DOMINION OF CANADA
DEPARTMENT OF AGRICULTURE
DOMINION EXPERIMENTAL FARMS

Dominion Experimental Station

SUMMERLAND, B.C.

RESULTS OF EXPERIMENTS

1932 - 1936

R. C. PALMER,
Superintendent

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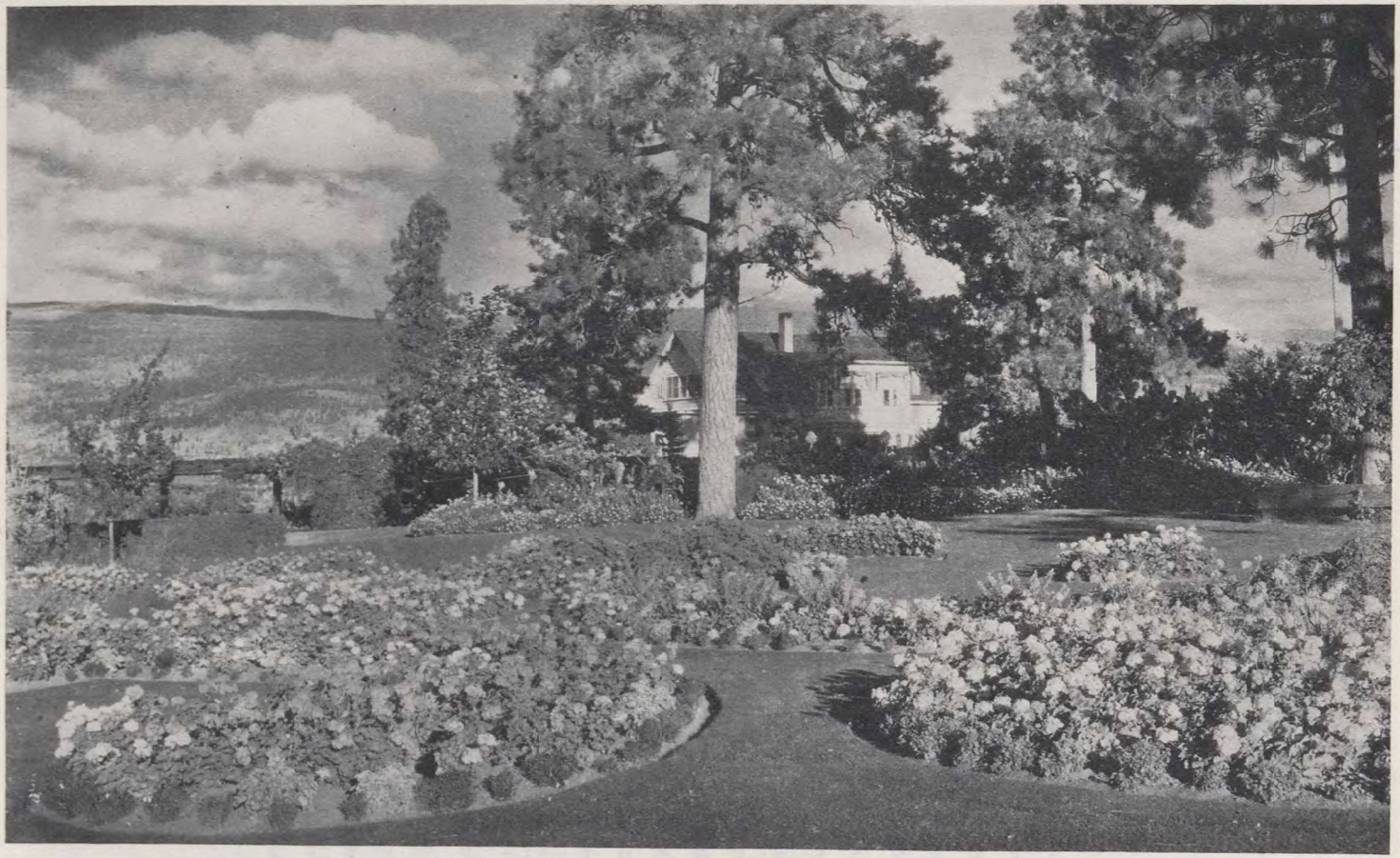
TABLE OF CONTENTS

37536—2



View of the Ornamental Grounds.

RESULTS OF EXPERIMENTS CONDUCTED AT THE

Dominion Experimental Station, Summerland, B.C., 1932 to 1936

R. C. PALMER, *Superintendent.*

INTRODUCTION

The purpose of this report is to acquaint the grower with the practical results of a number of experiments conducted at the Summerland Experimental Station. The results secured from related projects are discussed together under general subject headings. Recommendations are made without any attempt to present the methods of investigation or the wealth of data on which these recommendations are based. It is hoped that this procedure will provide the grower with information of practical value, and at the same time encourage him to write to the station for more detailed publications on those subjects in which he is especially interested.

WEATHER RECORDS

The influence of weather conditions on plant and animal behaviour constitutes a magnificent experiment conducted by nature. Man's part in this experiment consists of recording as accurately as possible the character of the weather and the effects which it produces.

Records of temperature, rainfall, sunshine and wind have now been kept at the Summerland Experimental Station for a period of twenty years. These records provide useful information regarding the climatic conditions which may be expected in this section of the Okanagan Valley.

Extremes of temperature are never experienced either in summer or winter. During the 20-year period the maximum temperature recorded was 103° F., the 100-degree mark having been reached ten times only. There was an average of 11 days each year when the temperature reached 90° F. and over. On the other hand, the coldest temperature recorded was 16° F. below zero. Most winters, periods of zero temperatures are experienced but these are only of very short duration. Light frosts may be expected up to the end of May and fall frosts as early as the last week in September. The average frost-free period over the 20 years, was 175 days.

High, damaging winds are of rare occurrence. Evaporation during the summer months is high, an average of 6·42 inches from an open tank being recorded for the month of July, over a period of 9 years.

The average precipitation was 9·8 inches, 10 inches of snow being regarded as 1 inch of precipitation. June was the wettest summer month, December having the greatest winter precipitation. The average sunshine was 2190·63 hours, which compares favourably with any station in Canada.

The five years covered by this report have not differed greatly from these general averages except that the fall and winter of 1935-36 provided some extremes. An exceptionally severe spell occurred between October 29 and November 6 doing much damage to fruit still remaining in the orchards, and to trees. Late January and the whole of February 1936 was the coldest and most prolonged winter period recorded.

ORCHARD SOIL MANAGEMENT

The problem of how to maintain soil fertility in orchards is of fundamental importance to the agriculture of the Okanagan Valley. There is now a great deal of experimental evidence in support of the statement that humus, nitrogen and boron are the elements of soil fertility in which Okanagan soils are most commonly deficient.

Where irrigation water is available, humus and nitrogen can be supplied at low cost by growing leguminous cover crops, such as alfalfa, sweet clover, and hairy vetch. Alfalfa is best adapted to deep soils which are retentive of moisture. Sweet clover is useful for breaking up heavy clay, and can also be used to advantage in building up the moisture-holding capacity of light sandy soils. Vetch has proved useful as a cover crop in non-irrigated districts.

In establishing a cover crop of alfalfa or sweet clover it is advisable to prepare a fine firm seed bed in the autumn. The seed may well be sown as early as possible in the spring at the rate of about 15 pounds per acre. Best results have been secured by seeding about an inch deep with a seed drill, but good stands have been obtained by broadcasting and covering lightly with a harrow. This procedure encourages good germination and enables the young seedlings to get an early start. The Grimm, Ontario Variegated, and Ladak varieties of alfalfa have proved satisfactory. The common White Blossom and the Yellow Blossom sweet clover have both given good results, but the lower growing Yellow Blossom variety is easier to handle. A low growing white-flowered variety called Alpha is very promising as an orchard cover crop.

While the young plants are becoming established, it is especially important to maintain favourable soil moisture conditions. On light soils it may be necessary to run the irrigation furrows as close as 18 inches apart so as to ensure uniform distribution of moisture in the surface soil where the tiny seedlings are taking root. It is usually advisable to check weed growth by clipping with a mower once or twice during the first summer.

In the second season of growth, sweet clover cover crops may well be knocked down with a disk or float just as they come into bloom. This procedure prevents the crop from growing tall and woody, but permits it to mature a crop of seed. The stems of sweet clover are stiff, with the result that they lie across well made irrigation furrows without seriously obstructing the flow of water. A light disking in the autumn reduces the risk of fire and rodent injury and also reseeds the cover crop.

It is a good plan to knock down alfalfa cover crops with a disk or float just before the fruit is picked. This procedure facilitates harvesting operations. Another *light* disking in late autumn is good practice as it eliminates risk of fire, reduces danger of rodent injury, facilitates pruning, helps to kill out grass and weeds, and destroys the hibernating quarters of insect pests such as the tarnished plant bug. However, heavy disking of alfalfa cover crops is not advisable, especially on shallow soils, as it increases the danger of winter injury to the roots of the trees. Some debris on the surface of the soil helps to retain snow and to prevent rapid lowering of soil temperatures. Furthermore, heavy disking has a tendency to kill out the cover crop.

Hairy vetch has a lower water requirement than alfalfa or sweet clover. In those Summerland Experimental Station orchards in which vetch has been used as a continuous cover crop, the water requirement has been about 2 feet per season, whereas those orchards cover-cropped with alfalfa and sweet clover have required from 2½ to 3 feet of water per season. Cultivation during the summer followed by a reseeding of the vetch in August, reduces the water requirement, but also reduces the effectiveness of the cover crop as a soil

improver. Vetch is comparatively shallow-rooted, and in the competition for soil moisture it suffers before the trees show any signs of injury from lack of water.

A serious disadvantage of vetch under irrigated conditions is the sprawling habit of growth which results in clogged furrows and which makes uniform distribution of irrigation water very difficult. Vetch is best adapted for use as a cover crop in non-irrigated districts and in orchards planted on light soil where there is likely to be a serious shortage of irrigation water in July and August. Good stands have resulted from sowing at the rate of 25 pounds per acre with a drill in the first week of August. Where no drill is available, the land may be ridged with a spring tooth, the seed broadcast and covered with a drag harrow. The crop may be disked in June or July. Disking during August is often impracticable on account of interference with trees laden down with fruit.

Cover cropping of stone fruit orchards presents a special problem as these fruits are harvested during the summer months. After the trees have reached bearing age a heavy cover crop in the orchard during July and August interferes seriously with picking operations. Furthermore, the presence of a heavy cover crop in bearing peach orchards is not advisable as it harbours tarnished plant bugs which cause serious disfigurement of peach fruits. With these facts in mind, it is especially important to build up the supply of humus in the soil of stone fruit orchards while the trees are young. Cover crops of sweet clover, alfalfa, or hairy vetch may be used for this purpose.

For the benefit of those orchardists who are fortunate enough to be able to secure barnyard manure at low cost, it may be said that there is no more satisfactory source of soil fertility. In orchards which are making poor growth an application of barnyard manure at the rate of about 10 tons per acre can be expected to bring about remarkable improvement. Even where the supply of humus is well maintained by the use of cover crops, a light application of barnyard manure often proves of great benefit to the trees. This is especially true of stone fruit orchards which respond favourably to heavy feeding.

On deep soils having large stores of plant food, the use of leguminous cover crops and careful distribution of irrigation water have been found to maintain sufficient fertility to produce good tree growth and large crops of high quality fruit over a long period of years. Indeed, there is evidence that in young orchards of the McIntosh apple and Bartlett pear continuous use of sweet clover as a cover crop has in some cases actually resulted in an accumulation of more humus and nitrogen than is desirable, encouraging poor colour in the McIntosh, and fire blight in the pear trees. In orchards where the trees are making strong growth, it is neither necessary nor advisable to apply nitrogenous fertilizers.

There are many orchards in the Okanagan, however, where leguminous cover crops have been practically killed out by heavy disking, by shading, or by competition with grass and weeds. The condition of the trees in these orchards varies greatly according to the nature of the soil, irrigation methods, and general care. In many cases the trees lack the vigour necessary to ensure heavy crops of high quality fruit. These orchards can be expected to respond favourably to applications of three to five pounds per tree of ammonium sulphate or the equivalent of some other nitrogen-carrying fertilizer, especially when the fertilizer is accompanied by improved cultural and irrigation practice.

It is better to apply comparatively small amounts of nitrogen every year than to make a heavy application every three or four years. Furthermore, it is quite possible to apply too much nitrogen which stimulates heavy wood growth and encourages production of overlarge poorly coloured fruit. This is especially true of orchards planted to the McIntosh apple. With this variety good crops of high quality fruit can be expected when the trees are making an average

terminal growth of about 9 inches each year. Unduly large applications of nitrogen also encourage fire blight in pears, and render young trees of all kinds subject to winter injury by stimulating wood growth late in the season.

Recent investigations conducted co-operatively by the Summerland Laboratory of Plant Pathology, the provincial Department of Agriculture, and the Summerland Experimental Station, have revealed that the supply of boron is deficient in many Okanagan soils. Wherever the occurrence of boron deficiency symptoms—such as drought spot and corky core of apples and gum spot of prunes—indicate a lack of boron, this element may well be applied to the soil in the form of boric acid at the rate of 30 pounds per acre.

Phosphorus and potassium are essential to the growth and health of fruit trees. However, most Okanagan soils appear to be fairly well supplied with these elements of soil fertility. Experiments have failed to show any significant improvement in colour or keeping quality of apples following the application of potassium and phosphorus to the soil. On the other hand, there is some evidence that on light soils, improvement in growth and yield can be expected following application of these materials. Several of the most successful fruit growers in the Okanagan Valley use a 6-10-10 fertilizer at the rate of 10 pounds per tree per year. Others use a 16-20-0 fertilizer at the rate of 4 to 6 pounds per tree. Whatever form of commercial fertilizer is used, experiments indicate that best results can be expected from fall application. The material should be scattered evenly over the surface of the soil covered by the outermost spread of the branches. It is not necessary to disk in the fertilizer.

ORCHARD IRRIGATION

In semi-arid areas the distribution of irrigation water constitutes one of the most important operations performed by the orchardist. Owing to the extremely variable soil and climatic conditions characteristic of the orchard areas of British Columbia, each orchard presents its own particular irrigation problems, which can be solved only by the grower himself. The efficient utilization of irrigation water depends very largely on the skill of the individual irrigator. Nevertheless, there are certain general principles which apply equally well under a wide range of conditions.

In order that the trees may function to full capacity, favourable conditions of soil moisture must be maintained in that portion of the soil where the effective feeding roots are located. In this connection it is important to bear in mind that fruit tree roots require air as well as water. It is largely due to lack of air that there are few tree roots found below a depth of 6 feet even in our most fertile soils. In orchards underlaid with hardpan or a high water-table, the effective area of root distribution is often much more shallow. Then again, in orchards with coarse gravel subsoils, the root system is often confined largely to the upper foot or two of soil on account of lack of food materials in the subsoil. On the other hand, the lateral spread of tree roots is far greater than many growers realize, usually extending several yards beyond the branch spread.

Application of more water than is necessary to throughly wet the soil occupied by the tree roots is wasteful of water and labour. It carries valuable plant food down beyond reach of plant roots. It also tends to create seepage and alkali problems on lower lands. Furthermore, on soils which are retentive of moisture it is quite possible to apply so much water that there is not enough air left in the soil for the healthy growth of tree roots. On the other hand, failure to supply sufficient moisture to the soil occupied by tree roots prevents them from obtaining the food supplies necessary for vigorous growth and heavy production.

In order to irrigate intelligently, the grower should first acquaint himself with the character of the soil and subsoil in his orchard, and with the distribution of the root systems of his trees. This information can be readily secured by digging a number of holes to a depth of 5 feet or until hardpan or coarse gravel is encountered. These holes should be about 9 inches in diameter, and sufficient in number and so located that they give a reliable picture of soil conditions and root distribution in the orchard. It is a good plan to locate the holes between irrigation furrows about 10 feet away from the trees. There should be at least one, and preferably several holes per acre. By cribbing the top of each hole with 1 x 6-inch lumber to which is fitted a strong lid, the pits can be made to serve as observation stations for study of soil moisture conditions throughout the year.

In general it may be said that irrigation water should be applied when the soil a foot below the surface has dried out to the extent that it just barely holds its shape when squeezed in the hand. Irrigation should continue until the observation pits indicate that the soil has been wetted throughout the region of effective root concentration.

While irrigation by flooding and by overhead sprinkler systems is practised in some orchards in the Pacific Northwest, most of the orchards in the territory served by this station are irrigated by the furrow method. Accordingly, the following recommendations refer to the application of irrigation water by means of furrows served by flumes or ditches.

On the light gravelly soils characteristic of the Summerland Experimental Station, it has been found desirable to make the furrows from 3 to 4 feet apart and not more than 300 feet long. Under these conditions, applications of from 2 to 4 inches of water at a time have been found to give good distribution of moisture to a depth of 4 feet without much loss from seepage below reach of tree roots.

The actual time required to apply this water depends on such factors as the slope of the land, the amount of organic matter in the soil, and the character of the irrigation furrows. In one of the experimental orchards on a steep slope where the humus content of the soil has been seriously depleted by continuous clean cultivation, the time required to apply 1 inch of water exceeds 24 hours. On the other hand, in a flat cover-cropped orchard where the soil is well supplied with organic matter, an inch of water can be applied in 4 hours. Under such conditions it is most important that there be adequate flumes and sufficiently well made furrows to ensure the application of a large amount of water in a comparatively short time.

In starting to irrigate comparatively flat orchards, it is advisable to run a large head of water in each furrow even if there is only sufficient water available to supply a few furrows at a time. This procedure makes it possible to deliver the water quickly to the lower end of the furrows and facilitates uniform distribution of moisture throughout the entire length of the furrow.

In cover-cropped orchards, labour can be expended to very good purpose in marking out permanent furrows early in the spring. Comparatively deep narrow furrows are advisable. A small 6-inch plough has been found very suitable for this purpose. Where tractor power is available, a disk marker can be expected to give good results. Failure to make good furrows in the spring necessitates a great deal of laborious hand work in the heat of the summer in order to get the water uniformly distributed.

The number of irrigations required during the season depends very largely on climatic conditions and on the nature of the soil. At the Summerland Experimental Station, where the precipitation averages about 10 inches a year, and the soil is shallow, cover-cropped orchards usually require one irrigation in May,

at least two irrigations in each of the months of June, July, and August, and one irrigation in September. The total amounts of water applied per season average between 2 and 3 feet.

In applying this information to commercial orchard conditions it is well to bear in mind that the irrigation furrows in these experimental orchards are well made and do not exceed 300 feet in length, that economical use of water is facilitated by adequate fluming, and that the water is distributed by experienced irrigators.

There is a popular belief that stone fruits do not require irrigating after the crop is picked. While it is undesirable to stimulate wood growth late in the season on cherries, apricots and peaches, it is equally undesirable to permit stone fruit trees to suffer from lack of moisture during August and September. Permitting weeds to grow in stone fruit orchards in the autumn cuts down the nitrogen supply and helps to ripen the wood.

With regard to the possible benefits to be derived from an application of irrigation water after the crop has been harvested, it has been found that such a procedure is of real value where the soil is badly dried out. Root injury is far more serious where trees are allowed to go into the winter with the soil in a dry condition than where good moisture conditions prevail. However, the application of irrigation water during late October and early November when freezing temperatures are experienced at night is anything but a pleasant procedure from the standpoint of the irrigator. Furrows have usually been destroyed during the picking season. Furthermore, the worries of the irrigator are increased by the falling leaves which block the control gates. With these facts in mind it seems preferable to ensure satisfactory soil moisture conditions throughout the winter by continuing the regular summer irrigations into September rather than by applying a special fall irrigation after the crop is picked.

IMPROVEMENT OF FRUITS

Progress in horticulture depends to a very large extent on the introduction of improved varieties. Excellent as our present commercial varieties are, none of them is perfect. With this fact in mind, extensive variety tests are conducted at the Summerland Experimental Station. In these tests promising new introductions are compared with standard commercial varieties, and bud sports are compared with the varieties from which they have originated. During the past five years these variety plantings have included over 100 varieties of apples, 40 pears, 50 plums, 30 peaches, 20 cherries, and 15 varieties of apricot.

Variety tests have revealed that three new peaches, Vedette, Valiant and Veteran, originated by the Vineland Experimental Station in Ontario, are well adapted to Okanagan conditions. These varieties are vigorous and productive, furthermore, the fruit buds are comparatively hardy. The fruit is of the yellow flesh, free stone type and of excellent quality for both fresh consumption and canning purposes. Provided these Vineland peaches are well fed, properly pruned, adequately thinned, and carefully harvested, they can be expected to prove satisfactory wherever Elberta and J. H. Hale can be grown to advantage. There is a good market demand for high quality peaches ripening earlier than the Elberta variety. Vedette, Valiant and Veteran ripen about three weeks, two weeks and one week earlier respectively than Elberta. Another promising new peach, Golden Jubilee, ripens just ahead of Rochester.

There is urgent need of a new apple combining the hardiness and high quality of McIntosh, the vigour and productivity of Delicious, and the long storage life of Newtown. In the search for a variety with these characteristics, a large number of new introductions have been tested. The most promising of these varieties are Sandow, which originated at the Central Experimental Farm,

Ottawa, and Cortland and Macoun, which originated at the New York Experiment Station. These varieties have sufficient merit to justify testing on a limited scale in the Okanagan and adjacent valleys. This is true also of Spartan, a seedling of McIntosh, crossed with Newtown, raised on the Summerland Experimental Station.

There is a keen market demand for a good dessert and culinary apple ripening earlier than Wealthy. In this connection, the variety Keetosh, produced at the Central Experimental Farm, and the variety Early McIntosh, originated at the New York Experiment Station, are worthy of limited trial.

Red colour sports of varieties such as Delicious. Jonathan and McIntosh have attracted a good deal of attention during the past five years. Careful harvesting experiments have substantiated the contention that a number of these sports develop red colour earlier and over a greater extent of their surface than do the striped varieties from which they originated. Nevertheless, the fruit appears to reach proper harvesting maturity at the same time as the original varieties. Storage experiments indicate that, provided they are picked at the right time, the red strains can be expected to develop just as good quality and last just as long in storage as the striped sorts from which they developed.

Two new grapes, Portland and Sheridan, have proved well adapted to Okanagan conditions. Portland is a green grape resembling Niagara but ripening about three weeks earlier. The vine is hardy, vigorous and productive while the fruit is suitable for both fresh consumption and wine making. Sheridan is a blue grape ripening a few days later than Concord but possessing much superior quality. The fruit is large and attractive. It holds up well in shipment and storage as it has a comparatively thick skin.

In raspberries, the Newburg and Taylor varieties are very promising. Newburg is a large high quality berry with excellent shipping characteristics. Unfortunately it is not as hardy as could be desired. Taylor is a seedling of Lloyd George, to which it is very similar, with the exception that the berries are much firmer.

Actual breeding of fruits in an endeavour to develop improved varieties is being carried on with apples, pears, peaches, apricots and cherries. Over 1,000 apple seedlings of known parentage have been raised to fruiting age. Several of these seedlings are deemed sufficiently promising to justify propagation on a limited scale for further trial. Over 1,300 peach seedlings, the result of controlled crosses, are now growing in the station orchards and are expected to reach the fruiting stage in the near future.

STOCKS FOR FRUIT TREES

Most commercial fruit trees are composed of at least two parts: the rootstock or part of the tree below ground; and the top, or scion variety. The usual procedure is to bud or graft the scion variety on a seedling rootstock at or near the ground level. This method of propagation is necessary because commercial varieties do not come true from seed, nor can they be raised easily from cuttings. Occasionally it is desirable to develop a double-worked tree, the trunk and main framework being some hardy or disease-resistant variety on which the desired commercial sort is budded or grafted.

Both the rootstock and the intermediate framework exert an important influence on the behaviour of the resulting tree. With this fact in mind, fruit tree rootstock and framework experiments are being conducted at the Summerland Experimental Station. The primary purpose of these experiments is to devise practical methods of propagating hardy disease-resistant trees which can be relied upon to produce heavy crops of high quality fruit over a long period of time.

To ascertain the influence of various rootstocks on the behaviour of pear trees, especially with reference to their resistance to fire blight, a 3-acre pear orchard was planted in 1925. Equal numbers of these trees were worked on each of two Oriental pear stocks, *P. calleryana,* and *P. ussuriensis,* and on the European pear stock, *P. communis.* Evidence to date indicates that the Oriental roots are resistant to fire blight, but have a tendency to induce in the fruit a condition termed " black-end " which is as undesirable as fire blight itself.

These same pear trees were used to provide information on the behaviour of Old Home pear as an intermediate or framework variety. Old Home is a vigorous grower, makes a very strong framework, unites well with commercial varieties, is comparatively hardy, and most important of all, is quite resistant to fire blight.

An extensive apple rootstock trial was started in 1928 for the purpose of studying the effect of rootstocks on the general behaviour of apple trees. In these experiments, both seedling rootstocks and vegetatively raised stocks propagated from layers or root cuttings were used. Over 300 trees of the Delicious and McIntosh varieties were propagated on their own roots, on seedling roots of known parentage, and on vegetatively propagated roots secured from England and the United States. This project was enlarged in 1933 when another 320 trees of the same two varieties worked on other promising stocks were planted. Again in 1935, over 500 trees of McIntosh and Delicious were set out in a comparative test of seedling and vegetatively propagated rootstocks.

Careful records are being kept of the growth and cropping performance of all trees in these rootstock investigations. While the trees are still comparatively young, evidence already secured indicates that the rootstocks are exerting a significant influence on size and disease-resistance of tree and on yield of fruit produced. In brief, McIntosh and Delicious on their own roots have made excellent trees, but serious difficulties are involved in propagation of these varieties on their own roots. Trees worked on seedlings of McIntosh and Canada Baldwin have given comparatively good results. These trees, however, have been less uniform in their performance than trees worked on vegetatively propagated rootstocks. Some of the vegatatively raised stocks have given uniformly bad results, the trees worked on them having proved very susceptible to collar rot. One of the vegetatively raised stocks secured from England, however, seems very promising for Okanagan conditions. This is the stock known as Malling No. 1, or English Broadleaf Paradise. When budded to McIntosh or Delicious, this stock produces a tree of medium size which comes into bearing early. Evidence to date indicates that it is comparatively hardy and resistant to collar rot. While more expensive to produce than seedling roots, stocks of Malling No. 1 are now being grown commercially in England and Holland.

Material for a test of intermediate frameworks for apples is being propagated in the Summerland Experimental Station nursery. Experience in Okanagan orchards indicates that while Canadian Baldwin has given comparatively good results as an intermediate stock, it is not as hardy as could be desired. Furthermore, it tends to be more upright in habit than is desirable in a variety used for framework purposes. Some growers report good results with Winter St. Lawrence as an intermediate framework. Red Astrachan and McIntosh have also been used successfully for this purpose where winters are not exceptionally severe. Experiments conducted in Eastern Canada and on the prairies suggest that the following varieties may be found useful as intermediate stocks for apples: Hibernal, Charlamoff, Antonovka, Melba, Olga, and Virginia Crab.

Whatever variety is used as the intermediate framework, it is essential that the double-working be done well out on the branches in order to ensure full advantage of the hardy framework.

PLANTING FRUIT TREES

Experience in the orchards at the Summerland Experimental Station indicates that the essentials of successful tree planting are few and simple. The primary requirement is well grown nursery stock. In British Columbia, one-year whips are more popular than two-year old trees, but the latter have given good results when carefully handled. Trees which have become dried out through accident or delay in transit may often be revived by burying completely in moist soil for several days. With this exception, planting should be done as soon as possible after the trees are received from the nursery. If planting is delayed until the trees have begun to leaf out, very poor growth is likely to result.

Great care should be taken to protect the roots from the drying action of wind and sun. Where large numbers of trees are being set out, it is best to draw them about in a tub of water on a stone-boat. Small quantities used in replanting may be conveniently carried from place to place wrapped in damp sacks. It is sometimes recommended that the holes be dug in advance of planting time, but in the Okanagan Valley very dry weather frequently prevails during the spring months with the result that it has been found advisable to dig the holes just ahead of the planting crew. By this procedure, loss of soil moisture is reduced to a minimum. In new plantings where the soil has been well prepared, very large holes have been found unnecessary, but when replanting vacancies in an established orchard, best results have been secured with fairly large holes. It is a good plan to fill these large holes with fresh soil to give the young trees a good start. In any case, the hole should be wide enough so that the roots may be spread out without bending, and deep enough to permit setting the tree an inch or two deeper than it stood in the nursery.

The most vital point in the actual operation of planting is to make sure that the soil is brought in close contact with the main scaffold roots, for it is from the ends and surface of these that the new root system commonly develops. The small fibre roots are usually dead by the time the tree reaches the planter. In fact it may be of advantage to remove them if they make it difficult to secure that close contact between main roots and soil which is the secret of success in tree planting. Good moist surface soil should be placed in the hole first and worked among the roots in such a way as to give these a natural downward and outward trend. If the soil is very dry, it is a good plan to pour two or three buckets of water into the hole when it is about half filled with earth. When water is used it should be applied plentifully in which case it helps to settle the soil closely about the roots. Best results have been secured, however, when the soil carries sufficient natural moisture to make the use of additional water unnecessary. Under these conditions close contact of roots and soil may be secured by vigorous tramping with the feet throughout the operation of filling the hole, an inch or two of loose soil being left on the surface to check evaporation. With the soil in good friable condition it is practically impossible to tramp it too tight. In fact, when a good tree dies it is usually because the soil has been filled in too loosely, thus permitting dry air spaces to develop about the roots.

GRAFTING FRUIT TREES

Conversion of fruit trees from one variety to another by top-grafting has been practised for centuries. Nevertheless, under commercial orchard conditions, top-grafting has definite limitations. It is possible to graft peaches, apricots, plums, and cherries with a fair measure of success, but experience has shown that in the long run it usually pays better to plant a new tree. Grafting of

apples and pears can be expected to give good results provided the trees are young, healthy and vigorous. It is not advisable to top-graft trees of the Transcendent Crab as this variety seldom unites well with scions worked on it.

Scion-wood should preferably be secured during the winter and buried in a sheltered spot or placed in damp sawdust in a root cellar to keep it dormant. Well matured one-year-old wood should be used.

Where care is taken in the selection of branches to be worked over, it is usually possible to complete the grafting of even quite large trees in one year, provided a number of small branches are left to act as feeders. In preparing a tree for bark or cleft grafting it is a good plan to cut off the limbs so as to leave stubs with a diameter of less than 2 inches and with a slanting top which will shed moisture. Several scions may be placed in each stub but all except one of these should be headed back severely after the first year's growth, and when the stub is completely healed over, only one graft should be allowed to remain. Water sprouts should not be permitted to rob the young grafts, but it is often advantageous to allow a few of them to grow, especially near large cuts, as they help to prevent so-called "sour sap".

Any one of the several methods of grafting, such as bark, cleft, and whip, can be used successfully provided care is taken to ensure close contact of the cambium layers of stock and scion. The cambium is the layer of growing cells from which both the wood and the bark of the tree are developed. When the bark is peeled from a tree at the time the " sap is running " part of the cambium is removed with the bark and part remains on the wood.

At the Summerland Experimental Station, the inlay graft, which is a modification of the bark graft, has given exceptionally strong, neat unions. In this method, starting from the end of the stub and cutting downward, a small section of the bark about 1½ inches long and the same width as the scion, is removed so as to leave a notch which tapers slightly towards the base. The scion carrying two or three buds is made with a slanting cut across its butt. The cut surface is the same width and length as the notch into which it is pressed. To hold the scion in place and ensure close contact of the cambium layers a small shoe tack or cigar box nail is driven through the scion into the stock. The union is then prevented from drying out by coating the entire scion and stub with hot grafting wax, or with one of the commercial grafting emulsions which can be applied cold.

The inlay method can also be employed to advantage in " bridge " grafting to connect two portions of a tree which have been separated by the attacks of rodents or by winter injury. In bridge grafting the scion should be inlayed into the bark of the tree for a distance of about 3 inches at each end. The scions may well be inserted 3 inches apart around the trunk of the stock. Care should be taken to keep them flat against the stock so that they will eventually form a continuous layer of conducting tissue around the original trunk.

" In-arching " is the term used to describe the process of grafting young trees into the trunk of an established tree. In-arching can often be used to advantage in repairing trees which are suffering from " collar rot " or winter injury. The procedure is the same as for bridge grafting with the exception that young trees are used instead of scions. It is desirable to use first-grade one-year-old whips long enough to permit planting the roots well out from the stock where soil moisture conditions are favourable. Each whip should be laid in a trench leading to the base of the tree, up which it is directed flat against the trunk and inlaid in the bark of the stock for at least 3 inches.

POLLINATION OF TREE FRUITS

The tendency of commercial orchardists to specialize on a few varieties has drawn attention to the fact that some varieties of fruit are self-sterile; that is, they require pollen from some other variety to ensure a satisfactory set of fruit. In some instances, important commercial varieties of fruit are inter-sterile; that is, they are unable to fertilize each other.

Most varieties of apples set better crops when they are fertilized with the pollen of some other variety. Such varieties as McIntosh, Delicious, Newtown, Jonathan, and Rome Beauty have proved satisfactory pollenizers for each other and for other varieties. On the other hand, there are several varieties, notably Winesap, Stayman, and Gravenstein, of which the pollen is abnormal and of no value for pollination purposes. Accordingly, in orchards where an abnormal variety such as Winesap is included in the plantings, at least two normal varieties such as Delicious and Jonathan are required to ensure a good set on all three varieties.

Practically all varieties of pears produce viable pollen, although there is some evidence that the Anjou is not always effective as a pollenizer for other varieties. Most varieties of pears are at least partially self-sterile, setting poor crops when planted in solid blocks of one variety. As Winter Nelis blooms comparatively late, it is not recommended as a pollenizer for other varieties. Flemish Beauty, Bosc and Clairgeau have all proved satisfactory as pollenizers for Bartlett. Clairgeau has the advantage that it is similar to Bartlett in growth habits and presents no special harvesting or storage problems. Clairgeau comes into bearing early and bears heavy crops, which usually bring a fair price in spite of the proverbial low quality of this variety.

The three most important commercial varieties of cherries grown in British Columbia, namely, Bing, Lambert and Royal Ann, are both self-sterile and inter-sterile. When planted away from other varieties they blossom profusely, but set fruit sparingly. When interplanted with a suitable pollenizer, such as Deacon, they set heavy crops. At least every third tree in every third row should be a pollenizer.

Most varieties of apricots and peaches are self-sterile, presenting no pollination problem. The J. H. Hale peach is an exception and should not be planted in solid blocks.

PRUNING FRUIT TREES

Pruning is essentially the removal of branches or parts of branches in order to modify the form and behaviour of a tree. In commercial orchards, the chief object is the development of trees which are structurally strong, carry a large bearing surface well exposed to sunlight, and have a form convenient for the performance of orchard operations such as thinning, spraying and harvesting.

For most varieties of fruit the modified leader type of tree fills the above requirements. Excellent trees of this type have been developed by the following procedure. First-grade yearling trees are headed at about 3 feet in height. By winter these trees have usually produced several shoots from which a leader and two scaffold branches may be selected, care being taken that the scaffolds leave the trunk at a good wide angle and that the lowest one is about 2 feet from the ground. These scaffolds may be tipped to preserve balance and to encourage branching but they should be left at least 18 inches long. More severe heading usually results in the formation of too many side branches close to the trunk, necessitating the removal of much wood later on.

The second and third prunings are similar in character to that done the first winter. With most varieties of fruit, very little heading back has been found necessary except to preserve balance between the scaffolds and maintain a slight dominance of the leader. Sweet cherries are an exception and require heading every year for the first three or four years to prevent the trees from becoming "leggy."

By the fourth winter a framework of three to five limbs has been developed along the main leader between 2 and 6 feet from the ground. At this time the leader is encouraged to assume the rôle of a main branch. In a well built modified leader tree the scaffold limbs are uniform in size, evenly distributed about the trunk and 6 or 8 inches apart vertically.

From the fourth year until the trees attain full bearing age, pruning is confined almost entirely to thinning out. The trees are kept in a vigorous condition by maintaining soil fertility and applying adequate quantities of irrigation water. Given favourable soil conditions and good irrigation practice, the young trees make vigorous growth and branch freely, giving plenty of choice for selection of limbs.

After apple, pear and cherry trees reach full bearing age, pruning should consist chiefly of the removal of weak wood, especially in the lower and shaded parts of the tree. Any fruit produced on this weak shaded wood is usually of low grade, and constitutes a liability rather than an asset. Low branches also obstruct the operations of sprayers, tractors, trucks and orchard implements.

Mature peach, apricot and plum trees require somewhat different pruning. These fruits bear their crop on young wood. When they become weakened through heavy bearing, fairly severe annual pruning is necessary to encourage the production of new fruiting wood. Pruning treatment is of little avail, however, unless accompanied by adequate enrichment of the soil.

Pruning in the upper parts of mature trees is sometimes necessary to bring the fruiting area down to a convenient height, and also to open up the tree so that sunlight can reach the bearing surface.

It is advisable to give trees a light pruning every year rather than to prune severely at intervals of several years. Heavy pruning tends to upset the balance of a tree, encouraging the production of water sprouts and dense foliage with consequent poor colour and low quality in the fruit. In a word, the chief function of pruning is to correct faulty growth.

THINNING TREE FRUITS

Thinning, or the removal of a portion of the crop with the object of improving the fruit permitted to remain on the tree, is an expensive operation. Accordingly, it is of vital importance that accurate information be secured as to what thinning practices are likely to yield the greatest returns to the grower. For this reason comprehensive apple thinning experiments begun at this station in 1920 have been continued during the past five years. These experiments have involved the use of 350 trees and the grading of many thousands of boxes of fruits for both size and colour.

The results secured indicate that the chief advantage to be gained from thinning is an increase in the average size of the fruit left on the tree. It has been found that leaf area is of paramount importance in determining fruit size. Thus, thinning should be thought of not as a mechanical procedure of spacing fruit a certain prescribed distance apart, but as a means of apportioning the number of fruits to the leaf area in such a way as to secure fruit of the desired size.

The degree of thinning which should be practised with any particular variety or individual tree of a variety depends on the amount of fruit set, the leaf

area carried by the tree, and the size of fruit required. Thus, with healthy McIntosh apple trees which commonly carry a large leaf area per foot of branch, it is seldom necessary to space the fruits more than 3 inches apart to secure fruit of desired market size. On the other hand, with varieties such as Winesap, characterized by a comparatively small leaf area per foot of branch, thinning to as much as 9 inches apart may be necessary.

Early apples such as Duchess and Yellow Transparent can be thinned to best advantage about a month after the blossom period. At this time the fruit is about 1 inch in diameter, the thinnings can be easily removed, and the maximum effect on the size of the remaining fruits is secured. Early thinning is also desirable with the Newtown, as the short stems characteristic of this variety make the fruits difficult to remove after they have reached a diameter of 1½ inches. Varieties such as McIntosh and Delicious, with which there is usually a heavy June drop, can be thinned to advantage about two months after blossoming. At this time the fruits have attained a diameter of about 1½ inches.

With peaches, fruit size depends largely on leaf area. However, even when the trees are vigorous, it is often necessary to thin the fruits to 6 inches apart in order to ensure desirable market size and quality.

Such varieties of plums as Peach Plum, Gold, Burbank, and Coe's Golden Drop respond favourably to thinning about 2 inches apart. However, with these plums and also with the Italian prune, fruit size can be greatly increased at comparatively low cost by spur-pruning practised during the winter time.

Thinning of apricots has proved to be a laborious and ineffective method of securing high-grade fruit. Heavy yields of good-sized apricots can be secured with the Wenatchee, Moorpark, Blenheim and Tilton varieties without resorting to thinning, provided the trees are kept in vigorous condition by adequate pruning, irrigation and soil fertilization, and the crop is harvested in several pickings.

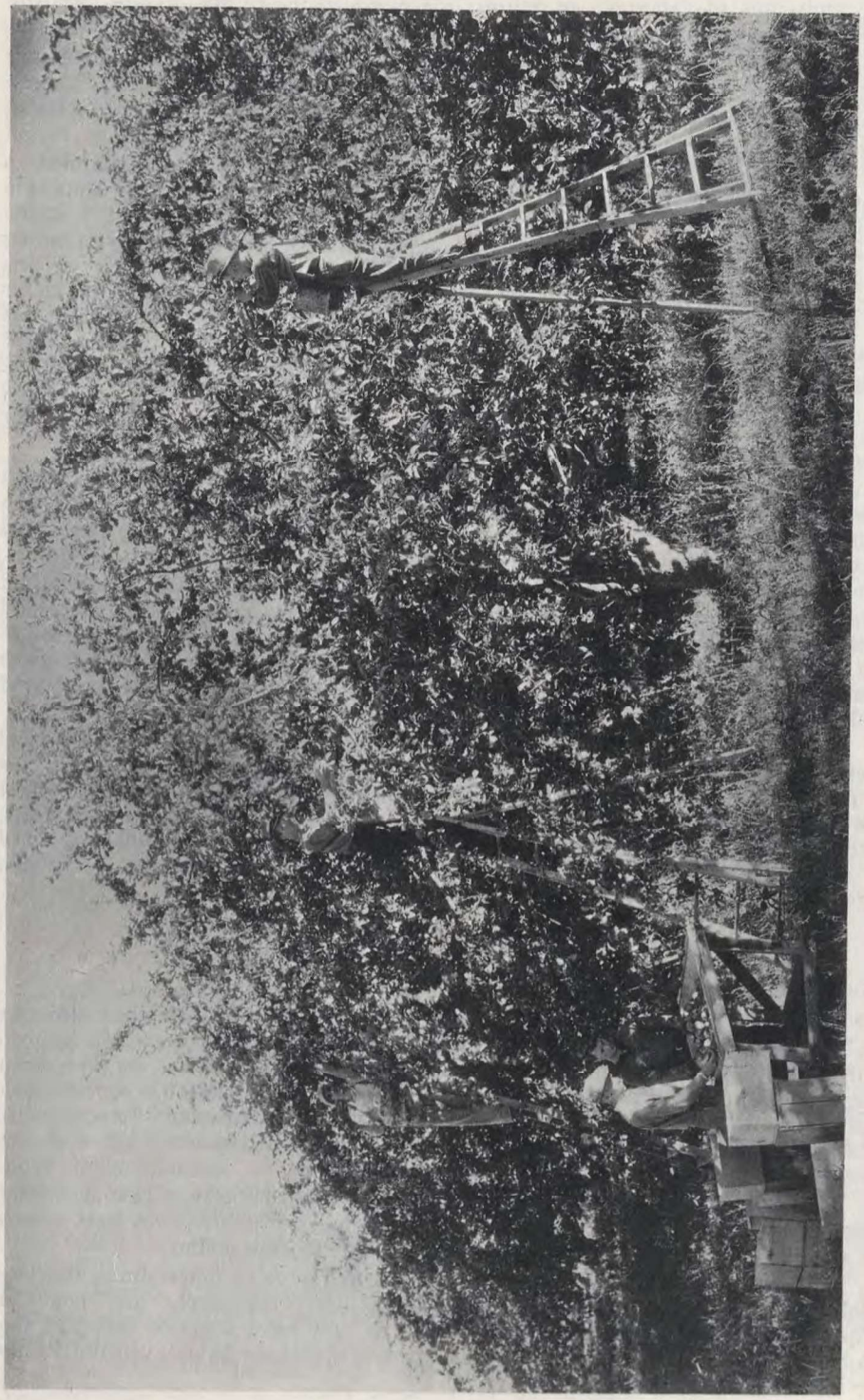
It should be constantly borne in mind that thinning is only one of several orchard practices which influence the size of fruit. The leaves play a major rôle in the performance of fruit trees. In them food is manufactured for growth of the bearing surface, extension of the root system, and development of the fruit. Accordingly, the grower can materially reduce the severity of thinning required to secure fruit of the desired size by adopting those cultural practices which produce a large healthy leaf surface.

HARVESTING TREE FRUITS

The maturity of fruit at the time it is picked exerts a profound influence on quality. It is therefore of the utmost importance that the grower be provided with information which will enable him to harvest his fruit at the proper stage of maturity. With the purpose of securing this information comprehensive harvesting investigations have been conducted at the Summerland Experimental Station during the past fifteen years. The main objective has been maturity tests which are simple and at the same time reliable.

From the standpoint of maturity tests, the most important changes which take place in an apple as picking time approaches are: increase in size, change in seed colour, change in flesh colour, and change in skin colour.

Increase in size is often the most important factor in determining the best picking time for early varieties such as Yellow Transparent and Duchess. These varieties may well be picked as soon as they have attained sufficient size to be saleable, though their quality is improved if picking be delayed until some yellowing of the skin can be discerned.



Harvesting the crop from a 20-year-old McIntosh apple tree.

Change in seed colour has proved somewhat deceptive as an indicator of maturity, for it has been found that with winter varieties such as Newtown and Winesap the seeds commonly turn brown several weeks before the fruit reaches proper picking condition. With McIntosh, however, browning of the seeds can be taken as a sign that the fruit is ready to pick.

With the Delicious, changes in flesh colour provide a reliable guide to maturity. In this variety flesh colour proceeds from a greenish white to a creamy yellow. Midway between these extremes, when the flesh is practically clear white in colour, is the ideal picking stage. This flesh colour test is especially useful with the new red strains in which development of red skin colour takes place in advance of proper picking maturity.

Changes in colour of the skin on the unblushed side of the fruit have proved a fairly reliable maturity test for such varieties as Jonathan, Rome Beauty, Wagener and Winesap. This test is especially valuable in harvesting the Jonathan, which is subject to scald and shrivelling when picked too early and is likely to be affected by internal breakdown when picked too late. Copies of a colour chart showing the stage of maturity at which Jonathan should be picked may be secured by writing to this station.

For pears the firmness of the flesh has proved the most satisfactory maturity test. This is measured by a mechanical pressure tester which is now in general use, suitable pressure ranges for the important commercial varieties of pears grown in the Okanagan Valley having been determined by this station.

With cherries and prunes the development of soluble solids, mainly sugar, in the fruit provides a satisfactory indication of proper picking condition. The soluble solids can be quickly and accurately determined by use of a refractometer. Unfortunately, this instrument is expensive.

Changes in skin colour and the " filling out " of the fruit constitute valuable guides to picking maturity in peaches.

With apricots and many varieties of plums, skin colour provides a useful maturity index.

In order to ensure that fruit is harvested at the proper stage of maturity it is often necessary to make two or more pickings from the same tree. This is especially true of the stone fruits. Furthermore, trees carrying a light crop commonly mature their fruit earlier than heavily laden trees growing in the same orchard.

For best results it is also essential that fruit be harvested carefully. There is a real art in the actual operation of picking a peach. To avoid bruising, the fruit should be grasped in the palm of the hand and removed gently from the tree. Care should be taken to use comparatively shallow picking containers and to avoid filling the orchard boxes too full.

Harvesting at the right time and careful handling of the fruit in orchard and packing house are essential steps in the delivery of a superior product to the consumer.

STORAGE OF TREE FRUITS

Fruit is still alive even after it is picked. It actually " breathes," taking in oxygen and giving off carbon dioxide through lenticels in the skin. Fruit is thus a delicately balanced living organism, quite sensitive to changes of environment especially temperature. In fact, actual respiration tests have shown that fruit may respire 20 times as fast at a temperature of 70° F. as at a temperature of 32° F. This explains why the life of some fruits such as the Delicious apple can be greatly prolonged by prompt storage at a temperature of 32° F.

It is equally true, however, that with many fruits, the normal life processes are so disturbed at temperatures below 36° F. that so-called "low temperature

diseases" may develop. Thus, storage at 32° F. is likely to cause soggy breakdown in Grimes Golden and soft scald in the Jonathan apple. The problem is complicated by the fact that fruit picked in an immature condition is more susceptible to these diseases than is fruit picked in a mature state. Furthermore, fruit from trees carrying a light crop and from trees heavily fertilized with nitrogen is especially prone to these diseases.

Then again apples which are stored at 32° F. after a delay of a week at orchard or packing house temperatures are commonly much more seriously affected with low temperature diseases than are apples stored immediately at 32° F. or held for three weeks at orchard temperatures before being placed in cold storage. The explanation probably lies in the fact that the respiration rate of apples held at orchard temperatures rises rapidly for a week or two up to a certain point, called the climacteric, after which it falls again. A chemical disturbance in the fruit results when it is changed from a condition of high respiratory activity to a condition of low respiratory activity. On the other hand, fruit which is cold stored immediately after picking before respiratory activity has been accelerated, or fruit which is cold stored after a delay sufficient for respiration to reach its peak and then fall off again, is not so greatly affected by changed temperature conditions.

The life processes of pears can be materially retarded by prompt storage at 32°F., but there is a limit to which each variety can be held at this temperature. Thus, Bartletts can be held at 32° F. for about two months, Anjous for four months, and Winter Nelis six months. When held for longer periods in cold storage these varieties often fail to ripen properly, remaining hard and developing a scalded appearance. Furthermore, it should be more generally known that after removal from cold storage, pears should be ripened at a temperature of about 60° F. for a week to ten days in order to develop that melting texture and delicacy of flavour for which this fruit is famous. After ripening, the fruit can again be reduced to low temperatures and kept in good eating condition for a week or two.

Most of the stone fruits are injured in flavour and texture by storage at low temperatures. As a general rule they keep better at 32° F. than at 40° F. but should not be held in cold storage for longer than two weeks.

The humidity of the air in the storage chamber also exerts an important influence on the behaviour of fruit. When stored in a dry atmosphere many varieties tend to shrivel. On the other hand too damp a storage atmosphere favours the development of rots and moulds. Most fruits store well in air carrying about 85 per cent of the moisture it can hold.

In so-called "common" storage houses, the temperature is lowered by means of ventilation, the ventilators being opened at night and closed during the warm hours of the day. Ventilation also serves to carry away injurious gases produced by the fruit itself. Apples give off certain gaseous products which, when permitted to remain in close contact with the skin of the fruit, cause the disease known as storage scald. This injury may be materially reduced by wrapping the fruit in paper impregnated with oil which absorbs the injurious gases.

The composition of the storage atmosphere is another important factor. When stored in a closed room without ventilation the respiration of fruit increases the carbon dioxide content of the air. Up to a certain point this accumulation of carbon dioxide has the effect of retarding the life processes of the fruit without materially injuring it. This fact is the basis of the so-called "gas storage" which has recently come into commercial use with apples in England. Unfortunately, the desirable concentration of carbon dioxide differs with the variety, the atmospheric conditions favourable for one variety causing serious injury to another. Furthermore exact control of temperature as well as gas concentration is necessary to ensure satisfactory results. Add to these disadvantages

the fact that concentrations of carbon dioxide sufficient to exert a material effect on the storage life of fruit are toxic to human beings, and it becomes apparent that gas storage presents difficult problems. Nevertheless, it may prove of commercial value in Canada with fruits which are susceptible to low temperature injury.

Storage is of great importance in prolonging the marketing season of fruit, but there is a limit to the time that each variety can be held even under the most favourable conditions. Realization of these limitations and accurate information concerning the response of each variety to the temperature, humidity and composition of the storage atmosphere will ensure greater satisfaction to the consumer and greater returns to the grower.

FRUIT PRODUCTS

No matter how well fruit is grown nor how carefully it is harvested, there will always be some low grades which cannot be sold to advantage in the fresh state. Furthermore, the public taste for fruit changes, with the result that once-profitable varieties lose their popularity and become difficult to market even at low prices. Accordingly, there is need of fruit product industries to convert these low grades and unpopular varieties into saleable products.

Development of the glaced cherry industry is an outstanding example of how an unprofitable variety can sometimes be converted into a profitable one. A few years ago, the Royal Ann cherry was a "drug on the market." Development of the processed cherry industry on the basis of information provided by the Summerland Fruit Products Laboratory so increased the demand for this variety that in 1935 and 1936 practically the entire crop was converted into glaced cherries. The processors paid the growers a satisfactory price for the fruit and could have used to advantage double the quantity available.

Improvements in the technique of processing cherries devised in the Summerland Laboratory made possible the manufacture of a very superior glaced cherry at comparatively low cost.

Special attention has been paid to development of products designed to provide profitable outlets for low grade apples. Canned unfermented cider, apple syrup, glaced apple chips, and cider vinegar have commercial possibilities.

Besides the development of new products, the Summerland Laboratory renders technical assistance in connection with problems encountered in the operation of commercial processing plants. During the past five years the services of this laboratory have been utilized extensively by commercial canners, jam makers, dehydrators, wine makers, and other fruit processors.

Nor has the housewife been forgotten. Many of the processes developed in the laboratory can be applied in the home. Accordingly, mimeographed instructions have been prepared on the home manufacture of such products as: vinegar, fruit juices, cider, pectin, wines, maraschino cherries, glaced apple chips, and candied fruits.

The manufacture of fruit products benefits the grower, the processor and the community. The grower benefits by increased returns for his culls and low grades. The processor benefits through provision of an economic outlet for what otherwise would be waste. By manufacturing a number of products, he is enabled to operate his plant over an extended season, thus reducing overhead. The community benefits through the creation of employment.

VEGETABLE GROWING

Irrigation, nutrition and the variety question constitute major problems in the vegetable industry of the Okanagan valley and adjacent territory. Experiments conducted at this station during the past five years have been designed to throw light on these problems.

An intensive study of the irrigation requirements of cantaloupes revealed that this crop thrives best when comparatively small amounts of water are applied. On a light sandy loam soil well supplied with organic matter, excellent results were secured with applications of one-half to one inch of water per week during the growing season. The cantaloupe is a heat-loving crop and is easily injured by unnecessarily large applications of water especially during the early part of the season. There is little to be gained by setting out cantaloupes before the soil temperature 2 feet below the surface has reached 50° F. Furthermore, the growth of the young plants can be materially encouraged and the maturity of the crop hastened by the use of individual paper protectors. The variety Hale's Best has proved well adapted to commercial conditions.

The tomato requires rather more water than the cantaloupe, good results having been secured by applying half an inch per week during June, followed by 1½ inches per week during July and August.

The nutritional requirements of the tomato are quite exacting, the ratio of nitrogen to potash being especially important. Furthermore, the treatment which the young plants receive in the propagating beds exerts a profound influence on the character of the fruit produced. This is especially the case with the Earliana variety. If the young plants are subjected to night temperatures lower than 40° F. or if they are allowed to suffer from drought for even short periods, they are likely to produce a high percentage of rough fruits. The explanation lies in the fact that differentiation of many of the fruit buds takes place while the plants are quite small. Adverse environmental conditions while the plants are still in the propagation beds cause abnormal development of the flower parts and irregular fruits.

Variety tests have shown that earliest maturity and highest yields can be expected from strains of the Earliana, or from hybrids of which Earliana is one parent. Unfortunately, the Earliana has a tendency to produce a high percentage of rough fruits which makes it undesirable for canning purposes. The variety Clark's Early A has many characteristics desired by canners.

Breeding work has resulted in the development of improved strains of tomatoes, peppers, corn, cucumbers and onions, especially adapted to Okanagan conditions.

ORNAMENTAL HORTICULTURE

The ornamental grounds at the Summerland Experimental Station give pleasure to many thousands of visitors every year. These plantings provide a wealth of information regarding the kinds of trees, shrubs and flowers best adapted for use in the beautification of Okanagan homes.

Where tall-growing evergreens are required, the Douglas Fir, Scotch Pine and native Bull Pine can be used to advantage. Of the deciduous trees, Russian Olive is attractive in appearance and resistant to drought. For the benefit of those interested in bird life, it may be remarked that the seeds of this tree are greatly relished by pheasants when winter snows cover the ground. Maples, poplars, willows and birch grow well where there is sufficient moisture available.

The mistake is often made of planting large-growing trees near the house, with the result that it is eventually hidden from view and the interior is unduly darkened. It is well to use low-growing trees such as the Junipers for the

foundation planting which forms the connecting link between house and lawn. Junipers are now available in a great variety of shapes, heights and colours. They are very hardy and quite resistant to drought.

In deciduous shrubs the planter has a wide choice including the Bush Honeysuckles, Lilacs, Deutzias, Barberries, Tamarisks, the Beauty Bush, Smoke Bush, Pearl Bush, Mock Orange and Korean Snowball, all of which thrive exceptionally well under Okanagan conditions.

For hedge purposes, the Western Arborvitae is in a class by itself. It is hardy and stands clipping well, producing a dense evergreen hedge of medium height. The Van Houtte Spiraea makes a very attractive deciduous hedge requiring the minimum of attention.

Where strong-growing climbers are required, the Virginia Creeper and the Fleece Vine can be expected to prove satisfactory. Where less rampant growers are needed, the climbing honeysuckles, Clematis and Wisteria will be found useful.

Many of the most popular hybrid tea roses such as Los Angeles, Rev. Page Roberts, Wm. Kordes, and Betty Uprichard, can be grown to perfection, the only winter protection necessary being to hill up the crowns with about 10 inches of earth before freeze-up. Hardy climbing roses such as Paul's Scarlet and Dr. Van Fleet are best laid on the ground and covered with fir boughs or other loose material to shelter from cold winter winds.

There is a wide choice of material for the perennial border. Columbines, Delphiniums, Bearded Iris, Paeonies, and Pyrethrums constitute only a few of the species adapted to Okanagan conditions. Russian Sage, which produces great sprays of lovely grey-blue flowers, and the broadleaved perennial Statice are very much at home under Dry Belt conditions. So also is Baby's Breath, which has gone native on railways fills and waste lands. Biennials such as the Hollyhock, Canterbury Bell, and Iceland Poppy also merit a place in home gardens throughout the Dry Belt.

Hardy lilies deserve a special bed to themselves. Besides the universally popular Regal, there are many other species such as the Coral, Willmott, David, Henry, Martagon and Hanson which grow exceptionally well in the light well-drained soils found in many parts of the Okanagan and adjacent valleys.

The hardy chrysanthemum is another plant which should be accorded a place of honour in every Okanagan garden. There are now many excellent varieties such as Sanctity, Kingcup, Goacher's Crimson, and Bronze Early Buttercup which can be counted on to bloom in September before danger of autumn frosts. Good drainage, plenty of sunshine, and ample supplies of plant food are the chief requirements for success with chrysanthemums.

For bedding purposes the geranium remains supreme, giving a profusion of bloom over a very long season. Excellent results have been secured from cuttings taken in October, rooted in sand, transplanted to compost pots made of manure, peat and clay early in March and set in the beds, pot and all, in May.

The new miniature dahlias are also useful as bedding plants, such varieties as Baby Royal and Bishop of Llandaff producing a profusion of exquisite blooms. The tall varieties of dahlia grow best in a fertile soil sheltered from wind. Jersey's Beauty, Daily Mail and Thomas Edison can be depended on to develop strong plants carrying magnificent blooms on long, stout stems.

The gladiolus thrives so well that this flower is grown commercially on quite a large scale in the Okanagan Valley. Blooms are shipped to the coast and to prairie cities, but the main business is in corms which find a ready market on the prairies and in Eastern Canada. Picardy, Bagdad, Gloriana and Commander Koehl are among the most satisfactory varieties. Tulip bulbs of excellent quality are also grown on a commercial scale.

Many annuals give a greater show of bloom in a semi-arid climate than they do under more humid conditions. Phacelia, Snapdragons, Marigolds, Petunias, Stocks, Asters, Zinnias, Nasturtiums and African Daisies of many kinds can be grown to perfection.

For the rockery enthusiast there are multitudes of Sedums, Saxifrages, Campanulas, Thymes, Arenarias and Phlox besides a host of native plants such as the Bearberry, Silver Wormwood, Sandhill Rose and Beard Tongue.

FORAGE CROPS

There are certain areas in the Okanagan Valley which are better adapted to the production of forage crops such as corn, mangels, and pasture grasses than they are to fruit or vegetable growing. The matter of pastures is especially important, as recent investigations have revealed that good pastures are the basis of economical live stock feeding.

In seeding down a pasture, it is good practice to plant several grasses, such as perennial rye, Kentucky blue, and timothy, and to include a legume such as wild white clover or alfalfa. For best results pasture grasses should be well supplied with plant food. In a properly managed pasture the legume gathers the necessary nitrogen from the air, but it is usually advisable to supply phosphorus and potash in chemical form.

Pastures of which wild white clover is the base should be kept close grazed, whereas pastures including alfalfa should not be grazed too closely.

At the Summerland Experimental Station, excellent results have been secured by dividing the pasture field into three sections. Each section is grazed in turn for a week at a time. Immediately after a section has been grazed the irrigation water is turned on to it, with the result that there is a good crop of young growth ready for the stock when it is again turned on this section.

Alfalfa grows exceptionally well in the Okanagan Valley, the Grimm, Ontario Variegated, and Ladak strains having all given good results. In an attempt to develop drought-resistant strains of alfalfa several local selections have been propagated and are being tested. Alfalfa has a high water requirement. On the light gravelly soils characteristic of the Summerland Experimental Station about 4 feet of irrigation water has been applied per season to the alfalfa fields.

Excellent yields of silage corn have been secured by planting the crop after alfalfa. The Golden Glow variety or a combination of Northwest Dent and Longfellow can be expected to give good results.

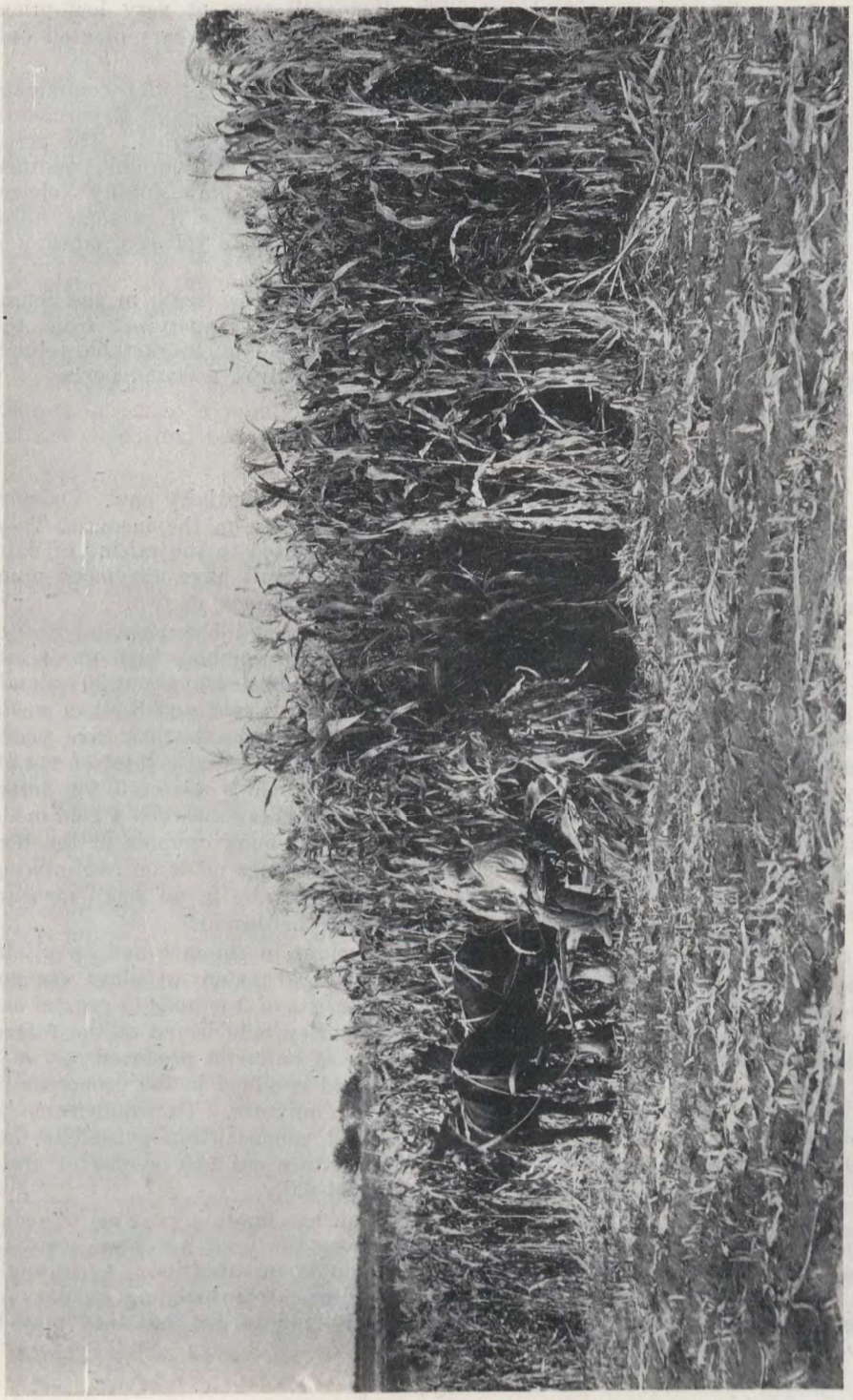
A good strain of White Intermediate Sugar mangel has been developed by selection over a period of years, and heavy yields of this strain have been grown.

Experiments with soya beans have shown that good crops can be produced, but that this plant is very likely to be attacked by virus diseases when grown under the climatic conditions experienced in the Southern Okanagan.

TOBACCO CULTURE

Several attempts have been made to establish a tobacco industry in the Okanagan Valley. Establishment of such industry is very desirable especially from the standpoint of providing employment during the winter months.

In 1927 a wave of enthusiasm swept over the Valley. Encouraged by commercial interests, growers planted quite a large acreage of tobacco, but they were inexperienced in the culture of this exacting crop, and lacked proper barns essential to the curing of a high quality product. The result was a crop



Cutting silage corn with a corn binder.

of poor quality tobacco which was difficult to sell even at very low prices. Growers lost interest in tobacco and during the next few years planted only a very small acreage.

However, having once undertaken an investigation of the commercial possibilities of tobacco culture in the Okanagan, the Summerland Experimental Station continued to conduct experiments over a 7-year period. The result is that there are now on file reliable data regarding the varieties, cultural practices and curing procedure necessary to produce high quality tobacco under Okanagan conditions. This information is available if at some future time it is decided to make another attempt to establish a tobacco industry in this Valley.

Meantime tobacco has been grown on a commercial scale in the Sumas valley every year since 1927. Fertilizer experiments supervised from this station have assisted the growers to produce good yields of marketable tobacco and there is evidence that the industry is established on a sound basis.

DAIRY CATTLE

It has been wisely stated that prosperity follows the dairy cow. Dairying in the Okanagan Valley and neighbouring territory is on the increase. There is a good deal of land in this area which is well suited to the raising of dairy cows. Furthermore, comparatively low prices for fruit have convinced many orchardists that it is good business for them to keep a cow or two.

In building up the Jersey herd at the Summerland Experimental Station the object in view has been to develop cows which combine high production with stamina and breed type. Although the herd is limited to about 30 animals, including from 10 to 15 milking cows, no less than 6 gold and 8 silver medal certificates were awarded to animals in the herd during the past five years. One of the foundation cows, Calgarth Starlight, has produced a total of 114,617 pounds of milk and 6,674 pounds of butterfat, which is a record for Jersey cows in Canada. Another cow, Sunflower Flora, has been awarded 4 gold medal certificates on successive lactations. Most of the young animals in the herd are progeny of these two cows. These records have been made on two milkings a day without any forcing. Nevertheless, they are due in no small measure to the unfailing care and constant vigilance of the herdsman.

The cows are fed chiefly on irrigated pastures in summer and on alfalfa hay in winter. To provide succulence from 30 to 40 pounds of silage, mangels or apples are fed per day. The grain ration consists of 3 pounds of ground oats and 3 pounds of bran, to 1 pound of ground barley, and is fed at the rate of about 1 pound of grain per day for each pound of butterfat produced per week. If additional protein is required, linseed oil meal is added in the proportion of 1 pound of oil meal to 6 pounds of the grain mixture. To supplement the minerals in the ration, equal parts of charcoal, monocalcium phosphate, and salt are fed at the rate of 3 pounds of the mixture per 100 pounds of grain. A small quantity of potassium iodide is also fed daily.

Formation of the Summerland Jersey Club has made it possible to secure the services of good proven sires. Furthermore the herd has been regularly tested and kept free from tuberculosis and contagious abortion. Accordingly, it now provides a source of high quality disease-free breeding stock. All heifers are retained until after their first lactation in order that they may be sold on the basis of their production records.

SWINE PRODUCTION

Pigs provide a profitable outlet for skim milk and other low priced products of the farm. There is some evidence that under semi-arid conditions white pigs are subject to scald. Packers prefer white pigs largely on account of the fact that Yorkshires have been bred with a body conformation suitable for the manufacture of high quality bacon and ham.

With these facts in mind, it was considered that a black pig with good bacon conformation might prove valuable in the territory served by this station. A consistent breeding program was carried on over a period of 15 years with the result that an excellent strain of bacon-type Berkshires was developed. In the meantime, however, the demand for white pigs had continued to increase, and the interest in black pigs had shown a corresponding decline. Furthermore, a Canada-wide policy of fostering development of bacon-type Yorkshires had been adopted.

Accordingly, in 1935 it was decided to sell the Summerland herd of Berkshires intact to a reputable breeder who could be expected to maintain the strain which had been built up.

POULTRY PRODUCTION

The White Wyandotte flock at the Summerland Experimental Station provides living proof that strains of poultry can be developed which combine high egg production with good health and desirable body conformation. For the past four years the pullet flock has produced an average of 226 eggs per bird per year. At the same time there has been no outbreak of infectious disease, and remarkably few deaths have occurred from ovarian troubles. Broodiness has been practically eliminated from the flock, and both body weight and egg size have been maintained. In a word, White Wyandottes have been bred up to the stage where they give egg production equal to the lighter breeds and at the same time produce birds with desirable conformation for sale as meat.

These very gratifying results are due partly to the scientific breeding program adopted and partly to the skill and unflagging interest of the poultryman.

Care should be taken to avoid introducing disease on breeding stock. A safe and economical way to introduce new blood is to purchase day-old chicks or hatching eggs from a flock which has been blood-tested for pullorum disease. It is especially important to raise the chicks on fresh ground each year. To avoid carrying disease from the old birds to the young stock the footwear of the attendant should be changed before approaching the chicks.

It is essential that the floor of the brooder house be tight, because draughts are very likely to chill the chicks. Similarly when the pullets are brought into the laying houses, all knot holes should be covered and broken windows repaired. It is a good plan to double-board the walls around the roosts.

The method of feeding is just as important as the composition of the feed. In simple language, it might be stated that the grain keeps up the strength of the bird, the green food supplies the vitamins necessary for health, and the mash makes the bird lay. Consequently, to ensure heavy production, the grain mixture should be fed in such a way that it will allow for a ready consumption of mash. When nine-tenths of the grain ration is fed in the evening, the laying stock go to bed with full crops, sufficient to provide sustenance through the long winter nights. The remaining tenth of the grain may well be fed in the morning merely as an appetizer, encouraging the birds to fill up through the day with mash, supplemented by green feed. At the Summerland Experimental Station excellent results have been secured by feeding a grain mixture composed of 400

pounds of whole wheat, 200 pounds of cracked corn, 100 pounds of whole barley, and 100 pounds of whole oats. The laying mash is fed dry and has the following composition: 100 pounds each of bran, shorts, pulverized oats, ground corn and beef scrap, plus 2 per cent of cod liver oil. Not more than three weeks' supply of mash containing cod liver oil should be mixed at one time because the oil loses its potency when exposed to the air for longer periods of time.

Alfalfa is one of the most valuable of all green foods from the standpoint of vitamin content. In winter the dry leaves from the bottom of the stack may be fed in conjunction with mangels, turnips or carrots.

One reason why many flocks fail to lay well in winter is because the drinking water is permitted to freeze during cold spells. This can be prevented by adding hot water several times during the day.

Success in the poultry industry is dependent largely on the maintenance of health and vigour in the flock. Vitality and stamina in their turn are dependent on good breeding, sanitary rearing and intelligent feeding.

BEE KEEPING

Bees render an important service to orchardists by assisting in the pollination of fruits. Unfortunately, however, the ungrateful fruit grower too frequently responds by applying arsenical sprays which poison the bees. The spread of codling moth in the orchard areas of the Okanagan and adjacent valleys suggests that increased use of arsenicals will be necessary and that beekeeping will become increasingly hazardous.

The average surplus of honey in the small apiary maintained at the Summerland Experimental Station over a period of years has been 125 pounds per colony, excepting the years 1930 and 1932 when arsenical poisoning seriously depleted the working forces.

The honey has been gathered mainly from sweet clover, alfalfa, alsike and various wild plants such as dogbane, dandelions and willow weed.

It has been found possible to winter bees successfully in either single colony "Kootenay" cases, or in four-colony cases. Spring feeding is advisable, and some effective method of swarm control should be adopted.

In a report of this nature it is only possible to refer briefly to many of the experiments which are being conducted. It is hoped that the information presented will prove of value to a large number of growers in the territory served by this station. Nevertheless, it is fully realized that no publication can take the place of personal contact. Visitors are always welcome whether they come singly, in pairs, or by the thousand. However, the nature of the experiments in progress and the character of the results secured can be most readily explained to groups of from ten to twenty-five people. If you care to make up a party from your district, the staff of the Summerland Experimental Station will do their utmost to make your visit both interesting and enjoyable.

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