May was warm with the temperature rising to 85° F. on the 31st, it being above 80° F. on five days. There was no long hot spell in June, which was a moderately warm month. July was moderately warm for that month. There was a warm spell from the 10th to the 23rd, during which time the temperature was above 80° F. on thirteen days. The hottest day of the month was on the 11th, when it was 90·4, and it reached 90° on the 16th, the only two days in the month when the temperature reached 90°. August was moderately warm on the whole, though there was one hot spell from August 12th to 18th, when on August 15th and 16th the temperature reached 94° on both days. September was warm and relatively dry, there being only 1·68 inches precipitation during the month. The temperature was above 80° on ten days, and reached 90° on the 10th. The first light frost of autumn occurred on the 26th, when the thermometer recorded 29·9 F. Except for the first four days it was cool throughout October. The first frost during the month was on the 13th, when the temperature was 29°. There were no severe frosts this autumn until the 19th, when it dropped to 16·2°. The 20th and 21st were also cold with minimum temperatures of 16·8° and 18·2°. Two inches of snow fell on the 19th, a very unusual occurrence for so early in the season. November was a cool month though not cold, the lowest temperature during the month being 16° on the 29th. During the month four and one-half inches of snow fell, there being one and one-half inches on the 24th and three on the 27th. Winter may be said to have set in on November 24th, which is one day earlier than the average for the past twenty-five years, the average date being November 25th. December was a comparatively mild month so far as absence of low temperatures were concerned, although the temperature only

rose above freezing on one day, the 1st, when it was 34·4°. It was six times below zero during the month, the lowest temperature being 12·4° below zero on the 19th. There was never more than about six inches of snow on the ground at any time during the month.

FRUIT AND VEGETABLE CROPS

The crop of apples was only a medium one at Ottawa in 1922 as there had been a heavy one in 1921. There was a good crop of plums, mainly of Americana, Nigra, and Hybrid varieties, the European or Domestica plums not being old enough to bear, as the older trees had been killed by the severe winter of 1917-18. There was a good crop of grapes, but they did not ripen as well as in some years. Bush fruits yielded well, as did strawberries. It was a good season for vegetables, most kinds succeeding well. The potato crop was good, and there was practically no rot.

Style of tent used for hybridization work at the Central Farm.

POMOLOGY

Fruit breeding or plant improvement has become the major part of the work in pomology. A brief discussion of the results of this work, together with a list of the more important parental combinations used and the methods of attack employed, are given under each sub heading in the following pages.

GLOSSARY

For those not familiar with the terms used in plant breeding literature, the following definitions of two expressions is here appended:—

Heterozygous is a term used to express the genetic constitution of an individual with respect to certain factor or factors. An individual is said to be heterozygous when it is formed by the union of two germ cells of unlike constitution. Thus: A white apple crossed with a red one would produce an individual the germ cell of which would have one dose of red and one of white—it would with respect to colour be heterozygous or a heterozygote.

Homozygous refers to the condition when the individual is of like gametic constitution; to use the above example, if a red apple is crossed with a red apple, the resulting progeny would, with respect to colour, be homozygous—it would have two doses of red, one from the male parent and one from the female. It is assumed of course, that the two parents above referred to would be pure for their respective colours, i.e., homozygous.

Briefly then, when an individual is pure for a certain character, it is said to be homozygous for that character. When it is impure or does not breed true it is heterozygous.

APPLES

The improvement of the apple has been a project of this division since 1890, and the results have been reported on from time to time. The earlier attempts to obtain better varieties were confined to growing seedlings where only one parent was known; later, controlled crosses were attempted, using, as parents, varieties growing in the divisional orchards and conducting all hybridization work out-of-doors. During the last ten years another step in advance has been made by performing a large part of the hybridization work in the greenhouse. This has permitted the introduction of blood from varieties possessing higher quality and other desirable characteristics not present to the same extent in the varieties growing in the orchard, where hardiness has been the limiting factor. The greenhouse breeding work has not as yet produced results from which a comparison of this method with the unguarded, or open fertilization, method can be made, but there is every reason to expect even better results for the possible combinations of characters is infinitely greater.

One outstanding feature which is now being stressed, is the attempt to get out F_2 and later generations. Heretofore, breeders have not gone beyond the F_1 to obtain their desired types. During the past three summers much attention has been paid to selfing, or self-pollinating varieties, and although the greater number are self-sterile, some measure of success has been attained. Especially in the case of breeding hardy varieties for the prairies by using *Pyrus baccata*, does it seem desirable to practice self-fertilization and there are already a considerable number of young trees in the nursery, as a result of self-fertilizing Jewel, a cross between *Pyrus baccata* and Yellow Transparent, and Martin, a cross between Pioneer and Ontario (Pioneer is a cross between *baccata* and Tetofsky). Theoretically, segregation of characters should take place with recombinations giving the desired types, combining the hardiness of the *Pyrus baccata* with the better size and quality of our commercial sorts. The result of both first and second crosses has not proven as replete with results as was expected, but it is hoped by self-fertilization, or, failing that,

by brother and sister mating, to get out all the combinations theoretically possible due to Mendelian segregation. Following is a list of the more important parents and combinations used in controlled crossing both under glass and outside. Trees of all these combinations are now growing in the divisional nursery or orchard.

Fameuse x Cox Orange
" x Cellini
" x Yellow Transparent
" x Wagener
Cellini x Yellow Bellflower
" x Fameuse

Red June x Hibernal
" x Wealthy
Wagener x Jewel Crab
" x Fameuse
" x Wealthy
" x Hibernal
" x Red June
" x McIntosh
Wealthy x Cox Orange
" x Delicious
" x Grimes Golden
Wealthy x McIntosh

Charlamoff x McIntosh
" x Wealthy
Cox Orange x Wealthy
" x Hibernal
" x Jewel
" x McIntosh
Duchess x McIntosh
Dudley x McIntosh
Delicious x Wealthy
" x McIntosh
Gravenstein x Fameuse
Grimes Golden x McIntosh
Hibernal x Barnack Beauty
" x Wealthy
" x Wagener

King of Tompkins x McIntosh
King David x McIntosh
Martin x Wealthy
" x Delicious
McIntosh x Delicious
" x Jonathan
" x Wealthy
" x Milwaukee
" x Dudley
Jonathan x McIntosh

Although studies in self sterility are reported upon in later pages, it is desirable to list the successful self fertilizations here of which seed has germinated.

Jewel crab.. .. ..selfed
Martin crab.. .. .. ..selfed
Wealthy.. .. ..selfed
Fameuse.. .. ..selfed
Duchess.. .. ..selfed
Dudley.. .. ..selfed
Bethel.. .. ..selfed

There are now growing in the test orchards over 1,115 controlled crosses which are just coming into bearing, and in the nursery there are 881, while in the seed-beds 700 more are growing, making a grand total of 2,696 hybrid apples as a result of breeding operations since 1911.

RECIPROCAL CROSSES WITH PYRUS BACCATA AND MALUS

In the original work with *Pyrus baccata* conducted by Dr. Wm. Saunders, *Pyrus baccata* was used always as a male parent. In later years the reciprocal has been made and as fifteen of these fruited in 1922 for the first time, it is now possible to make a comparison between the value of *Pyrus baccata* both as a male and as a female parent. The hardiness of the *Pyrus baccata* was transmitted to the great majority of the offspring in the original crosses, likewise the size of the Malus was diminished much more than the size of the *Pyrus baccata* was increased, none of the first crosses being larger than 1½ inches. The typical long stem and deciduous calyx of baccata were also transmitted to the great majority, and the crab-like quality was apparent in all the first generation crosses, although considerable variation in this respect was noted, still there was no approach to the Malus in appearance and quality which was desired. This would indicate that *Pyrus baccata* was homozygous for its characters, while, of course, the commercial varieties of fruit designated here as Malus, are known to be extremely heterozygous, so that it is not to be wondered at, that little improvement was made in the F_1. As comparatively large numbers were used

the homozygosity of *Pyrus baccata* would hardly account for the non-appearance of any fruit resembling Malus, unless it is assumed that baccata possesses all dominant characters, or, in other words, is a homozygous dominant. In intercrossing of varieties of Malus out of almost two thousand individuals there has only been about 3 per cent resembling crabs, so that one must conclude that although Malus is heterozygous, it must be homozygous for a large number of factors which constitute good quality. As quality is a term which includes flavour and acidity, juiciness, texture and many other characteristics, a large number of factors must be involved, and if *Pyrus baccata* with its very poor quality can completely dominate the Malus factors, it is logical to conclude that the higher quality of Malus is due to the inter action of a large number of recessive factors, and that this is so, is borne out by the non-occurrence of crab-like fruit between intercrosses of this species. Unless *Pyrus baccata* possesses sex-linked characters, we would expect therefore from the reciprocal (where baccata is used as a male) the same results as were obtained from the original crosses. Although only fifteen of these reciprocals fruited this past season, not one has resembled Malus. All were crab-like and showed the baccata characteristics developed to a high degree.

Thus far, the above reasoning has been borne out and it will be interesting to watch the results of the next few years from these reciprocal crosses. As soon as the complete results from this line of breeding are available, the data will be analyzed and published, but this much, which is now available, is here pointed out as suggestive to those breeders who may be attempting an improvement of the baccata by these methods. At this Farm, work in this direction is now being conducted on self-fertilization of baccata and Malus hybrids, and, fortunately, at least two have been found which are slightly self-fertile. In addition, brother and sister mating, where possible, is being made on a large scale. This appears to be the only avenue now left which promises quick results, as the work from second crosses, although showing some improvement, indicates a long and rather tedious line of attack.

DESCRIPTIONS OF NEW VARIETIES OF APPLES ORIGINATED IN THE DIVISION OF HORTICULTURE, RECENTLY NAMED

From time to time, descriptions have been published in the annual reports of new varieties of fruits, originated in the Division of Horticulture, which have been considered sufficiently promising to name. Following are descriptions of apples which have been named since the last report was published. In adopting these names, the object has been to give some idea of the parentage of the apple, and, at the same time, have a euphonious name. Thus Bethanis is a cross between Bethel and Anis. This method, it is believed, adds greatly to the interest of the variety, and, furthermore, if the hopes of the commercial value of these new sorts are not fulfilled when the trees have been thoroughly tested, the discontinuance of the variety will not mean that a well-known name has been used and lost.

Bethanis (Bethel x *Anis).*—Fruit above medium to large size; form roundish; cavity deep, medium width, russeted; stem short to medium, stout; basin deep, medium width, nearly smooth; calyx closed or open; colour pale green, washed with deep rather dull red and darker splashes; predominant colour rather deep, dull red; seeds below medium, acute to acuminate; dots numerous, pale yellow, distinct; skin moderately thick, moderately tender; flesh dull white or yellowish, crisp, tender, moderately juicy; core medium size, open; flavour subacid, pleasant; quality good; season late November to March or later. No marked resemblance to Anis, but suggestive of Bethel in colour of skin and in flavour.

Keetosh (Milwaukee x *McIntosh).*—Fruit medium to above medium size; form roundish to oblate; cavity deep, medium width; stem medium length, moderately stout; basin medium depth to deep, medium width, wrinkled; calyx open or partly open; colour pale yellow, well washed and splashed with crimson; predominant colour crimson; flesh white, tender, breaking, juicy; dots obscure; seeds small, plump, acute; skin moderately thick, tender; core small, open; flavour subacid, pleasant, good; quality good; season October to January. Resembles McIntosh considerably in colour of skin, flesh, flavour, core and seeds. No marked resemblance to Milwaukee. A good dessert apple. Attractive in appearance. Evidently about same season as McIntosh.

Maclaw (McIntosh x *Lawver).*—Fruit medium to above medium size; form roundish; cavity deep open to medium width; stem medium to long, moderately stout; basin deep, open to medium width, slightly wrinkled; closed or partly open; colour greenish yellow, washed and splashed with deep crimson; predominant colour deep crimson; seeds medium size, acute, and obtuse; dots small, moderately numerous, yellow, indistinct; bloom medium, lilac; skin moderately thick, tender; flesh yellowish, crisp, tender, moderately juicy; core small, open; flavour subacid, pleasant; quality good; season January to April or May. Resembles McIntosh considerably in colour of skin. A blend of both in other respects. A promising winter apple.

Newtosh (McIntosh x *Newton).*—Fruit medium to above medium size; form oblate to roundish, sometimes lopsided; cavity deep, open, russeted; stem long, moderately stout; basin deep to medium depth, open, wrinkled; calyx open; colour yellow, washed with crimson; predominant colour crimson; seeds medium size, acute; dots indistinct; skin moderately thick, tender; flesh yellowish, firm, crisp, juicy; core small, open; flavour subacid, pleasant; quality good; season late December to April or May. A promising winter apple. Resembles McIntosh somewhat in colour of skin and Newton in flesh and flavour.

Spimil (Northern Spy x *Milwaukee).*—Fruit medium to above medium size; form roudish to oblate, slightly ribbed; cavity deep, open; stem short to medium stout; basin deep, open, wrinkled; calyx open; colour yellow, well washed and splashed with attractive crimson; predominant colour attractive crimson; seeds above medium; dots moderately numerous, white, distinct; skin moderately thick, tender; flesh yellowish, crisp, tender, juicy; core medium size, open; flavour subacid, sprightly, pleasant, not high; quality good; season late December to March or April. Resembles Northern Spy considerably in outward appearance. No marked resemblance to Milwaukee except in crisp flesh and sprightly flavour. Better in flavour than Milwaukee.

Spiza (Northern Spy Seedling).—Fruit medium to large size; form roundish; cavity narrow, deep, russeted; stem medium length, moderately stout to slender; basin deep, narrow to medium width, abrupt, wrinkled; calyx partly open; colour pale greenish yellow, thinly washed and splashed with carmine approaching crimson; predominant colour carmine approaching crimson; seeds above medium, acute; dots obscure or few, yellow, distinct; skin moderately thick, moderately tough; flesh yellowish, crisp, tender, juicy; core above medium size, open; flavour briskly subacid, not high but pleasant; quality good; season November to February or March. Flesh considerably like Northern Spy. Flavour a little like Northern Spy. Shape and colour considerably like Northern Spy.

Stontosh (Stone x *McIntosh).*—Fruit above medium to large size; form roundish, conic; cavity narrow, shallow to medium; stem short to medium length, moderately stout; basin deep, medium width, abrupt, wrinkled; calyx partly open; colour yellow, washed with deep red; predominant colour deep red; seeds below medium, plump, acute and acuminate; dots numerous, pale yellow, conspicuous;

bloom thin, pinkish; skin moderately thick, tough; flesh dull white, tender, juicy; core, medium size, open, flavour subacid, pleasant, spicy; quality good; season probably late December to March or April. No marked resemblance to McIntosh except in core and seeds. Resembles Stone somewhat in colour of skin and about cavity.

CRAB APPLE

One new crab apple was named during the past year. This is from one of the second crosses made by the late Dr. Wm. Saunders with *Pyrus baccata* blood. The parents are Prince (a cross between *Pyrus baccata* and Tetofsky) and McIntosh. There have been some very promising crab apples where McIntosh was used as a parent, and this is one of the best.

McPrince (Prince x McIntosh).—Fruit very large for a crab, $1\frac{7}{8} \times 2$ in., small for an apple; form roundish, conical, slightly ribbed; cavity deep, medium width; stem long, slender; basin deep, open, wrinkled; calyx closed; colour pale greenish yellow, washed with deep crimson; predominant colour deep crimson; seeds medium size for an apple, acute; dots obscure; skin moderately thick, tender; flesh yellowish, crisp, tender, juicy; core medium; flavour briskly subacid, pleasant, sprightly, but not high, no astringency; quality good; season October probably to January. No marked resemblance to McIntosh except in colour of skin, which is very similar. Less crab-like than many, particularly in flesh.

PLUM BREEDING

Until the past year, attention in plum breeding has been focused upon improvement of *Prunus nigra* within the species, that is, by selection of the desirable variations which have been noticed. Results of this work have been reported upon previously.

As there is now a good collection of *Domestica* and *Triflora* varieties growing in pots, it is possible to undertake the improvement of *Nigra* by hybridization. In the following pages is a list of the most promising combinations which are growing in the trial grounds, but which have not as yet fruited. Next year it is hoped that we will be able to report a much larger number of combinations, as it is intended to stress plum breeding during the next few years. Special attention is to be given to the hybridization of *Nigra*, and members of the *Domestica* group, also the hybridization of Omaha and Emerald and the *Domestica*, as well as the introduction of *Triflora* blood into these parents.

Plum Hybrids now growing at the Central Experimental Farm

Cheney Seedling x Cheresoto.

Sdlg. of Rupert x Santa Rosa; this combination is interesting, as will be seen from the parentage of Rupert below:—

Rupert (P. *americana* x *P. pumila*).
Rupert (open fertilized) gave a
Sdlg. of Rupert which, when crossed with Santa Rosa, gave the hybrids above referred to.
Sdlg. Rupert x Terry
Ezaptan x Reine Claude
Ezaptan x Burbank
Ezaptan x Apple
Ezaptan x Admiral Schley

Domestica-Nigra combinations were attempted and a number of seeds obtained in 1920, but as the germination of all plum pits for that season was very poor, none of these germinated. Evidently Reine Claude is not completely incompatible with *Nigra* so that it is hoped successfully to complete this desirable combination.

Plum and Cherry Crosses

A few hybrids between the plum and the cherry are growing in the trial grounds, these being the result of the following hybridizations:—

Myrobolan x Gov. Wood
Ezaptan x May Duke

It appears to be fairly easy to fertilize cherry blossoms with plum pollen and to bring the fruit to full maturity, but the stones are practically all devoid of an embryo and consequently do not germinate.

CHERRY BREEDING

Although it is not possible to report progress on cherry breeding, attempts are being made to effect a cross between the following species and our common sour and sweet cherry varieties. To date, these attempts have been sterile of results, but hybridizations on a larger scale are being planned for the future. Species used as parents with sour and sweet varieties are:—

Prunus serotina	Prunus Maackii
" pennsylvanica	" Chamaecerasus
" Padus (various varieties)	" tomentosa
" Grayana	

Prunus pennsylvanica appears to be one of the most desirable species to use as a parent but appears to be incompatible when used as a female with either sweet or sour varieties. As the pistil of this variety is exceedlingly small as compared with any of our edible cherries, this may account in some measure for the incompatibility. As there are no commercial varieties growing on the farm grounds, it has not been possible to use this species as a male parent, but it may be possible to do so in a year's time, in the greenhouse. To date attempts at hybridizing *Prunus tomentosa* have also been failures, but considerable progress has been made in increasing the size of the fruit of this species by selection of the desirable variations. The average size of the fruit from a large number of bushes growing on the grounds, was from ten thirty-seconds to twelve thirty-seconds of an inch in diameter, while a considerable number of selected bushes yield fruit as large as eighteen thirty-seconds of an inch in diameter.

STRAWBERRY BREEDING

As a result of open fertilized seedlings of Bubach and Wm. Belt, the following varieties have been introduced to commerce:—

Portia	Lavinia
Cassandra	Mariana
Hermia	

The Portia, Cassandra, and Lavinia are the three most widely grown of these, and will be fruiting in comparatively large areas throughout Canada in 1924.

A large number of controlled crosses have been made, involving crosses and reciprocals of the following varieties:—

Jucunda	Beder Wood
Westney	New Globe
South Dakota	Valeria
Heritage	Bisel
Dr. Burrill	Portia
Parson Beauty	Greenville
Pocomoke	J. H. Cook
Senator Dunlap	Francesca

Self-fertilizations were also made.

To date, 1712 have fruited and, of these, 150 have been retained for test in 15-foot rows. On the whole, the results are disappointing. Of those discarded, none was as good as the poorest of the parents, and of those retained, the percentage that excel the parents is very low. What is being sought is a better shipper than is now on the market, with quality, colour, size and yield not appreciably diminished. Glen Mary, the most popular berry in Ontario at present cannot be considered desirable from the shipping standpoint, and if growers who are obliged to ship are to compete in distant markets, a much firmer variety must be obtained. In addition a deep, rich colour like that of Portia is extremely desirable from the canning and preserving standpoint, and yield and size are, of course, prime requisites. Doubtless, some of the quality imparted by very juicy texture will have to be sacrificed to get the required firmness for high shipping quality.

In addition to the 1712 hybrids mentioned above, there are 1,600 ready to fruit in 1923, and 2,375 that should fruit in 1924, making a total of 5,687 hybrids in the plant breeding area at present.

SELF-FERTILIZING FOR HOMOZYGOUS TYPES

Much attention is now being paid in this Division to self-fertilization for homozygous types. Such varieties as Parson Beauty, Beder Wood, and Valeria were selfed in 1920, and the progeny of these self-fertilizations have again been selfed, so the F_2 generation will fruit in 1924. It is expected to continue this until varieties homozygous for a number of commercial characters are obtained. When this point is reached, a re-combination of the homozygous types will be attempted.

BREEDING FOR FALL BEARING SORTS

A large number of hybrids between fall bearing and June bearing varieties fruited this past year. The parents used in this work were:

Americus	combined with	Portia
Superb		Parson Beauty
Minnesota 1017		Pocomoke
Progressive		Dunlap
		Dr. Burrill

In addition, intercrosses were made between the above fall bearing sorts. From the hybrids which fruited a large percentage were decidedly superior to any fall bearing sorts tried at this farm, and a number were marked for propagation and trial. There was a marked difference in the ability of these fall bearing sorts to produce stolons. Many of the best, as far as fruit was concerned, were almost barren of runners, but a few high-class ones were located which combined fall bearing and runner promotion, one individual

producing as many as 25 plants between August and freezing up, while several others produced from 12 to 20 runners.

Increase in size and attractiveness was especially noticeable and much is looked for from this group of very promising hybrids.

RASPBERRY BREEDING

Both varietal and specific hybrids have been attempted in the raspberry breeding work. The improvement of the shipping quality of Herbert and increase of hardiness is sought for. Sunbeam has been used as the parent to introduce hardiness, and Cuthbert and Newman 23 to introduce shipping quality. The parents used in varietal crosses are:—

Herbert	Cuthbert
Newman 23	Sunbeam
Latham	St. Regis

R. *odoratus* x R. *strigosus*.—A number of hybrids of the above combination and its reciprocal will fruit in 1923. This combination has been reported upon from other stations. The *odoratus* has been used for the purpose of introducing hardiness, as this species is very hardy under Ottawa conditions.

R. *strigosus* x *R. occidentalis* and its reciprocal has also been made, and a large number of these hybrids are fruiting in 1923 for the first time. A non-suckering red variety is sought. So far the results of this cross have not given non-suckering reds, but by self-fertilization of these hybrids in 1923 this combination is hoped for among the segregations obtained.

LOGANBERRY X RASPBERRY

A large number of this combination and of the reciprocal are also ready to fruit in 1923. The great majority of the hybrids from this cross are tender like loganberry, and all resemble it in appearance of foliage, whether loganberry was the male or female parent. In all there are 1,034 hybrid raspberries ready to fruit during the next two years, and 277 in the seed bed ready for transplanting to the trial plots.

GOOSEBERRY BREEDING

As a result of past years' work, three new varieties originated at this farm, are now being introduced to commerce, viz: Charles, Silvia and Mabel.

The improvement of our American sorts by the introduction of English or *R. Grossularia* blood has been the main line of attack by using such American varieties as Mabel, Red Jacket, Pearl and Houghton and English sorts, such as Victoria, Snowball, Eagle and Whinham Industry.

THORNLESS GOOSEBERRIES

A thornless gooseberry bush which will produce fruit of commercial size and quality is one of the main objects in gooseberry breeding. A few bushes of *Ribes Oxyacanthoides* which were entirely free from thorns were obtained a number of years ago, and crosses made between these and *R. Grossularia*, using *R. Grossularia* as a female parent. Self-fertilization of some of these hybrids produced thornless bushes with fruit slightly larger than Oxyacanthoides. Unfortunately, no detailed record was taken of the F_1 so it is not known whether any were thornless or not. From among the F_2 just referred to, three individuals were selected in 1920 which were thornless and possessed the largest number of desirable characters. These were 13-230-267, 13-230-271,

and 13-230-234. Crosses between these three and Mabel, an American variety, and Victoria, a variety of *Grossularia* were made. Ninety-nine hybrid bushes resulted and not one showed the thornless habit. This would indicate that thornlessness is a recessive character. As seedlings from selfed Mabel and Victoria bushes have failed to reveal any possessing the thornless character, it is fairly safe to assume that they are homozygous, for the factor or factors determining thorniness, also the thornless parents, when selfed in 1921, although only producing a small amount of seed, have given a few bushes which in the seedling beds appear to be thornless, and many which appear to be thorny, indicating a heterozygous condition, and also that thornlessness is recessive.

Evidently then it will be necessary to self-fertilize in large numbers the hybrids between 13-230 group and commercial varieties in order to get the necessary segregations from which to select a commercial thornless gooseberry.

PRELIMINARY REPORT ON SELF POLLINATION STUDIES

During the course of the past few years, many varieties of apples, both in the orchards and in the greenhouse, have been self fertilized, both with a view to obtaining information as to self sterility and to obtain seed for plant improvement work. In the following tables, the results of this work will be found in tabulated form, with a brief discussion at the conclusion.

In all cases, the bloom on trees in the open was bagged previous to the buds opening and remained protected in this manner until the petals had fallen and danger of pollination was over. In table number I, the method of pollination is shown in each case. Where "never open" appears, the method employed was to tap the bags several times during the period of pollen liberation.

Table number I represents the result of work done previous to 1919 under the supervision of Mr. A. J. Logsdail In this table the per cent of set represents the number of fruits on the trees at approximately three weeks after pollination. Tables II and III represent work done during the years 1920, 1921 and 1922, and here the set is given as the number of fruits actually reaching maturity.

TABLE NO. I.—SELF-POLLINATION STUDIES

Variety	Number pollinated	Per cent set	How pollinated	Per cent set when crossed
Rochelle	493	·81	With brush	16·3
Plodovitka	204	0	"	13·2
Grandmother	422	0	"	No data
"	227	0·44	Flowers on tree	"
Charlamoff	365	0	With brush	18·5
Ostrakoff	288	1	" "	No data
"	380	·53	Flowers on tree	"
Montreal Peach	264	·37	With brush	"
" "	441	0	Flowers on tree	3·6 to 15
Yellow Transparent	605	3·9	With brush	21·9
Hiberhal	350	0·85	" "	"
Milwaukee	83	0	" "	13·6 to 2·3
Wealthy	172	4·65	Pollen in vials	24·2 to 41·9
"	72	1·38	Never open	
Antonovka	313	8·9	With brush	17·8 to 31·9
Anisim	98	0	" "	
"	81	3·2	Outside flowers	No data
Lowland Raspberry	131	20·6	With brush	No data
" "	40	17·5	Never open	
Scott Winter	38	29·0	With brush	30·7 to 47·3
"	65	29·2	Outside flowers	
Duchess	224	11·1	With brush	20 to 46
"	755	20·6	Never open	
Haas	215	1·4	With brush	No data
"	148	1·3	Never open	

TABLE NUMBER II.—SELF-POLLINATION STUDIES

Variety	Number pollinated	Number set	How pollinated
Pedro	62	0	Bagged and shaken
Melba	39	0	" "
Rosilda	17	0	" "
Duchess	530	1	" "
"	23	7	Bagged and brushed
Dudley	107	1	" " shaken
"	27	0	" " brushed
Bethel	55	1	Bagged and shaken
Wealthy	68	2	" "
McIntosh	54	0	" "
Milwaukee	42	0	" "
Stone	66	0	" "

From the foregoing tables one notes that the varieties fall into the following groups with regards to self-sterility.

Completely self-sterile:—

Plodovitka
Charlamoff
Milwaukee
Pedro
Melba
Rosilda
Stone
McIntosh

Almost self-sterile, producing less than 2 per cent of a set:—

Rochelle
Grandmother
Ostrakoff
Montreal Peach
Haas
Hibernal
Dudley
Bethel

Varieties which show self-fertility, but set less than normal:—

Wealthy
Anisim

Varieties showing almost complete fertility:—

Duchess
Scott Winter
Lowland Raspberry
Antonovka

In addition to the above work performed outside, the varieties listed below were handled in the greenhouse. As this was done at a time of the year when insects were not flying, wind pollination was disregarded and the blooms were left unprotected, and in the self-fertilization tests were simply brushed over with the finger when pollen was free.

TABLE NUMBER III.—SELF-POLLINATION STUDIES

Variety	Number pollinated	Number harvested
Bramley Sdlg	3	1
Grimes Golden	24	0
King of Tompkins Co	6	1
Cellini	10	2
Martin	29	13
Cox Orange	29	3
Red June	33	0
Wagener	87	2
Wealthy	57	6
Spitzenburg	4	0
Fameuse	79	2

From this table it will be seen that, under the best conditions possible as regards temperature, pollen application and freedom from mutilation, there are quite a few varieties showing complete self-sterility.

INVESTIGATION INTO THE BLUEBERRY INDUSTRY

As a large number of inquiries are now coming in regarding information on blueberry culture, a preliminary survey of the blueberry situation in the Lake St. John district of Quebec, was made by Mr. A. E. Posselwhite, and Mr. P. M. Daly visited areas in New Brunswick and Nova Scotia.

From these various localities, a large quantity of seed was gathered from bushes producing the largest quantity and best sized fruit. This seed has been sown at Ottawa and the resulting seedlings will be used as a basis for plant improvement work with the blueberry. Two species only were located, viz:—*Vaccinium pennsylvanicum* and *V. canadense*. Two varieties of *V. pennsylvanicum* were found, one the ordinary blueberry with a heavy bloom and the other *V. pennsylvanicum nigrum*, the black-berried kind with little or no bloom. The nigrum is sweeter than the regular *V. pennsylvanicum*, is larger and also has lighter green foliage. Great variation was noted among the wild plants, some producing very small, poor-quality fruit, and other bushes producing fruit of high quality and large size. There would seem to be, therefore, a great opportunity to increase the production, size and quality of the wild product by eliminating the poorer individuals, and propagating those of outstanding merit.

Such procedure is, of course, not possible when blueberry barrens are not given any attention, but as the product finds a ready market at good prices, attention should be paid to this possibility, as undoubtedly the blueberry industry is of considerable importance in eastern Canada.

As an example of the variation in size, it might be noted that the average size of fruit in the shipments examined from the Lake St. John region was ten-thirty-seconds of an inch in diameter, while the largest fruit found was seventeen-thirty-seconds of an inch in diameter.

It was observed that the most recently burnt-over land providing it had not been burnt during the last two years, provided the best picking. It was also observed that bushes older than three or four years did not produce as large or as much fruit as the younger bushes. This would indicate that a system of pruning might be advantageous where cultural methods could be adopted.

In the Maritime Provinces, Mr. Daly observed the value of cultivation to blueberries in two places where land was ploughed with the intention of subsequent cultivation, which however, was never practised. The result was that the blueberries came up in rows between the furrows and produced wonderfully large and high quality fruit, far superior to adjoining areas which had not received such treatment.

Until it can be demonstrated that clearing, or partial clearing which will allow of cultivation, is a practical aid, the principal improvement in present treatment would appear to be a systematic yearly burning over of parts of the barrens, so that there would always be a large fruiting area two years removed from burning.

Blueberries were found on soils ranging from 50 per cent sand to 50 per cent clay, on peaty soils and on sandy soils. Excellent plants were also found on soils containing much broken down limestone, but as samples were not taken, it is not known whether this soil would give a neutral reaction or not.

GRAPES

Ottawa cannot be considered within the grape area of Canada, as the severe winters require that the majority of varieties receive protection in the

form of covering with earth in the fall of the year. The season also being somewhat short, it is with difficulty that full maturity is reached, so that only the earliest varieties can be recommended, thus limiting the selection to a comparatively small number.

There are eighty-three varieties of grapes growing in the vineyard at present not including a small collection of *Vitis vinifera* or European grapes. For the information of those who desire it, the complete list of these varieties, together with their average yield for five years, is attached. The varieties are arranged in alphabetical order and the maximum and minimum performance of each is given in order to show the variation and general tendency of the variety under these conditions. In the column headed "Number of Years Ripened" will be found a figure representing the number of years out of five that each variety ripened. This column is most useful in selecting a variety for this district. In the "Winter Injury" column, ten stands for perfect wintering, and O for complete winter-killing. As all varieties are protected, the great majority show a high value in this respect.

On the basis of earliness and general desirability, the following varieties may be recommended for this district:—

Blue

Peabody.
Cottage (home use only).
Early Daisy.
Craig.
Moore Early.

Red

Lindley.
Mary.
Brighton.
Delaware.

White

Wilkins.
Winchell (Green Mountain).

GRAPE TRAINING EXPERIMENT

There are numerous systems of training grape vines and each system has much to recommend it. In districts where winter protection is necessary, a system must be chosen which permits of the vines being laid down without undue injury. At this Farm what is known as the horizontal arm system had been used for a number of years on account of the ease of covering vines thus grown. In addition, as trouble had been experienced in ripening fruit, it was thought that vines trained in this manner would ripen fruit earlier, as the crop was borne close to the ground and would receive reflected heat from the earth during the day.

To obtain experimental evidence as to the best system for this district, an experiment was commenced in 1915 in which the following systems were adopted: Kniffin system (see fig. 1), Fan system (fig. 2), Upright arm system (fig. 3), Horizontal arm system (fig. 4).

From three years' results, using the same varieties in each system, it was found that the different methods of training stood as follows as regards yield:—

First—Upright arm system.
Second—Fan system.
Third—Kniffin system.
Fourth—Horizontal arm system.

It will be observed that the upright arm system gave by far the largest yield, with the fan system following. This is attributed to the greater amount of permanent cane in the Upright system, which produces just that much more fruiting wood. The Horizontal arm system, with only two permanent canes, produced by far the smallest amount of fruit, as would be expected, for two permanent canes could not produce as many fruiting shoots as five in the Fan system or as seven or eight in the Upright.

Despite the greater yield from the Upright arm system, the Fan system was adopted and is recommended where protection is necessary. The Upright arm system is too clumsy to lay down and almost impossible to handle in this way after three years. This is also true of the Kniffin system. The Fan system appears to embody the best combination of productiveness and ease of handling.

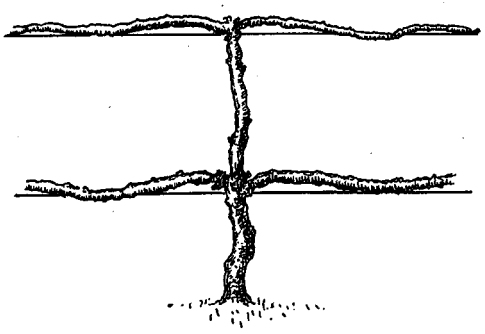


Fig. I. Kniffin system.

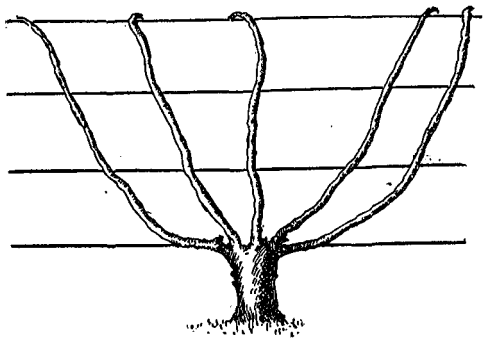


Fig. II. Fan system.

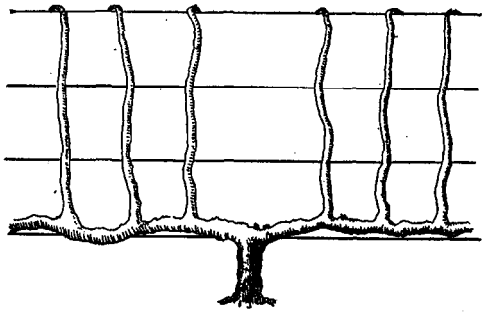


Fig. III. Upright arm system.

Fig. IV. Horizontal arm system.

PERFORMANCE RECORDS OF GRAPE VARIETIES

Variety	Average yield for five years	Range of yield for five years		Number of years ripened out of five		Average wintering for three years
		Max.	Min.	New plantation	Old plantation	
Abyssinia	7-7½	9-8	5-7	2	2	9·5
Advent	8-3	4-12	3-10	1	*2	9·4
Agawam	11-11	12-1	11-5	1	0	10·0
Aminia Black	11-13	13-4	10-6	2	*1	10·0
Aminia Red	16-12	17-13	15-11	1	*1	10·0
Bacchus	5-14½	6-0	5-13	2	0	9·8
Barry	11-11	16-1	9-3	1	4	9·8
Beta	13-¼	16-5	11-7	3	0	10·0
Brant	5-11	5-14	5-8	2	4	10·0
Brighton	8-7	10-11	6-11	2	5	10·0
Burnet	5-4	7-13	2-11	0	0	7·0
Canada	4-11	5-3	4-3	2	*3	10·0
Clinton	5-1	5-13	4-5	1	0	10·0
Columbian	1-4	2-2	0-6	0	0	8·4
Concord	7-3½	7-10	6-13	1	2	9·8
Cottage	10-14	11-1	10-7	3	5	9·6
Craig	5-9	6-10	4-9	2	3	9·*
Creveling	7-4¼	8-4	6-5	3	4	8·8
Delaware	8-11	10-3	7-3	3	5	9·9

PERFORMANCE RECORDS OF GRAPE VARIETIES—*Concluded*

Variety	Average yield for five years	Range of yield for five years		Number of years ripened out of five		Average wintering for three years
		Max.	Min.	New plantation	Old plantation	
Early Daisy	9–10½	15–15	6–6	3	4	9·9
Early Dawn	2–13	.....	.....	1	0	9·6
Early Victor	5–12½	6–1	5–8	3	3	9·4
Eclipse	5–5	.....	.....	1	2	9·4
Eldorado	11–0	.....	.....	4	*2	10·0
Emerald	10–2	.....	.....	0	1	10·0
Eumelan	17–0	19–4	14–8	2	4	9·9
Halo	1–11	.....	.....	0	3	9·3
Hartford	6–11½	8–6	5–4	3	1	9·5
Headlight	3–15	4–7	3–7	4	1	9·6
Herbert	10–2½	12–1	8–11	1	4	9·9
Kensington	5–8	6–12	4–4	1	1	9·6
Lucile	10–3½	11–10	8–13	2	4	9·8
Lutie	3–12½	5–1	2–8	3	4	8·0
Manitoba	10–5	14–2	7–7	4	0	9·8
Marion	15–14	18–5	13–7	1	*1	9·8
Martha	10–12	14–1	7–8	2	5	9·9
Mary	2–8	.....	.....	2	5	10·0
Massasoit	16–8	17–15	15–1	2	3	10·0
McKinley Early	19–0	.....	.....	1	0	10·0
McTavish	5–7½	5–8	5–7	0	0	10·0
Merrimac	10–11	14–7	8–1	2	4	9·9
Moore Diamond	11–1	14–4	5–9	3	5	9·3
Moore Early	3–15	.....	.....	4	5	9·3
Moyer	2–11	5–15	0–4	3	4	8 8
Naomi	3–7	4–1	2–13	2	2	10·0
Paragon	2–3	2–5	2–1	0	0	6·3
Peabody	19–10	21–1	18–5	2	3	10·0
Potter	6–13½	6–14	6–13	3	5	9·7
Poughkeepsie	9–8	10–11	8–5	2	2	9·6
Prentiss	4–11	5–2	4–5	2	2	10·0
President	20–9	.....	.....	1	1	10 0
Presley	7–1	.....	.....	3	3	10·0
Regal	8–14	.....	.....	1	0	9·3
Rogers No. 13	4–5	4–6	4–4	1	5	10·0
Rogers No. 17	10–0	17–14	5–10	2	*3	9·9
Rogers No. 24	9–12	10–11	8–13	2	5	10·0
Rogers No. 36	13–4	14–13	10–4	2	*3	10·0
Lincoln (Read Hybrid)	13–2½	14–5	12–0	2	5	8·5
Salem	6–12½	8–13	5–4	2	4	9·8
Saunders No. 1	6–9½	7–2	6–1	1	0	9·4
Sdlg. No. 1–1905	6–12	.....	.....	1	1	9·0
Sdlg. No. 1–1909	5–10½	7–9	3–15	2	0	9·1
Sdlg. No. 1 x Muscat d'Aout	8–7	.....	.....	0	0	10·1
Sdlg. No. 1 x Muscat Hamburg	5–0	.....	.....	1	2	9·6
Sdlg. No. 2–1909	0–6	.....	.....	2	0	8·6
Sdlg. No. 3–1905	0–5	.....	.....	0	.....	10·0
Sdlg. No. 4–1906	3–11	5–0	2–14	3	2	9·4
Sdlg. No. 6–1905	2–9½	3–5	1–14	3	0	8·3
Sdlg. No. 10–1906	5–0	.....	.....	0	0	9·6
Sdlg. No. 12–1906	2–1	3–2	1–0	2	0	7·3
Star Early	5–0	8–6	1–10	2	*1	9·1
Sunrise	5–6	.....	.....	0	0	10·0
Telegraph	18–1	21–1	13–12	4	3	9·8
Tukahoma	4–13	.....	.....	1	0	9·6
Ulster Prolific	4–9	5–12	3–6	0	1	8·3
Unico	10–0	11–12	8–4	3	*3	10·0
Vergennes	11–0	15–7	6–12	1	2	9·5
Whiting, G. H. from	14–4	16–8	12–0	2	0	10·0
Wilder	9–1	.....	.....	2	*2	10·0
Wilkins	15–4	18–1	12–7	3	2	10·0
Wyoming Red	6–8½	7–12	5–5	3	5	8·8
Yomago	1–9	2–5	0–13	1	2	9·1

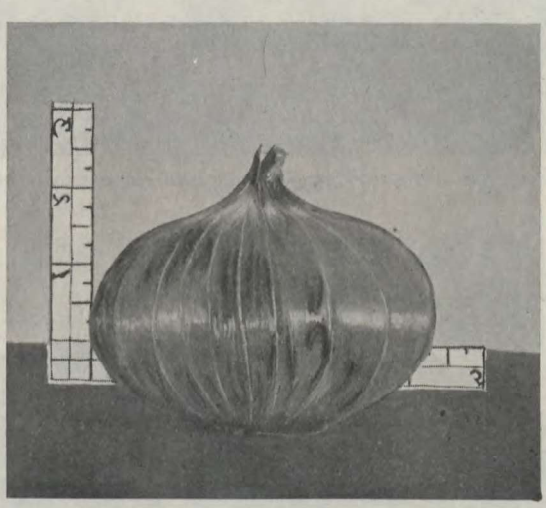
VEGETABLE GARDENING

During the past season, the work in vegetable gardening was quite similar in nature to that of former years, except that the improvement of special crops was stressed to a much greater extent than previously. The growing demand for improved strains of the various varieties of vegetables has been the cause of the change in our objective, consequently it has been found necessary to devote more attention to selection work and hybridizing.

With the development of this field of endeavour, and finding that the results obtained from this line of work, carried on formerly, are satisfactory, it has been found necessary to propagate the strains segregated, in sufficient quantities to introduce them throughout the country. The growing of seed from these strains has been carried on as extensively as possible, and a wide distribution made to interested parties. In fact seed of these strains was sent to England, Russia, China, New Zealand, Australia, South America, Central America and the United States. A reciprocal exchange of varieties was arranged which has brought in considerable material for further work.

The crops that have been under improvement by selection are carrots, beets, onions, lettuce, radish, celery, cabbage, beans, peas, tomatoes and corn.

Breeding work was conducted with corn, cucumbers, squash, pumpkins, beans, peas and tomatoes.



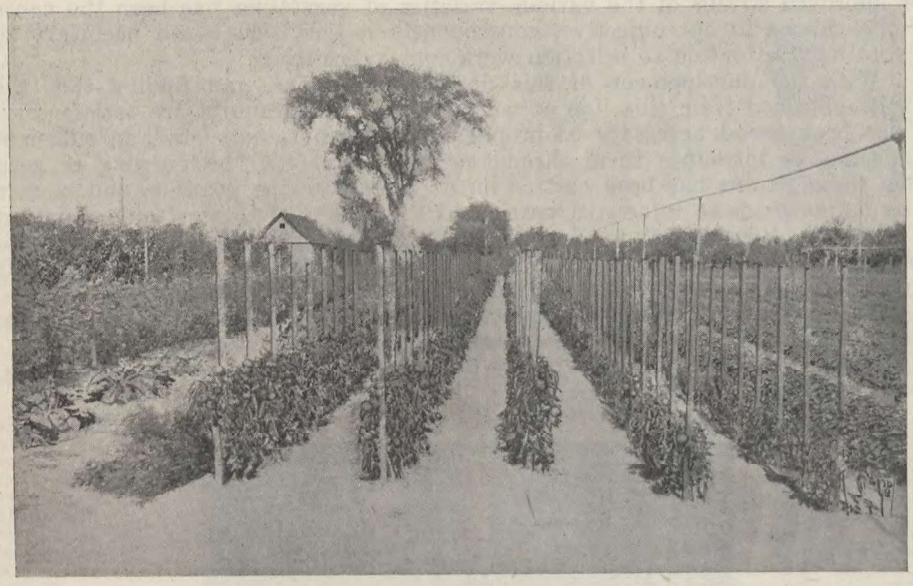
A selected specimen of large Red Wethersfield Onion, for seed growing.

VARIETY TEST OF TOMATOES

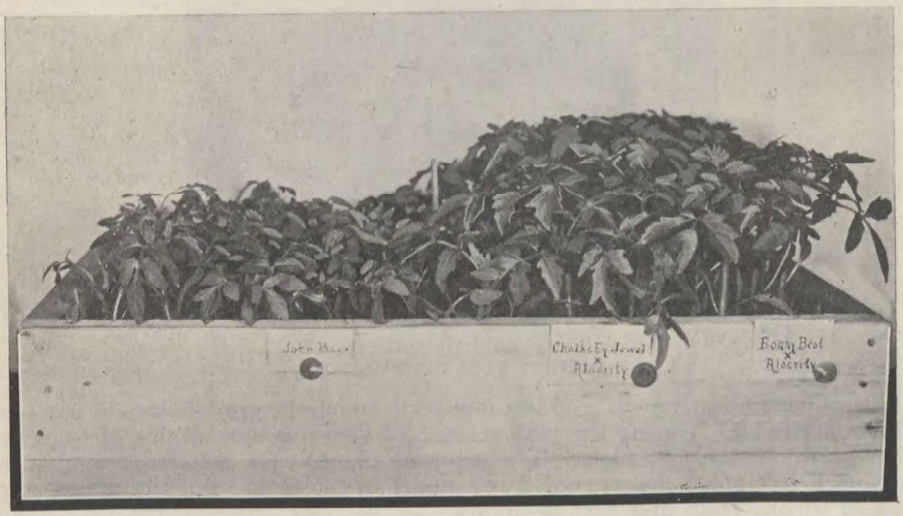
Earliness in the tomato crop is a feature to which the growers should pay particular attention. During the past season, 33 varieties and strains of tomatoes were grown in the test plots. Ten vigorous plants were selected and planted in rows 3 feet apart and spaced 2 feet apart in the rows. All the plants were trained to one stem and tied to stakes.

The object of this experiment was to find the varieties which would yield a fair percentage of ripe fruit in the early part of the tomato season. This in itself is but one phase of the work as there is a large portion of the country where the regular, standard, late-ripening, heavy-bearing varieties will not yield satisfactory returns excepting when very favourable years occur, whereas, with a

variety that produces considerable ripe fruit in the early part of the season, a fair amount can be obtained for use. It is well known that the earliest-maturing varieties are not always the best, but where special demands are to be met, or a crop grown under short season conditions, then it is necessary to resort to the use of such early maturing sorts so as to achieve the desired objective.



Variety Test of Tomatoes trained to one stem and tied to stakes.



Note the vigour of the F. 1. Cross-bred Tomato plant.

In the accompanying table, it will be noticed that the varieties are listed in order of heaviest yield during the first two weeks of crop. The varieties leading are Alacrity and Alacrity crosses, both originated at the Experimental Farm, Ottawa. This same statement bears true of the yield for the first month

except that Alacrity 1 drops from first to fourth place. In some cases, heaviest yield for the total season's crop might be of value, but the decision should be based to some extent on the average weight of the fruits throughout the season. It should be pointed out that many of the small fruited yield abundantly, and, as a consequence, are liable to be misleading.

TOMATOES ON STAKES IN ORDER OF YIELD EARLY RIPE FRUIT 10 PLANTS IN EACH LOT

Record number	Variety	Average weight of fruits in ounces	Yield of first two weeks		Yield of one month		Total marketable ripe fruit	
			lbs.	oz.	lbs.	oz.	lbs.	oz.
3053	Alacrity 1	4·08	9	2	12	5	22	2½
3062	Alacrity x Hipper 5	4·25	7	13	15	11	31	10½
3056	Alacrity 10	4·27	7	0½	13	14½	24	9½
3055	Alacrity 6	3·79	6	7	12	8	20	10½
3057	Alacrity Earliest ripe 21	3·85	6	0	14	8	22	2½
3058	Alacrity (Keith)	4·99	5	6	11	1½	26	8½
3067	Earliana x Tree Tomato	4·15	4	11½	8	13½	26	12
3076	The Bolgiano	4·54	4	9	11	7	27	0
3061	Alacrity x Hipper 2	3·91	4	7½	13	11½	26	2½
3085	Danish Export x Alacrity 7	1·85	3	14½	6	11	13	8½
3083	Danish Export	2·31	3	12	8	14	35	8
3060	Alacrity x Earlibell 4	2·55	3	8	11	13½	30	2½
3059	Alacrity x Earlibell 1	5·1	3	4	8	14½	19	12½
3054	Alacrity 4	3·82	3	3	10	14½	20	12½
3065	Earliana Nor. Adirondack Gr. 3	4·72	3	1½	5	8½	20	12½
3078	Burbank Early	3·87	2	6½	9	3½	32	11½
3084	Danish Export x Alacrity 5	2·36	2	1	5	5	27	15½
3063	Alacrity x Hipper 6	4·29	1	14½	8	9½	21	7½
3066	Select Earliana	4·85	1	13½	7	15½	25	7½
3075	Hudson Valley Maid (only nine plants)	5·0	1	10	7	3	36	10
3068	Victory (Bond)	2·35	1	8	8	8	37	10
3077	Froxfield	3·45		13½	3	10	25	15
3081	Chalk Jewel	4·6		13	7	10½	29	14½
3082	Victoria Whole Salad	2·62		11	5	10½	48	8
3080	Bonny Best	4·47		5½	5	6½	27	11
3070	Victoria	2·61		4½	4	15	56	7½
3079	John Baer	4·75	.....		6	14½	30	14
3071	Acme	4·27	.....		5	8½	38	3½
3064	Pink Tomato	5·96	.....		5	7	33	3
3069	Victory (Bolgiano)	5·7	.....		5	2	31	12
3073	Ponderosa	8·22	.....		2	1½	18	8
3074	Perfection	5·94	.....		1	8	19	5
3072	Albino	7·65	.....		.....		33	8

In the preceding table the value of the Alacrity tomato and crosses is very well shown, both from the standpoint of earliness, yield and average size of fruit. These features recommend this variety for particular localities, for which ample proof is available, in the numerous reports received from the experimenters in the Western provinces and Northern Ontario, Quebec and the Maritime Provinces.

CELERY

Twelve varieties of celery were tested this year in the plots. The celery crop was, without exception, extraordinarily good. From the time of sowing the seed, April 22, until planting was done in the field, June 29, the plants made continuous, unchecked growth. Seasonal conditions favoured the crop greatly, and disease was not in evidence to any appreciable extent.

It is important, in connection with raising the plants for a crop of this kind, to commence spraying with Bordeaux mixture when the plants are still quite small in the hotbeds and to continue to spray at regular intervals of ten days after the plants have been planted in the field. The Bordeaux spray is the most effective control for celery blight. The addition of black-leaf-forty to the Bordeaux mixture will help to control sucking insects.

Success in growing celery is based on how successfully the plants are kept growing from sowing the seed until harvesting. To check the development of the plants is a known cause for failure with this crop.

The varieties which have been found most satisfactory are : Golden Self Blanching, French Success and Evans Triumph.

CORN IMPROVEMENT

The selection work with sweet corn was continued this year, but in a slightly different manner to that of former years, in that formerly the strains segregated were used entirely for mass selection. This mode of procedure really gave a recombining of the characters found in all the strains, so that, relatively speaking, it was impossible to accomplish the desired objective. This year, isolated strains were grown apart from the principal seed plots with a view of obtaining the individual plants possessing desirable characters such as length of ear, number of rows per ear and number of ears per stalk. At the end of a three-year period of continued rigid selection and selfing, it is planned that these strains be recombined to establish the desired types if possible.

Three varieties of Ottawa-grown sweet corn are being treated in the manner mentioned. The three varieties, namely Pickaninny, Early Malcolm and Sweet Squaw, already possess very desirable qualities, but really require perfecting along the lines of constancy of type. These all originated at the Experimental Farm, Ottawa.

To point out the value of these three varieties, a comparison with our best quality sweet corn will show the direction of our efforts.

SWEET CORN—SELECTION WORK

Variety	Colour of kernels ready for table use	Average number of days planting to ready for use	Average height of plants in inches	Number of rows per ear	Length of ears in inches	1922 yield from twenty hills. Number ears	Quality
Pickaninny....	Dark.....	64	40	8-10	4-5	105	Tender, compares favourably with G. B.
Early Malcolm	White.....	70	66	12	6	104	More tender and sweeter than Cory.
Sweet Squaw..	White.....	72	72	12	6	102	Compares favourably with Early Malcolm.
Golden Bantam.	Yellow.....	82	84	varies	varies	110	Exceedingly good quality, tender.

In addition to the selection and breeding work with corn, a comparison test was made with fifteen varieties offered by the seedsmen. These varieties embraced all kinds of table corn and it may be safely said that Golden Bantam is the leading variety for quality, followed by Golden Giant.

PEAS

Sixty-nine varieties of garden peas were under test during the past season. These included all types, early smooth, dwarf, intermediate and tall. There is such a vast difference in the various varieties as to yield and quality that it is deemed necessary to mention only the varieties which are considered of the greatest value. In the dwarf class, many varieties are being offered, but it

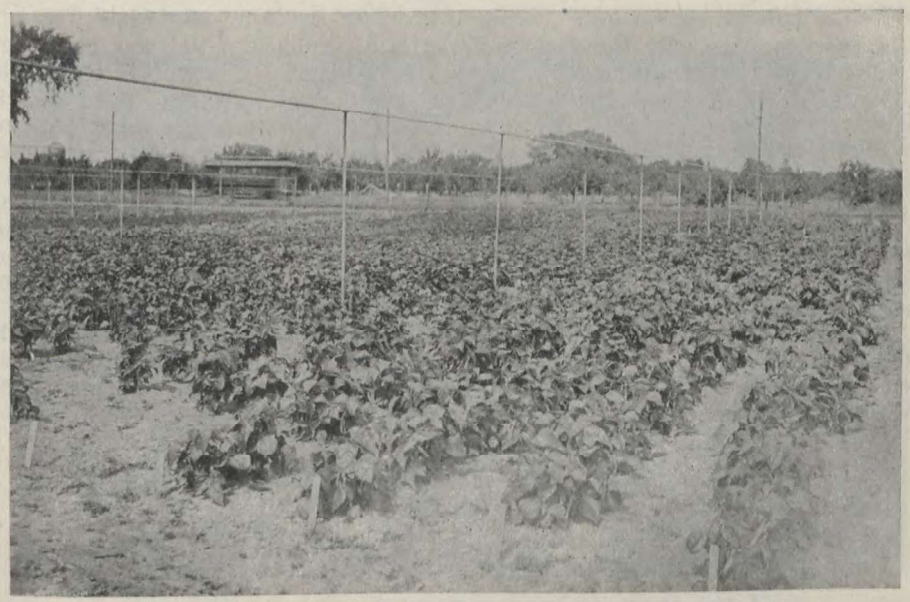
has been found that English Wonder possesses more of the desired qualities than any of the other varieties. This pea is very productive and produces well-filled pods.

Amongst the intermediate varieties there is a greater scope of choice and especially when a great range of the season is to be covered so as to provide an abundance of tender peas. Thomas Laxton is an outstanding variety when considering sweetness and quality, but, unfortunately, does not produce a very large crop. However, on quality it deserves a place as one of the leading early intermediate varieties. Gradus is an excellent variety which is slightly later than the former, but possesses excellent quality and is recommended for a second early intermediate sort. The best main crop variety is, without question, Stratagem. This variety had been a leader for many years, and stands at the head of the list for a main crop. The vines are intermediate in height and bear abundantly pods of medium to large size which average around five peas per pod.

While the tall varieties have been tested, yet it is not considered, under conditions here, advisable to grow this type of pea. Telephone has been found one of the best of the tall varieties as to yield and quality.

BEANS

Dwarf or bush beans are such an important crop that considerable care has been taken in connection with the comparison tests. During the past season, thirty-seven varieties and strains were under test, which included both wax and green pod varieties. It may be safely said that in both of these classes of beans, very desirable qualities are to be found, and while the preference may be shown in most cases for the wax-podded sorts, yet the quality of some of the green-podded varieties places these two classes on a par.



Round Pod Kidney Wax Beans. The progeny of heavy-bearing plants.

Below will be found the four varieties, both wax and green-podded, that have been found to possess the most desirable qualities. These are arranged in order of the number of days from planting to ready for use, and based on yields obtained over a period of four years.

WAX PODDED AND GREEN PODDED BEANS

—	Average number days planting to ready for use	Average number days planting to ripening	Average yield ripe seed from 30 feet row	
			lbs.	oz.
Wax Podded—				
Pencil Pod Black Wax	49¾	101	2	2
Grenell or Golden Wax	52	99	4	4
Round Pod Kidney Wax	53¼	110¼	4	8¾
Hodson Long Pod	71	119¼	4	4
Green Podded—				
Bountiful	51	97½	3	2¾
Extra Early Red Valentine	51	99¼	4	8¾
Stringless Green Pod	51	108	2	14½
Masterpiece	54	103	4	5

In the foregoing arrangement it will be noticed that it was not the variety requiring the fewest number of days from planting to ready for use that gave the largest total yield in an average for four years. It should be noted, where earliness is an important factor, that in both the green and wax podded varieties these qualities are obtainable.

RHUBARB

In connection with the various varieties of rhubarb, a test was made with ten sorts which extended over a period of five years. Many of the so-called varieties were found to be badly mixed, or were merely seedlings of the varieties under the names of which they went. In fact in several cases there was only a couple of plants within the variety that were actually true. Ten plants were set out in rows four feet apart, with the plants three feet apart in the rows.

The object of this test was to ascertain the value of the various named varieties available, and from the results of this test it seems that there are only three of these varieties that are worthy of being recommended, from the standpoint of size of leaf-stalk, yield and quality. In this respect Victoria, Linnaeus and New Zealand are outstanding.

Each season the crop was harvested in four pullings and the stalks graded for size and length, into marketable and unmarketable. The marketable grade constituted all medium to large stalks twelve inches in length and over, while the unmarketable grade took in all stalks under twelve inches in length or which were small in size.

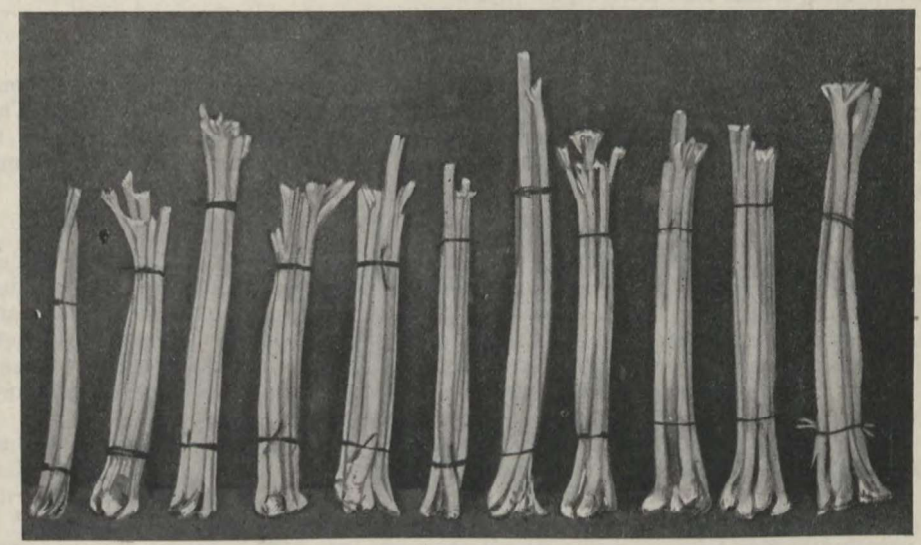
In the following table the varieties are arranged in order of merit:—

RHUBARB—TEST OF VARIETIES

Variety	Average date ready for use	Colour of stalk	Type of stalk	Five-year average four pullings		Quality
				Marketable	Unmarketable	
				lbs. oz.	lbs. oz.	
Victoria	19–V	Red	Medium size, long	110 13	.....	Good
Linnaeus	18–V	Pinkish red	Small medium long	80 ..	.....	Good
New Zealand	18–V	Reddish green	Large medium to long juicy.	52 10	.....	Medium good
Early Raspberry	16–V	" ..	Stringy tough	96 12	.....	Medium poor
Prima Donna	16–V	Bluish green..	Small stringy tough	86 5	3 7	Poor
Monarch	18–V	Green	Stringy	57 2	1 2	Medium poor
Hobday Giant	15–V	"	Stringy, tough angular ribbed	77 2	4 1	Poor
Paragon	16–V	"	Angular, short, small	62 6	2 ..	Poor
Cyclope	16–V	"	Small, stringy angular	75 2	.....	Poor
Champion (Daw)	19–V	Reddish green	Stringy	49 7	1 2	Medium poor

Victoria and Linnaeus are both well-known varieties and require little description as to character of growth and quality, but as the third-mentioned variety is of New Zealand origin, and not extensively grown in this country so far as is known, it might be well to point out that it is of fairly good quality. The habit of growth of the plant is similar to the other varieties but it does not develop seed heads as freely, which is a very important feature.

Improvement work by selection of seedling plants grown from seed of Victoria rhubarb has been under way for some years. Four strains of rhubarb have been obtained which are a great improvement upon the original



Varieties from left to right—Cyclope-Hobday Giant, Prima Donna New Zealand, Early Raspberry, Linnaeus, Victoria-Ottawa Seedling Nos. 10, 7, 3 and 1. Photo shows type of marketable leaf stalks taken from fourth pulling.

parent variety. The size, length, colour and freedom from stringiness in the leaf-stalks are the features most prominent in these strains, coupled with juiceness and lack of extreme acidity. These give the new seedlings a prominent rating, when compared with the commercial varieties.

These strains are numbered 1, 3, 7 and 10. The No. 1 and 10 strains are very productive, but No. 10 is outstanding as to quality. The stalks in all these seedlings are deep red externally and the red colouration is carried well into the stalks. During last season, the first pullings were made from these seedlings. A comparison with Victoria will be found in the accompanying table:—

RHUBARB SEEDLING VARIETY TEST, 1922
Ten Plants Each

Variety	Colour of leaf stalks	Record No.	First cutting	Last cutting	Marketable total yield	
					lbs.	oz.
Red Seedling No. 1	Red	23	16-V	30-V	75	8
Red Seedling No. 3	"	24	"	"	61	12
Red Seedling No. 7	"	25	"	"	66	0
Red Seedling No. 10	"	26	"	"	70	8
Victoria	"	27	"	"	56	4

BEETS

In reviewing the tests conducted during former years, the results obtained show that, out of the many varieties of beets offered, only a few of these so-called varieties are worth mentioning,; the others lack in quality to such an extent that they are unworthy of a place in the table beet class. Table beets cannot be judged entirely upon yield per acre, as in the case of field crops, but must be looked upon from the standpoint of tenderness, sweetness and colour, when prepared as a table vegetable. Few of the varieties offered conform to these requirements. The three which have proved most satisfactory are Detroit Dark Red, Black Red Ball and Eclipse.

BRUSSELS SPROUTS

The testing of Brussels sprouts over a five-year period has given poor results. This crop has not been a complete success during any season. The variety that did best, taking the average of five years into consideration, is Paris Market. It is quite dwarf in habit and formed, on the whole, more plump sprouts.

CABBAGE

In addition to the improvement work by selection of Extra Amager Danish Ballhead, a variety test was conducted. Twenty-nine varieties and strains were compared, and the results show that the varieties of best quality are unquestionably, in the earlies, Early Jersey Wakefield, Copenhagen Market; medium, Succession, and, late, Extra Amager Danish Ballhead and Drumhead Savoy. The red varieties did very well. Delecatessa is a very satisfactory variety, forming very solid heads of excellent quality.

To obtain plants for the early crop, the seed was sown in a mild hotbed April 13, and for the main crop the seed was sown in a cold frame May 13.

LETTUCE

A comparison test composed of sixteen varieties of lettuce was conducted. The results of the test show that Grand Rapids is the leading loose leaf variety followed by Black Seeded Simpson. Iceberg is, without doubt, one of the best

of the cabbage-headed varieties and keeps in form longer into the summer. New York, Giant Crystal Head and Crisp as Ice are very satisfactory varieties also.

Selection work has been conducted with two varieties of lettuce, Grand Rapids and Early Paris Market. The latter mentioned variety is an excellent small-headed sort for forcing. The Ottawa strains of both of these varieties have been found outstanding for uniformity as to type and quality.

BEAN AND PEA SELECTION

Bean improvement by selection has been undertaken on a quite extensive scale. The object of this experiment is to find out to what extent continued selection will influence the productiveness of the varieties and strains. The progeny of one plant from each variety was the original stock and by careful compilation of data regarding the yields obtained from each high yielding individual, it is hoped to prove or disprove the theory of constant selection as a means of maintaining strains that are high yielding. Seventeen varieties of beans were used in this work. but as this work has been conducted during only two seasons, it is not deemed advisable to make any definite statement at present as to the results obtained, except that some very high-yielding individual plants have been obtained. Should the progeny of these maintain a reasonable degree of the productiveness of the parent stock it may then be considered that progress has been made.

Improvement of garden peas has been conducted along the lines of the bean selection work. The results of this test have been essentially the same as in the case of the beans. Forty-five commercial varieties and strains were experimented with, and, in addition, further selection work was carried on with the pea hybrids, with the result that some very promising material has been obtained.

SEED DISTRIBUTION

The distribution of seed of the varieties of vegetables being improved in this division has yielded good information regarding the various strains. During the early part of the winter, 995 applications were received and placed on the mailing list to receive samples for testing. Had more seed been available, it would have been possible to have supplied double the number, as applications kept coming in until late into the season.

To obtain information regarding the different varieties from the different provinces, the collections of seed comprising five varieties each, were arranged in groups. These groups were then divided so as to have a certain number of packages of the different collections sent to the experimenters in the various localities.

While a large percentage of those receiving these packages took care to report their findings carefully, which is appreciated very much, as this information carefully compiled with fair criticism is of the greatest value in this work, there was a smaller number of experimenters whose reports were made out ostensibly to keep within the requirements so as to be kept on the mailing list for another year, but whose reports were too vague to be of any use. A still larger number did not report at all. The following figures will show the number of experimenters that reported and as classified: Clear reports, 233; Vague reports, 179; No reports, 458.

From the 233 good reports which came from all parts of Canada, and are pretty well distributed, it is possible to gain a fairly comprehensive idea of the relative value of the varieties, and to these experimenters we extend our thanks for this co-operation.

In addition to the general distribution in Canada, a reciprocal exchange of varieties was arranged between England, Russia, China, and Central America. The material thus received is to be used for further breeding work, or, if found of value as to quality and productiveness, may be an acquisition to the varieties which we already have.

In addition to the trial samples of seeds sent out to the various experimenters, samples were also sent to the twenty-five branch Farms throughout Canada. This work required 975 packages of seeds. Very valuable criticism has been received regarding the value of the Ottawa-grown strains, from the superintendents of the various Experimental Farms.

STORAGE OF CABBAGE AND CELERY FOR SEED GROWING

Storage of cabbage and celery for seed growing, without considerable loss during the winter months, has been quite a problem, as during the winter of 1921-22, practically all the cabbage and celery plants were damaged to such an extent by fungus diseases that only about 60 per cent of the cabbage stored were fit to plant out the following spring. The celery was almost a complete loss in the storage cellar. The remaining few plants when set out in the field died. Formalin treatment of the soil, previous to storing, had been tried as a means of cleansing the soil, but from the results obtained, it seems that this method is not a success. In addition to the formalin treatment of the soil, the plants were sprayed with Bordeaux mixture at regular intervals.

During the fall of 1922 there was placed in the same storage cellar 780 Extra Amager Danish Ballhead cabbage, and 1,473 Golden Self Blanching celery. Previous to storing the plants, an experiment was started with Bordeaux dust. This material was spread over the sand floor of the root cellar at the rate of 2 pounds per 15 feet square of floor space. The roots of the plants were then placed in this mixture of Bordeaux dust and sand, and Bordeaux dust applied at once over the tops of the plants, and at regular intervals of ten days apart, during the period of storage.

For a check on the dusting experiment, another lot of cabbage and celery was placed in the cellar and treated, in every respect, in a similar manner, except that the dust was omitted. By December 27, *botrytis* had made its appearance, and celery blight had also done severe damage to the celery plants. The plants were then attacked by soft rot which completed the destruction.

The results of the test are in brief, that the plants treated with Bordeaux dust showed very little damage from disease; 92 per cent of the cabbage were in perfect condition for planting April 28 and 67 per cent of the celery plants were found to be in first class condition.

While this experiment has only been tried but once, yet it seems probable that a much greater degree of success can be obtained in connection with carrying over the seed stock, where dusting is done.

POTATOES

Both variety and cultural tests of potatoes were discontinued last year, due to the prevalence of mosaic and leaf roll. It was discovered that most of the C.E.F. grown seed was badly diseased and this necessitated discontinuation of the tests. New seed of the various varieties was purchased, all of which was certified seed, and it is planned to resume the tests in the near future.

It might be well to draw the attention of growers to the fact that the three above-mentioned diseases are extremely common throughout the country and, in the interests of crop production, we would recommend that community co-operation be encouraged so as to minimize these diseases. The course which is most likely to yield results is for growers of this crop to ascertain if their seed stock is affected with disease; if so, get rid of all diseased plants or if necessary, get certified, disease-free seed for another year, also try to get other growers to purchase similar seed. In this way wipe out the possible source of infection of new stock from nearby fields that may be diseased.

Spraying is an important protective means against the introduction and spread of the above diseases by insects, especially aphis and leaf hoppers. By the use of a combined spray, leaf-eating and sucking insects, as well as blight,

can be kept under control. Use 4-4-40 Bordeaux mixture in combination with nicotine sulphate and arsenate of lime, the nicotine sulphate to be used at the rate of 6½ ounces to every forty gallons of Bordeaux mixture. This will destroy the aphis and leaf hoppers. If beetles are present, add 1½ pounds of arsenate of lime to the above mixture. This form of combined spray has been found very effective.

FORCING HEAD LETTUCE IN GREENHOUSE

Experiments in the forcing of head lettuce in the greenhouses were begun in the winter of 1917-18, and have been continued each winter since, or for five consecutive seasons. It has been determined by these experiments that one variety, the Early Paris, is the most satisfactory, and good results from the growing standpoint have been obtained with it, the plants heading well and there being little or no scald.

Object of the Following Experiment

First, to compare Early Paris head lettuce with Grand Rapids loose leaf for length of time required to come into condition for sale, the night temperature being kept as if the whole house were Grand Rapids.

Second, to compare Grand Rapids six by five inches apart with Grand Rapids six by six inches apart.

How the Experiment was Conducted

The vegetable house was used for this experiment and the plants were planted both in the bed and on the benches. The average night temperature was 45° F. The soil was sandy loam.

Date seed was sown—November 11, 1921.

Date of transplanting into flats—December 1, 1921.

Date of planting in beds and benches—January 12, 1922.

Total area occupied by plants in bed—440 square feet.

Total area occupied by plants in benches—408 square feet.

LETTUCE—FORCING IN GREENHOUSE

Variety	Number of plants	Distance apart	Date of first harvest	Date of main harvest	Number of marketable plants	Weight of marketable plants		Number of unmarketable plants	Weight of unmarketable plants		Average weight per marketable plant
						lb.	oz.		lb.	oz.	oz.
BED—											
Early Paris	1,248	5" x 5"	25/2/22	9/3/22	1,211	217	6	37	3	14	2·86
Grand Rapids	440	6" x 6"	24/2/22	.....	440	53	12	.....	.....		1·95
Grand Rapids	520	6" x 5"	24/2/22	.....	520	49	4	.....	.....		1.51
Total	2,208	.....	.....	.....	2,171	320	6	37	3	14	.....
EAST BENCH—											
Early Paris	326	6" x 6"	2/3/22	16/3/22	304	69	2	22	3	0	3·63
Grand Rapids	468	6" x 6"	25/2/22	7/3/22	449	92	0	19	2	4	3·27
Total	804	.....	.....	.....	753	161	2	41	5	4	.....
WEST BENCH—											
Early Paris	330	6" x 6"	6/3/22	16/3/22	305	76	3	25	2	15	3·99
Grand Rapids	462	6" x 6"	3/3/22	.....	448	85	7	14	1	9	3·05
Total	792	.....	.....	.....	753	161	10	39	4	8	.....
Total yield from whole house	.....	.....	.....	.....	3,677	643	2	117	13	10	.....

YIELDS FROM ALMOST EQUAL AREAS OF EARLY PARIS 5″ x 5″, GRAND RAPIDS 6″ x 5″ AND GRAND RAPIDS 6″ x 6″

Variety	Number of plants	Distance apart	Number of marketable plants	Weight of marketable plants		Number of unmarketable plants	Weight of unmarketable plants		Average weight per marketable plant
				lbs.	oz.		lbs.	oz.	oz.
Early Paris.....	624	5″ x 5″	605	108	11	18	1	15	2·87
Grand Rapids...	440	6″ x 6″	440	53	12	.....	.....		1·95
Grand Rapids...	520	6″ x 5″	520	49	4	.....	.....		1·51

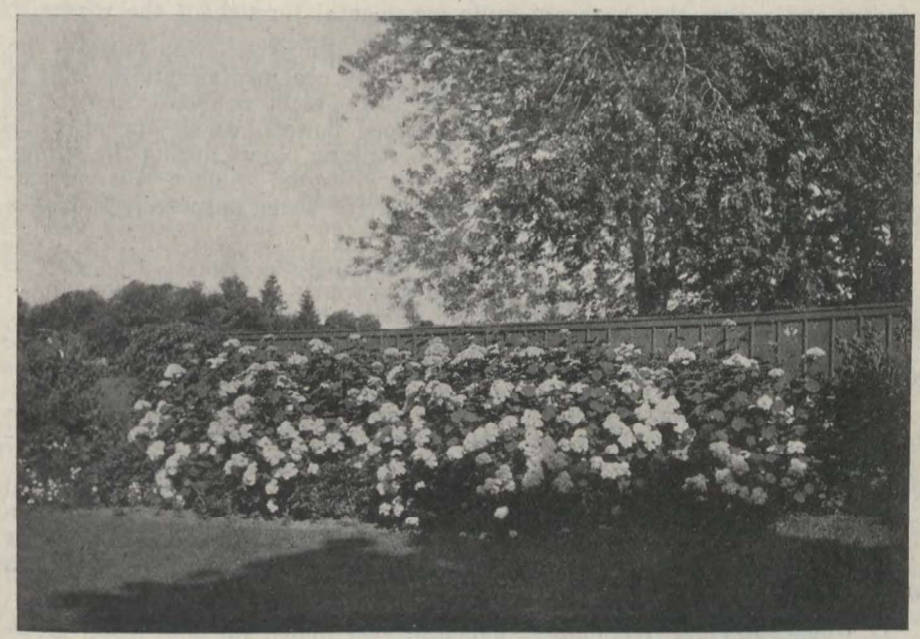
Time Spent on Various Operations

Sowing seed	½ hr.
Transplanting	30 "
Planting in beds and benches	49 "
Watering	14 "
Cultivation	7 "
Harvesting	17 "
Total	117½ "
Time and cost of work with Grand Rapids.....58·27 hours at 40c	$ 23.31
Time and cost of work with Early Paris.....58·70 hours at 40c	23.48

ORNAMENTAL GARDENING

BEST ORNAMENTAL SHRUBS HARDY AT OTTAWA

Many species and varieties of ornamental shrubs have been tested at the Central Experimental Farm, Ottawa, and at the Branch Farms and Stations during the past thirty-six years, and notes have been made on their hardiness and attractiveness of foliage, flowers, form, and fruit. The height to which they grow has also been recorded. There has been a great increase in interest in the beautifying of home grounds in recent years, and it is hoped that the following



Hydrangea arborescens grandiflora. Snowball Hydrangea.

descriptive list of species and varieties found to be the best at Ottawa will prove of value to those who contemplate improving the appearance of their places. This list is mainly of species and varieties with ornamental flowers. It is hoped to publish later an additional list, ornamental in foliage and fruit only.

Amelanchier laevis (Shad Bush) (June Berry)—Eastern Canada and Eastern United States.—There are several native species of *Amelanchier* which bloom early in the spring and are very ornamental at a time when there are few kinds of shrubs in bloom. Some, such as *A. alnifolia var. pumila,* are quite dwarf, while others become small trees. Perhaps the most ornamental is *Amelanchier laevis,* also called *A. canadensis,* which, early in May, is covered with loose, drooping racemes of white flowers. The first leaves, which are developing at this time, are purplish and make a pleasing contrast to the flowers. It reaches a height of from thirty to forty feet. Some of the June Berries have large fruit, which is of good quality. It is known in the prairie provinces as Saskatoon. Another common name is Service Berry.

Amorpha canescens (Lead Plant)—Southern United States.—An attractive, summer-blooming shrub with divided leaves and small, bluish flowers on long, close spikes. It grows about three feet in height, and looks well on a bank or in any stony or rocky place. It blooms during June and July.

Atraphaxis frutescens (*A. lanceolata*)—Caucasus, Turkestan, Siberia.—This is an attractive, low-growing, hardy shrub, flowering in summer, the blooms remaining attractive until autumn because of the calyx being persistent. It belongs to the buckwheat family, the flowers are suggestive of those of buckwheat and are pinkish in colour.

Berberis Thunbergii (Japanese Barberry)—Japan.—Height 2 to 4 feet. The best barberry for ornamental purposes. It is a dwarf, compact shrub, with bright green leaves in summer, changing in autumn to dep red. The flowers, while not very striking, are attractive. The scarlet fruit is borne very profusely and makes this barberry quite ornamental throughout the winter.

Caragana arborescens (Siberian Pea Tree)—Siberia, Manchuria.—The Siberian Pea Tree is one of the most useful hardy ornamental shrubs for it is really a shrub, though reaching a height of fifteen to eighteen feet or more. The foliage is attractive, and the yellow, pea-shaped flowers, which appear while the leaves are still young in May, make it a striking object during the spring. Because of its great hardiness and its ability to withstand drought, it is particularly useful on the prairies as a windbreak and for hedge purposes. It makes a very good hedge in Eastern Canada also.

Caragana frutex var. grandiflora (Large Flowered Caragana)—Caucasus.—Height 4 to 6 feet. In bloom third week of May. Flowers large, bright yellow, pea-shaped. Very pretty when in full bloom. This variety resembles *C. frutex,* or *C. frutescens* as it is sometimes called, but has larger flowers than this species. The bush is somewhat pendulous, which makes it rather graceful.

Caragana pygmaea (Dwarf Caragana)—Caucasus to Siberia and Thibet.—This species of Caragana differs very much from the others, but has an attractiveness all its own. It is a comparatively low-growing shrub of spreading habit, reaching a height of about four feet. The leaves are of duller green and narrower than either *C. arborescens* or *C. frutex,* and the flowers, which are in bloom in May, instead of being altogether yellow, are orange and yellow. This makes a neat, low-growing hedge plant, though the leaves are rather too dull in colour for best effect.

C. tragacanthoides resembles *C. pygmaea* very much, but is of looser-growing habit.

Chionanthus virginica (Fringe Tree)—Eastern and Central United States.—The Fringe Tree is usually really a shrub and one of the most interesting hardy species. It blooms in June after the flowers of most hardy shrubs are gone. They flowers are white and borne in long, loose panicles, and this, combined with their narrow petals, gives them the fringe-like look which suggests the name. Some shrubs bear only staminate flowers, and these are more ornamental than the others, as the panicles are larger. Specimens of this shrub are now about nine feet in height at Ottawa, but where native it will grow from twenty-five to thirty feet high.

Clethra alnifolia (Sweet Pepperbush)—Eastern United States.—One of the latest-blooming shrubs, being in flower from July to September. It grows from four to eight feet in height, and has small, sweet-scented, white flowers which bloom in compact racemes. This shrub succeeds best in rather moist soil. Another species, *Clethra acuminata,* is a taller grower, and is quite hardy at Ottawa.

Cornus alba sibirica (Siberian Dogwood)—Siberia, North China.—The Siberian Dogwood is attractive when it is in flower in late May or early June, but it is especially so in winter, when the bright-red bark is very striking. There is a yellow-barked dogwood called *Flaviramea* which looks well in winter in contrast with the red bark of the others.

Cytisus (Broom).—None of these is a very important flowering shrub in Eastern Canada, though a few of the lower-growing species are fairly hardy and quite ornamental. The hardiest is, perhaps, *Cytisus elongatus,* with bright but rather pale yellow flowers. *C. ratisbonensis* is very like it. These bloom in the latter part of May and are quite showy at that time. The bushes reach a height of about three feet.

Cytisus nigricans, which blooms in June and July, later than *C. elongatus,* is more ornamental than the latter, as the flowers are of a richer yellow and are in long, slender racemes, but it is not perfectly hardy at Ottawa and gradually kills out.

Another *Cytisus,* which blooms well every year, though the tips of the branches are usually killed back, is *Cytisus purpureus* and its varieties. This pretty shrub is low-growing, being two feet and under in height. The flowers vary in colour from light pink to purple. It is in bloom in May. A cross between this and *C. hirsutus,* namely *C. versicolor,* with pale-purple and light-yellow flowers, is trailing in habit.

Another low-growing species about one foot in height and very ornamental is *Cytisus purgans.* This usually blooms well and is practically covered with flowers of the rich yellow colour of the well-known Broom.

Daphne Mezereum—Europe to Altai and Caucasus.—The very sweet-scented flowers of this shrub appear in the latter part of April, and are among the first spring flowers. The flowers are pink, but there is a white-flowered variety also. This shrub will eventually reach a height of about four feet.

A low growing, almost creeping species, *Daphne Cneorum,* is very hardy also, and is one of the most sweet-scented of flowering shrubs. The flowers are pink also.

Deutzia gracilis—Japan.—This is a charming little shrub, reaching a height of about three feet, blooms during the early part of June, and is a mass of white flowers. It is not so hardy as *Deutzia Lemoinei,* which is quite hardy at Ottawa, though not so attractive as *D. gracilis.*

Diervilla hybrida.—One of the hardiest and most attractive of these at Ottawa is Eva Rathke. It begins blooming in June and continues throughout the summer. The flowers are very attractive and dark-red in colour. It grows

from three to five feet in height. Most of the Weigelias are too tender at Ottawa. Some specimens of *D. rosea* are fairly hardy.

Forsythia suspensa (Golden Bell)—China.—The Golden Bell blooms before the leaves are out in the spring, and if the flower buds are not killed in winter the branches will be covered with yellow flowers. It is a graceful shrub of pendulous habit, reaching a height of six to eight feet. Owing to the danger of the flower buds being killed in winter, it would be desirable to plant these shrubs where they will be out of the sweep of the wind. The hybrid variety, *F. intermedia,* though little, if any, hardier, is a very free bloomer, and its variety, *spectabilis,* has deeper-coloured flowers.

Genista tinctoria (Dyer's Greenweed)—Europe, West Asia.—Nearly all the *Genistas* winter-kill at Ottawa, but this species, which has deep-yellow flowers, though killing back a little, is fairly satisfactory, and individual bushes live for many years, reaching a height of about three feet. The variety, *elatior,* is somewhat stronger growing than the species. There is a double-flowered, almost creeping form, *G. tinctoria plena,* which is very attractive, especially for rockeries.

Halesia carolina (H. tetraptera) (Silver Bell)—South-eastern to Central United States).—The Silver Bell, or Snow Drop Tree, as it is sometimes called, does not make anything more than a shrub at Ottawa. In some years it is considerably injured by winter, while in others one is rewarded for growing this beautiful plant by having it bear, during the month of May, an abundance of drooping white, bell-shaped flowers, which are very conspicuous, as they open before the bush is fully clothed in leaves.

Halimodendron halodendron (H. argenteum) (Salt Tree)—Central Asia from Transcaucasia to the Altai.—The Salt Tree, which is really a shrub, grows from five to six feet high, and is especially valuable because it flowers late in June, after so many other shrubs are out of bloom. The flowers are lilac or pale pinkish-purple in colour and the leaves bluish-green. It is a very hardy shrub, and is succeeding well on the prairies.

Hydrangea arborescens grandiflora—United States.—Height 4 to 6 feet. A very free blooming variety with large panicles of white flowers which come in succession from July to September. The bush kills back each year, but it is sufficiently hardy to ensure abundant bloom.

Hydrangea paniculata grandiflora (Large Flowered Hydrangea)—Japan.—Height 6 to 10 feet. Blooms remain attractive from August until October. Flowers white, gradually becoming pink, and borne in very large panicles. This is one of the finest hardy shrubs. To get best results the bushes should be pruned back severely every spring and given an abundant supply of water during the growing season.

Lespedeza Sieboldii (Desmodium penduliflorum) (Bush Clover)—Japan.—This graceful plant is really not shrubby at Ottawa, as the branches kill to the ground every year, but strong stalks are thrown up from the ground each spring, and the shrub has usually a profusion of rosy-purple flowers in late September and early October. It is very graceful and attracts much attention when in bloom.

Lonicera tatarica (Tartarian Honeysuckle, Bush Honeysuckle)—Siberia, Tartary.—Height 5 to 10 feet. In bloom third week in May. Flowers bright pink. This is an old favourite and one of the hardiest shrubs grown. There are many varieties of this fine shrub and a large number of hybrids. These vary in colour of flower from white to rose. Some of them have yellow-coloured fruit. Among the best are: *L. tatarica pulcherrima,* with rosy petals, having

pink margins; *L. tatarica gracilis,* flowers rosy in bud, pink and rose when open; *L. tatarica speciosa,* flowers large, pink and rose; *L. tatarica splendens,* flowers pink in bud, pink and white when open; *L. tatarica grandiflora rubra,* flowers rosy in bud, rosy with pink margin when open; *L. tatarica elegans,* flowers pure white; *L. tatarica alba grandiflora, flowers* white; *Lonicera Morrowi,* with white flowers, is of more spreading habit, and is very ornamental also.

Mahonia Aquifolium (Oregon Grape or Holly Leaved Barberry—Canada and the United States.—Height 2 to 3 feet. A very attractive low growing shrub. The leaves are very glossy above, and sometimes have a pleasing bronzy tint. The edges are toothed, and the leaf, on the whole, is quite suggestive of that of English holly. During the latter part of May this shrub blooms freely, there being numerous clusters of small, bright-yellow flowers. While this is an evergreen, the old foliage is usually browned and disfigured by winter unless protected with a little straw, but the new growth soon appears in any case and the old foliage is not noticed. It increases rapidly by suckers, and is excellent for underplanting in partially shaded places.

Philadelphus coronarius (Mock Orange or Syringa)—South Europe.—Height 5 to 10 feet. In bloom second week of June. Flowers white with a strong, sweet odour; a well-known popular shrub. In addition to this species, there is *Philadelphus grandiflorus,* a taller and later blooming species, *P. grandiflorus speciosissimus,* several other species and many fine hybrid varieties, among the best of which are: Bouquet Blanc, Nuée Blanche, Voie Lactée. The golden-leaved variety of *Philadelphus coronarius* is one of the best hardy golden-leaved shrubs.

Physocarpus opulifolia (Ninebark)—Canada, United States.—This is a rather large shrub, which is satisfactory in rather shady places or along streams. It reaches a height of eight to ten feet or more and bears many white flowers in clusters in June. It is often known as *Spiraea opulifolia.* There is a golden-leaved variety of this, which makes a nice variety in the landscape if golden-leaved shrubs are desired.

Potentilla fruticosa (Shrubby Cinquefoil)—Canada, United States, Europe, N. Asia.—This is a native plant which succeeds well under cultivation, and blooms continuously from June until autumn. The flowers are an attractive shade of yellow. It grows from 2 to 4 feet high.

Prunus nana (Russian Almond)—Russia and West Asia.—The Russian Almond is grown under the name of *Prunus japonica* and *Prunus nana.* It blooms early in May; the flowers are pink in colour, and, though rather small, are conspicuous, as the bush is not yet in full foliage when it is in bloom. There are double-flowered forms, both pink and white, most of which may be referred to *Prunus japonica.* The height of these shrubs varies from three to five feet.

Prunus tomentosa (Down-Leaved Cherry)—Japan, North China, Manchuria.—It is desirable to have as many points of merit as possible in flowering shrubs, and this one is ornamental in flower and bears a useful fruit as well. It blooms early in May. The buds are pink, thought the petals are white when they expand, and the calyx is red. It is a very hardy bush cherry. The fruit is small compared with the cultivated sour cherries, but is excellent when canned. This shrub is very hardy, and has reached a height of about ten feet at Ottawa.

Prunus triloba plena (Flowering Almond)—North China.—This double-flowered ornamental almond is one of the most attractive shrubs in spring, those on their own roots being the most satisfactory. When top-grafted on other stock, they frequently winter-kill, and at Ottawa are not at all satisfactory, whereas when grown in bush form they bloom abundantly year after

year, and the double pink flowers, which are in bloom before the leaves are fully out, are very attractive and make this a striking looking shrub. Specimens at Ottawa have reached a height of about ten feet.

Pyrus japonica (Japanese Quince)—China and Japan.—This shrub blooms very early, and has bright red flowers. It is somewhat tender, and should not be planted in a very exposed place. A hardier form of this is *Pyrus Maulei.* The former grows from three to six feet high, and the latter only reaches about three feet in height.

Rhododendron viscosum (Clammy Azalea or White Swamp Honey-suckle) —Canada and United States.—The hybrid rhododendrons are not satisfactory at Ottawa, and few of the species either, though, with special protection in winter, fine blooms have been produced on some of the good hybrids. There is one native species, however, formerly known as *Azalea viscosa,* which does well under ordinary conditions. The sweet-scented flowers are white, sometimes tinged with rose, and this is well worth growing where one desires an assortment of flowering shrubs. It blooms during June to July. Varieties of *Rhododendron japonicum* can also be grown successfully with a little protection.

Ribes aureum (Missouri Currant)—Canada, United States.—Height six to eight feet. In bloom fourth week of May. Flowers yellow and very sweet-scented. This currant is quite ornamental, especially when in bloom, and again in summer, the fruit, which is quite palatable, makes it attractive.

Robina hispida (Rose Acacia)—Southeastern United States.—The rose acacia is one of the most attractive hardy shrubs. It blooms from June more or less throughout the summer, and the rosy pink flowers are very conspicuous and ornamental. The foliage is attractive also. If not propagated on a non-suckering stock, it is liable to sucker considerably, but usually not sufficiently to be troublesome.

Rosa (Roses).—It is almost needless to write that the roses are among the most attractive shrubs. A separate paragraph has been given to two of the hardy species, but, in addition to these, there are such hardy shrubs as the Persian and Harrison Yellow Roses, Austrian Briars, the Provence or Cabbage Roses, the Moss Roses, the Damask Roses, the Scotch Rose, and others. In Bulletin No. 17, New Series, on "Hardy Roses, Their Culture in Canada" will be found fuller particulars in regard to the many beautiful varieties that are now available.

Rosa rubrifolia (Red-Leaved Rose).—This is such a distinct shrub that it should be treated separately. The leaves are purplish red, making it a striking object during the growing season even when out of bloom. The flowers are rather small and deep pink in colour, and the fruit is bright red and shows up well after the leaves have fallen. It is very hardy, succeeding well on the prairies, and reaches a height of from six to eight feet.

Rosa rugosa (Japanese Rose)—Japan.—Height four to five feet. In bloom second week of June. Flowers very large and deep pink. This is a beautiful rose with fine flowers and very ornamental leaves, which are large, thick, and shiny. There is a white-flowered variety which is also good, also a number of hybrids between *rugosa* and varieties of hybrid perpetual and tea roses, most of which are quite hardy.

Sambucus (Elder).—There are several species of Elder which make very satisfactory shrubs for growing near streams or rather moist places. One species, *Sambucus racemosa,* and its variety, *pubens,* blooms in May and has red berries, and another one, *Sambucus canadensis,* blooms in June and July and has purple-

black fruit. A variety of this, called *maxima,* has enormous panicles of flowers and is very showy. *Sambucus nigra,* an European species, corresponds somewhat to *canadensis,* but blooms earlier. The golden-leaved variety of Elder is very attractive to many.

Sorbaria sorbifolia (*Spiraea sorbifolia*)—North Asia from Ural to Japan.—A well-known shrub, growing from four to five feet in height. It is one of the most useful on account of its flowering in summer when most other shrubs and trees are out of bloom. The leaves, which resemble those of the mountain ash, very much, from which it gets its name of *sorbifolia,* are quite attractive at all times, but in spring are particularly so. This shrub blooms from late June until autumn, and its large panicles of white flowers make it a conspicuous object. Its fault is that it suckers badly, and, on this account, should not be planted near anything which it is likely to crowd out. There is a taller growing species, not quite hardy enough at Ottawa, which blooms later, namely *S. Aitchesonii,* the long branches of which should be bent down so that the snow will cover them in winter. If this is done, one is likely to have very fine panicles of bloom during late summer and autumn. This grows from eight to ten feet in height and is very ornamental.

Spiraea alba (Meadow Sweet)—Eastern to Central United States.—The Meadow Sweet is a native shrub which is very useful for ornamental planting, especially in damp situations. It grows from four to five feet high and flowers in summer when there are few shrubs in bloom. The flowers are small and white but borne in good-sized panicles. There are two other species very much like the last, namely, *Spiraea latifolia,* with larger panicles, and *S. salicifolia,* both with white flowers though sometimes pinkish in colour. A hybrid species, known as *Spiraea Billardii,* is very similar to the above in habit, but has rosy-pink flowers.

Spiraea arguta—Europe.—Height 3 to 4 feet. In bloom third week of May. Flowers pure white, produced very profusely in compact clusters. This is the earliest flowering spiraea grown here, and is one of the best hardy shrubs of rather recent introduction. It is a graceful little spiraea with pendulous branches, but its chief beauty lies in the abundance of its pure white flowers.

Spiraea media—South East Europe to Japan.—One of the earliest blooming hardy spiraeas flowering at the same time as *S. arguta,* but being much hardier. The bush is not as graceful as either the latter or *S. Van Houttei,* but, when in full bloom and well covered with the compact clusters of white flowers, it is very ornamental, and, being very hardy, is especially desirable for the prairies. This is sometimes found under the name of *S. oblongifolia,* which is a synonym of *S. media subintegerrima,* and little different from the type.

Spiraea Van Houttei (Van Houtte's Spiraea)—Europe.—Height 3 to 5 feet. In bloom first week of June. Flowers pure white, borne very profusely in small, compact clusters on pendulous branches. This graceful shrub is very beautiful when in full bloom. Even when out of bloom, its pendulous habit and foliage make it attractive.

Syringa japonica (Japanese Tree Lilac)—Japan.—This is a very satisfactory small tree or shrub, as it blooms so late and is tall and striking-looking. Trees at the Experimental Farm, Ottawa, are, after thirty years' growth, some twenty feet in height, and about the end of June are a mass of creamy-white flowers. They are not perfumed, as the ordinary lilac is, but they are very handsome. *Syringa amurensis* is very similar.

Syringa villosa (Chinese Lilac)—North China.—This is a strong-growing lilac and is growing taller than at first expected, some specimens being now from

8 to 10 feet high. The leaves are rough and rather coarse looking, but this tends to make the shrub more striking. It flowers during the second week of June, closely following *S. Josikaea.* It is a free bloomer and the flowers, which are not highly perfumed, are bluish-pink and produced in good-sized panicles. This is a very desirable species. A hybrid between this and *S. Josikaea* called Lutèce is a very desirable lilac. *Syringa Josikaea* is not so attractive as *S. villosa,* but is a good hardy shrub.

Syringa vulgaris (Common Lilac)—Eastern Europe.—The common lilac and its varieties bloom during the first half of May, being usually at their best from the 20th to the 27th. There are many fine varieties of the lilac, varying in colour from white to the deepest purple. Some are single and some semi-double or double. Among the best are the following:—

Single:

Alba Grandiflora—white,
Aline Mocqueris—purplish-mauve, brighter in bud,
Congo—purplish-mauve, one of the deepest shades,
Decaisne—large, bluish lilac, very fine,
Delepin—bluish,
Jacques Calot—purplish-mauve in bud, violet mauve when opened, flowers large,
Lovaniensis—almost pink,
Toussaint-Louverture—bishop's violet, almost purple, one of the darkest in colour.

Double:

Charles Joly—vinous mauve, with twisted petals,
Comte de Kerchove—purplish-mauve changing to lighter shades,
Edith Cavell—flowers large, white, of good substance. A very fine white variety with large panicles of bloom,
Emile Lemoine—purplish-mauve changing to heliotrope,
Georges Bellair—purplish-mauve, petals tipped with white,
Hippolyte Maringer—lilac and bluish lilac effect, petals twisted,
Jean Bart—purplish-mauve to violet mauve, flowers with twisted petals,
Leon Gambetta—pinkish lilac, large panicle,
Madame Abel Chatenay—white,
Madame Casimir Perier—white,
Marc Micheli—violet mauve changing to heliotrope and white, flowers large,
Michel Buchner—violet mauve to bluish-violet,
Olivier de Serres—bluish lilac, large panicle,
Paul Thirion—later than most, rosy in bud, lilac when open,
President Fallieres—pinkish lilac, late,
President Viger—rosy in bud, lilac when opened, changing to pinkish,
Wm. Robinson—rosy lilac in bud, lilac when open.

Two other fine hardy lilacs which should be in every collection are *Syringa rothomagensis* and *S. pubescens.*

Tamarix pentandra (Summer Tamarisk)—Southeast Europe to Central Asia.—A very pretty tamarisk, blooming from July until late summer. The flowers are small and pinkish in colour. It makes a very useful and graceful shrub and grows from four to six feet in height.

Viburnum (Native Viburnum).—There are several native species of Viburnum, in addition to the High Bush Cranberry, treated separately, which are very satisfactory shrubs on account of their ornamental flowers and foliage

and because they will succeed in rather shady places where many other shrubs will not. Perhaps the most attractive of these is *V. cassinoides* or Withe-Rod, which blooms in June. This grows from five to ten feet in height. Other taller species are: *V. Lentago,* the Sheep Berry, and *V. prunifolium,* the Black Haw. All of these have white flowers and attractive foliage. The Arrow-wood, *Virburnum dentatum,* is also quite attractive and distinct in habit and foliage from the others. A good group of native Viburnums makes a very interesting and attractive feature of any ornamental grounds, and they are particularly useful where there is already some natural shrubbery.

Viburnum Lantana (Wayfaring Tree)—Europe.—Height 8 to 12 feet. In bloom third week of May. Flowers white in compact, flat heads. The fruit is very ornamental, being scarlet, turning to dark purple when ripe.

Viburnum Opulus (Guelder Rose, High Bush Cranberry)—Europe.—Height 6 to 8 feet. In bloom second week of June. Flowers white, in large clusters. This is, at all seasons of the year, an ornamental shrub, as the abundant bright scarlet fruit remains on the bush all winter. The native species, *V. americanum,* is also a very good ornamental shrub. *V. Sargentii* is handsomer in bloom than either of the above, but the fruit is not so attractive.

Viburnum Opulus sterile (Snowball).—Height 8 to 10 feet. In bloom second week in June. The almost round clusters of pure white flowers of this shrub are well known. This is one of the most ornamental hardy flowering shrubs, but for many years it has been badly attacked by aphis. To destroy these it is necessary to spray the bushes just as the buds are breaking in the spring. This is very important as at this time the eggs are hatching. A second spraying should be given in a few days, and while the leaves are still only partly expanded. Once the insects cause the leaves to curl, it is almost impossible to get at them. Kerosene emulsion, whale oil soap, or nicotine preparations may be used for spraying.

LIST OF TWELVE MOST SATISFACTORY ORNAMENTAL SHRUBS OR GROUPS OF SHRUBS IN ORDER OF BLOOMING, AND COVERING THE SEASON WELL

Spiraea arguta
Spiraea Van Houttei
Caragana frutex var. *grandiflora*
Lonicera tatarica and varieties
Lilacs
Viburnum Opulus
Philadelphus or Mock Orange
Roses
Robinia hispida
Hydrangea arborescens grandiflora
Hydrangea paniculata grandiflora
Tamarix pentandra

EASTER LILIES FROM SEED

Having read in a bulletin of the Bureau of Plant Industry, Washington, that Easter lilies could be successfully grown from seed, it was thought that it would be interesting to find out if it were possible to grow them to blooming size in the same time at Ottawa.

Self-fertilized seeds of *L. longiflorum variety formosum* and *variety giganteum* were sown in the greenhouse on October 18, 1921. They both germinated early in November and on March 13, 1922, twenty of each were potted, one to a 2½-inch pot. June 1 they were transplanted into a cold frame. September 22 they were re-potted into 5-inch pots and taken back into the greenhouse. Eight of the *formosum* variety bloomed in September and October, and the twenty all bloomed during April and May. The finest specimen was 24-inch high and had nine blossoms on the stem. Those that had previously bloomed divided into two and had three or four blossoms on each stem.

L. longiflorum giganteum were not so successful as the other variety. Most of them bloomed starting in November, but the plants were much dwarfer and the blooms not so well formed.

NEW GERANIUMS ORIGINATED IN THE HORTICULTURAL DIVISION

The geranium is a very popular flower in Canada. It is easily grown, blooms profusely, has very few insects and diseases affecting it, and is one of the showiest flowers either for the house or garden. For this reason, much attention has been paid to it in the Horticultural Division, both as an indoor and an outdoor plant. Many varieties have been imported from Great Britain and Ireland and other sources and tested at Ottawa, and a descriptive list of these was published in the Annual Report for 1916. Some of these varieties were noted for their very large flowers and fine colouring, and, in order to develop, if possible, even better sorts, a number of them were used from 1914 to 1916 as parents in cross-breeding by Mr. A. J. Logsdail, then of the Horticultural Division. Some of the principal parents used were Dublin, Chatsworth, Mrs.

New Geraniums. Experimental Farm, Ottawa, Ont.

Charles Platts, Manteau Rouge, Pamela, Shelley, Capt. Holford, King Victor, and Mrs. Kendall Barnes, and seedlings were again grown from these first crosses. A large number of very fine varieties resulted from this work, the best of which have gradually been selected from the others and named. The following were named after the Dominion Ministers of Agriculture since the Experimental Farms were established: Carling, Angers, Montague, Fisher, Burrell, Crerar, Tolmie, Motherwell. Brief descriptions of these and others follow:—

Angers.—Plant a strong grower and free bloomer; foliage very green; zone distinct. Flower single; diameter 2¼ inches; bright rosy scarlet, suffused with white, substance good; truss compact; flower stem strong. A very good variety.

Burrell.—Plant a strong grower and free bloomer; foliage pale green; zone faint. Flower single; diameter 2¼ inches; vermilion red or scarlet; substance good; truss compact; flower stem strong. Very good.

Byng of Vimy.—Plant a strong grower and free bloomer; foliage good; zone very distinct and deep. Flower single; diameter 2 in.; vermilion red or scarlet; substance good; truss moderately compact; flower stem moderately strong. Very good.

Carling.—Plant a strong grower and free bloomer; foliage good; zone faint. Flower single; diameter 2¼ in.; turkey red, two petals carmine, suffused with turkey red; substance good; truss moderately compact; flower stem strong. Very good.

Crerar.—Plant a strong grower and free bloomer; foliage good; zone dark and very distinct. Flower single; diameter 2¼ in.; carmine lake; substance good; truss very compact; flower stem strong. Very good.

Elspeth (Dublin x Chatsworth).—Plant a strong grower and free bloomer; foliage large and good; zone distinct. Flower single; diameter 2½ in.; rose pink; substance good; truss compact; flower stem moderately strong. Very good.

Evelyn Byng.—Plant a strong grower and free bloomer; foliage good; zone faint. Flower single; diameter 2¾ in.; carmine lake; substance fairly good; truss large and rather loose; flower stem strong. Very good.

Fisher.—Plant a moderately strong grower and free bloomer; foliage very green; zone faint. Flower single; diameter 2¼ in.; turkey red; substance good; truss moderately compact; flower stem moderately strong. Very good.

Gatineau.—Plant a strong grower and free bloomer; foliage rather pale green; zone obscure. Flower single; diameter 2½ in.; deep carmine, suffused with light carmine; truss compact; flower stem strong. Very good.

Logsdail.—Plant a strong grower and free bloomer; foliage good; zone distinct. Flower single; diameter 2 in.; vermilion, red or scarlet; truss compact; flower stem strong. Very good.

Lorn.—Plant a strong grower and free bloomer; foliage good; zone faint. Flower single; diameter 2¼ in.; cherry red, suffused with carmine lake; truss compact; flower stem very strong. Very good.

Margaretta.—Plant a strong grower and free bloomer; foliage good; zone distinct. Flower single; diameter 2 inches; white, suffused with bright rosy scarlet; truss compact; flower stem strong. Very good.

Meviovid.—Plant a strong grower and free bloomer; foliage good; zone medium. Flower single; diameter 2 inches; salmon pink; truss compact; flower stem strong. Very good.

Montague.—Plant a medium grower but a free bloomer; foliage good; zone faint. Flower single; diameter 2½ in.; deep crimson carmine with scarlet at base of upper petals; truss compact; flower stem very strong. Very good.

Motherwell.—Plant a strong grower and free bloomer; foliage good; zone obscure. Flower single; diameter 2¾ in.; deep turkey red; truss rather loose; flower stem strong. Very good.

Nepean.—Plant a strong grower and free bloomer, dwarfer habit than most; foliage dark green, good; zone deep and dark. Flower single; diameter 2½ in.; bright rosy scarlet, much suffused with white; truss moderately compact; flower stem moderately strong. Very good.

Patricia.—Plant a strong grower and free bloomer; foliage good; zone distinct. Flower single; diameter 2 in.; vermilion red or scarlet, white in centre; truss compact; flower stem strong. Very good.

Perrin.—Plant a strong grower and free bloomer; foliage good; zone obscure. Flower single; diameter 2¼ inches; turkey red, suffused with carmine; truss compact; flower stem strong. Very good.

Sir Douglas Haig (Dublin x Chatsworth).—Plant a strong grower and free bloomer; foliage rather light green, gold; zone faint. Flower single; diameter 2¼ in.; crimson carmine, suffused with lighter shade; truss compact; flower stem strong. Very good.

Tolmie.—Plant a strong grower and free bloomer; foliage light green, good; zone obscure. Flower single; diameter 2 in.; vermilion red or scarlet; truss compact; flower stem strong. Very good.

Verdun (Dublin x Chatsworth).—Plant a strong grower and free bloomer; foliage good; zone medium. Flower single; diameter 2¼ in.; strawberry red; truss rather loose; flower stem moderately strong. Very good.

A few of the above which give a good range of colour are Byng of Vimy, Motherwell, Tolmie, Elspeth, Margaretta, Montague, and Verdun. Burrell is very similar in colour to Byng of Vimy, but has not the distinct zone of that variety.