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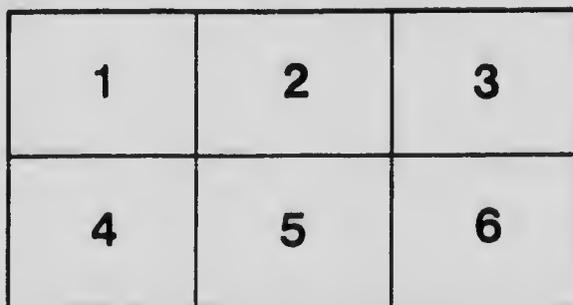
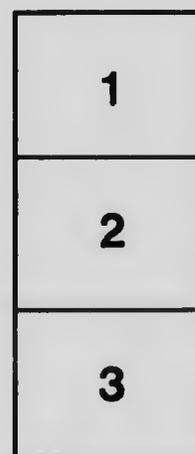
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THE STRAWBERRY AND ITS
CULTIVATION IN
CANADA

BY W. T. MACOUN
Dominion Horticulturist

WITH SECTIONS ON
INSECTS AFFECTING THE STRAWBERRY
By the Entomological Branch

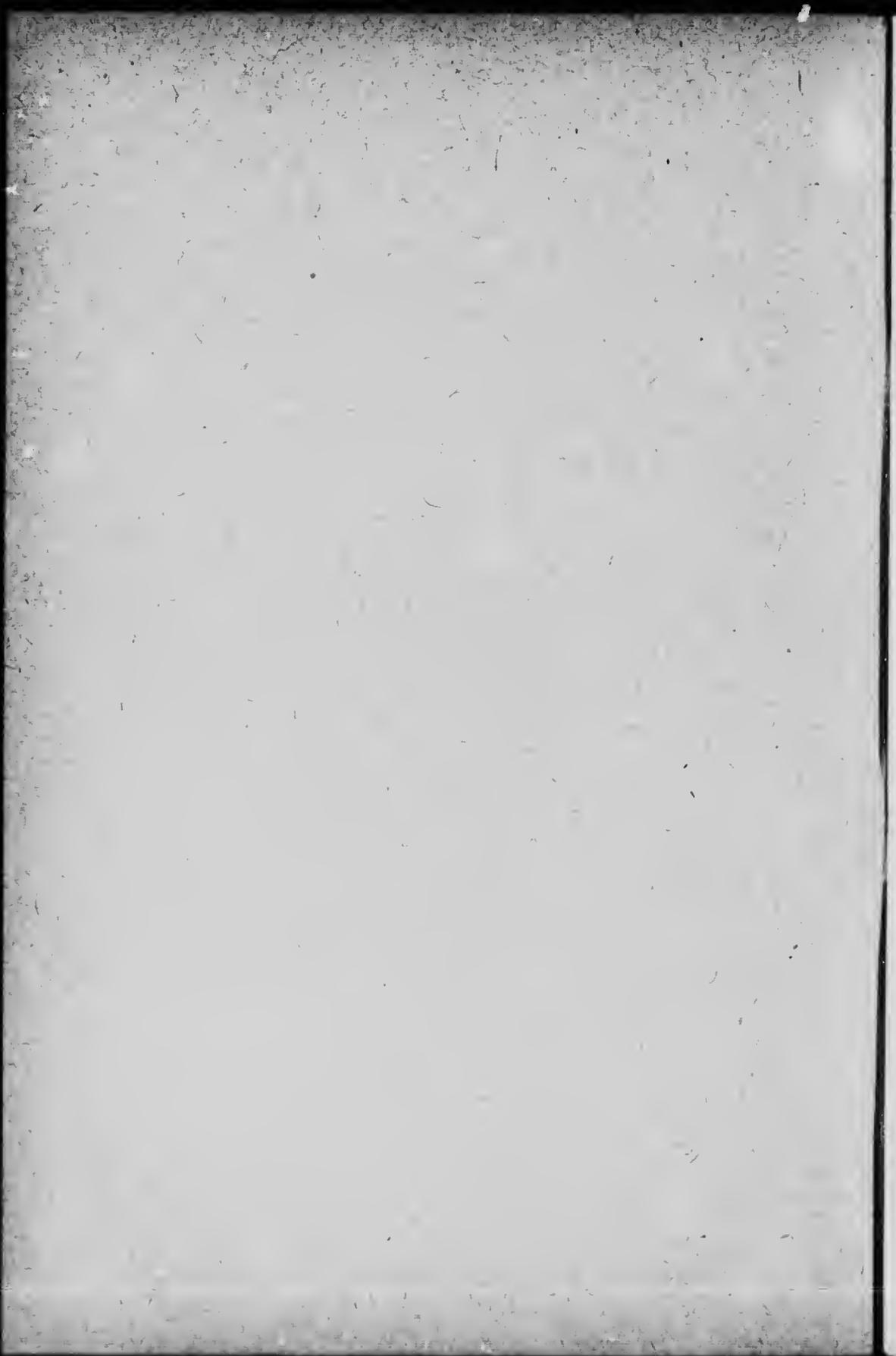
AND
COMMON STRAWBERRY DISEASES

BY W. A. McCUBBIN
Officer in Charge, Field Laboratory of Plant Pathology, St. Catharines, Ont.

BULLETIN 92

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1 by authority of the Hon. T. A. Crerar, Minister of Agriculture, Ottawa, Ont.



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DIVISION OF HORTICULTURE

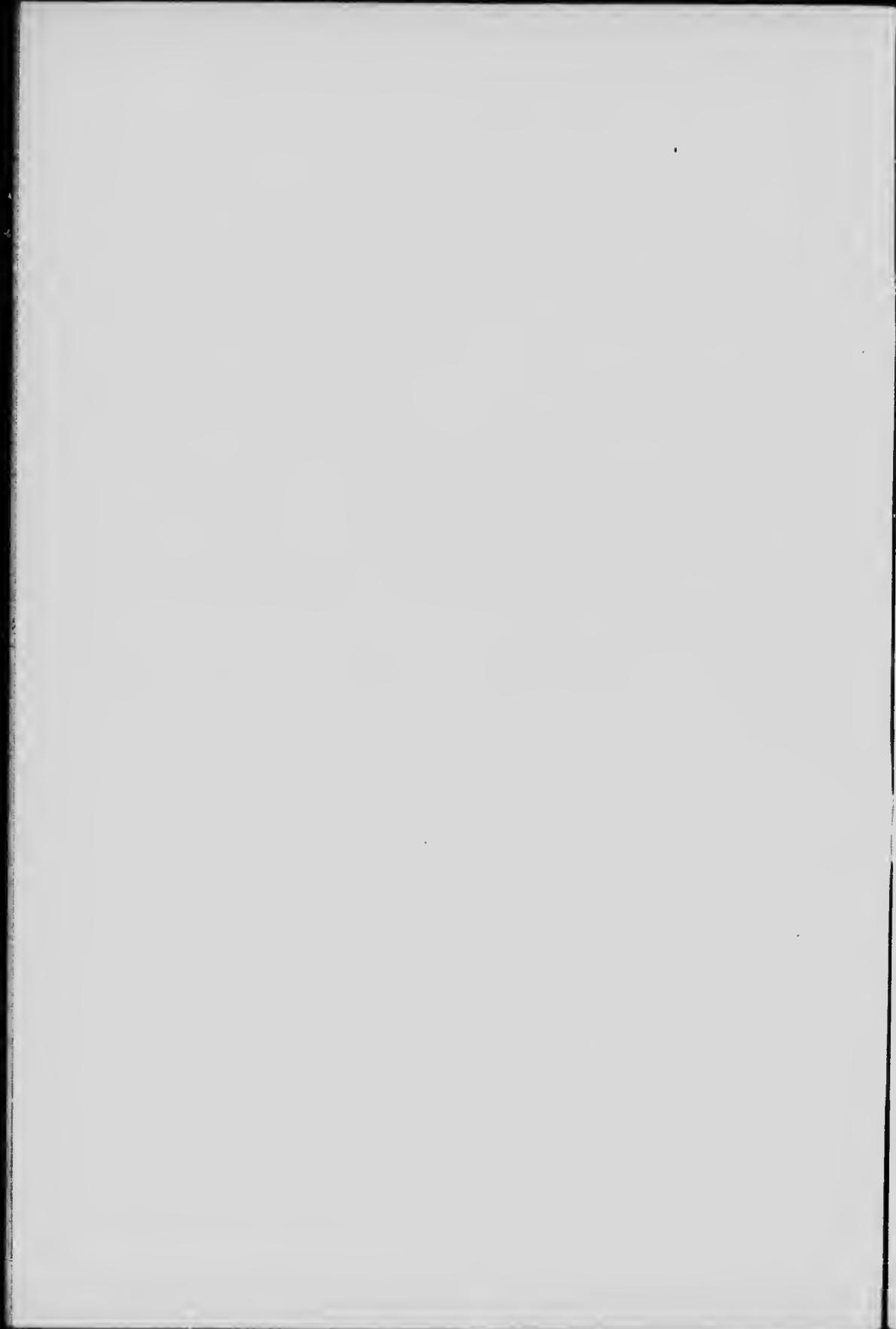
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BY W. J. G. WATSON
Officer in Charge, Field Laboratory, Pathologist, St. Catharines, Ont.

BULLETIN 92



OTTAWA, ONT.,

FEBRUARY 10, 1919.

The Honourable,
The Minister of Agriculture,
Ottawa.

SIR,—I beg to submit herewith for your approval, Bulletin No. 92, of the Experimental Farms Regular Series, entitled "The Strawberry and its Cultivation in Canada," which has been prepared by the Dominion Horticulturist, Mr. W. T. Macoun.

This bulletin is a revise of our former bulletin No. 62, on "Strawberry Culture", which was issued in 1909, and is now out of print.

The fact that the edition of the former bulletin has been so rapidly exhausted is the best indication of the widespread and sustained demand for information on the growing of this fruit.

To add to the completeness of this bulletin, sections on "Insects Affecting the Strawberry" and "Common Strawberry Diseases", prepared by the Entomological Branch and by Mr. W. A. McCubbin of the Division of Botany, respectively, have been incorporated.

I would recommend that a large edition of this bulletin be issued.

I have the honour to be, sir,

Your obedient servant,

J. H. GRISDALE,

Director, Dominion Experimental Farms.

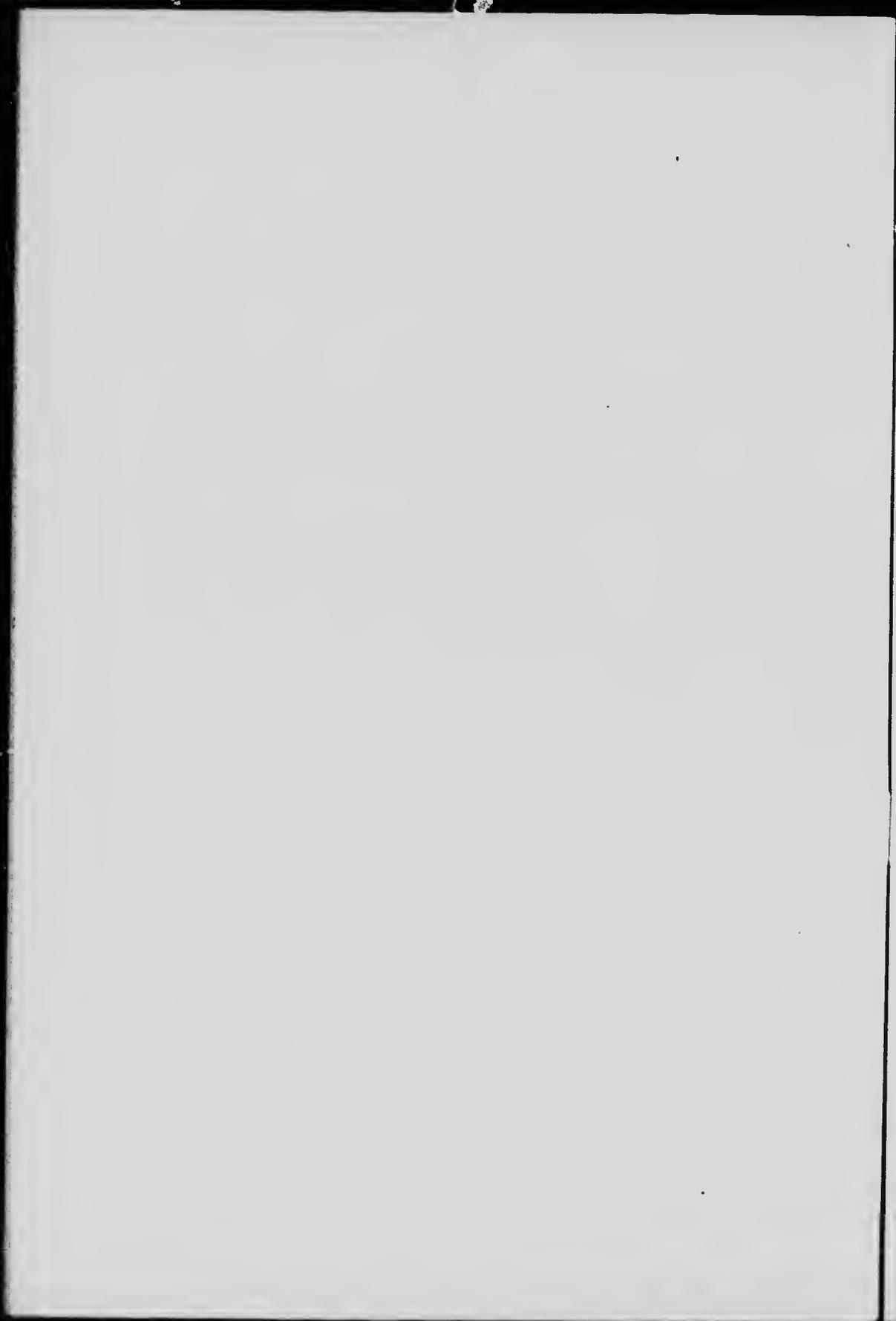


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THE STRAWBERRY AND ITS CULTIVATION IN CANADA

By W. T. MACCOWS, *Dominion Horticulturist.*

The demand for information on the growing of strawberries is greater than for any other fruit. This demand has been met by the Experimental Farms in the past by the publication of three bulletins, No. 5 in 1889, No. 27 in 1897, and No. 62 in 1909. In addition to these bulletins, information has been published in practically every annual report of the Experimental Farms for the past thirty years, and by means of papers and circulars. Nearly every one who has a garden, however, is interested in strawberries, as there are few who do not like them, and for the area occupied and the capital invested they give better returns than most fruits. Each year, also, there are many persons in Canada beginning to make gardens, or beginning to grow strawberries for profit; thus, because of the many applications for copies, even large editions of a publication become exhausted. Hence, it has become necessary to publish another bulletin on the strawberry in which the directions for the planting and care of this fruit are brought up-to-date, and in which the results of experiments in testing varieties at Ottawa and the branch Farms and Stations and by private individuals are given. There will be found in this bulletin, also, details in regard to the cost of growing strawberries, which have been furnished by growers in different parts of Canada, and which will prove a guide to prospective planters.

The strawberry is found wild in Canada from the Atlantic to the Pacific ocean, and from the southern boundary as far north as the 64th parallel, and large quantities of the wild fruits are gathered. The cultivated varieties are grown successfully almost everywhere where the wild ones are found, but in some districts they require protection or irrigation. The season for ripe fruit begins early in June in southern Ontario and in parts of British Columbia. At Ottawa the first ripe fruit has been obtained on June 17, and the last picking of the latest variety on July 19, for the varieties which usually bear only one crop in the season, but fruit is obtained from the everbearing sorts until late in October, unless the frosts are very severe. The season in the more southern parts of the province of Quebec is somewhat similar to that at Ottawa, except along the lower St. Lawrence, where it is much later, the fruit not being ripe until about the first week of July, and the season continuing until the second week of August. The season in Nova Scotia and Prince Edward Island extends into August also. In some parts of the Prairie Provinces also the season is not over until August. The later the spring and the cooler the summer, the later the strawberry ripens, as a rule.

SOIL AND ITS PREPARATION.

The site for the strawberry plantation should be chosen, if possible, where snow will lie in winter, unless planting is done in a part of Canada where there is little or no snow. A good covering of snow usually ensures a good crop of fruit where the winters are cold. If there is a choice of sites in parts of Canada where injury from spring frosts is likely to occur, low ground or pockets where there is not good air drainage should be avoided, as the crop is often much reduced by spring frosts. One of the most important requisites in a soil for strawberries is thorough drainage, as, where water lies on or near the surface, the plants are sure to suffer either in summer or winter. A sheet of ice over the plantation often causes the death of the plants. While too much moisture is bad, too little moisture is unfavourable to the development of fruit, hence a soil should be retentive of moisture, while not saturated with it. In some parts of Canada there is frequently a spell of hot, dry weather during the

fruiting season, and if the soil becomes dry, the strawberries will suffer badly, and what had promised to be a good crop may become a very poor one. Warm soils such as sandy loams will produce early fruit, but friable clay loam will usually produce the best crops. Much, however, depends on the richness of the soil, as strawberries need an abundance of available plant food to give the best results.

Soil which will grow good crops of roots will usually grow good strawberries. A soil should be chosen if possible which does not bake naturally, or which by thorough tillage may be brought into such good condition that it will not bake. It is difficult to keep the plantation free from weeds where there is a soil which bakes, and it is also hard to conserve moisture in such soil in a dry time.

Soil should be chosen, if possible, where there was a crop of roots the previous year for which the land had been heavily manured. After the roots, or other crops, have been removed in the autumn, it is a good plan with rather stiff soils to stir the soil deeply with the subsoil plough, following rather shallow ploughing, as deep stirring of the soil is desirable; but if ploughing deeply with the ordinary plough will not bring the subsoil to the surface, deep ploughing will be sufficient. Clover sod ploughed in the autumn is also good as the clover furnishes nitrogen, but grass sod land should be avoided as there is great danger of injury from white grub, if such land is used.

In the spring the soil should be brought into good tilth with the harrows, and in some cases it may be desirable to plough in spring. It is important, however, not to have the soil very loose at planting time as it is liable either to dry out, or settle, both unfavourable to the establishment of strawberry plants. An even surface to the soil is desirable so that the plants may be set at the proper depth, and a light rolling of the land before planting will insure this evenness and the necessary firmness near the surface to give best results.

FERTILIZERS.

The best fertilizer for strawberries is well rotted barnyard manure, which should be used in large quantities. There need be little fear of using too much, thirty tons of well rotted manure to the acre being a fair application, though good crops will be obtained with less manure if the soil is good. The manure may be applied in the autumn or winter, or early in the spring before planting, and thoroughly incorporated with the soil. Fresh manure is not as satisfactory as manure well rotted, for it may make the soil too loose, causing it to dry out and make the conditions unfavourable for newly-set plants. On heavy soils, fresh manure may be used with better results than on lighter soils, but as there are likely to be many weeds grow if green manure is used, rotted manure is preferable even on heavier soils. If fresh manure is used it will have become more thoroughly mixed with the soil by planting time if it is applied the previous autumn. Wood ashes are very useful for a top dressing, and from 50 to 100 bushels per acre may be applied broadcast early in the spring when the land is being harrowed. An application of even twenty-five bushels should give beneficial results. If barnyard manure cannot be obtained easily, nitrogen and humus may be added to the soil by ploughing under clover, peas, vetch or some other leguminous crop; potash, by using from 200 to 300 pounds of muriate of potash, if wood ashes cannot be obtained; phosphoric acid, by the use of ground bone at the rate of from 200 to 300 or more pounds per acre before planting. Nitrate of soda is also useful for furnishing nitrogen, although it can be obtained in a cheaper form by the use of barnyard manure or leguminous crops. An application of 100 to 150 pounds nitrate of soda per acre broadcast just before the flowers open is sometimes desirable if the plants are not making vigorous growth, but the important time for the plants to have available plant food is when they are making their crowns in the previous year, as the application of a fertilizer in the spring of the fruiting year is not likely to increase the number of berries produced, but to increase the size of the berries. Much nitrogen may cause the berries to be too soft.

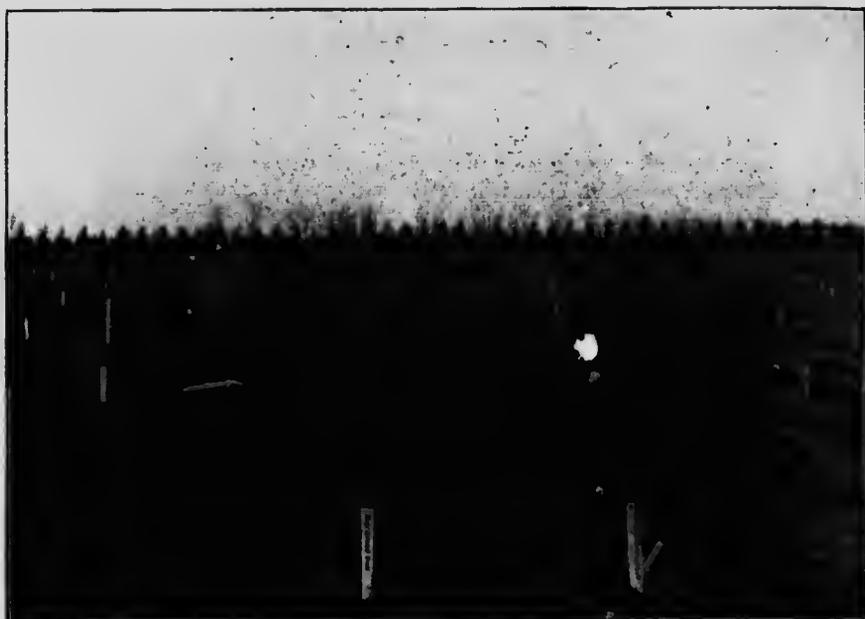


Photo by Frank T. Shutt.
Strawberry Plantation, Central Experimental Farm, Ottawa.
Mulched for winter.



Photo by Frank T. Shutt.
Strawberry Plantation, Central Experimental Farm, Ottawa.
Blooming Season.

PLANTS AND THEIR TREATMENT.

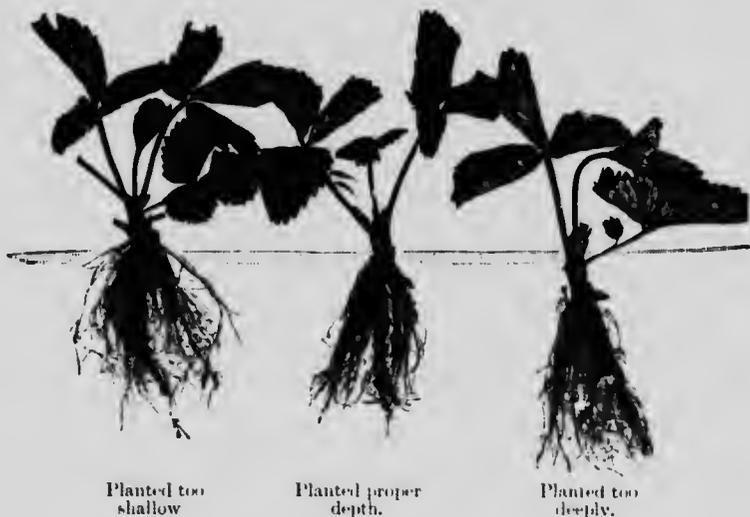
If the plants are obtained from a distance it is desirable to order more than are actually required, as there is usually considerable loss, and by heeling in the extra plants they can be used to fill vacancies as soon as it is known which plants are not going to grow. If, however, plants of the desired varieties can be obtained near home, they will, as a rule, be found much more satisfactory because most of them are likely to grow. Plants should be ordered to arrive as early in the spring as possible after the soil can be worked, and planted soon after their arrival. It is often, however, not convenient to plant at once; but, in any case, the parcel containing the plants should be opened up when it arrives, otherwise they are liable to heat or dry out, either one of which conditions should be avoided if possible. Roots which are in good condition are of a light or yellowish colour, while those which have heated are dark and it is a waste of time setting out plants with such roots. The plants when not planted at once should be heeled in where water will not lie. A trench is opened sufficiently deep to cover the roots well and so that the crown will be just above ground. The plants should be placed close together, but in a single row in the trench. Another trench is now opened parallel with the first and about six inches from it, using the soil to cover the roots of the plants in the first trench. The soil should be firmly tramped or packed against the roots so that the soil will not dry out. If loosely heeled in they are very likely to dry out and the plants die. It will help to keep the plants alive if they are partially shaded and watered, if the soil seems dry. By the time the soil is ready for planting these heeled-in plants may have made new roots and be in better condition for planting than if they had been set out at once. The number of plants required for an acre if set out 18 inches apart, in rows 3½ feet apart, is about 8,300, and to provide for loss in shipment at least 8,500 should be ordered. If a free-plant maker like Senator Dunlap is planted, the plants need not be less than two feet apart, and 6,500 plants should be sufficient to order.

The best plants for autumn planting are what are known as pot plants. These are obtained by sinking two and a half-inch pots to the rim in the ground several weeks before the plants are to be rooted, the pots being filled with rich friable soil and sunk from six to eight inches from the original plant. As soon as the new runners reach the pots they are placed over the soil and soon root and make good plants by late summer. The advantage they have over plants rooted in the ordinary way is that when they are transplanted, they are taken from the pot and replanted with a ball of earth without disturbing the roots. Hence they are but little checked and will soon go on growing again, making strong plants which will bear more fruit than those rooted in the ordinary way.

Before planting it is a good plan to remove all the developed leaves of the plants except about two of the healthiest ones. This prevents too rapid transpiration of moisture from the plant before it becomes established, and may often save it when dry weather sets in immediately after planting. Long and straggling roots may also be cut off at this time, the removal of about one-third of the roots being a good practice. When possible, one's own plants should be used, as they are much more likely to live than those procured from a distance as the former can be dug and planted within a few hours, while still fresh. The best plants to use are the strongest of those which have been made the previous year. Plants which have already fruited should not be used as they are much more difficult to transplant, and their vitality has been weakened by the production of runners. It is a good practice, if it can be managed, to grow plants for setting in a special propagating bed, the old plants in which, not being allowed to fruit, make stronger runners and plants than do the fruiting ones. Furthermore the extra attention to the cultivation of the soil and to the placing of the runners in such a bed will insure good plants.

PLANTING.

While successful planting may be done either in the spring or autumn, early in the spring is, as a rule, the more satisfactory time, as, if the plants are set then when the soil is in good condition and cool and moist, they will make rapid growth and many runners during the summer, if properly cared for, and produce a full crop of fruit the following season. If planted in the autumn there will, as a rule, be very little fruit the following season, and unless the season is very favourable, and the soil moist when the plants are set, many may die if planted in the autumn, unless pot plants are used. Where, however, one has his own plants they may be set out at a favourable time in the autumn, and plants which die can be replaced in the spring. In this way a perfect stand can be secured before it is too late in the spring.



The most satisfactory way for the average person to grow strawberries is in what is known as the matted row. The plants are set eighteen or more inches apart in rows three and one-half to four feet apart. The varieties which make a large number of runners such as Warfield, Senator Dunlap and Splendid, need not be planted so closely as those which make fewer runners, such as Glen Mary, Sample, Parson Beauty and Williams. If the plants are set early in the spring and have a long season for growth, the plants of varieties which make a large number of runners may be planted at least twenty-four inches apart in the rows, thus admitting of cultivation both ways for a time, thereby reducing the number of weeds, ensuring a better growth, and reducing the number of strawberry plants which become very thick if the original plants are set close. As soon as the distances have been decided upon, the rows may be marked with a marker and then again cross-marked so that the plants may be set where the lines intersect. Long rows are desirable, as, with them, time will be saved in cultivation. Planting may be done with a spade or with a trowel or dibble, and some growers stake off rows one way from $3\frac{1}{2}$ to 4 feet apart, and with a light plough make a shallow furrow and then set the plants about 18 inches apart along the sharp edge of the furrow drawing the soil about the plant and firming it well with the hand. When planted with a spade two persons are required to do the work, usually a man and a boy. The man takes the spade and opens the hole by forcing the spade into the ground, pressing it forward and backward. As soon as it is withdrawn, the boy places a plant in position and the man presses the soil firmly against it with his foot. This method is very rapid and if the

soil is well pressed against the plant, is quite successful. A surer method of obtaining a stand is by using a trowel or dibble for opening the hole, whereby the plant is more likely to be set the proper depth, and more care usually exercised in spreading the roots and firming the soil about the plants. By this method the same person opens the hole and sets the plant. Great care should be taken to have the crown of the plant just at the surface of the ground after it has been pressed in when planted. If the plant is set too high the roots and crown will dry out, and if too low will be smothered. Care should be taken when planting to spread the roots against the side of the hole. Planting machines are used by some growers, and give good satisfaction when the work is well done, the soil in very good condition, and the season favourable. When the soil is not in good condition and not well levelled, the plants are sometimes set at different depths and the stand is not good. When planting, the plants should be carried in wet sacking or in a pail with water in it, as the roots must not be allowed to become dry. The surface soil should be left loose after planting to check evaporation of moisture.

CULTIVATION.

As the value of the crop will depend largely on the strength of the runners, and new plants which are formed in the early part of the summer, it is very important to encourage rapid growth from the outset. From a dozen and a half to three dozen or more plants should come the first season from each plant set, and in moist seasons the number from each plant of some varieties may run into the hundreds.

Cultivation should begin as soon as possible after the plants are set, and the surface soil should be kept quite loose and free from weeds until the cultivator interferes with the runners. It is very important to reduce the weeds and grass to a minimum by cultivation, hoeing and hand-weeding, and by beginning early much trouble will be avoided later. The early cultivations should be deep in order to loosen the soil in which the runners are to strike root later on. If, however, the soil is naturally very loose, all cultivations should be shallow, as it is important to have moisture come near to the surface to supply the young plants when they become rooted. The roots of the strawberry are shallow, which explains why this fruit suffers so much in a dry time, but as the roots go almost straight down, cultivation can be quite close to them without there being any injury to the roots, and this gives an opportunity of destroying most of the weeds in this way. Hoeing will be necessary in order to destroy weeds that the cultivator does not kill. A wheel hoe or hand cultivator will be found very useful in small plantations. All blossoms which appear during the first season should be picked off so as to conserve the strength of the plants for the production of runners.

FORMING THE MATTED ROW.

As before stated, the best way to grow strawberries for general cultivation is in the matted row. By this method labour is economized, and the results, while sometimes not as good as where special methods are adopted, are obtained with the least expense and the greatest profit. Where a special market is to be entered for, and when desired for home use, strawberries may be grown by other methods which will result in larger and finer fruit.

While many who grow strawberries in the matted row do not take the trouble to place the runners as they form, but let them root without assistance, it pays to place them, as the sooner they take root the stronger the plants will be by autumn, and more fruit will be produced the next season. All that it is necessary to do is to place the runners so that they will be as nearly as possible uniformly distributed in order to economize space, and to put a little soil over them to hold them in place but leaving the terminal buds bare. In the Prairie Provinces where winds prevent the prompt rooting of runners, it is important to hold them in place, until they root, with pieces of sod, stones, an inverted crotch, or by any other suitable method. To get the best results, runners should not be nearer than from four to six inches apart, preferably six inches, all others being destroyed; but in practice it is often difficult to accomplish this and to restrict them to this area, as some varieties make a great many runners.

These are, however, the kinds which have the most need of thinning, as when the plants are very thick the fruit is too small. The width of the row formed by autumn will depend on the number of runners which are made, but if planted early and properly cared for, most varieties will make a row two feet or more wide. At this width there would be a path eighteen inches wide left for the pickers between the rows. As some varieties would cover the whole space between the rows with runners in one season, it is necessary to remove those not wanted with the cultivator or hoe.

The so-called single hedge and double hedge row systems are merely modifications of the matted row. The runners, instead of being allowed to form indiscriminately, are most of them removed and the rest placed where it is desired for them to grow. In the single hedge row system, two to four runners are left on, and these are placed in line with the row on each side of the parent plant.

When grown in this way the rows are two and one-half to three feet apart and the original plants about two feet or more apart in the rows. When the row is formed, the plants are six to eight inches apart in a single row.

In the double row system, six runners are left to each plant in the row and two on each side of the original row, all about equal distances apart. Trained in this way the original rows should be about three feet apart and the plants two feet or more in the row.

The twin hedge row system provides for two rows sixteen to eighteen inches apart with the plants at first about two feet apart in the row, with a wider space of two feet for a path and for cultivation between each pair of rows. The hedge row system requires considerably more labour than the matted row, but the returns will often well pay the grower for the extra amount of work. By this method the plants get more opportunity to develop strong crowns, better cultivation can be given and more of the plant food in the soil will be available, resulting in larger and better fruit.

HILL SYSTEM.

Large berries may be obtained by growing the plants by what is known as the "Hill System." The plants are set from twelve to fifteen inches apart, in rows two to two and one-half feet apart, or, where growth is very strong, eighteen inches apart, in rows thirty-six inches apart; the blossoms are pinched off the first season as in the other system, and no runners are allowed to form. By this method a very strong crown is developed; the plants, having more room, become vigorous and as a result the fruit is large, and sometimes as good crops are obtained as from the matted row.

However, winter injury is much more likely to occur when plants are grown individually, and if plants grown in hills die from heaving or from some other form of winter-killing they leave large blanks, causing a great lessening of the crops. Unless kept well cultivated or well mulched in summer, plants suffer more in a dry time in hills than in the matted row, where the crowns are better protected by foliage. If the plants are kept well mulched, very fine fruit is produced when strawberries are grown in hills, which sometimes makes this method preferable when growing strawberries for home use. In the milder parts of British Columbia, especially where there is a dry summer, without irrigation water available, the hill system is used as the ground can be kept cultivated and moisture conserved.

WINTER PROTECTION.

After permanent frost has set in and the ground is quite solid, the plants should be covered with a light coat of clean straw, that which will not pack closely over the plants being the best, marsh hay being very good and free from weed seeds. Green manure is sometimes used, but as this usually contains many weed seeds, it is not recommended and sometimes may smother the plants. This mulch will prevent the alternate thawing and freezing of the ground in the spring and protect the plants if there is not much snow in winter. It prevents heaving also which often causes much loss on heavy soils. A heavy mulch may cause heating in the spring before it is

removed, and as a light mulch of two or three inches is sufficient, more should not be used. The amount required is from 3 to 3½ tons per acre. It has occasionally been recommended to grow something between the rows of strawberries during the latter part of summer, which could be used to hold the snow in winter, but this is not a desirable method as, while growing, it exhausts the moisture from the soil at the expense of the strawberry plants. In those parts of Canada where the flowers are frequently injured by spring frosts it is desirable to hold them back as long as possible, and for this purpose, after the first heavy fall of snow, the snow is covered with straw or evergreen boughs, which are left on as long as possible in the spring. While plants will often come through the winter without protection it is best not to take any risks. After the frosty weather of early spring is over and before the plants begin to grow, they should be uncovered and the straw put between the rows to keep the fruit clean. If the soil is one which bakes or dries out easily, it is a good plan to remove the mulch, cultivate, and put it back between the rows when conditions will be better for conserving moisture. As soon as the fruit has been picked, the straw should be removed altogether, the plantation ploughed up, or, if left for another season, it should be weeded and the surface soil loosened with the cultivator so that the new runners will have a chance to root.

RENEWING THE PLANTATION.

The most satisfactory results are obtained when only one full crop is gathered from a plantation. If, for instance, plants are set this spring, the plantation should be ploughed up after the fruiting season of next year. There will thus be a new plantation made every year. By this system, much better fruit is obtained as the plants are not so thick in the row and the soil can be kept free of weeds. Where the white grub is troublesome, it is important to renew the plantation every year, as this pest increases rapidly in old plantations and sometimes almost ruins the crop. It is quite possible to obtain two good crops or even more from a plantation by careful management, but the older the plantation the less the crop will be and the smaller the fruit as a rule. In the Maritime Provinces where the summer is relatively cool and moist, plantations are left longer than in the drier and warmer parts of Canada.

RENOVATING AN OLD BED.

While, as a rule, the most profitable method of growing strawberries is to take only one crop from a plantation, and at the most two crops, it is sometimes not practicable to renew small plantations after the second crop.

Under such circumstances there are several ways in which the bed may be improved. Usually an old bed is grown up with grass and weeds and crowded with strawberry plants, and to improve the bed these must be reduced as much as possible. As soon as the fruit is off, the leaves and grass should be mown off and burned. The burning should be done when there is a strong wind so that the fire will pass over the plantation quickly. One plan is to plough or dig down the middle of the row, then thoroughly cultivate or rake. Another method is to narrow the row on each side to a width of 8 to 12 inches, turning the sod towards the row. Still a third plan is to plough lengthwise through the centre of the row, then cross-plough. It is necessary in following any of these methods to level the soil afterwards with the harrow, cultivator or hoe. Usually the work is finished with the hoe by cutting out all surplus plants and bringing the soil about those remaining, which will give them better conditions for making roots. It should be remembered, when renovating the bed, that it is not necessary to leave many plants. Plants left sixteen to twenty inches apart should make a good row by August. Those left should be the youngest and strongest. It is a good plan, when renewing, to work in some short, rotted manure to improve the soil.

IRRIGATION.

During the fruiting season the strawberry needs a large supply of moisture to give maximum crops. In some seasons, owing to dry weather, the crop is reduced very much, the season is shortened and the profits are small. If, under those condi-

tions, there were available a supplementary supply of water which could be used for irrigating, a marked improvement in the crop would be ensured in many cases. At Ottawa, increases in crop of from 10 per cent to over 50 per cent have been obtained by overhead irrigation, although in the same season earlier ripening varieties showed little or no increase. At Macdonald College, Que., the results have been somewhat similar to those obtained at Ottawa.

VARIETIES.

It occasionally happens that a person who has a variety of strawberry which yields much better with him than other varieties which he has growing alongside, concludes to discard all other kinds and grow that one variety. He does so, and is disappointed to find that he has very few berries, and these ill-shaped and worthless. He does not know what to think about it, but writes to the Experimental Farm to learn what is the matter. The reply is sent back: "Are you aware that the flowers of strawberries may be perfect or imperfect or bisexual and pistillate; in other words, do you know that some varieties of strawberries produce blossoms which have both male and female organs, while other varieties have only female organs? If you do not, the solution of your difficulty is very easy."



Imperfect Flower.



Perfect Flower.

The male and female organs in plants perform the same functions as in animals. The fine dust formed on the stamens, which is shed when the flower is in bloom, is the fertilizing agent, which falls on the pistil and fertilization takes place. If the stamens are absent, or nearly all absent, as is the case in imperfect or pistillate flowers, no fruit, or very little fruit, is formed. If a perfect, staminate or bisexual flowering variety, and an imperfect flowering variety, are growing in close proximity, the flowers on both will be fertilized as insects and the wind carry the pollen or dust from the perfect to the imperfect flowers. It very often happens that the imperfect flowering varieties produce the best crops when properly pollinated, and this experience may lead fruit growers who are ignorant of the foregoing fact to make the mistake of planting only one variety, which may be imperfect. While most flowers may be classed as either perfect or imperfect there are gradations between. Occasionally a staminate variety is as imperfect as a pistillate or more imperfect as it will not set fruit under any conditions.

A row of a perfect flowering sort should be planted to about every two or three rows of an imperfect variety for good results. The proportion will depend on the amount of pollen produced by the perfect sort. Of course, it is not necessary to plant an imperfect variety at all, as there are plenty of good sorts which have perfect flowers. It is essential to have the perfect and imperfect varieties in full bloom at the same time, as if the former bloomed before the latter there would be no object in planting it as a pollinator.

Owing to the ease with which a new variety of strawberry is originated, and the short time it takes to fruit the same, the number of new sorts each year in America is very large. Only a small proportion of those which are produced are better than, or even equal to, the best which are already on the market, but often the originator is not the most competent person to judge the relative value of his seedling, and as a result many sorts are offered for sale each year. It is the work of the Experimental Farms to test these new varieties as they appear, and having compared them with standard sorts, publish, when deemed advisable, a reliable description of them and the yield obtained. During the past thirty years 757 named varieties have been tested at the Central Experimental Farm. Of this number only a very few are still under test of those grown during the first two years. This does not mean that nearly all the varieties tested at first have deteriorated, but that better kinds introduced since have taken their places. In 1918 there were 170 varieties under test.

VARIETIES OF STRAWBERRIES SUCCEEDING BEST IN CANADA.

Although a very large number of varieties of strawberries are offered for sale by nurserymen in Canada and the United States, there are but a few main sorts which are grown by the commercial strawberry growers of Canada. In addition to these there are a few others especially suitable for the home garden. Soil, temperature and moisture vary much in the different parts of Canada, and as some varieties require richer, and some moister soil than others, and as some are much hardier than others, varieties which succeed best in one part of Canada may not do so well in another. Even in a certain district it is desirable for a grower to test several varieties in order to determine which succeeds best under his particular conditions.

In the following lists the varieties are given in order of popularity as far as it was possible to determine it by conversation and by correspondence with growers in different parts of Canada.

MARITIME PROVINCES.

Commercial.—Senator Dunlap (per.), Splendid (per.), Glen Mary (per.), Sample (imp.), Warfield (imp.), Wm. Belt (per.).

Domestic.—Senator Dunlap (per.), Bubach (imp.), Wm. Belt (per.). Other varieties succeeding well at Experimental Stations in Maritime Provinces—Valeria (per.), Bisel (imp.), Haverland (imp.), Cordelia (per.), Portia (imp.), Mariana (per.), Clyde (per.), Howard 17 (per.), Beder Wood (per.), Williams (per.).

QUEBEC.

Commercial.—Senator Dunlap (per.), Parson (per.), Splendid (per.), Beder Wood (per.), Sample (imp.), Pocumoke (per.), Warfield (imp.).

Domestic.—Senator Dunlap (per.), Bubach (imp.), Wm. Belt (per.). Other varieties succeeding well at Experimental Stations in Quebec—Valeria (per.), Portia (imp.), Glen Mary (per.), Cassandra (per.), Unele Jim (per.), Excelsior (per.), Nettie (imp.), Lovett (per.), Buster (imp.), Clyde (per.), Bisel (imp.).

ONTARIO.

Commercial.—Parson (per.), Glen Mary (per.), Williams (per.), Senator Dunlap (per.), Beder Wood (per.), Splendid (per.), Howard 17 (per.), Sample (imp.), Enhance (per.). Other sorts mentioned are Ozark (per.), Charles I (per.), King Edward (per.), Arnout (per.), Chesapeake (per.), Governor Fort (per.).

Domestic.—Senator Dunlap (per.), Parson (per.), Bubach (imp.), Wm. Belt (per.). Other varieties succeeding well at Experimental Farm, Ottawa, Lavinia (per.), Cassandra (per.), Mariana (per.), Bisel (imp.), Hermia (per.), Valeria (per.), Warfield (imp.), Portia (imp.), Greenville (imp.). Other promising new sorts are McAlpine (per.), Minnesota No. 3 (per.), J. H. Cook (per.), Early Jersey (Giant) (per.), Early Corneille (per.).

PRAIRIE PROVINCES.

Senator Dunlap (per.), Dakota (per.), Beder Wood (per.), Haverland (imp.), Warfield (imp.), Tennessee Prolific (per.).

BRITISH COLUMBIA.

Commercial.—Magoon (per.), Senator Dunlap (per.), Marshall (per.), Paxton (per.).

Domestic.—Royal Sovereign (per.), Marshall (per.), Triomphe de Ghent (per.).

Other varieties succeeding well at Experimental Stations in British Columbia—Glen Mary (per.), Clark Seedling (per.), Heritage (per.), Brandywine (per.), Sharpless (per.), Warfield (imp.), Cordelia (per.), Cassandra (per.), Virgilia (imp.), Valeria (per.).

HARDEST VARIETIES.

There have been some severe winters experienced at the Central Experimental Farm during the past thirty years, which have made it possible to learn which varieties are the hardiest. The injury to flowers from frost in the spring is often considerable as strawberry flowers are very sensitive to the cold, hence it is important in some districts to know which have the hardiest flower-buds. Among the hardiest varieties it has been found that the hardiness of the plant is usually correlated with hardiness of flowers, although the late blossoming sorts are less likely to suffer than the early ones. Following are some varieties which have proven hardiest: Beder Wood, Lovett, Senator Dunlap, Pocomoke, Creseent, Dakota. The last variety has proved the hardiest on the prairies.

ENGLISH VARIETIES.

Many English varieties of strawberries have been tested in Canada, but they have all proved too tender to be grown commercially, or even for home use, except in the mildest parts. The English sorts have been originated in a climate quite different from that in most parts of Canada, hence it is not a matter of great surprise that they are too tender. The best varieties of American origin have to withstand severe winters before they are recognized as valuable for general culture. In Great Britain and Ireland the plants are not subjected to such trying conditions and become popular for other reasons, hence when they are subjected to the frosts of winter and heat and dry weather of summer in Canada, they fail to succeed well. As a rule, English and European varieties make few runners and hence are not as well protected by their foliage for extremes of temperature in winter or in summer as the best American sorts. Of those which have been tested, the Champion of England, Noble and Albert appear the hardiest. The best English varieties are better in quality than the best American berries, but some of the most profitable kinds in England are not the best quality. The average variety there, however, is much sweeter and of higher flavour than those in Canada, but although the flavour is higher one misses the sprightliness in some varieties which is characteristic of Canadian strawberries. The Royal Sovereign is the most popular English variety in British Columbia. Others doing well in British Columbia are Paxton and Triomphe de Ghent. The Wm. Belt, Marshall, Brunette, and some others compare favourably in quality with the best English sorts, but unfortunately they are not the most productive.

CAUSES OF POORLY-SHAPED BERRIES.

There are two causes of poorly-shaped berries or nubbins. The commonest is unfavourable weather conditions. The flower and growing fruit are very susceptible to injury from cold winds or cold weather. Sometimes part of the berry is injured, while another part being, perhaps, more protected, escapes and develops normally. Another cause of poorly-shaped fruit is lack of pollination. The supply of pollen is either deficient in the fruit itself, or there has not been enough brought by wind and insects to pollinize all the stigmas of the berry. Bees do not work much in bad weather. Extremely dry, hot weather may injure the pollen. Rainy weather during the blossoming season

may cause much poorly-shaped fruit by preventing proper pollination. The remedy is to plant varieties with abundant pollen and mix these with any imperfect sorts which may be grown. Keeping the plants back as much as possible in the spring, by not removing the mulch early, will help to avoid injury from cold winds and frosts.

EVERBEARING STRAWBERRIES.

During the past twenty to twenty-five years, but particularly during the past six or eight years, there has been much interest shown in the so-called "everbearing" strawberries. These are varieties which continue to bloom and ripen fruit during the summer and autumn long after other kinds have stopped bearing. This everbearing habit is considered by some botanists to be due to the transformation of the runners of these varieties into flower-bearing stems, the everbearing sorts making few runners. The wild Wood strawberry and its variety, the Alpine, have long been known to fruit more or less all through the summer and autumn and for this reason, they and several cultivated varieties of them are often called the Strawberries of Four Seasons. These bear small fruit, hence they have little commercial value at present. In 1890, the Oregon Everbearing strawberry was exhibited at the Portland Exhibition and attracted much attention, being of good size. Whatever its everbearing habits may have been in Oregon, it proved very disappointing in this respect when brought to the Eastern and Middle States and to Canada. It was introduced into France about 1893 or 1894, and was highly thought of there for some time, as its everbearing habit was quite pronounced.

In 1893, the St. Joseph strawberry was introduced in France and its introduction marked a new epoch in the history of everbearing strawberries. This variety was the result of thirteen years' work by the Abbé Thivolet, Clanoes, France, who began in 1880 by crossing the Alpine strawberry with a large-fruited variety, the latter being the female parent. From this cross is supposed to have sprung the St. Joseph, through many generations and selections. In it there is no evidence of Alpine blood. While the St. Joseph strawberry was much larger than the Alpines, which up to its advent were the only cultivated strawberries which showed the everbearing habit regularly, they were small compared with some of the best large-fruited sorts. Seedlings were raised from the St. Joseph in France—the St. Antoine de Padoue, being one of the best of them. The Oregon Everbearing strawberry was planted at the Central Experimental Farm in 1895 and the St. Joseph in 1899, but neither of these varieties produced enough fruit after the regular strawberry season was over to make them worth cultivating.

The second American everbearing variety which attracted attention is the Pan American, which was shown at the Pan American Exhibition in Buffalo in 1900. The parent plant was discovered by Mr. Samuel Cooper, of New York state, in the autumn of 1898, in a field of the Bismarck variety, his attention being drawn to it on account of its having fruit in the autumn. From this variety, and through Mr. Cooper, several have been developed; among them are the Autumn, Productive, Superb, Peerless, Onward, Forward, and Advance; but none of these has so far become as popular as those which have been originated by Mr. Harlow Rockhill, Conrad, Iowa, who used as one of the parents the Louis Gauthier, one of the best of the European everbearing sorts. Some of his varieties are crosses between it and the Pan American, although the Progressive, which has done best at Ottawa, is a cross between the Senator Dunlap and the Pan American. Some of the best of Mr. Rockhill's introductions are Progressive, Americus, Francis, and Iowa.

The Minnesota Plant Breeding Station has done considerable work in breeding these everbearing varieties, and one of the best which has been introduced is the No. 1017.

The everbearing varieties differ from the ordinary sorts in that they usually continue blooming and bearing fruit from the time when the crop of the ordinary varieties are ripe until severe frosts in the autumn, although in the hot, dry weather of

midsummer they do not fruit much. Sometimes when there is a protracted drought in summer followed by warm, wet weather in the autumn, the ordinary sorts will bloom and fruit a second time, but this is unusual.

Most of the varieties of everbearing strawberries are poor plantmakers, and, on this account, the price of some of them has remained comparatively high. The Progressive and Americus, however, which are two of the best, make a fair number of runners. The fruit of these is medium in size, bright red in colour, attractive in appearance, and of good to very good quality, the Americus being very good. The Superb has larger fruit and is also a good variety.

While there is often a good crop of fruit during late summer and autumn of these everbearing varieties, it is doubtful if they will be grown very generally commercially, as there are so many other fruits at that season of the year; but those who desire to have ripe strawberries for home use until late autumn will find these everbearing sorts produce in most seasons a fairly good crop of delicious berries. These varieties succeed well in some seasons in the Prairie Provinces.

The plants are set out early in the spring like the ordinary varieties, and there will be a crop in the autumn of the same year. It will be better if the first flowers are removed. The removal of the first bloom is not, however, necessary to ensure an autumn crop after the plants are well established.

The yields of everbearing strawberries vary much with the season. If the autumn is dry the yield will not be nearly so great as if it is fairly wet. In one season the Progressive yielded on a small plot at the rate of 4,333 pounds per acre after July 22, when the regular strawberry season was over. In 1918, the Americus yielded at the rate of 4,796 pounds between August 16 and September 26. Other yields have been much smaller, sometimes not one-fourth of the above amounts. The everbearing varieties bear a fair crop in early summer if allowed to do so.

Following are descriptions of the four varieties which have done best at Ottawa and elsewhere. All of these should be tested by those desiring to grow the everbearing varieties to learn which succeeds best. Other varieties tested are Francis, Productive, Iowa, etc.

Americus (per.) (Pan-American x Louis Gauthier).—Orig. 1905, Harlow Roekhill, Conrad, Iowa; introduced 1911. Fruit roundish, somewhat flattened to sugar loaf shaped, medium in size, bright red, glossy, seeds prominent; flesh bright to rather pale red, tender, juicy, firm; briskly subacid, good flavour, good to very good quality; season early to late; plant vigorous; makes a few to a moderate number of runners; foliage medium. One of the best in quality.

Minnesota 1017 (per.) (Dunlap x Progressive). Orig. 1909, Charles Haralson, Minnesota Fruit Breeding Farm, Excelsior, Minn.; introduced about 1914. Fruit conical, medium in size, rather dull red, seeds prominent; flesh bright red, tender, juicy, firm; briskly subacid to acid; quality above medium; season early to late; plant vigorous, makes few runners; foliage, glossy, good. This is a productive variety, but it is not so attractive in appearance nor as good in quality as either Americus or Progressive.

Progressive (per.) (Pan-American x Dunlap).—Orig. 1908, Harlow Roekhill, Conrad, Iowa; introduced 1912. Fruit roundish, flattened to sugar loaf shaped, medium in size, deep red, glossy, seeds prominent; flesh bright red, tender, juicy, moderately firm; briskly subacid, pleasant flavour, good quality; season early to late; plant fairly vigorous, makes a moderate number of runners; foliage medium. This makes more runners than most of the everbearers, and as it is of attractive appearance and good in quality it is, perhaps, the best allround variety.

Superb (per.) (Autumn x Cooper x Sherman).—Orig. 1908, Samuel Cooper, Delevan, N.Y.; introduced 1911. Fruit roundish, medium to large, deep red, glossy; flesh deep red, firm; subacid; pleasant flavour; quality good to very good; season early to late; plant vigorous but makes few runners. This is larger than the other three varieties but has not proved so productive at Ottawa.

GROWING STRAWBERRIES FOR HOME USE.

There should be at least a small plantation of strawberries in every home garden large enough to grow fruits and vegetables. For the area of land occupied the returns from this delicious fruit compare very favourably with vegetable crops and strawberries are particularly appreciated when one can go to the garden and gather them fresh for the table. Moreover strawberries do particularly well in the average garden as the soil is usually rich and owing to the better protection strawberries have in the garden, they usually suffer less from winter than they do in the open fields. The directions for growing strawberries for market are in the main applicable when they are grown for home use. The ground is well manured and dug and brought into good condition for planting with the rake. Plants may either be set in single rows as recommended for field culture, or they can be made into beds not more than four feet wide. Most persons who grow strawberries for home use like to have large fruit and to obtain large berries throughout the season, the plants must not be crowded, and the best fruit is obtained when they are kept as individual plants rather than when they are grown in the matted row. Under good cultivation a box or pound of strawberries should be obtained from each lineal foot, or from two square feet, in the garden. Thus if one had a matted row thirty feet in length and two feet in width, one might expect to obtain thirty pounds of strawberries. There might of course be considerably less than this, but there might be more. As high as 41 pounds 10 ounces have been obtained at the Experimental Farm, Ottawa, from thirty feet of matted row.

COST OF GROWING ONE ACRE OF STRAWBERRIES.

The strawberry is one of the most profitable fruits to grow, but it is also one of the most expensive. It does not, however, require a large capital to begin the growing of strawberries, hence the cultivation of this fruit should appeal to many. In order that some figures showing the cost of growing strawberries might be available to prospective growers, a letter was sent to strawberry growers in different parts of Canada asking for estimates of what it cost them to grow this fruit. Relatively few of those who were asked for this information had kept an account of the cost, or could make an estimate of it, but we desire to thank those who were able to furnish this useful information. The plots of strawberries on the Experimental Farms and Stations are not large enough to make a fair estimate of the cost of growing by the acre.

TABLE.

	1	2	3.	4	5.	6	7.	8.	9.	10.	11.	12.	13.
	\$	\$	\$	\$	\$	\$	(1918).	(1917).	\$	\$	\$	\$	\$
Rent of Land.	28 00	32 00	12 00	10 00	10 00	20 00	40 00	50 00	50 00	50 00	25 00	25 00	50 00
Preparation of soil	5 00	30 00	10 00	10 00	25 00	5 00	5 00	6 00	5 00	8 00	15 00	15 00	5 00
Fertilizers	45 00	200 00	106 00	40 00	50 50	56 00	39 00	40 00	100 00	125 00	80 00	60 00	50 00
Plants	24 00	28 00	50 82	28 00	28 00	24 00	17 50	28 00	25 00	50 00	30 00	40 00	33 00
Planting	12 00	20 00	18 00	12 00	14 00	10 00	7 00	14 00	10 00	22 50	20 00	10 00	13 75
Cultivation	30 00	100 00	25 00	29 00	28 00	60 00	13 50	18 00	80 00	45 00	115 00	50 25	30 00
Mulching	24 00	20 00	45 00	20 00	40 00	10 00	12 00	16 50	20 00	36 00	10 00	15 50	18 00
Crates	37 00	37 00	13 56	24 00	42 68	36 00	15 00	30 00	40 00	10 00	7 50	15 00	
Boxes	37 00	37 00	21 67	20 00	43 75	42 00	22 50	52 50	25 00	54 00	35 00	57 50	106 10
Picking	125 00	10 00	87 03	80 00	105 00	130 00	60 00	140 00	75 00	160 00	111 00	125 00	160 00
Marketing	40 00	60 00	43 35	20 00	78 00	40 00	45 00	71 00	50 00	45 00	70 00	50 00	15 00
Insects and disease		35 00											
Total	406 00	689 00	432 43	293 00	461 03	433 00	267 50	466 00	480 00	611 50	506 50	463 25	470 85
Crops in quart boxes	5000	5000	4335	4900	7000	6000	3000	7000	5000	5550	4000	5000

14. Rent of land, \$40; preparation of soil, \$8.50; fertilizers, \$98; plants, \$36; planting, \$8; cultivation, hoeing and placing runners, \$50; mulching, \$32.50; cost of picking, including breakage, baskets, etc., \$110; management, \$10; interest on investment, \$10. Total, \$403. Crop in quart boxes, 4,000.

- No. 1. A. E. Dewar, Charlottetown, P.E.I.
- No. 2. J. Walter Jones, Charlottetown, P.E.I.
- No. 3. P. J. Shaw, Agricultural College, Truro, N.S.
- No. 4. Manning Ells, Port Williams, N.S.
- No. 5. R. E. Floyd, Bloomfield Station, N.B.
- No. 6. O. W. Wetmore, Clifton, N.B.
- No. 7-8. T. G. Bunting, Macdonald College, Que.
- No. 9. W. G. Horne, Clarkson, Ont.
- No. 10. Sam. Baker, Hintonburg, Ont.
- No. 11. Chas. P. Stewart, Blackburn, Ont.
- No. 12. Jos. Levesque, Blackburn, Ont.
- No. 13. Geo. A. Davenport, Hammond, B.C.
- No. 14. Jas. E. Johnson, Simcoe, Ont.

The figures of the growers differ considerably, as is to be expected, as conditions vary so much in different parts of Canada. Different kinds of soils also require different treatment, and the distance from the point of shipment or market makes a difference in the cost of marketing. Rent of land varies considerably, it being much higher near cities. In one case the cost of cultivation is very high. Where such weeds as chickweed become established, or other weeds requiring much hand work, the cost of cultivation will be very high. Prospective growers should remember that to keep down expenses it is important to have clean land, and manure and straw for mulching as free from weeds as possible, and to plant so as to do as much work with the cultivator as possible. There is a great difference in the cost of the fertilizer used. Good soils do not need as much as the poorer ones.

The profits in growing berries will, of course, vary with the price obtained for the fruit. Only four of the growers gave their net profits based on the expenses given above, and on the price obtained for the fruit. At the Agricultural College, Truro, N.S., the fruit was sold in 1918 at 17 cents a box, and the net profit per acre was \$304.52. Col. O. W. Wetmore, Clifton, N.B., sold his fruit at 20 cents a box in 1918, and his profit per acre was \$767. At Macdonald College, Que., the fruit sold for 10½ cents a box in 1917, and the net profit per acre was \$284. In 1918 the price obtained was 18½ cents a box, and the profit was \$280. Although the price obtained per box in 1918 was nearly twice as much as in 1917, the crop of 1918 was less than half that of 1917, so that the profits of the two years were nearly the same. Geo. A. Davenport, Hammond, B.C., received 10 cents a pound for his fruit in 1918. He estimates the net profit on his fruit at \$165.25, but valuing the plants available for setting out a new plantation in 1919 at \$50, his total net profit is \$215.25. His cost for boxes includes crating. As he sold his fruit to a local canning factory he was saved the cost of boxes and crates charged in above table. The value of plants available for a new plantation the following year has not been estimated in the above figures by other growers, but should be taken into consideration.

The prices obtained for strawberries in 1918 were abnormally high, and 10 cents a box would probably be more like the price they are likely to bring when conditions are more normal. The cost of growing strawberries is also somewhat above what it has been in the past and what it should be in a few years. The average crop of strawberries will run from 4,000 to 5,000 boxes per acre. There is about a pound of fruit in a quart box. In the colder districts occasional injury from winter and spring frosts are the chief causes of reducing the average crop; in the warmer districts spring frosts and drought in the fruiting seasons cut down the yield, and in other places insects attacking the roots greatly reduce the crop.

FIFTY MOST PRODUCTIVE VARIETIES.

Central Experimental Farm, Ottawa, Ont.

Variety.	5-year Average, 1912-14-15-16-17.					Three-year average.
	Average yield per acre.	Average date first ripe fruit.	Average length of season in days.	Average height of season in days.	Average number of pickings.	
1 Mele, imp.	8,792 0	June 26	121	7-2	9-0	16.6
2 Parson, per.	8,656 3	" 29	119	4-8	7-0	9.0
3 Lavinia, per.	8,654 4	" 29	119	6-6	8-4	7.3
4 Mariana, per.	7,956 10	" 29	123	11-0	9-0	8.6
5 New Globe, per.	7,919 3	" 29	123	7-6	8-4	17.0
6 Herma, per.	7,432 14	" 29	123	7-4	8-0	16.0
7 Beder Wood, per.	7,098 13	" 29	124	7-6	10-6	19.3
8 Cassandra, per.	7,054 1	" 29	124	11-0	9-2	14.6
9 Valeria, per.	6,978 9	" 29	124	6-8	9-0	11.0
10 Warfield (No. 2), imp.	6,911 3	" 29	124	8-0	8-6	16.0
11 Biel, imp.	6,910 7	" 29	124	7-9	8-6	13.6
12 Poconoke, per.	6,791 13	" 29	124	8-8	8-6	18.3
13 Viola, imp.	6,619 2	" 29	124	8-4	8-2	17.6
14 Portia, imp.	6,609 14	" 29	124	8-4	8-0	13.3
15 Julia, per.	6,608 8	" 29	124	20-2	8-6	12.6
16 Fountain, per.	6,590 10	" 29	124	20-4	8-4	16.6
17 Bianca, per.	6,499 2	" 29	124	21-8	6-6	9-0
18 Dora, imp.	6,296 6	" 29	124	18-0	6-2	7-4
19 Cordelia, per.	6,291 8	" 29	124	20-4	9-4	8-6
20 Arnot, per.	6,178 7	" 27	126	26-6	7-8	8-2
21 Afton, imp.	6,111 10	" 27	126	26-6	8-6	14.6
22 Autumn, imp.	6,099 2	" 25	125	20-2	9-8	12.0
23 Maggie, imp.	5,922 9	" 21	121	21-6	7-8	10.3
24 Virgilia, imp.	5,908 14	" 25	124	24-4	7-8	14.6
25 Sample, imp.	5,869 10	" 26	122	22-2	10-2	16.6
26 Greenville, imp.	5,760 15	" 26	122	19-2	9-4	14.3
27 Donald Boone, imp.	5,710 9	" 28	122	19-2	6-2	8-2
28 Commander, per.	5,699 15	" 25	121	17-2	8-6	12.0
29 Clyde, per.	5,680 9	" 25	121	18-4	6-6	9.3
30 New Dominion per.	5,664 6	" 25	121	18-4	7-2	18.6
31 Paul Jones, imp.	5,640 11	" 26	121	17-6	7-2	12.4
32 Thompson Late, imp.	5,633 15	" 26	121	20-4	7-4	12.6
33 Daisy, imp.	5,618 11	" 24	120	18-4	7-6	17.0
34 Hattie Warfield, imp.	5,520 9	" 24	120	21-4	8-4	11.6
35 Lyon, per.	5,519 2	" 23	119	21-2	11-0	8-8
36 Bomba, imp.	5,471 15	" 24	119	19-8	8-8	9-0
37 Meteor, imp.	5,455 10	" 25	119	19-0	7-8	8-6
38 Sdg. from Livingston, imp.	5,351 8	" 30	118	17-8	8-0	8-6
39 Desdemona, imp.	5,276 13	" 26	120	20-6	8-0	7-2
40 Ophelia, per.	5,228 13	" 27	120	20-2	7-6	8-0
41 Olivia, per.	5,220 7	" 27	120	20-2	8-0	8-4
42 Thompson Earliest, per.	5,215 13	" 27	120	21-2	6-8	8-4
43 Howard (No. 17), per.	5,200 8	" 21	116	21-2	8-8	8-2
44 Lovett, per.	5,166 14	" 23	118	21-6	6-2	9-6
45 Francesca, per.	5,190 10	" 24	118	23-8	10-0	9-6
46 Williams, per.	5,091 14	" 27	120	20-8	7-4	8-2
47 Hood River, per.	5,011 5	" 25	118	19-6	6-2	8-2
48 Ruby, per.	4,838 14	" 26	119	21-4	7-0	8-4
49 Morgan Favorite, per.	4,759 0	" 26	119	17-6	5-4	7-6
50 Buster, imp.	4,677 3	" 28	121	22-8	8-0	8-8
		" 27	120	14-0	6-4	6-8
		" 26	119	9-6	8-0	11-6
		" 25	118	9-6	8-0	17-9

* Ruby and Herma had no crop in 1915. The 1918 crop was used to make the five-year average.

The above yields were estimated as a rule from two matted rows, each fifteen feet in length and three and one-half feet apart. The 1912 crop was estimated from rows four feet apart. The plants were set eighteen inches apart in the rows. The column "Average Height of Season" refers to the number of days on which the largest pickings were made. The highest yield obtained from these small plots was from Valeria, which, in 1912, yielded at the rate of 15,109 pounds per acre. This is one of the seedlings originated at the Experimental Farm, Ottawa. The same year the Parson yielded at the rate of 14,293 pounds per acre. Yields are usually much larger from small areas than from large ones. It will be noted on the table of cost of producing strawberries that where grown by the acre the crops run from 3,000 to 7,000 boxes or pounds per acre.

DESCRIPTIONS OF VARIETIES.

Following are descriptions of the principal varieties of strawberries grown in Canada, and some others that have yielded very well at the Experimental Farms and which should be tested by growers for comparison with those they are accustomed to plant. Some of the oldest varieties continue to be the most productive. The Senator Dunlap, however, is the most popular variety in Canada, and this is of more recent introduction than some of the others. Nearly all of these descriptions were made by the author from the variety as grown at the Central Experimental Farm, Ottawa. The information in regard to the origin of a number of the varieties was obtained from Technical Bulletin 11 of the Virginia Agricultural Experiment Station by S. W. Fletcher:—

Arnout (per.)—Orig. J. L. Arnout, Luzerne county, Pa., introd. 1905. Fruit conical and wedge conical, large, bright scarlet, glossy, seeds prominent; flesh bright red, juicy, tender, firm; briskly subacid, above medium in quality; season medium late; plants vigorous, runners numerous; foliage good. One of the best of the later varieties.

Beder Wood (per.)—Orig., Beder Wood, Moline, Ill.; introd. 1890 as Raester, and in 1891 as Beder Wood. Fruit round conical, medium size, pale red, not prominent seeds; flesh pale, juicy, moderately firm; acid, medium quality; season early to extrn early; plant vigorous; runners numerous; foliage moderately good; rusts considerably. Valuable on account of earliness, productiveness and for being a good pollinizer.

Bisel (imp.) (Seedling of Wilson).—Orig. 1887, D. L. Bisel, Southern Illinois; introd. 1893 as Dan Bisel; roundish, large, bright red, handsome with rather prominent seeds; flesh bright red, juicy, inclined to be hollow; briskly subacid, moderately firm, above medium quality; mid-season; plant vigorous, runners numerous; foliage moderately good, but rusts considerably. A productive variety.

Brandywine (per.) (Chance seedling, supposed cross between Glendale and Cumberland Triumph).—Orig. 1880, E. A. Ingram, Westchester, Pa.; introd. 1895. Fruit roundish to sugar-loafed, above medium to large, deep, dull red, seeds not prominent; flesh bright red, juicy, firm; briskly subacid, quality good; season late; plant vigorous, runners moderately numerous; foliage moderately good to good; rusts slightly to considerably. While not as productive as some, it is a good variety for home use because of its quality and lateness.

Bubach (imp.)—Orig. 1882, J. G. Bubach, Princeton, Ill.; introd. 1886. Irregular wedge conical, very large, bright red, seeds not prominent; flesh bright red, juicy; subacid, moderately firm to firm, good quality; season medium to late; plant vigorous, runners medium in number; foliage moderately good, but rusts slightly to considerably.

Charles I (per.)—Orig. 1907, Geo. Mann, Bridgeman, Mich.; introd. 1911. An early variety thought well of by some growers.

Chesapeake (per.) (Chance seedling).—Orig. 1903, Geo. W. Parks, Nanticoke Point, Md.; introd. 1906. Fruit roundish conical, large, bright red; flesh red, firm; subacid, good quality; season medium late; plant vigorous, runners moderately numerous; has succeeded well in some places.

Clark (per.) (Thought to be a seedling of Wilson).—Orig. Fred. E. Clark, near Portland, Oregon; introd. about 1890. Succeeds best in the irrigated districts; needs much moisture. A very firm berry, and good for shipping.

Clyde (per.) (Seedling of Cyclone).—Orig. J. Stayman, Leavenworth, Kansas; introd. about 1890. Fruit roundish, large to very large, pale red, seeds not prominent, flesh pale red, juicy, firm; subacid, pleasant, quality above medium; season medium early; plant vigorous, runners numerous; foliage poor to moderately good, liable to rust considerably; often productive but suffers from scalding in a dry time owing to lack of foliage.

Dakota (per.) (Jessie x wild strawberry of Manitoba).—Orig. N. E. Hansen, Brookings, South Dakota. Fruit below medium to small; bright red; quality above medium; runners very numerous. This variety has proved hardier than any other variety tested at the Experimental Stations on the prairies.

Dunlap (Senator Dunlap) (per.) (Parentage uncertain).—Orig. 1890, J. R. Reasoner, Urbana, Ill.; introd. 1900. Fruit pointed, wedge and long wedge conical, necked, medium to large in size, deep glossy red, seeds not especially prominent; flesh rich red, juicy, tender; briskly subacid, moderately firm; above medium quality; season early; plants vigorous, large number of runners; foliage moderately good, rusts considerably; the most generally popular variety.

Early Jersey Giant (per.).—Orig. 1907, W. Van Fleet, Little Silver, N.J.; introd. 1912. Fruit long, obtusely conical, necked, large, bright red, glossy, seeds prominent; flesh deep red, moderately juicy, tender, moderately firm to rather soft; briskly subacid, pleasant, above medium to good quality; season early; plant moderately vigorous, runners numerous, foliage medium. A promising early sort, especially for home use.

Enhance (per.) (Windsor x Sharpless).—Orig. 1887, Henry Young, Ada, Ohio. Fruit roundish or roundish conical, above medium to large, deep red, seeds not prominent; flesh bright red, meaty, firm; subacid, above medium to good quality; season medium; plant vigorous, runners numerous; foliage moderately good, rusts considerably. A fine productive variety.

Excelsior (per.) (Wilson x Hoffman).—Orig. 1892, Louis Hubach, Judsonia, Ark.; introd. 1897. Fruit roundish conical, medium to above medium in size, deep glossy red, not prominent seeds; flesh bright red, juicy, firm; briskly subacid, above medium quality; season early to extra early; plant vigorous, runners numerous; foliage good but rusts considerably.

Glen Mary (per.) (chance seedling).—Orig. J. A. Ingram, East Bradford, Pa.; introd. 1893. Fruit irregular, roundish to wedge conical, very large to large, deep red at base becoming pale towards tip, seeds not prominent; flesh bright red, juicy, rather watery, firm, subacid, of medium quality; medium season; moderately vigorous, runners numerous; foliage moderately good to good, rusts considerably; not a very good pollinizer. One of the most popular commercial varieties.

Greenville (Imp.) (chance seedling).—Orig. 1883, E. M. Buechly, Greenville, Ohio; introd. 1893. Fruit roundish to wedge-shaped, large to very large, bright red; flesh bright red, juicy, moderately firm to rather soft; subacid, pleasant, good quality; plant vigorous, runners numerous; foliage good, rusts slightly to considerably.

Haverland (Imp.) (Crescent x Sharpless).—Orig. 1882, B. H. Haverland, Cincinnati, Ohio; introd. 1887. Fruit irregular, long, pointed and wedge conical and roundish, above medium in size; bright, but rather pale red, rather prominent seeds;

flesh pale red, juicy, moderately firm; subacid, above medium in quality; season medium early; plant vigorous, making a moderate number of runners; foliage moderately good, rusts considerably. Rather too pale in colour, but although introduced more than thirty years ago, still succeeds well in some places.

Heritage (per.) (Barton x Marshall).—Orig. 1902, J. E. Heritage, Marlton, N.J.; introd. 1906. Fruit wedged-shaped, large, bright red, glossy, seeds moderately prominent; flesh bright red, tender, moderately juicy, sometimes hollow in centre, moderately firm; subacid, pleasant, quality good; season medium; plant vigorous, runners moderately numerous; foliage good. A large handsome berry. Especially promising for home use.



Mariana. (Per.)

Howard (17) (per).—Orig. A. B. Howard, Belchertown, Mass.; introd. about 1909. Fruit large, long, conical to somewhat wedge-shaped, large, bright scarlet; flesh light red, moderately firm; quality good; season medium early; plant vigorous, runners numerous. This variety is thought much of by some growers.

John Cook (J. H. Cook) (per).—Orig. 1907, W. Van Fleet, Little Silver, N.J.; introd. 1914. Fruit roundish conical to wedge conical, large to very large, deep red, glossy, seeds prominent; flesh deep red, juicy, tender, moderately firm, briskly subacid, pleasant, good quality; season early; plant moderately vigorous, few runners; foliage good. Promising for home use.

Lady Cornelle (per.)—Orig. 1903, Mrs. Cornelle, Ponchatoula, La.; introd. 1912. Fruit obtusely conical with a neck and reflexed calyx, large, deep red, glossy, inclined to be white tipped; seeds prominent; flesh deep red, tender, moderately juicy, core sometimes hard, moderately firm to rather soft; acid, little flavour, medium quality; season medium late; plant vigorous, runners numerous, foliage good. Handsome and productive, but inferior in quality.

Lovett (per.) (Chance seedling, supposed Crescent x Wilson).—Orig. 1895, J. H. Morris, Fairview, Ky.; introd. 1890. Fruit pointed to wedge conical, above medium size, bright red, glossy; flesh bright red, tender, moderately firm; acid, and above medium in quality; season early to medium; plant vigorous, few runners; poor to moderately good foliage, rusts considerably to badly. An attractive productive berry.

McAlpine (per.) (Glen Mary x Bubaeh).—Orig. 1910, Newark, N.J.; introd. 1914. Fruit obtusely conical, large, bright red, white at tip, glossy, seeds moderately prominent; flesh pale red, tender, juicy, firm; subacid, pleasant, good quality; season medium; plant vigorous, runners numerous; foliage good. A promising, productive variety.

Magoon (per.) (chance seedling).—Orig. W. J. Magoon, Portland, Oregon; introd. 1894. Fruit roundish, somewhat irregular, medium to large, deep red; flesh deep red, moderately firm; sub-acid, good quality; season medium to late; plant very vigorous, runners only moderately numerous. A popular variety in British Columbia.

Marshall (per.) (chance seedling).—Orig. 1890, Marshall F. Ewell, Marshfield Hills, Mass.; introd. 1893. Fruit pointed conical to roundish, large to very large, dark red, rather conspicuous seeds; flesh bright red, juicy, firm; subacid, good flavour, very good quality; season medium; plant moderately vigorous, runners moderately numerous; foliage good though rusting slightly to considerably. Productive only where heavily fertilized and where there is abundance of moisture. One of the tenderest American varieties, but one of the best in quality.

Melo (Imp.) (Seedling of Crescent.—Orig. A. H. Griesa, Lawrence, Kan.; introd. 1894. While this variety has proved the most productive at Ottawa in a five year's average, the fruit is so soft and inferior in quality that it is not recommended.

Minnesota No. 3 (per.) (Dunlap x Pocomoke).—Orig. 1909, Charles Haralson, Minnesota Fruit Breeding Farm, Excelsior, Minn.; introd. about 1914. Fruit long conical with a neck, calyx reflexed, above medium to medium in size, bright red, seeds conspicuous; flesh bright red, tender, juicy, moderately firm; briskly subacid, pleasant, quality good; season medium early; plant vigorous, runners numerous; foliage good. Resembles Senator Dunlap somewhat, and has the fault of that variety in running small quickly in some seasons.

Nettie (Imp.) (Bubaeh x Yale x Sharpless x Gandy).—Orig. 1893, J. H. Black, Son & Co., Hightstown, N.J.; introd. 1899. Fruit pointed or wedge conical, large, rather dull pale red, seeds not prominent; flesh tender, juicy, firm; briskly subacid, quality above medium; season very late; plant vigorous, makes only a moderate number of runners; foliage good. In districts where late varieties do well, the Nettie has given good crops.

New Globe (per.).—Orig. 1898, Eugene Sutherland; introd. 1901. Fruit obtusely conical to roundish, dull, rather pale red, seeds moderately prominent; flesh bright red, juicy, firm; briskly subacid to acid, pleasant flavour, quality medium to good; season medium to late; plant vigorous; foliage good. This has proved to be one of the most productive varieties at Ottawa.

Ozark (Early Ozark) (per.).—Orig. 1902, Chas. Shull, Sarcocie, Mo. Fruit roundish conical, medium to large, dark red; flesh deep red, firm; subacid, good quality; season early; runners numerous. This has proved a profitable early variety in some places.

Parson (Parson's Beauty) (per.) (chance seedling).—Orig. about 1895, R. G. Parsons, Parsonburg, Md.; introd. 1899. Fruit obtusely conical, above medium to large in size, bright red, glossy, prominent seeds; flesh bright red, juicy, tender, firm; subacid, above medium quality; season medium late; plant vigorous, large number of runners; foliage moderately good, rusts slightly to considerably. A very popular commercial variety.

Parton (per.).—This English variety succeeds well in Vancouver island and is one of the most popular varieties there. The fruit is large, deep red with green tip, ovate, pointed. It is very sweet and good in quality. The plant makes a moderate number of runners.

Pocomoke (per.) (chance seedling).—Orig. E. H. Hamblin, Pittsville, Md.; introd. about 1902. Fruit obtusely conical, large to very large, bright glossy red inclined to have white tips, seeds rather prominent; flesh bright red, juicy, tender, very firm; briskly subacid, above medium quality; season medium late; plant vigorous, large number of runners; foliage moderately good, rusts considerably to badly. Very similar to *Parsons' Beauty*.

Royal Sovereign (per.).—One of the best allround English varieties. It is of excellent quality and is highly regarded for home use in British Columbia. The fruit is of large size and bright red in colour. The plant makes many runners.

Sample (Imp.) (chance seedling in old bed of *Leader*).—Orig. 1894, J. V. Gowling, N. Reading, Mass.; introd. 1898. Fruit pointed conical, very regular in shape; above medium to large; bright or rather deep glossy red, seeds fairly prominent; flesh bright red, juicy, almost watery, moderately firm; subacid, medium quality; season medium to late; plants vigorous, large number of runners; foliage moderately good to good; rusts considerably. A handsome berry.



Portia. (Imp.)

Sharpless (per.) (supposed seedling of Chas. Downing). Orig. 1872, J. K. Sharpless, Catawissa, Pa.; introd. 1877. Fruit irregular, wedge conical, large, bright red, seeds prominent; flesh juicy, moderately firm; subacid, good quality; season medium to late; plant very vigorous, runners only moderately numerous. This is one of the oldest varieties grown in Canada, but is still highly regarded in British Columbia.

Splendid (per.).—Orig. C. H. Sumner, Sterling, Ill.; introd. about 1892. Fruit roundish, medium to large, deep red, seeds not prominent; flesh red, juicy, moderately firm; acid, above medium quality; early to medium season; plants vigorous, numerous runners; foliage moderately good, rusts considerably to badly.

Triomphe de Ghent (per.).—A European variety which is regarded highly for home use on Vancouver island. The fruit is large, wedge-shaped, red in colour and is very sweet and of good flavour. The plant makes many runners.

Tennessee (Tennessee Prolife) (per.) (Crescent x Sharpless).—Orig. J. C. Hodges, East Tennessee; introd. about 1892. Fruit wedge-shaped, flattened, rather irregular, large, bright red, glossy, seeds not prominent; flesh bright red, juicy, moderately firm; subacid, above medium in quality; season medium late; plant vigorous; runners numerous; foliage moderately good to good, rusts slightly. A very attractive productive variety which has done particularly well at the Experimental Station, Lethbridge, Alta.

Uncle Jim (per.) (chance seedling).—Orig. 1898, J. F. Dornan, Glenn, Mich.; introd. 1902. Fruit roundish to obtusely conical, large bright red, seeds not prominent; flesh bright red, juicy, to moderately firm; subacid, good flavour, good quality; season medium late to late; plant vigorous, runners only moderately numerous; foliage good. Does well under high cultivation.

Warfield (No. 2) (Imp.) (chance seedling, thought Crescent x Wilson).—Orig. about 1882, C. B. Warfield, Sandoval, Ill.; introd. 1885. Fruit pointed conical, medium to above medium size, deep red, glossy, rather prominent seeds; flesh deep red, juicy, moderately firm; acid; medium quality; early to medium season; plants vigorous, large number of runners; foliage moderately good, rusts considerably to badly. A handsome berry and a good cropper, but needs abundance of moisture.

Williams (per.) (Crescent x Sharpless).—Orig. Mr. Williams, Burford, Ont.; introd. 1891. Fruit wedge conical, large, bright, rather deep red with a white tip, rather prominent seeds; flesh bright red, juicy, firm; subacid, good flavour, quality good; medium season; plants vigorous, large number of runners; foliage moderately good, but considerable rust. Popular in some parts of Ontario.

Wm. Belt (per.).—Orig. about 1888, Wm. Belt, Mechanicsburg, Ohio; introd. 1896. Fruit irregular, first fruit wedge-shaped, others wedge and pointed conical, large, bright red, seeds fairly prominent; flesh bright red, meaty, juicy, firm; subacid, good flavour, very good quality; season late; plants vigorous, with a large number of runners; foliage moderately good to good, but rusts considerably to badly. One of the best for home use.

PROMISING VARIETIES ORIGINATED AT THE CENTRAL EXPERIMENTAL FARM, OTTAWA.

Some very good varieties of strawberries were raised from seed of the Bubach and Wm. Belt in the Horticultural Division at Ottawa, and after testing them at Ottawa and other places for a number of years, some of the best of them are described below. All of these except Bianca and Lavinia were described in the Annual Report for 1913. These are all named after Shakespeare's heroines.

Bianca (Per.) (Wm. Belt seedling).—Orig. 1906, Horticultural Division, Experimental Farm, Ottawa, Ont.; introd. 1919. Wedge conical to roundish conical, above medium to large, bright scarlet, glossy, seeds moderately prominent; flesh rich red, tender, juicy, firm; briskly subacid, good flavor, good quality; season medium; plant vigorous, runners numerous; foliage medium; productive; fruit of good size and quality, and attractive in appearance.

Cassandra (Imp.) (Bubach seedling).—Orig. 1906, Horticultural Division, Experimental Farm, Ottawa, Ont.; introd. 1913. Form roundish, wedge-shaped, regular; size large; external colour bright scarlet, glossy; colour of flesh deep salmon; core

tender; texture juicy; flavour briskly subacid, pleasant; quality above medium to good; season medium to late; shipping quality moderately firm; plant vigorous; foliage good; a handsome variety of good size, form and colour. Productive.

Cordelia (Per.) (Bubaeh seedling).—Orig. 1906, Horticultural Division, Experimental Farm, Ottawa, Ont.; introd. 1913. Form roundish, wedge-shaped; size large; external colour bright red, glossy; colour of flesh deep salmon; seeds medium; core tender; texture juicy; flavour briskly subacid, pleasant; quality above medium to good; season medium to medium late; shipping quality moderately firm; plant vigorous; foliage good; attractive in appearance; of good size and productive. Should make a good commercial berry.



V. leria. (Per.)

Desdemona (Imp.) (Bubaeh seedling).—Orig. 1906, Horticultural Division, Experimental Farm, Ottawa, Ont.; introd. 1913. Form wedge-shaped; size medium to large; external colour dark red; colour of flesh dark red; seeds medium; core solid but tender; texture juicy; flavour briskly subacid, pleasant; quality above medium to good; season medium to late; shipping quality moderate; firm to firm; plant vigorous, productive; foliage good. A good berry for home use.

Hermia (Per.) (Wm. Belt seedling).—Orig. 1906, Horticultural Division, Experimental Farm, Ottawa, Ont.; introd. 1913. Form conical to wedge conical; size medium to large; external colour bright deep red, glossy; colour of flesh deep red; seeds medium; core tender; texture juicy; flavour subacid, good; quality good; season medium; shipping quality firm; plant vigorous, productive; foliage good. A good berry, attractive in appearance.

Lavinia (Per.) (Wm. Belt seedling).—Orig. 1906, Horticultural Division, Experimental Farm, Ottawa, Ont.; introd. 1919. Fruit wedge-conical to wedge-shaped and roundish conical, large; deep, rather dull red; seeds moderately prominent; flesh bright red, tender, firm to moderately firm; briskly subacid, quality above medium; season medium late; plant vigorous; runners numerous; foliage good. While not so good in quality as some others, it has proved very productive.

Mariana (Per.) (Bubaeh seedling).—Orig. 1906, Horticultural Division, Experimental Farm, Ottawa, Ont.; introd. 1913. Form wedge-shaped to roundish wedge-shaped; size large; external colour bright, deep scarlet, glossy; colour of flesh deep salmon; seeds medium; core tender; texture juicy; flavour subacid, pleasant; quality above medium to good; season medium to medium late; shipping quality moderately firm; plant vigorous, productive; foliage good; of good size and attractive appearance. Good for home market.



Virgilia. (Imp.)

Ophelia (Per.) (Wm. Belt seedling).—Orig. 1906, Horticultural Division, Experimental Farm, Ottawa, Ont.; introd. 1913. Form long wedge-shaped, somewhat necked; size large; external colour bright scarlet, glossy; colour of flesh pale red; seeds medium; core tender; texture juicy; flavour briskly subacid; quality good; season medium late; shipping quality firm; plant vigorous, productive; foliage healthy. A large berry of good quality.

Portia (Imp.) (Wm. Belt seedling).—Orig. 1906, Horticultural Division, Experimental Farm, Ottawa, Ont.; introd. 1913. Form roundish conical to wedge conical; size large, external colour deep red, glossy; colour of flesh deep rich red; seeds very prominent; core tender; texture juicy; flavour briskly subacid, pleasant; quality good; season medium late to late; shipping quality firm; plant vigorous; foliage good. A late berry of good form and colour.

Viola (Imp.) (Wm. Belt seedling).—Orig. 1906, Horticultural Division, Experimental Farm, Ottawa, Ont.; introd. 1913. Form conical to somewhat wedge-shaped; size large; external colour bright to dark red; colour of flesh deep rich red; seeds large, prominent; core tender; texture juicy; flavour briskly subacid, pleasant; quality good, season medium late, shipping quality firm; plant strong grower; foliage good. A large-fruited variety. Should make a good shipper.

Virgilia (Imp.) (Wm. Belt seedling).—Orig. 1906, Horticultural Division, Experimental Farm, Ottawa, Ont.; introd. 1913. Form roundish to wedge-shaped; size large; external colour deep red; colour of flesh deep red; seeds medium; core tender; flavour

subacid, pleasant; quality above medium to good; season medium; shipping quality moderately firm to firm; plant vigorous, productive; foliage good. An attractive looking berry, being of good size, colour and form.

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INSECTS AFFECTING THE STRAWBERRY.

BY THE ENTOMOLOGICAL BRANCH, DEPARTMENT OF AGRICULTURE.

There are several important insects which almost every year effect serious damage to strawberry plants and it is, therefore, important that the strawberry grower should guard against injury by insect enemies. The following information on insects affecting the strawberry has been prepared by the Entomological Branch. Enquiries regarding insect pests should be directed to the Dominion Entomologist, Department of Agriculture, Ottawa. Letters and packages containing insects or their work, weighing up to twelve ounces, may be sent through the mails free of postage.

WHITE GRUBS (*Lachnosterna Spp.*).

White Grubs, which are the larvæ of the well known May Beetle, or June Bugs, are some years very destructive, particularly in eastern Canada. The grubs feed naturally on the roots of grasses, so when sod land is ploughed up they are deprived of their usual food and readily attack strawberries and certain other crops if these are grown on the land. The injurious species require three years to complete their life-cycles; in other words, a period of three years elapses from the time the eggs are laid until the grubs, which hatch from the same are mature, transform to the pupal state and appear as beetles. The female beetles lay their eggs in sod land and also in land bearing such crops as timothy and small grains. Suitable land nearest to groves or woods is favoured by the beetles which feed upon the foliage of the trees and then visit such nearby fields to lay their eggs. Land intended for the growing of strawberries should be previously planted to a crop which will not attract the insect, such as alfalfa, clover or buckwheat. Commercial growers of strawberries in eastern Canada are advised to correspond with the Dominion Entomologist before establishing new strawberry plantations in order to learn of the then present stage in the life of the insect.

Under garden conditions grubs are often turned up when the land is being dug or ploughed. As many of these as possible should be removed by hand and destroyed. Under acre conditions there are unfortunately no practical measures known to destroy the grubs when they are known to be present in the land and destroying the crop. Late summer ploughing which brings many grubs to the surface, crushing numbers of them and exposing others to adverse weather conditions, is useful, particularly in years when the grubs are changing to beetles. At such a time, too, if hogs are available, they will root them out and destroy large numbers. Limited areas may be practically freed of white grubs by such a method.

The practice of taking only one crop of fruit from a plantation and then ploughing it up is followed by many commercial growers.

THE STRAWBERRY WEEVIL (*Anthonomus signatus* Say.).

Occasionally the yield of strawberry plantations is very seriously reduced by the strawberry weevil—a small reddish-brown or blackish snout beetle which cuts off the blossom buds. Early varieties of strawberries apparently are most subject to serious injury. Varieties with imperfect or pistillate flowers are practically immune.

Habits and Life History.

The winter is passed in the adult stage. The weevils hibernate under rubbish, particularly in woodlots and waste land adjoining the strawberry fields. In spring the insects leave their winter quarters and appear on the strawberry plants about the time the first buds are forming. By means of her slender snout the female weevil punctures the blossom buds and deposits her oval, whitish eggs singly in the interior of the buds among the stamens. After depositing an egg the male then crawls down the blossom stem and girdles it so that the bud either falls immediately or is left hanging for a few days by a mere thread. Within the severed buds the whitish larvæ or grubs, which hatch out from the eggs, feed at first on the pollen and later on other interior parts. They become mature in about a month, pupate and emerge from the buds as adults during July. The new adults feed for a short time on the pollen of various flowers and then in midsummer they seek their hibernating quarters. There is only one generation a year.

Control.

Clean Farming.—In combatting this insect it is very important to secure as clean conditions as possible in and around the strawberry plantations. This involves the destruction of weeds, rubbish and anything which may afford the weevil winter protection. It is also advisable not to plant the strawberries near bush or waste land.

Dusting.—According to extensive experiments conducted in New Jersey, almost complete protection from the weevil may be obtained by coating the plants with a dust composed of one part (by weight) arsenate of lead and five parts finely ground sulphur. Ordinarily two applications are sufficient, the first when weevil-feeding begins and the second about seven days later. It is essential that every bud should be coated with the dust.

THE STRAWBERRY-ROOT WEEVIL (*Otiorynchus oratus* L.)

The strawberry-root weevil ranks foremost among the insects affecting the strawberry in the Province of British Columbia. In the older strawberry-growing sections it annually exerts a marked influence upon the returns of established plantations. The adult, which deposits eggs, giving rise to the well-known "grubs" which infest the roots, is a beetle and belongs to the class commonly known as "weevils." In life it is dark-brown almost black in colour, and is approximately ½-inch in length. Its upper surface is striated and deep, but minute punctures are discernible in these lines. It is remarkable in having its wing-covers fused together along a certain median line over the back, so that the body is encased in a hard shell-like structure. It is thus unable to fly and is doomed to walk the earth.

While this insect has been named the strawberry-root weevil, it must be clearly understood that its food-plants are many and varied. Under strictly natural conditions this weevil and its "grubs" infest the roots of grasses. It has, however, shown a marked liking for the strawberry-plant, and where this fruit is grown to the exclusion of all other forms of vegetation it has become thoroughly established.

The life-history is simple. The eggs are laid during June, July, and August in the soil near the crown of the plant. These eggs hatch in July, August and September, appearing as larvæ or "grubs," and these larvæ remain localized in the root system, feeding upon the finer roots.

At the approach of winter the larvæ are still very small, and they lie more or less dormant for several months until the warmth of the soil in the spring again induces them to continue feeding. The main injury is caused in the early spring months, for the reason that the larvæ commence to grow rapidly at this time and start feeding upon roots proportionate to their size. This feature of the life-habits of this insect accounts for the fact that plantations show little sign of injury until the spring, and then the evil results rapidly become apparent. Pupæ are formed in the soil in the late spring, and adults appear in due course on the surface of the soil.

It may be seen, therefore, that there is only a single generation of this weevil in a single year. Further, inasmuch as an individual adult female does not lay very many more than fifty eggs during the course of her life, it may be understood that unless the adults occurred in great numbers no severe damage would result. We know, however, that the adults do frequently occur in great numbers, and it is from the numbers present that we find so much injury. The endeavour, therefore, should be to reduce the numbers of adults as much as possible, because few weevils in a plantation would cause no material damage.

Strawberry-growers are inclined to expect a recommendation of some simple insecticide by the application of which the injurious effects of this root-weevil would be mitigated. Insects which affect the roots of plants are necessarily difficult to control, and while certain processes of fumigation, by such substances as carbon bisulphide and pulverized cyanide of potassium, have been suggested, not one of these substances, or for that matter any other known insecticide, can be applied satisfactorily with commercial results. If the insecticide is strong enough to destroy the weevil larvæ in the soil, the plant has been observed to suffer. Vice versa, if the plant is not affected, only a small proportion of the "grubs" are destroyed. Consequently, growers must be satisfied with cultural control measures and they must realize that the control of this weevil is dependent almost altogether on horticultural considerations.

On this understanding the following are suggested:—

(1) *Rotation of crops.*—Because the weevil is unable to fly and remains more or less localized in a given area. This naturally involves a judicious proportioning of strawberries to the land available on each farm and a consideration of the areas planted on neighbouring farms.

(2) *The growing of strawberries on the one- or two-year cropping plan.*—Because this prevents the weevil becoming too thoroughly established in a given area. This measure involves the question as to the choice of varieties of strawberries which thrive under this system of culture in the locality. Further, it appears that land which has been growing strawberries for too great a length of time is not conducive to the most healthy growth. The presence of the weevil in this instance only intensifies the trouble, which is largely based on soil and other conditions.

(3) *Autumn ploughing.*—Because the weevil contemplates its egg-deposition in late summer (September), and very minute larvæ are present in the soil at this time. If the plantation is ploughed after September and kept cultivated so thoroughly as to prevent any weed-growth, the small larvæ are practically starved out of existence. Cultivation should be continued again early in the spring and as much harrowing as possible undertaken during the winter-time. If ploughing is performed in the middle of summer, at a time when egg laying is in progress and the adult beetles are on the surface of the ground, the adult females will be forced to migrate to the nearest plantation and there complete their egg-deposition.

(4) *The use of chickens.*—Because it has been observed that chickens readily devour the larvæ in the soil. This plan is more suitable to growers who farm only 5 and 10 acres, inasmuch as the old strawberry plantation may be ploughed up after the crop is removed and the land made available for other crops in the same year.

(5) Sections of the country which are contemplating the growing of strawberries on a commercial scale are advised to adopt these general control measures before they are forced to.—Because it has been clearly observed in the past that it does not require very many years of intensive strawberry culture for the weevil to become thoroughly well established, and the insect is known to occur from the Kootenays to Vancouver Island.

There is, further, little danger of introducing the weevil into new plantations on nursery stock, provided the planting is done before June and the roots shipped partially separated from their original soil.

The growing of fruit trees and strawberries on the same piece of land do not harmonize one with the other. Consequently, whenever a district is found suitable to strawberry culture in a commercial way fruit trees should be eliminated.

ARISTOTELIA SPECIES.

In British Columbia, also, the caterpillars of a small moth, probably of a species of *Aristotelia*, have been found some years rather freely, in the crowns of the plants. The caterpillar is pinkish in colour and about half an inch long.

STRAWBERRY LEAF-ROLLER (*Ancylis comana* Froel.)

This insect has not proved very troublesome in Canada although occasionally it has effected important injury.

The strawberry leaf-roller folds the leaves of the strawberry, fastening them with strands of silk. The caterpillar feeds on the green inner surface of the leaves, soon causing them to turn brown, which when abundant gives the beds a scared appearance. The first brood of caterpillars is found during the month of June, when most of the injury is done. There is a second brood in autumn. The caterpillars when full grown are about one-third of an inch long and vary in colour from yellowish-brown to dark brown or green. The first brood of caterpillars change to pupae in late June or in early July and soon afterwards the moths lay eggs for the second brood of caterpillars. These latter larvae attack the strawberry leaves in late summer and early autumn. By the end of September the insect is again in the pupal stage in which it passes the winter.

Remedy.—Prompt spraying with dry arsenate of lead 2 pounds to 40 gallons of Bordeaux mixture before the leaves become folded should effectively control an outbreak. If a bed becomes seriously infested the foliage should be burned, or raked off and burned immediately after the crop is harvested.

CUTWORMS.

Several of the well known cutworms may in any season cause much injury to young strawberry plants. In general, cutworms are similar in appearance, being smooth, cylindrical caterpillars about one inch or more in length and in colour of some dull shade similar to the ground in which they hide during the day. Injury by cutworms usually ceases before the end of June. When they are present in numbers in a garden or field the plants will soon be seen to have been cut or eaten off, and if an examination is made, the cutworms will most likely be discovered in the soil, coiled up and just below the surface.

Remedy.—The poisoned bran remedy is the one which is now used most extensively for the destruction of cutworms generally. This is made as follows:—

Bran	20 pounds
Molasses	1 quart
Paris green or white arsenic	1 pound
Water	2 or 2½ gallons.

Mix the bran and Paris green (or white arsenic) thoroughly in a wash tub, while dry. Dissolve the molasses in the water and wet the bran and poison with the same, stirring well so as to dampen the bran thoroughly.

Shorts or middlings in place of bran are also useful for cutworm control.

A simple formula for small gardens is one quart of bran, one teaspoonful of Paris green and one tablespoonful of molasses, with sufficient water to moisten the bran.

The mixture should be applied thinly as soon as cutworm injury is noticed. It is important too, that the mixture be scattered after sundown, so that it will be in the very best condition when the cutworms come out to feed at night. This material is very attractive to them, and when they crawl about in search of food, they will eat it in preference to the growing vegetation. If the mixture is put on during a warm day, it soon becomes dry, and is not, of course, as attractive to the cutworms. In treating fields of strawberries, a simple method is to have a sack filled with the bran hung around the neck, and by walking between two rows and using both hands the mixture may be scattered along the row on either side. When cutworms are so numerous as to assume the walking habit, the poisoned bran may be spread just ahead of their line of march. In gardens, a small quantity of the material may be put around, but not touching, each plant.

COMMON STRAWBERRY DISEASES.

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KEY TO STRAWBERRY DISEASES.

The disease occurs:—

A. On the Leaves.

- I. Spots, either purple in colour, or light coloured with purple border.
Leaf Spot.
- II. Leaves rolling upward; edges or exposed parts of lower surface turning purple or dying; scanty white mildew on lower surface. Powdery Mildew.

B. On the Fruit.

- I. In the field.
 - (1) Before ripening—
 The fruit fails to develop or remains hard, or browns and dries up; often covered by a grey, velvety mould. Dry Rot.
 - (2) When ripe—
 The fruit develops rot.
 Rot areas very watery. Leak.
 Rot tissue dry like normal fruit tissue Dry Rot.
- II. On the picked fruit, in shipment, in storage or in stores.
 - (1) The fruit turns soft and watery, sags together in the container, and loses much juice. Leak.
 - (2) A mouldy growth on the fruit
 Either the Dry Rot or Leak fungus.

C. On the Roots:

- Root system browned or blackened, dying in spring or early summer.
Winter Killing.

POWDERY MILDEW.

(*Sphaerotheca Humuli* (Fries) Burr.).

Strawberry Mildew appears during late June and the first of July. The fungus grows mainly on the under sides of the leaves, and may be seen there as a white, webby or frost-like coating, usually rather scanty in amount. It causes the leaves to curl upwards, and a field which is badly affected has a peculiar whitish cast due to this curling. Later on the lower surfaces of these curled up leaves which are exposed to the sun are likely to turn purple or die at the edges, and when the leaves are badly attacked they may be totally destroyed. Besides reducing the feeding power of the leaves, a very serious effect of the Mildew is to allow the sun's rays to penetrate through the leaves so that the fruit which ought to develop in a comparatively cool shaded position is exposed to the drying action of the hot sun. The fungus also attacks and rots the fruit.

The Mildew is rather erratic in its occurrence. In some years it is almost absent and other years very prevalent over large areas. It develops most rapidly in warm and moist weather and will hardly spread at all when the weather is dry and hot, or very cool.

Little is recorded regarding the susceptibility of varieties to this disease, and perhaps no strongly marked constant differences in susceptibility are to be looked for. However, some hitherto unpublished data on this point are kindly supplied by Mr. O. Robb of the Vineland Horticultural Experiment Station, where a considerable number of varieties are annually grown side by side. In 1915 and 1918 the varieties present were graded according to the extent of Mildew observed on them, (0) representing entire freedom from the disease and (10) a very severe attack. The records made in these two years are as follows:—

1915—(0) Superb, Sample, Cobalt, Nettie, Haverland; (1) Climax, Glen Mary, No. 42, Three W's, New York, Joe, Jerome; (2) Texas, Jessie, Buster, William Belt; (3) Beder Wood, Lovett, Downing Bride; (4) Splendid, Cardinal; (5) August Luther, Michel Early, Clyde, Aroma; (6) St. Louis Prize, No. 44; (7) No. 43, King Edward, Oren; (8) Senator Dunlap, No. 45-Williams, Highland Beauty, Parson Beauty, Enormous, Gandy; (9) Clark seedling, Warfield, Pocomoke, Lady Thompson.

1918—(0) Parson Beauty, Senator Dunlap, Superb, Gandy, Cobalt, Portia, Julia, Mariana, Klondike, Cassandra, Thompson seedling, Valeria; (1) Joe, Steve, Late Champion; (2) William Belt, Virginia; (3) Pocomoke, St. Louis Prize, Desdemona; (4) Haverland; (5) Enhancee.

Control.—The most useful means of combatting Strawberry Mildew is in the use of ordinary sulphur, which should be applied to the rows when the first symptoms of Mildew are noted. The sulphur may be applied either by using a dusting apparatus, by shaking through a fine sieve, or by putting it in a cotton bag and pounding the bag as it is carried over the rows. Since it is the fumes of the sulphur which are produced in the hot sun that are effective against the disease it is not necessary to cover every leaf with the dust as has to be done in spraying. One feature of this treatment should be noted: If the sulphur is applied too close to picking time the fumes are apt to be rather irritating to the pickers on a hot day.

LEAF SPOT.

(*Mycosphaerella Fragariae* (Schw.) Lind.).

The Leaf Spot disease is often very damaging to strawberry plantations where it is allowed to become prevalent. As the name indicates, spots caused by the fungus mentioned occur in the leaves. These spots are purple in colour at first, but develop a grey or white-coloured centre with a purple border as the spots get older. Some

varieties found most susceptible to Leaf Spot at the Experimental Farm, Ottawa, are Splendid, Warfield, Lovett, Burton, and William Belt.

Control.—The leaf Spot is not generally a serious pest where a one or two-crops rotation is followed. It is in fields kept for a third or fourth crop that the disease is apt to increase and become troublesome. Measures of control should begin when setting out the plants. Select healthy young plants and remove any spotted leaves from them. The plants should be sprayed with Bordeaux mixture (4-4-40) shortly after they are set out, and the leaves should be kept covered with the same mixture by two or more sprayings as needed throughout the growing season. In the second year they may be sprayed before the blossoms are out with the same material. After the fruit is picked another spraying of Bordeaux mixture may be given, or else the leaves should all be mowed after picking, and either raked off or burned as they lie. The treatment given will keep the disease under control for two crops after which it is usually desirable to plough up the field. Continued spraying will of course give protection after this but after second crop diminished returns make such effort unprofitable.

WINTER KILLING.

During the last few years a great many strawberry plants have been lost and many plantations badly damaged by a browning and dying of the roots, which is noticed during the spring and early summer. The plants which are worst affected die early in spring and others survive only till blossoming time or until the fruit is being formed, when they gradually shrivel up and die. It is considered that the injury is mainly due to winter although there is some evidence for believing that soil fungi may play a minor part in aggravating this trouble.

We are again indebted to Mr. O. Robb for notes on the comparative hardiness of the varieties grown on the Horticultural Experiment Station at Vineland, Ont., in 1915 and 1918. He lists those examined in 1915 according to their hardiness, as good fair, medium, poor and very poor, while in 1918 the several varieties were placed in grades running from no injury (0), up to complete killing (10). His records are as follows:—

1915—(Good), Wm. Belt, Michel Earl, Warfield, No. 43, No. 44, Joe, Parson Beauty, Pocomoke, Highland Beauty, Glen Mary, Cobalt; (Fair), Three W's, Enormous, Lovett, Lady Thompson, Excelsior; (Medium), St. Louis Prize, Clark seedling, Nettie, Crescent, King Edward, Sample, Beder Wood, August Luther, Jerome, Clyde, Splendid; (Poor), Senator Dunlap, No. 42, Haverland, Buster, New York, Superb, Jessie, Orem, Aroma, Gandy, Texas, Clin. x, Downing Bride, Longfellow; (Very poor), Cardinal.

1918—(0), William Belt, Pocomoke, Julia; (1), Williams, Cobalt, Enhance, Portia, Valeria; (2), Crescent, Beder Wood, Three W's, Joe, Glen Mary, Parson Beauty, Senator Dunlap, St. Louis Prize, Stephen Late Champion, Virginia, Island King, Wolverton, Helen Davis, Kellogg Prize, Heritage, Clark seedling; (3), Highland Beauty, Sample, Haverland, Ohio Boy, Ophelia, Fendall; (4), August Luther, Excelsior, Superb, Ruby, Bubach, Doran, Jerome; (5), Molena, Jueunda, Commonwealth, Arizona, Warfield; (6), Desdemona, Cordelia, King Edward; (7), Gandy, Mariama, Magoon, Staples, Marshall; (8), Clyde, Klondike, Cussandra, Early Ozark, Chesapeake, Brandywine; (9), Goodell.

It has been found that when young transplants are taken from a badly affected field they are likely to die and result in a poor stand. It is therefore advisable when setting out a new plantation to examine the roots carefully. Even though the roots are browned on the outside, if the small cord-like centre is still white and moist they are still alive, but if the central cord-like part is also browned then these roots are dead.

It is encouraging to note that many cases have been observed where plantations which were rather seriously affected one year recovered and did well during the following year.

Control.—The only control measure that seems necessary in this case is the protection of the plants from winter conditions. It is probable that the damage is done by late spring frosts after an early start of growth processes, rather than by severe winter conditions. In either case, however, the remedy is a mulch of straw, strawy manure, leaves or other litter applied in late fall after frost has set in. Protection of this sort may be desirable where the plants are not protected by snow or where they are grown on a warm soil which is readily heated in early spring.

DRY ROT.

(*Botrytis* Spp.)

This is mainly a field trouble. The fruit may be attacked at any time after it is set and examination of fields in the Niagara peninsula in 1918 indicated that a great deal of fruit failed to mature because it was destroyed by this fungus in the early stages of growth.

The affected fruits remain firm and hard if they are very young, and all growth ceases. If attacked when half grown or later they are likely to turn brown, but remain firm and dry out. In all cases moist conditions may enable the fungus to develop as a greyish, velvety mould all over the surface of the affected fruits or even on the fruit stems and old leaf stalks.

The fungus develops best in moist, still air, and thus is likely to be most destructive in old, weedy fields, in periods of heavy rainfall, or in poorly-drained land.

Control.—Quick rotation, thorough cultivation, freedom from weeds, and good drainage, are the essential features of control. The sprayings recommended for Leaf Spot will also help to some extent but sanitation methods are the most important consideration.

LEAK.

(*Rhizopus nigricans* Ehr.).

Ripe strawberries deteriorate in shipment and storage from a number of causes, one of the most important of which is rot induced by various fungi; of these fungi the ordinary bread mould (*Rhizopus nigricans*) is probably the worst offender. It rots the ripe fruit rapidly and breaks down the tissue, thus liberating the juice, which runs down into the container, and at the same time the softened fruit sags downward, so that in a basket affected by this rot the bulk of fruit is considerably lessened and the juice runs out at the bottom. Because this loss of the fruit juice is so outstanding a symptom the rot from this cause has been called "Leak."

While probably not so prevalent under northern conditions as in the warmer regions of southern United States the Leak disease occurs on Canadian strawberries, frequently to a considerable extent. The following facts concerning the disease have been taken from Bulletin No. 531 of the United States Department of Agriculture:—

The fungus cannot enter the fruit unless the skin is broken in some way.

The rot is of small importance in the field, but is apt to become considerable in shipment or in storage.

The fungus grows very little below a temperature of 50 degrees, but will rot the fruit rapidly above that temperature.

Moisture has little or no effect in assisting or hindering the rot.

Control.—The following recommendations indicate the best method of avoiding this disease:—

The fruit should be injured as little as possible. No fruit should be packed which shows signs of Leak—that is, a soft, watery rot. The packing-houses and the

conditions of shipment and storage should be sanitary; no rotten fruits should be allowed to remain as a breeding ground for the fungus. The most important point in reducing losses from Leak, however, is in keeping the temperature low from the time of picking until the fruit is used. In this connection the practices of allowing berries to stand in the warm sun, or of carrying them to market exposed to the sun's rays, are objectionable. Fruit which is heated in this way cools slowly, and this gives the Leak fungus every opportunity to get in its work. The berries should be picked and packed as early as possible in the day, and even if wet with dew will not rot to such an extent as if they are allowed to become heated. Washing the fruit before packing has been tried. This ... some tendency to injure the berries, but if the washing is done with clean water the amount of infection is greatly reduced and the evaporation from the berries after they are packed tends to keep them cool and thus further reduce the amount of the rot. Washing the berries continuously in the same water will increase the amount of rot since the water rapidly becomes contaminated by the Leak fungus and infection is therefore increased. In general the disease can be greatly reduced by cleanliness in packing, and in keeping the temperature after picking down below the dangerous point of 50 degrees.

