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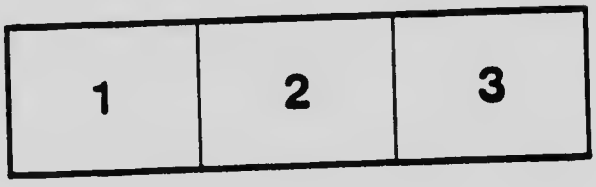

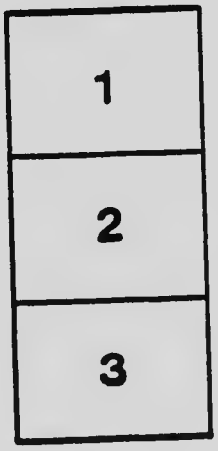

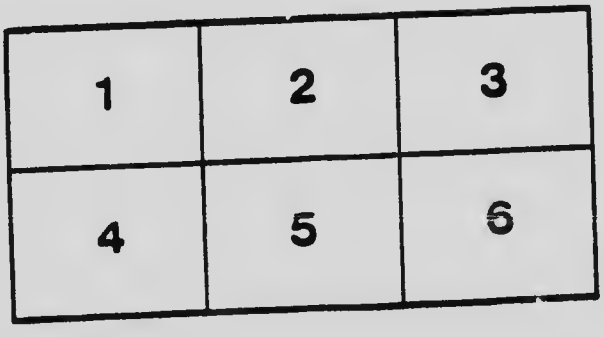

DOMINION OF CANADA
DEPARTMENT OF AGRICULTURE
DOMINION EXPERIMENTAL FARMS

DIVISION OF HORTICULTURE

THE APPLE IN CANADA

ITS CULTIVATION AND IMPROVEMENT

BY

W. T. MACOUN

Dominion Horticulturist

BULLETIN No. 86

Published by authority of Hon. MARTIN BURRELL, Minister of Agriculture, Ottawa, Ont.

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9289—1

Apple orchard near tidewater, Nova Scotia.

OTTAWA, February 10, 1916.

The Honourable the Minister of Agriculture,
Ottawa.

SIR,—I have the honour to submit herewith, for your approval, Bulletin No. 86 of the regular series, entitled The Cultivation and Improvement of the Apple in Canada, which has been prepared by the Dominion Horticulturist, Mr. W. T. Macoun.

The growing importance of the apple-producing industry in Canada and the increasing interest in the growing of this fruit now being shown in every province of the Dominion render the publication of this bulletin at the present time most opportune. The large amount of information included therein and the comprehensive character of the same, render it something of a reference book and a bulletin that should be in the hands of every apple-grower and would-be apple-grower in Canada.

I have to recommend, therefore, that a large edition be issued at as early a date as practicable.

I have the honour to be, sir,

Your obedient servant,

J. H. GRISDALE,
Director, Dominion Experimental Farms

92898—1½

J. H. GRISDALE, Esq., B.Agr.,
Director, Dominion Experimental Farms,
Ottawa.

SIR,—I have the honour to submit herewith, for your approval, a bulletin entitled "The Cultivation and Improvement of the Apple in Canada."

The purpose of this bulletin is both to record the results of experimental work with the apple at the Central Experimental Farm and Branch Farms and Stations, and to give information in regard to the best methods of propagating this fruit and of planting and caring for apple orchards.

Lists of varieties of apples recommended for the different provinces of Canada will be found in this bulletin with descriptions of these and of other varieties. The lists of those recommended are based on experiments with varieties at the Central and Branch Farms and Stations, and the experience of fruit growers in different parts of Canada. Suggestions for exhibiting and judging apples are also included in this bulletin and other information in regard to this important fruit.

I have the honour to be, sir,

Your obedient servant,

W. T. MACOUN,
Dominion Horticulturist.

OTTAWA, January 22, 1916.

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THE APPLE IN CANADA, ITS CULTIVATION AND IMPROVEMENT.

(By W. T. Macoun, *Dominion Horticulturist.*)

The continued popularity of the apple throughout the world is well shown by the enormous quantities of this fruit consumed annually and by the very extensive plantings made in recent years. So many trees have been planted that many persons are in doubt as to the wisdom of planting any more and others believe that too many have been planted already. Time alone will tell whether these persons are correct in their judgment or not. The writer is one of those who believes that if the methods of distributing the crop are improved rapidly enough it will be a long time before there is actual over production. It would require many million more barrels of fruit than are being produced per annum to-day to give every man, woman and child in Canada and other countries all the apples that they might be expected to consume were they able to obtain them at a reasonable price when they wanted them. So many apple trees die every year; so much poor fruit is produced every year; so many orchards are neglected every year and so many persons are discouraged every year; that the man who grows good fruit should, taking one year with another, continue to make a fair profit. The man who has some other crops to depend upon in a season when good apples are very plentiful and prices low, will of course be in a better position than he who depends solely on the apple for his income.

As the market becomes flooded with great quantities of apples the merits of the different varieties will become better known; the differences between Fancy, No. 1, No. 2 and No. 3 apples will be better appreciated and apples will be sold more on their intrinsic values than they are to-day. Let every apple grower therefore see to it that he plants only the best varieties and where these are already planted, that he cares for his trees well, packs and markets his apples in the best manner and is not content until the fruit he puts on the market is of as bright colour, as free from blemishes and as high in grade as it is possible to be.

The best flavoured, most highly coloured and longest-keeping apples are produced in Canada and, if the Canadian apple grower does his part well, Canadians should have a large share in supplying the markets of the world with this wholesome fruit.

The origin of the cultivated apple is unknown. It is supposed, however, that it had its beginning in the wild apple of Europe (*Pyrus Malus*), but there is no evidence to show when the improvement began, nor when the fruit reached the size, colour and quality of what is considered a good apple to-day. It is known, however, that at the beginning of the Christian era, the Romans cultivated a few varieties of apple which might compare favourably with some that are grown at the present time. Although the apple is mentioned in Holy Scripture many years prior to that period, the word evidently referred to another fruit, or other fruits, and not to what is now called an apple.

While the range of successful culture of many other fruits is comparatively limited, the apple has a very wide one in the temperate climates of the old and new worlds and is able to accommodate itself to conditions under which many other cultivated fruits would not thrive. It is, however, in the temperate parts of America that it reaches the highest state of development, where there is an ever increasing area devoted to this fruit. Named varieties of apple are very numerous, being, probably, over

3,000 in number, so that every taste, no matter how eccentric, may be satisfied, and a selection made of those best suited to a particular person or place.

No other fruit, probably, has as long a season as the apple. By a judicious selection of varieties, apples may be had in good condition the whole year round, and now that cold storage has been so perfected, some of the best varieties, which, under ordinary circumstances, would not keep until spring, may be kept in good condition until late in the following summer.

Some varieties of apple begin to bear paying crops when five years planted. Some of the best sorts, however, do not bear heavily for ten years or more. The profitable life of an apple tree will depend greatly on the climate it is grown in, the culture given, and the variety. There are, however, other factors which influence it. In the best apple districts of America, profitable crops are gathered from trees sixty to one hundred years of age.

The uses of the apple are too well known to need mentioning. Truly, this is the king of fruits.

APPLE CULTURE IN CANADA.

The fruit industry has become one of the chief industries of Canada and the apple is by far the most important fruit grown. The area in Canada over which the apple can be grown successfully commercially is very great, so great that if it were all covered with apple trees in bearing there would be more than enough apples to supply the markets of the world. As new and hardier varieties are introduced the area of successful apple production is gradually widening and no one is bold enough to say where the northern limit will eventually be. A large proportion of the provinces of Prince Edward Island, Nova Scotia and New Brunswick is suitable for commercial orcharding. The provinces of Ontario and Quebec have an area about 700 miles in length and varying in width from 30 to 150 miles where apples can be successfully grown. Apples can be grown successfully on Vancouver Island and the Lower Mainland of British Columbia and in innumerable valleys from the boundary line north to the Grand Trunk Pacific railway or farther which vary in size from a few acres to many thousands of acres in extent. In the Prairie Provinces, apples are grown to a very limited extent yet, but in time, no doubt, large areas in these provinces will be devoted to this fruit.

The extent of the apple industry so far as the number of trees and quantity of fruit produced is concerned, can be gathered from the following table compiled from the Dominion Census of 1911.

APPLE TREES AND APPLES GROWN IN CANADA IN 1910.

Province.	Bearing.	Non-Bearing	Bushels.
Ontario	6,544,788	2,053,302	6,250,672
Nova Scotia	1,534,820	884,070	1,666,382
Quebec	1,252,523	860,064	1,481,239
British Columbia	510,763	1,465,602	575,377
New Brunswick	3 ,862	229,833	272,886
P. E. Island	147,637	58,342	160,124
Manitoba	4,292	17,801	1,498
Saskatchewan	1,449	5,434	90
Alberta	333	4,448	189
Total	10,390,457	5,578,956	10,408,457

Prince Edward Island.—The culture of apples has not developed as rapidly on Prince Edward Island as the climate and soil justify. This is due to a large extent to the fact that transportation between the island and the mainland and with the markets of Great Britain and Europe is not yet very good. The apple succeeds well in this province and owing to the comparatively cool summer and autumn, causing slow ripening, the fruit keeps as long or longer than in any other part of the Dominion. The soil of a very large proportion of the province is well adapted to the cultivation of the apple. In places windbreaks are necessary owing to the high winds and exposed nature of the sites in some of the best districts. While some apple trees are grown by most of the farmers on the island, there are comparatively few commercial orchards for the reason given above. Apple trees have been grown on Prince Edward Island since about 1763, when the English first settled there.

New Brunswick.—The climate of New Brunswick is admirably suited to the cultivation of the hardier varieties of apple, and as some of the apples of the most attractive appearance and the best quality are among the hardier sorts, this province could grow a very large quantity of the finest fruit. Land is relatively cheap, also, in New Brunswick, which should be an inducement to many persons to plant apple orchards. The transportation facilities are good, and being near the seaboard the growers have not far to send their fruit intended for export. The development has been slow, however until recently when there has been an awakening of interest and more trees are being planted. While, perhaps, the largest area of land suitable for growing apples is in the St. John River valley, yet many other sections, particularly in the eastern part of the province, will grow very fine fruit. Although the apple has not been grown as long in New Brunswick as in some other parts of Canada, it has been cultivated since the early part of the nineteenth century and possibly before.

Nova Scotia.—The apple has been grown in Nova Scotia longer than in any other province of Canada with, perhaps, the exception of Quebec. The French settlers who occupied this province, then called Acadia, in the early part of the seventeenth century, no doubt, planted seeds and trees. When settlers from New England came in 1761 they found trees in bearing and there is a record of top-grafting being done in 1764, showing that cultivation of the apple had advanced considerably at that date. It is only within the last fifty or sixty years, however, that the apple has been grown commercially to any extent, but the industry has now reached great proportions. The largest crop so far was produced in 1911 when 1,734,000 barrels were packed and sold from the Annapolis and adjacent valleys. The total crop for the Province was, however, considerably greater than this.

The parts of Nova Scotia which so far have been used to the greatest extent for apple orchards are the Annapolis and adjacent valleys, making a district of about 100 miles long and from 6 to 11 miles wide. The south-eastern part of Nova Scotia, while not yet planted very much to apple trees, is attracting more and more attention as the climate and soil are well adapted to the successful culture of most of the varieties grown in the Annapolis valley and the time will come, no doubt, when this part of Nova Scotia will be noted for it apples. In northern Nova Scotia also and in Cape Breton, good fruit of the hardier varieties can be successfully grown.

Quebec.—The apple was probably planted in what is now the province of Quebec as early as in any part of Canada. There are records which show that as long ago as 1663 this fruit was being produced there and doubtless some seeds or trees were planted when the first settlements were made near the beginning of the seventeenth century. While the apple industry has not grown as rapidly in this province as in some other parts of Canada, there are many fairly large orchards there and some new orchards are being planted every year. The capabilities of Quebec for the production of apples of the finest appearance and best quality are very great. It was in this province that the Fameuse apple is thought to have originated, and

this is one of the varieties which grows to perfection here. Like other parts of Canada there are great opportunities in the province of Quebec for growing apples. In the Ottawa and St. Lawrence river valleys, throughout the eastern townships, and in the other parts of the province there are many thousands of acres which will grow apples.

Ontario.—Of all the provinces of the Dominion of Canada, Ontario grows the most apples at present as will be seen from the figures given from the census. The quantity now produced could be increased many times over without exhausting the land where the best apples can be grown successfully. The great winter apple districts are, first that bordering lake Ontario and extending back 30 miles and more from the lake; second, that along lake Huron and Georgian bay, several miles in depth; and third, the south-western part of the province. Farther east and north, and including an area east of the Lake Huron district there are large areas of land where the hardier varieties of apples are most suitable and above latitude 46° the hardiest sorts of apples and crab apples are being tested. The apple industry is growing rapidly in Ontario. Many new orchards have been set out in recent years and large areas are coming into bearing every year. The development of commercial orcharding in Ontario has taken place within the past fifty or sixty years, and was made possible when the building of the railways permitted trees and fruit to be transported rapidly from one place to another, but apples have been grown in the province since the middle of the eighteenth century.

British Columbia.—Apple growing in British Columbia was only begun in comparatively recent years, but the development of commercial orcharding has been very rapid. The first trees were planted about 1850, but not until after the completion of the Canadian Pacific railway in 1887 were there many trees planted for commercial purposes. The Dominion Census of 1891 gave the area devoted to all kinds of fruit as 6,500 acres. The greatest planting of apple trees has occurred during the past ten years. The climate of British Columbia is very varied. On Vancouver island may be found both wet and dry growing seasons. The climate of the lower mainland is relatively wet while in the many valleys of the upper country there are dry and moderately dry climates, in some places irrigation being necessary and in some places not. This great diversity of climate permits of the successful culture of many types of apple varying in colour from the duller shades to the brightest and most attractive that can be found anywhere. In such a diversity of climate the quality of fruit also varies, some districts producing apples of much better quality than others, though of the same variety. The most noted district at present is that of the Okanagan valley where some of the finest orchards in the province and in the Dominion are to be found, but other valleys not so well known are quite equal to it and possibly better. There are difficulties in marketing apples profitably, at present in this Province, but with the recent increased duty it is hoped that these will be overcome.

Manitoba.—While the quantity of apples so far produced in Manitoba has not been large compared with other provinces, more apples have been grown there than in any of the other prairie provinces of Canada. This is partly due to the fact that it has been longer settled and partly to the fact that the climate and soil of southern Manitoba appear to be better suited for the culture of apples than other parts of the prairies, but this remains to be proven by careful experiments in other places. Where apples have succeeded best they have had more or less natural protection from trees, from hills, and even from fences. There is also usually a more open sub-soil where the best results have been obtained, favouring a ripening of the wood in autumn. As varieties are developed more suitable to the climate there is no doubt but that apples will be grown much more generally in Manitoba than they are to-day.

Saskatchewan.—The fact that the small apples or crab apples originated by the late Dr. Wm. Saunders can be grown so successfully in many places in the province

of Saskatchewan and that some apples of the very hardy Russian varieties have been matured, leads one to believe that there will be, in the future, other varieties originated which will succeed more generally. The wooded parts of northern Saskatchewan where the natural protection is good and where the sudden changes of temperature in spring, which are so disastrous to trees, are not so frequent as in other parts, may yet be found to be well suited to the culture of the hardiest apples.

Alberta.—The climate of Alberta varies much from north to south, some parts being very dry and with little snow in winter, other parts having a good rainfall and snowfall. The best results so far have been obtained in southern Alberta where, on

Silvia apple tree in bloom, Experimental Station, Lethbridge, Alta.

the Experimental Station at Lethbridge and at other [illegible]s, good apples have been produced. This success is no doubt due to the fact that, owing to the dry autumn, the wood of the trees ripens well; but apples have been produced in the vicinity of Edmonton where the climate is much moister. The farthest north that apples have been grown in Canada, at least as far as the writer is aware, is at the Sub-Station at Fort Vermilion, Peace River District, Alberta, in latitude 58° 23′ where the crab apples or small apples originated by the late Dr. Wm. Saunders have fruited.

Apple orchard, Experimental Station, Lethbridge, Alta.

Apple trees in bloom, Experimental Station, Lethbridge, Alta.

APPLE CULTURE AT THE CENTRAL EXPERIMENTAL FARM.

Most of the information contained in this bulletin is based on experience gained in growing apple trees and apples at the Central Experimental Farm. The lines of work have included the testing of the hardiness, productiveness, quality, and relative freedom from disease of the different varieties of apples. New varieties have been originated, tested, described and named. Records have been kept each year of the individual yields of each bearing tree in the orchards since 1898. The different methods of propagating and grafting have been tried, using various stocks for this purpose. The top-grafting of tender varieties on hardy stocks has received much attention. Different methods of culture have been tried in the orchard and various cover crops have been tested to ascertain which were the best.

Spraying has been a prominent feature of the work since 1890, and many experiments have been tried with different mixtures and solutions for controlling insect pests and fungous diseases.

The apple orchards at the Central Experimental Farm were started in 1887, but it was not until the spring of 1888 that much progress was made. Since that time the number of varieties tested and the area devoted to this fruit have both increased very much. Up to the present time 734 named varieties have been tested, of which 613 are now growing. Many other unnamed seedlings sent in for test have also been tried. Many of the varieties have been replaced several times so as to be certain that they were too tender for this climate. The Russian apples have received especial attention as it was thought that these would prove of particular value for the northern parts of this country. There have been about 160 Russian varieties tested, though many thought at first to be different have proved to be identical. There are 1,114 apple trees in permanent positions in the main orchards, occupying about 18½ acres, and 61 crab apples. There is also a small closely planted orchard mainly of the Wealthy apple; another small orchard containing trees of the best seedlings originated at Ottawa. Still another small orchard contains trees of cross-bred apples originated in the Horticultural Division. There is also an orchard containing cross-bred apples originated by the late Dr. Wm. Saunders, and there is another orchard of seedling apple trees. Scattered through the permanent orchards and used as fillers between the permanent trees are seedling and cross-bred apple trees which are left until they fruit. In all about 25 acres are devoted to the apple in 1915.

EXPERIMENTS WITH APPLES AT THE BRANCH EXPERIMENTAL FARMS AND STATIONS.

The main experiment carried on at the older experimental farms and stations is the testing of varieties to determine which are the best for the parts of Canada in which the farms are situated, and in the prairie provinces to determine, in some places, if any varieties would succeed. Much data have been obtained, and information as to results has been published from time to time in the annual reports.

At the newer stations cultural experiments have been planned and are being carried out. At the experimental station, Kentville, N.S., where many cultural experiments are under way, some results have already been published. The cost of developing an orchard at the Experimental Farm, Nappan, N.S., has been reported on from time to time. Other stations at which cultural experiments are being carried on are: Cap Rouge, Que.; Ste. Anne de la Pocatière, Que.; Lennoxville, Que.; Lethbridge, Alta.; Invermere, B.C.; Summerland, B.C.; and Sidney, B.C.

Apple tree, Experimental Station, Lacombe, Alta.

Apple trees at the Experimental Sub-station, Fort Vermilion, Peace River, Alta.

ORIGIN OF VARIETIES.

Varieties are originated in three different ways. First, from seed of fruit that came from flowers which have been open pollinated or pollinated naturally and which we shall call seedling varieties; second, by artificial cross-fertilization and hybridization, which we shall call cross-bred or hybrid varieties; and third, by sporting or bud variation.

SEEDLING VARIETIES.

Each seed of an apple produces a different variety. Thus if there were six seeds in a McIntosh apple, every tree raised from these would bear different fruit.

Most of the named varieties of apples growing in America to-day were originated as seedlings. Our forefathers brought apple seeds with them from the old land and sowed them in this country. The young trees raised from these seeds grew up and bore fruit, and occasionally a variety of merit would thus be produced, and then propagated. In later times chance seedlings grew up in the fence corners and other waste places, and these also bore fruit and added their quota of good sorts. From trees like these have originated such fine varieties as Northern Spy, Baldwin, Fameuse, McIntosh Red, and many others.

Of late years more systematic efforts have been made to originate new varieties from seed. But the varieties of really useful apples which have originated in this way have been very few indeed. As an example may be given the work of the late Peter Gideon, of Excelsior, Minn., U.S., who devoted much time to this work. He published the results of his experience in the Thirteenth Annual Report of the Minnesota State Horticultural Society. The following are extracts from that report:

"Our efforts and trials in Minnesota began thirty years ago last spring by planting one bushel of apple seed, a peck of peach seed, and five hundred apple, pear, plum and cherry trees, and for eleven years thereafter planted each year enough apple seed to bring 1,000 trees, and in the time named frequent additions to the orchard of old named varieties—all southern or eastern grown trees and seeds, and all kept as long as they could be made to live in Minnesota, and to-day only two trees remain. One of these, the Wealthy, grown from a cherry-crab seed, obtained of Albert Emerson, of Bangor, Maine, of whom I obtained scions at the same time, from which I grew the Duchess, Blue Pearmain, and the Cherry-crab, all of which, combined, were the foundation of Minnesota horticulture, that to-day is the pride and hope of the Northwest. But since these varieties came into bearing we have planted only of our own growing of seed, with forty first-class varieties the result."

"Thus far it has taken from three to five hundred seedlings to give us one first-class apple, and that from seed taken from the best apples we had."

Although the Wealthy is probably the most valuable variety of its season in the colder parts of Canada and the United States, Gideon's attempts to produce a hardy late keeping apple of good quality were of no avail and even up to the present time there are few hardy winter varieties that can be recommended.

SEEDLING VARIETIES ORIGINATED AT THE CENTRAL EXPERIMENTAL FARM.

At the Central Experimental Farm, considerable work has been done in raising seedling and cross-bred apples and some good varieties have been produced from seedlings of which 105 have been named. The results from cross-breeding will be found in the next chapter.

In the year 1890 an orchard was planted, comprising about 3,000 trees grown from seed imported from E. Goegginger, Riga, Russia. The seed from which these were grown was said to have been taken from apples grown north of Riga, Russia. These began to fruit in 1897, when about fifty trees bore. The number of trees was gradually reduced by winter-killing, by fire blight, or were removed on account of

weak growth and inferior quality. All but a few of those which fruited were as good as the named varieties of Russian apples. Nearly all of them were summer apples. A few only were considered sufficiently promising to propagate, among the best of them being Claire, Neville, Oscar, Percival, Roslin, and Rupert.

In 1898 the writer, believing that in an orchard at the Central Experimental Farm, Ottawa, containing between 400 and 500 named varieties of apples all sorts of combinations of characters would be taking place by natural pollination and that the chances of obtaining some good seedlings by sowing seeds from some of these varieties would be very great, had seed saved of some of the best-flavoured apples then fruiting in the orchard, as well as some other varieties desirable on account of other characteristics. There were included in these the McIntosh, St. Lawrence, Famense, Wealthy, Shiawassee, Swayzie, Scott Winter, Salome, Lawyer, Gano, Northern Spy, Winter St. Lawrence, and Bullock (American Golden Russet). The seedlings of these and others which were sown later have been planted out at different times, beginning in 1901, until about 2,000 trees were planted, this being all we had room for. The first tree to fruit from seed was a Wealthy seedling now called Crusoe, which fruited in 1903, two years after planting and five years from seed, and it may here be stated that the great majority of the Wealthy seedlings were early bearers like the female parent.

The good results which it was hoped to obtain by planting seedlings from fruit from trees which must have received pollen from a great many varieties has been abundantly borne out by the actual results. During the past twelve years, 1,211 of these seedling varieties have fruited, of which detailed descriptions had been made up to this year, and of these 83·30 per cent were of marketable size (medium to large), and only 3·95 per cent were small or crab-like. Of the 1,211 varieties, there have been 378 considered so promising that they are being propagated for further test and 99 of the best have been named.

Some most interesting facts have been noted in regard to the way in which the seedlings resemble the female parent. If the parent is bright in colour most of the seedlings are bright in colour, but if dull in colour then the seedlings are dull in colour. If the parent is an apple of good quality then with few exceptions the seedlings are above medium to good in quality, and on the other hand if the parent is of inferior quality the seedlings are of medium quality also. If the parent is a long keeping apple then most of the seedlings are good keepers. Size has not been as constant as some other characteristics. Where there is a marked difference in size between the majority of the seedlings and the female parent it is in the direction of larger fruit in the seedlings. For instance, the fruit of the seedlings of American Golden Russet, Swayzie, and Fameuse average larger than the parent. Where seed has been examined carefully it has been noted that as far as size of seed is concerned the seed of the majority of the seedlings resembles the female parent. The varieties which gave seedlings which had the most characteristics of the female parent are Wealthy, Gano, McIntosh, Northern Spy, and Langford Beauty. Those least resembling the female parent are Swayzie and Fameuse. The seedlings of Fameuse have been the most disappointing of all, there being a large proportion of varieties of inferior quality. The largest proportion of promising seedlings are among McIntosh, Langford Beauty, Northern Spy, and Wealthy. Elsewhere will be found descriptions of a few of the most promising varieties.

As there are very few winter apples hardy enough for the colder parts of Canada where the apple is grown successfully and as there is room for better summer and autumn varieties all over Canada, these new varieties should prove of great value, and they are being propagated with a view to a more extended test of them. As this kind of apple breeding had given such good results, seed was saved in 1908 of some more of the best hardy winter apples grown at Ottawa, including Milwaukee, Bethel, Winter Rose, Baxter, La Victoire, Stone and Forest, of which 312 were in the orchard in 1915.

As it is important to obtain apples suitable for the prairie provinces of Canada as soon as possible, another method than that followed by the late Dr. Wm. Saunders is being practised by the writer. Seed was sown in 1910 of some of the hardiest Russian apples, including Transparent, Charlamoff, Beautiful Arcade, Oldenburg, Tetofsky, Anis, Antonovka, and Hibernal. More seedlings of these and other varieties have been grown since and from these about 75,000 have been sent as yearlings to the Dominion Experimental Farms in the prairie provinces and planted close together in nursery rows. After three years any which prove hardy may be removed to an orchard for further test or are left to fruit in the nursery row. Many of these have proved hardy so far. It is planned to continue this work in the hope that from some of these hardy Russians, which stand so much cold in Russia, will be obtained some which will be useful in the cold districts of Canada, where early growth in the spring followed by frost seems as destructive as low temperatures of winter.

In addition to the trees sent from Ottawa, other trees of the same varieties have been grown from the seed of fruit ripened in Manitoba for comparison. At the Brandon Experimental Farm some seedlings of the Cluster, a cross-bred variety fruited there, are promising.

CHARACTERS OF SEEDLING APPLES ORIGINATED IN THE HORTICULTURAL DIVISION.

Descriptions are taken of the seedling apples which are originated in the Horticultural Division, whether they are good, medium or poor. By doing this, it is possible to tell after a time what parent varieties are giving the largest proportion of promising varieties, and what the least. It gives valuable information for future work in breeding apples, as showing what characters of the female parent are apparent or conspicuous in the seedlings. The descriptions of these seedlings were all made by the writer, hence the same relative values are more likely to be given to the characters of the different seedlings than if several persons having different standards had described them.

In the following table, certain characters of 1,211 seedlings of twelve varieties are given in such a form that they can be readily compared. These seedlings were raised from seed saved from apples which fruited in 1898. The flowers were not hand-pollenized and the male parents can only be suggested by the characters of the seedlings and the varieties which grew nearest to the tree from which the seed was taken. Of these we have a record. While the male parent is thus not known with certainty, a study of the following table will be found very interesting and, it is hoped, suggestive. The following characters of the seedlings of the twelve varieties are quite marked.

Fameuse Seedlings.—It is generally supposed that seedlings of Fameuse resemble the female parent in a marked degree. In this case the number of good Fameuse seedlings has been small, while a large proportion of the seedlings of McIntosh, which is a seedling of Fameuse, have been good.

Gano Seedlings.—A large proportion of the seedlings resemble the female parent in regularity of form, in colour, in absence of flavour, and in having large seeds. A large proportion of the seedlings are winter apples like the female parent.

American Golden Russet Seedlings.—It is interesting to note that of 28 seedlings which have fruited none have russet skins. In 78·58 per cent green or yellow predominates. A comparatively small proportion has been propagated and only one has been thought good enough to name.

Langford Beauty Seedlings.—A large proportion are handsome, fine-grained apples of the Fameuse type with a marked resemblance to the female parent or to Louise, a seedling of Fameuse.

Lawver Seedlings.—While 29 per cent of the seedlings are late-keeping apples like the female parent, it is interesting to note that a large proportion have a season before December. Some of the Lawver seedlings show marked signs of Northern Spy blood, particularly in character of flesh and flavour. Both Lawver and Northern Spy are late-blooming sorts and were not very far apart in the orchard in 1898.

McIntosh Seedlings.—The McIntosh is supposed to be a seedling of Fameuse and has many Fameuse characteristics. Its seedlings have been much better than the Fameuse seedlings, nearly one-half the McIntosh seedlings being thought worthy of propagation, while less than a fourth of the Fameuse seedlings were propagated.

Northern Spy Seedlings.—Though at least partially self-sterile and thus doubtless pollenized by some other variety or varieties, there has been a marked resemblance to the Northern Spy in a large proportion of the seedlings in outward appearance, flesh, and flavour, and in being late-keeping apples.

Salome Seedlings.—The Salome has given some good seedlings, though the best are not from this variety. A large proportion of the seedlings bore a marked resemblance to Salome in outward appearance, flesh and flavour.

Shiwassee Seedlings.—The Shiwassee is a seedling of Fameuse. A large proportion of its seedlings had fine grained, tender flesh and were above medium to good in quality, but the percentage thought worth propagating was only a little larger than with the Fameuse seedlings.

Swayzie Seedlings.—Only a small proportion of the seedlings resemble the parent in outward appearance, though a large percentage bear a marked resemblance to Swayzie in flavour. The Swayzie is a small apple, but of the seedlings, over 78 per cent were medium to large.

Wealthy.—There is a general resemblance to Wealthy in a large proportion of the seedlings, particularly in colour and the regular outline of the fruit and character of flesh and flavour.

Winter St. Lawrence.—The Winter St. Lawrence has given a large proportion of seedlings above medium to good in quality, but the proportion thought worthy of propagation is about the same as for Fameuse. There are a few late-keeping apples among them.

In describing the apples of which the characteristics are given in the following table, the standards adopted for size were as follows:—

Small—2¼ inches in diameter, and below.

Below medium—2¼ to 2½ inches in diameter.

Medium—2½ to 2¾ inches in diameter.

Above medium—2¾ to 3 inches in diameter.

Large—3 to 3½ inches in diameter.

Very large—Above 3½ inches in diameter.

The notes and figures under RESEMBLANCE do not apply to all the seedlings described. If a character of a female parent was conspicuous in the seedling it was noted but, no doubt, there were many slight resemblances which were not noted, hence the percentages after the various headings under RESEMBLANCE are merely suggestive, but all the other characters were recorded for all the seedlings.

CHARACTERS of Seedling Apples originated in the Horticultural Division.

	Character of female parent.	Hamense seedlings.	Character of female parent.	Gano seedlings.	Character of female parent.	American Golden Russet seedlings.	Character of female parent.	Langford Beauty seedlings.	Character of female parent.	Lawyer seedlings.	Character of female parent.	Melntosh seedlings.	Character of female parent.	Northern Spy seedlings.	Character of female parent.	Salome seedlings.	Character of female parent.	Shawnessy seedlings.	Character of female parent.	Swayzie seedlings.	Character of female parent.	Wealthy seedlings.	Character of female parent.	Winter St. Lawrence seedlings.
No. Seedlings fruited		91		83		24		140		62		150		136		45		90		120		186		54
No. Seedlings propagated		21		16		4		61		13		39		64		25		26		36		44		15
No. Seedlings named		1		1		1		16		3		12		21		9		3		8		15		6
		%		%		%		%		%		%		%		%		%		%		%		%
Size—																								
Small		6·59		6·02		·66		0·00		6·45		5·00		2·21		2·75		3·01		5·39		1·35		3·57
Below medium		15·39		12·05		10·71		5·00		11·29		18·33		10·29		16·67		11·11		16·15		13·24		12·50
Medium	•	58·24		40·36		42·86		54·29		62·90	•	50·34		47·06	•	50·00		54·39	•	43·85		43·38		53·57
Above medium		17·59		38·56		35·71		35·00		19·36		23·33		30·15		21·33		31·49		34·61		39·41		30·36
Large		2·19		2·41		10·71		5·71		0·00		2·34		10·29		8·33		3·00		0·00		2·67		0·00
Total		100·00		100·00		100·00		100·00		100·00		100·00		100·00		100·00		100·00		100·00		100·00		100·00
Form—																								
Oblate		30·77		13·25		32·14		35·00		35·48		46·67		37·78		18·52		66·67		40·00		35·00		11·10
Roundish	•	53·85	•	38·56	•	35·15	•	23·57	•	38·71	•	44·39	•	36·03	•	67·55	•	31·31	•	53·05	•	61·05	•	72·44
Conical		13·19		43·35		0·00		11·43		16·13		3·33		26·47		3·70		2·02		3·94		3·94		6·42
Oblong		2·19		4·82		10·71		0·00		9·68		1·67		0·00		10·19		0·00		3·06		0·00		0·00
Total		100·00		100·00		100·00		100·00		100·00		100·00		100·00		100·00		100·00		100·00		100·00		100·00
Colour—																								
Entirely green or yellow		2·19		0·00		3·57		2·14		0·00		·83		1·47		0·00		5·05		4·61		0·00		0·00
Green or yellow predominating		36·49		25·30		28·58		17·14		12·90	•	24·16		8·09		5·56		20·20		40·77		5·15		15·36
Crimson or red	•	60·44	•	67·47	•	3·57	•	76·43	•	58·06	•	65·83	•	72·79	•	44·44	•	59·60	•	23·08	•	73·53	•	66·07
Pink or pinkish red		14·29		6·00		3·57		4·29		8·07		5·01		2·21		4·41		1·01		23·07		16·17		1·79
Orange or orange red		6·59		1·25		10·71		0·00		20·97		4·18		15·44		42·59		13·13		9·24		5·15		16·78
Russet		0·00		0·00		0·00		0·00		0·00		0·00		0·00		0·00		0·00		0·00		0·00		0·00
Total		100·00		100·00		100·00		100·00		100·00		100·00		100·00		100·00		100·00		100·00		100·00		100·00

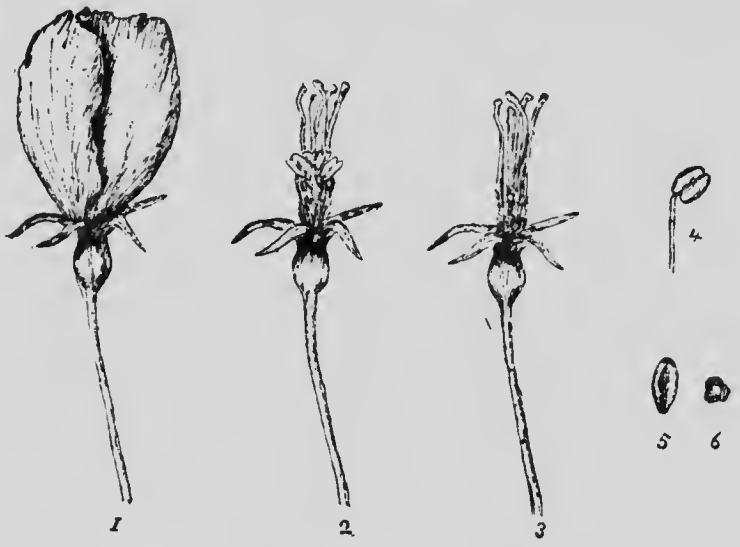
CHARACTERS of Seedling Apples originated in the Horticultural Division—*Concluded.*

—	Character of female parent	Fameuse seedlings.	Character of female parent.	Gano seedlings	Character of female parent.	American Golden Russet seedlings.	Character of female parent.	Langford Beauty seedlings.	Character of female parent.	Lawyer seedlings.	Character of female parents.	McIntosh seedlings.	Character of female parent.	Northern Spy seedlings.	Character of female parent	Salome seedlings.	Character of female parent.	Shiawassee seedlings.	Character of female parent.	Swayzie seedlings.	Character of female parent.	Wealthy seedlings.	Character of female parent.	Winter St. Lawrence seedlings.
Flavour—																								
Sweet		16·49		9 64		0 00		3·57		16·13	..	19·16		6·62		17·59		2·02		10·77		13·97		16 67
Mildly subacid		6·59		16·87		3·57		5·00		11·29		4·18		5·15		11·11		2·02		7·69		·73		5·12
Subacid	*	56·04	*	56·62	*	75·00	*	60·71		59·68	*	60·00	*	60·29	*	46·30	*	65·66	*	53·08		38·97	*	56·41
Briskly subacid		18·69		16·87		21·43		29 29	*	11·29		15·83		25·00		22·22		26·26		24·62	*	36·77		19·23
Acid		2·19		0·00		0·00		1 43		1·61		·83		2·94		2 78		4·04		3·84		9·56		2·57
Total		100 00		100·00		100·00		100·00		100·00		100·00		100·00		100·00		100·00		100·00		100·00		100·00
Quality—																								
Poor		0·00		0·00		0·00		0·00		0·00		0·00		0·00		0·00		0·00		0·00		·73		0 00
Below medium		1·10		1·20		0·00		0·00		0·00		0·00		0·00		0·00		2·02		0·00		2·21		1·28
Medium	*	27·47	*	67·47		57·15		15·71		40·32		11·66		23·53		41·67		18·18		23·85		27 94		24·36
Above medium		50 55		31·33		35·71		49·29	*	41·94		41·67		50·00		40·74		47·48		47 69		50·74		48 72
Good to very good	*	20·88		0·00	*	7·14	*	35·		17 74	*	46·67	*	26·47	*	17·59	*	32·32	*	28 46	*	18 38	*	25·64
Total		100 00		100·00		100·00		100 00		100·00		100·00		100·00		100·00		100·00		100·00		100·00		100·00
Season—																								
August-mid-September		10·99		0·00		0·00	*	16·43		6 45		1·67		·74		8·33		20·21		5·39		26·47		26·92
Mid-September to mid-October		21·98		10·84		7·14		27·86		12·90		18·33		14·70		19·45		24·24		6·15		16·18		15·38
October-November	*	31·87		14·46		28·58		29·29		22·59		28·33		38·25		20·37		24·24		30·77	*	36·77		19·23
November-February		29·67		25·30		32·14		20·71		29·03	*	34·17		27·21		26·85	*	18·18	*	30·00		11·76	*	34·62
December-April		5·49	*	49·40	*	32·14		5·71	*	29·03		17·50	*	19·12	*	25 00		13 13		27·69		8 82		3 85
Total		100·00		100·00		100 00		100·00		100 00		100·00		100·00		100·00		100·00		100·00		100·00		100·00
Resemblance—																								
In outward appearance		19·78		21 69		10·71		22·86		12·90		15·83		25·00		25·00		13·13		3·08		41 18		19·23
In flesh		36·26		56·62		21 43		47·14		20·97		18·33		40·44		71·30		52·53		23·85		46·32		29·49
In flavour		34·07		48·19		35·71		26·43				25·00		34·57		36·11		32·32		37·69		19·12		28·21
No resemblance		2·		4·82		32·14		30·00		35·48		28·33		27·94		14·81		32·32		40 77		27·91		28·21
In whiteness of flesh only								1·43										5·05						
In form and not colour		3·30		20·48		17 86		12·14		1·61		7·50		8·09		3 70		26·26		11·54		5·15		6·42
In colour and not form		2 19		0·00		3·57		7·86				17·50		1·47		30·56		2·02		·77		2·21		25·64
In large seeds				66·27						46·77														
In form only				2·41		10·71								2·94										
In colour				12·05						8·07				13·24										
In colour only				1·20						3·23				4·41										

CROSS-BRED AND HYBRID VARIETIES.

Those varieties which are originated by artificial cross-fertilization and hybridization are called cross-bred and hybrid, respectively. A hybrid is a cross between two species: as for instance, between *Pyrus Malus*, the apple, or a variety of it, and *Pyrus baccata* the Siberian crab. A cross-bred is a cross between two varieties of the same species, as, for instance, between the Northern Spy and McIntosh Red apples.

Although nearly all our best apples have been originated as seedlings, the reason is, not that good varieties cannot be produced by artificial cross-fertilization, but that comparatively little systematic work had been done in this direction in America until recent years. When one considers that a very large number of chance seedlings have been the result of natural cross-fertilization of the flowers of different varieties (for it is now an established fact that many varieties of apples are self-sterile) it seems reasonable to suppose that a much larger percentage of good apples will be obtained if the flowers are pollinated artificially, as then only the varieties which have the characteristics desired in the seedlings will be used as the parents, and although it has been already said that apples have been so intercrossed in nature for hundreds of years that there is no certainty what the seedlings of any variety will be like, yet the



Flower of apple prepared for cross-pollination.
1. Flower just before opening. 2. The petals removed. 3. The anthers removed.
4. One of the anthers. 5 6. Views of pollen highly magnified.

characteristics of the parents will be more likely to predominate than those of varieties whose blood has intermingled at a more remote period. Before beginning any work of this kind, it is important, then, to decide what kind of an apple is most desired, and to select as parents those varieties which have as many of the qualities sought for as possible. As there is yet not sufficient information available to know with certainty what will result by using certain varieties of apples as both the male and female parent it is wise to do some crossing with one variety as the female parent, and some with the same variety as the male parent. The results obtained with cross-bred apples at the Central Experimental Farm between cultivated varieties show that the male and female parents may influence the character of the fruit almost equally, though some varieties appear dominant in certain characteristics as female parents. A hybrid, however, is almost certain to have more characteristics of the female parent if the species differ widely. Such, for instance, as the hybrids between *Pyrus baccata* and the apples which are described further on.

The season when one may pollinate apple blossoms in the orchard is very limited, as there is only from a week to ten days during which the work may be done.

In the blossom of the apple the organs of reproduction represent both sexes. When the pollen, which is the fine dust constituting the male part of the flower, comes in contact with the stigma, which is the upper part of the female organ, fertilization is liable to take place, and this must be prevented if artificial pollination is to be performed. The pollen which is contained in the anthers is shed almost as soon as the blossoms open, and work must begin, therefore, when the flower is in bud.

There are usually five or six buds in a cluster on apple trees, but generally only the strongest of these set fruit. The more the flower bud is developed, the greater chances there will be that artificial pollination will be successful. The operator, however, must be certain that no pollen has already been shed. Two or three of the weakest and least developed buds are pinched off and the remainder are left to be operated upon, or if some of the flowers are open they are removed and the others left. A pair of small tweezers are very good for this purpose. They should be perfectly smooth at the tips, both outside and inside, so that no pollen will lodge there. The petals of the buds are now removed by means of the tweezers; the anthers which contain the pollen are then removed, by breaking the filaments off, and thrown away. In removing the petals and anthers, great care should be taken that the stigmas are not injured, as, if they are, failure is certain. Only the female part of the flower now remains. The stigmas are in condition to receive the pollen when they become moist. They will remain in this condition for a day or two. Pollen may, however, be applied to the stigmas before they are ready, as pollen will stay in good condition longer than the stigmas. If the pollen is not applied immediately, the flowers which have been operated upon should be covered with a stout paper bag, not much larger than is necessary to cover the flower cluster and permit tying but large enough so the flowers will not be crushed. The mouth is tied tightly about the twig, so that no insect can get in. Flower clusters of the variety of apple which is to supply the pollen and be the male parent of the future seedlings, should be gathered just before the buds open, and the twigs put in water until the blossoms open and the pollen is shed, which can be easily detected as the anthers burst open, when the pollen becomes quite visible to the naked eye. If the flowers are taken in the orchard after they open there is every probability that insects may have deposited pollen from other varieties there, and thus the parentage of the cross-bred variety would not be certain. Pollen may be kept in good condition for several weeks if in a dry condition in closed bottles in a dark place. It is thus possible to bring pollen for crossing from one part of Canada to the other if desired. When the pollen and stigmas are ready, the bag is removed and the stigmas then well covered with the pollen. This may either be effected by holding the flower in the fingers and rubbing the anthers against the stigmas, by putting some of the pollen on the finger nail and thus rubbing it on, or by applying it on the end of a knife or some other flat surface. The camel's hair brush which is often recommended is not a safe thing to use unless the person using it is very careful, as pollen may stick in the hairs, and if several kinds are worked with, there will be no certainty as to the parentage. After this operation has been performed the bag should be put on again and tied tightly as before. A label should then be attached to the twig, on which should be written a number, the names of the male and female parents, the number of flowers operated on, and the date on which the work was done. This record should also be kept in a notebook. When the blossoming period is over and the fruit is well set the paper bag should be removed, a record taken of the number of apples which have set, and then a gauze or muslin bag tied over the fruit instead of the paper one. The apples should then be left to grow and ripen in the orchard. Late apples which are not thoroughly matured when harvested should be left as long as possible before the seeds are taken out. The seeds should be removed, however, in time to sow them before winter sets in. They should be counted and the number recorded with the other data, and then treated the same as has already been recommended in the paragraph on Seedling Varieties.

CROSS-BREEDING APPLES IN CANADA.

Much work has been done by a few men in Canada in originating varieties of apples by cross-breeding and hybridization. To the late Chas. Arnold, Paris, Ont.; the late P. C. Dempsey, Trenton, Ont., and to the late Francis Peabody Sharp, Upper Woodstock, N.B., is due great credit for work done at a time when few were interested in the scientific aspects of fruit growing. The Ontario apple which was originated by Chas. Arnold by crossing the Northern Spy with the Wagener is a worthy memorial to that gentleman, it being a good, and, in some sections, a profitable, commercial variety. The Trenton and Walter apples are two of Mr. Dempsey's crosses, and are among the best apples of their season. The Crimson Beauty apple, a handsome variety now grown to a considerable extent as a very early summer apple in New Brunswick and Nova Scotia particularly, was originated by Mr. Sharp and the "New Brunswick" apple which, however, most pomologists cannot distinguish from the Duchess of Oldenburg, is said to have been originated by him and has been largely planted in New Brunswick.

At the Ontario Agricultural College, Guelph, Ont., and at the Horticultural Experimental Station, Vineland, Ont., work in cross-breeding apples has been in progress for some years and no doubt some good varieties will be produced at these institutions.

CROSS-BREEDING APPLES AT THE CENTRAL EXPERIMENTAL FARM, OTTAWA.—APPLES ORIGINATED BY THE LATE DR. WM. SAUNDERS.

The beginning of the work of the late Dr. Wm. Saunders is described as follows in his own words in Bulletin No. 68, Experimental Farm Series "Progress in the Breeding of Hardy Apples for the Canadian North-west."

Wild Siberian crab apple (*Pyrus baccata*)

"Shortly after the first Dominion Experimental Farms were established experiments were begun, both with large and small fruits, with the object of finding out what varieties, if any, could be successfully grown, especially in the colder districts in the Northwest Provinces. The apple, on account of its relative importance, naturally claimed special attention. During the first eight or ten years more than two hundred of the hardiest sorts of cultivated apple trees obtainable in northern Europe and other northern countries were thoroughly tested, especially at the experimental farms at Brandon, Man., and at Indian Head, Sask. These trees were planted in considerable numbers, often from twenty to fifty trees of a kind, some in shelter more or less dense, others without shelter, but in no case were any fruits produced. New varieties originated since then, considered to be of especial merit and hardiness, have been subjected to similar trials.

"In 1887, the year during which work on the experimental farms was begun, seed was obtained from the Imperial Botanic Gardens, St. Petersburg, Russia, of a small wild Siberian crab-apple, known as the 'Berried Crab,' *Pyrus baccata*. This crab

grows in abundance about the shores of the Baikal Sea and in many parts of Northern Siberia. Young trees were raised from seed of this crab, and, as soon as the specimens were large enough for transplanting, some were sent to Brandon, Man., and others to Indian Head, Sask., and in both places they were found to be entirely hardy. During a trial of about twenty years the Berried Crab has never been injured by winter and the trees have started from the terminal buds on the branches every season. These trees have fruited abundantly for many years, but the fruit of most of them is small—not much larger than a cherry—and is also astringent and acid and in some cases bitter. The fruit of *Pyrus baccata* makes excellent jelly, however, and hence, in its improved form, has been found useful. It is also highly ornamental in the spring, when in blossom, or when adorned with fruit in the autumn. The trees are rather dwarf in habit, low-branched and strongly built, with the fruit firmly attached to the tree. From its general habit of growth, it is well adapted to resist the high winds to which trees are often exposed on the northwestern provinces.

Commencement of the Work of Cross-Breeding.

After four or five years' experience had thoroughly established the character of the berried crab for extreme hardiness, efforts were made to improve the size and quality of the fruit by cross-fertilizing the flowers of *Pyrus baccata* with pollen from many of the hardiest and best sorts of apples grown in Ontario. This work was begun in 1894, and has since been continued along several different lines. The seeds obtained from the first crosses were sown in the autumn of that year and germinated in the following spring, producing, in all, about 160 young trees. These were planted in the spring of 1896, when many grew rapidly and soon made shapely specimens. These, and other young trees, resulting from similar subsequent experiments, have been planted from year to year in orchards at Ottawa, Brandon, Indian Head and other Northwestern stations. In 1899 thirty-six of the cross-bred apples first produced and grown at Ottawa fruited, and some of them were of such size and quality as to justify their being propagated for more general test. The fact that so many of these fruited on the fourth year from the sowing of the seed indicates a very early fruit-bearing habit. Since then several hundred more of these cross-bred apples have borne fruit, and the number of varieties worthy of extended cultivation has been considerably increased. Root-grafts of some of the more promising sorts were early made and these have been tested for eight or ten years past at each of the northwestern farms and have shown very slight inclination towards tenderness, even when planted in exposed situations. The cross-bred sorts grafted on roots of seedlings of *Pyrus baccata* have produced trees which, so far as they have been tried, seem to be quite as hardy as the wild form of *baccata*. There seems every reason to expect that they will prove generally hardy throughout the northwestern country.

"In all cases of crosses mentioned in this bulletin the first parent named is the female, the second the male.

"Experiments with 'Pyrus prunifolia' and 'Pyrus Malus.'"

"In 1896 a series of crosses was begun on another sort of wild crab, known as *Pyrus prunifolia*. This is regarded by some botanists as a distinct species; others believe it to be a hybrid between *P. Malus*, the wild crab of Europe, and *P. baccata*. Seeds of this form were also obtained from the Royal Botanic Gardens, St. Petersburg, Russia. The fruit of *P. prunifolia* is usually larger than that of *baccata*, and will average nearly twice the size. Its hardiness in the Northwest has also been established by a test covering a number of years on both of the experimental farms at Brandon and Indian Head. The first crosses with this species were made in 1896, and since then many new sorts have thus been originated.

"Another line of work in producing new apples was begun in 1902, in crossing *Pyrus Malus*, the wild apple of Europe, with some of the best Canadian sorts. T

fruit is about an inch in diameter to start with, and of fair quality. A hardy form of this tree has been secured which has stood several winters at Brandon and Indian Head without injury, and with this additional crosses have been made.

"Many of the best of the crosses produced on *P. baccata* and *P. prunifolia* have been recrossed, thus introducing a second quota of the blood of the larger apple with the hope of obtaining fruits of larger size and higher quality. Regarding these there is as yet not much proof that they are sufficiently hardy to endure the climate of the Northwest; this can only be fully determined by further experiment. Two varieties of these crosses of Ontario and Spy have been tested for several years at Indian Head, but have not yet fruited. Thus far they have been fairly hardy. The first one-year-old trees produced by this method were planted in the orchard at Ottawa in the spring of 1904, and a full list of those now growing in these orchards is submitted in this bulletin.

"*Apples from which Pollen has been Used.*

"In the first crosses made on *Pyrus baccata,* in 1904, pollen was used from the Tetofsky, Duchess and Wealthy apples, but since then pollen has been obtained from many other varieties and used on *P. baccata, P. prunifolia* and *P. Malus,* among them Anis, Beautiful Arcade, Broad Green, Excelsior, Famense, Golden Russet, Haas, Herren, Krimskoe, McIntosh Red, McMahan White, Osimoe, Pewaukee, Red Astrachan, Ribston Pippin, Scott's Winter, Simbirsk No. 9, Swayzie Pomme Grise, Talman Sweet, Winter St. Lawrence and Yellow Transparent. The number and variety of the crosses have thus been very much increased. Many hundreds of these cross-bred varieties of *baccata* origin have been produced (about 800 in all), and most of them have fruited. While a large number have proved of inferior quality, there have been originated, up to the present time, about sixteen varieties in all, most of which, from their superior size and quality, may be regarded as useful for domestic purposes and deserving more extended trial.

"*Second Crosses.*

"Many of the best of the crosses produced on *Pyrus baccata* and *Pyrus prunifolia* and their related forms have been recrossed, thus introducing a second portion of the characteristics of the larger apple, with the hope of obtaining fruit of larger size and higher quality. From these second crosses, which were made in 1904 and following years, there are now 407 trees growing in the orchards at Ottawa, several of which fruited for the first time in 1910."

SOME HARDY VARIETIES.

After being propagated and thoroughly tested on the prairies some of Dr. Saunders' hybrids have proved hardier than any other varieties of apples or crab apples tested, thus marking a stage of development in hardy apples for the prairie provinces. Some of the hardiest varieties have proved to be Jewel (*P. baccata* by Yellow Transparent, size 1·4 by 1·3 inches), Columbia (*P. baccata* by Broad Green, size 1·8 by 1·6 inches), Charles (*P. baccata* by Tetofsky, size 1·6 by 1·5 inches), Silvia (*P. baccata* by Yellow Transparent, size 1·4 by 1·5 inches), Tony (*P. baccata by McMahan,* size 1·6 by 1·4 inches), Elsa (*P. baccata* by Yellow Transparent, size 1·4 by 1·3 inches), Eve (*P. baccata* by Simbirsk No. 9, size 1·6 by 1·2 inches.) Descriptions of these published by Dr. Wm. Saunders in Bulletin No. 68 will be found on page 124 of this bulletin. Seedlings grown from these gave in nearly every case fruit smaller than the parent. As none of the fruits resulting from this cross was large enough to compare favourably with less hardy varieties of apples and crab apples, the best of these first crosses were, in 1904, recrossed with named varieties of apples with the object of obtaining varieties bearing larger fruits but which would retain sufficient hardiness to be grown in the open on the prairies.

In this work Dr. Saunders used the crosses as the mother parents in all cases. The varieties of apples used as male parents are McIntosh, Baldwin, Cranberry, Duchess, Northern Spy, October, Scott Winter, Simbirsk No. 9, Tetofsky, Yellow Transparent, Ontario, Gideon, Rideau, Hams, August, Walter, Wealthy, McMahan. From seeds obtained through this work 407 trees were grown at Ottawa which began to fruit in 1910 and of which a large proportion have borne. While many of these have borne fruit no larger than the mother parent, 24 have produced apples two inches and more in diameter. Some of the largest varieties which have fruited are Wapella (Dean by Ontario) size 2·25 by 2·25 inches; Angus (Dean by Ontario) size 2 by 2·5 inches. The parentage of Dean is *P. baccata* by Wealthy. Martin (Pioneer by Ontario) size 2·25 by 2·37 inches; Gretna (Pioneer by Northern Spy) 2 by 2·25 inches. The parentage of Pioneer is *P. baccata* by Tetofsky. Most of these second crosses retain the long, slender stem, the thin, tender skin, and the crisp, breaking flesh which are characteristic of *Pyrus baccata*, but a few are quite apple like.

It is not known yet whether these will be sufficiently hardy or not, but this will soon be determined.

It is to be regretted that the apple (*Pyrus Mal. s*) was not used as the mother in these crosses, as it is believed by the writer that larger apples would have been obtained more quickly, but size might have been obtained at the expense of hardiness which is the first consideration on the prairies. If these second crosses prove hardier than any other apples or crab apples which have been tested they will mark another step in advance.

CROSS-BREEDING APPLES IN THE HORTICULTURAL DIVISION, OTTAWA, ONTARIO.

A little work in cross-breeding was done in the Horticultural Division in 1895 when McMahan was crossed with Scott Winter and Walbridge with Northern Spy, but beginning in 1899 some work has been done almost every year since. The parents used in making crosses are Anis, Anisim, Antonovka, Baldwin, Baxter, Bethel, Bingo, Cobalt, Crusoe, Duchess of Oldenburg, Dyer, Danville, Fameuse, Forest, Glenton, Gravenstein, Hibernal, Lawver, Lowland Rasberry, Malinda, Milwaukee, McIntosh, McMahan, Newton, Northern Spy, North Western Greening, R. I. Greening, Rosalie, Rouleau, Scott, Winter, Stone, Winter Rose, and Walton. Reciprocal crosses have been made in many cases. There have been two main objects in view in this work, first to obtain hardier winter apples for the colder parts of Canada where apples are grown commercially and, second, to obtain early bearing varieties covering the whole season, as there seems to be no good reason why more apples of the Northern Spy type should not be obtained which will bear as early as Wealthy and Wagener.

More than 1,000 trees are now growing as a result of a little crossing almost every year and nearly 100 of these have already fruited. So far not many apples have fruited which have been thought worthy of propagation, but there have been a few from a cross between McIntosh and Lawver where the object was to obtain varieties which would keep better than McIntosh.

In six out of ten crosses which have fruited with Lawver as the mother no marked resemblance to either parent is recorded, and similarly in three of the six with McIntosh as the mother. Of the four varieties with Lawver as the mother that have marked characteristics of the parent, two have distinct McIntosh flavour and two resemble McIntosh in colour. The Lawver characeristics are not very marked. Of the six varieties with McIntosh as the mother only two show marked resemblance to either parent in the important characteristics of colour, flesh, and flavour, although as regards season a large proportion resembles both parents. The McIntosh seedlings from open pollination have given a larger proportion with marked McIntosh characteristics than has been the case in this cross. While there are none of the sixteen varieties

of this cross which have yet fruited which are as good as McIntosh in quality, ten of the sixteen are better than Lawver in quantity and thirteen of the sixteen are later in season than McIntosh, and most of the varieties are of high colour and attractive in appearance. Following are those which have been named: Lawver by McIntosh-Holz, Vermac. McIntosh by Lawver-Mavis, Rustler.

BUD SPORTS.

A few varieties of apples, or perhaps some of them might be called sub-varieties, are originated by bud variation. For instance a bud on a Fameuse tree may develop into a branch which bears apples much redder than those on other parts of the tree. There are some of these Red Fameuse in Canada which, however, were noticed as individual trees in an orchard of Fameuse, not as fruit on a special branch of a tree but it is supposed that they originated as a bud variation on some tree. These propagate true to type. The Banks Red Gravenstein which originated in Nova Scotia is an example of a "bud sport" but there are few of these "bud sports" which have been recorded so far.

INDIVIDUALITY IN APPLE TREES.

In the annual report for 1903 and in several of the reports since, yields have been published from individual trees of the same varieties of apples planted at the same time and growing under apparently very similar conditions. It has been shown that there was a great difference in the yields from different trees, some producing from two to three times as much as others. It is not known whether this difference in yield is due to a difference in the soil or whether, as some horticulturists believe, each bud of an apple has an individuality of its own which is perpetuated by propagation.

A table is given below of the yields of individual trees of McMahan, Patten, and McIntosh apples. There was a table giving the yields of Wealthy apple trees in previous reports, but these trees have now been thinned and are not now under very similar conditions.

Apples McMahan.—Planted, 1888. Yield in Gallons.

Row 1.	1898.	1899	1900.	1901.	1902.	1903.	1904.	1905.	1906.	1907.	1908.	1909.	1910.	1911.	1912.	1913.	1914.	1915.	Total yield 1898-15.
Tree 1	62·0	·0	83·0	2·0	147·0	1 5	141·0	40·0	124·0	11·0	142·0	2·5	133 0	20·0	110·0	0	216 0	19·0	1254 0
" 2	42·0	1·0	6·0	12 5	98·0	23·0	116 0	30·0	114·0	17·0	120·0	11·0	93·0	35·0	80·0	38·0	112 0	52·0	1000·5
" 3	32·0	29 0	49·0	18·0	55·0	63·5	56·0	108·0	9 0	84·0	12·0	121·5	2·0	179·0	·0	128 0	29 0	163·5	1138 5
" *4	35·0	0	34·5	4 0	63·0	34·0	67·0	69·0	49·0	31·0	73·0	22·0	72 0	50·0	Removed for road.				603·5
" 5	·0	37·5	55·0	49·0	·0	51·0	·0	98·0	0	54 0	·0	100·0	24 0	127·5	32·0	108 0	39·0	131·5	916·5
" 6	25·0	4·5	86·0	0·5	69·5	43·0	72·0	96·0	75·0	52·0	81·0	78·0	97·0	94·0	50·0	74 0	143·0	109·0	1209·5
" †7	0 5	9·5	19·5	4 0	19 0	39·5	14·0	37·0	·0	20·0	·0	63·0	·0	69 0	11·0	54 0	16·0	.....	376·0
" 8	7 0	9 0	27 0	9 0	53 0	15·5	54 0	35·5	64·0	21·0	96·0	32·5	102 0	56·0	58·0	31·0	114 0	38·0	822·5
	203 5	90 5	32·0	99 0	504 5	281·0	520·0	513 5	435·0	290 0	524 0	430·5	523·0	630·5	341·0	433·0	669·0	513·0	7321·0

* It should be noted that the total yield of No. 4 should not be compared with the total of others as it had to be removed in 1912 to permit a road going through.
† The trunk of No. 7 is now diseased hence this tree should not now be compared with the others, but it has been a relatively poor yielder since 1898.

Apples, McIntosh.—Planted, 1890. Yield in Gallons.

Tree.	1898.	1899.	1900.	1901.	1902.	1903.	1904.	1905.	1906.	1907.	1908.	1909.	1910.	1911.	1912.	1913.	1914.	1915.	Total Yield. 1898-1915.
1	17·5	26·0	37·0	6·5	7·5	94 0	12 0	109·0	3·0	109·0	41 5	184 0	50 0	166·0	55 0	145 0	112·0	44 0	1219 0
2	1·0	9·5	10·5	1·0	37·5	31·0	6·0	72·0	6·0	23 0	33·0	110 0	27·0	89·0	57·5	82·25	41·0	33 0	670·25

Apples, Patten (Greening).—Planted, 1892. Yield in Gallons.

Tree.	1898.	1899.	1900.	1901.	1902.	1903	1904.	1905.	1906.	1907.	1908.	1909.	1910.	1911.	1912.	1913.	1914.	1915.	Total Yield. 1898 1915.
1	27 0	2·0	35 0	1·5	71 0	15 0	84·0	34·0	92·0	3 0	138 0	0	95·0	0	205 0	0	172 0	·0	974·5
2	2·0	6 0	14·0	19 0	24 0	55 5	7·5	66 0	·0	82·0	·0	88·0	1·0	152·0	14 0	142 0	4 0	162·0	839 0
3	2·0	31 0	1·5	40·5	22 0	67·0	26·0	69·0	0·5	71 0	6·0	70·9	·0	113 0	2·0	91 0	0	144·0	756 5
4	13·0	·0	6·5	·0	12·0	15·0	45·0	45·0	13·0	48·0	12·0	52·0	30·0	45·0	63 0	64·0	50 0	73·0	586 5
5	1·0	·0	19·0	·25	17·5	21·0	54 0	75·0	·5	74·0	·0	68 0	5	135·0	2·5	115 0	3 5	140 0	726·75

Picking apples and recording yields from individual trees, Central Experimental Farm, Ottawa Ont.

To determine, if possible, whether these differences would be continued in trees grafted from them, scions were taken from the least productive tree, the most productive tree and the tree which bore a good crop every year in a row of eighteen Wealthy apple trees. These trees were propagated in 1905, being root grafted on seedlings of the Rose of Stanstead Crab and planted out in 1909 on a uniform piece of soil. They began bearing in 1912 and in the following table will be found the yields obtained for 1912, 1913, 1914 and 1915. It will be seen that the trees from the productive and regular bearing tree has, so far, given slightly the best crop but the yield from the trees from the poorest bearer are not much behind. The results are interesting, though several years' more crops are necessary before one should draw any conclusions.

YIELD of Heaviest Bearing Tree. Bud Heredity Experiment.

Record No.	Tree.	Yield 1912.	Yield 1913.	Yield 1914.	Yield 1915.
6320	3/1	0·25 gal.	0 0 gal.	4·0 gal.	0 50 gal.
6321	3/2	0·00 "	0 0 "	7·0 "	1·25 "
6322	3/3	0·00 "	0 0 "	4 0 "	0 50 "
6323	3/4	0·00 "	0 0 "	4 0 "	0·25 "
6324	3/5	0 50 "	2·75 "	8·0 "	0 00
6491	13/3	0·50 "	1·0 apple	7·5 "	0·00 "
6475	12 4	1 00 "	0·25 gal.	4·0 "	0·75 "
Yearly totals	.....	2 25 gal.	3 0 gal.	38·5 gal.	3·25 gal.

Total yield from seven trees for four years 47 gallons.

YIELD of Heaviest and Regular Bearing Tree. Bud Heredity Experiment.

Record No.	Tree.	Yield 1912.	Yield 1913.	Yield 1914.	Yield 1915.
6354	5/1	2 apples	3·25 gal.	3·0 gal.	1·75 gal.
6355	5/2	3 "	2·00 apples	7 0 "	3·00 apples.
6356	5/3	0 "	0·00 "	3 0 "	1·75 gal.
6357	5/4	0 "	0·00 "	3 0 "	0·50 "
6358	5/5	0·5 gal.	2·75 gal.	10 0 "	2·00 "
6476	12 5	0 0 "	1·75 "	5·0 "	0·00 "
6481	12/10	2 0 "	10·00 "	9·0 "	0·00 "
Yearly totals	...	2·75 gal.	17·75 gal.	40·0 gal.	6·00 gal.

Total yield from seven trees for four years 66·5 gallons.

YIELD from Least Productive Tree. Bud Heredity Experiment.

Record No.	Tree.	Yield 1912.	Yield 1913.	Yield 1914.	Yield 1915.
6337	4 1	0·0 gal.	0·75 gal.	3 0 gal.	1 5 gal.
6338	4/2	0 0 "	0·00 "	5·0 "	0·75 "
6339	4/3	0·0 "	0·00 "	6·0 "	4·5 "
6340	4/4	0·0 "	0·00 "	3·0 "	5 0 "
6341	4/5	0·5 "	0·25 "	5·0 "	3 5 "
6479	12/8	0·0 "	0·00 "	9 0 "	0·0 "
6490	13/2	0 0 "	0·00 "	4 0 apples	0·0 "
Yearly totals	.....	0·5 gal.	1 00 gal.	31·0 gal.	15·25 gal.

Total yield from seven trees for four years 47·75 gallons.

When the scions from which these trees were propagated were taken from the parent trees in 1905, the latter which had been planted in 1896, had yielded 103½ gallons, 88½ gallons, and 39 gallons, respectively.

NAMES GIVEN TO VARIETIES OF APPLES AND CRAB APPLES ORIGINATED IN THE HORTICULTURAL DIVISION AT THE CENTRAL EXPERIMENTAL FARM, OTTAWA, ONT.

The following names, with reference as to where the original descriptions may be found, have been given to apples and crab apples originated at the Central Experimental Farm. When the names were given it was thought that these varieties promised to be useful in some part of Canada. Their hardiness, which is one of the most important considerations, is being determined at the different Farms and Stations.

Names given to apples originated in the Horticultural Division, Central Experimental Farm, Ottawa, up to spring of 1915:

Seedling Varieties.	Female Parent.	Date of Sowing Seed		Date of Planting Tree.		Date of First Fruiting.	Fruit Described.
Ascot	Northern Spy	Autumn	1898	Spring	1903	1912	R. 1913, P. 222
Biugo	"	"	1898	"	1902	1910	R. 1911, P. 110
Donald	"	"	1898	"	1902	1909	R. 1912, P. 92
Elmer	"	"	1898	"	1902	1911	R. 1912, P. 92
Emilia	"	"	1898	"	1902	1914	R. 1915, P. 595
Epsom	"	"	1898	"	1902	1912	R. 1913, P. 293
Galton	"	"	1898	"	1906	1912	R. 1915, P. 595
Glenton	"	"	1898	"	1902	1909	R. 1911, P. 111
Homer	"	"	1898	"	1902	1908	R. 1910, P. 135
Lipton	"	"	1898	"	1902	1914	R. 1915, P. 595
Marcus	"	"	1898	"	1902	1911	R. 1912, P. 93
Nestor	"	"	1898		1904	1912	R. 1912, P. 93
Niobe	"	"	1898	"	1902	1909	R. 1911, P. 111
Rocket	"	"	1898	"	1902	1910	R. 1911, P. 112
Rosalie		"	1898	"	1901	1908	R. 1911, P. 112
Sandow	"	"	1898	"	1902	1911	R. 1912, P. 94
Sparta	"	"	1898	"	1901	1912	R. 1914, P. 495
Marne	"	"	1898	"	1903	1913	R. 1915, P. 595
Orlando	"	"	1898	"	1902	1911	R. 1913, P. 294
Pandora	"	"	1898	"	1902	1908	R. 1913, P. 294
Tasty	"	"	1898	"	1902	1911	R. 1912, P. 94
Thurso	"	"	1898	"	1901	1909	R. 1908 P. 103
22 Varieties.							
Brisco	Langford Beauty	"	1898	"	1903	1910	R. 1913, P. 292
Cora	"	"	1898	"	1902	1907	R. 1911, P. 110
Diana	"	"	1898	"	1903	1912	R. 1913, P. 292
Dulcet	"	"	1898	"	1903	1911	R. 1914, P. 494
Galena	"	"	1898	"	1903	1911	R. 1913, P. 293
Garner	"	"	1898	"	1902	1907	R. 1908, P. 101
Gerald	"	"	1898	"	1903	1911	R. 1912, P. 92
Horace	"	"	1898	"	1902	1908	R. 1912, P. 93
Kildare	"	"	1898	"	1902	1908	R. 1911, P. 111
Kinn	"	"	1898	"	1902	1908	R. 1911, P. 111
Linda	"	"	1898	"	1902	1908	R. 1915, P. 595
Moreno	"	"	1898	"	1902	1908	R. 1913, P. 293
Monitor	"	"	1898	"	1903	1909	R. 1912, P. 93
Ripon	"	"	1898	"	1902	1908	R. 1911, P. 111
Sonora	"	"	1898	"	1902	1907	R. 1908, P. 102
15 Varieties.							
Brock	McIntosh	"	1898	"	1901	1908	R. 1910, P. 134
Carno	"	"	1898	"	1901	1907	R. 1911, P. 110
Caruso	"	"	1898	"	1903	1909	R. 1912, P. 91
Casco	"	"	1898	"	1903	1913	R. 1914, P. 494

Names given to apples originated in the Horticultural Division, &c. *Continued.*

Seedl' ...eties.	Female Parent.	Date of Sowing Seed.	Date of Planting Tree.	Date of First Fruiting.	Fruit Described.
Garnet	McIntosh	Autumn 1898	Spring 1901	1908	R. 1912, P. 92
Gilda	"	" 1898	" 1904	1909	R. 1914, P. 494
Grover	"	" 1898	" 1901	1908	R. 1913, P. 293
Lobo	"	" 1898	" 1901	1906	R. 1910, P. 135
Forerunner	"	" 1898	" 1904	1901	R. 1915, P. 595
Melba	"	" 1898	" 1901	1908	R. 1909, P. 111
Nemo	"	" 1898	" 1901	1908	R. 1912, P. 93
Joyce	"	" 1898	" 1901	1911	R. 1912, P. 93
Pedro	"	" 1898	" 1903	1911	R. 1913, P. 294
Service	"	" 1898	" 1901	1908	R. 1912, P. 94
Seton	"	" 1898	" 1901	1908	R. 1911, P. 112
Toohlet	"	" 1898	" 1901	1912	R. 1914, P. 495
Valerie	"	" 1898	" 1903	1908	R. 1914, P. 495
Winton	"	" 1898	" 1901	1908	R. 1915, P. 590
18 Varieties.					
Humber	American Golden Russet	" 1898	" 1902	1911	R. 1913, P. 293
1 Variety.					
Lucia	Salome	" 1898	" 1902	1912	R. 1914, P. 494
Cleaver	"	" 1898	" 1902	1910	R. 1912, P. 92
Manda	"	" 1898	" 1902	1910	R. 1913, P. 293
Nepean	"	" 1898	" 1902	1908	R. 1910, P. 135
Oswald	"	" 1898	" 1902	1908	R. 1910, P. 136
Rondo	"	" 1898	" 1902	1911	R. 1912, P. 94
Roulean	"	" 1898	" 1902	1907	R. 1910, P. 136
Stella	"	" 1898	" 1902	1908	R. 1910, P. 136
8 Varieties.					
Petrel	Shiawassee	" 1898	" 1901	1907	R. 1910, P. 136
Ramona	"	" 1898	" 1902	1908	R. 1913, P. 294
2 Varieties.					
Albert	Winter St. Lawrence	" 1898	" 1901	1909	R. 1912, P. 91
Anso	"	" 1898	" 1901	1909	R. 1910, P. 134
Atlas	"	" 1898	" 1902	1910	R. 1912, P. 91
Drumlo	"	" 1898	" 1902	1910	R. 1915, P. 594
Linton	"	" 1898	" 1901	1907	R. 1908, P. 102
Nile	"	" 1898	" 1902	1908	R. 1912, P. 94
6 Varieties.					
Adonis	Wealthy	" 1898	" 1901	1905	R. 1905, P. 107
Battle	"	" 1898	" 1901	1906	R. 1910, P. 134
Clive	"	" 1898	" 1902	1907	R. 1908, P. 101
Consort	"	" 1898	" 1901	1908	R. 1914, P. 494
Crusoe	"	" 1898	" 1901	1903	R. 1906, P. 107
Galetta	"	" 1898	" 1902	1906	R. 1906, P. 108
Jethro	"	" 1898	" 1902	1911	R. 1914, P. 494
Luke	"	" 1898	" 1902	1906	R. 1911, P. 111
Medford	"	" 1898	" 1901	1906	R. 1908, P. 102
Melvin	"	" 1898	" 1901	1905	R. 1910, P. 135
Mendel	"	" 1898	" 1902	1906	R. 1906, P. 108
Pinto	"	" 1898	" 1902	1906	R. 1909, P. 111
Prosper	"	" 1898	" 1902	1908	R. 1910, P. 136
Noel	"	" 1898	" 1901	1905	R. 1906, P. 108
14 Varieties.					
Roger	Gano	" 1898	" 1902	1908	R. 1911, P. 112
1 Variety.					

Names given to apples originated in the Horticultural Division, &c.—*Continued.*

Seedling Varieties.	Female Parent.	Date of Sowing Seed.	Date of Planting Tree.	Date of First Fruiting.	Fruit Described.
Cobalt	Lawyer	Autumn 1898	Spring 1902	1908	R. 1910, P. 134
Congo	"	" 1898	" 1901	1906	R. 1906, P. 107
Danville	"	" 1898	" 1902	1908	R. 1909, P. 111
3 Varieties.					
Herald	Fameuse	" 1898	" 1902	1909	R. 1910, P. 135
1 Variety.					
Ambo	Swayzie	" 1898	" 1904	1912	R. 1914, P. 493
Cromer	"	" 1898	" 1902	1905	R. 1909, P. 111
Navan	"	" 1898	" 1902	1906	R. 1906, P. 108
Nome	"	" 1898	" 1904	1909	R. 1915, P. 596
Ottawa	"	" 1898	" 1902	1906	R. 1906, P. 108
Radnor	"	" 1898	" 1902	1907	R. 1909, P. 111
Severn	"	" 1898	" 1901	1906	R. 1908, P. 102
7 Varieties.					
Bruno	Scott Winter	" 1898	" 1902	1907	R. 1908, P. 101
1 Variety.					
Claire	Russian	" 1889	" 1890	1906	R. 1906, P. 107
Neville	"	" 1889	" 1890	1904	R. 1906, P. 108
Oscar	"	" 1889	" 1890	1897	R. 1908, P. 102
Rupert	"	" 1889	" 1890	1897	R. 1906, P. 109
Percival	"	" 1889	" 1890	1906	R. 1906, P. 108
5 Varieties.					
Cross-bred Varieties.					
Rustler	McIntosh x Lawyer	" 1899	" 1903	1912	R. 1913, P. 294
Mavis	" "	" 1899	" 1903	1909	R. 1915, P. 599
Vermac	Lawyer x McIntosh	" 1899	" 1902	1908	R. 1913, P. 295
Holz	" "	" 1899	" 1903	1911	R. 1912, P. 92
Granby	McMahan x Scott Winter	" 1895	" 1896	1907	R. 1908, P. 101
Kelso	" "	" 1895	" 1896	1907	R. 1908, P. 102
Sorel	" "	" 1895	" 1896	1907	R. 1908, P. 102
Dorval	" "	" 1895	" 1896	1905	R. 1906, P. 107
Roberval	" "	" 1895	" 1896	1905	R. 1906, P. 108
Valois	" "	" 1895	" 1896	1905	R. 1906, P. 108
Walton	" "	" 1895	" 1896	1903	R. 1906, P. 109
11 Varieties.					
Total, 115 Varieties.					

The following names recorded first in the Annual Report of the Experimental Farms for 1906 were given to seedling varieties of Russian origin descriptions of which have not yet been published. These were among the best and apparently the hardiest of 2,000 trees. They have been sent to the prairie provinces for trial and should any of them prove promising descriptions will appear in the annual reports:—Arcola, Birtle, Bolton, Beaver, Bomba, Bison, Carlyle, Carman, Cicero, Cecil, Carrie, Crescent [illegible]e, Dauphin, Dewar, Earliana, Grenfell, Hanley, Hamlet, Harbinger, Jarvis, [illegible]sper, Jacko, Lang, Leroy, Mentor, Melfort, Morden, Murillo, Morley, Nepigon, Osler, Otter, Pingree, Ponoka, Parma, Polaris, Roslin, Rawdon, Selkirk, Snelling, Solina, Sorley, Sanford, Souris, Selwyn, Vesta, Virgil, Varna, Virden, Woburn and Wesley—53 varieties.

CONCLUSIONS REACHED IN REGARD TO ORIGINATING NEW VARIETIES OF APPLES.

(1). To produce a hardy apple where no apples have yet been found hardy: (*a*) Cross the apple with the wild Siberian Crab apple (*Pyrus baccata*); (*b*) Sow seeds of apples which have ripened in a climate as nearly similar as possible.

(2). To produce a hardy long-keeping apple of good quality: Sow seeds of long keeping varieties of apples of good quality which have ripened fruit and proved hardy in a somewhat similar climate, and when possible have both parents long keeping varieties.

(3). To produce an apple having certain characteristics, as regards hardiness, vigour and productiveness of tree, and quality, size and appearance of fruit: Sow seeds of varieties having most of the characteristics desired.

(4). If seedlings are to be grown on a large scale, more varieties having the characteristics desired will probably be obtained if trees of several named sorts blossoming at the same time be planted in close proximity in the orchard, and the seeds used from fruit borne on these trees. The trees thus planted should combine all the good points in the standard aimed at, for the variety to be originated.

(5). In cross-breeding apples where quality is an important factor, as it should be in most places, cross two varieties which are both good or very good in quality. It has been the experience at Ottawa that in crossing a variety of good quality with one of inferior quality the crosses will nearly always bear fruit with quality inferior to the one with good quality.

SOWING THE SEED.

Apple seeds germinate best when sown in the autumn. If, however, it is not convenient to sow them at that time, they may be stratified; that is, mixed with sand, slightly moist, but not wet, and kept in a cool but dry place until spring. Seeds should not be sown in the autumn in soil which heaves much; better hold them over and sow them as early in the spring as the soil can be worked. If apple seeds become very dry they may not always germinate satisfactorily, and this should be guarded against. The seeds should be sown thinly, about 1 to 2 inches deep, in rows from 2½ to 3 feet apart. Or, if the quantity is small, beds may be prepared and the seeds sown in rows about 6 inches apart. If sown in the autumn, most of them should germinate the following spring and make a growth of from one to two feet that season. They should be transplanted the following spring into rows from 2½ to 3 feet apart, placing them 12 inches apart in the rows. The next spring they should be in good condition for planting in the seedling orchard.

PROPAGATION BY GRAFTING AND BUDDING.

When a good variety has been originated, more trees of it are usually wanted, and the process of increasing the number is called propagation. Plants which come true from seed, are, as a rule, increased by growing them from the seed; but as a

variety of apple cannot be reproduced in that way, other methods must be adopted, and recourse is had to grafting and budding. There are other methods of propagation, but these are what are usually adopted in this country. In grafting the apple, the name scion is given to a cutting of wood of the variety that it is desired to propagate. The stock is the tree or portion of the tree, be it young or old, that the scion is to be, or is, united with. As it is only through the stock that the scion can procure the sap which nourishes it, at least for a time, the former must be furnished with roots.

Stocks.—Some kinds of fruits may be grafted successfully on others which are closely related to them botanically, such as the pear on the quince; but there is nothing so satisfactory to graft the apple on as the apple, and, under certain circumstances, the crab apple.

Although the stock and scions are united by the process called grafting, both of them retain almost entirely their individual characteristics. The stock does, however, modify the vigour and fruitfulness of the variety grafted on it. If a variety is grafted on a dwarf or slower growing tree than itself the result is that the stock tends to dwarf it, as a sufficient quantity of crude sap does not pass through it to maintain the natural vigour of the top; and as a lessening in vigour tends to the development of fruit buds, this kind of stock is often used for the purpose of inducing fruitfulness in a variety and for dwarfing the tree. The Paradise stock of Europe is an example of this kind of stock. There is, however, often such a difference in the growth of the stock and the variety grafted on it that the result is not satisfactory. It is quite possible that the stock may have the effect of making the tree hardier, as if growth is checked the wood may ripen better; although the results obtained by top-grafting 92 varieties at the Central Experimental Farm on hardy stocks showed that there was not a sufficient increase in the hardiness of tender varieties to enable them to withstand a test winter. In top-grafting trees, great care should be taken that the stock is a vigorous growing variety, as, if it is not, the union may be bad, or the top outgrow it and the tree will become top heavy and finally break down. While good results have been obtained by top-grafting on crab apple stock, it is not very satisfactory and should not be used unless in exceptional cases, as the union is often bad or the grafted part outgrows the scion. Some of the best varieties for stock on which to top-graft are McMahan, Hibernal and Haas, and Tolman in the best apple districts.

Dwarf or slow-growing stocks such as Paradise and Doucin are not recommended for general use. The stocks used in root grafting and budding in the districts where the best apples can be raised successfully are usually obtained from apple seeds which are procured at cider mills or anywhere else where they can be got easily and in large quantities, and no pains are taken to learn what varieties produced the seeds. Stocks grown from this kind of seed, while quite satisfactory, as a rule, are not desirable in the coldest parts of the country where root-killing is liable to occur, as individual trees vary much in hardiness, and one might graft a hardy variety on a tender stock without knowing it. At Ottawa, what stocks are required for root-grafting are usually grown from seeds of the Martha and other hardy vigorous crabs. Seeds from the hardiest varieties of both apples and crab apples are more likely to produce hardy stocks than if the seeds were obtained promiscuously.

For the very coldest parts of Canada where the apple can be grown at all, the berried crab, *Pyrus baccata*, will probably make the most satisfactory stock for root-grafting or budding. It is perfectly hardy at Indian Head, Sask., where the winters are very severe, having endured the climate there. The seeds from which the stocks are to be grown for root-grafting or budding should be treated in the manner already described under the heading 'Seedling Varieties.' It is important to cultivate the young trees thoroughly the first season if it is desired to use them for root-grafting,

tho others left to grow for another season, when they may be used for budding, if propagation is done that way, or for root-grafting as before. They will not be large enough for budding the first season. If it is known that a hardy variety is growing on its own roots, hardy stocks may be obtained if pieces of the roots are cut off and scions grafted on them.

There are many of the best apples which will not succeed in certain parts of Canada when grown in the ordinary way, as they are either root-killed, or sunscalded so badly that they die from the effect of it. Experiments conducted at the Central Experimental Farm go to prove that by top-grafting these varieties on hardy stocks some will grow well and produce fruit of fine appearance and quality for a time but when a test winter comes they succumb. To obtain these stocks it is necessary, first of all, to have hardy roots. This may be effected to a large extent by raising seedlings from tho very hardiest apples or crab apples. A variety is then grafted or budded on them, which forms a straight, clean trunk which does not sunscald, and on this variety is top-grafted the kind that does not succeed when grown in the ordinary way. The surest way, however, of obtaining hardy stocks is to grow the hardy varieties on their own roots as explained in the paragraph on root-grafting.

SCIONS.

As much of the success in grafting depends on the condition and quality of the scions, too much stress cannot be laid on the importance of having them of the best quality, and in the best condition at tho time of grafting.

Scions may be cut any time after the wood is well ripened in the autumn and before the buds begin to swell in the spring. The best time, however, is in the autumn, as they may then be kept in the condition desired, although scions which are not kept in good condition all winter are not as good as those cut from the tree early in spring and grafted at once.

If they are cut in cold weather, in winter, there is less sap in the scions at the time, and thus the chance of their drying up is greater than if they were cut in the autumn. One cannot tell very well, either, in winter, whether the young wood has been injured or not. Scions should be cut from healthy, bearing trees. The wood of old trees is liable to be diseased, and if diseased wood is used it is likely to produce a diseased tree when grafted. Scions should also be cut from the most productive trees. Occasionally, one or more trees of a variety will produce more and heavier crops than the others. If scions are taken from these trees, the probability is that a larger proportion of the grafted trees will produce crops like the trees from which the scions were taken than they otherwise would, although this is not satisfactorily proven yet. It is, however, true that scions from a tree with especially highly coloured fruit of a variety will, if taken from certain trees of the variety, produce highly coloured fruit. The scions should be cut from the wood of the current season's growth, as older wood is not satisfactory. The buds should be well developed and the wood thoroughly ripened. It is not wise to use the water sprouts or young shoots which spring from the main branches or trunk for this purpose. They may not be thoroughly ripened, and it is also possible that sprouting propensities may be thus more developed in the grafted trees. The entire season's growth may be cut off and packed away until required for grafting, when it should be cut into pieces from four to six inches in length having three well developed buds.

Scions may be kept in good condition in moss, saw-dust, sand, or forest leaves. The last two named are found very satisfactory at Ottawa. These materials should be slightly moist, but not wet; the object being to keep the scions fresh and plump without there being any danger of their rotting. They should be kept in a cool cellar which is not too dry, and should remain dormant until ready for use.

Root-Grafting.—The cheapest and one of the best methods of propagating apples, especially in Canada, is by root-grafting. The strongest of the young stocks which have been grown in the manner already described are heeled in during the autumn in a cool cellar in moist sand. Grafting may be done any time during the winter, but it is usually not started until January or February.

At Ottawa, the best success has been obtained when grafting was done early in February. By grafting early the wound has time to callus well before the grafts are planted out, which is important. Whip or tongue-grafting is the method usually employed. As only the root is required, the trunk and branches are cut off and thrown away. As there is but little advantage in using the whole root, it may be divided into several pieces, much depending on its size. Each piece should be at least four inches long. A smooth, sloping cut up-wards, about two inches long, is made across the main part of the root most suited to receive the scion. The scion is prepared by cutting off a piece of the wood procured for the purpose in the autumn from four to six inches long and with about three well developed buds on it; a smooth, sloping cut downwards and across it is now made of about the same length as that already

Example of root-grafting.

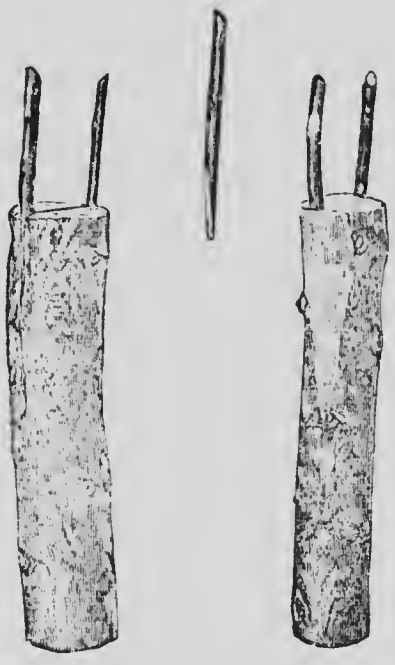
made on the stock. Clefts are now made in the sloping surface of both scion and stock, in the former, upwards; and in the latter, downwards. They are then joined together by forcing the tongue of the scion into the cleft of the stock. The inner bark or cambium, of both scion and stock should be in contact with one another on at least one side of the graft, as it is at this point of contact where the union begins to take place. In order to ensure a speedy and successful union, waxed cotton thread is wound tightly around to hold the parts together. Amateurs are also advised to rub grafting wax all over where the two parts are joined, as with this treatment success is likely to be more certain.

The operation having been completed, the grafts are packed away in moss or sawdust until spring. They are then planted out in nursery rows about three feet apart and one foot apart in the rows, the point of union being about three inches below the surface of the soil. The ground should then be kept thoroughly cultivated throughout the season. Some varieties of apples throw out roots quite readily from the scion and after a time they thus become practically on their own roots. If it is

desired to have a variety on its own roots, a scion from eight to twelve inches long may be used and the graft planted deep in the nursery row, only leaving one bud of the scion above the surface of the ground. Roots will then be thrown out on the scion, and when the tree is dug the stock may be cut away, and the tree will then be on its own roots. Or, on the other hand, a piece of root from a tree of the same variety as the scion may be used as the stock.

Crown-Grafting.—Crown-grafting is usually done on young stocks in the nursery row in the spring. The trees are cut at or just beneath the surface of the soil at the crown or collar. A sloping cleft is then made in the side of the crown, and a scion, cut wedge-shape at the lower end, is inserted in the cleft. The same precautions should be observed as in root-grafting, of having the inner bark of both stock and scion touching on at least one side. The grafted part should then be well covered with grafting wax, in order to exclude the air. The trees usually make a strong growth when grafted in this way, but as the work has to be done in April before growth begins it is often inconvenient to do it at that busy season of the year.

Top-Grafting.—Where there are trees which produce poor or unprofitable fruit they may be made to bear good fruit by top-grafting other varieties upon them. If it is desired to grow a variety which, when grown in the ordinary way, proves a failure,



Example of cleft-grafting.

on account of root-killing or smscalding, it is possible to grow it successfully by top-grafting. Varieties which ordinarily take a long time to come into bearing will fruit much sooner when top-grafted. The[re] are some of the most important results which may be obtained by this method.

Up to the present time in Canada, top-grafting has usually been done on old or bearing trees which produced poor fruit, and as very satisfactory results have been obtained, this practice will continue to be popular.

The work is done in the spring before growth begins, but it is possible to graft successfully even when the trees are coming into leaf, provided the scion is quite dormant, but the chances of success are much lessened if it is done late. As the shock to a large tree would be very great if all or nearly all of the branches on which the leaves develop

were cut off the first season, from three to four years should be devoted to removing the top of the tree. If, however, a large number of scions are inserted, the top may be changed in less time, but, as a rule, it is not wise to do it in less than three years. Furthermore, a too severe pruning at one time will cause a large number of shoots to grow on the tree, and considerable labour will be involved in removing them if many trees are grafted. Cleft-grafting is usually adopted in top-working trees, it being a simple and satisfactory method.

The branches to be grafted should not exceed an inch and a half or two inches in diameter. If they are larger it is so long before the stub heals over that disease may set in. It is possible, however, to graft larger branches by putting in more scions. The top-grafting of a large tree should be done with a view to having the new top as symmetrical as possible, and great care should be taken in selecting the branches to be grafted upon. After the branch is sawn off, it is cleft by means of a mallet and strong knife to the depth of an inch and a half to two inches. It is held open to receive the scion by driving a wedge into it. Scions for use in top-grafting are cut from dormant wood which has been kept in good condition in the manner already described, or from wood taken from the tree before the buds swell in the spring. They should have about three strong buds and be cut wedge-shape at the base, one side, however, being a little thicker than the other. Two scions are now inserted in the cleft of the stub, with the wide side of the wedge on the outside, and thrust down until the lowest bud is almost on a line with the edge of the stub. The inner bark of both scion and stub should meet at some point, so that the union will take place readily, and this is more easily effected if the scion is given a slightly outward slope when inserted. When the wedge has been withdrawn from the cleft the advantage of having the wedge-shaped end of the scion thicker on one side will be apparent, as it will be held much more tightly than if both sides were the same. If the scion is not a tight fit all along, there is something wrong in the way it has been cut or the stub has been cleft. The cut parts should now be covered with grafting wax to exclude the air and hold the scion in place. Cotton is also sometimes wrapped around the wax in order to more effectively hold the scion in place. If both of the scions grafted on a stub should grow, the weaker one should be removed after the other is well united and the surface of the stub at least partially healed over.

It is often desirable to top-graft young trees, and this may be done very readily. The main branches are cut back to within a short distance of the trunk, and the scions grafted on, either by cleft or whip-grafting. The closer the grafted part is to the trunk, the better, as the tree will be stronger than if the union occurred further out on the limb, since the growth of graft and scion may not be equal. It is well, however, to have one bud left on the stub so that in case the grafting is not successful a new shoot can readily start. Otherwise the stub may die back to the trunk. It is possible to cut off the whole top of the tree and graft successfully on the main trunk, when the tree is young, but unless one is sure that the union will be perfect and the top not outgrow the stock, it is better not to run the risk of losing the tree. Furthermore, if the whole top is cut off there will be such a growth the first season that the scions are liable to get broken off. In top grafting a young tree that has been planted from three to five years, it is better to take two seasons to do the work, as the result will, as a rule, be more satisfactory. The central or leading branches should be grafted the first year as if the side or lower branches are grafted first there may be too much growth in the ungrafted part for the grafts to do well.

It is necessary to examine the grafted trees during the summer and remove any young shoots from the stocks which are interfering with the scions. It is not wise, however, especially when the tree has been cut back severely for grafting, to remove all the shoots until the grafts have grown considerably and furnish a good leaf surface. In the chapter on stocks, reference was made to the top-grafting of tender varieties on hardy stocks, in order to make the former hardier. The trees should be double worked as described there, planted out in the orchard, and when large enough, which will be in two or three years, top-grafted with the tender sorts.

In 1896, trees of McMahan, Gideon, Haas, and Hibernal apples were planted in the orchards at the Central Experimental Farm. These are all very hardy, strong-growing varieties, which do not sunscald at Ottawa and which are fine, straight-trunked trees. They were grafted on hardy roots. In 1898, the work of top-grafting

Young tree top-grafted on main stem. Not recommended.

Part of tree top-grafted. It would have been better to have grafted the central branches the first year.

these with varieties that are not perfeetly hardy was begun, and continued until 92 kinds had been tested. These included: Baldwin, Belle de Boskoop, Benoni, Domine, Early Harvest, Esopus Spitzenburg, Fallawater, Keswick Codlin, King of Tompkins Co., Mother, Newtown Pippin, Northern Spy, Ontario, Rhode Island Greening, Rome

Beauty, Sutton Beauty, Wagener, Winesap and York Imperial. Few of these varieties can be grown successfully at Ottawa as standard trees. Top-grafted, they endured several winters, but the severe winter of 1903-4 killed practically all of them, thus demonstrating the inability of hardy stocks to make tender varieties hardy enough to withstand test winters. The following experience had warranted the hope that the results would have been otherwise:—

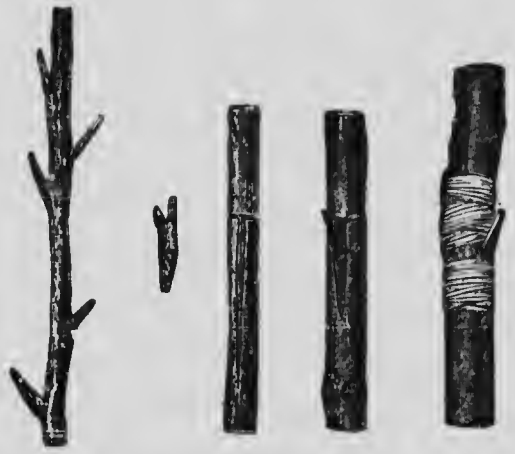
In 1891, a tree of Duchess and two trees of Wealthy were top-grafted with Northern Spy, which will not live at Ottawa when grown as a standard tree. All of these fruited in 1897. The grafts on Duchess produced fruit in 1897 and 1899, and those on Wealthy in 1897 and 1898. The wood of the Northern Spy appeared quite hardy until the winter of 1903-4, when this variety was killed, while the stocks on which it was grafted remained alive.

Budding.—Although grafting is a common method of propagating apples; budding is very popular among nurserymen. The latter has some advantages over the former and can also be done at a time when grafting could not be performed successfully.

The best season for budding the apple is in late summer, some time during August being the best time in most places in Canada. Young stocks of the first or second seasons's growth from seed are generally used. The process of budding adopted for apples consists of inserting a bud with very little or no wood, under the bark of the stock and on the surface of its wood. It is called shield-budding.

Budding is best performed when there is still sufficient sap beneath the bark to permit of the latter being easily raised with a knife. On the other hand, if the work is done when the tree is still growing vigorously the bud is liable to be 'drowned out,' or, in other words, forced out by reason of too much sap and growth of the stock.

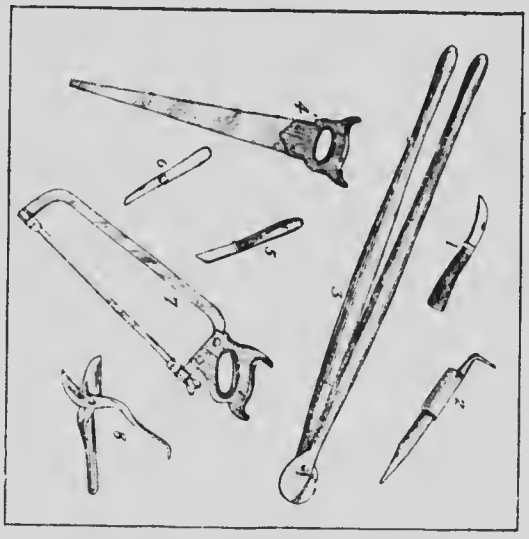
The stock which is to receive the bud should be at least three-eights of an inch in diameter near the ground. The lower leaves are rubbed off to a height of five or six inches to enable the budder to work more freely. A perpendicular cut is now made in the stock as near the ground as possible from an inch to an inch and a half long and perferably on the north side of the tree, as the bud will not be so readily dried out by the sun on that side. The cut should only extend through the bark. Another cut should now be made across the top of the perpendicular one. The two cuts when made will appear thus: T



Example of shield budding.

The buds are cut from well developed or nearly mature shoots of the current season's growth of the variety it is desired to propagate. Before the buds are removed the leaves should be cut off the shoots; a piece of the petiole or leaf stem is left, however, by which the bud may be handled after it has been removed. A very sharp, thin-

bladed knife is necessary in removing the bud. Knives are specially made for this purpose. The bud is cut off the shoot downwards or upwards, whichever is most convenient, the general practice, however, is to cut upwards. The length of the piece removed with the bud should be about one inch long, and the cut surface smooth. It should be quite thin, as but little of the wood is taken with the bud. The buds or twigs should be kept where they will not dry out while the work of budding is going on The bud is inserted under the bark by raising the latter with the blade of the knife or the part of the budding knife made for that purpose. The bud is then pushed down and under the bark with the fingers, and finally the piece of leaf stalk which was left when it was removed from the twig is pressed with the blade of the knife to bring the bud into the proper position. The bark on each side of the bud, which should now be under the bark of the stock will hold it in position. In order to bring the bud and stock into close contact and prevent the former from drying up before the union takes place, they should be tied together with raffia or some soft string, taking care not to cover the bud with it. The bud should unite with the stock in two or three weeks, and after that time the string should be cut, as otherwise the bud may be injured. If the proper season has been chosen for the work the bud should remain dormant until spring. If it starts in the autumn it may be killed during the winter. In the following spring the stock should be cut off just above the bud, which will cause all the strength of the stock to be directed into the bud and produce rapid growth, four feet and more not being an exceptional growth for the first season.



Tools used in propagating and pruning.

1. Pruning knife; 2. Wedge; 3. Pruning shears; 4. Saw; 5. Grafting knife; 6. Budding knife; 7. Saw; 8. Pruning shears.

Budding is now a very popular method of propagating apples. The first season's growth is greater than from root-grafted trees and there is a larger proportion of straight-trunked trees by this method. If it is desired also to prevent trees from becoming on their own roots, budding is preferable, as trees propagated in this way may be planted so that the stock is just at the surface of the soil and all roots are thrown from it.

TOOLS AND APPLIANCES USED IN PRUNING AND GRAFTING.

While grafting implements and appliances are numerous, the work can be done with a few, and as it is not often convenient for the farmer or fruit grower to get a large outfit, only the really necessary things are mentioned. These are:—A sharp

fine-toothed handsaw, to be used for sawing off large limbs, or for making the stubs on trees to be top-grafted. Unless in the hands of a careful man, a saw with one edge is better than one with two, as the upper one is liable to tear the wood above.

A strong pruning knife for cutting the smaller limbs; for smoothing the wounds made by the saw or pruning shears; for trimming off torn edges of branches, and for pruning roots of young trees when planting.

A budding knife, with a thin steel blade, for removing buds, having an ivory handle which is made thin at the end and is used for raising the bark.

A grafting knife, which is used in top-grafting trees. Home-made grafting knives can be easily made. A strong, sharp blade is the chief requisite.

Pruning shears, which are intermediate in their uses between the saw and the pruning knife. They are used for cutting off branches which are too large for the latter and too small to need the saw; for rough pruning and for cutting scions.

A wedge and mallet are also necessary in top-grafting large trees.

Raffia, which is one of the best tying materials. It is very strong and very pliable and is particularly useful for bandaging when budding.

Cotton yarn, which is used for tieing root grafts and is one of the most satisfactory materials for the purpose. The size known as No. 18 knitting cotton is the best. It is bought in balls, which should be soaked for a few minutes in melted grafting wax before using. The yarn may also be drawn through melted wax, which ensures it all being thoroughly soaked, and is, perhaps, on this account preferable to soaking the ball.

There are many kinds of grafting wax recommended, but it is unnecessary to enumerate them all. One of the cheapest and best is made as follows:—

Resin, 4 parts, by weight; beeswax, 2 parts; tallow, 1 part. Melt together and pour into a pail of cold water. Then grease the hands and pull the wax until it is nearly white. One of the best waxes for either indoor or outdoor use. This should be heated before using if too hard.

Another and more pliable wax for outdoor use is made in the following proportions. Resin, 5 parts by weight; beeswax, 1 part; boiled linseed oil 1½ parts.

The principal value of grafting wax is to exclude air from the wound, and thus prevent the wood from drying before a union takes place. A good grafting wax should not crack when on the tree, else the air will reach the wound and the wax prove of little value. Many materials may be used instead of grafting wax for this purpose, one of the simplest being a mixture of clay and cow dung, but grafting wax is much to be preferred. Strips of cotton are often used, especially in top-grafting and crown-grafting, for wrapping around the wound after the wax has been applied, for the purpose of helping to exclude the air, and also to assist in holding the scion in position until the union takes place. This cotton is unnecessary if good grafting wax is used; but if a very valuable variety is grafted it is safer to use the cotton, as when the growth of the scion is rapid, there is a chance of its getting broken off during the first season before it is thoroughly united with the stock. Large wounds on trees should be covered with some material that will protect the cut surface from the weather, prevent disease from setting in, and which will not peel off easily. A good dressing of white lead is probably the best material to use for this purpose. Grafting wax may be used on smaller branches.

THE NURSERY.

Although, as a rule, it will be the most convenient plan to buy trees from the professional nurseryman, yet he who propagates apple trees by root-grafting, crown-grafting, or budding, for his own use, should have a nursery in which to grow them until they are ready for the orchard. A good sandy loam soil, which does not bake and is well drained, is best suited for this purpose, and will grow the strong, healthy trees which are desired. The ground should be thoroughly prepared and the young

trees planted about 12 inches apart in rows from 2½ to 3 feet apart. Cultivation should be thorough up to about the middle of July, when it should cease, as in colder climates, especially it is very desirable that the wood ripen well, and late cultivation would encourage late growth. It will be necessary the first year the grafted or budded trees are growing in the nursery to go over them carefully, and cut out any shoots which may be coming from the stock, and also to reduce the graft to one stem should more develop. If any side branches grow, however, they should be left intact. In small nurseries it is sometimes advisable to tie the young trees to stakes the first season. This will make them straighter and will help to keep them from being broken. These trees may be planted in the orchard the following spring if one-year-old trees are to be used. During the second year any shoots from the stocks or side shoots from the graft near the ground should be removed but the fewer branches that are removed the stockier the tree will be and it can be pruned up to the desired height when planted out. By the end of the second year or the beginning of the third, after the branches have been pruned to the proper height and the tops shaped, the trees will be in the best condition for planting in the orchard.

In nurseries in the colder districts the wood of yearling and sometimes two-year-old trees will kill back in winter. Unless injured wood is cut back to healthy wood in the spring, the trees are liable to remain black-hearted although this condition if it only happens once may not seriously injure the trees. The practice with the best nurserymen in the North is to cut yearling trees back to near the ground in spring, thus ensuring a healthy trunk and a strong growth for that season.

THE ORCHARD.

Site and Soil.—The farmer's orchard is, as a rule, near the house, and probably will be in the future, in most cases. There are many advantages in having it there which will offset the reason why it should not be. The man who makes fruit growing his main business, however, should consider well before deciding where he will plant his trees, so that good and profitable returns may be obtained. There has been much discussion in recent years as to what slope is best suited for the apple. The trees planted on a southern or south-western slope are more subject to sunscald than if planted on a northern or eastern one. On the other hand, it has been proven that in a very severe climate, trees suffer more from root killing on a northern slope, the intensity of the frost being greater. As sunscalding probably causes the death of more trees than root killing where the apple can be grown at all, and as root killing can be prevented to a large extent by growing cover crops, a northern or eastern slope would generally be best. In the Prairie provinces where warm days in early spring cause the buds to swell, southern slopes should be avoided as the severe frosts which often come later on may cause serious injury. It is not, however, necessary to have the orchard on any slope, but sloping land is usually freer from early frosts and is better drained than level land, and good drainage is one of the chief essentials to successful apple growing. Good natural drainage is best, but if this cannot be had the soil should be thoroughly drained either with tiles or in some other way. Trees growing in badly drained soil will become stunted, diseased, short-lived and will rarely prove profitable.

The question of spring frosts should also be considered. All practical farmers and fruit growers know that spring frosts are often very local, occurring on one part of a farm and not on the other. As these frosts sometimes mean much loss if they occur at the blossoming period, it is very important to avoid choosing a site where they are liable to do injury, if another good site is available where frosts do not occur so often.

It is important, if possible, to have the orchard protected in some way from prevailing winds, and natural protection is an important factor in successful orcharding. The orchard can, however, be protected by planting windbreaks, reference to which is made elsewhere.

Apple trees grow well in almost any kind of soil if it is thoroughly drained. It is this adaptability of the apple which causes the trees to be planted frequently on poor land; but the better the soil, the better the results will be. A good orchard soil should, in the first place, be abundantly supplied with plant food in a form that may be made easily available. It should be rich in humus and should be easily worked, and if possible, it should be of limestone formation. Sandy soil is easily worked, but is, as a rule, not rich in available plant food and is also lacking in humus. Plant food also which is applied in the form of barnyard manure and artificial fertilizers is easily leached away in sandy soils. In the colder parts of the country root killing is also more prevalent in sandy soils, but in cold districts sandy loam soils are better than heavier ones if the roots are protected by cover crops as wood will ripen better on such soils. Clay land, on the other hand, is too stiff and is hard to work, the soil baking easily, and making it difficult to cultivate. Where however, the ground is not kept cultivated and the fertility maintained by top-dressing, trees are grown very successfully and good crops produced on this kind of land. The trees make less growth and on this account may develop more fruit buds than on light soils. Sandy loam and clay loam soils are, as a rule, the most suitable, and probably clay loam soils are the best for apple growing in the best apple-growing districts. Sandy loam soils with open subsoils are better further north, as they are warmer. Land which has been exhausted of much of its plant food by growing cereals or other crops upon it is less suitable for orchard purposes.

Preparation of the Land.—It very often happens that the farmer or fruit grower suddenly decides to plant an orchard. No previous thought had been given to the matter, or if there had, nothing was done to get the land into better condition for the young trees. The trees are bought, the land hastily, and not very well, prepared and the trees set out to take their chances. No after cultivation will fully make up for neglect of the thorough preparation of the land. Trees should begin to grow thriftily from the time they are planted if they are to obtain a good size before they begin to bear heavily, and if the land is not thoroughly prepared and in good condition when they are planted, growth is likely to be slow. It is much better, if one has no land in good condition, to delay planting for a year, and give the soil the necessary attention. The time will not be lost, as the trees will do much better. Land which has been well manured for root crops, ploughed in the autumn, and again ploughed in the spring and thoroughly levelled and pulverized with the harrow should be in good condition for planting the trees. If the subsoil is near the surface, the subsoil plough should be used after the ordinary one, loosening the soil from four to six inches deeper than the former. Dynamiting the soil before planting has been recommended in recent years but has not always been shown to be an advantage. Stiff soils which need loosening for trees to make a good start are usually not the most suitable on which to have an orchard.

Sod land ploughed in the autumn, top dressed in the spring with a good coating of barn-yard manure and then ploughed again and thoroughly pulverized with the harrow, should also bring the soil into good condition. A green crop, such as clover, ploughed under in the spring and the land thoroughly harrowed, would also be a very good method.

Time of Planting.—Although trees may be planted successfully in the autumn, early spring is undoubtedly the best time in most places and especially in the colder parts. In places where the spring is very late and there is a good covering of snow in the winter, fall planting may give better results than spring planting and where there are not long spells of dry very cold weather in winter fall planting may give as good results as spring planting.

One of the advantages of fall planting is that there is more time to do it then than in the spring. If trees are planted early in the autumn they will throw out some

roots and be in a fair condition for standing the winter, but by the time the trees are ordered from the nurseryman and received, it is usually rather late, and if they are planted late the chances are that a large proportion will die, although this is not always the case. If trees are dug early in the nursery for fall planting the wood is sometimes not sufficiently ripened and then it kills back, especially in cold climates. Another cause of death appears to be that when the roots are not in close contact with the soil and the trees are not well charged with sap, the trees dry out during the winter, and so die. It very often happens also that to begin with, the autumn is dry, and this makes the chances of success still less. It also often occurs, especially where the land has not been thoroughly prepared and only small holes dug for the trees that rain, when it falls, does not escape from the holes. The water thus accumulated saturates the soil in the holes, freezes, and causes the trees to heave badly. If when this occurs it is overlooked and the trees not lowered in the spring, they may never thrive well. On the other hand, if trees are planted in the spring, the best conditions are afforded them for growing. They should, however, be planted in good season before growth begins and as soon after the ground is in condition to work as possible. As it is of the greatest importance to get the trees planted early and as, when ordered from nurserymen in the spring, it is difficult to get them as early as required, a good plan is to order them to be delivered in autumn and heel them in until spring, when they may be had as soon as required. A place should be chosen for this purpose where the drainage is good, where they will not be in danger from mice, and where the trees will be well covered with snow. A trench should be made deep enough to permit of the roots being well covered with soil. After cutting off any broken roots, the trees should be laid in a single layer in such a slanting position that the tops will almost touch the ground, and the roots and half or more of the trunk then well covered with soil, the latter being well worked in among the roots. In exposed places they may be entirely covered if in well-drained soil.

Laying out the Orchard.—The distance apart that apple trees should be planted will vary according to the varieties used, the locality, the land at the planter's disposal, and the other purposes, if any, for which he intends to use the land. In order to thrive best and produce fruit of good size and colour, the trees should have abundance of sunlight and air, and they cannot obtain these if planted too closely together. Early bearing varieties may, however, be planted as closely as 15 feet apart each way in blocks of about 100 feet in width with a wider space every 100 feet for a road for the spray pump, the trees being thinned out later on. This method is, however, not recommended for the average orchardist. Spraying has become such an integral part of successful fruit growing that sufficient space must be left between the trees to permit of doing this work thoroughly. When planted closely injurious insects and fungous diseases are more prevalent than where there is abundance of light and air. The great mistake in the past has been that trees have been planted too closely, the result being the production of poorly coloured, ill-shaped and scabby fruit.

In the best apple-growing districts of Ontario and Nova Scotia, most of the winter varieties should be planted from 35 to 40 feet apart each way. This seems a great distance when the trees are young, but they will continue to bear profitable crops for many years when trees planted much more closely will have ceased to bear good fruit. In the colder parts of Ontario, the province of Quebec, New Brunswick, Northern Nova Scotia, and Prince Edward Island 30 to 35 feet apart each way is a good distance. In the prairie provinces 20 feet apart each way is sufficient. In British Columbia 30 feet apart each way is a satisfactory distance. A growing practice now-a-days, and one which is giving good satisfaction, is to plant what are called 'fillers' between the permanent trees. These are early, heavy-bearing varieties, such as Wealthy, Duchess and Wagener, which begin to produce profitable crops of fruit when very young, and which may be removed when they interfere with the permanent trees. Other fruits, such as plums, cherries and peaches, may also be used for this purpose, but are not as satisfac-

tory as apples as they are not sprayed at the same time and it is not recommended to use them. If, however, the permanent trees are planted much less than 40 feet apart each way, the 'fillers' should only be planted between the trees in the permanent rows, as in a few years the trees would be too crowded for best results, and spraying could not be thoroughly done. When the distance apart at which the trees are to be planted has been decided upon, the orchard should be laid out, or, in other words, the places marked where the trees are to be planted. There are several ways in which the orchard may be laid out, but the rectangular system with the permanent trees the same distance apart each way is, as a rule, the most satisfactory. The rows of trees should be perfectly straight, both for the sake of easier cultivation and appearance. This may be easily accomplished if a little trouble is taken. If the field is irregular, it is more difficult than if it is square. It is important to make the planting area perfectly square to start with otherwise it will be impossible to have the trees in straight lines in all directions. The places where the trees are to go should all be marked with stakes before the holes are dug, as it will be easier to keep the former in line if this is the case. A wire stretched from one side of the field to another will save much sighting. The trees should be sighted both ways when placed in the holes. A planting board will be found a great convenience in planting. This is a 6-inch board about five or more feet long, either with three notches cut the same distance into the board along one side, or one may be at each end and one at the centre; or, instead holes may be bored in the board near each end. One notch is at the middle of the board and two near or at the ends. After the pegs are put down where each tree is to go and before each hole is dug the planting board is laid down with the tree peg in the notch. Two other pegs are then put in the other notches. All three pegs should be exactly in line. The board and tree peg may now be removed and the hole dug and when the tree is placed in it and before the soil is put back it can be moved to the exact spot in the hole where the peg was by putting the board back over the pegs which remained. The tree should now be in the centre notch. The pegs should be all as nearly the same size as possible. In laying out small orchards, 12-inch wooden labels which are exactly the same size have been found very satisfactory.

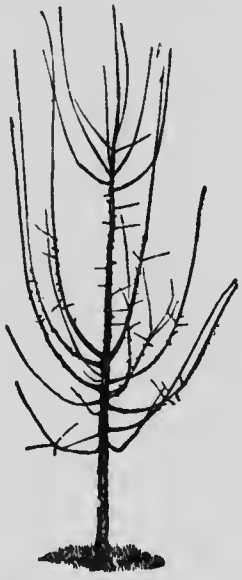
Windbreaks.—If the orchard is not naturally protected from the wind by trees or by rising ground, a windbreak may be planted with good effect along the north and west sides, or any other side from which the greatest injury comes, the object being not to stop the wind altogether, but simply to check its velocity, as, if a windbreak is high and very dense, it stops the circulation of air in the orchard to a large extent, and this gives very favourable conditions for the spread of both insect pests and plant diseases. On the other hand, a proper windbreak lessens the force of the wind and thus protects the trees, which will grow straighter and shapelier; it will also very materially lessen the amount of windfalls, and it will permit of growing varieties which will not succeed under ordinary exposure. Wind is one of the most important factors in drying out the land and causing drought. If its force is checked by a windbreak, the evaporation of moisture from the soil will not be so great.

One of the best trees to plant for a windbreak in Eastern Canada is the Norway Spruce (*Picea excelsa*). It is a rapid-growing evergreen and is hardy almost everywhere where apples can be grown successfully. A single row of these planted from eight to ten feet apart is quite sufficient. It should be at least fifty feet from the apple trees. The trees should grow, if properly cared for, at the rate of from 2 to 3 feet a year until they reach a height of 50 to 60 feet. In very exposed places it may be desirable to plant two rows of trees, the trees forming the second row being planted from 8 to 10 feet behind the trees in the first row. The first row may be composed of Arbor-vitæ, which are rather slow-growing, and the row behind made of Norway spruce, if desired. White pine and European larch are rapid growing trees which may be used for this purpose. Scotch pine is inclined to be irregular in growth, and is, on this account, sometimes not satisfactory. If the trees already mentioned cannot be obtained, there are other native trees which will give good satisfaction. Lom-

hardy poplar planted about 8 feet apart makes a windbreak in a short time, as this is a very fast growing tree. On the prairies the Manitoba maple or box elder is a good tree for a windbreak. The Siberian Pea tree is also desirable for this purpose and native evergreens can come on later when they get the protection of the former.

Kind of Trees to Plant.—In the past, the popular tree was one with a trunk from five to six, and even at times, seven feet high. The reasons why such trees were desired being that they enabled the planter to grow other crops nearer them than he could have done if the tops had been lower; they also enabled him to drive under the branches when working the land. The result, however, of training trees with such high trunks is that the apples are much more difficult to pick and the expense of picking them greater. When the trees are young the trunks are exposed to the sun, and sunscald is much more prevalent than it would be if there were less bare trunk and the head nearer the ground. These high-headed trees are, however, gradually giving place to ones with less trunk, and from three to four feet is now considered the proper length by most of the best fruit growers in Eastern Canada, while in

Two year old apple tree marked for pruning.



Three-year old low-headed apple tree.

British Columbia, trunks from eighteen inches to two feet in length are preferred. Where there is a great depth of snow in the winter, if the head is less than two and a half feet from the ground, the branches are liable to be broken on young trees when the snow is melting. If trees of this kind are grown, the fruit can be much more easily picked, there is less trunk exposed to the sun, and the trees are stronger. There is also a less proportion of windfalls than from high-headed trees, and it has been found that proper cultivation can be given them at this height. If other crops are grown in the orchard, they should take second place and trees should not be trained high on that account.

In the colder parts of the country, and particularly on the prairies, the best results will be had by starting the top at the ground or within one or two feet from it, as the trees will be much better protected than if the branches started higher up.

Two or three-year-old trees are, as a rule, the most satisfactory kind to plant in Eastern Canada, as when they are older than three years, growth is so checked and the trees so stunted by transplanting that it is not at all desirable to plant them when

they are so old. Furthermore, the freight or express will be less on smaller trees. If low-headed trees are desired, they may be planted when one year old, if the growth is strong, and cut back to the desired height, leaving only the bare stem. One-year-old trees are those most in demand in British Columbia. The ordinary farmer in Eastern Canada, however, who may not give his trees much attention, requires a tree two or three years old, so that it may easily be seen, if he grows other crops in the orchard. Trees should be procured from reliable nurserymen, as it is important to have them true to name and well shaped. A local nurseryman is best if he carries good stock. It will pay to get the highest grade of trees offered. Stunted, unshapely trees will never give the same results as healthy, straight ones.

The 2- or 3-year-old trees should have the heads well formed when received from the nurseryman. The best head consists of a central leader with three or four side branches rising alternately from the trunk. If the branches are opposite, a crotch is formed and when the tree is heavily laden a branch may be easily broken. Moreover, trees are often ruined in the colder parts of Canada by frost in the crotch of the tree, which causes the death of large branches, and a weakening at the crotch causing the tree to eventually split there. It is not always possible to get a central leader, and the next best top is one with from three to five branches rising alternately from the main trunk, forming a symmetrical head.

Planting.—As many of the roots of apple trees are destroyed when they are dug, this should be taken into consideration when planting the tree, and the top headed in. If the top is not headed in, there will not be enough sap from the roots which are left to support it, and the moisture transpired by the leaves being greater than the quantity supplied by the roots, the tree is liable to wither up and die. If the trees are grown by the person who plants them, great care should be taken in digging to destroy as few roots as possible. The amount of heading in will depend upon the number of roots and the condition of the tree. Trees which have come from a distance and are rather dry need pruning more than those planted fresh from the nursery. The wood should be cut off close to a bud. The branches should be cut back at least one-half, and in the majority of cases it will pay to cut them back to about four buds. The work of heading in can be best done immediately after the trees are planted, as one can see better then what to do.

The 'Stringfellow' method of planting trees was advocated by H. W. Stringfellow, of Texas. The theory of this method is that trees when transplanted in the ordinary way lose their tap-root, but if the roots are pruned back to a mere stub a new tap-root will be formed and the tree will be more permanent than when treated in the ordinary way. Trees pruned in this way would also be easier and more cheaply shipped, and make less labour in planting. To counterbalance the cutting off of the roots nothing is left of the top of the tree but a mere stub about eighteen inches long. While trees planted by this method may succeed under moist conditions of soil and climate, it is not a practice to be adopted in Canada where the soil and air are dry.

The roots of the trees should not be allowed to become dry from the time they are dug in the nursery or received from the nurseryman until the trees are planted. Much of the failure in planting comes through carelessness in this regard. When taking the trees to the orchard, it is a wise precaution, especially if there are drying winds blowing, to have a barrel partly filled with water in the field to dip the roots in. In addition to this, the roots should be protected until the trees are planted, by covering them with wet sacking or straw. Too much precaution cannot be taken in this matter. Before exposing the roots of the trees, however, the holes should be made. Many planters seem to have the idea that if they dig a hole barely large enough for the roots to be crowded into, they will have good results. Sometimes they do; much oftener they do not. If the whole field has been subsoiled and is in a thorough state of tillage, it would not matter so much, as the soil all over would be in the same state of friability, but this is very rarely the case. So that, as a rule, it is necessary to

make the hole somewhat larger than will accommodate the roots, spread out to their full extent. It should be made about 18 inches deep, after which the subsoil should be loosened a few inches more, but not removed. In digging the hole, the surface soil should be kept separate from the subsoil or that of poorer quality. Sufficient surface soil should now be thrown back into the hole to make the tree, when planted, about an inch deeper in the ground than it was before. If a tree is not planted deep enough, the roots may become exposed and the tree die. On the other hand, it should not be planted too deep. Before it is planted permanently in the hole, the soil which has been thrown in should be raised and rounded off in the centre. If this is done, the roots of the tree can be spread out much more readily and placed more in their natural position. Roots of apple trees have not many fibres and it is necessary to spread what are left on the tree, carefully, in order to get the best results. Broken or bruised roots should be cut off before planting the tree.

The tree being now placed upright in the hole and the roots carefully spread out, the surface soil is gently thrown in and worked in among them, by the hand, if necessary. It is very important to have the soil come in close contact with the root fibres, in order that the best conditions may be afforded the tree to begin growth promptly. When the roots are well covered, more good soil should be thrown in and when the hole is about half full it should be well tramped with the feet, after which the hole should be filled level with the surface of the soil, tramping being done while it is being filled. The surface of the soil should be left loose, as this will help to prevent evaporation of moisture from the soil which has been thrown in. It is not necessary to water any tree except, perhaps, in very dry districts, if planting is done at the proper season and the soil is fairly moist and well compacted about the roots.

If the orchard is in an exposed position and the trees large and with high trunks, it will pay to tie them to stakes to keep them from getting loose.

In districts where drought is liable to occur, or even in places where the soil is likely to become rather dry, it will be wise to mulch the trees immediately after planting, to a depth of from 4 to 6 inches with manure, straw, sawdust, or anything of that nature which will not become a compact mass. If this is placed about the base of the tree and left during the summer, it will keep the surface soil loose and prevent evaporation of moisture and growth of the tree will be much more rapid. A good mulch may be the means of preventing a tree from dying if the season is very unfavourable or the tree in poor condition. If the mulch is loose when winter sets in, there may be danger from mice, and this should be guarded against.

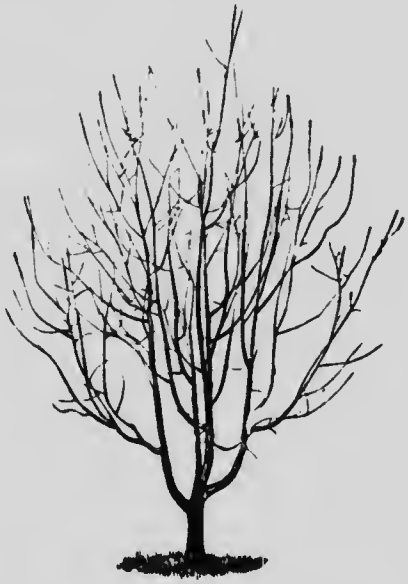
PRUNING.

There are several objects in pruning trees, the principal being the production of well coloured fruit of good size, in paying quantities, and the maintaining of a symmetrical top and well balanced tree to bear this fruit. Trees will bear fruit without pruning, but it is often small in size and not so attractive. Unpruned trees, also, are likely to bear heavily one year and have no crop the next. Pruning lessens the number of apples produced and the tree not being so much exhausted at one time is likely to bear more regularly. It does not exhaust a tree as much to bear a good crop of fine fruit as it does to produce a heavy crop of small fruit, as the exhaustion of the tree is more in proportion to the number of seeds matured, than to the size of the fruit.

Trees should be pruned regularly, beginning when they are young. If much pruning is done at one time it would be likely to injure the tree. When the trees begin to grow thriftily many new branches will be formed, and it is the work of the pruner to remove all those which are not necessary and to cut back others. The top of the tree should be kept open, to admit air and sunlight, but pruning should be so carefully done that there will be no bare limbs. Most of the fruit will be borne on fruit spurs or short woody branches on the larger branches; and if the top of the tree is very dense these do not develop well. In Eastern Canada, however, there is now a tendency to do

comparatively little pruning for the first few years after planting, the object being to bring the trees into bearing sooner than if trees are pruned heavily every year, and if the main branches are limited to three to five at the outset the tree will not become too thick for some time with a very little pruning each year. It is best to prune from the outside of the tree as much as possible, rather than from the inside, as the work can be done there with much better judgment. In order to keep the lower branches vigorous the leader is sometimes kept headed back somewhat, so that there will be more growth on the other branches.

Low-headed apple tree, unpruned.



Low-headed apple tree, pruned.

In British Columbia where the annual growth in many places is very great, more attention must be paid to pruning the young tree than in other parts of Canada. Heading in of trees of spreading habit, particularly, is necessary to strengthen the limbs for the future heavy crop of fruit.

All branches which are growing across and through the top should be cut out. If two branches touch one another, one of them should be removed. If a branch on one side of the tree has outgrown another, it should be headed back so as to make the tree symmetrical, cutting it off just above a bud which is on the side that it is desired to have the new growth. If, when the trees are young, they are treated in this way every year, comparatively little work will have to be done at one time. Perhaps the best time to prune would be between the middle of May and the middle of June when the trees are growing thriftily, as the wounds will heal over quicker if done at that time, but as this is a very busy season of the year, the customary practice is to prune during the month of March, when quite satisfactory results are obtained. By pinching off young growth which is not required, in summer, labour will be saved in pruning. Heavy summer pruning is being practised by some fruit growers, especially in British Columbia, but summer pruning must be carefully done and done neither too early nor too late for best results and bad results may follow improper summer pruning, hence before practising it one should learn what has been the experience of someone who has been practising it for some time nearby. It is much better to prune at any time of the year than to neglect it altogether, as it is not a matter of great consequence what month it is done in, except that very heavy winter

pruning may induce strong wood growth at the expense of fruit. The tools used should be a sharp pruning knife and a fine saw; the branch should be cut off close to the limb or trunk from which it is removed and the cut should be as clean and smooth as possible. A bad practice in pruning, and a very common one, is to leave the stub remaining of the branch cut off. In many cases this never grows over, rot sets in and reaches the heart of the tree, and eventually ruins it. A clean, close cut will heal quickly and needs no paint or wax, unless a large limb has been removed.

Unfortunately, too many of our farmers and fruit growers neglect pruning their trees regularly, the result being that when they do begin, it is necessary to remove many large limbs. In cases of this kind it is not wise to do too much pruning in one season, as a severe pruning of the tree will cause so much young growth that it will be necessary to thin it out. It will also expose the limbs which have been protected, and may cause sunscald. A better practice is to do it regularly. If large limbs are removed the wounds should be given a coating of white lead paint, which will protect them from weather and prevent rot from setting in until they begin to heal over. The wounds should be kept painted until they heal over.

It is generally believed that winter or spring pruning tends to the production of wood; and summer pruning, to the production of fruit buds. The reason for this is that pruning before growth begins, or when it is beginning, destroys the balance between top and root, and there being then more sap supplied by the roots than the remaining top can elaborate, stronger growth is made or new branches formed to readjust this balance, but injudicious summer pruning may result in less fruit. If pruning or pinching off part of the new growth is done in the summer after most of the growth has been made, a part of the elaborated sap, which is as necessary to the production of strong roots as it is to the production of top, is removed, and the tree is checked in its growth and somewhat weakened, although the pruning should not be so severe as to make the latter apparent. Summer pruning to produce fruitfulness, is, however, seldom necessary. If trees are given even a fair measure of attention they will reward the owner with abundant crops. Some varieties of apple do not come into bearing as quickly as others and often growers think that something is wrong with these trees when they do not bear early. Root pruning, which also tends to weaken the trees and promote favourable conditions for the development of fruit buds, is sometimes advocated, but this likewise is seldom necessary. This is done by digging around the trees, and thus destroying part of their roots. Anything which checks the downward flow of sap in healthy trees seems to favour fruitfulness. A branch which has been injured will bear before another. A top graft, in which the free downward flow must be checked at the union, fruits earlier than a standard tree. Ringing, which checks the downward flow of sap, favours fruitfulness, but as the fruit buds develop in the early part of the summer for next year, the check must be given early. A sudden dry spell in the early part of summer should favour fruitfulness as the growth is checked when fruit buds are being made.

A branch which is broken or split by the wind or by weight of fruit may often be saved if it is carefully bent back to as near its original position as possible and bolted with an iron bolt. An auger hole is made through the broken branch and the uninjured part and a bolt run through. By doing the work carefully, the branch may be drawn almost into its original position by tightening the nut well. The bolt should be as near the size of the auger hole as possible, as the tighter the fit the better. The nut and end of the bolt are better large, as they will not sink so readily into the wood. After the bolting is done the ends of the auger hole should be closed up with grafting wax or paint, as the bolt will not fit tightly enough to exclude air, and germs of disease may enter. If the split or break is a bad one the branch should be headed back, so as to lessen the leaf surface. Although a branch may often be saved by treating it in this manner, a better practice is to bolt the trees before the branch breaks. A weak branch is often indicated by a splitting at the crotch, and if the bolt

is run through then the branch is almost certain to be saved. It is sometimes advisable to brace the tree higher up, and this can be done with a longer bolt or with heavy wire, putting screw eyes in the wood to fasten the ends of the wire so as to prevent girdling the limb, which would occur if the wire were wound around it.

Patching up trees is not, however, on the whole a very satisfactory practice, and it may be avoided to a large extent by having trees without crotches, and this may in a large measure be accomplished by pruning the trees properly when young.

Trees are often ruined by neglecting to treat wounds or allowing rot to set in at the crotch. In such cases all the decayed part should be removed and the wood scraped back to living tissue, and in the case of rough wounds made by bruises or breaking of limbs, the edge and surface should be trimmed until quite smooth, so that healing may begin rapidly. These should now be painted, or, if not painted, sprayed with Bordeaux mixture, and then covered with paint or grafting wax. Wounds should be kept covered with these substances until they are healing nicely. Holes may be filled with cement after cleaning and disinfecting them.

MAINTENANCE OF FERTILITY.

When it is at all possible, it is better not to remove any crops but apples from the orchard land after the trees are planted, although the growing of intercrops when the trees are young may cover the cost of bringing the orchard to the bearing age, and usually the grower desires to do this. When it is considered that the apple trees are to bear crops for fifty years or more on the same land, it may easily be understood that the trees to do their best will need all the plant food that they can get from the soil, and as much more as can be economically applied. If the soil is cropped with grass, cereals and roots, for instance, for eight or ten years, much plant food will be removed, and although these crops may be manured, there is but a small percentage of persons who will manure the land sufficiently to make up for the plant food removed. Furthermore, the moisture in the soil is lessened if other crops are grown, owing to the evaporation from the leaves of the growing crops, and as droughts occur frequently in some parts of the country, as much moisture as possible should be conserved for use of the young trees. Where land is expensive, however, or where one has only a limited area it is desirable to raise intercrops until the trees begin to bear and even when one has much land the temptation will be to grow intercrops while the trees are young and if care is taken no great harm to the trees should follow. These intercrops should be such as may be cultivated or hoed. A crop of potatoes is one of the least objectionable crops to grow. Beans may also be grown. Corn is often planted in young orchards, but an instance has come under our notice where corn evidently had caused injury by shading the trunk too much, and the wood, not being thoroughly ripened, was badly sunscalded, or injured by winter, and many trees did not recover.

If other crops, such as hay or grain, are grown, there should be four or five feet left on each side of the tree without any, and the strip thus left may be cultivated. If no other crops are grown in the orchard, the trees, if cultivated properly, will need very little manure until they come into bearing, as apple trees will grow quite thriftily when young on comparatively poor soil, as the exhaustion of the soil from the production of wood is small compared with that when large crops of fruit are removed.

Barnyard manure is one of the best complete fertilizers where it can be procured cheaply and conveniently.

The weight of the fertilizing constituents which are removed from the soil in the production of a crop of apples when the trees are in full bearing, has been estimated by careful analyses, and if about fifteen tons of fresh barnyard manure were applied every three years, considerably more plant food would be restored to the soil than would be removed by the crops of apples. But as some of it will leach away and some never be reached by the feeding roots of the trees, it is wise to give a liberal dressing.

As in many places barnyard manure cannot be profitably used because of its scarcity, the following extract from the annual report of Dr. F. T. Shutt, Dominion Chemist, for 1894, will prove valuable to those who desire to maintain the fertility of their land by other methods than the application of barnyard manure:—

COMPOSITION OF THE FRUIT.

Analysis of Apples.

"The general composition, viz., the percentage of water, organic matter and ash (which make up the whole) and the amount of nitrogen, are given for the four varieties examined in the following tabulated form:—

Name of Variety of Apple.	Water.	Organic Matter.	Ash.	Nitrogen.
Duchess of Oldenburg	88·61	11·14	·25	·0382
Wealthy	87·00	12·71	·29	·0375
Fameuse	85·22	14·46	·32	·0512
Northern Spy	87·08	12·65	·27	·0445
Average	86·98	12·74	·28	·0428

Although there is a great similarity in composition in the varieties examined, and none differ much from the average deduced from them all, it is of interest to note that the Fameuse is the richest in organic matter, in ash constituents and in nitrogen. The Wealthy and Northern Spy contain almost identical amounts of organic matter and ash, and the Duchess of Oldenburg has the largest percentage of water and lowest percentage of organic matter and ash.

PERCENTAGE OF IMPORTANT CONSTITUENTS IN ASH.

Name of Variety of Apple.	Phosphoric Acid.	Potash.	Soda.	Oxide of Iron.	Lime.	Magnesia.	Silica.
Duchess of Oldenburg	8·90	53·67	3·28	1·77	5·80	5·20	·36
Wealthy	8·15	57·00	2·65	1·76	3·33	3·84	·63
Fameuse	7·19	56·25	2.56	1.26	3.55	4·03	·32
Northern Spy	11·68	54·11	1·94	2·13	3.86	3·99	1·11
Average	8 98	55 26	2·61	1·72	4.38	4·27	·60

In this table the composition of the ash in detail is given. Of its components, phosphoric acid and potash are the principal. The latter constitutes over half of the ash (55·26 per cent), while the former is about 9 per cent, the average being 8·98 per cent.

No great differences between the varieties are here to be noticed, though the Northern Spy presents some striking variations from the average. Its ash contains nearly 3 per cent more phosphoric acid, nearly 1 per cent less soda, about ·5 per cent more oxide of iron and alumina, and about ·5 per cent more silica than the ash of the other apples.

The ratio of the potash to the phosphoric acid in the ash of the fruit is 6 to 1; in the ash of the older leaves it is 2 to 1. Relatively, therefore, the demands of the leaf and the fruit on the soil of these two constituents are very different. It might here be remarked that the greater quantity of the ash ingredients of the fruit is con-

tained in the seeds and walls of the ovary, comparatively little being found in the flesh of the apple.

A comparison of this table with that showing the composition of the ash of the leaf, will reveal further interesting features. The total percentages of ash in similar weights of leaf and fruit, are as 3·46 to ·28. Lime is much more abundant in the ash of the leaf, while magnesia, oxide of iron and silica are about the same, taking the older leaves for comparison.

For the purpose of a practical presentation of the subject, the data presented in the following table have been prepared:—

WEIGHT of Important Fertilizing Constituents withdrawn from the Soil.

Name of Variety of Apple.	Average weight per bushel in pounds.	NITROGEN.		PHOSPHORIC ACID.		POTASH.	
		Lbs. per barrel.	Lbs. per acre, or 160 barrels.	Lbs. per barrel.	Lbs. per acre, or 160 barrels.	Lbs. per barrel.	Lbs. per acre, or 160 barrels.
Duchess of Oldenburg . . .	44	·046	7·359	·027	4·307	·162	25·975
Wealthy	50	·057	8·220	·032	5·181	·226	36·232
Fameuse..... ...	50	·070	11·223	·031	5·043	·256	39·456
Northern Spy..	46	·056	9·006	·039	6·383	·185	29·570
Average	47·5	·057	8·952	·032	5·228	·217	32·803

NOTE.—In the above calculations the following data are used: Forty trees per acre in an orchard twenty-five years old yield, on an average, one hundred and sixty (160) barrels. One barrel contains two bushels and three pecks.

We have here the number of pounds of nitrogen, phosphoric acid and potash estimated as contained in one barrel of the fruit, and the amounts removed per acre by a good crop. None of the quantities are at all excessive, and the cost of returning them would not be great. The largest demand is on the potash in the soil; next comes the nitrogen, and lastly the phosphoric acid. In the case of the leaves, the nitrogen stood first.

For the vigorous development of the tree and an abundant crop of fruit, the soil must contain these constituents in a more or less *immediately available condition*. It is for this reason, as well as to replace the exhausted plant food, that fertilizers are necessary to profitable apple growing.

Nitrogen.—To supply nitrogen, some organic manure is perhaps the most economical. Barnyard manure or the turning under a leguminous crop (the latter being rich in nitrogen) are to be recommended. Besides adding nitrogen, they furnish humus or decaying vegetable matter, which serves a useful function by liberating carbonic acid, and which in turn sets free locked-up forms of mineral food. Humus, moreover, has much to do in bringing about good tilth and in the retention of soil moisture. As the period of growth and fruit development in the apple is comparatively long, organic manures in most instances will probably give better returns than those containing more soluble forms of nitrogen, such as nitrate of soda or sulphate of ammonia.

Potash and Phosphoric Acid.—To furnish potash and phosphoric acid, we would first mention wood ashes. In most parts of Canada they are the cheapest form in which to purchase these constituents. Moreover, they possess them in the relative proportion best suited to tree requirements and in a condition that renders them easily available.

If wood ashes are not obtainable, kainit and muriate of potash may be substituted to supply potash; and bone meal and superphosphate, the phosphoric acid. Bone meal contains 2 per cent to 3 per cent of nitrogen, in addition to the phosphoric acid, but requires a greater length of time in the ground to give up its constituents; its effects naturally last longer. For this very reason it is often advocated for orchard fertilization.

Both wood ashes and bone meal furnish lime, which we have seen to be a necessary and somewhat important element.

Soils differ so much in composition that it is impossible to state definitely the amounts of these fertilizers that should be employed in all cases. The wants of the tree for fruit and leaves have been given and the principles for an economical return of these requirements indicated. In conclusion, it may be said that the best and most profitable crops can be obtained only when the soil contains what might be thought to be a large amount of plant food, the greater part of which is more or less assimilable. A good tilth, among other advantages, tends to a good root development. In such the rootlets are able to procure food from a much larger area than otherwise; but in every orchard, owing to the disposition of the roots, there must of necessity be much unoccupied soil, and hence the importance of supplying liberally and in excess of that which is absolutely needed for a season's growth and fruit, those forms of plant food which we have been considering."

About 200 pounds of ground bone and 200 pounds of muriate of potash (if it is available) applied annually to bearing orchards should furnish an abundant supply of phosphoric acid and potash.

Leaves in proportion to their weight contain a much larger amount of plant food than the fruit. The amount contained in 1,000 pounds of leaves gathered in September was 8·87 pounds of nitrogen, 1·94 pounds of phosphoric acid, 3.92 pounds of potash, this being the average of five varieties analyzed by Dr. Shutt.

CULTIVATION.

Of late years, orchard cultivation and management have received the serious attention of all progressive fruit growers. The droughts, which are frequent in certain parts of Canada, have led to the adoption of methods which are more conducive to the conservation of moisture. The plant food, also, which is in the soil, is made more easily available by the tillage which many orchards now receive.

Shall we keep our orchards in sod or adopt clean cultivation? This is the question asked time and again at meetings of farmers and fruit growers, and something is to be said in favour of both methods, though, as a rule, and under most conditions, clean cultivation with cover crops will give the best results.

Many good crops of apples have been grown in orchards which are in sod. In fact, until recent years, comparatively few orchards were kept cultivated. If the soil is good and the trees never suffer from lack of moisture, and are in a thriving condition, it will not be necessary to cultivate. But how few orchards there are in which the trees do not suffer from drought when in sod, and where they thrive as well as they would if the land were cultivated! If grass is growing in the orchard a very large amount of moisture will be transpired through the leaves and the soil being thus deprived of it will be much drier, and the apple trees will suffer. Rain, which falls during summer showers, will often not soak through the sod, as it will be evaporated before it does so. When a thick sod is formed in the orchard the air does not penetrate as freely and the plant food, which requires the action of air to make it available for the use of the tree, will not become available so readily.

In the coldest parts of the country where the apple will grow, however, it may be desirable to keep the orchard in sod after the trees are well established, as the roots will be much better protected from frost. There will also not be as much growth as if the ground were kept cultivated, and the wood on this account will be better ripened

and more prepared to withstand the winter. When trees begin to show the need of cultivation, which is indicated by a lack of vigour, the sod should be broken up.

Cultivation of the soil in orchards offers such great advantages over non-cultivation that in the best apple-growing districts it is unquestionably the better practice to adopt in most cases. When the surface soil is cultivated it forms a mulch and prevents the evaporation of moisture in a large measure. The air also is able to enter the soil very easily and nitrification takes place readily. With sufficient moisture and with plenty of plant food the trees will make vigorous growth and good crops of fruit will be borne.

Fruit growers who have followed the custom of keeping their orchards in sod, and who decide to cultivate them in future, should be careful not to break up the sod in the autumn, especially in those parts of the country where the winters are severe. The roots which have not been disturbed, it may be for years, will be near the surface and are likely to be injured, and are perhaps destroyed altogether by hard frost. It is better to plough in the spring. The first ploughing, to break up the sod, should be shallow, as it is not wise to destroy too many roots at one time. Sometimes, if the sod is not too thick, a spade or disc harrow can be used successfully instead of the plough. A method of orchard cultivation known as the Johnson method is giving good results in Nova Scotia and promises well elsewhere. Instead of cultivating all the land, alternate sides of a row of trees are cultivated each year, or alternate ridges, a crop of clover cut for mulching being grown in alternate ridges each year, thus saving half the cost of seed for cover crop and half the cost of cultivation each year and, it is claimed, inducing greater fruitfulness.

If a cover crop has been left over the winter, it should not, as a rule, be allowed to grow in the spring until there is a good crop to plough under, especially in districts where droughts occur; the land should be ploughed as soon as it is dry enough to work, not waiting for the plants to grow up; thus much moisture which would otherwise be transpired by the leaves of the plants would be saved, and the chance of suffering from drought lessened, by beginning cultivation earlier than it is generally begun in some places. A good setting of fruit depends very much on an ample supply of moisture in the ground at blooming and setting time and if there should be a drought after a heavy crop of clover or vetch has been ploughed under conditions will not be at all favourable. Ploughing should be done in alternate years towards and from the trees, so as to keep the soil level. The following extract from Bulletin No. 164 of the Michigan Experiment Station, giving the results of an experiment to test the amount of moisture in the soil, shows what may be saved by early cultivation:—

"Two tests were made of this question in Field No. 6. The ploughing was done May 2. Samples were taken for determination of moisture on May 10 and 17, with the following results:—

May 10.	1st Foot.	2nd Foot.	3rd Foot.	Average 3 Feet.
	Per cent.	Per cent.	Per cent.	Per cent.
Spring ploughed	10·50	10·07	8·04	9·54
Not ploughed	10·10	8·12	7·26	8·49
	·40	1·95	·78	1·05
May 17.				
Spring ploughed	9·33	6·75	6·97	7·68
Not ploughed	8·78	5·92	6·82	7·17
	·55	·83	·15	·51

"This gives a difference in the first instance of 2·8 pounds per square foot to a depth of three feet and 1·4 pounds in the second instance, in favour of the land ploughed early in the spring.

"Experiments tried by Professor King and reported in the Wisconsin Report for 1881, p. 101 and 102, show larger differences. The ploughing was done April 29 and samples taken May 6, showing a difference for the upper three feet of 7·02 pounds of water per square foot. On another plot the observed difference of the samples taken May 14 to the same depth was 4·65 pounds."

These determinations all show that to have as large a supply of moisture as possible for the crop it is necessary to plough or work the soil in some way to form a mulch to prevent evaporation as early in the spring as the condition of the land will allow.

In some districts and particularly in Nova Scotia, fall ploughing is practiced with good results, but where there is little snow it is desirable to have a cover crop to help hold it.

After the land has been ploughed it should be harrowed or cultivated at intervals until about the middle of July in the warmer parts of Canada, and not later than July 1 in the colder sections where early ripening of the wood is a very important consideration. There is no fixed rule as to the number of times that harrowing should be done, as much will depend on the character of the season. The object, however, should be to keep the surface soil loose from spring till July. The soil should be cultivated after every shower of any consequence, and even if no rain falls it should be stirred at least once a week. Cultivation should cease in July, in order that the late growth will not be encouraged, and that the wood may get thoroughly ripened. If cover crops are grown they will need the intervening time before winter to make the growth necessary to form a good protection for the roots of the trees.

Constant cultivation year after year has the effect of reducing the humus in the soil, and the system recommended should not be followed too rigidly. Circumstances should guide the fruit grower as to the best methods he should adopt to maintain sufficient humus in the soil. At the Central Experimental Farm there is naturally very little humus in the soil, as most of the orchard land is a light, sandy loam. There is, however, sufficient moisture, and drought is not feared.

MULCHING VERSUS CULTIVATION.

During the past few years much has been written about the "Mulch Method" in orchard practice. The object of this method is to accomplish by mulching with grass what is done by thorough cultivation, namely, conservation of moisture. A heavy mulch will retain moisture better than cultivation, as proved by experiments by the Chemist, at Ottawa, but it is often difficult and expensive to maintain a heavy mulch during the growing season, and a thin mulch does not prevent the evaporation of moisture well, hence does not serve the purpose for which it is used. The mulch in an orchard makes a harbour for mice, which is an objection to its use, unless the young trees are protected as described later on. Where the ground is rough and cultivation not easy, a mulch may be used to advantage. Good results have been obtained from mulching, but where thorough cultivation is possible, the latter is to be preferred.

MULCHING THE SOIL WITH GREEN CLOVER.

From 1898 to 1902 a system of mulching was adopted in part of the orchard at the Central Experimental Farm, Ottawa, but for another object than the conservation of moisture. Seed was sown in May, and the clover was allowed to grow during that season and to remain and protect the ground the following winter. The second season, instead of ploughing under the clover in the spring, it was allowed to grow and was cut at intervals during the summer and was not ploughed up until the next

spring. By cutting the clover when the flower heads were just beginning to show, when it was from eighteen to twenty inches in height, it was found that from four to five good cuttings could be made and by weighing some of the material at each cutting it was found that about 25 tons of green clover per acre were cut during the season. The clover from each cutting was left to rot on the ground and acted as a partial mulch. The trees did well under this treatment, but the system had to be discontinued for a time on account of the increase of Couch grass in the land. The objects of growing the clover in this way were to increase the humus in the soil and also to lessen the moisture by transpiration, as the soil was considered too wet. When an orchard soil is wet or so moist that drought is not feared, this method will give good satisfaction, but we do not advise it for most situations, as conservation of moisture is usually a most important consideration, and this can be brought about best by thorough cultivation.

COVER CROPS.

The importance of cover crops as a factor in the successful culture of large fruits is now well recognized, although it is only during recent years that much attention has been given to the subject. The main uses of the cover crop in the orchard are: to hold the snow in winter, and thus afford greater protection to the roots of trees; to prevent the thawing and freezing of the ground; to lessen the depth to which the frost will go in the soil; to furnish vegetable matter in the spring for the purpose of obtaining humus and nitrogen; and to act as a catch-drop in autumn to prevent the leaching of plant food made available during the summer. The cover crop is also a means of reducing the moisture in the soil by transpiration, and thus aids in ripening the wood of fruit trees liable to be injured. In certain parts of Canada, some of the uses of the cover crop are more important than in others, and some plants are better adapted for special purposes, hence the plant which makes the best cover crop in one district may not do so in another. Where the soil has been long cultivated, as in the older settled parts of Ontario, and needs additional plant food, especially nitrogen, a leguminous plant, or one which will take free nitrogen from the air, and thus add a large quantity of this useful and expensive fertilizer to the soil at slight expense, is usually best; while where the soil has not been long under cultivation and is well supplied with humus and nitrogen, a non-leguminous plant may be better, as the holding of snow and the protection of the roots of the trees is more important than adding fertility to the soil, especially where the snowfall is light.

In the colder parts of Canada, where there is usually plenty of moisture in summer, it is better to sow seed for the cover crop in the first half of July, rather than in the second half, as it is important to have the wood of trees thoroughly ripened before winter sets in, and by sowing the seed early the growth of the tree should be aided in ripening by the drying of the soil caused by the transpiration of moisture from the growing cover crop. In the dryer and milder parts of Canada it is not necessary to sow seed for the cover crop until about the middle of July, as the early ripening of the wood is not so important as the conserving of moisture in the soil by cultivation through the early part of the summer. After the seed is sown, the soil should be rolled with a heavy land roller, which will cause the moisture to rise to the surface of the soil and assist the germination of the seed. This rolling is very important, as should the seed lie in the ground for any length of time without germinating there will not be time for a good cover crop to be formed before winter. No nurse crop is, as a rule, necessary. Some of the desirable characteristics of a good plant for cover crops are, first that it will germinate quickly and grow rapidly, so that weeds will be checked. It should be a strong grower, as there should be a dense cover to prevent the frost from penetrating deeply into the ground. It should stand fairly erect, so that it will hold the snow well in winter. It should also be a plant which can be easily handled in the orchard. In districts where there is danger of making

the soil too dry by late growth a cover crop should be chosen which will be killed by early frost. Among the plants which have been tested as cover crops at Ottawa are: Crimson Clover, Mammoth Red Clover, Common Red Clover, Alfalfa, Soy Beans, Cow peas, English Horse Beans, Hairy Vetch, Summer Vetch, Buckwheat and Rape.

Crimson Clover has been found too uncertain in the colder districts, the plant not making sufficient growth before winter. In some districts it does well sown at the rate of 10 pounds per acre. Mammoth Red Clover and Common Red Clover, sown about the middle of July and earlier at the rate of about 12 pounds to the acre, make very good cover crops, the Mammoth Red giving a little the better results.

Alfalfa is not as satisfactory as Mammoth Red Clover, being more exhaustive of soil moisture and more difficult to handle in spring. It has been grown considerably in the irrigated districts of British Columbia recently both as a cover crop and for hay but where irrigation is to irrigate for it to the detriment of the apple trees, hence it is doubtful if it is wise to grow it in orchards there unless irrigating is very carefully done.

Soy beans were sown in drills 28 inches apart, at the rate of 57½ pounds per acre, on June 18, made a good growth, but were killed by the first frost, and were hence not satisfactory. Cow peas were too tender.

English Horse Beans were sown in drills 28 inches apart, at the rate of one bushel per acre, had continued growing till severe frosts. They hold the snow well in winter and they do not break down easily. They are rolled in the spring and work into the ground easily. Rape, sown broadcast among the Horse Beans, makes a good bottom cover.

Hairy Vetch is a good cover crop, making strong growth late in the season. It may be sown broadcast or in drills. It is somewhat difficult to plough under in the spring.

Summer Vetch or Tares.—The Summer vetch is much cheaper than the Hairy vetch and is a rapid grower. It should be sown at the rate of about 50 pounds per acre. It kills out in the winter, but furnishes a good cover.

Buckwheat.—This is not a good cover crop, as it adds no plant food to the soil, and the leaves are killed by the first frost, but it is better than nothing and sometimes proves useful for late food for bees, at the same time helping to hold the snow.

Rape grows rapidly in the autumn and makes a good ground cover. It does not add any plant food to the soil but is easy to plough under in the spring, as in most places it is killed by winter. Of the non-leguminous plants, or those which do not add nitrogen to the soil, it is one of the best; on the prairies, particularly, this has been found very satisfactory, as with it one is practically sure of a good crop and one that will hold snow well. At Ottawa rape and tares in the proportion of 6 pounds of the former and 30 pounds of the latter have been sown for a mixed cover crop, the latter furnishing the nitrogen. From 8 to 10 pounds of rape seed alone per acre ensures a good stand.

Cover crops and Conservation of Moisture.—As some plants exhaust the soil more rapidly of soil moisture than others, experiments have been conducted in the orchard with cover crops, and chemical analyses have been made by the Chemist, Dr. Frank T. Shutt, to determine the percentage of moisture in the soil under different crops at different dates, for comparison with soil without cover crops, and with each other. The moisture in cultivated ground is almost always greater than where cover crops are growing, but some plants are much more exhaustive of moisture than others. The results of these experiments have appeared from time to time in the Chemist's report.

IRRIGATION.

In some parts of Canada there is not sufficient rainfall during the growing season to supply apple trees with the necessary amount of moisture, hence where it is possible to get additional water and apply it artificially it is desirable to do so when it can be done economically. Before undertaking to install an irrigation system or to plant trees with the expectation of irrigating them, it is important to be reasonably certain

that there will be an unfailing, continuous, and adequate supply, otherwise a man might bring his trees to the bearing age and just when the irrigation would be of the greatest value to him the water supply might cease. Before beginning to irrigate it is necessary to have the land well graded so that it will be possible for the water to run without a check where it is desired for it to go and at the speed required. If there are hollows or pockets where the water settles such spots will be over-irrigated and there is likely to be more harm than good result. In Canada the water is usually run in open ditches four to six inches deep. In young orchards one ditch on each side of a row of trees is sufficient but for bearing orchards the furrows should be from five to six feet apart between the rows of trees. Few and thorough irrigations are better than frequent and light ones. There is always the danger when one has an abundant supply of water to use too much of it and if this is done trees may grow too late and will not ripen their wood well and be badly injured by frost. Thorough drainage is desirable to help prevent the accumulation of too much water in the soil if it is over irrigated. The ground should be harrowed after each irrigation to conserve the moisture and admit air into it and more than one harrowing is desirable between the different irrigations. The ground should be moist when winter sets in as there will not be so much

Apple orchard being irrigated, Okanagan Lake District, B.C.

danger from root killing as if it were dry. If a special irrigation is necessary to make the ground moist for winter it should be made late enough so that there will be no danger of causing the trees to continue growing, otherwise it may lead to much injury by frost. Different soils will require different treatment and the grower will have to learn the details for his special case by careful experimenting.

THINNING APPLES.

The thinning of apples is not as common a practice in Eastern Canada as it is in British Columbia where it is quite general. By removing a proportion of the fruit in the early part of the season that which is left has a better opportunity to develop satisfactorily and will usually be more uniform, larger, and better coloured than an unthinned tree. The advantages of thinning are thus more apparent when there is a

heavy crop of fruit. When thinning, the poorest looking and injured fruit is removed thus saving picking it later on in the season and also saving the tree from a certain amount of exhaustion which must follow the production of a very heavy crop of fruit which makes the tree less able to bear a good crop the following year. Thinning should commence as soon as the development of the fruit shows that it is well set. Thinning should be carried out in such a way that if possible the fruit after thinning will be well distributed over the tree. If the crop is a very heavy one, one fruit to each spur is sufficient to leave. Sometimes thinning has not proved profitable and each one must find out for himself whether it will pay him to do it. The following small experiment at the Experimental Farm, Ottawa, and reported on in the annual report for 1915 will give some idea of the results which may be obtained. More extensive experiments in thinning have been carried on by the Dominion Government in Nova Scotia in the Demonstration Orchards there.

THINNING EXPERIMENTS WITH WEALTHY APPLES, 1914.

A thinning experiment on a small scale was conducted with 12 Wealthy apple trees, three being left unthinned, three having 19 per cent of the fruit removed, three having 25.9 per cent removed, and three having 30.1 per cent removed.

The apples were removed from the trees about the time that they were the size of large walnuts and every apple removed was counted.

At the time of harvesting all apples harvested from these trees were also counted. In this way a record of the total number of apples originally on the trees was obtained.

In the packing, the apples were graded into fancy, No. 1, No. 2, No. 3 and culls and were sold on the market as such, a record being kept of the pack-out from each plot, and of the returns obtained in the sale of the different grades of fruit.

The results of the experiment appears as follows:—

TABLE No. 1.—Pack out results in 11 quart baskets.

Plot.	Fancy.	No. 1.	No. 2.	No. 3.	Culls.	Drops.	Total Number of Baskets.
Thinned 25·9 per cent	2	10	13	13·5	3	41	82·5
Thinned 30·1 "	8	18	4	4·5	3	32	69·5
Thinned 19·0 "	2	5	5	12·0	3	20	47·0
Not Thinned	0	15	11	16·0	3·5	65·5	111

TABLE No. 2.—The above results expressed in terms of per cent.

Plot.	Fancy.	No. 1.	No. 2.	No. 3.	Culls.	Drops.
Thinned 25·9 per cent	2·4	12·1	15·7	16·3	3·6	49·6
Thinned 30·1 "	11·5	25·8	5·7	6·4	4·3	46·0
Thinned 19·0 "	4·0	10·6	10·6	24·6	6·3	42·5
Not Thinned	0.0	13·5	9·9	14·4	3·1	59·0

It will be noted that the greatest percentage of No. 1 and Fancy apples came from the plot thinned 30·1 per cent, while the total Fancy and No. 1 apples from the other two thinned plots is about equal and very little in excess of the unthinned plot. The percentage of culls, it will be seen, remains about the same for all four plots.

In order to compare the actual merits of the thinned and unthinned plots, it will be necessary to determine what the results from the unthinned plot would have been, had it been thinned. By actual count the unthinned plot produced 11,786 apples and 39

of these were required to fill a gallon, while from the plot thinned 30·1 per cent, only 29 apples were required to fill a gallon.

Had the unthinned plot been thinned, 30·1 per cent of the apples would have been removed which would have left 8,239 apples to be harvested in the autumn.

The size of the apples would then have increased to the same size as those from the 30·1 per cent thinned plot or, to 29 per gallon.

This would have given yield in gallons of 8,239 ÷ 29 or 284 gallons, whereas the actual yield was 300 gallons, so that there was a decrease in total yield of 16 gallons, or 5·3 per cent.

This loss due to decrease in yield, however, may have been offset by the increased value of the apples resulting from thinning. This can be arrived at by working out the pack-out from the above theoretical yield, using the percentage actually obtained from the 30·1 per cent plot.

These pack-out results show that the 30·1 per cent thinned plot gave:—

11·51	per cent	Fancy apples.
25·8991	"	No. 1.
5·7553	"	No. 2.
6·4748	"	No. 3.
4·3165	"	Culls.
46·0431	"	Windfalls.

Referring now to table No. 1 and using these percentages on the crop from the unthinned trees it is found that had they been thinned to 30·1 per cent the total crop would have been 103 eleven quart baskets instead of 111 as was the actual case. The pack-out would have been as follows:—

11·8	baskets	Fancy, valued at	$ 3 54
26·6	"	No. 1, valued at	6 65
5·8	"	No. 2, valued at	1 30
6·6	"	No. 3, valued at	1 32
51·9	"	Culls & Drops, valued at	2 59
		Total	$15 40
Instead of 15	baskets	No. 1, valued at	$ 3 75
" 11	"	No. 2, valued at	2 47
" 16	"	No. 3, valued at	3 20
" 69	"	Culls & Drops, valued at	3 45
		With a total value of	$12 87

This gave a gain of $2.53 for the three trees in this plot. Against this is the cost of thinning which amounted to $1.05 in this plot, leaving a net gain of $1.48 for the three trees. This figuring out for an acre with 45 trees on it would mean a net gain of $22.20 due to thinning.

Working on these same principles it was found that the results of the other three plots appear as follows:—

When 20·1 per cent of the fruit was removed the gain was 20 cents, but when cost of thinning was considered this turns to a net loss of seventy cents or $10.50 per acre.

When 16·1 per cent of the fruit was removed a gain of 69 cents resulted or a net loss of $0.16, when cost of thinning was considered. This equals a loss of $2.40 per acre.

It will be seen from these results that only in one instance did thinning pay, but in that one case the profit was worth while. From these results it appears that thinning may or may not pay, depending upon the amount of fruit removed, and also upon conditions over which there is no control. In every case uniform trees were selected as much as possible.

HIGH COLOUR IN APPLES.

The cause of colour in apples is not thoroughly understood, but it may be said that each variety of apple has a colour or a possibility of a colour or colours peculiar to itself and it requires the proper conditions and chemical changes to develop them and make them apparent to the eye. Certain conditions will intensify the colour of a variety, and others will lessen it. Some of the principal apparent causes of the development of colour in fruit may be considered. It is well known how important a factor sunlight is in the development of colour in fruit. Fruit that is hidden by foliage is not as well coloured as that exposed to full sunlight, hence the importance of thorough pruning and thinning. During the past few years it has become quite an amusement to cover part of an apple early in the season with a letter or letters or the profile of some person; underneath these letters or profile the natural colour does not develop and when they are removed the letters stand out in green and yellow in the surrounding red, to the wonder of the uninitiated, thus showing that sunlight is necessary for the development of high colour. Heat is also an important factor in determining intensity of colour. Each kind of fruit appears to have its optimum or best mean temperature in the growing season. In countries or districts with cool summers for the kind of fruit in question the fruit is not as a rule highly coloured and where the summer temperature is very high some varieties of apples are not as well coloured as where the summers are a little cooler. Fruit on young trees growing vigorously and causing the fruit to grow late is not well coloured. This leads to the conclusion that the degree of maturity of the fruit has much to do with the colour. In Ontario late keeping varieties have the best colour in the warmer districts where the fruit becomes most mature before picking. Early varieties, or those that mature in summer or early in the autumn, get sufficient heat in most places in Canada where apples are grown to reach their full development in comparatively warm weather, hence are highly coloured over a much wider area than are the late winter varieties which, where the season is relatively short and the autumn cool, do not reach their best condition. In warm, dry seasons fruit matures earlier than in seasons which are less so, and if well developed the more mature the fruit is before it is harvested the higher the colour will be. The fruit in the dry districts of British Columbia, Oregon, Washington, California and some other states is noted for its high colour. There the trees are irrigated and by stopping irrigation and causing a ripening of the wood of the tree and a thorough maturing of the fruit the latter becomes highly coloured. In orchards where the trees are in sod, winter apples are usually more highly coloured though smaller than in cultivated orchards, evidently because the trees ripen sooner and the fruit matures more quickly than in cultivated ground. This leads to the conclusion that moisture must play an important part in the colouring of fruit, as the relative amount of moisture and heat will determine to a large extent when the tree stops growing and when the fruit will mature. British Columbia, Oregon, Washington and other places where irrigation is practiced afford the best combinations of sunlight, heat, dryness and moisture, hence it is that some of the most highly coloured fruit is produced there. What part, then, do soils or plant food in soils play in the production of highly coloured fruit? This is a question in which every fruit grower is interested. From the foregoing statement it can easily be seen that warm, well drained soils are most likely to produce apples of a high colour, as on these soils the tree and fruit will mature earlier than on wetter soils.

Here is a suggestion as to the effect of climate on flavour which some one, however, may disprove. Where a variety matures thoroughly with a relatively low mean temperature for that variety, then one gets the best flavour in that variety. Where a variety matures thoroughly with a relatively high mean temperature then one gets the poorest flavour. Where the mean temperature is too low for full maturity, but where there is almost maturity there one gets a medium flavour. Where the mean temperature is so low that the fruit is immature there one gets the greatest acidity and lack of flavour.

POLLINATION OF APPLES.

It is now known that the cause of the unproductiveness of some varieties of apples when planted in large blocks by themselves is often due to either complete or partial self-sterility of the blossoms. It has also been found that varieties self-sterile in themselves will, if planted near each other, be cross-fertilized, if the two varieties bloom at the same time, and fruit will set on both kinds. As it has been found that a variety which is self-sterile in one locality is not necessarily so in another, it is impossible to give an accurate or complete list of those which are self-sterile and those which fertilize themselves. The relative blossoming periods of the different varieties of apples, however, are fairly regular in the provinces of the Dominion, and by planting those kinds which bloom about the same time it is not absolutely necessary to know whether a variety is self-sterile or not. For five years, observations on the dates of blossoming of varieties of apples were made by persons in various parts of Canada for the Horticultural Division of the Central Experimental Farm. The data thus accumulated have been compiled and it is now possible to give the following list of apples, divided into three groups, according to their average time of blooming. While this division may not hold good in all parts of Canada, it will be found to be fairly correct on the whole.

EARLY GROUP.

Antonovka, Duchess of Oldenburg, Early Harvest, Fameuse, Gravenstein, Gideon, Haas, Hurlbut, Longfield, Patten Greening, Red Astrachan, Scott Winter, Shiawassee, Tetofsky, Wagener, Scarlet Pippin—16 varieties.

MEDIUM GROUP.

Alexander, Baldwin, Baxter, Ben Davis, Blenheim Pippin, Canada Baldwin, Esopus (Spitzenburg), Fallawater, Fall Jenetting, Gano, Golden Russet (American), Hubbardston, Jonathan, Keswick, King, Langford Beauty, McIntosh, McMahan, Magog, Milwaukee, Maiden Blush, Malinda, Mann, Newtown Pippin, Peach, Pewaukee, Pomme Grise, Primate, Lonise, Greening, Red June, Rome Beauty, Roxbury, St. Lawrence, Salome, Stark, Stayman Winesap, Swaar, Swayzie, Wealthy, Winter St. Lawrence, Wolf River, Yellow Transparent, Ontario, Ribston, Colvert, Brockville (Beauty)—42 varieties.

LATE GROUP.

Blue Pearmain, Cranberry Pippin, Grimes, Lawyer, Northern Spy, Roseau (Canada Red), Tolman, Walbridge, Westfield (Seek-no-Further), Yellow Bellflower—10 varieties.

DWARF APPLE TREES.

In Great Britain, apple trees on dwarf stocks have been grown successfully for many years and it is but natural that Canadians should conclude that they would prove satisfactory in this country also. The climatic conditions in most places in Canada where apple trees are grown are quite different from in England, however. In Great Britain owing to the many cloudy days during the growing season and the relative lack of heat, neither conditions being conducive to early fruiting of the trees, every effort is made by special methods to check the wood growth which is made there and cause the trees to bear fruit earlier than they would otherwise do. In Canada these special methods are not so necessary as the bright sunshine and high summer temperatures favour early bearing of the trees and it is not uncommon for some varieties to begin bearing two and three years after the trees are planted, when they are propagated on ordinary free growing seedling stocks. By growing trees propagated on dwarf or semi-dwarf stocks the British fruit grower

accomplishes somewhat similar results as he does when he summer prunes or root prunes his trees to check the growth of the top. The dwarf stocks dwarf or check the growth of the trees and the latter come into bearing sooner than on ordinary seedling stocks. Two kinds of stocks are usually used; the French Paradise stock which, owing to its very slow growth, checks the growth of the trees propagated on them very much; and the Doucin stock which may be called a semi-dwarf and which does not check the growth to nearly the same extent.

No extensive experiments have been made at the Central Experimental Farm with dwarf stocks though both the French Paradise and Doucin have been used. In the case of the French Paradise the tendency was for this stock to stunt the growth of some of the trees making them less able to resist the oyster shell scale. Others which made a good start have not been so checked, but this may be because some of the roots from the scion were thrown out. The Doucin stock did not materially check the growth of the trees. Fruit is usually borne sooner on trees propagated on French Paradise stock than on ordinary stock, but on Doucin stock there is little difference.

In Canada the only advantage there would appear to be in growing trees on dwarf stocks is that in the case of the amateur who has only a backyard in which to grow fruits he could grow more trees and a greater variety than he otherwise would. He will, however, find that to keep dwarf trees in good condition he will have to prune carefully and watch that roots thrown out from the scion do not eventually take the place of those from the stock, as if they do the tree will be on its own roots and will be dwarfed no longer. In parts of Canada where root killing is liable to occur Paradise stock should not be used as it is not very hardy. Experiments carried on at the New York Experiment Station on a comparatively large scale confirm our own experience with a few trees. We should, therefore, not advise the planting of apple trees on dwarf stocks for commercial purposes in Canada.

SPRAYING.

If the fruit grower faithfully performs all the operations described in this bulletin from the planting of the tree to the time when it comes into bearing and after, but does not spray, one of the most important factors in successful orcharding will have been neglected. Owing to the numerous injurious insects and fungous diseases which, unfortunately, affect the apple in Canada it is absolutely necessary to spray if a large proportion of No. 1 fruit is to be obtained from one year to another.

The advantages of spraying have been thoroughly proven by many experiments which have been carried out during the past twenty-five years and one might be led to think that all farmers and fruit growers would spray their trees. It is true that many do spray, but only a comparatively small proportion have really satisfactory results. This is not the fault of spraying in itself, but usually because the work has not been thoroughly or intelligently done or the mixtures have not been properly made. Some are discouraged because in seasons when apple scab is not bad the man who does not spray at all may have as good fruit as the man who sprays. This should not, however, be a discouragement as in a year when there is much disease the man who sprays will be rewarded for both year's work. Spraying is an expensive operation and it is surprising that so many continue to waste money by not doing the work well. The early sprayings are the important ones and if these are neglected much loss is almost sure to follow. Spray calendars have been issued from the Experimental Farm, Ottawa, from time to time in which a certain number of sprayings are suggested at certain stages in the development of the leaves, flowers, and fruit, and one is now available to any one who asks for it.

Spraying should be done thoroughly so that every leaf, bud, and fruit if possible will receive some of the material, not only on one part of it but as nearly all over as possible. Every leaf, flower bud or young fruit missed means a possible starting point for disease or insect pests.

In preparing the mixtures and solutions, the formulæ recommended by the Experimental Farms, Entomological Branch of the Department of Agriculture, and other public institutions should be followed as closely as possible. If a man knows the chemical composition of the materials he uses, and has made a study of spraying, he may alter them slightly to meet certain circumstances, but, if his knowledge of the materials used goes no further than the name, he should follow the instructions closely. He should also do his spraying as nearly as possible at the seasons suggested. A delay of a few days might mean practically the loss of the mixture or solution used as there might be no return for the labour and expense. Sometimes there is a rapid development of the apple scab in cool, moist weather in summer. Late sprayings are important in such seasons.

In spraying to control insects it must be remembered that there are two great classes into which they are divided, namely those which bite or chew their food and so eat parts of the leaves, flowers, or fruit; and those which suck the sap by penetrating the epidermis of the leaves, fruit or branches. In the first class are, as examples, the codling moth and the curculio ,and in the second class the San Jose scale, oyster shell scale and the aphides. To destroy the biting insects a so-called "internal" poison is required so that when the insect eats a certain amount of the leaf or fruit on which is poison, it will die. For the sucking insects a "contact" spray is required, as to destroy these it is necessary to strike the body of the insect with the spray either to close the breathing pores or to injure the body by the penetrating properties of the spray. Most insecticides used for biting insects have little if any effect on the sucking insects.

Power sprayers, Central Experimental Farm, Ottawa, Ont.

To control the codling moth which is the most troublesome insect in many parts of Canada it is very important to spray the trees within a week after the flowers fall. A large proportion of the insects enter the apple through the blossom end and what is desired in spraying is to put poison in the opening or "calyx cup" at the blossom end of the fruit. The calyx lobes are open for a few days after the flowers fall permitting

the spray to enter, but they afterwards close, and the spray should be applied before they close, otherwise the results will not be satisfactory.

To control apple scab which is the disease which causes most injury to apples in Canada, it is very important to destroy the spores as soon as they germinate in the spring, hence the necessity of having the tree well covered with the spray material so that if a spore germinates it will be destroyed and the disease prevented from developing further.

For full particulars in regard to the life histories of insects and diseases and other information in regard to them the reader is referred to the Entomological Branch of the Department of Agriculture, Ottawa, and the Botanical Division, Experimental Farm, Ottawa.

Owing to the practical impossibility for the fruit grower to get time to make a special spray for each particular insect or disease it is desirable to control a number of kinds as well as possible in a few applications. For this reason a number of insects and diseases which may be controlled in this way are mentioned in the following Spray Calendar.

SPRAYING CALENDAR.

Plant.	1st Application.	2nd Application.	3rd Application.
Apple. Scab or black spot fungus, sooty blotch, black rot, codling moth, leaf-eating caterpillars, borers, blister mite, curculio, apple aphis, scale insects.	*Lime-sulphur wash* or *Poisoned Bordeaux.* Just as leaf buds are opening *(Important.)*	*Lime-sulphur wash* or *Poisoned Bordeaux.* Just before blossoms open. *(Important.)*	*Lime-sulphur wash* or *Poisoned Bordeaux.* As soon as blossoms fall. *(Important.)* From one to three more sprayings may be necessary to control the apple scab, depending on the season and prevalence of the disease.
	Nicotine sulphate, Kerosene emulsion, or *Whale-oil soap* just when buds break and eggs are hatched for aphis; again in late May or June when young scale insects hatch. Nicotine sulphate, if used mixed with the Lime Sulphur wash, will kill many of the aphis. For oyster-shell scale, spray trees late in autumn with *Lime wash*, two coats, applying the second as soon as the first is dry. Lime Sulphur wash for San Jose scale, first application.		

FORMULÆ.

LIME-SULPHUR WASH.

(For San José Scale and Fungous Diseases.)

Lime	lb	20
Sulphur, powdered	"	15
Water to make	gal.	40

Slake the lime with only enough water to do it thoroughly. Add the sulphur by dusting it over the lime while slaking; stir well and boil for at least an hour adding only so much hot water as is necessary for easy stirring. When thoroughly cooked, strain through sacking, and apply hot.

COMMERCIAL LIME SULPHUR.

When commercial concentrated lime sulphur wash is used, it should be diluted for use, when there are no leaves on the trees to 1 gallon of the concentrated wash to about 9 gallons of water varying with the intensity of the wash. For use when there

is foliage the lime-sulphur should be diluted to 1 gallon of the concentrated wash to 35 to 40 gallons of water. Arsenate of lead is the best poison to use with the lime-sulphur wash. Arsenite of lime will injure foliage. Arsenate of lime is a promising insecticide to use with lime sulphur wash.

CONCENTRATED LIME SULPHUR.

This can be made at home instead of buying the commercial lime sulphur. With a formula of 50 pounds fresh lime, 100 pounds sulphur to 40 gallons of water. Heat the water to near boiling, then put in the lime, and when it is slaked, add the sulphur having first broken any lumps and screened it. Keep the mixture boiling well for an hour when, if it has been frequently stirred, it should be in condition. Then replace water lost in boiling to make up forty gallons. Strain through a 20 to the inch mesh and store in barrels until needed. If barrels are not closed, covering the surface with oil will prevent evaporation. This is usually a little weaker than the commercial washes.

USE OF THE HYDROMETER IN DETERMINING PROPER DILUTION OF CONCENTRATED LIME SULPHUR.

The hydrometer which can be obtained from most druggists with specific gravity readings, is a small instrument costing about $1, which it is very desirable to use when lime sulphur is used as a summer spray, as different concentrated solutions vary somewhat in strength, and in dealing with tender foliage it is very essential to be sure of the strength one is using. To test the strength of the solution with the hydrometer, the latter is put in it when it is cool and any sediment has gone to the bottom, and the reading noted. The reading will indicate the density of the concentrate. To obtain the total dilutions required, the decimal of the reading of the concentrate is divided by the decimal of the strength required. For summer strength the reading should be 1.000 to 1.01.

SELF-BOILED LIME SULPHUR.

(Especially for Brown Rot affecting Peaches.)

Unslaked lime	lb.	8
Sulphur (flour or flowers)	"	8
Water	gal.	40

Slake the lime in a barrel with a little cold water. After screening to break up lumps, put the sulphur in another vessel and add enough water to make a thin paste. Now pour the sulphur paste, or even the dry sulphur slowly into the barrel containing the slaking lime. Stir the mass thoroughly and add enough cold water to keep the lime from sticking to the bottom of the barrel and to ensure thorough slaking, but avoid using more water than is necessary until the lime is slaked when enough water should be at once added to cool the mass. Strain before spraying and add enough water to make up to the proportion in the formula. It is found that a desirable amount of heat is obtained by slaking 24 pounds of lime with 24 pounds sulphur at one time.

LIME WASH.

(For Oyster Shell Scale.)

Unslaked lime	lb.	1 to 2
Water	gal.	1

Strain through sacking before spraying. To be applied late in autumn.

BORDEAUX MIXTURE.

(For Fungi.)

Copper sulphate (bluestone)	lb.	4
Unslaked lime	"	4
Water (1 barrel)	gal.	40

When spraying peach and plum foliage which may be injured by the ordinary formula, it is safer to use Bordeaux mixture in the proportion of 3 pounds copper sulphate, 4 pounds lime to 40 gallons of water.

Dissolve the copper sulphate (by suspending it in a wooden or earthen vessel containing 4 or 5 or more gallons of water). It will dissolve more quickly in warm water than in cold. Slake the lime in another vessel. If the lime, when slaked, is lumpy or granular, it should be strained through coarse sacking or a fine sieve. Pour the copper sulphate solution into a barrel, or it may be dissolved in this in the first place; half fill the barrel with water; dilute the slaked lime to half a barrel of water, and pour into the diluted copper sulphate solution, then stir thoroughly. It is then ready for use. (Never mix concentrated milk of lime and copper solution.)

A stock solution of copper sulphate and milk of lime may be prepared and kept in separate covered barrels throughout the spraying season. The quantities of copper sulphate, lime and water should be carefully noted. Bordeaux mixture deteriorates with age and should be used as soon as made.

To test Bordeaux mixture, let a drop of ferrocyanide of potassium solution fall into the mixture when ready. If the mixture turns reddish-brown, add more milk of lime until no change takes place.

POISONED BORDEAUX MIXTURE.

(For Fungi and Leaf-eating Insects.)

To the 40 gallons of Bordeaux mixture prepared as above, add 4 to 8 ounces of Paris green, or 3 pounds of arsenate of lead.

INTERNAL POISONS (FOR BITING INSECTS).

PARIS GREEN.

Paris green	lb.	1
Unslaked lime	"	1
Water	gal.	160

ARSENATE OF LEAD.

Arsenate of lead	lb.	2 to 3
Water	gal.	40

Mix thoroughly before using. If dry arsenate of lead is used, one half the above quantity will be sufficient.

CONTACT POISONS (FOR SUCKING INSECTS).

*NICOTINE SULPHATE.

(Containing at least 40 per cent nicotine).

(*For Aphis.*)

Nicotine sulphate	oz.	1
Water	6½	or 1 part to 800 to 1,000 of water.

It should be more concentrated for some species.

NICOTINE.

(For Rose Thrip and Aphis.)

Nicotine	1 teaspoonful.
Water	1 gallon.

* A preparation of this known as "Black Leaf 40" is offered for sale in Canada.

KEROSENE EMULSION.

(For Aphis, Scale and other Sucking Insects.)

Kerosene (coal oil)	gal.	2
Rain water	"	1
Soap	lb.	½

Dissolve soap in water by boiling; take from fire, and, while hot, turn in kerosene and churn briskly for 5 minutes. For use, dilute with 9 parts of water so that the above 3 gallons of stock emulsion will make 30 gallons of spraying mixture.

FLOUR EMULSION.

(For Aphis, Scale and other Sucking Insects.)

Kerosene	quart.	1
Flour	oz.	8
Water	gal.	2

Stir together the flour and kerosene, then add the water, and churn violently for five minutes. To be used at once.

WHALE-OIL SOAP.

For brown or black aphis	1 lb. in 4 gallons water.
For scale-insects (young)	1 lb. in 5 " "
For green aphis or thrip	1 lb. in 6 " "

TOBACCO AND SOAP WASH.

(For Aphis and other Sucking Insects.)

Soak in hot water for a few hours 10 pounds of tobacco leaves (home-grown will do); strain off and add 2 pounds of whale-oil soap. Stir until all is dissolved, and dilute to 40 gallons. Apply early and two or three times at short intervals.

SPRAYING APPLIANCES.

To do spraying satisfactorily, one should have a good pump. The man with a few trees in his garden will find a pump fitted to a half barrel on wheels quite suitable. A pump of this kind costs from eighteen to twenty dollars. For small orchards up to two or three acres a barrel pump which can be placed on a cart or truck and worked by hand will be found satisfactory. Such pumps cost from twenty-five to thirty dollars. With pumps of all kinds, it is desirable to keep up a good pressure, hence with small pumps where the pressure is kept up by hand it is important to have a good pump. For larger orchards the power sprayer has now taken the place of the hand sprayer as the work can be done quicker, more thoroughly and more economically than with the hand pump. A 2½ horse power engine with a two cylinder pump can be purchased for about $300. The hose recommended is three-eighth inch which is not so heavy as one-half inch and there is less friction than in the one-quarter inch. There are many kinds of good nozzles those giving a wide spray being preferred for most purposes to those giving a narrow or relatively straight spray although the latter are desirable where great force is wanted. Two nozzles to each line of hose have been found to be as a rule, the most desirable number, a "Y" on which these are carried is preferred and angle nozzles are better than straight ones as one can with the former

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N.B.—All the above recommendations are dependent on weather. If heavy rain falls immediately after spraying, applications should be repeated, but spraying shortly before rain is better than spraying after rain.

Always wash out thoroughly with clean water all pumps and nozzles immediately after using. The gallon referred to above is the Imperial gallon.

Several different formulae are recommended in some cases for the same insects or diseases. This is to make it easier for those in out-of-the-way places to obtain at least one good insecticide or fungicide.

spray better in all directions. For further information in regard to spraying machinery the reader is referred to Bulletin No. 79 of the Experimental Farm Series by M. B. Davis on Renovation of the Neglected Orchard with Special Reference to the Best Orchard Practice.

RESISTANCE AND SUSCEPTIBILITY OF VARIETIES OF APPLES TO SCAB.

There is a marked difference in the relative resistance and susceptibiltiy of varieties of apples to scab. Among those which are most resistant in Canada are the Yellow Transparent, Duchess of Oldenburg, Wealthy, Alexander, American Golden Russet, Blenheim and Roxbury (Nonpareil). Among those which are most susceptible to the disease are the Famense, Gravenstein, and McIntosh, and there are many varieties which in seasons especially favourable to the development of the disease will scab moderately to badly. It may be that some day more thought will be given to the desirability of planting varieties which are highly resistant to disease. At present there is such a limited number available of really good varieties of apples of each season that one has little choice in this regard, but many new varieties are now being originated by experimental stations and private individuals, and it is hoped that within a reasonable time there will be as good varieties available of all seasons which are practically immune to scab as there are of those which are susceptible to the disease. It will be a great boon to the fruit growers when this comes to pass.

RENOVATING ORCHARDS.

Many orchards have been neglected so long and have reached such an age that it will not be profitable to attempt to renovate them, and the best plan would be, in such cases, to plant young trees. On the other hand, there are many orchards where the trees, if cared for, would be in the prime of life, and neglect is the only cause which prevents profitable crops from being grown. It is of orchards such as these that a few suggestions are offered as to how to bring them back into good condition. For fuller particulars the reader is referred to Bulletin No. 79 of the Experimental Farm series as recommended under spraying appliances. The results desired cannot be accomplished in one year.

To begin with, the trees should be pruned, not too heavily at first, but enough limbs should be taken out to open up the top and permit a free circulation of air and the admission of sunlight to it, and as much as possible of this work should be done from the outside of the tree. The trees may need severe heading back or possibly those in every other row should be removed. These operations are fully described in the bulletin referred to.

The trees will probably be much moss grown, and both they and the fruit affected with various diseases, and injurious insects are almost certain to abound. Spraying should be begun early in the season, as recommended in the spraying calendar in this bulletin, and the trees should be kept covered from top to bottom with lime sulphur wash or Bordeaux mixture and arsenate of lead until the fruit is almost fully grown. Scraping the trunks and large branches of the trees may be done if there is much moss, but as soon as the tree becomes more vigorous, and air and sunlight are admitted, much of the moss will disappear. If the oyster-shell scale or other scale insects infest the trees, they should be sprayed with the lime mixture, or other materials mentioned in the spraying calendar. As the orchard, if neglected, is almost certain to be in sod, the soil should be ploughed shallow in the spring, turning under a good dressing of manure if it can be procured. If the sod is not too thick, it might be worked up with the disc or spade harrow. The ground should then be kept thoroughly harrowed until July, working in other fertilizers if the land is poor and manure is not to be had, and then seed of some leguminous plant sown and the ground rolled.

A good cover crop should be formed by autumn. This would conclude the first season's work. The results would probably be a greatly increased vigour in the trees, and the fruit, though perhaps not plentiful, would be cleaner. The second season, additional, but less, pruning should be done, the trees kept thoroughly sprayed as before, the cover crop ploughed under in the spring, and the land kept harrowed or cultivated till July, and then some seed sown for another crop.

The fruit should be better than the year before, but not until the third year should the trees be expected to bear heavily and the orchard be in good condition.

PICKING AND PACKING.

It is difficult to give exact information as to the best time to pick apples. Each fruit grower must learn this from personal experience. Some varieties require to be picked at one stage of maturity, and some at another. There are, however, several general directions which may be given. Early apples which are intended for near markets should be picked when almost mellow, and disposed of as soon as possible, as their season is short. The best way of putting up early apples is in 6 or 11 quart baskets with leno covers, or in boxes. For export purposes they should be picked when well coloured but still firm. Experience will soon teach the best time to pick for this purpose. Winter apples may be left on the trees until there is danger of injurious frost. In large orchards it is necessary to begin picking in good season, and the different varieties will have to be taken in succession, beginning with the early winter sorts and those varieties which drop easily. For this reason and on account of the scarcity of labour, it is important to grow varieties which lengthen the picking season.

An apple before being picked should have its seeds almost mature, and have taken on most of its colour. As seasons vary considerably, judgment has to be shown as to the best time to gather the fruit. When the season is hot, the fruit matures sooner and should be picked earlier.

It often happens that a good crop of apples of the best quality is ruined by improper picking or gathering. Winter varieties appear so hard when they are picked that one might be led to think a little careless handling would have no injurious effects upon them, but this is not the case. Apples are easily bruised, and some varieties much more easily than others. When an apple is bruised, its appearance is often spoiled for the home market and its shipping qualities very much lessened for the export trade. The bruises of some varieties, while disfiguring the fruit, do not induce the apple to rot rapidly; on the other hand, there are many varieties which will rot rapidly when once bruised. Bruises may be avoided by careful handling and nothing should induce the practice adopted by some people of shaking the apples from the trees. Apples should not be picked and piled in the orchard, as they are liable to heat in the piles and ripen rapidly and thus have their keeping quality impaired.

There are many kinds of receptacles for picking apples in but half-bushel baskets are about as convenient and satisfactory as any. They should be lined with some soft material to prevent bruising, as too much caution cannot be taken in this regard. A hook may be fastened on the handle, so that the basket may be suspended while the picker is at work. The easiest way to remove the apples from the branch will soon be learned. The stem should remain on the apple, as if broken off, decay is more likely to set in. The fruit may be either sorted immediately or taken to a storehouse and packed at some future time. Many of the best growers sort and pack in the orchard, and certainly the fruit has much less danger of being bruised if treated in this way. But owing to the scarcity of labour, this is seldom done now by the best growers, who prefer to use all their help for harvesting the crop and getting it under cover in a cool place, leaving the packing until later, and the apples when picked are merely emptied into barrels and drawn to the storage house.

A sorting board covered with some soft material is arranged at a convenient distance from the ground on which the apples are emptied from the baskets, boxes or barrels. They are then usually sorted into three grades, namely No. 1, No. 2, and No. 3, and if the fruit is especially good, a "fancy" grade is also made. The No. 1 and No. 2 are put in baskets as selected, and the culls thrown to one side. These baskets should be small enough to go into a barrel, should the latter be used. Machines for grading and sizing fruit have been used for this work in recent years but, unless the fruit is free from spot or codling moth, the hand will have to be used also. The usual practice is to face the end of the barrel with two layers of apples placed neatly and tightly in it with the hand, stems down. If the stems are long, they should be cut off to prevent injury. This faced end is the end which will be opened and on which the marks are placed. These should be a fair sample of the kind of apples which are in the middle of the barrel. The other apples are now gently emptied out of the baskets into the barrel, and the fruit is made to settle down by rocking the barrel backward and forward on a plank after every two or three baskets are emptied in. This rocking or "racking" is a very important factor in successful packing. The last row of apples should come slightly above or just up to the heading groove. If they are above this, there will be too many bruised when the head is pressed in. The apples are pressed into place by means of a lever and a circular band lined with felt just fitting the barrel, until the top boards can be fitted in. If the apples have been well shaken when being put into the barrel, very little pressing is necessary. As all the pressing that is required is to keep the apples from moving, the more pressure that is put on, the greater quantity of bruised apples there will be. Some yielding material, such as excelsior or felt, placed in each end of the barrel would lessen the amount of bruised fruit very much; but excelsior is not approved of by buyers, as too much of it is sometimes used. When the head has settled into the groove, the hoops should be tightened and the liners nailed on, as is done to the other end of the barrel before starting to pack.

During the past few years there has been a marked increase in interest in Eastern Canada in packing apples in boxes and in Western Canada they are practically all packed that way. A minimum sized box for the whole of Canada has been adopted by the Dominion Government. The inside measurements of this standard box are 10 inches in depth, 11 inches in width, with 20 inches in length, or 2,200 cubic inches, being very nearly 1 bushel, and almost one-third of a barrel. It is a little more expensive to pack apples in boxes than in barrels, but for the best grades of dessert fruit considerably better prices are obtained in some markets, proportionately, than for apples packed in barrels. Boxes are particularly suitable for tender-fleshed apples like Fameuse and McIntosh. More skill is required to pack a box than a barrel, but once the art of regulating the character of the pack to the size and form of the apple used is learned, packing in boxes becomes simple. When packing is well done, no excelsior or padding of any kind is needed to keep the apples tight. Many of the early apples are wrapped in tissue paper and a considerable quantity of winter fruit as well. In order that packing may be done more intelligently and legally by the readers of this bulletin, they are referred to the Fruit Commissioner, Fruit Branch, Department of Agriculture, Ottawa, for a copy of a bulletin on "Modern Methods of Packing Apples and Pears" and a copy of that part of the Inspection and Sales Act which deals with the packing of fruit intended for sale.

STORING.

If the fruit is not disposed of at once, it should, as soon as it is picked or packed, be put where the temperature may be controlled and the fruit kept cool. Every fruit grower who has a large orchard should have a proper place for storing his fruit. It often happens that, at the time of picking, the prices for apples are very low. If a grower has not a proper place to store them, he is obliged to sell, while if he were able to hold them for a time, better prices would be obtained.

A cellar often answers the purpose of a storeroom, but it takes a large cellar to store fruit from a large orchard. For most varieties of apples a well ventilated room above ground with comparatively dry air, the temperature of which may be kept low, is the best. Apples such as Russets which shrivel easily keep better in a moist atmosphere. A fruit building may be erected without a great expenditure of money. It should be built in such a manner that the warm air may be kept out and the cooler air kept in, or vice versa. The temperature should be kept as cool as possible in the autumn, and in the winter it should be maintained at from 32° F. to 35° F. The cooler apples are kept without freezing, the better.

Apples may be kept in such a building until they are required for shipment. If they are kept late into the winter, they should be repacked before shipping, to avoid sending away anything that will be a discredit to the grower and a loss to the consumer.

In houses in cities it is often difficult to get a place where the temperature may be regulated, as it is usually either too warm or too cold. However, the coolest place should be chosen where there is no danger of frost. If there is a choice of two rooms, that with the moister atmosphere would be the better, for, as a rule, the air is too dry for keeping apples properly in a city house. If the apples are in good condition and none of the specimens shows signs of rotting, they may be left in the barrel or box. If, however, they show signs of rotting, they should be sorted and the perfect specimens wrapped in paper. If the room is very dry, it will be better to put them back in the barrel or box after wrapping, as they will shrivel less when left in a mass where the air will not get at them so readily. Tissue paper or pieces of newspaper may be used for wrapping. Moreover, there will be much less danger of rot spreading if the fruit is wrapped. It is important to keep the fruit in clean receptacles, otherwise they may absorb unpleasant flavours.

The increased shipment of early and tender fruits to Great Britain and to the western provinces of Canada has made the need of cold-storage buildings felt, and many have been erected in recent years. The temperature in such buildings is kept down by means of ice or by some other artificial method, as the ordinary storeroom could not be kept cool enough in the heat of summer. To ship early apples successfully to Great Britain and the prairie provinces of Canada it is necessary to pick them when well coloured but before they have begun to soften, and to keep them constantly cool in the pre-cooling chamber of the cold storage house or [illegible].

Further information in regard to pre-cooling and cold storage can be obtained from the Dairy and Cold Storage Commissioner, Department of Agriculture, Ottawa.

YIELDS OF APPLE TREES AT DIFFERENT AGES.

Each year there are a large number of new fruit growers in Canada, men who believe that they can make a success of the industry and who are determined to try. These men, before making their decision, estimate present and future expenses; they also endeavour to estimate probable crops and profits, but when they come to look for figures showing the yields of different varieties of apples they are disappointed. It is a remarkable fact that there has been very little reliable information published in America on the actual crops obtained from trees of different ages of the varieties of apples which are usually planted for commercial purposes. There is the general statement that Wealthy and Wagener are early bearers, that Northern Spy does not bear anything to speak of until it is about twelve years of age, that King is a very shy bearer, and that McIntosh is a rather light cropper in some places, and so on, but few actual figures are available. In fact, until a table of such yields was published in the annual report of the Experimental Farms for 1903 we do not think that any records of yields had been published when trees came into bearing and afterwards. Other records have been published in the reports for 1905, 1909, and 1911.

Since the year 1898 or for eighteen consecutive years, records have been kept of the yearly crops of over 3,000 apple trees in the orchards at the Central Experimental Farm. Unfortunately, among these trees the winter varieties of most commercial value in the warmer parts of Canada are not to be found, such varieties for instance as Tomkins King, R. I. Greening, Baldwin, and Northern Spy, as they have not proved hardy at Ottawa, but other well known sorts such as Yellow Transparent, Duchess of Oldenburg, Wealthy, Fameuse, and McIntosh have been recorded with many others. The number of trees of each variety grown at Ottawa, however, is very limited as so many sorts are under test. In the table which has been prepared, only the heaviest yields are given as it is believed that where only a few trees of each variety are grown, the highest yielding tree would be fairly near the average of an orchard of several acres. These figures are not given for the main purpose of basing future profits in orcharding, but rather to give some idea of the crop one might expect from trees of different ages. For estimating probable profits, the yields from whole orchards should be taken for a series of years but while, no doubt, many such figures will be available in a few years, few have been published yet except those in connection with demonstration orchards where mature trees are under test.

It has been found that the McIntosh apple comes into bearing the sixth year after planting at Ottawa. In that year a tree has borne about two eleven-quart baskets of fruit and by the eighth year nearly a barrel of fruit is borne on a tree. By the tenth year a barrel and a half; by the twelfth year three barrels; the fifteenth year four and a half barrels; the nineteenth year seven and a half barrels; the twenty-first year seven barrels; the twenty-third year six barrels and the twenty-fourth year four and three-quarter barrels, or an average during the past two years (1913, 1914) of nearly five and a half barrels a year. Taking the average per year for nineteen years during which it has been in bearing, we find the average yield per year from one tree has been about two and three-quarter barrels. It would look as if one might safely count on two barrels a tree.

The Duchess of Oldenburg apple is one of the most reliable and productive varieties. It begins bearing the third year after planting and by the sixth year the trees will bear nearly a barrel apiece, by the eighth year two barrels, and by the tenth year three barrels; by the eleventh year more than four barrels and the maximum crop so far has been reached in the twenty-fourth year when a yield of over eight barrels was obtained from one tree. One tree bore the following crops in thirteen consecutive years, beginning with the eleventh year: 2½, 2, 3½, 3, 4½, 3, 4, 2, 4½, 4, 6, 2, 5½ barrels. Other trees bear a heavy crop every other year. The average yield per tree from the third year to the twenty sixth is about two barrels per tree, and from the tenth year to the twenty-sixth, three barrels.

The Wealthy is one of the earliest and most productive bearers, but it does not become a large tree and the maximum crops have not been as large as some other varieties. It begins bearing the second or third year after planting. One tree gave as much as nine gallons of fruit the third year, but as a rule there are only a few apples, the second and third years and most trees do not give more than from three to five gallons the fourth year. The fifth year there is about half a barrel to a tree although there has been over a barrel on one tree. By the seventh year the trees will be bearing a barrel or over, and by the eighth year there has been as high as two barrels on a tree. By the eleventh year some trees will bear two and a half barrels and by the thirteenth and fourteenth year from three to four barrels. The highest yield obtained from a Wealthy in one year was 5¾ barrels in the twenty-fourth year. The average yield per year from the third to the twenty-sixth year is about a barrel and a half. This is a low average compared with some other varieties but the Wealthy is a small tree and as a rule bears heavily one year and has a light crop the next which brings down the average. But from the twentieth to the twenty-sixth year the average is two and three-quarter barrels a tree.

Other varieties could be discussed in the same way but the records of these will be found in the table which follows. One of the highest yields obtained from any one tree in any one year was from a McMahan which, in the twenty-sixth year, which is the greatest age of trees in our orchards, yielded nine barrels.

In Bulletin No. 376 of the New York Agricultural Experiment Station the yields are given of an acre of Baldwin orchard of trees twenty-seven years old at the beginning of the experiment and thirty-seven at the end. For ten years the average yield per tree was 4·29 barrels consisting of 2·91 barrel stock and 1·38 culls and drops. These are the only figures for a long period of years outside of those obtained at Ottawa that the writer has been able to find, except the following which were given by Prof. J. W. Crow at the Annual Meeting of the Ontario Fruit Growers' Association in 1914:—

"Referring to the figures mentioned by Mr. Macoun (figures which follow), they were collected in Norfolk county, Ontario, and give the average yield per tree for the years 1911, 1912, 1913 as follows: 1,329 Baldwins, 1,124 Spies, 1,077 Greenings. The trees were of bearing age, that is possibly about twenty-five years, and all under uniform conditions of ordinary care. The inferior trees, or orchards, not well cared for, have not been included in this estimate. The average yield per tree was: Baldwins, 2·41 barrels; Spies, 2·35 barrels; Greenings, 2·03 barrels. This is the total yield of No. 1 and No. 2 fruit, but does not include culls."

Yield of Fruit in Gallons, per tree, Yearly, from Date of Planting.

Number	Variety.	Date of Planting.	3rd year.	4th year.	5th year.	6th year.	7th year.	8th year	9th year.	10th year	11th year.	12th year.	13th year.	14th year.	15th year.	16th year.	17th year.	18th year.	19th year.	20th year	21st year.	22nd year.	23rd year.	24th year.	25th year.	26th year.	Total.	Number.
1	Yellow Transparent	1890						*27	1	173½	0	59	1	97	25	109	10½	100	0	91	...	...	...	...	...	...	538½	1
2	"	1897			3	6	11	26	5	46½	0	42	6	...	...	...	...	...	...	...	...	...	...	...	...	...	142½	2
3	Duchess of Oldenburg	1888								*46	22½	66	6	82	16	100	54	143	0	126	1	131	0	175	1½	169	1,139	3
4	" "	1888								*32	½	42½	1	63½	47	89	70	111½	68	100	52½	111½	93	149	49	132	1,201¾	4
5	" "	1897	½	1	24	18½	9	41	0	79½	0	78	0	109½	½	107	0	...	...	...	...	...	...	...	...	...	451	5
6	Wealthy	1888						*33		0	52	2	93	0	111	22	96½	1½	75	5	118	15½	129	0	119	372½	6
7	"	1896		5	3¾	12½	½	32	28½	21	51	32	52	42	55	61	46	56	...	...	...	...	...	...	...	...	497½	7
8	Fameuse	1888								* ½	35	23¼	11¾	97	31	42	73	¼	39	72	13½	77	1	38	3½	49	609½	8
9	"	1897			1	16½	0	29	0	10	20	25	38	28	77½	45	70	...	...	...	...	...	...	...	...	...	351	9
10	McIntosh	1890						*17½	25	37	6½	71½	94	12	109	3	109	41½	184	50	166	55	115	112	...	...	1,239	10
11	"	1893				4½	0	19	21	19	16½	64	28	96	24	79½	80	...	...	...	...	...	...	...	...	...	433	11
12	Milwaukee	1895	3	6	10	5	19	25	12	50	1	56	43½	62	1	116	25	31	4½	...	...	...	...	...	...	...	473	12
13	Baxter	1889							* 8	2½	0	0	14	28½	18	55	55½	62	36	50	20	30	24	24	6	...	433½	13
14	Lowland Raspberry	1888								*14½	0	½	1½	15½	30	18	65½	7½	74½	14	91	13½	123	11	78½	15	576¼	14
15	"	1892								*	0	1	8½	1	9	29	11½	46½	0	20	36½	36	...	...	...	...	199½	15
16	Langford Beauty	1897				1½	1½	24	3	0	17	25	61	0	25½	18	13½	...	...	...	...	...	...	...	...	...	190	16
17	McMahan	1888								*62	0	83	2	147	1½	141	40	124	11	142	2½	133	20	110	0	216	1,235	17
18	"	1888								*25	4½	46	½	69½	43	72	96	75	52	81	78	97	94	50	72	143	1,098½	18
19	Peach of Montreal	1888								* 1½	27½	32	36½	71	47	61	82	58	51	38	55	27	82	54	75	59	860½	19
20	Canada Baldwin	1888								* 8	4½	10½	2½	29	30	17	70	17	54	11	46	27	54	16	12½	18	427	20
21	Antonovka	1888								* 3	0	9½	2	87	7	88	68	105	84½	84	77	112	65	113	0	152	1,027	21
22	"	1888								* 0	2½	12½	10	17	22	67	40	69	15	110	33	87	10	120	13	129	787	22
23	"	1888								* 2½	0	14	9	15	41	12½	70	0	73	2	109	0	169	0	129	0	649	23
24	"	1897			2½	2½	18	18	33	41	55	9½	50	10	58	0	59	...	...	...	...	...	...	...	...	...	356½	24
25	Hibernal	1888								*19	0	74	0	60½	0	98	18	121	22	134	3	120	17	78	0	198	962½	25
26	"	1892						2	4½	4	24	7	60	0	122	½	61	0	153	9	47	130	...	...	...	...	624	26
27	Charlamoff	1888								*20	4½	32	6½	66	6	106½	33	81	33	103	38	97½	15	108½	25	133	908½	27
28	"	1897			7	12½	15	40	0	88	0	73	0	46½	0	80	5	...	...	...	...	...	...	...	...	...	387	28
29	Dudley	1891					*12	4	2	6	39	39	88	68	64	48	25	27	73	80	88	52	51	...	...	...	744	29
30	Patten	1892				*27	2	35	1½	71	15	81	31	92	3	138	0	95	0	205	0	172	...	...	...	...	974½	30
31	Bethel	1890							0	0	1½	17½	8½	1	30	3	78	0	55	208	92	29	28	20	...	...	384½	31
32	"	1895							½	11	0	22	31	18	44	2½	35	41	38	...	...	...	...	...	...	...	249	32
33	Anis	1888								8½	0	13½	8½	76	12½	86	70	83	62	119	353	142	0	132	8	165	1,022½	33
34	"	1890						*13	0	5	3½	62½	10½	69	74	65	60½	92	40	135	0	67	23	159	...	...	887¾	34
35	"	1890						* 1	0	6	1½	67½	16½	80	106	8	146	0	155	½	133½	0	53	122	...	...	896½	35
36	Anisim	1888								* 0	½	5½	4	42	37	16	88	8	110	1½	130	52	183	0	75	30	752¼	36

* Record previous to 1898 not kept.

Photo by F. T. Shutt.

Closely planted Wealthy apple trees in bloom, Central Experimental Farm, Ottawa, Ont.

Photo by F. T. Shutt.

Closely planted Wealthy apple trees in fruit, Central Experimental Farm, Ottawa, Ont.

A WEALTHY APPLE ORCHARD CLOSELY PLANTED.

In 1896 a small orchard of Wealthy apples was planted at the Central Experimental Farm. This orchard contained 144 trees, 10 by 10 feet apart, or at the rate of 435 trees per acre.

The idea in connection with this orchard was to ascertain whether or not the close planting of such early bearing varieties as Wealthy was a profitable undertaking. As the trees have crowded each other they have been removed from time to time, and eventually a very large number will be removed until practically the whole orchard is demolished. It is considered that by planting such orchards as these, with the idea of tearing out the trees and replantiug, a greater average profit per acre might be obtained than by placing the trees farther apart and waiting for some years for all the space to be utilized. This, of course is only practicable with such varieties as the Wealthy, Wagener, and Duchess, and trees which are comparatively small-growing trees and bear at an early age. In removing trees the poorer yielding ones have been removed as far as possible instead of the heavier yielding trees, a record having been kept of what each tree has produced since 1899. Of the original 144 trees there are now 88 left.

The treatment of this orchard is different from the general practice, as the orchard is left in sod and the grass kept cut and allowed to remain as a mulch. It is manured once in three years.

Following will be found a statement of yields, dates, expenses and profits from the time the orchard was planted until the end of 1914:—

WEALTHY ORCHARD, 1911.

	Gallons.
Fruit picked	1,043·5
Windfalls	867·0
Total	1,910·5

Sales of Fruit.		Estimates per Acre.
40 baskets at ·20	$ 8 00	$ 25 62
145 " ·225	32 62	101 48
40 " ·25	10 00	32 03
181 " ·30	54 30	173 92
20 bags small apples at ·50	10 00	32 03
	$114 92	$368 08

Expenses, 1914.		
Mowing, 1 man, 5 hours at 20 cents	$ 1 00	$ 3 20
Lime sulphur and poison, one spraying	1 75	5 61
Bordeaux and poison, 3 sprays	1 60	5 13
Spraying four times	3 20	10 25
Putting on tree protectors, 1 man, 4 hours, at 20 cents	0 80	2 56
Rent of land	0 94	3 01
406 baskets at 5 cents with covers	20 30	65 02
Commission on sales	11 50	36 83
Picking fruit, 137 hours at 20 cents	27 40	87 76
Packing fruit, 52 hours at 20 cents	10 40	33 31
Total expenses	$ 78 89	$252 68
Net profits	36 03	115 40
	$114 92	$368 08

WEALTHY ORCHARD, 1896-1914.

Average net profit per acre from date of planting, 1896-1914—	
Net profits per acre, 1896-1904	$ 487 16
" " 1905	103 13
" " 1906	112 80
" " 1907	37 54
" " 1908	104 34
" " 1909	108 98
" " 1910	105 47
" " 1911	49 38
" " 1912	399 44
" " 1913	95 64
" " 1914	115 40
Total net profits per acre 1896-1914, 19 years	$1,719 28
Average net profit per acre from date of planting, 1896-1914	90 49
Average net profit per acre from date of fruiting, 1899-1914, 16 years	107 46

COST OF DEVELOPING AN APPLE ORCHARD BY W. S. BLAIR.

Twenty-five acres of land at $80 per acre	$2,000 00
One thousand trees (forty trees per acre), at 25 cents	250 00
Labour setting, 1,000 trees at 10 cents	100 00
Preparation of soil and fertilizing	200 00
Total	$2,550 00
Interest on $2,550 for ten years at 6 per cent	2,016 61
Cultivating and pruning, nine years at $4 per acre per year	1,217 95
Fertilizing and spraying, nine years at $4 per acre per year	1,217 95
(Compound interest charged on the above investment)	.....
Total cost of 25 acres to ten years of age	$7,002 51
Cost per acre at ten years of age	280 10

An orchard of 1,000 trees should at the end of the tenth year have produced 500 barrels apples which should fairly represent a revenue of $1,000 above expenses of handling them. This revenue deducted from the $7,002.51 would leave an indebtedness of $6,002.51 or $240.10 per acre. The estimate of $250 per acre as the cost of developing a ten year old orchard is approximately correct.

COST OF PRODUCTION PER ACRE AFTER THE TENTH YEAR.

Pruning	$ 4 00
Ploughing and first cultivation	3 00
Four cultivations at 50 cents each	2 00
Spraying four times, using five gallons per tree at each application, 800 gallons at 1 cent per gallon	8 00
Cost of application of spray as shown below	5 66
Cultivation and cover crop	4 00
Fertilizers	7 00
Two men on rods at $1.75	3 50
Total	$33 66

COST OF SPRAY MATERIAL.

One gallon concentrated lime sulphur to 40 gallons water	20
Two pounds arsenate of lead to 40 gallons water at 10 cents	20

Forty gallons mixture cost 40 cents = 1 cent per gallon.

COST OF APPLICATION.

Five gallons per tree at four applications equals 20 gallons per tree. Forty trees per acre at 20 gallons each equals 800 gallons per acre. One power outfit should put on an average of 1,200 gallons per day or do 1½ acres

COST TO OPERATE.

One power outfit, $8.50 per day as follows—	
One boy to drive	1 00
One team	3 00
Gasolene and wear and tear of machine	4 00
Total	$8 50
Cost per acre	5 66

An acre of orchard should produce from the tenth to the fifteenth year an average of 1,000 barrels or 1 barrel per tree, and from that on at least 2 barrels per tree. The cost of managing 25 acres at $33.66 per acre would amount to $841.50 which, if 1,000 barrels are produced, would equal 84·15 cents per barrel. After the fifteenth year the crop will increase to 2,000 barrels whereas the expenditure per acre will not be any greater which increase will at once lessen the cost of production by one-half, or to 42 cents per barrel.

To the above should be added the charges for handling the crop, which will be approximately as follows per barrel.

	Cents.
Barrel	40
Picking	15
Packing	10
Hauling to station or warehouse	10
Total	75

The cost per barrel will therefore be $1.59 for from the tenth to fifteenth year and $1.17 after the fifteenth year.

Allowing for an interest on investment, assuming that the orchard cost $250 per acre to ten years of age and interest on the money required to develop the crop we have an additional $17.01 per acre equal to 42 cents per barrel, or a total cost of $2.01 from the tenth to fifteenth year, and $1.59 from the fifteenth year on. Should the crop increase the cost of production will of course correspondingly lessen.

It would appear that up to the fifteenth year apples will cost to produce, harvest and market and pay interest on investment $2.01 per barrel, and after that period $1.59 per barrel.

The estimate of 40 barrels per acre from the tenth to the fifteenth year and 80 barrels per acre from the fifteenth year on is considered by growers generally to be too low. They claim that an average of 1½ barrels per tree from the tenth to the fifteenth year and 3 barrels per tree from that on is a fair average.

COST OF GROWING A BARREL OR BOX OF APPLES.

Very few records are available in Canada of the actual cost of growing a barrel or box of apples from year to year, but some estimates have been made and expenses recorded by a few persons, some of which are given below.

Expenses have been kept of growing a barrel of apples by Mr. Manning Ells, Port Williams, N.S., based on an orchard of 32½ acres over ten years planted. In 1914 they cost $1.32½ per barrel tree run laid down to be packed on the warehouse floor. In 1915 the cost per barrel was $1.22 tree run landed at the warehouse. Mr. Ells states in a letter to the writer: "In making up these expenses, I charge the orchard 17 cents an hour man labour and 15 cents an hour horse labour. A charge of 5 cents a barrel is made on the crop for interest and depreciation of tools and equipment. Barrels are charged at their cost, 28 cents in the last two years, and a charge for interest on investment is made on a valuation of $500 an acre for all orchard over ten years out. My orchard on which I am keeping accounts is 32½ acres over ten years out, which makes an interest charge at 6 per cent of $990 a year. To find the cost per packed barrel one needs to add 15 per cent to these figures (cost when landed

to be packed at warehouse) and add the packing expenses. I think in a five-year average the tree run cost should not go over $1.10 per barrel, as we did not have more than an average crop last year."

From this and other records it would seem that the cost of growing a barrel of apples, on the average, in Nova Scotia runs above $1.25.

New Brunswick.—As per information obtained from annual report of Mr. A. G. Turney, Provincial Horticulturist, average cost for 1911, from four orchards, $1.07 per barrel.

Ontario.—According to the late Mr. Robt. Thompson, St. Catharines, Ont., at the Dominion Fruit Conference at Grimsby, Ont., 1914, the cost of growing a barrel of apples averages $1.75.

Quebec.—As per information obtained by Mr. W. S. Blair, superintendent, Experimental Station, Kentville, N.S., the cost of growing a barrel of apples in the province of Quebec varies from $1.12½ to $1.50.

British Columbia.—According to Mr. John E. Reekie, Kelowna, as given at the Dominion Fruit Conference, Grimsby, Ont., in 1914, the cost of growing a box of apples in British Columbia is about 70 cents, and according to Mr. R. M. Winslow, Provincial Horticulturist it ranges from 70 cents to 85 cents, not including interest on the investment. Mr. F. N. Holes, Armstrong, B.C., gave the cost a few years ago at 75 to 93 cents per box and $2.25 to $2.79 per barrel.

MONTHLY EXPENSE SHEET FOR RECORDING THE COST OF GROWING APPLES.

Every farmer and fruit grower should know how much it costs him to grow his apples in order that he may know how profitable they are; but, unfortunately, few men keep an accurate record of the expenses from day to day and are not able to tell with certainty at the end of the year just how much net income they have had from their fruit. In order to encourage fruit growers to keep more accurate records the monthly expense sheet given below was devised in the Horticultural Division and is distributed free to any fruit grower who asks for it. A considerable number have taken advantage of this offer and it is hoped that the appearance of a copy of this expense sheet in this bulletin will lead others to apply.

MONTHLY EXPENSE SHEET.

This Form is supplied free by Division of Horticulture, Dominion Experimental Farms, Ottawa, Ont.

Farm of ..... Crop.....

Post Office.....

Record for Month of..... No. of Acres.....

Manual Labour.

Days of the month and hours worked each day.

Operations.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total hours for month.	Cost of labour and materials.
Scraping and Renovating.....																																	
Pruning.....																																	
Ploughing.....																																	
Cultivating.....																																	
Thinning.....																																	
Picking.....																																	
Hauling and Marketing.....																																	
.....																																	
.....																																	

Horse Labour.

Ploughing			
Spraying			
Cultivating			
Hauling and Marketing			

Kind of Material used during month.	*Amount and Price of Materials used during month.*		
		Total expenditure	

FROST INJURY. DIFFERENT WAYS IN WHICH APPLE TREES ARE AFFECTED.

During the past twenty-seven years much experience has been had at Ottawa with frost injury to fruit trees, and the observations which have been made during that time and the conclusions drawn and recommendations made are now summarized, in the hope that much injury will be prevented by adopting the best methods. It would appear that there are at least eleven distinct forms of winter injury.

If one could make an accurate estimate of the number of fruit trees which have been winter killed in the colder parts of the different provinces of Canada the figures would be astounding, they would be so large. Trees which were killed the year after planting; trees that were killed just when they were beginning to bear fruit; and trees which were in their prime and bearing bountiful crops, all have suffered. This terrible destruction from winter has caused great discouragement among the people and has been one of the chief causes of the slow development of the fruit industry in the colder parts of Canada.

Much of this loss could have been avoided if the hardiest trees only had been planted, but how few there are who know the details connected with the establishment and maintenance of an orchard and who know there is almost or quite as much difference in the hardiness of varieties of fruits as there is between the hardiness of the tenderer and the hardier kinds of vegetables. All farmers have learned by observation that with a very slight frost potato tops will be killed, but that it will take a much lower temperature to kill a cabbage. But the cause of death in fruit trees still continues to be a very mysterious thing to most farmers who, when a tree has been root killed, for instance, sees it leaf out and bloom but eventually wilt under his very eyes during the summer without any apparent reason. Unfortunately this lack of knowledge on the part of the farmer has been taken advantage of by unscrupulous men and farmers have been urged to buy the varieties of fruits which appeal to them most strongly in the coloured plate or from the glowing description given by the agent. Of late years our best nurserymen seem to be impressing upon their agents the importance of offering only those varieties suited to the district in which they are sold and we have been very pleased to have these agents call at the Experimental Farms and get what information could be given them on the fruits most suited for the districts they were working in. For a long time it was not known what varieties of fruit were hardy in the different parts of Canada, but experience has taught which will succeed and the results of this experience have been recorded. With the literature now available and the information which may be obtained by applying to the proper authorities, there is no reason why any one should plant varieties which will not succeed with him, provided he has the proper soil in which to grow them and gets good trees and looks after them properly.

The forms of frost injury which will be discussed here are, root-killing, bark-splitting, trunk-splitting, sunscald, trunk or body injury, crotch injury, killing-back, black-heart, discoloration of sap wood, killing of dormant buds, killing of swollen buds.

Root-killing.—Root-killing is caused by the exposure of roots to severe frost and by the alternate thawing and freezing of the roots. It is most prevalent in winters when the soil is dry and when there is little or no snow. Roots are in many cases tenderer than the tops and are sometimes killed when the tops remain uninjured. It is sometimes desirable to have trees on their own roots as these may be hardier than the stock. Some valuable experiments were conducted by the Nebraska Agricultural Experiment Station to determine the conditions under which root-killing occurred. Trees were planted in boxes 2 feet square and 15 inches deep, each box having 25 young apple trees. Six boxes were left outside about the middle of December with soil having different percentages of moisture. One box was covered with a mulch of

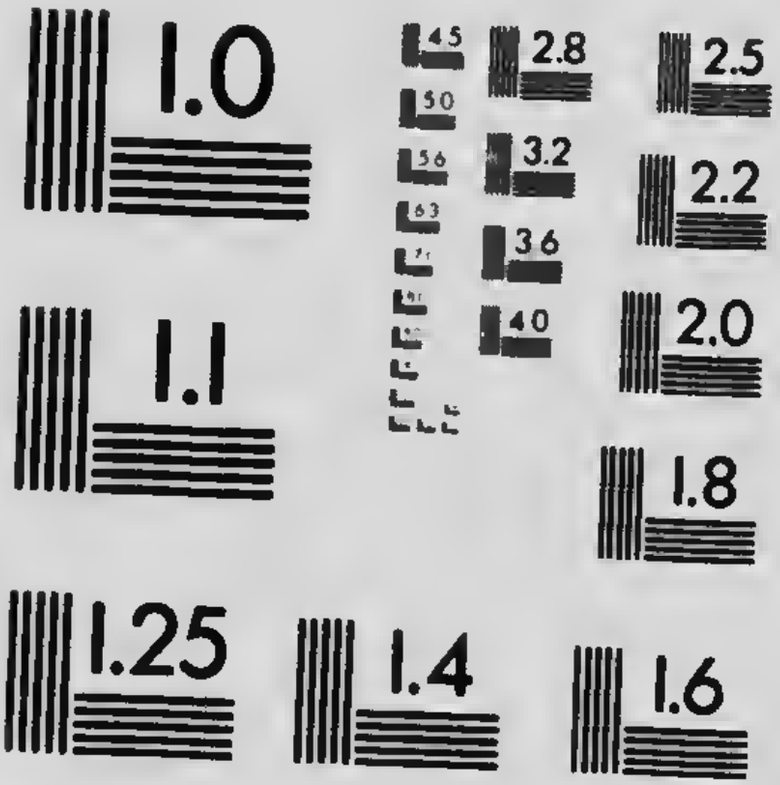
straw about 4 inches deep. One was kept covered with about 4 inches of snow whenever snow fell. The remaining boxes were left without any covering, and snow which fell being swept off. The trees were examined in February when out of 25 apple trees set in the unprotected box containing 10·4 per cent of moisture the roots of 20 trees were dead and the remaining 5 uninjured. In the unprotected box containing 15·2 per cent of moisture, 19 trees were dead and 6 injured. In the box with a moisture content of 19·8 per cent, 3 were dead, 10 injured, and 12 uninjured. In a box with 25·6 per cent moisture, 8 trees were dead, 4 injured, and 13 uninjured. The box covered with the straw mulch contained 16 per cent of soil moisture and none of the trees were dead in this box, and but 7 injured. In the box covered occasionally with snow and containing 15·8 per cent moisture 7 were dead and 8 injured. Not a root was injured in a box stored in a cool, dry cave, though it contained but 10 per cent soil moisture. These figures are very striking. The fact that the trees kept in a cool, dry cave were uninjured was believed by the experimenters to prove that cold as well as dryness was necessary to cause the death of the roots, which is borne out by our own experience. The fact that the injury was found to be so great in the dry soil would appear to show that the dry, cold air entering the soil killed the roots and that in the soils which were moist even thawing and freezing would not destroy them. It is possible that the lower temperature of the dry soil had much to do with the killing. As the soil in some parts, and provinces, of Canada is usually moist in the autumn and further drying out is usually prevented by a covering of snow, root-killing does not often occur, there having only been four times during the past twenty years when there has been much injury. This infrequency of root-killing is, however, liable to make fruit growers careless, and a time comes when an orchard is just in its prime when the trees are swept out by root-killing to the owner's great disappointment and discouragement. What, then, are the preventives of root-killing?

At the Central Experimental Farm Ottawa, many trees were root-killed in the winter of 1895-6, a winter when there was little snow. At that time cover crops were not used to any extent and the soil at the farm was bare. Since that time great care has been taken to have a cover crop in the orchard before winter sets in. This cover crop in itself protects the roots of the trees and helps to hold the snow for further protection. The roots of trees in sod are also protected in the same way. The mulching of the ground about trees with straw or manure will also protect the roots from injury. Another reason why we have not been troubled with root-killing during the past twenty years at Ottawa is that practically all our grafted trees have been since that time grafted on crab apple roots, not on *Pyrus baccata*, although some are on this stock, but on the seedlings of Martha, Transcendent, and other cultivated varieties. The apple seedlings used by nurserymen for stocks vary much in hardiness. Every tree probably differs more or less and some are undoubtedly quite tender. The result is that varieties otherwise hardy, when grafted on these roots, fail. Seedlings of the crab apples are much more likely to be hardy, and we believe that if some nurseryman would make a specialty of growing the apples suitable for the colder parts of Canada on crab apple stocks, he would in time sell a large number of these trees. The advantage of crab apple roots has been very marked in the Northwestern States where trees on ordinary apple stocks have been killed out, while those on crab roots were uninjured.

Bark splitting.—This is an injury which usually occurs on young trees. It is due to the expansion caused by frost when trees are in a very succulent condition. It occurs when trees have grown late in the fall and there is a sudden low drop in temperature. It will occur when trees have grown late and there is a heavy fall of snow before the ground freezes. The soft snow appears to soften the bark of the trees and when the temperature drops suddenly the bark is loosened. The injury is usually greatest near the ground. In Nova Scotia the Gravenstein and other apples are

MICROCOPY RESOLUTION TEST CHART

(ANSI and ISO TEST CHART No 2)



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affected with what is known there as "Crown rot," which apparently destroys the bark about the tree near the ground. From what can be learned of this injury, which occurs mostly in well cultivated orchards, and in moist ground, it is believed that the cause is that the Gravenstein grows too late and is subjected to the conditions just referred to, namely, of being too full of sap. Traces of disease have been found at these injured parts but it is believed that the disease is secondary rather than the principal cause. Bark splitting can be prevented to a large extent by having the wood of the trees well ripened when winter sets in, and this can be brought about, usually, by stopping cultivation in good time. When young trees are injured by bark splitting they may be saved if not too badly hurt by covering the injured parts with grafting wax.

Trunk splitting.—Trunk splitting, while not a common injury in orchards, is not rare. It was long thought to be due to the expansion of trees which had been "hide-bound." This splitting is now thought to be due to the cells of the medullary rays contracting to a greater degree than those of other parts of the wood when there is a sudden lowering of temperature below freezing. The medullary rays are plates of

Apple tree badly affected by sunscald.

cellular tissue which radiate from the centre of the trunk to the bark. It is trees which have made late growth and are well charged with sap that are usually affected, hence thorough ripening of the wood is necessary for the prevention of this injury also.

Sunscald.—The injury to apple trees known as sunscald is one of the most serious hindrances to successful apple culture, particularly in the northern and eastern parts of Ontario, in the province of Quebec and other parts of Canada where there is warm bright weather in early spring followed by severe frosts. Newly planted or young trees are, as a rule, more seriously affected by it than older ones. The unhealthy

appearance of the bark on the south and southwestern sides of the trunk of the tree and on the larger branches is the first indication of this injury. Afterwards the bark and wood dry up and fall away. Trees are often so badly affected that they die. Sunscald occurs during the latter part of winter or very early in the spring when there are warm days and cold nights. In the case of the apple tree, only a part of the trunk is thus affected, being that part which is exposed most to the sun. The hardiest varieties are the least affected. The injury may be prevented to a large extent by only planting trees which are headed low, thus exposing but a short trunk to the rays of the sun; also, by inclining the young trees somewhat to the southwest when planting, thus preventing the sun's rays from striking the trunk except for a short time each day. When trees have been planted and are liable to become sunscalded the trunks may be protected by using a veneer of wood which encircles the trees, thus preventing the rays of the sun from striking the trunk. White building paper tied around the tree is also useful and as it is very good as a protection from mice is one of the best preventives. Boards, sacking and many other things may be used to protect the tree from sunscald. Nothing, however, that will be likely to harbour mice should be used.

Crotch injury.—The effects of crotch injury have been very serious in the province of Quebec and in some parts of Ontario in recent years. On examination it is found that in the centre of the crotch and on the branches diverging from it, but close to it, the bark is dead. As a result of this killing in the crotch the tree loses its strength there, rot sets in and eventually the tree is destroyed by the loss of one limb after another at the crotch. This crotch injury is thought by some to be due to ice lodging in the crotch. There are several theories as to why the ice should cause the bark to die. One is, that it acts as a lens and concentrates the rays of the sun, causing a scalding of the bark. The position of the injured limbs alone would seem to be sufficient to show that this theory is not a good one. It seems more likely that the injury is caused by the softening of the bark by the melted snow or water before freezing, and that after freezing the bark which is, even before this, probably tenderer than at any other part, owing to its being most shaded there in summer, is subjected to a severe frost and it and the cambium are both injured. It has been also suggested that as this part of the tree is later to mature than some other parts, a severe frost will cause injury by tearing the bark from the wood owing to the contraction of the latter. One of the best means of preventing crotch injury is to grow trees with as little crotch as possible, training with a central leader.

Killing-back.—This is the indication of inherent tenderness of the variety, or of immaturity of wood. Plants which need a long season in which to mature their wood will go on growing so late when cultivated in a climate having a shorter season that their wood is not matured and the young wood or the whole tree may be killed. When the wood of a tree which would otherwise prove tender is well ripened it will often survive, but there are fruits and varieties that will stand only certain minimum temperatures, after which their protoplasm or life is destroyed. It sometimes happens that varieties of fruits which are apparently hardy will survive until after a heavy crop followed by a severe winter when, owing apparently to lowered vitality, they will be destroyed. The Ben Davis apple is an example of this. As has been said, killing back may be due to the immature condition of the wood, or it may be due to the death of the protoplasm. When winter killing is due to immaturity of wood it may be prevented to a large extent by methods of cultivation. From experiments conducted at Ottawa by the chemist, Dr. Frank T. Shutt, it was found that varieties of apples which were known to be tender had usually more moisture in their twigs in winter than those which were hardier, partly owing, no doubt, to the fact that they were more immature than those of trees which were hardier. When trees of certain varieties are liable to be killed after heavy bearing, thinning of the fruit should be practised in order to prevent the lowering of vitality.

Black Heart.—Black Heart is a condition found in trees grown in cold climates. It is caused by the death of the alburnum or young wood in winter. The bark and cambium remaining uninjured, growth continues in the spring much as usual, but the injury remains. Another severe winter or several winters while the trees are young may cause repeated blackening in the same tree and yet the tree continues to make good growth, the cambium not being killed. If a branch breaks off a tree which has been blackened for a number of years, rot may gain an entrance and most of the interior of the tree may rot and some day the tree will blow over and it will be found merely a shell which has been held together by the trunk and a few outside layers of wood. Where repeated frost injury occurs, as in such a case, the tree is not hardy enough for the climate it is growing in. At the Central Experimental Farm many trees are black-hearted but most of these trees are growing and bearing well and there is no outward evidence of this injury. On cutting down many bearing trees which it was desired to remove for other reasons black heart was present but there was no evidence that rot had set in. Black Heart in its incipient stage may be prevented by careful attention to northern grown nursery stock. During the winter after the first season's growth of the young grafted trees, most varieties are likely to be killed back, and when the tree begins to grow in the spring it will be found that the alburnum or sap wood is blackened below the point where growth begins. This is Black Heart. Careful nurserymen now cut back the young trees almost or quite to the ground the first year, in order that the tree may start growth from healthy wood. The same thing may occur the second season, and the trees are again cut back, but it is usually not necessary to cut so far. Even after trees are three and four years of age and have been planted in the orchard they may get Black Heart by winter injury, but it is much rarer than when they are neglected in the nursery. In November of 1911, 22 degrees of frost caused much Black Heart in nursery stock. It is very important to have the wood ripened up well where such severe frosts are likely to occur in autumn. Trees badly affected with Black Heart the previous year do not make as vigorous a growth as uninjured trees. The growth also will be somewhat spindly. The tenderer varieties are more susceptible to Black Heart than the hardy ones.

Discoloration of Sap Wood.—In parts of Canada where there is often a sudden drop in temperature several degrees below freezing while the wood of nursery stock or young trees in orchards is not yet well ripened, a discoloration or browning of the sap-wood occurs. The writer found on examination of nursery stock after eight degrees Fahrenheit of frost that some varieties showed this discoloration. So far as we are aware there is no evidence to prove that this slight discoloration will seriously injure the tree if it has any bad effect at all. In districts where these early severe frosts occur trees already planted in the orchard are liable to become discoloured and if the frost is severe enough they are likely to become black hearted.

Trunk Injury—Body Injury.—The fact that trees loose moisture in the winter has been proved by careful experiments. In an experiment conducted at the Central Experimental Farm by Dr. Frank T. Shutt, Chemist, in the winter 1902-3 to determine the moisture-content of apple twigs, it was found that during the depth of winter there was a gradual loss of moisture. Experiments at other places confirm this. In the Northwest, where the weather is very cold in winter and there are often no trees to check the force of the wind, trees lose so much moisture that it is a common occurrence for them to die simply from drying out. The same trees if protected by a good windbreak would in many cases not be injured. It has been written, although we are not sure that the figures are correct, that the same surface which would in calm weather exhale 100 parts of water would exhale 150 parts in a high wind. These proportions would probably be considerably less in the case of fruit trees protected by bark, but it shows what a drying effect wind has. The winter of 1906-7 was a very cold one in eastern Ontario and the province of Quebec, and there was considerable injury from body-killing. This, for the most part, took the form of trunk killing,

the upper part of the trunk unprotected by snow being apparently dried out. The result was that the bark and cambium all around the trunk were killed. At Ottawa quite a number of trees was lost in this way. The reason, in our judgment, why the trunk was killed and the top uninjured was that the top had more moisture and was not dried out sufficiently to be killed. In past experience it has been noticed at Ottawa that sometimes the younger growth of apple trees will come through the winter uninjured, while the older parts of the branches will be killed. Trees in sod orchards will sometimes die from 'body killing' when those which are cultivated do not, the latter having more moisture. In a letter received from Mr. A. P. Stevenson, Morden, Man., he writes:—'Outside of sunscald, our chief winter injury is killing back. This is serious when the following winter conditions prevail: Light snowfall, high winds and extremely low temperature continuing for some time. Some varieties are killed to the snow-line. Two years ago we had a winter like that, and another seven years previous to that. The trees are simply frozen dry.' There have been some indications at Ottawa that body-killing or trunk injury has occurred under the veneer protector. This may have been due to ice held about the tree too long by the protector.

Two means of prevention of body-killing may be mentioned. One, to see that the trees have made vigorous growth the previous summer, not forgetting, however, to have the wood well ripened. The second is to plant windbreaks to check the force of the wind. In the Northwest the trunks are sometimes protected by sacking or veneer. It is even suggested by those who live in the West to make a box around the trunk with about six inches space and fill it with soil.

Killing of dormant buds.—While the killing of dormant buds evidently comes about partly from the same cause as body-killing, namely, a drying out in cold weather, it would seem that buds are more tender than wood, and their life is destroyed at certain minimum temperatures. Not only are fruit buds destroyed when the twig is not injured, but leaf buds as well. The buds being more exposed to the air may dry out when the wood does not. The buds of apples are not killed in Canada to the same extent as the buds of plums and cherries. In the province of Quebec and the colder parts of Ontario the buds of the European and Japanese plums and cherries are nearly always injured more or less in winter. This seems undoubtedly to be due to the drying out of the twigs, for when these fruits are grown near bodies of open water in winter they do well. The marked success of Mr. Aug. Dupuis, and others, in growing the European plums along the Lower St. Lawrence is well known. But what are the conditions there? It is only within a comparatively short distance of the river that these fruits succeed. When we get further back from the river the buds are killed as in other parts of the province. The reason of the successful culture of plums and cherries is evidently due to the fact that from the water there rises in winter a fog which blowing over the land keeps the air moist enough to save the buds from death. It will be remembered that it required dryness with cold to kill the roots of trees. When the roots were moist they were little injured, even if exposed to the same temperatures. There is, as yet, no very practicable way to prevent this drying out of the fruit buds. The fact that the parts of the trees which are under the snow produce fruit, when the parts which are exposed do not, suggests the plan of bending over the trees so that they will be covered, which has been done successfully by some growers. Another plan which we think deserves further experiment is low training of trees growing them with horizontal arms, for instance, which would be under the snow. A third plan is the breeding of varieties having hardier fruit buds. This we believe should, and is being done.

Winter-killing of swollen buds.—During winters with very changeable weather when some days are quite warm there is often a premature swelling of buds, especially of the cherry, plum and peach. These warm spells may be followed by cold weather, and there may be several such changes before spring. The buds

being swollen and more or less active are more subject to injury from frost and changes than the dormant buds and the result is that they are killed. Apple buds do not swell readily and hence are seldom injured from this cause in Canada, except it may be in the prairie provinces, although just before the flowers open if there are severe frosts much injury may occur. Great injury is often caused in the peach districts by the killing of swollen buds, and in the province of Quebec injury to the buds of plums and cherry is no doubt done when they are in this condition. It was long thought that if the ground could be kept frozen about the trees it would prevent the buds from swelling as the roots would thus be kept in an inactive condition, but it has been proved over and over again that this has no effect whatever in delaying the swelling of the buds. The expanding of the willow buds in our swamps before ice is gone is a good example of how buds will develop while the roots may yet be in a frozen condition. There is sufficient sap in the tree to supply the buds and even the leaves when they first expand and when the temperature about the top of the tree is high enough growth begins. Swelling of buds can be prevented by bending over the trees as suggested to prevent killing of dormant buds, but this could not very well be done on a large scale. A few years ago experiments were conducted at the Missouri station to determine if whitewashing the trees would retard the buds, the principle being used that white surfaces do not absorb heat as readily as darker ones. It was found that the whitewashing did retard the buds and in the case of peaches would sometimes prevent injury from frost. An experiment was tried at Ottawa in whitewashing plums and cherries, and it was found that it retarded the swelling of the buds. This means of prevention is not, however, a very practicable one as it is difficult to get the whitewash to cover the branches well for a long period. After further investigations at the Missouri station, it was found that the buds of varieties of peaches having the lightest coloured twigs required higher temperatures to cause them to swell than those with darker coloured twigs, and the former suffered less from killing than the latter. Not having in these lighter twigged varieties the kinds of peaches for commercial purposes the Missouri station is now at work breeding good varieties with light coloured twigs. It was also found at the Missouri station that the buds of peaches which matured their wood late did not swell as readily as those which were well ripened and thus were less liable to injury from frost.

FROST INJURY TO FLOWERS.

Apple flowers in bud will stand more frost than when they are fully open. When the petals fall less frost will cause injury than when the trees are in full bloom. From five to seven degrees Fahr. of frost are likely to cause severe injury to apples when in full bloom and after the bloom has fallen from four to five degrees may do much harm. Much depends on the length of time the flowers are frozen and on the weather following the freeze. If the flowers have been injured by frost, an examination after the petals are open, if the frost occurs when they are in bud, will reveal the centre of the flower or pistil discoloured or brownish. The fruit will not set when flowers are injured in this way. The frost may, however, come after pollination has taken place when the fruit may set.

RUSSETING OF FRUIT DUE TO FROST.

Sometimes frost affects the fruit when it is still quite small and later on the evidence of the injury will be a russeted area usually about the calyx end but sometimes at the stem end of the fruit and sometimes as a band of russet around the fruit. This, no doubt, is often attributed to some other cause than frost.

OTHER ORCHARD TROUBLES.

Dropping of Apple Leaves.—Many leaves drop from apple trees in summer and cause anxiety to fruit growers. Probably the three most important reasons why the leaves drop are: First, that the tree may regain a proper balance between top and

root. There is often a great leaf development, owing to moist conditions, and when drier weather comes, there are too many leaves for the tree to support, hence some of them drop off. Second, that under certain conditions, especially when there has been a wet season, leaves will scald and drop off. Spraying sometimes causes this scalding. Third, that the leaves are affected with a leaf spot disease. The development of this disease may, however, come after they become weak from lack of moisture to support them, or when the leaf is weakened by sunscald. As a rule, under good cultivation, there are quite sufficient leaves left to develop the fruit properly.

Spray Injury—Russeting of Apples.—For the past few years complaints have been made that spraying trees with Bordeaux mixture injured the apples, causing them to become russeted, the Ben Davis suffering in particular. There is no doubt that when Bordeaux mixture is not made with sufficient lime, injury will occur, but injury has followed the use of properly made Bordeaux, and it has been found that the climatic conditions which have prevailed, either before or when the spray was applied, have much to do with it. The worst injury has occurred in the districts bordering the Great Lakes and in the Maritime Provinces, where the air must be considerably moister than further inland, and in a damp season the air is still moister, hence the skin of the apples is more tender than it is where the atmosphere is drier, and when a spray or even heavy dew rests on the fruit during bright sunshine and hot weather, scalding and russeting follow. This may be due in part to the fungicide in the mixture. Russeting occurs even when trees are not sprayed, due, it is believed, to scalding caused by a heavy dew in bright, hot weather. It would be a good practice, where it is possible to carry it out to spray the south side of the trees in the morning and the north side in the afternoon, so that the mixture would have a chance to dry on the tree before the sun shone on it.

WATER CORE.

In some seasons, and in certain parts of Canada more than others, a few varieties of apples become more or less water cored and are rendered less valuable on this account. This condition is now considered to be brought about by sap pressure caused by cool nights following very warm days. The transpiration of water from the leaves is more rapidly checked, than the upward flow, by a considerable lowering of the air temperature with the result that the flesh of the apple is flooded with sap.

Trees growing rapidly in moist soil are liable to be more affected than others making slower growth and trees which have lost part of their foliage through any cause are also more subject to it than trees with good foliage. Water coring is difficult to guard against as it is due to climatic conditions. There is likely to be considerable loss from water cored fruit if packed for expor

ORCHARD HEATERS TO PROTECT TREES FROM FROST.

It is not likely that orchard heaters or fire pots will be used much in Canada for protecting apple trees from frost as it is so seldom in most places that the apple crop is seriously affected by frost, but these heaters are being used quite extensively in some parts of the United States especially for tenderer fruits, and it may be that they will be yet found useful in Canada for protecting apple orchards where spring frosts do material damage. Several hundred of these heaters have been in use at the Central Experimental Farm, Ottawa, and it has been found that the temperature can be readily kept above freezing when there are several degrees of frost outside the heated area by the use of from 50 to 100 pots per acre. Crude oil is burned in these pots. Further information in regard to these may be obtained from the Horticultural Division.

PROTECTION OF APPLE TREES FROM MICE AND RABBITS, AND CARE OF INJURED TREES.

Every year thousands of trees are injured in Canada by mice, and, in the newer districts, a large number by rabbits also. There could be nothing more discouraging to a fruit grower, or would-be fruit grower, than to see his orchard which he had cared for, perhaps, for five or six years, ruined by mice; and yet this frequently happens. All this could be prevented if the farmer or fruit grower would use the information available and protect his trees from mice. Some years there is less injury than others, and this fact leads to carelessness, and when a bad year comes the trees are unprotected.

While the depredations from mice and rabbits in winter vary from one year to another, depending on the scarcity or abundance of food, the number of mice which are in the vicinity and the character of the winter, the injury is always greatest when the orchard is in sod, and when there is rubbish lying about; hence the latter should be removed before the winter sets in. In most cases it is not necessary nor advisable to have the orchard in sod, particularly when the trees are young, although it is highly

Apple trees protected from mice by building paper, Central Experimental Farm, Ottawa, Ont.

important to have a cover crop, which also may sometimes become a harbour for mice. As mice may be expected in greater or less numbers every winter, young trees should be regularly protected against their ravages. Mice usually begin working on the ground under the snow, and when they come to a tree they will begin to gnaw it if it is not protected. A small mound of soil from eight to twelve inches in height raised about the base of the tree will often prevent their injuring the tree, and even snow tramped about t' trees has been quite effectual, but the cheapest and surest practice is to wrap the tree with ordinary building paper, the price of which is merely nominal. Tar paper is also effectual, but trees have been injured by using it, and it is well to guard against this when building paper will do as well. After the paper is wrapped around the tree and tied, a little earth should be put about the lower end to prevent the mice from beginning to work there, as if they get a start the paper will not stand in their way. It may be stated, however, that although two thousand young trees

have been wrapped with building paper for several years at the Experimental Farm at Ottawa, there have been practically no instances where the mice have gnawed through the paper to get at the tree. The use of a wire protector, or one made of tin or galvanized iron, is economical in the end, as they are durable.

In the north, protection from sunscald is almost as important as protection from mice. At the Central Experimental Farm, wooden veneer protectors have been used for several years past for the standard trees, as these protect from mice and on account of being loose about the tree leave a good air space which appears to protect the tree from those sudden changes of temperature which seem to be the main cause of sunscald.

There are a number of washes and poisons recommended for the protection of fruit trees and the destruction of the mice and rabbits, but none of these are very satisfactory, as if the mice or rabbits are numerous the poison has not sufficient effect upon them to prevent injury altogether. The following method of poisoning has been found fairly successful.

Make a mixture of one part by weight of arsenic with three parts of corn meal. Nail two pieces of board each six feet long and six inches wide together so as to make a trough. Invert this near the trees to be protected and place about a tablespoonful of the poison on a shingle and put it near the middle of the run, renewing the poison as often as is necessary.

The following formula, as a protection from rabbits, is recommended by the Department of Agriculture, Washington, D.C.: Unslaked lime, 20 pounds; flowers of sulphur, 15 pounds; water, 50 gallons (40 Imperial gallons). This is applied to the trunks of the trees with a brush.

TREATMENT OF INJURED TREES.

If a tree is badly girdled by mice it usually dies. If as soon as the wound is noticed it is cleaned and covered with grafting wax or some paste, such as sulphur, cowdung and clay, and wrapped with cloth to exclude air and prevent the wound from drying out, there is a possibility of saving the tree if the girdle is a small one, as the sap which rises through the wood will continue to do so, and returning through the inner bark in an elaborated condition will cause growth to be made all around the upper part of the wound, and if the latter be not too large there is a chance of its healing over. If, however, the wood becomes dry before the bandage is put on, the tree will almost certainly die, although it may continue to grow throughout the season. When the wax and bandage are applied the tree should be headed back considerably to lessen the amount of transpiration of moisture, as there will not be as much sap rise as if the tree were uninjured, and the wood will thus dry out sooner than if it were headed back. If the girdle is near the ground, in addition to covering the injured part with wax or cowdung and clay, it is advisable to mound up the soil about the tree to cover the wound and thus help to prevent the wood from drying out.

Girdled trees are frequently saved, and more surely saved than by the above method, by connecting the upper and lower edges of the girdle with scions, which are inserted about an inch apart all around the trunk. This is known as bridge grafting. The more scions that are used the quicker they will grow together and form a new trunk, but two or three scions successfully grafted on a small tree will carry enough sap to keep the tree alive. A slanting cut is made at each end of the wound in the uninjured wood in which the ends of the scions are to be inserted. Strong, plump scions of the previous season's growth—not necessarily from the same tree, nor even the same variety—cut a little longer than the distance between the slanting cuts, are made wedge-shaped at each end. They are made a little longer than the distance between the cuts in order that when inserting the ends into the cuts it will be necessary to bend them, and thus have them under pressure, which helps to keep them in posi-

tion. After inserting, some of the inside bark of the stock should remain in contact with the inside bark of the scion, as it is here or at the cambium layer where union takes places. As soon as the scions are all placed the wound, especially about the ends of the scions where inserted in the stock, is covered with grafting wax. The ends are also at the same time bandaged with a piece of sacking around the trunk to aid in keeping the scions in place and to exclude the air. The tree should then be well headed back. The scions, if properly made and inserted, should soon unite with the stock and then carry the sap to the top of the tree.

Another method of bridging is to cut back the uninjured bark evenly all round the trunk and insert the wedge-shaped scions underneath the bark at the upper and lower ends of the wound. There are other methods also employed, such as using a scion bevelled at each end. Also, boring holes with an auger at each end in the uninjured bark and shaping the scion at each end so that it will fit into it.

One of the most satisfactory methods of utilizing the girdled tree is to cut it off close to the ground and insert a scion of some variety. This graft should grow at least three feet in height the first season and make a nice young tree.

A tree may sometimes be saved when the girdling is well above the graft by cutting the tree back so as to remove all of the injured part. Under such conditions young trees will usually start fresh growth and the strongest shoot may be selected to form a new trunk and top for the tree.

INTRODUCTION OF VARIETIES.

Many varieties of apples have been tested in Canada and the United States since these countries were first settled, and during the last century, especially the number has increased very rapidly. These have either been introduced from Great Britain and Europe or have been originated in America. It has been found that a much larger proportion of the varieties which have originated in America, are more profitable sorts to grow than of those from other countries, and in Canada the facts are much the same, except in the very coldest parts of the country, where apples can be grown, and there the Russian varieties take a predominant place, but this is probably because the colder parts of the country have not been settled so long, and hardy seedlings of value are, on this account, not so often met with.

During the past twenty-seven years 734 named varieties of apples have been tested at the Central Experimental Farm, Ottawa. These have been obtained from many sources, but the largest proportion of them were of American and Russian origin.

Of the apples which are succeeding best at Ottawa, nearly all the most profitable summer varieties are of Russian origin, but most of the best autumn and winter sorts were originated in America.

VARIETIES OF APPLES RECOMMENDED FOR PLANTING IN CANADA OR SUGGESTED FOR TRIAL.

In a country of as vast an extent as Canada with so many different climatic conditions, it requires quite a long list of varieties from which to select those which have shown themselves to be particularly suitable for different climates and covering the season from summer to late winter. On the other hand it has been found that a certain few varieties have a very wide adaptation and except under the most adverse conditions are the best varieties of their season from the Atlantic to the Pacific. Among such may be mentioned the Yellow Transparent, Duchess of Oldenburg, and Wealthy. It is, however, being more and more impressed upon horticulturists that there are certain districts and certain soils where certain varieties reach their highest state of development, and no doubt this fact will be given more thought when trees are planted in the future and as the area devoted to apples increases in Canada. Some winter varieties, especially, require a much warmer and longer growing season than

others in order to bring out their best qualities. Others again do not reach their highest state of development if they are matured in very warm weather. The study of the relation or the number of heat units during the growing season to the maturing of the variety to be planted in a certain place or to the suitability of a variety will no doubt receive more attention in the future. The ability of a variety to withstand frost and other adverse climatic conditions must, however, be taken into consideration, as no matter how suitable the growing season may be for a certain variety, if the dormant season is unfavourable then that variety is not to be recommended.

There are great areas in Eastern Canada where the climatic conditions are sufficiently similar to warrant the recommending of almost the same varieties for places widely separated. It is desirable to reduce the number of varieties recommended as much as possible as, at present, there are far too many grown in Canada. It is much easier to profitably market large quantities of a few varieties than small quantities of many varieties.

Following are lists for different parts of Canada based on experience of fruit growers and Experimental Stations in these districts.

ONTARIO.

The province of Ontario may be divided roughly into six districts where the climate is sufficiently different to warrant some difference, even though slight, in the varieties recommended.

District 1.

Counties north of Lake Erie.

Summer.—Red Astrachan, Duchess of Oldenburg.

Autumn.—Gravenstein, Wealthy, Blenheim.

Early Winter.—Tompkins King, Hubbardston, McIntosh, Fameuse, Rhode Island Greening.

Winter.—Baldwin, Northern Spy.

District 2.

Counties on Lake Huron and the southern part of the Georgian Bay and inland to Wellington and Waterloo counties.

Summer.—Red Astrachan, Duchess of Oldenburg.

Autumn.—Gravenstein, Wealthy, Alexander, Blenheim.

Early Winter.—Tompkins King, Rhode Island Greening, McIntosh, Fameuse.

Winter.—Baldwin, Northern Spy.

District 3.

Counties on Lake Ontario north to a line south of Lake Simcoe on the west and converging to Kingston on the east.

Summer.—Duchess of Oldenburg.

Autumn.—Gravenstein, Wealthy, Alexander, Blenheim.

Early Winter.—McIntosh, Fameuse, Rhode Island Greening.

Winter.—Baldwin, Northern Spy. Baldwin is too tender in some places.

Additional varieties suggested for trial, home use or local market for districts 2 and 3, Yellow Transparent, Primate, Ribston, Swayzie, Tolman, Rome Beauty.

District 4.

Counties of Wellington and Waterloo and the higher elevations in the adjacent counties.

Summer.—Duchess of Oldenburg.

Autumn.—Wealthy, Alexander.

Early Winter.—McIntosh, Fameuse.

Other varieties such as Gravenstein, Blenheim, Ribston and Northern Spy will succeed in the most favourable parts, but it is safer to top-graft them.

District 5.

From near Kingston, north and east to latitude 46° and along this line west to and including Manitoulin Island, and south to District 3.

Summer.—Yellow Transparent, Crimson Beauty, Duchess of Oldenburg, Langford Beauty.

Autumn.—Wealthy, Alexander, Dudley, McMahan. Okabena is promising.

Early Winter.—McIntosh, Fameuse, Wolf River.

Winter.—Milwaukee, Bethel, Scott Winter. Scarlet Pippin succeeds well near the St. Lawrence river but is not hardy enough inland.

Additional varieties suggested for home use:—

Summer.—Lowland Raspberry.

Autumn.—Peach of Montreal, St. Lawrence.

Winter.—Pewaukee, American Golden Russet, Tolman.

While a few winter varieties are recommended for this district, extensive plantings of them are not advised.

District 6.

North of District 5.

Summer.—Blushed Calville, Lowland Raspberry, Duchess of Oldenburg and Charlamoff; the two latter being autumn varieties in this district.

Autumn.—Golden White, Antonovka, Wealthy, Hibernal, McMahan, Longfield and Patten Greening. All of which might be called early winter apples in this district. Where apples will not grow, the following crab apples should be tried:—Whitney, Transcendent, Florence, Martha and Hyslop. Where the climate is most severe the hybrid crab apples originated at the Central Experimental Farm, Ottawa, such as Silvia, Jewel, and Charles should succeed.

QUEBEC.

The province of Quebec may be divided into two districts so far as the growing of apples is concerned.

District 1.

North to latitude 46° and south to the American boundary, in the western part of the province and east to the counties of Lotbinière and Dorchester, south of the St. Lawrence river, and on the north side within five miles of the St. Lawrence river from about Three Rivers, east to the Island of Orleans; and then again south of the St. Lawrence river within a few miles of the river from Nicolet county to L'Islet county. Where there are high elevations or especially unfavourable conditions of soil, the varieties for District 2 would be the better to plant.

Summer.—Yellow Transparent, Crimson Beauty, Duchess of Oldenburg, Langford Beauty.

Autumn.—Wealthy, Alexander, Dudley, McMahan, Okabena is promising.

Early Winter.—McIntosh, Fameuse, Wolf River.

Winter.—Milwaukee, Bethel, Scott Winter.

Additional varieties suggested for home use.

Summer.—Lowland Raspberry.

Autumn.—Peach of Montreal, St. Lawrence.

Winter.—Pewaukee, American Golden Russet, Tolman.

While a few winter varieties are recommended for this district, extensive plantings of them are not advised.

Bethel is not very hardy and should not be planted in the coldest parts of this district.

District 2.

North of latitude 51°, north of the St. Lawrence river; and south of the St. Lawrence river in the counties of Rimouski, Matane and Gaspé.

Summer.—Blushed Calville, Lowland Raspberry, Duchess of Oldenburg and Charlamoff; the two latter being autumn varieties in this district. Yellow Transparent will succeed in the most favourable parts.

Autumn.—Golden White, Antonovka, Wealthy, Hibernal, McMahan, Longfield and Patten Greening, all of which might be called early winter apples in this district. Where apples will not grow the following crab apples should be tried, Whitney, Transcendent, Florence, Martha and Hy-lop. Where the climate is most severe the hybrid crab apples originated at the Central Experimental Farm, Ottawa, such as Silvia, Jewel and Charles should succeed.

PRINCE EDWARD ISLAND.

Autumn.—Duchess of Oldenburg.

Early Winter.—Wealthy, Alexander.

Winter.—Tompkins King, Ribston, McIntosh, Northern Spy, Roxbury and Stark.

Other varieties which might be grown for home use especially are:

Summer.—Lowland Raspberry, Yellow Transparent.

Autumn.—St. Lawrence and Gravenstein.

Early Winter and Winter.—Grimes, American Golden Russet.

On Prince Edward Island the summer and autumn varieties especially, keep much longer than in most other places in Canada. Gravenstein and Wealthy, for instance, keeping well on into the winter, hence the term "autumn" for these as grown on Prince Edward Island may be somewhat of a misnomer.

NEW BRUNSWICK.

The following information in regard to varieties of apples for New Brunswick is taken from the Report on Horticulture for the Province of New Brunswick for the year 1914:—

Apples.

Not recommended at all: Ben Davis, Gano, Gideon.

Not to be planted on their own roots except in the most southerly sections: Northern Spy, American Baldwin, Rhode Island Greening, King of Tompkins Co., Gravenstein, Bishop Pippin, Ribston, Blue Pearmain, Blenheim and Ontario.

In the best sections of Albert, Kings, Charlotte, Queens, Sunbury, Westmorland and York counties, the Bishop Pippin and Blue Pearmain can be grown successfully by top-grafting to hardier stocks, such as Tolman, Alexander and McMahan White. While good specimens grown top-grafted of Northern Spy, Gravenstein, American Baldwin, King of Tompkins Co., Rhode Island Greening and Blenheim have been shown, and they may be grown for home use, they are not recommended for commercial plantings, except perhaps to a certain extent in the southern part of Albert and Charlotte counties, where the climate is milder and they do well.

South of a straight line drawn east and west from Woodstock to Moncton, the following varieties have proved hardy and valuable:—

Summer.—Crimson Beauty, Red Astrachan, Yellow Transparent.

Autumn.—Duchess, New Brunswick and Dudley.

Early Winter.—Wealthy, Alexander, Wolf River, Fameuse, McIntosh Red, Ribston (best top-grafted).

Winter.—Bishop Pippin top-grafted. Bethel, Canada Baldwin and Tolman. Additional winter varieties well worthy of trial are Milwaukee and Northwestern Greening. Scott Winter and Golden Russet have both proved hardy, but the former bears large crops of undersized apples, and needs heavy thinning, while the latter, being a shy bearer, is only recommended for home use.

North of the same line the following varieties are recommended:—

Summer.—Crimson Beauty, Yellow Transparent.

Autumn.—Duchess, New Brunswick, Dudley (doing well in the illustration orchards on the North Shore).

Early and Midwinter.—Wealthy, Wolf River, Fameuse, Alexander, McIntosh Red.

Winter.—Scott Winter, Canada Baldwin, Winter St. Lawrence, Milwaukee.

Some of the varieties mentioned in the southern district may prove hardy enough for the northern section, but they have not been sufficiently tested yet to recommend them as reliable.

For commercial apple growing, where the orchards will range larger, the Fameuse, McIntosh Red, Bethel and Bishop Pippin will find a ready sale at good prices on the local markets. For export purposes we would omit from this list the Bishop Pippin, and add the Duchess, Dudley, Wealthy and Alexander or Wolf River.

NOVA SCOTIA.

Annapolis and adjacent valleys.

Summer.—Crimson Beauty, Williams Favorite.

Autumn.—Gravenstein, Wealthy, Alexander.

Early Winter.—Tompkins King, Ribston, McIntosh, Blenheim.

Winter.—Northern Spy, Wagener, Stark, Baldwin and American Golden Russet.

Other good varieties which do well there are Yellow Bellflower (Bishop Pippin), Roxbury (Nonpareil), and Cox Orange.

Eastern Nova Scotia.

Summer.—Crimson Beauty, Yellow Transparent, Duchess of Oldenburg.

Autumn.—Dudley, Wealthy, Alexander.

Early Winter.—McIntosh.

Winter.—American Golden Russet, Stark..

The possibilities of this part of Nova Scotia are not fully demonstrated yet. In places some of the other varieties recommended for the Annapolis Valley will succeed.

Colder parts, including Cape Breton.

Summer.—Crimson Beauty, Yellow Transparent.

Autumn.—Duchess of Oldenburg, Dudley.

Early Winter.—Wealthy, McIntosh, Wolf River.

Winter.—Bethel, American Golden Russet.

Other varieties will do very well in places and are particularly useful for home use.

Summer.—Red Astrachan, Charlamoff.

Winter.—Ribston, Tolman, Blue Pearmain, Pewaukee, Grimes and Northern Spy.

Apples recommended for the Prairie Provinces.

Apples, in the most favoured situations.—Blushed Calville, Anisette, Duchess, Charlamoff, Lowland Raspberry, Beautiful Arcade (Repka Kislaga), Patten (Greening), Antonovka, Hibernal.

Crab Apples.—Transcendent, Florence, Virginia, Hyslop.

Saunders' Hybrid Crab Apples.—Jewel, Charles, Silvia, Prince, Tony, Robin, Elsa and Norman. These are about the size of other named crab apples, but hardier.

BRITISH COLUMBIA.

There are so many climates in British Columbia due to the many valleys, to the difference in elevation, and to difference in humidity that without dividing the province into a great many districts for which lists of best varieties are given the fruit grower might plant a variety in a certain district which would be quite unsuited to it. The following list of districts is taken from Bulletin 51 of the Department of Agriculture for the Province of British Columbia (by R. M. Winslow, Provincial Horticulturist) and the varieties which follow are in most cases the varieties recommended for these districts. Even within these districts, however, there are high or low elevations or peculiar climatic conditions and the prospective grower must not follow the general list too closely, but judge for himself as to whether his climate is representative of the district and, if not, what other district has a climate most like it. For the very coldest places where apples are grown, only with the greatest difficulty, or where it is doubtful if they will succeed at all, we should recommend trying the varieties recommended for the prairie provinces.

List of Fruit Districts.—(1) Vancouver Island-Southeast section; (2) Vancouver Island-West coast; (3) Mainland coast; (4) Northern coast valleys; (5) Lower mainland; (6) Lytton, Lillooet, Spences Bridge; (7) Kamloops-Wallachin; (8) Southern Central plateau; (9) Shuswap lake; (10) Upper Okanagan lake; (11) Lower Okanagan lake; (12) Similkameen; (13) Kettle river; (14) West Kootenay; (15) East Kootenay; (16) Central British Columbia.

FRUIT DISTRICTS IN BRITISH COLUMBIA.

Varieties of Apples Recommended.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Alexander		X	X	X	X			X					X	X		
Blenheim	X				X				X	X	X	X		X		
Canada Reinette		X	X													
Charlamoff															X	X
Cox Orange	X								X							
Duchess	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Grimes	X				X	X	X		X	X	X	X	X			
Gravenstein	X	X	X		X				X					X		
Famense								X								
Delicious										X	X	X				
Jonathan						X	X			X	X	X	X	X		
McIntosh				X		X	X	X	X	X	X	X	X	X	X	X
McMahan								X							X	X
Milwaukee															X	X
Northern Spy						X			X	X			X	X		
Ontario													X	X		
Red Astrachan								X								
Red Cheeked Pippin										X	X		X		X	X
Rome Beauty																
Scott Winter				X			X	X							X	X
Tetofsky															X	X
Tompkins King	X	X	X		X				X	X	X	X		X		
Wagener	X	X	X	X												
Wealthy	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Winesap						X	X					X				
Wolf River								X								
Yellow Newton						X				X	X	X				
Yellow Transparent	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

(X means recommended.)

DESCRIPTIONS OF VARIETIES.

The following descriptions of varieties have been nearly all made by the writer from typical specimens either grown at the Central Experimental Farm or received from fruit growers throughout Canada. Nearly all the varieties recommended in the district lists are described and many others which are interesting for some special reason. Most of the apples grown to any extent in Canada will be found here.

The varieties are divided into four groups, namely, Summer, Autumn, Early Winter to Mid-winter and Winter. The names in each group are arranged alphabetically.

SUMMER VARIETIES.

Anisette.—This is a Russian variety, very similar, if not identical with Duchess of Oldenburg, which has done particularly well in Southern Manitoba.

Beautiful Arcade (Repka Kislaga)—Originated in Russia. Fruit medium to above medium in size, roundish, slightly conical, regular; cavity medium depth, narrow; stem short, moderately stout to stout; basin medium depth and width, slightly wrinkled; calyx open or partly open; colour pale yellowish and whitish green, sometimes with a slight pink blush; dots numerous, pale, indistinct; skin thick and moderately tough; flesh white, moderately juicy; core small, closed; flavour sweet, pleasant; quality above medium; season mid-August to September. A very hardy and productive Russian variety. It has been growing at Ottawa under the name of Good Peasant and Herren, in addition to the synonym given above.

Blushed Calville.—Originated in Russia. Fruit roundish conical, angular, medium to large; cavity medium depth and width, slightly russeted; stem long, moderately stout; basin narrow, medium depth, wrinkled; calyx closed; colour pale greenish yellow with a faint pink blush on sunny side, sometimes without; dots few, pale, indistinct; bloom none; skin thick, moderately tender; flesh white, crisp, juicy, tender; quality medium to above medium; season mid-August to early September. A very hardy, early variety, but shows bruises badly and on this account is desirable mainly for home use. The tree is productive but not a very vigorous grower.

Charlamoff (Pointed Pipka, Arabka).—A Russian variety, grown under several different names in this country, the most common being Pointed Pipka and Arabka. Fruit above medium to large, oblong, conical; skin pale yellow well splashed and streaked with bright purplish red or carmine; a few small white, fairly distinct dots; cavity deep, and of medium width; stem of medium length, stout; basin shallow and of medium width, wrinkled; calyx open; flesh white, rather coarse, juicy, mildly subacid, with a pleasant flavour; core small; quality good; season, August, just before Duchess; tree very hardy, a spreading, strong grower and heavy bearer. The chief fault of this variety is that it only remains in good condition for a very short time. It is a good dessert apple when at its best. Does very well at Ottawa and farther north.

Crimson Beauty.—Originated by Francis Peabody Sharp at Woodstock, New Brunswick. Fruit medium to above medium, roundish slightly ribbed; cavity open, deep; stem long, moderately stout to slender; basin open, deep furrowed or wrinkled; calyx open; colour pale greenish yellow well splashed and washed with lively deep attractive crimson; predominant colour lively deep crimson; dots few, yellow, distinct; skin thin, tender; flesh dull white, or yellowish, sometimes tinged with red near skin, tender, moderately juicy; core medium; acid, little flavour; quality medium; season early August to late August. While this variety is only medium in quality it has proved quite profitable on account of its earliness and handsome appearance. The tree is hardy and bears well.

Duchess of Oldenburg.—Originated in Russia. Fruit medium to large, roundish to oblate; skin yellow, well splashed and streaked with bright red; cavity of medium depth and width; stem short, moderately stout or rather slender; basin deep, open; calyx partly open; flesh white, crisp, tender, juicy, acid. Quality only above medium as a dessert fruit, but one of the best cookers; season, August, but will keep until September further north; tree very hardy, a moderately spreading grower, and an early and very productive bearer.

Langford Beauty (Russell).—Originated near Gatineau Point, P.Q. Fruit medium to above medium in size, roundish to oblate; skin pale yellow, almost, or completely, covered with deep red; dots few, gray, not prominent; cavity shallow, open;

stem long, slender; basin shallow, open, slightly wrinkled; calyx closed; flesh white, tender, melting, juicy, subacid, with a pleasant flavour, having a suggestion of Fameuse about it, slightly astringent; core large, quality good; season, middle of August to middle of September, ripens rather unevenly; tree vigorous, productive in alternate years, and hardy.

Lowland Raspberry (*Lierland Raspberry*).—Originated in Russia. Fruit roundish to oblate, conic, angular, medium to large; cavity medium depth, narrow; stem medium length to short, moderately stout; basin shallow, narrow, slightly wrinkled; calyx closed or partly open; colour pale yellow, waxy, more or less blotched, splashed and washed with bright red; dots few, pale yellow, indistinct; skin moderately thick, tender; flesh white, tinged with red, crisp, tender, juicy; core medium size to large, open; flavour sub-acid, pleasant, good; quality very good; season mid to late August. A handsome early apple of very good quality and especially valuable for home use. It bruises easily and drops badly, hence must be handled carefully if grown for market. The tree is very hardy and a moderate to good bearer.

New Brunswick.—Originated in New Brunswick by Francis Peabody Sharp, but is practically identical with Duchess of Oldenburg.

Red Astrachan.—According to Downing this was first imported into England from Sweden in 1816, and thence to America. Fruit medium to above medium in size, roundish, slightly conic; skin pale green, almost covered with bright and deep crimson, very handsome, dots few, pale, obscure; cavity deep and of medium width; stem of medium length, fairly stout; basin shallow and of medium width, slightly wrinkled; calyx open; flesh white, firm, crisp, juicy, almost acid, with an agreeable rich flavour; core small, quality good; season, latter part of July and first half of August; tree hardy and an upright strong grower, but a rather shy bearer.

Red June (*Wilson's June, Carolina Red June*).—Probably originated in South Carolina. Fruit medium size, obtusely conical; cavity shallow, sometimes lipped, medium width; stem medium to long, stout; basin open, medium depth, wrinkled; calyx closed, or partly open; colour, yellow, well washed with deep crimson; predominant colour deep crimson; seeds numerous, below medium size, acute; dots few, yellow, distinct; skin thick, tough; flesh white, tender, moderately juicy; core rather large, open; flavour sub-acid, pleasant; quality good; season August, but will keep until late autumn. This is a promising summer apple for some parts of Canada. It has been bearing for four years as a top-graft at Ottawa. It should ship well.

Strawberry (*of Montreal*).—Originated on Capt. Raynes' property, Westmount, P.Q. Fruit of medium size, roundish conical; colour yellow, well splashed and striped with carmine; briskly subacid, pleasant flavour; quality above medium; season mid to late August. The tree is a strong, upright grower, and productive, and formerly was considered of value in the province of Quebec. A hardy early apple, but it has been superseded by Yellow Transparent and is rarely planted now.

Tetofsky.—Originated in Russia. Fruit oblate to roundish, angular in form, and medium to below medium in size; cavity medium depth and width, slightly russeted; stem short and stout; basin shallow, medium width, wrinkled; calyx closed; colour pale greenish, yellow, with a slight pink blush, though sometimes without; sometimes also splashed and streaked with carmine or pink; dots fairly numerous, pale, not prominent; bloom none; skin thick, moderately tough; flesh dull white, firm, juicy, coarse; core small; briskly sub-acid, flavour not marked; quality medium to above medium; season first week of August and earlier. Very productive in alternate years. Has been planted to a limited extent on account of its earliness, but is not as good an apple as Yellow Transparent, though a few days earlier.

Titovka (*Gipsy Girl*).—Originated in Russia. Size large to very large; form oblong to roundish, angular; cavity deep, medium in width, slightly russeted; stem short, stout; basin deep, medium width, wrinkled; calyx closed or open; colour pale

yellow, well splashed with bright red; dots obscure; bloom none; skin moderately thick, tender; flesh yellow, firm, rather coarse, juicy; core small; flavour subacid, not high; quality above medium; season late August to early September. This is a large, handsome apple, but is not good enough in quality to be recommended.

Williams (Favorite.)—Originated in Massachusetts. Fruit medium in size; form oblong to roundish, slightly angular; cavity shallow, medium width to open; stem medium length to long, stout; basin medium depth and width, slightly wrinkled; calyx closed or partly open; colour yellow, well washed and splashed with bright and deep orange red and crimson; dots few, small, indistinct; skin moderately thick, moderately tough; flesh yellowish, slightly tinged with red, tender, moderately juicy; core medium; flavour mildly sub-acid, spicy, pleasant; quality good; season late August to early September. This old variety is not much grown in Canada, but is a summer apple of good quality. It bruises easily which lessens its value for commercial purposes.

Yellow Transparent.—Originated in Russia, and was introduced into America in 1870 by the Department of Agriculutre, Washington. Fruit medium to above medium in size, roundish, slightly conical, slightly angular; skin pale yellow; dots fairly numerous, pale and rather obscure; cavity deep, narrow; stem of medium length, fairly stout; basin narrow, shallow, slightly wrinkled; calyx closed; flesh white, firm, crisp, juicy, sprightly sub-acid, not high flavoured but pleasant; core small; quality good; season, latter part of July and first two weeks of August, tree an upright moderate grower, a good and early bearer and fairly hardy.

AUTUMN VARIETIES.

Alexander.—Of Russian origin. Fruit large to very large, roundish conical; skin greenish yellow, well splashed and washed with deep red; dots few; obscure; cavity deep, and of medium width, russeted; stem short; moderately stout; basin deep, of medium width, almost smooth; calyx large, open. Flesh yellowish, rather coarse, moderately juicy, sub-acid, with a pleasant flavour; core, medium size. Quality medium to above medium. Season, late autumn. Tree hardy, vigorous, spreading and productive.

Antonovka.—Originated in Russia. Fruit large to very large; roundish to oblong, ribbed; cavity deep, moderately open, heavily russeted; stem short, stout; basin deep, medium width, wrinkled; calyx closed, sometimes open; colour yellow; dots obscure; skin thick, tender, surface rough; flesh yellow, firm, coarse but tender, moderately juicy; core small; flavour briskly sub-acid, peculiar, spicy, pleasant; quality almost good; season September to mid October. Productive and very hardy. One of the standard varieties in the colder parts of Russia.

Cellini.—Originated in England. Fruit large, roundish, obtusely conical in form; cavity open, medium depth, russeted; stem medium length, stout; basin deep, open, or very open, slightly wrinkled; calyx open; colour pale greenish yellow, washed and splashed with deep crimson; predominant colour deep crimson; seeds medium size, acute; dots obscure, or a few white distinct ones; skin moderately thick, tender; flesh, white, tinged with yellow, tender, melting, juicy; core small; flavour briskly sub-acid sprightly but not high; quality almost good; season late October and November. Has been grown to some extent in the province of Quebec. It is an excellent cooking apple.

Dudley (North Star).—Originated in Maine. Fruit roundish, regular, and above medium to large in size; cavity open, deep, slightly russeted; stem medium length, slender; basin deep, medium width, slightly wrinkled; calyx partly open or closed; colour pale yellow, striped and splashed with deep lively red; dots few small, pale yellow, indistinct; bloom thin bluish; skin moderately thick, tender; flesh yellow, tender, moderately juicy; core small; flavour sub-acid, pleasant; quality above medium

to good; season late September and October. A hardy productive variety of about the same season as Wealthy though not as good a keeper. The fruit is handsome in appearance and is quite popular in New Brunswick where it is best known.

Fall Pippin.—Origin unknown. Fruit large to very large roundish, ribbed, cavity open, medium depth; stem medium to short, stout; basin deep, open, almost smooth; calyx open; colour greenish yellow to yellow sometimes, washed with pinkish red mostly on sunny side; dots indistinct; skin moderately thick, tender; flesh yellowish, tender, buttery, juicy; core small to medium; flavour sub-acid, pleasant; quality good; season autumn to early winter. Not so much grown as it once was but is good both for dessert and cooking.

Fanny.—Originated near Strasburg, Lancaster Co., Pa., U.S. Fruit above medium size, roundish to oblate, slightly conical; skin yellow, heavily splashed and washed with deep red; dots few, yellow and not prominent; cavity deep, moderately open; stem short, slender; basin of medium depth, narrow, almost smooth; calyx partly open. Flesh white, crisp, tender, juicy, sub-acid; core small; quality good. Season September. Tree vigorous, spreading, and productive.

Gideon.—Originated by Peter M. Gideon, Excelsior, Minn., U.S. Fruit above medium size to large, roundish conical, ribbed; skin yellow with a bright rosy red blush; dots fairly numerous, yellow, distinct; cavity narrow, medium depth; stem short to medium, slender; basin shallow and of medium width, wrinkled, calyx closed; flesh white, crisp, juicy; briskly sub-acid; liable to watercore or browning of flesh; core large; quality above medium. Season October and early November, tree hardy, a strong grower and very productive.

Golden White (*Winter Stripe*).—Originated in Russia. Fruit roundish, somewhat ribbed, conical; size above medium to large; cavity narrow, medium depth, russeted; stem short, moderately stout; basin deep, medium width, wrinkled; calyx large, open; colour yellow, splashed and striped with bright carmine; dots moderately numerous, pale yellow, distinct; bloom slight; skin thick, tough; flesh dull white, sometimes tinged with red, tender, moderately juicy, rather coarse; core small to medium; flavour sub-acid, pleasant; quality good; season late September to early October. This is of better quality than most of the Russian varieties. The fruit is attractive in appearance and the tree is hardy and productive. It has been received and grown at Ottawa under the name of Plikanoff, Antmann, and Longfield 56M.

Gravenstein.—Originated in Germany. Fruit medium to large, roundish; skin yellow, splashed and streaked with orange and red; stem short, stout; basin wide and rather deep. Flesh tender, crisp, juicy, sub-acid and high flavoured; quality very good; season September and October. Tree a strong spreading grower and very productive.

Haas (Fall Queen).—Originated near St. Louis, Mo. Fruit medium to above medium in size; oblate; skin yellow, well splashed and washed with deep, sometimes brownish red; cavity deep; moderately open; stem short, stout; basin narrow, of medium depth, almost smooth. Flesh white, juicy, sub-acid, with little characteristic flavour, rather astringent; core small, quality medium to above medium. Season autumn. Tree hardy, a strong, moderately upright grower and a good annual bearer. Not desirable except in the coldest parts of the apple growing districts.

Hibernal (Romna).—Originated in Russia. Fruit medium to large, oblate conical; skin pale greenish yellow, splashed and streaked on sunny side with bright purplish red; a few white dots; cavity deep, of medium width, russeted; stem short, stout; basin of medium depth and width, slightly wrinkled; calyx open. Flesh yellowish, crisp, tender, juicy, acid; core small; quality medium; season September to November. Tree very hardy, a strong, spreading grower, and very productive. Although not a good dessert fruit this is a good cooking apple and on account of its great hardiness and productiveness is one of the best of the Russian apples for the coldest parts of Canada.

Hoadley.—Originated in Wisconsin. Fruit oblate conic; size above medium; cavity deep, moderately open, slightly russeted; stem short, slender to stout; basin

medium depth and width, almost smooth to slightly wrinkled, calyx open, colour yellow splashed and streaked with carmine; dots few, yellow, indistinct; skin thick, moderately tender; flesh yellowish with traces of red, juicy, rather tender, briskly sub-acid; pleasant flavour; core medium; quality above medium; season October. Tree an upright grower, hardy and productive.

Longfield.—A Russian variety introduced in the year 1870. Fruit sometimes medium, mostly below medium in size, roundish conical slightly angular; skin pale yellow, almost white, with a bright pink blush; dots few, obscure; cavity very narrow, deep, more, or less russeted; stem short, slender; basin narrow, of medium depth, wrinkled; calyx partly open; flesh white, crisp, very juicy, very tender, melting, briskly sub-acid, almost acid, pleasant; core medium; quality good; season October and November. Owing to the great crops, the fruit is liable to be undersized, and because of its tender flesh and pale skin, it shows bruises badly, which lessens its commercial value and is against it. It is a good apple for the north on account of its hardiness and low growth.

McMahan.—Introduced by A. L. Hatch, Wis., U.S. Fruit large to very large, roundish, slightly conical; skin pale waxy yellow, almost white when in best condition, with a delicate pink blush; cavity deep, medium width to open, slightly russeted; stem short, stout; basin of medium depth, narrow, almost smooth; calyx open; flesh white, rather coarse, crisp, juicy, briskly sub-acid; quality above medium. An excellent cooking apple. Season October and November. Tree a very strong grower and a good cropper. Owing to its vigour and apparent great hardiness it should be one of the best apples to plant near the limits of successful apple culture.

Maiden Blush.—Originated in New Jersey. Fruit medium to above medium size; oblate conic; colour pale yellow with a bright crimson blush; flesh white and yellowish, crisp, juicy, tender, briskly sub-acid; quality above medium to good; season September to December. Has not been planted much in Canada in recent years.

Okabena.—Originated in Minnesota. Fruit, above medium in size; form oblate to roundish conic, regular; cavity deep, moderately open to open, russeted at base; stem medium length, moderately stout; basin deep, open, slightly wrinkled; calyx open or closed; colour pale yellow, washed and splashed with deep orange red approaching carmine; predominant colour deep orange red; seeds medium size, acuminate; dots obscure; skin moderately thick, moderately tough; flesh dull white or yellowish, tinged with red, tender, rather coarse, juicy; core medium; flavour briskly sub-acid, pleasant; quality above medium to good; season late September to mid October. Fruit resembles Duchess of Oldenburg somewhat, but is a much better keeper. The tree is hardy and productive.

Ostrakoff (Glass).—Originated in Russia. Fruit, medium in size; form roundish; cavity narrow to medium width, deep; stem short to medium, stout; basin open, medium depth, wrinkled; calyx open; colour pale yellow, thinly washed with carmine on sunny side; predominant colour pale yellow; seeds large, broad, obtuse; dots obscure; skin uneven to the touch, thick, moderately tender; flesh dull white, firm, rather coarse, moderately juicy; core medium; sub-acid, little flavour; quality medium; season October and November. This has proven a very hardy variety, succeeding in Southern Manitoba, but the fruit is inferior in quality. This keeps well into winter in Manitoba.

Patten (Greening).—Originated in Iowa. Fruit above medium to large; form oblate; cavity deep, medium width, russeted; stem short, stout; basin deep, medium width, almost smooth; calyx large, open; colour pale yellow with traces of pale green with a pink blush; dots moderately numerous, pale green, distinct; bloom slight; skin moderately thick to thick, tough; flesh yellow moderately juicy, tender, coarse; core small; flavour sub-acid, pleasant; quality above medium; season October to mid November. This variety is very productive and very hardy but is not good enough in quality to compare favourably with other varieties of the same season.

Peach (of Montreal).—Introduced to the Province of Quebec from France. Fruit above medium to large; form conical, roundish; cavity narrow to medium depth, slightly russeted; stem medium length to short, slender or moderately stout; basin narrow, medium depth, wrinkled; calyx closed; colour pale greenish yellow with a pink blush on sunny side; dots numerous, pale, indistinct; skin moderately thick, moderately tough; flesh dull white, juicy, tender, melting; core medium size; flavour sub-acid, pleasant; quality good; season late August and early September. This variety has been grown in the province of Quebec for many years. The tree is very hardy and quite productive, but the fruit shows bruises badly.

St. Lawrence.—Originated in Montreal early in the 19th century. Fruit, above medium to large; form oblate conic; cavity medium depth, open; stem short, stout; basin medium depth and width, wrinkled; calyx closed; colour pale greenish yellow, splashed and striped with dark carmine; dots obscure; skin thin, tender; flesh white tinged with red, tender, juicy; core medium; flavour sub-acid, pleasant; quality very good; season mid September to October. This is one of the best dessert apples of its season but is not productive enough in most places to be very profitable. The tree is a strong, spreading grower.

Switzer.—Originated in Russia. Fruit medium to above medium in size; form roundish to oblate, regular; cavity shallow to medium depth, medium width; stem short to medium, moderately stout to slender; basin narrow, rather shallow, slightly wrinkled; calyx partly open or closed; colour pale yellow, almost entirely overspread with rich lively red; dots few, yellow, indistinct; skin moderately thick, moderately tough; flesh white, firm, crisp, moderately juicy; core medium; flavour sub-acid, pleasant; quality good; season early September to late September, and early October. This very handsome variety is sometimes mistaken for the Lowland Rasberry but is quite distinct, and keeps longer. Tree is very susceptible to fire blight, which is against it as a commercial variety.

Trenton.—Originated by P. C. Dempsey, Trenton, Ontario. Fruit, medium to above medium in size; form roundish conical; cavity deep, medium width, russeted; stem medium length, slender; basin open, medium depth, wrinkled; calyx open; colour yellow washed and splashed with deep, rather dull red; dots obscure; bloom pink; skin moderately thick, tender; flesh yellowish, rather coarse, crisp, breaking, tender, moderately juicy; core above medium; flavour sub-acid, pleasant; quality good; season late September to early October. Not as attractive looking an apple as Wealthy nor as long a keeper. Season is just before Wealthy. An early bearer.

Twenty Ounce (Cayuga Red Streak).—Originated in Connecticut, U.S. Fruit large to very large, roundish; skin yellow, splashed and streaked with bright purplish red; cavity deep and wide; stem short and stout; basin of medium depth; calyx small, open; flesh, white, coarse, juicy and bri[illegible] sub-acid; quality above medium, but a first-class cooking apple; season late aut[illegible]n to early winter. Tree a strong grower and productive.

Walter.—Originated by P. C. Dempsey, Trenton, Ont. Fruit roundish, ribbed; size large to very large; cavity deep, medium width to open; stem short, moderately stout; basin deep, medium to open, almost smooth to moderately wrinkled; calyx open; colour greenish yellow, splashed and streaked with crimson; dots few, small, white distinct; skin moderately thick, moderately tender; flesh yellow, tender, rather coarse, juicy, melting; core small to medium; sub-acid, pleasant high flavour; quality good to very good. A suggestion of Gravenstein flavour about this apple; season, October. Tree hardy and productive at Ottawa.

Wealthy.—Originated by Peter M. Gideon, Excelsior, Minn., U.S. Fruit of medium size, almost large on young trees, roundish; skin yellow, well splashed and washed and sometimes completely covered with crimson; dots yellow, fairly numerous, distinct, but not prominent; cavity deep and of medium width; stem short to medium,

slender to moderately stout; basin narrow, rather deep, almost smooth; calyx partly open; flesh yellowish, sometimes tinged with red, crisp, tender, juicy, briskly subacid with a pleasant aromatic flavour; core small; quality good; season September to November, and later in some parts of the provinces; tree spreading, a medium grower and an early and heavy bearer. This is another apple which is hard to excel in its season.

EARLY WINTER TO MID WINTER.

Arabskoe (Winter Arabka).—A Russian variety. Fruit large and roundish; cavity deep, narrow, russeted; stem medium length, moderately stout; basin medium depth and width, wrinkled; calyx partly open or open; colour green, almost covered with dark rather dull purplish red; dots moderately numerous, small, yellow, indistinct; skin moderately thick, tough, often with a suture line; flesh greenish white, coarse, tender, juicy; core above medium; acid, little flavour; quality medium; season early to mid-winter. The tree is not as hardy as some of the Russian varieties. It is grown to a limited extent in the colder parts of Ontario and Quebec, also in New Brunswick. The fruit is attractive in appearance but of inferior quality.

Baxter (La Rue).—Originated near Brockville, Ontario. Fruit, large to very large; form roundish, slightly ribbed; cavity medium depth and width, russeted towards base; stem short, moderately stout; basin deep, open, slightly wrinkled; calyx open; colour yellow, washed and splashed with orange red; predominant colour orange red; seeds medium size to below medium, acute; dots numerous, yellow, conspicuous; skin moderately thick, moderately tender; flesh dull white and yellowish tinged with red, coarse, tender, moderately juicy; core medium, open; flavour sub-acid, pleasant, not high; quality above medium; season November to mid winter. This is a handsome apple but is not good enough in quality to be planted commercially. At Ottawa it has proved only a moderate bearer.

Bismarck.—Originated in New Zealand. Fruit, above medium to large; form roundish; cavity deep, narrow to medium width, russeted; stem short, moderately stout; basin very deep, open, slightly wrinkled; calyx open; colour greenish yellow well washed with crimson; predominant colour crimson; seeds medium size, broad, acute; dots few, indistinct; skin moderately thick, moderately tender; flesh dull white, crisp, rather coarse, tender, juicy; core small to medium; briskly sub-acid, little flavour; quality medium; season December to February. An early bearer, and the fruit is attractive, but not good enough in quality.

Blenheim (Orange).—Originated at Woodstock, Oxfordshire, England. Fruit large, oblate; skin golden yellow, well washed and splashed with orange red mostly on the sunny side; dots few, pale, distinct but not prominent; cavity moderately deep, narrow, russeted; stem short, moderately stout; basin of medium depth, smooth, open; calyx large, open; flesh yellow, crisp, tender, melting, moderately juicy, mildly sub-acid, of good flavour; core small; quality good to very good. Season November and December. Tree a strong grower and a good bearer.

Canada Baldwin.—Said to have originated from seed of Pomme de Fer on the farm of Alexis Dery, St. Hilaire, Que. It was given its name by N. C. Fisk, Abbotsford, Que., who propagated it in 1855. Fruit of medium size, roundish to slightly oblate; skin yellow, well washed, splashed and streaked with bright red and with darker carmine splashes; bloom pinkish; dots fairly numerous, large, yellow, conspicuous; cavity deep, open; stem short to medium in length, slender to stout; basin medium in depth and width, slightly wrinkled; calyx closed or partly open; flesh white tinged with red almost to the core, rather coarse, firm, inclined to be corky, fairly juicy mildly sub-acid, with a pleasant flavour; slightly astringent; core small; quality good; season midwinter; tree an upright, strong grower; a light to medium, but annual bearer at Ottawa; said to be subject to sun-scald, but trees have not suffered much from it here.

Cox Orange (Pippin).—Originated in England. Fruit, medium in size; form oblate, conic; cavity medium depth and width, russeted; stem short, rather slender; basin medium depth and width, smooth; calyx closed or open; colour yellow, well washed with orange red and with carmine splashes; dots few, distinct, irregular; skin moderately thick, moderately tough; flesh yellow, firm, crisp, breaking, tender, juicy; core small; flavour sub-acid, sprightly, spicy, very good; quality very good to best; season early winter. Has done best in Canada in Nova Scotia and British Columbia. The tree is moderately vigorous and only fairly productive, as a rule.

Cranberry Pippin.—Originated near Hudson, N.Y. Fruit large, roundish, skin yellow, splashed, streaked and washed, especially on the sunny side, with bright purplish red or carmine; dots fairly numerous, small, gray, not prominent; flesh white, crisp, moderately juicy, rather coarse, sub-acid, flavour not very marked; core small; quality medium; season, early winter to midwinter; tree a very strong, spreading grower and productive.

Delicious.—Originated in Madison County, Iowa, and introduced by Stark Bros., Louisiana, Mo., in 1895. Fruit, large; form oblong to roundish, flattened at ends, prominently ribbed; cavity deep, open; stem medium length, stout; basin very deep, very open, prominently wrinkled; calyx closed or partly open; colour greenish yellow washed with rather dull orange red with carmine splashes; predominant colour rather dull orange red approaching carmine; dots moderately numerous, white, distinct; skin thick, tough; flesh yellow, tender, melting, moderately juicy; core below medium; flavour mildly sub-acid, pleasant, good; quality very good; season early to late winter. Seems more suitable for British Columbia than for eastern Canada. Has not proved hardy at Ottawa. Productive where it succeeds.

Fameuse (Snow).—Origin unknown. Supposed either to have been brought to Canada with the early French settlers or to have been a seedling originated in this country. Fruit of medium size, roundish to oblate; skin pale yellow, either almost or completely covered with deep red or splashed and washed with red when fruit is not well coloured; dots indistinct to obscure; cavity of medium depth and width; stem short to medium in length, slender or moderately stout; basin medium depth and width to rather narrow, almost smooth; flesh very white, sometimes with traces of red, very tender, juicy, sub-acid with a fine flavour and a delicate perfume; core small; quality very good to best; season early winter; tree a strong grower, spreading, and a heavy bearer. This is one of the best dessert apples and one of the most profitable where it succeeds well.

Grimes (Golden).—Originated in West Virginia. Fruit, medium in size; form roundish to slightly oblong, somewhat flattened at ends; cavity medium depth and width, russeted; stem medium length, slender; basin deep, open, wrinkled; calyx closed or open; colour greenish yellow to yellow sometimes with traces of pinkish red on sunny side; dots obscure; skin moderately thick, tender; flesh yellowish, crisp, tender, somewhat buttery, firm, moderately juicy to juicy; core medium to small; flavour sub-acid, spicy, good; quality good to very good; season early to mid-winter. A fairly hardy variety, though it has not succeeded at Ottawa. This variety is much esteemed where it is known. It does very well in British Columbia where it yields well.

Hubbardston.—Originated at Hubbardston, Mass., U.S. Fruit above medium to large, roundish to oblong, conical; skin yellow, splashed and washed with orange red and purplish red; dots fairly numerous, gray, distinct, but not conspicuous; cavity deep, narrow, russeted; stem short, slender; basin narrow of medium depth, slightly wrinkled; calyx open; flesh yellowish, crisp, very tender, melting, juicy, mildly sub-acid, with a pleasant flavour; core small; quality very good. Season early winter. Tree a strong, spreading grower and a good bearer.

Jonathan.- Originated in Ulster county, New York. Fruit medium to below medium in size; form roundish conical; cavity deep, medium width; stem medium to long, slender; basin deep, medium width, smooth to somewhat wrinkled; calyx closed or partly open; colour pale yellow covered with rich deep crimson; dots few, small, yellow, indistinct; skin thin to moderately thick, tough; flesh yellowish, crisp, tender, juicy; core medium size; flavour sub-acid, sprightly, aromatic; quality good to very good; season early to mid-winter. This variety is grown to a large extent in British Columbia where it is an early and heavy bearer, but in eastern Canada the fruit is usually too small to be profitable.

King David.—Originated in Arkansas. This is a new variety which has not fruited at Ottawa but is doing well in some parts of British Columbia. The following description is that contained in Bulletin 385 of the New York Agricultural Experiment Station: "Fruit of medium size, roundish-oblate to oblate conic, slightly ribbed; stem medium in length, slender; cavity moderately deep and broad, usually russeted; calyx small, closed; basin medium in depth, somewhat abrupt, furrowed; skin thin, tender, smooth, colour pale greenish yellow almost entirely overspread with a very attractive deep dark red, changing to scarlet; flesh distinctly yellow, firm, crisp, moderately tender, juicy, briskly sub-acid, spicy, aromatic, good to very good; season November to February."

Louise (Princess). Originated near Grimsby, Ontario, on the farm of L. Woolverton. Fruit, medium to above medium in size, form roundish, slightly ribbed; cavity shallow to medium depth, medium width; stem short to medium, moderately stout to slender; basin medium depth and width, slightly wrinkled; calyx partly open; colour pale greenish yellow washed with pinkish red to crimson, mainly on sunny side, seeds below medium in size, obtuse and acute; dots few, white, distinct; skin moderately thick, moderately tender; flesh white, crisp, tender, firm, fine-grained, juicy; core medium; flavour mildly sub-acid, sprightly, pleasant; quality good to very good; season December to February. This belongs to the Fameuse group but is not as valuable a variety as either McIntosh or Fameuse, nor as hardy.

McIntosh.—Originated with John McIntosh, Dundela, Ont. in 1796. Fruit above medium, roundish, slightly ribbed; skin pale yellow, almost entirely covered with crimson, dark on sunny side and brighter on rest of fruit; dots few, small, yellow, distinct but not conspicuous; cavity of medium depth and width; stem short, stout, sometimes medium length and moderately stout; basin narrow, almost smooth, medium depth; calyx partly open; flesh white and yellow, crisp, very tender, melting, juicy, sub-acid, sprightly with a pleasant aromatic flavour; core of medium size open; quality very good to best; has a strong aroma; season November to February, or later; tree hardy, and a strong moderately upright grower and an annual and good, but not heavy bearer. For its season the McIntosh apple is one of the best varieties grown. It is very subject to scab but at the Central Experimental Farm where the trees are sprayed there has been practically no scab on the fruit.

Milwaukee.—A seedling of Duchess which originated in Wisconsin. Fruit large, oblate, slightly angular; skin pale yellow well splashed and washed with bright red and crimson; dots few, small, white, not prominent; cavity deep and of medium width, slightly russeted; stem short, moderately stout; basin, deep, open, slightly wrinkled; calyx open. Flesh yellowish, crisp, very tender, juicy, acid sprightly with but little characteristic flavour; core small. Quality above medium; season, November to March. Tree spreading, a moderate grower and an early and heavy cropper. A promising apple for the north, as it appears to be very hardy.

Opalescent.—Originated in Ohio. This is a new and promising variety which has not yet fruited at Ottawa but following is a description of the tree and fruit from bulletin 364 of the New York Experiment Station: "Tree vigorous, roundish, open, productive. Fruit uniformly large to very large, roundish-conic, usually symmetrical,

obscurely ribbed; stem short, slender; cavity deep, broad, acuminate, usually symmetrical, often russeted; calyx large, open, with small, obtuse, reflexed lobes; basin deep, wide, obtuse to acute, sometimes slightly furrowed, symmetrical; skin thick, rather tough, glossy, takes a brilliant polish; colour bright pale yellow nearly or quite overspread with dark, deep red with faint splashes of purplish-carmine; dots numerous, small, conspicuous, yellowish or russet, often submerged, frequently mingled with irregular lines and flecks of russet, especially around the basin; core small; cells usually closed; seeds medium in size; flesh yellowish, firm, crisp, tender, juicy, pleasant mild sub-acid, aromatic, good to very good; season November to January."

Rhode Island Greening.—Originated on Rhode Island. Fruit large, oblate to roundish, skin green, often with a light [illegible]nk blush; dots numerous, pale or gray, distinct, but not very prominent; cavity narrow and of medium depth; stem short, moderately stout; basin narrow, shallow, slightly wrinkled; flesh yellow, crisp, tender, juicy, sub-acid, rich, slightly aromatic; core of medium size; quality very good. Season, early winter to midwinter. Tree a spreading very strong grower and a heavy bearer. This variety is quite subject to scab and needs thorough spraying. It also lacks high colour, which is against it in some markets as an export apple.

Ribston (Pippin).—Originated in Yorkshire, England. Fruit medium to large; form roundish, flattened at ends, slightly ribbed; cavity of medium depth, russeted; stem short, stout; basin deep, open, wrinkled; calyx partly open; colour yellowish green splashed and washed with brownish red; predominant colour brownish red; dots few, white, indistinct; skin moderately thick, tender; flesh yellowish, firm moderately juicy, crisp, breaking; core below medium; flavour sub-acid, sprightly, pleasant; quality good to very good; season early to midwinter. This variety does particularly well in Nova Scotia. The tree is fairly hardy but at Ottawa is top-grafted. The Ribston is a moderate bearer.

Rochelle.—Originated with R. W. Shepherd, Cowe, Quebec. Fruit medium to large size, roundish, slightly ribbed; cavity deep, medium width, lipped but not to surface, russeted; stem short, stout; basin deep, medium width, wrinkled; calyx partly open; colour pale yellow well washed and splashed with lively attractive crimson, splashes darker, more carmine than crimson; dots few, small, yellow, indistinct; skin moderately thick, moderately tough; flesh white or yellowish with traces of red, crisp, tender, juicy; core medium; flavour sub-acid, pleasant but not high; quality above medium, almost good; season late October to February. A promising new variety with handsome fruit and evidently very hardy.

Scarlet Pippin (Leeds Beauty).—Originated at Lyn, Leeds Co., Ontario, near Brockville. Mr. Harold Jones, Maitland, Ont., has had most to do in bringing this fine apple before the public. Fruit of medium size, oblate to roundish; skin yellow, waxy, more or less washed and splashed with bright and dark crimson, and covered with a light bloom; cavity deep, medium width to open; stem short, slender; basin narrow, shallow, almost smooth; calyx generally closed; flesh white, firm, crisp, tender, melting, juicy, a mild sub-acid, with a pleasant but not high flavour; core small; quality very good; season early winter. A very attractive looking apple and said to sell better than Fameuse, which it does not, however, equal in quality. Tree a strong, upright grower, and said to be a heavy bearer.

Strawberry King.—May be a bud sport of Tompkins King. Found in Norfolk county, Ontario. Fruit large, roundish conic, slightly angular; cavity medium depth to shallow, medium width; stem short, stout; basin medium depth and width to narrow; calyx closed; colour yellow well washed with deep crimson; dots numerous, yellow, distinct to conspicuous; skin thick, tough; flesh yellow, rather coarse, moderately juicy; firm but tender, core above medium; flavour sub-acid; quality good to very good; season early winter in [illegible] county. An apple very much like the Tompkins King and called locally the "Strawberry King." The colour is darker than King, and different from King about [illegible].

Stone.—Originated in Vermont. Fruit above medium to large; form roundish somewhat globular; cavity narrow, sometimes closed, shallow; stem short, slender; basin narrow, medium depth to shallow, slightly wrinkled; calyx partly open; colour yellowish green, splashed and washed with dull, deep, orange red; dots moderately numerous, gray, distinct; skin thick, moderately tough; flesh yellowish, rather course, crisp, tender, moderately juicy; core small; mildly sub-acid, spicy, good flavour; quality above medium to good; season, early to midwinter

Appearance is rather against this apple, as it is not very bright in colour nor attractive. It is a fair dessert apple but rather too mild for most tastes. Tree apparently very hardy. Belongs to the Blue Pearmain group.

Shiawassee (Beauty).—Originated in Shiawassee Co., Mich., U.S. Probably a seedling of Fameuse. Fruit of medium size, oblate, flattened; skin yellow, well washed and splashed with deep crimson; dots few, pale, distinct; cavity deep, open; stem of medium length, slender to moderately stout; basin medium in depth and width, and almost smooth; calyx closed or open. Flesh white, crisp, tender, juicy, sub-acid, with a good flavour; core medium. Quality good to very good. Season early winter. Tree a hardy, strong, moderately upright grower, and a heavy bearer in alternate years.

Sutton (Beauty).—Originated at Sutton, Mass, U.S. Fruit of medium size, symmetrical roundish conic; skin waxen yellow, washed and splashed with crimson; dots fairly numerous, pale, distinct, cavity of medium depth, narrow; stem of medium length, moderately stout; basin medium in depth and width; slightly wrinkled; calyx of medium size, open or partly open; flesh dull white, crisp, firm, juicy, a sprightly mild sub-acid with a pleasant but not high flavour; core small; quality good. Season early to midwinter. Tree an upright, strong grower and productive under good conditions. Has not been planted much in Canada.

Tompkins King (*King of Tompkins Co., King.*) Origin uncertain; said to have originated in New Jersey. Fruit large, roundish, somewhat oblate, obscurely angular; skin yellow, well splashed and washed with bright crimson and orange red; dots fairly numerous, white, distinct, prominent; cavity of medium depth and width; stem short, moderately stout; basin of medium depth and width, almost smooth; calyx closed; flesh yellow, rather coarse, crisp, tender, melting, moderately juicy with a rich, high, aromatic and very agreeable flavour; core small; quality very good to best.

Wagener.—Originated in the State of New York. Fruit medium to above medium in size, oblate, ribbed; yellow, well washed and splashed with crimson; dots pale, distinct; cavity deep, open, russeted; stem medium length, slender; basin medium in depth, wrinkled; calyx, open; skin thin, tough; flesh yellowish, crisp, very tender, juicy, briskly sub-acid, pleasant flavour; quality very good to best; season, midwinter. Tree an upright and moderate grower and an early and heavy bearer.

Westfield (Seek-no-further).—Origin, Connecticut, U.S. Fruit of medium size, roundish conical; skin yellow, well washed and splashed with deep rather dull orange red; dots numerous, large, yellow, distinct, conspicuous; cavity deep, narrow, russeted; stem medium length to short, moderately stout; basin narrow, shallow, smooth; calyx open, lobes reflexed, flesh yellow, tender, melting, juicy, mildly sub-acid with a pleasant flavour; core above medium in size; quality very good; season, midwinter. Tree vigorous and productive.

Winter Banana.—Originated in Indiana. Fruit medium to large, roundish, conical, slightly ribbed; cavity medium depth, open, slightly russeted; stem short to medium, stout to moderately stout; basin shallow to medium depth, open, slightly wrinkled; calyx open; colour yellow with a deep pinkish red blush, waxy; dots pale, obscure; skin moderately thick, tender; flesh yellow and white, crisp, tender, juicy; core medium size, open; flavour mildly sub-acid, sprightly, pear-like, good; quality very good; season early to midwinter or late winter. A handsome apple of very

A large number of Russian apples have now been tested for twenty-seven years at the Central Experimental Farm. In the year 1888 there were planted in the orchards 131 supposed varieties. Since that time others have been added at intervals, and, notwithstanding those which have been winter-killed, there are now about 160 varieties, though some of these may be synonyms, as a number of synonyms have been discovered.

A few of the trees planted in 1888 fruited in 1890. The trees did well and made vigorous growth up to the year 1892, when blight appeared in the orchard and did considerable injury, and in 1893 the disease appeared earlier in the season and made great ravages among the trees. This left the orchard in a very bad condition. Some trees had died altogether others were reduced to stumps, and again others which had large diseased limbs sawn off had lost their symmetry. The trees were not so much affected in 1894 and 1895, but owing to the severity of the winter of 1895-6 a large number were root-killed. Further injury from root-killing occurred during the winter 1896-7. During the past eighteen years there has not been much blight, most of the trees have made good growth, and many of those which were formerly badly affected by blight have regained symmetrical proportions.

In 1915 an examination was made to learn which Russian apple trees were still in best condition in the orchards at the Central Experimental Farm. Trees of the following varieties planted between 1888 and 1895 were in good condition and are evidently among the hardiest of the Russian varieties, though a few of these are hardier than others as shown by those which have succeeded best in Manitoba. There are, no doubt, some of the following varieties which have not been thoroughly tested on the Canadian prairies yet but they are being propagated for further test. The names here given, and the synonyms in parentheses, under which they were obtained may not be the correct ones in all cases, but it is difficult to find the correct names of these Russian varieties, in many cases, as the confusion in Russian nomenclature in America is very great. It will be seen that some varieties have been received under a great many different names.

HARDIEST RUSSIAN APPLES AT OTTAWA.

Anis (Blue Anis, Kursk Anis, Golden Reinette, Orel No. 5, Simbirsk No. 4, Simbirsk No. 11.) Red and Yellow Anis though evidently nearly related are slightly different.

Anisim (Melonen).

Antonovka (Cinnamon, German Calville, Tiesenhausen, Yellow Arcad, 20 M.)

Beautiful Arcade (Arkad, Good Peasant, Herren, Osimoe, and is known in Manitoba as Repka Kislaga).

Blushed Calville (White Transparent).

Bode.

Bogdanoff Gluss (Bogdanoff Steklianka, Grandmother, Red Queen, White Pigeon).

Borsdorf (Borsdorfer, Round Borsdorf).

Charlamoff (Arabka, Summer Arabka, Pointed Pipka, Throne, Broad Cheek, Rosy Voronesh, Saccharine, 135 M).

Duchess of Oldenburg (Borovinka.) The variety grown as Anisette in Manitoba is very similar to Duchess.

Dvinnoe Solovieff.

Enormous.

Garden Sweet.

Golden White (Winter Stripe, Antmann, Plikanoff, Ukraine, Schwartze Glas, Skrut Grell).

Green Sweet (Lebonkey Sweet).

Handsome White.

Hibernal (Romna, Romenskoe, Silken Leaf, Aport, Yellow Arcadia, Longfield 57 M, Reinette Kievskoe, Sultan).
Lapouchoe.
Lebedka.
Lowland Raspberry (Lievland Raspberry, Livland Raspberry, Melonen).
Lubsk Queen.
Moscow Pear.
Orel.
Ostrakoff (Glass).
Paperovka.
Plodovitka.
Repka Winter (Bogdanoff)
Rosy Repka (Repolovka, Miron, Sugar Miron)
Russian Preserve.
Simbirsk No. 1
Simbirsk No. 9.
Vargul (Marmalade, Lead of St. Peterburgh)
Vargulek.
White Russet.

The most promising varieties are recommended in the district lists and described elsewhere in this bulletin.

The following case for and against the Russian apples, which was published by Prof. F. A. Waugh, in Bulletin No. 61, of the Vermont Agricultural Experiment Station, so fully expresses our own opinion of them that it is endorsed, and herewith quoted:—

"For.

"They have given us several varieties of recognized value, like Oldenburg and Yellow Transparent.

"They promise to give us other useful varieties through gradual intercrossing with our common apples.

"They furnish hardy trunks on which more tender varieties may be grafted to advantage.

"The trees are very hardy.

"They are mostly free from disease (except blight)

"They usually bear early and abundantly.

"The fruit is often large and finely coloured.

"Their introduction has encouraged many persons to grow apples in regions where they would not otherwise have attempted it."

"Against.

"Very many of the varieties introduced are immensely worthless.

"Most of them ripen too early and will not keep. This is due to their introduction from a zone of shorter season to one of longer season.

"The fruit of many varieties drops badly before mature.

"The fruit is usually coarse grained and of poor quality.

"The skin is often very thin and tender, making the fruit liable to injury.

"Their nomenclature is so badly confused that no one can be sure of what he is handling.

"The young growth is extremely subject to fire blight."

EXHIBITING AND JUDGING APPLES.

During recent years more attention has been paid to the judging of fruit than formerly. Judges are much more numerous than they used to be and it seems very desirable that judges of fruit in Canada should have some standard from which to work. Owing to the judges of fruit at certain fairs being changed very frequently, in some cases almost every year, and each judge having a different standard for judging, exhibitors are at a loss to know what kind of fruit to send or how to pack it and, as a result, we believe that in many cases they are discouraged from exhibiting. One judge may place too much importance upon size, another upon colour, and too little on freedom from blemishes, while another may think little of the uniformity and trueness to type, all of which leads to great confusion. A beginning was made to improve these conditions in 1910 when a Committee of the Ontario Fruit Growers' Association of which the writer was chairman submitted a number of score cards in a pamphlet called "Standards for Judging Fruits" for the use of judges and exhibitors with explanations of the terms used. These score cards were adopted by most of the Provincial Fruit Growers' Associations in Canada and much good has, it is believed, been accomplished through them but a more general familiarity with these score cards and explanations of terms used is desirable, hence score cards are published in this bulletin where they will receive wide publicity. These score cards unless otherwise marked are those adopted in 1913 by the Society for Horticultural Science and are considered improvements over those in the pamphlet referred to. A few introductory words are, however, necessary.

A good judge must be familiar with many varieties, otherwise he is liable to cause much confusion, annoyance and injustice to exhibitors, and will soon lose any reputation he may have had as a good judge. A judge must be unprejudiced, otherwise at a small fair where he will probably know who grew the apples exhibited he is liable to do an injustice.

A good judge makes a quick but accurate decision.

The regulations in regard to the number of specimens required, size and kind of package, etc., should be plain.

Nomenclature should be correct. It will add much to the interest of an exhibit if the judge or exhibition committee arranges to put the names of the winners on cards so that the public can see them as soon as the awards are made.

Single Plates—

Form	15
Size	15
Colour	20
Uniformity	20
Freedom from blemish	30
	100
Quality when scored	25

Collection of Fruits With Specified Number of Plates.

Value of varieties for purpose stated	50
Condition of fruit (average of individual plate score)	50
	100

Largest and Best Collection.

Number of varieties	33⅓
Value of varieties for purpose stated	33⅓
Condition of fruit (average of individual plate score)	33⅓
	100

Alternative Score Card for Collections (Standards for Judging Fruit)—

Form	10
Size	10
Colour	15
Uniformity	10
Freedom from blemish	20
Quality	10
Commercial value	10
Nomenclature	5
Arrangement	5
Season	5
	100

Single Plates of Seedlings or "Any Other Variety" (Standards for Judging Fruit)—

Form	15
Size	15
Colour	20
Uniformity	10
Freedom from blemish	10
Quality and texture	25
Season	5
	100

For Barrels and Boxes of a Given Yard

Box—		Barrel—	
Texture and flavour	100	Texture and flavour	100
Size and form	100	Size and form	100
Colour	150	Colour	150
Uniformity	150	Uniformity	150
Freedom from blemish	150	Freedom from blemish	150
Total	650	Total	650
Material	30	Staves	10
Marking	10	Hoops	10
Solidity (nailing, cleats, etc.)	10	Heads	10
		Nailing	20
Total	50	Marking	20
		Total	70
Bulge or swell	100	Facing	80
Alignment	20	Tailing	50
Height of ends	60	Pressing	70
Attractiveness and style	40	Racking	80
Compactness	80		
		Total	280
Total	300		

Explanation of Terms—Fruit.

Arrangement.—Taste and skill in staging so as to attract attention and add to the general appearance of the exhibit.

Colour.—Bright, clear, well developed colour, characteristic of the variety.

Commercial value.—Standard, known market varieties, as grown in and suited to the district, preferred.

Form.—In all cases, except seedlings, refers to the normal type or shape of the variety, but in case of seedlings it refers to the shape as desired in a commercial variety. A roundish apple is of the most desirable shape, and oblate and oblong apples least desirable.

Freedom from Blemish.—Any injury by insects, fungi, bruises, loss of stem, or other cause, lessening the value or appearance of the Exhibit shall be called a blemish.

Nomenclature.—Exhibits must be correctly named according to the nomenclature adopted by the Society, Association or Exhibition at which they are shown. The use of the standard nomenclature adopted by the American Pomological Society is recommended to such bodies.

Polishing.—Fruit on exhibition should have as much of the natural bloom as possible, but it has become the practice to rub off the bloom to heighten the colour. As long as this practice continues the person who does not rub off the bloom is at a disadvantage hence, unless there are rules prohibiting rubbing it will be better to do it.

Quality and Texture.—To be considered in collections, seedlings, new varieties on trial, or other sorts in competition.

Season.—In collections it is desirable to have as long a season as possible represented by the varieties shown. Varieties past condition shown for the purpose of lengthening the season will not, however, score as high as apples in condition though of later season.

Size.—While size in some cases indicates care and skill in production, it is not usually found with the highest colour and with freedom from blemishes; and as large size is not as important as high colour and freedom from blemishes, the largest fruit should not take the first prize unless it is equal to or better in other respects than those in competition with it.

Uniformity.—Specimens should be as nearly alike in size, form and colour as possible.

EXPLANATION OF TERMS—PACKING AND PACKAGES.

Alignment.—Alignment refers to the rows of fruit in the box, the straighter and more regular the rows the better is the alignment.

Attractiveness and Style of Pack.—When the box is opened the fruit should look attractive. The skill and good taste of the packer is shown in the appearance of the fruit and the style of the pack. There are many styles of pack, but the one should be used which lends itself best to the variety and size of fruit packed. The diagonal 3-2 pack is a very popular one. The fruit should be as nearly alike in size and colour as possible. The box also should be clean and attractive looking.

Bulge.—A bulge or swell in the top row of fruit is necessary in order to ensure the fruit carrying well. Before the top is put on there should be a bulge of 1¼ inches in the centre of the top row and the fruit should be ¼ of an inch above the top of the box at the ends and sides. When the cover is on there should be a bulge of ⅜ of an inch at the centre, at both top and bottom.

Compactness.—This may also be expressed by the term firmness and compactness. The more solid the pack the better the fruit will carry.

Facing.—When facing a barrel, or when beginning to pack a barrel, the apples for the first row should be put carefully in with the stem end down, the stems having been first cut off so that they will not injure the fruit when pressed. If slightly smaller apples are used in the outside rows and larger ones in the centre it improves the appearance of the face. A second row is now put in in the same manner as the first, and these apples should be arranged so that they will show through the spaces between those in the first row. These two rows constitute the face of the barrel. The fruit used for the face should fairly represent the fruit throughout the barrel, but the apples in these two rows should present as attractive an appearance as possible. The law in regard to facing, as defined in the Inspection and Sales Act, is as follows: "No person shall sell or offer, expose, or have in his possession for sale any fruit packed

in any package in which the faced or shown surface gives a false representation of the contents of such package, and it shall be considered a false representation when more than fifteen per centum of such fruit is substantially smaller in size than, or inferior in grade to, or different in variety from, the faced or shown surface of such package." Apples in barrels for exhibition should be packed as required by law.

Marking.—The marking of barrels and boxes should be distinct and attractive. It should comply with the regulations of the Inspection and Sales Act, which call for the initials of the Christian names of the packer, his surname, and his address; the name of the variety of fruit, and the designation of the grade, whether it be "Fancy," "No. 1," "No. 2," or "No. 3." Such mark may be accompanied by any other designation of grade or brand if that designation or brand is not inconsistent with, or marked more conspicously than, the one of the said four marks which is used on the said package. Bright coloured brands or marks are now being used, sometimes of paper.

Materials for Barrels.—The standard barrel must be large enough to contain at least 96 quarts of fruit. Smaller barrels should not be exhibited. The barrel in general use in Ontario has staves 30 inches in length. In Nova Scotia the staves are 28½ to 29½ inches long. The dimensions called for in a standard barrel of minimum size are: Between heads, 26½ inches wide, inside measurement; head diameter, 17 inches, inside measurement; middle diameter, 18½ inches, inside measurement. The barrel generally used in Ontario is 27½ inches between the heads, 17 inches in diameter at the head, and with a middle diameter at the bilge of 19½ inches. A good barrel should have sixteen staves with 9/10 jointing, cut five to two inches and average four inches in width at the bilge, and be free from large knots or shakes. The head should not be less than half an inch in thickness, dressed clean and sound. The hoops should be about 1⅜ inches in width and from ⅜ to ⅝ inches in thickness and eight in number. The barrel should be new and clean.

Material for boxes.—The box should be made of material strong enough to withstand handling in transportation. The heads, or end pieces, should be each of one piece of wood and not less than ¾ of an inch thick nor more than ⅞ inch. The sides also should be each of one piece and not less than ⅝ of an inch thick. The top and bottom boards may be of one or two pieces, preferably two, but not more than ¼ of an inch in thickness. They must be thin so that they will bend readily when the box is closed. There should be two cleats each for the top and bottom. Dove-tailed boxes are not desirable. The standard box must be used. This is 10 inches deep, 11 inches wide, and 20 inches long, inside measurement.

Pressing.—Apples are often over-pressed. If the barrel is racked well there need not be much pressing. The proportion of fruit that is injured by pressing will be evident when the barrel is opened. The less fruit that has been injured by pressing the better the barrel has been packed, provided, always, that the pressing given has been sufficient to give the required firmness. Barrels loosely packed frequently show more injury to the fruit through shaking than barrels over-pressed.

Racking.—All barrels of apples should be racked when being packed, so that the fruit will settle, and the packer thus be able to tail his barrel so that the fruit will carry well. When the barrel is opened the fulness or slackness will indicate how well the fruit has been racked. Over-pressed fruit is usually found where apples have not been racked well.

Solidity (Nailing, Cleats, etc.)—By solidity is meant the handling, lining, cleating, and marking of the box or barrel. The heads of the barrel should fit snugly into the chine. For barrels, six rosined 1¼-inch nails in each head are usually sufficient. One inch nails for the quarter hoops are large enough. They should be carefully driven through the barrel into the head. Liners should be used on the head for greater strength. The cleats should be put neatly on the box and four rosined nails driven skilfully through them and through the top or bottom into the ends of the box. The sides of the boxes should be nailed with four nails at each end of each side of the

The nails used for boxes are those known as fourpenny. Lining paper improves the appearance of unwrapped apples in boxes.

Tailing.—By tailing is meant the putting and placing of the last fruit into the barrel. All that is necessary in good tailing is to have the surface as level as possible with the stem end down when the apples are pressed. The apples should come up to the chine but not appreciably above it as if much above it too much fruit will be bruised when the head is pressed in. The care in tailing will be known when the barrel is open by the manner in which the fruit has been bruised when pressing.

SUGGESTED IDEAL SIZE OF APPLES FOR EXHIBITION.

As a member of a Committee of the Society for Horticultural Science the writer obtained the opinions of a number of fruit growers' in Canada as to the ideal sizes of apples for exhibition and following are the sizes which were most favoured and which were published in the S. H. S. report for 1914. It may be that it will be desirable to change some of these, but in the meantime they should prove helpful:

Variety.	Inches. Diameter.
For Ontario, along Lake Ontario and Districts West and South—	
Alexander	1
Baldwin	2¾
Ben Davis	2¾
Blenheim	2¾
Fallawater	3¼
Fameuse	3¼
Golden Russet	2¾
Gravenstein	2¾
Hubbardston	2¾
Mann	2¾
McIntosh	2¾
Northern Spy	2¾
Oldenburg	3¼
Ontario	3¼
Red Astrachan	3¼
Ribston	2¾
Rhode Island Greening	2¾
Stark	3
Tolman	3
Tompkins King	2¾
Wagener	2¾
Wealthy	2¾
Wolf River	2¾
Yellow Transparent	2¼

Eastern Ontario, Quebec, New Brunswick, Northern Nova Scotia, Prince Edward Island—

Variety.	Inches. Diameter.
Alexander	4
Baxter	3½
Bethel	2¾
Ben Davis	2¾
Canada Baldwin	2¾
Crimson Beauty	2¾
Dudley	2¾
Fameuse	3
McIntosh	2¾
Milwaukee	2¾
New Brunswick	3
Oldenburg	3
Pewaukee	3
Red Astrachan	3
Scarlet Pippin	2¾
Scott Winter	2¾
St. Lawrence	2¾
Wolf River	3
Wealthy	4
Yellow Bellflower (Bishop Pippin)	2¾
Yellow Transparent	2¼

For Nova Scotia, Annapolis and Adjacent Valleys—

Variety.	Inches. Diameter.
Alexander	4
Baldwin	3
Ben Davis	2¼
Blenheim	3½
Cox Orange Pippin	2½
Crimson Beauty	2¾
Fallawater	3¼
Gravenstein	3
Golden Russet (American)	2¾
Hubbardston	3
Mann	3
Northern Spy	3¼
Oldenburg	3
Ontario	3½
R. I. Greening	3¼
Roxbury Russet (Nonpareil)	3¼
Red Astrachan	3
Ribston	3
Stark	3
Tolman	3¼
Tompkins King	3½
Wagener	3¼
Wellington	3
Wealthy	3
Yellow Bellflower (Bishop Pippin)	3

For British Columbia—

Variety.	Inches. Diameter.
Cox Orange Pippin	3
Oldenburg	3
Esopus	3½
Gravenstein	3½
Grimes	3¼
Jonathan	3
King David	3½
McIntosh	3½
Northern Spy	3¼
Rome Beauty	3
Red Astrachan	3½
Tompkins King	3¼
Wagener	3½
Wealthy	3½
Winesap	3
Winter Banana	3½
Yellow Transparent	3
Yellow Newtown	3

good quality, but as it shows bruises readily it is not planted extensively commercially. The tree is a fairly early bearer.

Winter Rose.—Originated in Dundas county, Ontario. Fruit oblate; size above medium; cavity medium depth, narrow, lipped towards base of stem; stem short, moderately stout; basin narrow, shallow to medium, slightly wrinkled; calyx partly open or open; colour yellowish green, well washed with dull red; dots obscure; skin rather thick, tough; flesh white, tender, moderately juicy, mildly sub-acid, sprightly; core small; quality above medium to good; season, early to midwinter. Tree hardy, vigorous and an early bearer. May be useful in the north, but fruit is not sufficiently attractive in appearance.

Winter St. Lawrence.—Imported in 1833 from Manchester, England, under the name of Mank's Codling, by the late Wm. Lunn, of Montreal. Named Winter St. Lawrence by the Montreal Horticultural Society about 1873. Fruit medium to large, roundish, slightly conical; skin greenish yellow well covered with deep red through which are dark purple splashes and streaks; dots fairly numerous, pale, distinct; cavity rather deep and medium in width; stem short, slender to moderately stout; basin narrow, almost smooth, of medium depth; calyx partly open, sometimes closed. Flesh white, moderately, juicy, sub-acid, good flavour; core medium; quality good; season early winter. Tree a moderately spreading strong grower and hardy. A light to medium but annual bearer at Ottawa.

Wolf River.—Originated with W. A. Springer, near Wolf River, Fremont, Wis U.S., and disposed of to H. Rifen before coming into bearing. It is supposed to l a seedling of Alexander. Fruit large to very large, oblate, conic, slightly angular: skin greenish yellow, becoming lighter later in the season, nearly covered with dark red or crimson, with a few pale yellow distinct dots; cavity deep and of medium width, russeted; stem short, stout to slender; basin narrow to medium width, abrupt; and of medium depth to deep; calyx closed or open; flesh yellowish, moderately juicy, rather tender, sub-acid with a pleasant flavour; core of medium size; open; quality above medium; season early to mid-winter; tree hardy and a strong spreading grower and a good cropper in alternate years.

Yellow Bellflower.—Originated in Burlington, N.J., U.S. Fruit large, oblong conical; skin pale yellow, often with a pinkish or orange blush on the sunny side; dots few, gray, prominent; cavity of medium depth and width; stem of medium length, moderately stout; basin narrow, shallow to medium, wrinkled; calyx closed or partly open; flesh yellow, tender, buttery, juicy, sub-acid, with a pleasant flavour; core large; quality good; season, midwinter. Tree a spreading, moderate grower, and productive. This is called Bishop Pippin in the Maritime Provinces.

MIDWINTER TO LATE WINTER VARIETIES.

Baldwin.—Originated in Massachusetts, U.S. Fruit above medium to large, roundish; skin yellow, well washed and splashed with crimson and red; dots fairly numerous, gray, distinct; cavity of medium depth and width; stem short and stout; basin deep, open, somewhat wrinkled; calyx closed or open; flesh yellowish, firm, rather coarse, moderately juicy, mildly sub-acid, with a pleasant flavour; core small; quality good; season, late winter; tree moderately upright, vigorous and productive. Has been a very profitable variety in the past on account of its productiveness, appearance and good shipping qualities.

Ben Davis.—Originated in North Carolina early in the 19th century. Fruit medium to large, roundish conical; skin yellow, well splashed and streaked with red; dots obscure; cavity deep, of medium width, slightly russeted; stem short, slender; basin of medium depth and width, wrinkled; calyx open; flesh dull white, firm, moderately juicy, mildly sub-acid, but has no characteristic flavour; core medium; quality medium; season late winter; tree hardy, spreading, vigorous and very productive.

Bethel.—Originated in Vermont. Fruit large, roundish, slightly angular; skin greenish yellow, splashed and streaked with deep orange red to carmine; dots numerous, greenish yellow, prominent; cavity deep, of medium width, slightly russeted; stem short to medium, moderately stout to slender; basin shallow, medium width, smooth to wrinkled; calyx partly open; flesh yellowish with traces of pink, moderately juicy, mildly sub-acid; core of medium size; quality good; season, midwinter to late winter; tree a strong grower. Blue Pearmain group.

Black Ben Davis.—This cannot be distinguished from Gano.

Blue Pearmain.—Origin unknown. Fruit above medium to large; form roundish, slightly ribbed; cavity medium depth and width, russeted towards base, stem short to medium, stout; basin medium depth and width, slightly wrinkled; calyx open; colour yellow, almost entirely covered with dark purplish red; dots numerous, yellow, conspicuous; bloom bluish; skin thick, tough, seeds acuminate; flesh yellow, a little coarse, tender, moderately juicy; core medium size, open; flavour mildly sub-acid, pleasant, spicy; quality good; season mid to late winter. A fairly hardy winter apple of good quality, but is too shy a bearer in most places. Tree is a vigorous grower, of spreading habit.

Esopus (Spitzenburg).—Originated on the Hudson river. Fruit medium to above medium in size, oblong, tapering, angular; skin yellow, nearly covered with bright rich red which is darker on the sunny side; dots numerous, yellow, prominent; cavity deep and narrow; stem short, moderately stout; basin narrow, of medium depth, wrinkled; calyx of medium size, partly open; flesh yellow, crisp, tender, juicy, sub-acid with a rich high flavour; core of medium size; quality very good to best; season, early to midwinter; tree a poor grower of moderately spreading habit and usually a light bearer, except in very favoured places, which lessens its value for commercial purposes, though one of the best for home use.

Fallawater.—Originated in Pennsylvania. Fruit large to very large, roundish; skin yellowish green washed with pink or dull red, mostly on the sunny side; dots few, pale, large and prominent on the red portion of skin; cavity narrow, of medium depth, slightly russeted; stem short, rather slender; basin narrow, of medium depth, slightly wrinkled; calyx partly or fully open; flesh greenish yellow, crisp, tender, juicy, mildly sub-acid, with a pleasant flavour; core small; quality good; season, mid-winter to late winter; tree a strong grower and a good bearer.

Forest.—Originated in Wisconsin. Fruit above medium size; form oblong to roundish conical; cavity medium depth and width, sometimes lipped, russeted; stem short, stout; basin medium depth and width, wrinkled; calyx open; colour greenish yellow washed with deep rather dull red, mostly on sunny side; dots few, gray, distinct; skin thick, rather tough; flesh yellow, crisp, juicy; core small; sub-acid, good, pleasant flavour; quality good to very good; season, mid to late winter. Tree hardy. Would be very promising if fruit were a little more attractive.

Gano.—Originated in Missouri and is said to be a seedling of Ben Davis. Fruit above medium size, roundish conical; skin yellow, almost completely overspread with crimson, not splashed or streaked as Ben Davis; dots gray, obscure; cavity of medium depth and width; stem short; basin of medium depth and width, slightly wrinkled; calyx open. Flesh dull white, somewhat tenderer than Ben Davis, moderately juicy, mildly sub-acid, has no characteristic flavour; core medium; quality medium, but little, if any better than Ben Davis; season, late winter. Tree a fairly hardy, upright, strong grower and an annual and good bearer. This is a very handsome apple, being more highly coloured than Ben Davis.

Golden Russet (American).—Origin uncertain. Fruit medium to above medium in size, roundish; skin greenish yellow, more or less russeted sometimes with bronzed blush; dots obscure; flesh greenish yellow, juicy, sub-acid with a high rich flavour; core medium; quality good to very good; season, late winter; tree a strong, upright

grower, sometimes but a light cropper. This is a valuable variety in the colder parts of Ontario and Quebec, as it is hardy.

Grindstone (*American Pippin*).—Origin uncertain. Fruit medium to large, roundish; greenish yellow with a pink or orange blush or lightly splashed with same; dots fairly numerous distinct but not prominent; cavity deep, medium in width, sometimes slightly russeted; stem short and stout; basin rather deep, medium in width and slightly wrinkled; calyx large, open; flesh yellow, firm, crisp, juicy, sub-acid; core small; quality good. Season, late winter. Tree a vigorous spreading grower and productive. An exceptionally good keeping apple.

La Salle (*McDonald*).—Originated at Lachine, Quebec. Fruit, medium to above medium in size, roundish to almost oblong in form; cavity medium depth and width to open; stem short to medium, stout; basin deep, open, slightly wrinkled; calyx open; colour greenish yellow, splashed and washed with rather dull red; dots obscure; skin moderately thick, tough; flesh dull white or yellowish, firm, crisp, juicy; core medium to rather large; flavour sub-acid, pleasant, not high; quality above medium to good; season mid to late winter.

La Victoire.—Originated near Grenville, Que. Probably a seedling of Fameuse. Fruit above medium size, oblate to roundish regular; skin greenish yellow, almost covered with crimson; dots fairly numerous, gray, distinct; cavity of medium depth and width, slightly russeted; stem short and stout; basin of medium depth and width, almost smooth; calyx open and medium in size; skin moderately thick, moderately tough; seeds medium size, obtuse; flesh white, tinged with red, rather course, moderately juicy, sub-acid, with a pleasant flavour; core small; quality good; season, mid-winter; tree hardy and a strong, moderately spreading grower.

Lawver (*Delaware Red Winter*).—Origin uncertain. Fruit above medium size, roundish to oblate, somewhat angular; skin yellow, nearly all, or quite, covered with bright to deep red; dots few, pale, distinct; cavity medium in depth, narrow; stem long and slender; basin very shallow, narrow, wrinkled; calyx small and closed, flesh yellow, sometimes faintly tinged with pink, firm, crisp, tender, juicy, sprightly sub-acid, slightly aromatic; core small; quality above medium; season late winter; tree, fairly hardy, vigorous, moderately upright. An annual bearer but not a heavy cropper, and the fruit is rather uneven in size. This is an exceptionally good keeper. The fruit may be kept for a year in an ordinary cellar without difficulty.

Mammoth Black Twig.—This name has been given to three varieties of apples, namely Arkansas, Arkansas Black, and Paragon, none of which have gained much prominence in Canada.

Mann.—Originated in New York State. Fruit above medium to large, oblate; skin very green in early winter, changing to yellow when fully ripe, often with a brownish pink blush; dots numerous, pale, and quite prominent in early winter; cavity deep, medium in width, russeted; stem short, slender; basin of medium depth and width, slightly wrinkled; calyx partly or fully open. Flesh yellow, crisp, juicy, mildly sub-acid, with a pleasant flavour; quality good; season, late winter. Tree a vigorous, spreading grower and an early and heavy bearer. A good keeping apple but lacks attractive colour.

Newtown Pippin.—Originated on Long Island, New York. Both the Yellow Newtown and Green Newtown are known under the above name and it is not known whether the Yellow is a sport of the Green or *vice versa*. The Yellow Newtown, sometimes known as Albermarle, is the one which is now generally planted. Both are much alike, however. The Yellow Newtown is yellower and has a higher coloured blush at maturity than the Green Newtown, and the flesh of the former is yellower and has less acidity.

Fruit medium to large, roundish, slightly ribbed; cavity deep, open, russeted; basin medium depth and width; colour green when picked but changing to greenish

yellow and often with a brownish pink blush; flesh greenish to yellow, firm, crisp, juicy, sub-acid with a high flavour; quality best; season mid to late winter.

Northwestern (Greening).—Originated in Waupaca county, Wisconsin. Fruit large, roundish conical, regular, symmetrical, has an appearance as if from a mould; cavity deep, medium width, russeted; stem short, stout; basin deep, medium width to open, almost smooth; calyx open or partly open; colour green turning to greenish yellow, deeper on sunny side, and sometimes with a bronzy tinge; predominant colour greenish yellow; seeds below medium, light brown, acute; dots white, indistinct; skin moderately thick, moderately tender; flesh yellowish, firm, rather coarse, moderately juicy; core medium; flavour sub-acid, spicy, pearlike, pleasant; quality good; season January to late winter. An attractive looking apple on account of its symmetry and glossy appearance. The tree is rather hardy and is a strong grower and a moderately to good bearer, but becoming top heavy it frequently splits. The flesh often becomes brown near the core, while outwardly the fruit looks well.

Northern Spy.—Originated near Rochester, N.Y., U.S. Fruit above medium to large, roundish conical, slightly angular; skin yellow, usually well washed, splashed and streaked with pinkish red, which in highly coloured specimens becomes bright red; there is also a pale pink bloom which increases the attractiveness of this variety; dots few, small, whitish, distinct; cavity deep, open; stem short; moderately stout; basin of medium depth and width to narrow, slightly wrinkled; calyx small, closed or open; flesh creamy white, crisp, tender, juicy, sub-acid, sprightly, aromatic, of a good flavour; core medium to above medium, open; quality very good to best; season, mid-winter to late winter. Tree an upright, strong grower and yields good crops in alternate years, when it comes into bearing, but it is usually from twelve to fifteen years before full crops are produced.

Ontario.—Originated by the late Charles Arnold, Paris, Ont., by crossing Wagener with Northern Spy. Fruit large to very large, oblate, sometimes roundish, slightly angular; skin yellow, usually well washed and splashed with bright red and carmine, there is also a pale pink bloom which adds to the appearance of this variety; dots few, pale and a little larger and more distinct than on the Northern Spy; cavity deep, open, slightly, russeted; stem short, moderately stout; basin medium to rather deep, slightly wrinkled; calyx small, open or closed; flesh creamy white, crisp, tender, juicy, a brisk sub-acid (more acid than Northern Spy) sprightly, slightly aromatic; core small; quality good to very good; season, midwinter to late winter. Tree moderately vigorous, but an early and heavy bearer. A good apple both for commercial purposes and for home use but shows bruises easily.

Pewaukee.—Originated in Wisconsin. A cross between Duchess of Oldenburg and Northern Spy. Fruit large, roundish, ribbed; cavity narrow, shallow, uneven, russeted, one side with a characteristic lipped growth; stem short, moderately stout; basin narrow to medium in width, medium depth, wrinkled; calyx open; skin yellow, splashed and washed with orange and purplish red; dots few, small, yellow, distinct but not prominent; skin moderately thick, tender; flesh yellowish, breaking, crisp, juicy, rather coarse; core small; flavour sub-acid, pleasant; quality good; season mid-winter to late winter. Pewaukee is a productive winter apple and the tree is fairly hardy. Its chief fault is that the fruit drops badly, but the fruit is not quite attractive enough in appearance.

Red Canada (Steele's Red Winter).—Origin unknown. Fruit medium to above medium in size, roundish, conic; cavity deep, open; stem medium to slender; basin narrow, shallow to medium depth, yellow, almost covered with attractive crimson, dots gray and yellow, distinct; flesh yellowish, crisp, tender juicy, sub-acid, sprightly, pleasant; quality very good; season mid to late winter. This is an old variety in which there is a revival of interest. The rather poor growth of the tree when young has probably had a good deal to do with checking the dissemination of this fine variety.

Rome (Beauty).—Originated in Lawrence county, Ohio. Fruit medium to large in size, roundish conic; cavity open, medium depth; stem long to medium, slender to moderately stout; basin open, medium depth, slightly wrinkled; calyx open; colour greenish yellow, well washed and splashed with attractive crimson, usually greenish about cavity; predominant colour crimson; seeds above medium, broad, scarcely acute; dots few, white, distinct; skin thick, moderately tender; flesh yellowish, crisp; juicy, tender; core large, open; flavour sub-acid, pleasant; quality good; season midwinter to late winter. An attractive looking apple. This is an early and productive winter variety and is increasing in popularity in Canada where it succeeds. Has fruited as a top-graft at Ottawa since 1911.

Roseau (Canada Red, Pomme de Fer).—Origin unknown. Fruit medium to large, oblate to roundish, slightly conical; skin yellow, well splashed and washed with deep, rather dull orange red; dots fairly numerous, large, yellow, conspicuous; cavity deep, narrow; stem medium to short, moderately stout to slender; basin narrow, shallow, slightly wrinkled; calyx small, partly open; flesh yellowish, firm, moderately juicy, mildly sub-acid with a pleasant but not high flavour; core of medium size; quality good; season, midwinter to late winter. Tree a strong grower and has proved productive in some places, while a shy bearer in others.

Roxbury (Russet).—Originated in the State of Massachusetts and is the same as the Nonpareil of Nova Scotia. Fruit above medium to large, oblate, conic, slightly angular; skin greenish yellow more or less russeted, sometimes with a bronze blush; dots obscure; cavity of medium depth, open; stem short, stout; basin of medium depth and width, smooth; calyx open or closed; flesh yellowish, tender, moderately juicy, sub-acid, with a good, rich flavour; core small; quality good to very good; season midwinter to late winter; tree moderately vigorous, spreading and a good cropper.

Salome.—Originated with Elias C. Hathaway, Ottawa, Ill., U.S. Fruit medium to below medium in size, roundish conical, somewhat angular and inclined to be irregular; skin pale yellow splashed and washed with bright and sometimes rather pale orange red, overspread with a delicate pink bloom making the fruit very attractive looking; dots numerous, pale yellow, prominent; cavity deep and medium in width; stem short, moderately stout; basin narrow, medium in depth, almost smooth; calyx small, closed or partly open; flesh yellow, crisp, tender, moderately juicy, sub-acid, slightly aromatic; core large, open, quality good; season midwinter to late winter; tree a strong, upright grower, hardy and a good cropper. When the crop is large the fruit is liable to be below medium in size. This is a handsome apple and being fairly hardy and a good keeper is valuable in the colder parts of the country.

Scott Winter.—Introduced by Dr. F. H. Hoskins, Newport, Vt., U.S. Fruit medium to below medium in size, roundish conical, angular; skin yellow, well splashed and washed with deep orange and purplish red; dots obscure; cavity of medium depth to deep, medium width, russeted; stem short, moderately stout; basin deep, rather narrow, slightly wrinkled; calyx partly open; flesh yellowish, crisp, tender, juicy, acid but with a pleasant flavour; core medium; quality above medium, almost good; season, late winter. Tree, very hardy and a strong, upright grower. An annual bearer and a good cropper.

Stark.—Origin not known. Fruit large, roundish, slightly angular; skin greenish yellow when in good condition, more or less splashed and washed with brownish pink, mostly on the sunny side; dots not prominent; cavity of medium depth and width; stem short, moderately stout; basin of medium width, rather shallow; calyx large, partly open or open; flesh yellow, moderately juicy, rather coarse, mildly sub-acid, pleasant but not high flavoured; core medium; quality almost good; season, late winter. Tree a strong, moderately spreading grower and productive. Fruit has not enough acidity for a winter apple.

Stayman Winesap.—Originated in Kansas. Size medium to above medium; form round[illegible]conical; cavity deep, medium width, russeted; stem medium length, slender to moderately stout; basin medium depth and width, wrinkled; calyx partly open or closed; colour greenish yellow washed and splashed with dull red; predominant colour dull red; seeds medium size, obtuse, slightly curved; dots moderately numerous, yellow, distinct, skin moderately thick, moderately tender; flesh yellow, crisp, juicy; core medium to small; flavour sub-acid, pleasant; quality good to very good; season mid to late winter. This has proven hardy at Ottawa when top-grafted and has now fruited for two years. The season is not quite long enough here for this variety to reach its best development, but it should prove a desirable commercial apple in some parts of Canada. It is not quite attractive enough in appearance.

Swayzie.—Supposed to have originated near Niagara, Ont. Fruit below medium, sometimes almost medium in size, oblate to roundish; skin yellow covered with a thin russet nearly all over; dots fairly numerous, pale, distinct but not prominent; cavity deep, narrow; stem short, slender; basin narrow, of medium depth, almost smooth; calyx partly open; flesh pale greenish yellow, crisp, breaking, tender, juicy, sprightly sub-acid with a high aromatic flavour; core small; quality very good to best; season, midwinter; tree fairly hardy and an upright but only moderate grower and rather light cropper. A fine dessert apple.

Tolman.—Originated in Rhode Island. Fruit medium to above medium in size, roundish; skin yellow when fully matured with often a faint blush on the sunny side; a distinct line usually runs from stem to calyx; dots few, gray, not prominent; cavity open, medium in depth; stem rather long, slender; basin medium in depth and width, wrinkled; calyx open; flesh white, firm, moderately juicy, sweet, with a high flavour; core small; quality very good for a sweet apple; season, early winter to late winter. Tree a strong, spreading grower and very productive.

Windsor (Chief).—Originated in Wisconsin. Fruit above medium to large in size, oblate to roundish, slightly ribbed; cavity shallow, open, more or less russeted; stem medium length, stout; basin medium depth and width, almost smooth; calyx open; colour yellow, well washed with dark red; dots few to medium, yellow, conspicuous; skin thick, tough; flesh yellowish, firm, juicy; core small; flavour mildly sub-acid, pleasant; quality good; season late winter. Has not proved hardy at Ottawa though it has fruited here. A little too dark in colour for a good commercial apple.

Winesap.—Origin unknown. Fruit of medium size, roundish, conical, ribbed; cavity deep, medium width, russeted; stem short to medium, slender; basin shallow to medium, narrow, wrinkled; calyx closed, small; colour yellow, well washed with deep red, and having an orange tinge; dots few, small, yellow, distinct but not prominent; skin thick, tough; flesh yellow, firm, crisp, juicy; core medium to small; flavour sub-acid, sprightly, high, rich, quality very good; season late winter. Needs a long season in which to mature its fruit, hence is only useful in the warmest parts of Canada.

York Imperial.—Supposed to have originated in York Co., Pa., U.S. Fruit of medium size, roundish, oblate, flattened and somewhat one-sided, angular; skin yellow, splashed and washed with bright red; dots few, yellow, distinct, but not prominent; flesh yellowish, firm, crisp, tender, moderately juicy, mildly sub-acid with but a slight characteristic flavour; quality above medium; season, late winter. Tree a moderate grower, but productive. A very popular commercial apple in some parts of the United States.

CRAB APPLES.

Dartmouth.—Originated in New Hampshire. Size large; form oblate to roundish; cavity deep, open; stem long, slender; basin shallow, medium width, slightly wrinkled; calyx closed; colour yellow, almost entirely covered with crimson; dots few,

yellow, indistinct; bloom moderate, bluish; skin thin, moderately tender; flesh firm, juicy; core medium; flavour briskly sub-acid, slightly astringent, quality medium; season mid-September to early October. A very handsome crab and should be more generally grown.

Excelsior.—Originated by Peter M. Gideon, Excelsior, Minnesota. Size very large for a crab, about the size of a medium apple; form roundish, angular; cavity narrow, shallow to medium in depth; stem long to medium, moderately stout; basin shallow to medium in depth, slightly wrinkled, narrow; calyx closed or partly open; colour pale yellow well washed on sunny side with bright red and extending nearly around apple in some cases; dots few, yellow, distinct but not prominent; bloom slight; skin moderately thick, tender; flesh yellowish, tender, melting, juicy; core large, open; flavour sub-acid, pleasant, quality good as a crab, above medium to good as an apple; season early to mid-September. Good both for eating raw and cooked.

Florence.—Originated by Peter M. Gideon, Excelsior, Minn. Size above medium to large; form oblate; cavity medium to open, medium depth; stem long, slender; basin shallow, open, slightly wrinkled; calyx closed; colour pale yellow, well washed with crimson, yellow shows through crimson in lines making it very attractive; dots obscure; bloom very slight amount; skin thin, tender; flesh yellow with traces of red, crisp, firm, breaking, juicy; core small; flavour briskly sub-acid, slightly astringent, quality above medium; season just before Martha, late August to early September. A very handsome crab apple which is very popular in Minnesota and is promising in Canada.

Hyslop.—Origin unknown. Size medium to large; form, roundish; cavity narrow, shallow; stem long, slender; basin shallow, open, wrinkled; calyx partly open; colour yellow, well washed with deep crimson; dots moderately numerous, yellow, indistinct where colour is deepest, distinct on lighter shades; skin thin, tender; flesh yellow, firm, moderately juicy; core small; flavour sub-acid; quality medium; seeds small for an apple, medium for a crab, acute; season October. A hardy productive variety, and a better keeper than most crab apples.

Lyman Prolific.—Originated by H. M. Lyman, Excelsior, Minn. Size large for a crab; form roundish; cavity medium depth and width; stem long, slender; basin deep, open, smooth, calyx open; colour yellow well washed with deep orange red; predominant colour deep orange red; seeds small, acute; dots numerous, yellow, distinct; skin thin, tender; flesh yellow, crisp, breaking, juicy; core small; flavour briskly sub-acid; quality above medium; season October.

Martha.—Originated by Peter M. Gideon, Excelsior, Minn. Size large; form oblate to roundish; cavity medium depth and width; stem long, moderately slender; basin medium depth and width, almost smooth; calyx open; colour yellow well washed with lively or bright red; dots fairly numerous, yellow, distinct; bloom slight; skin thin, tender; flesh yellow, firm, crisp, breaking, juicy; core small; flavour brisk sub-acid, pleasant, no astringency; quality good; season early to mid-September. One of the most handsome and best crab apples. Evidently needs another variety to pollinate it.

Montreal Beauty.—This beautiful crab is a seedling raised by the late Robert Cleghorn, a short distance south-west of the original "Blinkbonny" apple tree (Montreal). "Trees" says Mr. Guilbault, "were propagated from it as early as 1883." They are strong, vigorous growers, hardy, though not equal to the Transcendent in this respect, and long-lived. The tree is rather large, with a head which is very close and upright, until the weight of fruit presses it downwards and open. It bears heavily, but not early. On young trees the fruit is large, for a crab, very oblong-conic. On older trees the fruit is oblong to roundish-oblong, and truncate. In old age the fruit is still fine and salable; its colour is yellowish green, mostly covered with red. The basin is wide, shallow, even; the calyx is closed; the segments are medium in length. The flesh is yellowish-white, tender, rather juicy (but mealy if over

rine), sub-acid, very slightly astringent. It ripens about the middle of Sep- [illegible]er. This variety seems almost unknown outside the province of Quebec."—(First rep[illegible] of Fruit Committee of the Montreal Agricultural and Horticultural Society, 1[illegible]

Transcendent.—Origin unknown. Size above medium; form roundish angular; cavity medium depth and width; stem long, slender; basin open, shallow, wrinkled; calyx closed or partly open; colour rich yellow well washed with orange red; dots obscure; bloom thin; skin thin, tender; flesh deep yellow, firm, crisp, breaking, juicy; core medium to small; flavour briskly sub-acid, slightly astringent; quality above medium to good; season early to mid-September. Not as good in quality nor as large or handsome as Martha. One of the most popular crab apples. It is very productive. The tree is more subject to fire blight than some varieties.

Virginia.—Found by N. K. Fluke, Davenport, Iowa. "Fruit medium, roundish, flattened, regular; surface yellow, thinly covered with red, sometmes nearly solid red; cavity obtuse, regular, slightly russeted; stem long; basin nearly or quite flat, corrugated and wrinkled; calyx closed; flesh juicy, acid, good for culinary use; September, November."—(Hansen). This variety has proved hardy in Manitoba.

Whitney.—Originated with A. R. Whitney, Franklin Grove, Ill. Fruit large for a crab apple; roundish conic; yellow, well washed, and splashed with deep red, approaching orange red; flesh yellowish, crisp, tender, juicy; quality good; season late August to early September. The flesh of this crab apple is tenderer than most varieties. It is a good dessert fruit when in prime condition and one of the earliest in season.

SOME OF THE MOST PROMISING APPLES ORIGINATED IN THE HORTICULTURAL DIVISION, CENTRAL EXPERIMENTAL FARM, OTTAWA, CANADA.

Brock (McIntosh seedling).—Originated in the orchards of the Horticultural Division, Experimental Farm, Ottawa. Seed sown autumn of 1898. Tree planted in orchard in spring of 1901. First fruit 1908.

Size large; form roundish, slightly ribbed; cavity medium depth and width, slightly russeted; stem short, stout; basin deep medium width, slightly wrinkled; calyx closed or partly open; colour yellow well splashed and washed with orange red; predominant colour orange red; dots few, pale yellow, indistinct; bloom thin, pinkish; skin moderately thick, tender; seeds medium size, acute; flesh yellowish, tender, moderately juicy; core medium, open; flavour sub-acid, pleasant vinous; quality good; season mid-September to early October. Does not resemble McIntosh except in having tender flesh. It is attractive in appearance, and of good quality. Suggestive of Gravenstein in appearance and flavour.

Diana (Langford Beauty seedling).—Originated in the orchards of the Horticultural Division, Experimental Farm, Ottawa. Seed sown autumn of 1898. Tree planted in orchard in spring of 1903. First fruit, 1912. Size medium to above medium; form roundish; cavity medium depth and width; stem medium length, moderately stout; basin medium width, deep, wrinkled; calyx closed or partly open; colour yellow well washed and splashed with attractive crimson; predominant colour attractive crimson; seeds medium size, acuminate; dots few, white, indistinct; bloom thin, pinkish; skin moderately thick, moderately tender; flesh white with traces of red, crisp, tender, juicy; core medium size, open; flavour briskly sub-acid, aromatic, quality good; season late September to November. Resembles Langford Beauty somewhat in colour and character of flesh. A handsome apple.

Donald (Northern Spy seedling).—Originated in the orchards of the Horticultural Division, Experimental Farm, Ottawa. Seed sown autumn of 1898. Tree planted in orchard in spring of 1902. First fruit, 1909. Size above medium to large; form oblate

to roundish, regular in shape, slightly ribbed; cavity deep, medium width to open, russeted; stem short, moderately stout to stout; basin deep, medium width to open, wrinkled; calyx closed or partly open; colour yellow splashed and washed with crimson; predominant colour crimson; seeds medium size, acute; dots few, yellow, distinct; bloom pinkish; skin moderately thick, tender; flesh yellowish, crisp, tender, rather coarse, juicy; core medium; flavour sub-acid, pleasant, sprightly; not high; quality good; season late October to March or later. A handsome apple resembling Spy somewhat in colour.

Lumer (Northern Spy seedling).—Originated in the orchards of the Horticultural Division, Experimental Farm, Ottawa. Seed sown autumn of 1898. Tree planted in orchard in spring of 1902. First fruit, 1911. Size medium to above; form roundish, slightly ribbed; cavity deep, narrow, russeted at base; stem slender, medium length, basin deep, medium width, slightly wrinkled; calyx partly open or open; colour greenish yellow well washed and splashed with deep crimson; predominant colour deep crimson; seeds medium size, acute; dots obscure; bloom pinkish; skin moderately thick, moderately tender, flesh yellowish, juicy; crisp, tender; core medium size, open; flavour sub-acid, pleasant, sprightly; quality good; season late December to late winter. Looks and tastes considerably like Spy. Flesh much like Spy. One of the best of the seedlings.

Galetta (Wealthy seedling).—Originated in the orchards of the Horticultural Division, Experimental Farm, Ottawa. Seed sown autumn of 1898. Tree planted in orchard in spring of 1902. First fruit, 1906. Size above medium to medium; form roundish to oblate, flattened at both ends; cavity deep, open, slightly russeted; stem short, stout; basin deep, open, wrinkled; calyx closed or partly open; colour pale yellow, washed and splashed with red, with a suggestion of pink, mostly on sunny side; dots obscure; skin thick, moderately tough; flesh white, crisp, tender, juicy; core medium; flavour, sub-acid, pleasant; quality good, season late August to early September. Resembles Wealthy somewhat in outward appearance. A good dessert apple.

Gerald (Langford Beauty seedling).—Originated in the orchards of the Horticultural Division, Experimental Farm, Ottawa. Seed sown autumn of 1898. Tree planted in orchard in spring of 1903. First fruit, 1911. Size above medium to medium; form roundish to oblate, slightly ribbed; cavity medium depth and width; stem medium length to short, stout; basin deep, medium width, wrinkled; calyx partly open; colour yellow washed with crimson; predominant colour crimson; seeds above medium size, acuminate; dots few, yellow, distinct, skin moderately thick, moderately tender; flesh white, crisp, tender, juicy; core medium, open; flavour sub-acid, pleasant, quality good; season late November to February or later. An attractive looking apple of good quality. Resembles Langford Beauty considerably in outward appearance, flesh and flavour.

Joyce (McIntosh seedling).—Originated in the orchards of the Horticultural Division, Experimental Farm, Ottawa. Seed sown autumn of 1898. Tree planted in orchard in spring of 1901. First fruit, 1911. Size medium; form oblate to roundish, ribbed; cavity medium depth and width, stem short, moderately stout; basin medium depth and width, wrinkled; calyx closed; colour yellow washed and splashed with crimson; predominant colour crimson; seeds medium size, acute; dots few, yellow, distinct; skin moderately thick, tender; flesh dull white, tender, melting, juicy; core medium size, open; flavour sub-acid, pleasant, aromatic; quality good to very good; season September and October. Resembles McIntosh very much in flesh and flavour. Earlier than McIntosh.

Kildare (Langford Beauty seedling).—Originated in the orchards of the Horticultural Division, Experimental Farm, Ottawa. Seed sown autumn of 1898. Tree planted in orchard in spring of 1902. First fruit, 1908. Size medium to above

medium; form oblate to roundish conic; cavity medium depth and width; stem medium to long, slender to moderately stout; basin narrow, medium depth, nearly smooth; calyx partly open or closed; colour pale yellow, washed and splashed with crimson; predominant colour crimson; seeds medium size, tapering, acute; dots moderately numerous, white, distinct; bloom bluish; skin moderately thick, tough; flesh white with traces of yellow, crisp, very tender, juicy; core medium; flavour sub-acid, sprightly, pleasant; quality good; season late August to mid-October. Resembles Langford Beauty a little in outward appearance and in character of flesh and considerably in flavour. An attractive looking apple of the season of Wealthy but better in quality. Flesh and flavour somewhat like McIntosh.

Kim (Langford Beauty seedling).—Originated in the orchards of the Horticultural Division, Experimental Farm, Ottawa. Seed sown autumn of 1898. Tree planted in orchard in spring of 1902. First fruit, 1908. Size medium to above; form roundish, regular; cavity medium depth and width, russeted; stem short, slender to moderately stout; basin deep, open, nearly smooth; calyx partly open or open; colour yellow washed and splashed with crimson; predominant colour crimson; seeds medium size, acute; dots few, white, distinct; bloom pinkish; skin moderately thick, tender; flesh dull white, with traces of red, crisp, juicy; core medium; flavour sub-acid, sprightly, pleasant; quality good; season November to late winter. Resembles Langford Beauty a little in outward appearance.

Lipton (Northern Spy seedling).—Originated in the orchards of the Horticultural Division, Experimental Farm, Ottawa. Seed sown autumn of 1898. Tree planted in orchard in spring of 1904. First fruit, 1914. Size medium; form roundish to oblate conical, ribbed; cavity deep, open, russeted; stem short, stout; basin deep, medium width, wrinkled; calyx partly open or open; colour yellow well washed and splashed with crimson; predominant colour crimson; seeds medium size, acute; dots moderately numerous, yellow, distinct; skin moderately thick, moderately tender; flesh yellow with traces of red, crisp, tender, juicy; core medium; flavour sub-acid, pleasant; quality good; season late September to February. Colour, shape, flesh and flavour much like Spy.

Melba (McIntosh seedling).—Originated in the orchards of the Horticultural Division, Experimental Farm, Ottawa. Seed sown autumn of 1898. Tree planted in orchard in spring of 1911. First fruit, 1908. Size medium to above medium; form roundish conical, ribbed; cavity open, medium depth; stem medium length, stout; basin medium depth and width, wrinkled; calyx closed; colour pale waxy yellow well washed and splashed with bright carmine and crimson; predominant colour bright carmine; seeds medium or above, broad; dots few, pale, indistinct; bloom bluish; skin moderately thick, tender, perfumed; flesh white, crisp, tender, juicy; core above medium, open; flavour sub-acid, sprightly, aromatic, pleasant; quality good to very good; season late August to mid-October. A handsome apple suggestive of McIntosh in perfume, flesh and flavour, but little in outward appearance except about cavity. Same season as Lowland Raspberry, but would ship better.

Niobe (Northern Spy seedling).—Originated in the orchards of the Horticultural Division, Experimental Farm, Ottawa. Seed sown autumn of 1898. Tree planted in orchard in spring of 1902. First fruit, 1909. Size above medium; form roundish conical, regular or slightly ribbed; cavity deep, medium width; stem medium to long, slender to moderately stout; basin deep, medium width, smooth to slightly wrinkled; calyx partly open; colour greenish yellow washed and splashed with rather dull crimson; predominant colour rather dull crimson; seeds above medium; dots few, white, indistinct; bloom thin, pinkish; skin moderately thick, tough; flesh yellowish, crisp, tender, rather coarse, moderately juicy; core medium, open; flavour mildly sub-acid, pleasant, sprightly; quality good to very good; season December to late winter. Resembles Northern Spy somewhat in outward appearance, and considerably in flavour.

Pedro (*McIntosh seedling*).—Originated in the orchards of the Horticultural Division, Experimental Farm, Ottawa. Seed sown autumn of 1898. Tree planted in orchard in spring of 1903. First fruit, 1911. Size above medium; form oblate, conic; cavity medium width, deep, russeted; stem short to medium, stout; basin deep, medium width, slightly wrinkled; calyx partly open or open; colour greenish yellow well washed with crimson; predominant colour crimson; seeds medium size, acute; dots few, indistinct; skin thin, tough; flesh dull white, crisp, tender, melting, juicy; core small, open; flavour briskly sub-acid, pleasant, McIntosh like; quality good; season September and October. Does not resemble McIntosh much in outward appearance, but is much like it in flesh and flavour.

Ramona (*Shiawassee Beauty seedling*).—Originated in the orchards of the Horticultural Division, Ottawa. Seed sown autumn of 1898. Tree planted in orchard in spring of 1903. First fruit, 1908. Size medium to above medium; form oblate; cavity deep, open, slightly russeted; stem short, stout; basin open, medium, wrinkled; calyx closed; colour pale yellow, washed and splashed with carmine on sunny side; dots obscure; skin moderately thick, tender; flesh white, fine grained, tender, juicy; core medium to small; flavour sub-acid, pleasant; quality good; season late August to mid-September.

Rocket (*Northern Spy seedling*).—Originated in the orchards of the Horticultural Division, Experimental Farm, Ottawa. Seed sown autumn of 1898. Tree planted in orchard in spring of 1902. First fruit, 1910. Size above medium to medium; form roundish conical; cavity deep, medium width, russeted; stem short, moderately stout; basin deep, narrow slightly wrinkled; calyx partly open; colour yellow washed and splashed with crimson; predominant colour crimson; seeds medium size, acute; dots moderately numerous, yellow, distinct; bloom pinkish; skin thick, moderately tough; flesh yellowish, crisp, tender, juicy; core medium to small, open; flavour sub-acid, pleasant, sprightly; quality good; season late October to January. Looks much like Spy, and is much like Spy in flesh, flavour and perfume.

Rupert (*Seed from Russia*).—Originated in the orchards of the Horticultural Division, Central Experimental Farm, Ottawa. Seed sown, 1889. Tree planted, 1890. Fruited first, 1897. Above medium in size, oblate; cavity medium depth and width, russeted; stem short, stout; basin medium depth and width, wrinkled; calyx closed; pale greenish yellow, sometimes with a faint pink blush; dots numerous, green, indistinct; skin thick, tough; flesh white, juicy, tender; core medium; pleasant flavour, briskly sub-acid almost acid; quality above medium to good; season early August. As early or earlier than Tetofsky and much better in quality. Better in quality than Yellow Transparent. Inclined to water core.

Thurso (*Northern Spy seedling*).—Originated in the orchards of the Horticultural Division, Experimental Farm, Ottawa. Seed sown autumn of 1898. Tree planted in orchard in spring of 1901. First fruit, 1909. Size medium to above medium; form roundish to oblate, slightly angular; cavity medium depth and width, sometimes russeted; stem medium length, slender to moderately stout; basin medium depth and width to deep, nearly smooth; calyx closed or partly open; colour pale greenish yellow washed and splashed with attractive red or crimson; dots few, small, pale, indistinct; seeds below medium, acute; skin moderately thick, tough; flesh yellowish, with traces of red, firm, crisp, juicy; core above medium, open; flavour sub-acid, sprightly, pleasant; quality good; season late September and October or later. An apple, looking, smelling and tasting somewhat like a Spy.

DESCRIPTIONS OF SOME OF THE HARDIEST AND BEST HYBRID APPLES OR CRAB APPLES ORIGINATED BY THE LATE DR. WM. SAUNDERS.

(The descriptions were made by the originator and appeared in Bulletin 68, "Progress in the Breeding of Apples for the Canadian Northwest," by Wm. Saunders, March, 1911.)

Charles (*P. baccata* with Tetofsky).—Tree, a very upright and strong grower, with large leathery leaves, and a medium bearer. Fruit, size, 1·6 inches across and 1·5 inches deep; nearly round, slightly ribbed. Calyx, persistent. Stem, rather long. Colour, yellow. Flesh, yellowish, solid, crisp, juicy, with a pleasant flavour, mildly acid and slightly astringent. Season, early in September.

Columbia (*P. baccata* with Broad Green).—Tree, a very strong grower and a fair bearer. Fruit, size, 1·8 inches across and 1·6 inches deep; nearly conical, distinctly ribbed. Calyx protruding and persistent. Stem, of medium length. Colour, red, with stripes and dots of a deeper shade. Flesh, yellowish, lightly streaked with red, juicy, subacid, with a pleasant flavour; slightly astringent. Quality, fair to good. Season, late September and October. Thus far free from blight.

Elsa (*P. baccata* with Yellow Transparent).—Tree, a strong grower and a heavy bearer. Fruit, size, 1·4 inches across and 1·3 inches deep; nearly round, slightly ribbed. Calyx persistent on a slightly raised eminence, ribbed. Stem, about one inch long, slender but strong. Colour, bright yellow. Flesh, fine-grained, tender, juicy, rather acid, but of pleasant flavour. Quality good. Season, latter part of August and early in September. Thus far free from blight.

Eve (*P. baccata* with Simbirsk No. 9).—Tree, a rather slow grower and a fair bearer. Fruit, size, 1⅝ inches across and 1⅛ inches deep; ribbed. Calyx, prominent, without basin, persistent. Colour, bright red, brightest and deepest on the sunny side. Stem, ¾ to 1 inch long. Flesh, yellowish, fairly juicy, of pleasant flavour. Quality, good. Season, September. Thus far free from blight.

Jewel (*P. baccata* with Yellow Transparent).—Tree, a strong grower and a heavy bearer. Fruit, size, 1·4 inches across and 1·3 inches deep; nearly round. Calyx, persistent. Stem, about 1½ inches long. Colour, yellowish, with a pale red cheek; very pretty. Flesh, moderately firm, crisp, juicy, of good flavour, subacid, with very little astringency. Quality, good, one of the best. Season, last week in August to middle of September. Thus far quite free from blight.

Norman (*P. baccata* with McIntosh Red).—Tree, a fair grower and a good bearer. Fruit, size, 1⅝ inches across and the same in depth; round. Colour, bright red. Flesh, yellowish-white, crisp, juicy, with a sprightly, pleasant flavour and a slight trace of astringency. Quality good. Season, October. Has been slightly affected by blight.

Pioneer (*P. baccata* with Tetofsky).—Tree, a strong grower and a heavy bearer. Fruit, size, 1½ inches across and 1·3 inches deep; nearly round, sligly ribbed. Calyx, persistent. Stem, rather long. Colour, yellow, with a pink cheek. Flesh, white, fine-grained, firm, crisp, subacid, slightly astringent, moderately juicy, with a pleasant flavour. Season, latter part of September and October. Has been considerably affected by blight during the last two or three years.

Prince (*P. baccata* with Tetofsky).—Tree, a strong and upright grower and very productive. Fruit 1·6 inches across and 1·3 inches deep; nearly round. Calyx drops in many of the specimens. Stem, 1 to 1½ inches in length. Colour, bright red, of a deeper shade on the side exposed to the sun, with a few paler dots and streaks. Flesh, nearly white, juicy, subacid, somewhat astringent; astringency lessens as the fruit ripens. Of a pleasant flavour. Ripe early in Septemher. Has proven quite liable to blight and on this account cannot be recommended.

Robin (*P. baccata* with Simbrisk No. 9).—Tree, a good grower and a medium bearer. Fruit, size 1·5 inches across and 1·4 inches deep; nearly round, strongly ribbed. Calyx, large, persistent and projecting. Stem, about one inch long. Colour, yellow and red. Flesh, very firm, juicy, subacid, with a slight astringency and a pleasant flavour. Quality, good, one of the best. Season, latter part of August to end of September. Thus far has been free from blight.

Silvia (*P. baccata* with Yellow Transparent).—Tree a strong and upright grower and a fair bearer. Fruit, size, 1·4 inches across and 1·5 inches deep; form somewhat pointed and ribbed. Calyx, persistent. Stem, ½ to ¾ inch long. Colour pale yellow. Flesh of pleasant flavour, subacid, no astringency. Quality, good. Ripe, August 9th or 10th, but does not keep long; one of the earliest to ripen of the cross-bred apples which have yet fruited. Has, thus far, not shown any tendency to blight.

Tony (*P. baccata* with McMahon White).—Tree, a strong and spreading grower and a heavy bearer. Fruit, size 1·6 inches across and 1·4 inches deep; form round, somewhat flattened. Calyx, persistent. Stem, about 1·8 inches long. Colour, greenish-yellow, streaked and splashed with bright red and with many yellowish dots. Flesh, yellowish-white, juicy, sprightly, subacid, slightly astringent.

DESCRIPTIONS OF SOME OF THE BEST SECOND CROSSES ORIGINATED BY THE LATE DR. WM. SAUNDERS.

(Descriptions made by W. T. Macoun, and published in the Annual Report of the Dominion Experimental Farms for the year ending March 31, 1913.)

Angus (Dean x Ontario).—Fruit below medium to medium in size, 2 by 2¼ inches; form roundish, slightly ribbed; cavity narrow, medium depth; stem long, slender; basin open, medium depth, wrinkled; calyx partly open; colour yellow washed with pinkish red; predominant colour pinkish red; seeds medium size for an apple acute, dots few, small, white, distinct; skin thin, tender; flesh, yellow, crisp, breaking, moderately juicy, core medium; flavour, briskly subacid; quality above medium; season October to middle November. *General Notes:* No marked resemblance to Ontario. Of good size. Flesh, skin and stem, crab-like; seeds apple-size.

Elkhorn (Jewel x Gideon).—Fruit large for a crab, small as an apple, 1¾ by 2¼ inches; form oblate to roundish; cavity open, medium depth; stem long, slender; basin open, wrinkled; calyx closed; colour yellow, well washed with crimson, predominant colour crimson seeds small for an apple, acute; dots obscure; skin thin tender; flesh yellowish, crisp, breaking, juicy; core, above medium; flavour acid, pleasant; quality above medium; season late September and October. *General Notes:* This should make a good late crab apple for any part of Canada. No resemblance to Gideon. All marked characters are crab-like.

Gretna (Pioneer x Northern Spy).—Fruit large for a crab, small for an apple, 2 by 2¼ inches; form oblate; cavity deep, open; stem medium to long, stout to moderately stout; basin open, medium depth, wrinkled; calyx open; colour yellow, washed and splashed with crimson, predominant colour crimson; seed below medium for an apple, large for a crab, acute; dots few, white, distinct; skin moderately thick, tender; flesh yellowish, crisp, breaking, juicy; core medium; flavour briskly sub-acid, pleasant, sprightly; quality good; season November to January. *General Notes:* Resembles Northern Spy considerably in colour, flesh and flavour. Promising.

Martin (Pioneer x Ontario).—Fruit below medium, 2¼ by 2⅜ inches; form roundish; cavity narrow, medium depth, russeted; stem medium length, slender; basin medium depth and width to shallow almost smooth; calyx open; colour pale yellow washed with pinkish red; predominant colour pinkish red; seeds medium for an apple, acuminate; dots obscure; skin moderately thick, tender; flesh yellow, crisp, tender,

juicy; core medium size, open; flavour sub-acid, pleasant; quality good; season October to mid-December.

Ruth (*Pyrus prunifolia* x Pewaukee).—Fruit small for an apple, but as large as Martha crab apple, 1⅝ by 1¾ inches to 1⅞ by 1⅞ inches; form roundish conical; cavity open, medium depth; stem long, slender; basin deep, medium width, wrinkled; calyx open; colour yellow well covered with deep crimson; predominant colour deep crimson; dots moderately numerous, white, distinct; skin, thin, tender; flesh yellow, stained with red, tender, juicy; core above medium; flavour subacid, pleasant, no astringency; quality good; season October to November.

Trail (Northern Queen x Rideau).—Fruit large for a crab, a little larger than Martha; form oblate, almost roundish; cavity medium depth and width; stem very long, slender; basin open, deep, nearly smooth; calyx closed; colour pale yellow splashed and washed with orange red and crimson; predominant colour orange red; thin, tender; flesh yellowish, crisp, breaking; core medium; flavour sub-acid, sprightly, very pleasant; quality good to very good; season late August.

Wapella (Dean x Ontario).—Fruit below medium for an apple, very large for a crab 2¼ by 2¼ inches; form roundish to oblong, ribbed; cavity medium depth and width; stem medium length, slender to moderately stout; basin open, deep, wrinkled; calyx partly open, or closed; colour yellow washed with red; predominant colour red; seeds medium size for an apple, obtuse; dots very few, indistinct; bloom pinkish, thin; skin moderately thick, moderately tender; flavour briskly subacid, pleasant; core medium; flesh yellowish with traces of red, crisp, breaking, juicy; quality above medium; season November to midwinter.

HARDY WINTER VARIETIES OF APPLES.

The search for hardy productive varieties of winter apples with fruit of high colour and good quality for the Northwestern states, the north, central and eastern portions of the province of Ontario, throughout the province of Quebec, and over a large part of the province of New Brunswick still goes on and a number of persons are now trying to obtain such varieties by cross-breeding and the growing of seedlings in large numbers. What is desired is a variety or varieties which will compare favourably with the best winter apples produced where the climate is milder. Why have the desired varieties not yet been found and will they ever been found are questions worth asking and answering if possible.

Of the 734 named varieties of apples which have been tested at Ottawa it has been found that a far larger proportion of those which originated in the Eastern and Southwestern States are tenderer than those which originated in the Northeastern and Northwestern States and in Canada. The same may be said of Europe. The hardy varieties from Great Britain, France and Germany are few compared with those from the colder parts of Russia. It may be safely stated that the hardiest apples are those which have originated in Russia. They are the hardiest survivors of the hundreds of thousands of varieties which have originated in Russia during the past centuries and have shown their ability to withstand the winters there as far north as latitude 55°, or further, in a continental climate. In America, and especially in the colder parts of the country, the origination of varieties has been more recent and it may be some time before such hardy large apples as Hibernal, Charlamoff, and Duchess will be originated on this continent, although some quite hardy varieties have already been obtained.

By again analysing the list of varieties tested, we find that the season of all the hardiest varieties is summer or autumn. The winter of 1903-4 was a very severe one in the province of Ontario, and in the orchards at the Central Experimental Farm 164 varieties were winter killed. An analysis of these varieties, a list of which was published in the annual report for 1904, shows that 130 of these were early winter and winter varieties, and 34 summer and autumn. We believe that this is sufficient

evidence to prove that summer and autumn varieties are hardier than later keeping sorts.

Let us now consider the difference between a summer and a winter apple.

A summer apple is one which is ready for use in the summer; a winter apple is one which is not ready for use until winter. The season of the first is much shorter than the second, mainly, we believe, because it reaches maturity in a hotter time of the year than the others. Duchess and Wealthy apples will keep much longer in Prince Edward Island, where the climate is cooler and development slower, than they will at Ottawa. Winter apples will also keep better there than they will in those parts of Ontario where they succeed.

It has been frequently observed that apples which mature early and are in condition for eating in summer and autumn are grown on trees which ripen their wood early, and on the other hand an apple which is not ready for use until winter is usually grown on a tree which does not ripen its wood early. A fact which many have observed and which we believe is perfectly natural. The fruit of most varieties of winter apples has to be kept on the trees at Ottawa until there is danger of severe frost, in order to get the apples sufficiently mature that the flavour will develop and that there will be a fair colour. The wood of such trees is also equally slow in arriving at that stage of ripeness which will enable it to withstand the winter, as has been proven by the figures given above.

Some winter apples are hardier than others, but from our experience with a large number of varieties we are forced to conclude that unless the fruit of a variety reaches a certain stage of development or maturity every season a certain time before it has to be picked, owing to danger from severe frost, that variety is not a safe one to plant. What that stage of maturity is we cannot at present definitely say.

In brief, then, we believe that it is a physiological impossibility for the majority of winter apples which have yet been produced to prove hardy in the colder apple districts of Canada because the trees having originated where the season is longer, grow too late for our short season. Must we then conclude that the origination of a hardy winter apple for the north, of good colour, and the best dessert quality, is an impossibility? We believe not. Apples which will keep nearly all winter when grown in some districts are autumn apples elsewhere. Some of the hardy varieties of Russian apples which have been introduced are found to be much earlier in season in America than they are in Russia. We believe that the growing and ripening season in two countries, or districts, while about the same length of time, may vary sufficiently to cause a marked difference in the season of a variety. As an example, take again Prince Edward Isand, where there is a late spring, but where severe frost does not come until late, as compared with the colder parts of Ontario, where the spring is early, but where fall frosts are early also. In order, then, to get an apple most suited to a district or climate and to get it of the season required, it must be originated in that climate. The work of originating apples has been comparatively recent in the colder parts of Eastern Canada and in the Northwestern States, and by far the largest majority of seedling apples of merit which have been produced are summer or autumn kinds. This we think is due to two principal causes. In the first place, because most of the seedlings have been raised from summer or autumn varieties, these being the hardiest, and we should naturally expect that most of such seedlings would be of the same season as their parents. In the second place, and on the other hand, seedlings have been raised from the best late keeping varieties, but which are not hardy enough to stand a test winter, and the seedlings from such trees have not, as a rule, proven hardy. We do not believe that because seedlings are raised in a climate with a short season that the largest proportion of them will prove early apples regardless of their ancestry. We believe that in most cases in the past the ancestry of the seedling varieties originated in the North has not been favourable to the production of hardy winter varieties. The importance of ancestry in the origination of

a hardy winter apple is well illustrated, we think, in a number of cross-bred apples which have fruited at the Central Experimental Farm. Of a cross between Scott Winter male and McMahan female, made by Prof. John Craig, when horticulturist, 23 trees fruited. Both of these varieties are hardy at Ottawa. None of these are earlier in season than McMahan and 11 of them are later keeping apples. Practically all of them have some visible resemblance to the parents and some are very similar to both parents. All withstood the test winter of 1903-4.

On the other hand, trees of crosses between Lawver and McIntosh and vice versa are, on the whole, tenderer than McIntosh, the Lawver having proved tender at Ottawa, while the McIntosh is hardy.

It is believed that the basis for the production of the desired winter apple for the north should be a variety or varieties which have withstood test winters in the north and are also the latest keepers of such varieties.

It has been already said that late keeping varieties mean late ripening of wood, hence tender trees, but most of the late keeping hardy varieties that have already been originated in the north are of a different class. They are varieties which, although they mature or are fit for use early in the winter, keep all winter with good care. The fact that they are fit for use early means that the wood has ripened comparatively early, and hence is able to withstand the cold. Pomologists are well aware that certain varieties of fruits which are ready for use at the same time as other varieties will keep much longer. It is to this class that the desired winter apple for the north will belong.

The following winter varieties originated in the north stood the test winter of 1903-4 at Ottawa and are just such apples as have been described.

Canada Baldwin, originated in the province of Quebec.
Winter Rose, originated in Dundas County, Ont.
Calumet, originated on Calumet Island, in the Ottawa river.
Baxter, originated near Brockville, Ont.
La Victoire, originated in the province of Quebec.
Stone, originated in Vermont.
Scott Winter, originated in Vermont.
Milwaukee, originated in Wisconsin.

Other promising unnamed late keeping seedlings obtained from the colder parts of Canada and the United States are growing at Ottawa. None of the varieties above mentioned have all the desired points, but with the many promising winter varieties originated at the Experimental Farm, Ottawa, we consider the outlook very bright for obtaining a hardy, productive, long keeping variety of good colour and best dessert quality for the north.

RUSSIAN APPLES.

When the Russian apples were first introduced into Canada it was thought that some of them would prove to be the solution of the winter apple problem in the colder parts of the Dominion where apples were being grown. Most of the varieties, and a large number have been imported, have proved to be of inferior quality, and almost all of them summer or autumn varieties, in this country. There are, however, a few of them which are very valuable, and, being hardier than most varieties of American origin, are useful to those who live near the extreme limits of successful apple culture. As far north as Ottawa, however, which is about latitude 45°, many apples of American origin succeed well, and these are, in most cases, preferable to the Russian. North of latitude 45° the Russian apples increase in value the further north they are grown. The Yellow Transparent and Duchess apples are exceptions to almost all the others, these being standard varieties in nearly all parts of Canada where apple trees are grown.

A large number of Russian apples have now been tested for twenty-seven years at the Central Experimental Farm. In the year 1888 there were planted in the orchards 133 supposed varieties. Since that time others have been added at intervals, and, notwithstanding those which have been winter-killed, there are now about 160 varieties, though some of these may be synonyms, as a number of synonyms have been discovered.

A few of the trees planted in 1888 fruited in 1890. The trees did well and made vigorous growth up to the year 1892, when blight appeared in the orchard and did considerable injury, and in 1893 the disease appeared earlier in the season and made great ravages among the trees. This left the orchard in a very bad condition. Some trees had died altogether others were reduced to stumps, and again others which had large diseased limbs sawn off had lost their symmetry. The trees were not so much affected in 1894 and 1895, but owing to the severity of the winter of 1895-6 a large number were root-killed. Further injury from root-killing occurred during the winter 1896-7. During the past eighteen years there has not been much blight, most of the trees have made good growth, and many of those which were formerly badly affected by blight have regained symmetrical proportions.

In 1915 an examination was made to learn which Russian apple trees were still in best condition in the orchards at the Central Experimental Farm. Trees of the following varieties planted between 1888 and 1895 were in good condition and are evidently among the hardiest of the Russian varieties, though a few of these are hardier than others as shown by those which have succeeded best in Manitoba. There are, no doubt, some of the following varieties which have not been thoroughly tested on the Canadian prairies yet but they are being propagated for further test. The names here given, and the synonyms in parentheses, under which they were obtained may not be the correct ones in all cases, but it is difficult to find the correct names of these Russian varieties, in many cases, as the confusion in Russian nomenclature in America is very great. It will be seen that some varieties have been received under a great many different names.

HARDIEST RUSSIAN APPLES AT OTTAWA.

Anis (Blue Anis, Kursk Anis, Golden Reinette, Orel No. 5, Simbirsk No. 4, Simbirsk No. 11.) Red and Yellow Anis though evidently nearly related are slightly different.

Anisim (Melonen).

Antonovka (Cinnamon, German Calville, Tiesenhausen, Yellow Arcad, 20 M.)

Beautiful Arcade (Arkad, Good Peasant, Herren, Osinnoe, and is known in Manitoba as Repka Kislaga).

Blushed Calville (White Transparent).

Bode.

Bogdanoff Glass (Bogdanoff Stekliankn, Grandmother, Red Queen, White Pigeon).

Borsdorf (Borsdorfer, Round Borsdorf).

Charlamoff (Arabka, Summer Arabka, Pointed Pipka, Throne, Broad Cheek, Rosy Voronesh, Saccharine, 135 M).

Duchess of Oldenburg (Borovinka.) The variety grown as Anisette in Manitoba is very similar to Duchess.

Dvinnoe Solovieff.

Enormous.

Garden Sweet.

Golden White (Winter Stripe, Antonnm, Plikanoff, Ukraine, Schwartze Glas, Skrut Grell).

Green Sweet (Lebonkey Sweet).

Handsome White.

Hibernal (Romna, Romenskoe, Silken Leaf, Aport, Yellow Arcadia, Longfield 57 M, Reinette Kievskoe, Sultan).
Lapouchoe.
Leledka.
Lowland Raspberry (Lievland Raspberry, Livland Raspberry, Melonen).
Lubsk Queen.
Moscow Pear.
Orel.
Ostrukoff (Gluss)
Paperovka.
Plodovitka.
Repka Winter (Bogdanoff)
Rosy Repka (Repolovka, Miron, Sugar Miron)
Russian Preserve.
Simbirsk No. 1
Simbirsk No. 9.
Vargul (Marmalade, Lead of St. Petersburgh)
Vargulek.
White Russet.

The most promising varieties are recommended in the district lists and described elsewhere in this bulletin.

The following case for and against the Russian apples, which was published by Prof. F. A. Waugh, in Bulletin No. 61, of the Vermont Agricultural Experiment Station, so fully expresses our own opinion of them that it is endorsed, and herewith quoted:—

"For.

"They have given us several varieties of recognized value, like Oldenburg and Yellow Transparent.

"They promise to give us other useful varieties through gradual intercrossing with our common apples.

"They furnish hardy trunks on which more tender varieties may be grafted to advantage.

"The trees are very hardy.

"They are mostly free from disease (except blight)

"They usually bear early and abundantly.

"The fruit is often large and finely coloured.

"Their introduction has encouraged many persons to grow apples in regions where they would not otherwise have attempted it."

"Against.

"Very many of the varieties introduced are immensely worthless.

"Most of them ripen too early and will not keep. This is due to their introduction from a zone of shorter season to one of longer season.

"The fruit of many varieties drops badly before mature.

"The fruit is usually coarse grained and of poor quality.

"The skin is often very thin and tender, making the fruit liable to injury.

"Their nomenclature is so badly confused that no one can be sure of what he is handling.

"The young growth is extremely subject to fire blight."

EXHIBITING AND JUDGING APPLES.

During recent years more attention has been paid to the judging of fruit than formerly. Judges are much more numerous than they used to be and it seems very desirable that judges of fruit in Canada should have some standard from which to work. Owing to the judges of fruit at certain fairs being changed very frequently, in some cases almost every year, and each judge having a different standard for judging, exhibitors are at a loss to know what kind of fruit to send or how to pack it and, as a result, we believe that in many cases they are discouraged from exhibiting. One judge may place too much importance upon size, another upon colour, and too little on freedom from blemishes, while another may think little of the uniformity and trueness to type, all of which leads to great confusion. A beginning was made to improve these conditions in 1910 when a Committee of the Ontario Fruit Growers' Association of which the writer was chairman submitted a number of score cards in a pamphlet called "Standards for Judging Fruits" for the use of judges and exhibitors with explanations of the terms used. These score cards were adopted by most of the Provincial Fruit Growers' Associations in Canada and much good has, it is believed, been accomplished through them but a more general familiarity with these score cards and explanations of terms used is desirable, hence score cards are published in this bulletin where they will receive wide publicity. These score cards unless otherwise marked are those adopted in 1913 by the Society for Horticultural Science and are considered improvements over those in the pamphlet referred to. A few introductory words are, however, necessary.

A good judge must be familiar with many varieties, otherwise he is liable to cause much confusion, annoyance and injustice to exhibitors, and will soon lose any reputation he may have had as a good judge. A judge must be unprejudiced, otherwise at a small fair where he will probably know who grew the apples exhibited he is liable to do an injustice.

A good judge makes a quick but accurate decision.

The regulations in regard to the number of specimens required, size and kind of package, etc., should be plain.

Nomenclature should be correct. It will add much to the interest of an exhibit if the judge or exhibition committee arranges to put the names of the winners on cards so that the public can see them as soon as the awards are made.

Single Plates—

Form	15
Size	15
Colour	20
Uniformity	20
Freedom from blemish	30
	100
Quality when scored	25

Collection of Fruits With Specified Number of Plates.

Value of varieties for purpose stated	50
Condition of fruit (average of individual plate score)	50
	100

Largest and Best Collection.

Number of varieties	33⅓
Value of varieties for purpose stated	33⅓
Condition of fruit (average of individual plate score)	33⅓
	100

Alternative Score Card for Collections (Standards for Judging Fruit)—

Form	10
Size	10
Colour	15
Uniformity	10
Freedom from blemish	20
Quality	10
Commercial value	10
Nomenclature	5
Arrangement	5
Season	5
	100

Single Plates of Seedlings or "Any Other Variety" (Standards for Judging Fruit)—

Form	15
Size	15
Colour	20
Uniformity	10
Freedom from blemish	10
Quality and texture	25
Season	5
	100

For Barrels and Boxes of a Given Variety.

Box—		Barrel—	
Texture and flavour	100	Texture and flavour	100
Size and form	100	Size and form	100
Colour	150	Colour	150
Uniformity	150	Uniformity	150
Freedom from blemish	150	Freedom from blemish	150
Total	650	Total	650
Material	30	Staves	10
Marking	10	Hoops	10
Solidity (nailing, cleats, etc.)	10	Heads	10
		Nailing	20
Total	50	Marking	20
		Total	70
Bulge or swell	100	Facing	80
Alignment	20	Tailing	50
Height of ends	60	Pressing	70
Attractiveness and style	40	Packing	80
Compactness	80		
		Total	280
Total	300		

Explanation of Terms—Fruit.

Arrangement.—Taste and skill in staging so as to attract attention and add to the general appearance of the exhibit.

Colour.—Bright, clear, well developed colour, characteristic of the variety.

Commercial value.—Standard, known market varieties, as grown in and suited to the district, preferred.

Form.—In all cases, except seedlings, refers to the normal type or shape of the variety, but in case of seedlings it refers to the shape as desired in a commercial variety. A roundish apple is of the most desirable shape, and oblate and oblong apples least desirable.

Freedom from Blemish. Any injury by insects, fungi, bruises, loss of stem, or other cause, lessening the value or appearance of the Exhibit shall be called a blemish.

Nomenclature.—Exhibits must be correctly named according to the nomenclature adopted by the Society, Association or Exhibition at which they are shown. The use of the standard nomenclature adopted by the American Pomological Society is recommended to such bodies.

Polishing.—Fruit on exhibition should have as much of the natural bloom as possible, but it has become the practice to rub off the bloom to heighten the colour. As long as this practice continues the person who does not rub off the bloom is at a disadvantage hence, unless there are rules prohibiting rubbing, it will be better to do it.

Quality and Texture.—To be considered in collections, seedlings, new varieties on trial, or other sorts in competition.

Season.—In collections it is desirable to have as long a season as possible represented by the varieties shown. Varieties past condition shown for the purpose of lengthening the season will not, however, score as high as apples in condition though of later season.

Size.—While size in some cases indicates care and skill in production, it is not usually found with the highest colour and with freedom from blemishes; and as large size is not as important as high colour and freedom from blemishes, the largest fruit should not take the first prize unless it is equal to or better in other respects than those in competition with it.

Uniformity.—Specimens should be as nearly alike in size, form and colour as possible.

EXPLANATION OF TERMS—PACKING AND PACKAGES.

Alignment.—Alignment refers to the rows of fruit in the box, the straighter and more regular the rows the better is the alignment.

Attractiveness and Style of Pack.—When the box is opened the fruit should look attractive. The skill and good taste of the packer is shown in the appearance of the fruit and the style of the pack. There are many styles of pack, but the one should be used which lends itself best to the variety and size of fruit packed. The diagonal 3-2 pack is a very popular one. The fruit should be as nearly alike in size and colour as possible. The box also should be clean and attractive looking.

Bulge.—A bulge or swell in the top row of fruit is necessary in order to ensure the fruit carrying well. Before the top is put on there should be a bulge of 1¼ inches in the centre of the top row and the fruit should be ¼ of an inch above the top of the box at the ends and sides. When the cover is on there should be a bulge of ¼ of an inch at the centre, at both top and bottom.

Compactness.—This may also be expressed by the term firmness and compactness. The more solid the pack the better the fruit will carry.

Facing.—When facing a barrel, or when beginning to pack a barrel, the apples for the first row should be put carefully in with the stem end down, the stems having been first cut off so that they will not injure the fruit when pressed. If slightly smaller apples are used in the outside rows and larger ones in the centre it improves the appearance of the face. A second row is now put in in the same manner as the first, and these apples should be arranged so that they will show through the spaces between those in the first row. These two rows constitute the face of the barrel. The fruit used for the face should fairly represent the fruit throughout the barrel, but the apples in these two rows should present as attractive an appearance as possible. The law in regard to facing, as defined in the Inspection and Sales Act, is as follows: "No person shall sell or offer, expose, or have in his possession for sale any fruit packed

in any package in which the faced or shown surface gives a false representation of the contents of such package, and it shall be considered a false representation when more than fifteen per centum of such fruit is substantially smaller in size than, or inferior in grade to, or different in variety from, the faced or shown surface of such package." Apples in barrels for exhibition should be packed as required by law.

Marking.—The marking of barrels and boxes should be distinct and attractive. It should comply with the regulations of the Inspection and Sales Act, which call for the initials of the Christian names of the packer, his surname, and his address; the name of the variety of fruit, and the designation of the grade, whether it be "Fancy," "No. 1," "No. 2," or "No. 3." Such mark may be accompanied by any other designation of grade or brand if that designation or brand is not inconsistent with, or marked more conspicuously than, the one of the said four marks which is used on the said package. Bright coloured brands or marks are now being used, sometimes of paper.

Materials for Barrels.—The standard barrel must be large enough to contain at least 96 quarts of fruit. Smaller barrels should not be exhibited. The barrel in general use in Ontario has staves 30 inches in length. In Nova Scotia the staves are 28½ to 29½ inches long. The dimensions called for in a standard barrel of minimum size are: Between heads, 26½ inches wide, inside measurement; head diameter, 17 inches, inside measurement; middle diameter, 18½ inches, inside measurement. The barrel generally used in Ontario is 27½ inches between the heads, 17 inches in diameter at the head, and with a middle diameter at the bilge of 19½ inches. A good barrel should have sixteen staves with 9/16 jointing, cut five to two inches and averaging four inches in width at the bilge, and be free from large knots or shakes. The head should not be less than half an inch in thickness, dressed clean and sound. The hoops should be about 1¾ inches in width and from 7/16 to 5/16 inches in thickness and eight in number. The barrel should be new and clean.

Material for boxes.—The box should be made of material strong enough to withstand handling in transportation. The heads, or end pieces, should be each of one piece of wood and not less than ¾ of an inch thick nor more than ⅞ inch. The sides also should be each of one piece and not less than ⅜ of an inch thick. The top and bottom boards may be of one or two pieces, preferably two, but not more than ¼ of an inch in thickness. They must be thin so that they will bend readily when the box is closed. There should be two cleats each for the top and bottom. Dove-tailed boxes are not desirable. The standard box must be used. This is 10 inches deep, 11 inches wide, and 20 inches long, inside measurement.

Pressing.—Apples are often over-pressed. If the barrel is racked well there need not be much pressing. The proportion of fruit that is injured by pressing will be evident when the barrel is opened. The less fruit that has been injured by pressing the better the barrel has been packed, provided, always, that the pressing given has been sufficient to give the required firmness. Barrels loosely packed frequently show more injury to the fruit through shaking than barrels over-pressed.

Racking.—All barrels of apples should be racked when being packed, so that the fruit will settle, and the packer thus be able to tail his barrel so that the fruit will carry well. When the barrel is opened the fulness or slackness will indicate how well the fruit has been racked. Over-pressed fruit is usually found where apples have not been racked well.

Solidity (Nailing, Cleats, etc.)—By solidity is meant the handling, lining, cleating, and marking of the box or barrel. The heads of the barrel should fit snugly into the chine. For barrels, six rosined 1¼-inch nails in each head are usually sufficient. One inch nails for the quarter hoops are large enough. They should be carefully driven through the barrel into the head. Liners should be used on the head for greater strength. The cleats should be put neatly on the box and four rosined nails driven skilfully through them and through the top or bottom into the ends of the box. The sides of the boxes should be nailed with four nails at each end of each side of the box.

The nails used for boxes are those known as fourpenny. Lining paper improves the appearance of unwrapped apples in boxes.

Tailing.—By tailing is meant the putting and placing of the last fruit into the barrel. All that is necessary in good tailing is to have the surface as level as possible with the stem end down when the apples are pressed. The apples should come up to the chine but not appreciably above it as if much above it too much fruit will be bruised when the head is pressed in. The care in tailing will be known when the barrel is open by the manner in which the fruit has been bruised when pressing.

SUGGESTED IDEAL SIZE OF APPLES FOR EXHIBITION.

As a member of a Committee of the Society for Horticultural Science the writer obtained the opinions of a number of fruit growers' in Canada as to the ideal sizes of apples for exhibition and following are the sizes which were most favoured and which were published in the S. H. S. report for 1914. It may be that it will be desirable to change some of these, but in the meantime they should prove helpful:

For Ontario, along Lake Ontario and Districts West and South—

Variety.	Inches. Diameter.
Alexander	1
Baldwin	2¾
Ben Davis	2¾
Blenheim	3¼
Fallawater	3¼
Fameuse	2½
Golden Russet	2½
Gravenstein	2¾
Hubbardston	2¾
Mann	2½
McIntosh	2½
Northern Spy	3¼
Oldenburg	3
Ontario	3½
Red Astrachan	2¾
Ribston	2¾
Rhode Island Greening	3
Stark	3
Tolman	2½
Tompkins King	3½
Wagener	2¾
Wealthy	2¾
Wolf River	1
Yellow Transparent	2¾

Eastern Ontario, Quebec, New Brunswick, Northern Nova Scotia, Prince Edward Island—

Variety.	Inches. Diameter.
Alexander	4
Baxter	3½
Bethel	2¾
Ben Davis	2¾
Canada Baldwin	2¾
Crimson Beauty	2½
Dudley	3
Fameuse	2½
McIntosh	2¾
Milwaukee	3
New Brunswick	3
Oldenburg	3
Pewaukee	3
Red Astrachan	2½
Scarlet Pippin	2¾
Scott Winter	2½
St. Lawrence	3
Wolf River	4
Wealthy	2¾
Yellow Bellflower (Bishop Pippin)	3
Yellow Transparent	2½

For Nova Scotia, Annapolis and Adjacent Valleys—

Variety.	Inches. Diameter.
Alexander	4
Baldwin	3
Ben Davis	3¼
Blenheim	3½
Cox Orange Pippin	2½
Crimson Beauty	2¼
Fallawater	3¼
Gravenstein	3
Golden Russet (American)	2¾
Hubbardston	3
Mann	3
Northern Spy	3¼
Oldenburg	3
Ontario	3½
R. I. Greening	3¼
Roxbury Russet (Nonpareil)	3¼
Red Astrachan	3
Ribston	3
Stark	3
Tolman	3
Tompkins King	
Wagener	
Wellington	3
Wealthy	3
Yellow Bellflower (Bishop Pippin)	3

For British Columbia—

Variety.	Inches. Diameter.
Cox Orange Pippin	3
Oldenburg	3
Esopus	3½
Gravenstein	3½
Grimes	3¼
Jonathan	3
King David	3¼
McIntosh	3½
Northern Spy	3¼
Rome Beauty	3
Red Astrachan	3¼
Tompkins King	3¾
Wagener	3¼
Wealthy	3¼
Winesap	3
Winter Banana	3½
Yellow Transparent	3
Yellow Newtown	3