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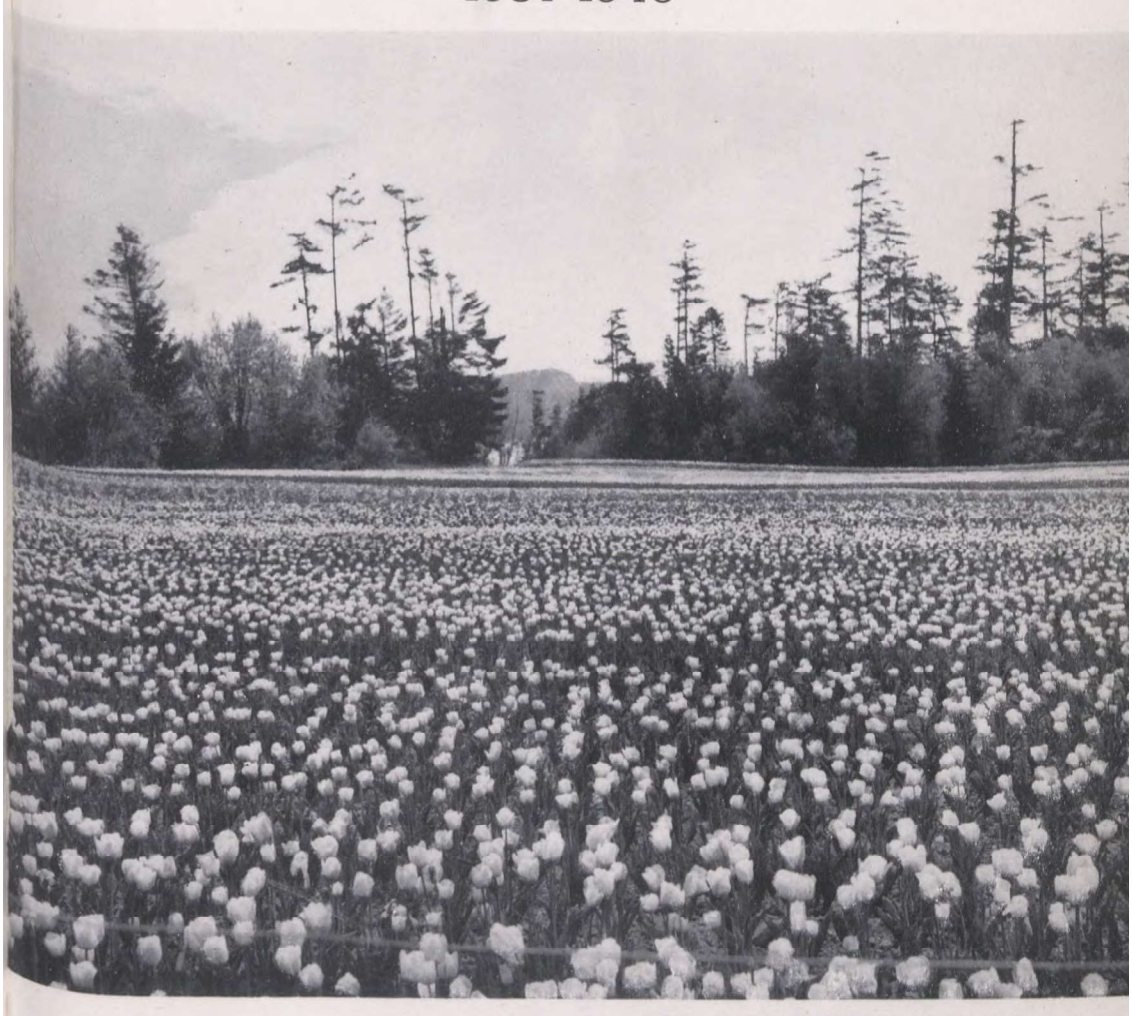
DEPARTMENT OF AGRICULTURE
EXPERIMENTAL FARMS SERVICE

DOMINION EXPERIMENTAL STATION
SAANICHTON
B.C.

J. J. WOODS, B.S.A., M.S.A., SUPERINTENDENT

PROGRESS REPORT
1937-1946



TULIP FARM IN BRITISH COLUMBIA
— B.C. GOVERNMENT PHOTO

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INTRODUCTION

The Dominion Experimental Station at Saanichton, B.C. is located on Vancouver Island, about 15 miles north of the city of Victoria. With three associated Illustration Stations it serves the interests of the farmers on the Island, the majority of whose holdings are small. In this district most of the land has been, or still is, heavily wooded. The agricultural problems under study at Saanichton are those of the small farmer and fruit grower. Horticulture and poultry are important lines of study and the production of seeds and bulbs receives particular attention.

A progress report was printed covering the work at the Saanichton station during the years 1932-1936. The present report brings the printed information on experimental results up to the end of the year 1946. Should further information be required reference to the publications listed at the end of this report is recommended.

The former superintendent at Saanichton, E. M. Straight, B.S.A., was succeeded in 1941 by J. J. Woods, B.S.A., M.S.A., previously assistant superintendent at the Dominion Experimental Farm, Agassiz, B.C. This report has been compiled by Mr. Woods and the other members of the technical staff.

METEOROLOGICAL RECORDS

Vancouver Island enjoys a mild and comparatively humid climate. It is divided, however, into two climatic zones extending from south to north with the southern portion being somewhat drier, more moderate in temperature and with spring growth starting much earlier. Precipitation along the Pacific-exposed west coast is greater than along the sheltered east coast facing the British Columbia mainland.

The average precipitation at Saanichton is 29·56 inches, 59 per cent of which falls during the four winter months, November to February, inclusive, and only 12 per cent during the summer months, May to August inclusive. The heaviest annual precipitation ever recorded here was 41·55 inches in 1933, and the lowest 18·66 inches in 1929. January, 1935, furnished a record for monthly precipitation—12·74 inches, of which 11·74 inches was rain. A twenty-four hour record of 2·88 inches was also established during that month.

Extremes of temperature are seldom experienced. The lowest recorded during the past 33 years was 9 degrees above zero in January, 1917, and the highest. 94 degrees in July, 1941. The annual mean temperature for the period covered by this report was 49·3 degrees.

On an average, the sun shines for 2,089·5 hours during the year. In 1938 the annual sunshine amounted to 2,306 hours, but in 1946 only 1,901·8 hours were recorded.

The meteorological records presented at the end of this report were prepared in co-operation with the Meteorological Division of the Department of Transport.

The following table shows the monthly high-low and mean temperature, average precipitation and sunshine recorded over a 33-year period.

TABLE 1.—METEOROLOGICAL RECORDS, DOMINION EXPERIMENTAL STATION, SAANICHTON, B.C., 1914-1946

33-YEAR AVERAGE

Month	Temperature F.			Precipitation			Bright Sun (hrs.)
	Highest	Lowest	Mean	Rain (in.)	Snow (in.)	Total Precip. (in.)	
January	55·0	9·0	36·6	4·15	4·81	4·63	63·8
February	59·0	10·0	38·2	2·96	3·60	3·32	92·5
March	67·0	23·0	42·8	2·64	0·65	2·71	141·2
April	74·5	28·0	47·5	1·54	0·03	1·54	189·8
May	85·0	31·0	53·8	1·09	.....	1·09	261·7
June	93·0	36·0	58·7	1·10	.....	1·10	267·8
July	94·0	43·0	62·6	0·65	.....	0·65	322·8
August	91·0	40·0	62·5	0·72	.....	0·72	292·1
September	84·0	35·0	56·6	1·41	.....	1·41	200·4
October	76·0	25·0	50·0	2·93	.....	2·93	123·0
November	61·0	25·0	43·0	3·88	0·81	3·96	70·0
December	58·0	13·5	39·2	5·27	2·94	5·56	60·1
Annual	.....	.....	49·3	28·34	12·84	29·62	2,083·8

Additional meteorological information will be found at the end of this report, under the heading Appendix A, B and C.

FRUITS AND NUTS[1]

Original plantings of the common tree fruits at the Saanichton Station date back to the spring of 1914. These plantings were extensive and included many varieties of pears, plums and cherries unknown to American nurserymen. In such instances the new varieties came from Baltet Nurseries, France. Since the original plantings were made many other varieties have been added and have been obtained chiefly from the Horticultural Division at other Dominion Experimental Stations and from local nurserymen.

In recent years many varieties of all fruits have been discarded as it was felt that twenty years is sufficient to determine the worth of a variety and in many cases much less time is required.

In this report it is impossible to give more than a brief summary of work and results covering any one crop.

Apple Variety Trials

Nearly 100 varieties of apples have been under observation in these trials conducted since 1914. As would be expected, certain varieties have attracted attention as being the most suitable for the gardens and small orchards of Vancouver Island and adjacent islands. Brief notes are given herewith on varieties considered to be most suitable.

Close is the earliest variety tested having been picked as early as July 4. This variety carries considerable colour and possesses good size for an early apple. Yellow Transparent is widely grown as a standard early variety and is a week or more later than Close. Melba (Red) is definitely a high quality apple, very attractive because of its colour and size, and ripens in early August. Gravenstein has been standard for quality for many years and the newer Red Gravenstein has the good qualities of its parent and high colour appeal as well. McIntosh has not been strongly recommended in past years chiefly because of its small size; however, in locations where there is enough moisture for the fruit to size up, McIntosh is a good late fall apple. Blenheim is an old variety and is a heavy yielder of high quality, storing under ordinary conditions until

[1] Written by E. H. Hall.

early March. Grimes Golden and Wagener are two good winter apples usually storing well until early April. Yellow Newtown is the best very late variety for use in the spring months.

Early apples maturing in August and to mid-September bring a very good return to the grower. Much of the surplus fruit finds its way to market through road-side stands and local retail stores.

Apple Rootstocks

Extensive trials are being made with trees of several varieties on East Malling rootstocks including Nos. I, II, VII, IX, X, XII, XIII, XV and XVI. Rootstock E.M. IX produces a marked dwarfing effect on trees and at the same time trees on this stock come into bearing almost at once or in two or three years from time of planting. These small trees are most useful for the small garden where a number of trees may be grown in a limited area. Some of the East Malling stocks have a semi-dwarfing effect while others are vigorous. At this date no detailed report on the merit of these stocks can be given.

Apple Pollination

Studies of pollination requirements in 14 apple varieties show that self-compatibility exists to a marked degree in most varieties. Even with this ability to set fruit from its own pollen, in only a few instances were satisfactory sets obtained from self-pollinations. Cross-pollinations should be provided for all varieties by interplanting. Wagener and McIntosh have shown themselves to be good pollenizers for many commonly grown varieties such as Gravenstein, Grimes Golden, King and Yellow Transparent.

Fig. 1.—Cotton bag fitted over a wire frame and used in pollination studies.

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Apple Breeding

A good market exists for early apples usable in July and August. Yellow Transparent has been the earliest good market variety and it is felt that a red apple of equal or better quality, preferably earlier, would be a decided acquisition. With this idea in mind several controlled crosses were effected between early varieties such as Close, Crimson Beauty, Melba, McIntosh and Rupert. From six separate controlled crosses, 566 seedlings resulted in 1944 and these were set in the field in November, 1945. Fruit-bearing results of these seedlings are being watched.

Fig. 2.—View of Station orchards with Straits of Georgia in background. Pollination bags installed on trees.

Cherry Variety Trials

In recent years cherry variety trials have been greatly reduced and the orchard area given over to other work. Fifty varieties of sweet and sour cherries have been dropped because of being below the standard required of a variety worthy of planting. Bing and Lambert were two of the outstanding black varieties and Napoleon (Royal Ann) the best white for both quality and yield. Montmorency was the outstanding sour variety. All four varieties are recommended for planting. While a number of other varieties had considerable merit none are considered good enough to be listed here.

New varieties added to the trials in recent years include Carnival, Giant, Hedelfingen, Royal Stewart, Victor, Van, Schmidt and Sparkle.

Cherry Pollination

A study of unfruitfulness in the cherry was undertaken at this Station in 1931 and had as its objectives: (1) the verification, for this locality, of the reported complete self-sterility of the sweet cherry; and, (2) the determination of compatible varieties which when planted together could be expected to give reasonably heavy commercial sets of fruit. All self and cross-compatibility trials were conducted for 5 years in duplicate. Results obtained from pollinations carried out with popular comercial varieties show that:

1. Sufficient overlapping occurs, in flowering periods of the varieties under study, to ensure a supply of viable pollen at the time the stigmatic surfaces are ready to receive it.
2. An abundance of pollen was produced by all varieties.
3. All sweet cherry varieties proved to be completely self-sterile.

4. Bing, Lambert and Napoleon (Royal Ann) form an incompatible group.
5. Deacon is an excellent pollenizer.
6. Sweet and sour varieties cross readily.

TABLE 2.—GOOD POLLENIZING CHERRY VARIETIES FOR OTHER VARIETIES USED AS FEMALE PARENTS

Female Parent	Pollenizing Variety	
	First Choice	Second Choice
Bing	Deacon	Victor
Black Tartarian	Napoleon	Bing
Deacon	Bing	Napoleon
Early Rivers		
Lambert	Deacon	Pelissier
Napoleon	Deacon	Pelissier
Pelissier	Deacon	Lambert

Cross-pollinations involved the counting of 43,410 flowers, self-pollinations 8,684 flowers and open-pollinations 23,621 flowers.

Cherry Splitting

Considerable loss is sustained some seasons through cracking or splitting brought about by rain just as the crop is ripening. For several seasons investigations were carried out in which the various chemicals were used as sprays during the period when the fruit was developing and ripening. These materials included bordeaux, bordeaux plus Agral, Bordinette, gum arabic, ammoniacal copper carbonate and lime sulphur. None of the chemicals tested had any value in preventing fruits splitting.

Pear Variety Trials

Extensive variety trials with pears have been maintained since 1914 when fifty-five varieties were planted. Most of these varieties were obtained from France but all varieties being distributed by local nurserymen were included as well. It soon became apparent that pears are well suited to soil and climatic conditions on Vancouver Island. Trees have made satisfactory growth and production has been heavy with a tendency among some varieties towards biennial bearing. Heavy thinning of fruit tends to correct this habit.

Varieties recommended for planting are: Anjou, Bartlett, Bosc, Conference, Glou Morceau, Hardy, Louise bonne de Jersey, and Winter Bartlett.

Pear Rootstocks

Trees of 31 varieties of pears have been grown on both dwarf and standard rootstocks. Trees on dwarf stock were planted 15 by 15 feet apart and those on standard stock (seedling) 20 by 25 feet apart. Thus, each dwarf tree occupied one-half the area of a standard tree. Close planting is desirable in a small garden area but trees on dwarf stock give correspondingly lower yields so that it is doubtful if anything is gained by planting dwarf trees. Standard trees can be planted and cropped satisfactorily when planted 20 by 20 feet apart and where a limited number is required, as in a garden, the space saved by planting dwarfs is not very great. Commercial plantings of Bartletts should be on a standard stock. There is always the danger as well of dwarf trees rooting above the point of grafting, on the scion wood, in which case they may become as large as trees on standard stock.

Pear Pollination

Studies in the pollination requirements of pear varieties have been in progress since 1929. Methods employed cannot be related here in detail but 23,618 flowers received self-pollination. Of these 1·5 per cent matured into fruit as against 38,287 open-pollinated flowers, of which 5·6 per cent developed into fruit.

Self-incompatibility has been found to be very prevalent among pear varieties. Twenty varieties were found to be wholly self-sterile in failing to set fruit from their own pollen. In another group of 15 varieties, less than 1·0 per cent of flowers developed into fruit and can be considered self-sterile for practical purposes. Out of 55 varieties only 6 gave sets equal to or better than the average set of fruit for all varieties. An attempt to correlate yield and set of fruit shows that in trees full of flower about 4 per cent should develop into fruit to give a commercial crop.

Cross-pollinations have been carried out with many of the more commonly grown pear varieties in order to determine satisfactory pollenizers. In this phase of work 200 crosses were effected involving 28,845 flowers. Based on these trials results are set forth in Table 3 as to the best pollenizers for some common varieties.

TABLE 3.—POLLENIZERS FOR SOME COMMONLY GROWN PEAR VARIETIES

Female Parent Variety	Pollenizing Variety	
	First Choice	Second Choice
Anjou	Conference	Howell
Bartlett	Conference	Bosc
Bosc	Bartlett	Clairgeau
Boussock	Bartlett	Anjou
Conference	Bartlett	Anjou
Hardy	Bartlett	Anjou
Howell	Bartlett	Anjou
Louise bonne de Jersey	Bosc	

It will be seen from the foregoing table that Anjou and Bartlett are good pollenizers for varieties on which they have been used and from this it would seem safe to assume that these two varieties are good general pollenizers. Out of 12 pollens tested, Conference gave the highest sets on flowers of Anjou and Bartlett. Anjou is completely self-sterile, while Bartlett is partially self-fertile, with 2·0 per cent of its flowers maturing into fruit. When planting pear trees, attention should be given to the pollination requirements of the varieties being planted. Where a large planting of Bartletts is desired one tree in six should be Conference or some other good pollenizing variety.

Pear Marketing

There is much evidence to show that commercial pear growing offers good opportunities. The market demand for Bartlett pears for canning has not been met in the past 20 years and at the present time there seems no likelihood of the demand being overtaken for a long while. A large market exists for Bartlett pears and, while other varieties are accepted by canneries, Bartletts are desired. During the period 1932-42 the average price received for first grade Bartletts was $50.00 per ton, with the minimum size varying between 2⅜ inches and 2½ inches. In recent years, cannery prices have advanced to $100.00 per ton, in 1947 on a minimum size of 2⅛ inches. Fruit has to meet specific requirements in grade, and standards are similar to those of the fresh fruit market. Top grade pears

FIG. 3.—Bosc pear tree frame-worked with long Bartlett scions Mar. 30/40.

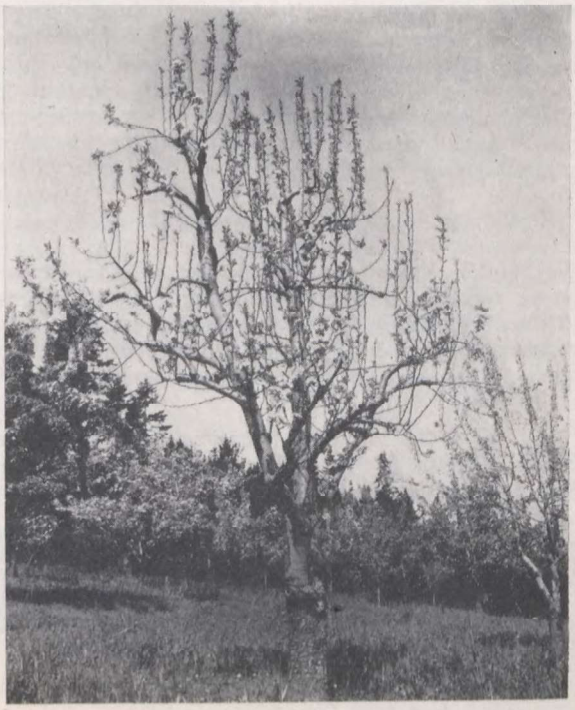


FIG. 4.—Bosc pear tree frame-worked with long Bartlett scions Mar. 30, 1940. Photo taken April 10, 1941. Same tree as in Fig. 3.

are required for canning rather than lower grade fruit that moves slowly anywhere. No difficulty need be experienced in meeting requirements on pear grades in this area if good cultural practices are followed.

Pear Grafting—Frameworking vs. Top-Working

This project was undertaken in 1942 to determine the value of frameworking as a method of grafting mature pear trees. This method was first used in the spring of 1939 when a Dr. Jules Guyot tree was frameworked with long Bartlett scions. This tree produced 100 pounds of excellent fruit the next year, being only one season (1939) out of production. Other trees have produced up to 200 pounds in the next season after grafting with the loss of only one cropping year.

In the spring of 1942 eight mature Boussock trees were grafted by frameworking and 8 similar trees were top-worked. Total yields up to the present time show double the yield from frameworking that was obtained from top-worked trees. More labour is involved in the former method of grafting because of the extra pruning required in preparing the scaffolding branches and in setting the large number of scions required. However, this is more than balanced by the larger yields from frameworked trees that quickly return to cropping.

Plum Variety Trials

The variety test orchard has been considerably reduced during the past ten years. Thirty-one varieties were active at the end of the 1946 season. while 25 varieties had been discarded. Beauty is the earliest variety being grown, ripening some seasons in the first week of July. It makes a small tree and is well worth planting because of its earliness. Gold is a good medium-early yellow plum and finds a ready sale. Peach is very early and worthy of planting in the home garden where a red plum is desired. Mallard is one of the most popular red plums, excellent for canning or dessert. Michelson is a small blue plum of excellent quality for jam making but trees here have not yielded heavily. Reeves is not yet well known but is one of the best large red plums (free stone) maturing in mid-season. Italian, Green Gage and Golden Drop (Coe's) are the best late varieties. In planting one or two trees in small gardens care should be taken that pollination requirements are met as several varieties are self-sterile.

Plum Pollination

Studies have been carried out with pollination requirements of commonly grown varieties in order to determine: (1) degree of self-incompatibility, and, (2) suitable pollenizers for self-incompatible varieties. These studies have yielded much valuable information. Self-pollinations involved 22,605 flowers, cross-pollinations 37,542 and open-pollinations 44,449 flowers. A summary of the work to date shows:

1. That the following varieties of plums are self-sterile or nearly so: Beauty, Black Diamond, Burbank, Gold, Grand Duke, Golden Drop, Mallard, Maynard, Michelson, Peach, Pond's, Reeves, Santa Rosa and Washington.

2. That Bradshaw, Green Gage, Monarch, Sugar, Victoria and Yellow Egg are self-fertile to a marked degree and could be expected to give satisfactory yields from self-pollinations.

3. That satisfactory pollenizers have been determined for many commonly grown varieties. These are shown in Table 4:

TABLE 4.—GOOD POLLENIZERS FOR COMMON PLUM VARIETIES

Pollinated Variety	Pollenizing Variety		
	First Choice	Second Choice	Third Choice
Black Diamond	Victoria		
Gold	Michelson	Santa Rosa	
Golden Drop	Victoria	Ponds	Peach
Italian	Golden Drop		
Mallard	Michelson	Victoria	Green Gage
Michelson	Mallard	Peach	
Peach	Victoria	Italian	Yellow Egg
Santa Rosa	Green Gage	Burbank	
Washington	Victoria	Green Gage	

Bees provide the chief agency through which pollen is transferred from flower to flower. Wind is not a factor in the transfer of fruit pollen. It will be seen that because of the activity of bees a single tree standing alone in a garden may set fruit because of pollen from other trees within a radius in which bees can operate.

Quince Variety Trials

Eight varieties of quince have been grown since 1914. Trees are thrifty and comparatively free from pests but yields are considerably below those obtained from other fruits. Rains near the ripening season may cause considerable cracking and resulting loss.

De Bourgeaut has been the heaviest yielding variety with De Bereczki and De Portugal being next in order. These varieties have been brought to the attention of local nurserymen and scion wood provided. Champion and Pineapple have been slow coming into bearing and are much lower in yield.

Peach Variety Trials

Peaches do best when grown against a wall, although they can be grown successfully in a sheltered spot in the garden. Leaf-curl is very common in most varieties, completely defoliating the tree in some instances where spraying has not been carried out early enough. To ensure protection, spray with lime sulphur 1-10 in mid-November and again in early January. Many peach trees are sprayed after buds begin to swell. At this time infection has taken place as spores of the leaf-curl organism have worked their way under the tiny bud scales and spray does not reach them.

Peach varieties are changing with the years. Rochester is still worthy of planting. Valiant, Vedette and Veteran are doing well against walls, with the latter variety being nearly two weeks later than the other two. Other recent introductions are not being grown here.

A mimeographed publication, "The Cultivation of Tree Fruits", which is available from this Station, gives greater detail on the methods of caring for these crops.

Filbert Variety Trials

Of the 26 varieties originally planted in 1914 all have been discarded except Barcelona. Until recent years, Barcelona was reported under the names of Fertile de Coutard and Red Hazel, as received from nurserymen. Barcelona is still one of the most productive and satisfactory filberts to grow. The nut is roundish, medium size and has a shell of sufficient weight to discourage blue jays. Average yield from 6 trees of Barcelona (mature trees) for four years is 17·0 pounds per tree. Daviana was recommended for many years and

is a fine nut of large size, attractive and with thin shell. This latter quality made it very attractive to blue jays with the result that only a portion of the crop could be harvested.

In recent years other varieties have been added to the trials, including Du Chilly and Nooksack. Young trees of 11 varieties planted in 1943 are now bearing and the highest yielding varieties to date are Nooksack, Du Chilly and Barcelona. All three varieties produce attractive nuts of medium to large size and are recommended for planting. At four years of age Nooksack trees averaged 1·5 pounds per tree in 1946.

Filbert Pollination

Studies in pollination requirements of filberts show that all varieties investigated are unable to give satisfactory sets from the use of their own pollen. Self-pollinations in the Barcelona variety gave a set of 28·7 per cent (4-year average) as against 75·3 per cent from open crossing. In no instance have controlled cross-pollinations equalled sets obtained from open crossing but in nearly all cases sets from controlled cross-pollinations have been greater than sets from self-pollinations. These studies are being continued with Nooksack and Du Chilly to determine to what degree these varieties are compatible.

A more detailed discussion on filbert culture is to be found in a pamphlet prepared at this Station entitled "Nut Culture".

Walnut Variety Trials

In the spring of 1917 five acres were set with walnut trees of 12 grafted varieties and a large number of seedlings. At the time of planting, some of the holes were "blown" with powder to shatter the close-lying subsoil and make conditions more favourable for root pentration and development. Data obtained show little or no difference in trunk circumference or terminal growth between "blown" and "dug" holes. No advantage in yield has been obtained from trees set in "blown" holes.

Yields have been disappointing on all trees. Fertile, Franquette, and Ordinaire have given highest yields among the grafted varieties averaging about 20 pounds per tree per year for 4 years. Three seedling trees have given 35 pounds per tree for the same period. These yields are considered very low for trees 25-30 years old.

While conditions are not favourable throughout the district for commercial plantings, yet it would seem highly desirable for every garden to be planted with one or two walnut trees.

Miscellaneous Kinds

Tests conducted during the early activities of this Station soon proved that almonds, chestnuts and pecans had no chance of becoming established in commercial areas. Chestnut trees have value as ornamentals and hard-shelled almonds grow well and are beautiful when in bloom.

Brambles

Comparative yields from plots of loganberry, boysenberry and youngberry, for a six-year period, show that loganberry and boysenberry are equal in average yield with youngberry being somewhat less. Loganberries have been grown for wine and canning purposes for many years and are a well established crop for this area. The boysenberry is not so well known but is a high quality berry of the blackberry type and is very suitable for freezing. Where yields can be obtained similar to those of loganberries, boysenberries should be grown but reports from

growers indicate yields from the latter are lower than those from the former. A replicated plot series established at this Station in the spring of 1946 is expected, after a few years, to give additional data on relative yields of boysenberries and loganberries and the value of these fruits for commercial plantings.

Other material appearing in bramble plots includes thornless boysenberry, thornless youngberry, thornless evergreen blackberry, Himalaya, Lowden, Cascade, Pacific and *Rubus macropetalus* (wild dewberry).

"Dry-berry" disease has had a marked effect on yields of most bramble varieties in recent years. A 54·3 per cent infection occurred in loganberries in 1944 reducing yields accordingly. In 1945, counts of infected fruits showed 62·0 per cent affected. In 1946, counts in 32 selected (superior) loganberry plants showed an average of 28·1 per cent dry-berry infected fruit with the lowest plant showing a 7·0 per cent infection.

Bramble Breeding

Because of the economic importance of dry-berry disease in reducing yields of loganberries a breeding project was undertaken in 1944 having for its objective the development of a resistant strain. It has been noted that the amount of dry-berry diseased fruit varied in individual plants from 7·0 per cent to 62·0 per cent in a group of 32 plants in 1946. Whether some plants are definitely more resistant than others is not known.

In a breeding project where crosses are made and seedlings grown, at least one parent ought to be highly resistant to or entirely free from the trouble. Much bramble material is being assembled in a search for resistant plants but at the present time all Rubus plants examined are susceptible to dry-berry.

Sixteen hundred, loganberry, boysenberry and youngberry seedlings fruited in 1946. These arose out of open-pollinated flowers in 1943 and young plants were set in field in 1944. Eight hundred loganberry×raspberry hybrid seedlings fruited in 1947. From all of this material selections have been made with the view of obtaining parent material for further crossing work.

Blueberries

The high-bush blueberry (*Vaccinium corymbosum*) is usually grown in peaty soils that are well drained and where the water-table during the growing season is at a level that provides a regular and constant supply of moisture at all times. Such soils are limited in area on Vancouver Island and no soil meeting these requirements is found on the Station farm. However, plants of 10 varieties have been grown in heavy clay loam and while growth has been limited, plants have survived and some fruit has been produced. Varieties active at the present time are Adams, Grover, Katharine, Pioneer and Rubel.

Several attempts have been made to root blueberry cuttings. These attempts have all resulted in a very low percentage of cuttings taking root. Greenwood cuttings taken in August and hardwood cuttings taken while dormant in midwinter have been tried in equal parts of peat moss and sand as a rooting medium in a cold frame. The best rooting was obtained with the June variety, when 61·5 per cent rooted. Because of this difficulty in rooting, rooted plants should be obtained from a nurseryman when setting out a plantation.

Currants

In the early years of the Station extensive variety trials with black and red currants were conducted. These trials showed the currant to be productive but that the fruit fly made unfit for use a large part of the crop. As control measures at that time were ineffectual the growing of currants at the Station was discontinued.

In recent years, however, sprays such as DDT have become available that give control of the currant fruit fly and a small plantation has been set with the following varieties: 0-381, 0-393, Boskoop, Buddenborg and Viking 894. All varieties are black except the last named which is red.

A hybrid berry known as the Worcester berry (Boskoop × Whinham's Industry) has been grown for several years. It resembles its gooseberry parent, in its spininess and in its rather medium-sized gooseberry-like fruit. Fruit is pleasant and of good quality but the plant is so well armed that picking is difficult. For this reason in particular it does not seem that this fruit will come into general use.

The black currant varieties, Boskoop and Buddenborg are recommended as having done well over many years.

Gooseberries

This crop has not been included in the small fruit plantings at this Station for many years. Because of mildew and damage from fruit fly the growing of this fruit has not been encouraged in this area. However, the situation has changed with the years. Mildew-resistant varieties are now available and new chemical sprays give a greater measure of control over the fruit fly. Because of these changes new variety trials have been undertaken with the planting of a score of English varieties. A number of varieties and strains received from the Horticultural Division, Ottawa, are also under test. All plants are too young as yet for the evaluation of varieties.

Seedling plants of the Chinese gooseberry (*Actinidia chinensis*) have been grown and set in the field for fruiting.

It is impossible to make specific recommendations for planting at the present time.

Raspberries

Variety trials with raspberries in properly replicated plots are not being carried on at the present time. Small plots of a number of varieties are being maintained for observation and demonstration. In addition to these a few tetraploid varieties are on trial so that material of this type may be at hand as required for breeding purposes. Crosses have already been effected between these tetraploid raspberry varieties and *Rubus zielinski*, a selection of the wild dewberry.

Of the standard varieties, Washington is a vigorous grower with a medium-sized berry of good quality and is recommended for planting. Taylor is a fine appearing berry but lacks quality. Newburgh is a large berry of very ordinary quality and plants lack in vigour. Tahoma is not equal to Washington and neither is Cuthbert when plants and yields are considered.

Grapes

In recent years most of the old varieties of grapes have been discarded in favour of newer varieties with more quality. Campbell's Early is still the best of all the varieties which was first grown at the Station 20 years ago. Average yields of this variety for 7 years were 21·5 pounds per plant. This is not heavy but at this rate 4·5 tons per acre would be produced. The average date of picking Campbell's Early is October 8. Niagara, Reed's Hybrid and Vergennes are about 10 days later.

American varieties and vinifera hybrids being grown at the present time are Brocton, Diamond, Emerald, Eurle, Fredonia, Buffalo, Erie, Geneva 17102 and 15708, Gold Muscat, Heron, Ontario, Patricia, Portland, Seneca, Siebel 5279, Van Buren and Worden. In addition to these varieties 12 selected European (vinifera) varieties have been obtained from Chas. De Gallier, Royal Oak, B.C.,

who has imported a large number of varieties from France over a period of many years. A few of these European varieties have already fruited and are of high quality though berries are medium to small. Most of these varieties are early enough to fit into the season here.

The best green varieties in order of maturing are: Pearl of Csaba, Seneca, Courtillier, Emerald and Gold Muscat. Black varieties worthy of planting are: Fredonia, Campbell's Early and Worden. These recommendations are likely to change as more information is acquired on the performance of new varieties.

Refractometer readings have been taken for sugar determination at time of picking. By this method Emerald showed 20·5 per cent, Pearl of Csaba, 20·0 per cent and Courtillier, 19·0 per cent. The average for all varieties was 16·0 per cent.

Grapes are easily grown on Vancouver Island and every garden should be planted with a few vines. Some attention has to be given to pruning and training which is carried out while vines are dormant.

Strawberries—Variety Trials

Extensive variety trials have been carried on with this crop during the past 10 years with varieties obtained from many strawberry growing areas including Washington, Oregon, California, Maryland, New Jersey, England and B.C. Forty named varieties from these centres are now being grown along with selected seedlings arising from breeding work at this Station.

British Sovereign continues to be the chief commercial variety grown on Vancouver Island. This variety, however, is subject to root troubles (rots) in the presence of excessive winter moisture on heavy soils. Varieties resistant in a marked degree to root rots (red stele) have been developed by breeders in various parts of America and Britain. A number of these resistant varieties have been acquired and added to the trials at this Station.

Strain trials with British Sovereign are being conducted. Plants have been obtained from seven of the leading growers in B.C. and are included in trial plots.

Strawberry Breeding

Improvement work with the variety British Sovereign has been followed for many years through parent selection. In this procedure new stock is produced only from parent plants that have fruited and proved to be vigorous and productive.

Methods employed in the selection and crossing of parent varieties need not be discussed in this report. However, parent varieties being used include: British Sovereign, Magoon, Royal Sovereign, Premier, Marshall and the varieties Pitt, Sovereign, Aberdeen and Temple which are resistant to red stele.

Many thousands of seedlings have been fruited in the past 10 years and single plant selections have been screened and eliminated as rapidly as possible. In 1945, fourteen controlled crosses carried out gave rise to 7,000 seedlings and, in 1946, seventeen crosses produced 7,425 seedlings. In this large mass of new material it is expected that a few valuable plants may be found. Further crossing work and the screening of new material is in progress.

More detailed instructions regarding the management of the various small fruits can be obtained from the mimeographed publication "Growing and Pruning Small Fruits" obtainable from this Station.

TREES AND SHRUBS[1]

In 1914 a strip of land lying along the west boundary of the Station, comprising about 10 acres, was planted to trees and shrubs obtained from American, European and Oriental nurseries. Many specimens of native plants have also been added.

[1] Written by E. H. Hall.

The great majority of plants became established but some failed partly because of unsuitable soil or moisture conditions and partly because of lack of hardiness, as some of the plants brought in would be classed as sub-tropical. There has been some crowding as the larger trees have pressed their demands for room. Removals have been made where advisable to landscaped areas of the Station to relieve crowded conditions.

The Station's park lying just east of the highway has been an attractive area throughout the years. Many excellent trees and shrubs are to be found along the park borders, and as specimen plants in the more open spaces of the park. Space, however, does not permit discussion of the merits of the several fine groups of trees and shrubs that do well here. In all, there are 611 species and varieties active at the present time, represented by over 1,000 specimens.

In the 1936 report, detailed descriptions were given of many of the best trees and shrubs for this area. A small pamphlet entitled "Ornamental Trees and Shrubs for Coastal Areas", is listed among available publications at the end of the report. This pamphlet discusses some rules to be followed in landscaping and gives extensive groupings of trees and shrubs of use for various purposes.

FIG. 5.—Eucalyptus on Station grounds killed back to ground level in severe winter of 1942-3. Photo taken Aug. 1944.

CASCARA

Trees of *Rhamnus Purshiana* (Cascara) were planted in the Station Arboretum in 1914. A number of these trees are active at the present time. One tree cut down and stripped in August, 1941, had a trunk circumference of 22 inches and yielded 12·5 pounds of dried bark. Another tree cut in June, 1943,

and with a trunk circumference of 25 inches yielded 11·5 pounds of dried bark. These trees were cut about 15 inches above ground level and in two years after cutting sucker growth from the stump was 6 feet high.

A young plantation of seedlings (150) was set in November, 1943, and good growth is being obtained.

Peppermint

While mint does not fall within the category of trees and shrubs, mention of work done with this crop will be given in this section.

In 1936 peppermint oil experiments were conducted at Saanichton and small plantings were set out in Duncan, Qualicum and Courtenay. The first trials indicated superior growth on peat soils and additional plantings were made in the Qualicum area in 1937, 1938 and 1939. The distilled oil from these plantings was shown to be of good quality both by U.S. and British standards. It was also clearly shown that the quality of the oil produced at Courtenay was different to that produced at Saanichton. This is the normal expectation. The yields of hay obtained in most of these trial areas were comparatively light and weeds were a problem. Weeds not only limit the growth of the mint but any weeds harvested with the mint and distilled with it will cause off flavours and may quite spoil the peppermint oil qualities. The experiments conducted at the various points noted above have not led so far to commercial production on Vancouver Island.

In mint growing the mechanical operations are of as great if not greater importance than the agronomic aspects. Weed control is the most important of the latter. An ordinary hay mower and hay rake may be used for harvesting, and loading may be done with hay loaders or forage crop harvesters. In some of the more intensive areas sweeping machines are used to sweep over the field to collect any fallen leaves as it is the leaves which contain the oil.

The distillation of mint offers many problems. An appreciable investment is necessary for equipment. While there is reason to believe that satisfactory crops of mint could be grown on Vancouver Island no industry has become established. During recent years in the Ladner district mint growing has been undertaken commercially.

Plant Propagation with Hormones

During 1937 the public press drew attention to the phenomenal results to be obtained in stimulating root development in plants and cuttings by means of substances known as plant hormones. In short order commercial hormone preparations began to appear under trade names. This appearance prompted trials at this Station which were undertaken in 1938. Six of these root growth substances were obtained under the following names—Auxilin, Hormodin A, Hortomone A, Indanol, Auxan and Rootone. The last two were in dust form. Later Hormodin powders 1, 2 and 3 were used in the trials.

More than 10,000 cuttings have been processed. Standard methods of preparation and handling have been used throughout. Preliminary trials were carried out mainly with cuttings of Prunus, Pyrus, Malus and Syringa. It was felt, in view of the claims made for hormones, that it might be found possible to root cuttings of apple, pear, plum, cherry, etc. Cuttings of many other plants have been treated with hormone preparations to study their effect upon root development. These include Acer (Japanese), Azaleas, Ceanothus Camellia, Cornus, Cryptomeria, Chamaecyparis, Juniperus, Ilex, Rhododendron, Rosa, Rubus, Prunus, Picea, Pinus, Syringa and Vaccinium.

SUMMARY

1. More than 10,000 cuttings have been used in the trials. Hormone treatments have numbered 30 and have been applied to a wide range of plants and varieties.

2. Results with hard and soft wood cuttings of apple, pear, plum, cherry and filberts were entirely negative.

3. Hormone treatments failed to induce rooting in plants that are ordinarily considered difficult or impossible to root from cuttings.

4. In most plants that can be rooted from cuttings, hormones increased the rooting. This increase in rooting over the checks varied with the treatment used, and with the plant variety, but in most lots increases were limited.

5. Responses were more pronounced in Camellia, Cryptomeria, Ilex, Syringa and Thuja.

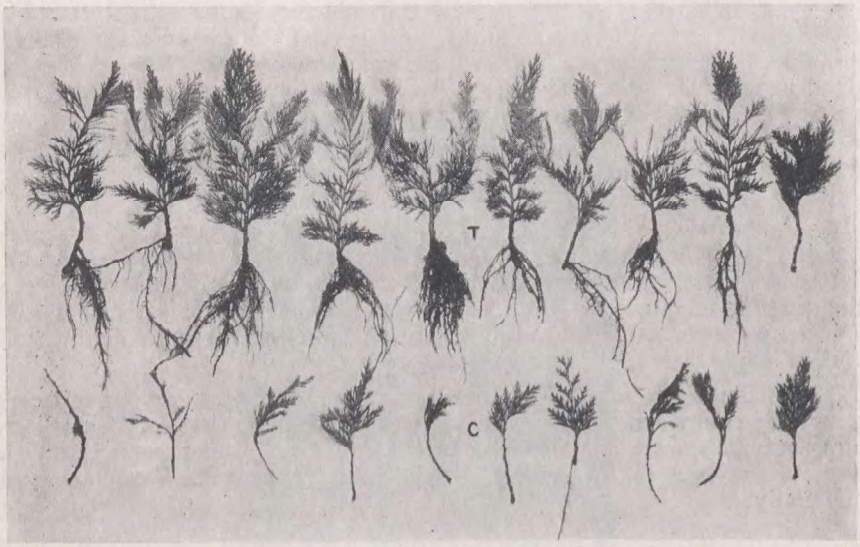


FIG 6.—Thuja aurea (Cypress). Cuttings taken Feb. 10, 1940. Photo taken Dec. 3, 1940. T. Treated with Hormodin powder No. 3. C. No treatment. This was the most outstanding effect obtained amongst the thousands of cuttings tested.

BULBS[2]

The first experimental work with bulbs in British Columbia was conducted at the Saanichton Station as early as 1916. Results from these early experiments which were concerned with the culture and varieties of narcissus, tulip, hyacinth, lily and miscellaneous spring flowering bulbs were published in two bulletins under the titles "Bulbs and Bulb Bloom", No. 48, 1921, and "Some Flowering Bulbs", No. 95, 1928. Copies of the former are still available from this Station.

Commencing in 1939 experimental work was intensified. In the period 1937-1946, which is covered by this report, the work has been pursued along two main lines. These deal with variety testing, which has always been a major feature of the work, and also with a series of projects which were meant

(2) Written by J. H. Crosley.

primarily to furnish needed information to aid growers to establish and expand soundly and effectively their bulb plantings in the boom years during and immediately following the war.

Expansion in the bulb industry in British Columbia, indicated by the increased acreage, is noteworthy. During the period 1937-1946, the acreage in the province increased 110 per cent; actually from 249 to 523 acres. At the end of the period this represented an annual revenue to the province of approximately two-thirds of one million dollars. Of this amount about half was derived from the sale of bulbs and half from the sale of flowers. Such rapid expansion was the result of a war-created scarcity of bulbs of all kinds. The bulb scarcity, resulting in very satisfactory prices to the grower, lured many individuals into this specialized type of farming for which they had no particular qualification. This situation and the fact that there was insufficient information concerning the commercial growing of bulbs and flowers under local conditions, indicated the need for considerable experimental work of a wide nature.

Project work with bulbs, exclusive of variety testing, has been approached from three main angles, as follows: (1) bulb production problems under field and storage conditions (2) greenhouse flowering problems especially as related to previous field and storage treatments and (3) bulb and flower shipping investigations. For the purpose of this report results from (1) and (2) above are combined; bulb and flower shipping tests (3), are treated separately. The sections on bulbs in the following pages deal with the principal crops being studied and cover certain major projects and problems with each kind of bulb. A complete list of projects dealing with bulbs follows at the end of the report. Additional information on bulb culture based on the experiments at Saanichton is available in mimeographed pamphlets, a complete list of which is cited in the last pages of the report.

Two important facts have been revealed during the ten-year period 1937-1946. Although outside the scope of the work covered by experiments, they have nevertheless an important bearing on continued experimental work with bulbs as well as the future stability of the bulb industry in British Columbia. These facts are, first, that in spite of difficulties, British Columbia bulbs are today more widely accepted than ever before for use in Canadian trade channels; second, these bulbs have been shown experimentally and commercially to have the very desirable factor of extra earliness and are superior in this respect to imported stocks. This is very important because the greenhouse industry, which consumes approximately 80 per cent of all the bulbs used in Canada, values highly the early flowering characteristic. Continued development in the British Columbia industry would appear to be assured by capitalizing on this climatically-derived factor and backing it with quality through continued, intensive research and sound production methods.

Tulip Variety Tests

Variety testing of tulips has been consistently a major project and, in recent years, more attention is being given to this phase of the work. As a result, over 300 varieties have been tested over a period of several years. Data obtained with about two-thirds of this number concern rate of increase in respect to size, weight and quantity. In addition, data have been taken on general flowering behaviour and suitability for field and greenhouse purposes. Based largely on these results, the following list of recommended varieties have been prepared. In order to conserve space only brief descriptive data are given. Greater detail and a more comprehensive selection of outstanding varieties are being made available in mimeograph form. Copies may be had upon request from the Dominion Experimental Station, Saanichton, B.C.

Recommended Varieties

(F) Indicates varieties suitable for forcing under glass.

(x) Indicates a variety is a comparatively recent accession and therefore not fully proved but highly promising.

A. (Early Flowering)

Single—Brilliant Star, (F), red; Gen. de Wet, (F), orange; Keizerskroon, red and yellow; Yellow Prince (F).

Double—Peach Blossom, (F), rose-pink.

Mendel—xHer Grace, white, edged rose; Jordan, dazzling red; King of the Reds; Saanich Queen, violet rose; xVan der Eerden, red.

Triumph Varieties—xAlberio, cherry red, edged yellow and white; xCrater, red; xKorneforos, (F), carmine; Lybra, rose and white; Telescopium, (F), reddish-violet; Thuban, (F), cerise, edged white, inside reddish-orange.

B. May Flowering (late)

Cottage (Single Late)—(Pink and Salmon shades)—Inglescombe Pink; Marjorie Bowen, salmon rose; Dido, fawn, shot rose; (Yellow shades)—xGolden Harvest, (F); Inglescombe Yellow, late, good shipper; xMrs. John T. Scheepers, large blooms; Mrs. Moon, pointed petals; (Orange shades)—Grenadier; (White)—xAlbino, (F); Carrara, (F); (Scarlet)—xMarshal Haig.

Breeder Varieties—Bronze King, purple on pale yellow ground; Louis XIV, bluish violet, best in this class; xDillenburg, orange-red, edged bronze.

Darwin Varieties—(Pink and Rose shades)—Antony Roozen, rose; Clara Butt, salmon pink; Le Notre, rose; xMr. van Zijl, deep rose; Princess Elizabeth, (F), rose-pink, best forcer in this colour, widely grown, highly recommended; (Yellow shades)—xNiphetos; xYellow Giant; (White shades)—Duke of Wellington; Mrs. Grullemans, creamy-white; Zwanenburg, white, black anthers; (Mauve-Rose; Cerise)—Rose Copland, early, prolific propagator, considered an outstanding forcing variety but only average in Saanichton greenhouse tests; Pride of Haarlem, dependable; (Bright red shades)—xAllbright, (F); xCampfire, (F); Bartigon, (F); Farncombe Saunders; xGloria Swanson; Wm. Pitt, (F), the most popular early red variety for forcing; (Dark red shades)—Allard Pierson, (F), early, crimson maroon; City of Haarlem; xUtopia; (Mauve, lilac shades)—Bleu Aimable; Wm. Copland, early, prolific propagator, once regarded as one of the most valued Darwin's for forcing; less popular now as demand is for brighter colours; only average in Saanichton greenhouse tests; (Purple shades)—xDemeter, (F), reddish-purple; The Bishop; (Black and Purple-black)—La Tulip Noire; Zulu.

Parrot Varieties—Blue Parrot, bright violet, bronze outside, purple inside; Fantasy, salmon-pink; Sundew, cardinal red with crystal-like fringe.

C. Species

Chrysantha; Clusiana; Dasystemon (Tarda); Eichleri; Fosteriana; Mme. Lefeber (F. Red Emperor).

Increase from Various Sizes of Bulbs

During the war when propagation stock was in short supply, a heavy demand was created for all, even the smallest sizes and there arose the need for information concerning the relative values and the productive capacities of various sizes and varieties of bulbs. Examples of this information are set forth in a 3-year summary in Table 5 for the two popular commercial varieties, Bartigon and Wm. Pitt.

TABLE 5.—AVERAGE INCREASE FROM 100 TULIP BULBS OF VARIOUS SIZES 1944-46 INCLUSIVE

Variety	*Sizes planted	Per cent. increase		Value crop planted to value crop dug
		By weight	Marketable sizes (10 cm.) larger	
	cm.	%	%	ratio
Bartigon	6	280	34	1 : 4·24
Bartigon	7	200	50	1 : 3·40
Bartigon	8	129	80	1 : 2·59
Bartigon	9	89	79	1 : 2·05
Wm. Pitt	6	236	44	1 : 3·56
Wm. Pitt	7	213	66	1 : 3·31
Wm. Pitt	8	171	84	1 : 2·77
Wm. Pitt	9	106	84	1 : 2·01

* 1200 hand-graded bulbs planted in each size.

Results in Table 5 show that smaller sizes of tulips are more remunerative than larger sizes. Hence, a grower who has to establish himself in the bulb growing business by no other means than by purchasing all his stock at market prices, would be well advised to obtain all or as large a proportion as possible of the smaller sizes. Once having sufficient propagation stock and being in the position of an established grower who wished only to maintain a given acreage, the data show it is advisable to plant only the larger propagating sizes as the latter produce a bigger percentage of larger or saleable size bulbs.

Soil Type in Relation to Flower and Bulb Production

In this project three soil types (heavy clay loam, light sandy clay and light black loam) are compared from the standpoint of bulb and flower production. Concerning flower production, the matter is considered from the angle of results obtained in the field and the residual effect of soil type when the bulbs are forced in the greenhouse. The project, which is still active, covers 5 years, for the period from 1942 to 1946.

In general, results have shown that satisfactory bulbs were produced in all three soil types. The largest quantity of saleable sized bulbs by weight and the highest percentage of top grade flowers were obtained in the soil types that had the most satisfactory conditions for aeration and drainage, with a high moisture holding capacity. In this experiment these conditions prevailed more often in the light, fine-textured soils, that is, in the light sandy loam and the light black loam types. Marketable yields of bulbs from the plots used in each of these two light soil types averaged 34 pounds for the 4-year period, compared with 25 pounds from the heavy clay loam. The average total yields for the same period compare as 71, 59 and 59 pounds for the light sandy clay, the light black loam and the heavy clay loam, respectively, from similar areas of land.

It was also shown that harvesting operations in the heavy clay loam were more time-consuming by 20 to 100 per cent as compared with those in the lighter soils. In addition, harvesting was less efficient. Heavy soils, therefore, are not recommended for tulip growing unless they can be effectively and cheaply made suitable by means of drainage and soil improving crops. In the greenhouse, small and inconsistent differences were obtained in the number of top grade flowers and in the number of forcing days when the bulbs from the three soil types were forced. These differences are regarded as inconsequential from a practical standpoint.

Sowing vs. the Conventional Method of Planting Bulbs

The conventional practice of setting pulbs upright while planting and spacing them requires extra effort, time and expense. In extensive plantings, the extra time and cost for the setting up phase of planting assumes major importance. This consideration receives added significance when time for planting is a limiting factor, which often is demonstrated on large bulb farms of the Pacific coast where early fall rains cause numerous lengthy and costly delays. Methods that shorten the time for planting and at the same time provide for the necessary spacing for maximum bulb development have a decided advantage. Accordingly, tests were made to determine the value of the sowing method of planting as this method seemed to offer a ready and satisfactory solution. In addition, sowing by hand provided a valuable check on bulb planting machinery because machine planting was the near equivalent of planting by the sowing method. In this experiment tulips were used. Results from tests comparing the conventional method of planting tulips and the hand sowing method are tabulated in Table 6. The data are for a five-year period and include the combined results from planting identical quantities by size, weight and number in each treatment. The varieties tested were Wm. Pitt, Princess Elizabeth and Wm. Copland. All sizes up to and including 9 cm. were included.

TABLE 6.—FIVE-YEAR COMPARISON OF RESULTS FROM TWO METHODS OF PLANTING TULIP BULBS

Material harvested	Spaced and set upright by hand (Conventional method)	Sowing by hand
Total weight (lb.) of marketable sizes (10 cm. and larger)	70·5	74·6
Total weight (lb.) all bulbs	145·3	145·7
Total number grade 1 flowers	920	857
Total number of flowers all grades	1498	1447

The results in Table 6 indicate that the sowing method of planting tulips is of value, particularly in bulb production. In flower production, and on a basis of the number of grade one flowers obtained, better results were obtained by the conventional method.

In general, the sowing method is recommended for large scale trial with tulips, with the qualification that its value should be determined as it applies to the individual variety and purpose.

Salvaged vs. Normal Bulbs

As a war emergency forced bulbs which were salvaged from the greenhouse cutflower industry became an important source of supply of propagation stock for British Columbia bulb growers. It was important, then, that the value of such stock be determined. Results obtained from planting forced tulip stock under field conditions in order to rejuvenate the bulbs are shown in Table 7. The data are based on a series of experiments, each experiment covering a two-year period. Three varieties are dealt with. Equivalent plantings of salvaged and normal stock are compared.

TABLE 7.—COMPARISON OF SALVAGED AND NORMAL TULIP STOCK UNDER FIELD CONDITIONS[1]

Combined results of first and second year plantings.

Material harvested	Normal tulip stock	Salvaged tulip stock
Total number of flowering plants	2,422	1,963
Total weight (lb.) bulbs harvested	239·0	231·9
Total weight (lb.) marketable sizes (10 cm. and larger)	154·3	135·3

[1] Data for varieties Wm. Pitt, Princess Elizabeth and Pride of Haarlem.

Results in Table 7 show that salvaged tulip stock is approximately 12 per cent less productive of saleable sizes than is normal stock; in total weight of bulbs obtained, salvaged stock is approximately 3 per cent less productive.

Greenhouse data in this war emergency experiment show that tulip bulbs of recognized forcing size derived from forced stock will force with complete satisfaction after such bulbs have been rejuvenated for one year under field conditions. Previously, it was generally considered that even though one year rejuvenated bulbs were large enough, an extra year's rejuvenation was needed to produce satisfactory flowers.

Because salvaged stocks frequently show high percentages of diseased bulbs and serious proportions of mixed varieties it is important that anyone considering using forced stock consider these two important factors. Satisfactory results from forced stock will depend on the degree of control exercised in eliminating diseased bulbs and mixtures. Individuals who force and grow their own stock are best able to profit from any use of salvaged stock.

Annual vs. Biennial Harvesting of Tulip Bulbs

Leaving tulip bulbs in the ground undisturbed for two growing seasons before harvesting, a practice sometimes considered advantageous, was shown to be definitely less satisfactory than annual harvesting. Experiments during the 3 years, 1944-46, showed the chief disadvantages were an average reduction of 27 per cent in the weight of marketable size bulbs; 36 per cent reduction in the total weight of all bulbs harvested and a decidedly greater prevalence of the fungous disease *Botrytis tulipae* (fire). This disease was responsible for a marked reduction in the quality and grade of flowers produced in the biennially grown plots. For best results, annual harvesting and replanting in soil that has no grown a crop of tulips for at least three, and preferably four or five years, is recommended.

Maturity and Controlled Storage Temperatures

This project was begun in 1939 and covers the results for the years 1940, '41, '43 and '44. The prime purpose was to determine the optimum condition for harvesting tulip bulbs from the standpoint of satisfactory crop increase, bulb quality, and subsequent field and greenhouse flowering. For this purpose tulips were harvested at various stages of maturity, based on the appearance of the tops and the bulbs. The bulbs from each maturity level were then subjected to four different storage temperature treatments, as follows:

(1) 2 weeks at 80 degrees F., immediately after lifting, followed by uncontrolled temperatures in a well ventilated bulb-house until planting time.
(2) Uncontrolled temperatures in well ventilated bulb-house, then one month at 46 degrees F., just before planting.
(3) 2 weeks at 80 degrees F., immediately after lifting, followed by uncontrolled temperatures, then one month at 46 degrees F., just before planting.

(4) Uncontrolled temperatures in a well ventilated bulb-house from time of digging until time of planting; temperature fluctuated between 55 and 75 approximately.

(In treatments (2) and (4), 36 degrees F. was substituted for 46 degrees F., in 1944, as the latter temperature was not available. Storage at 36 degrees F., was satisfactory as far as could be ascertained.)

Results show that while the appearance of the tops and the bulbs was not a completely reliable index for the optimum time to dig tulip bulbs, the method was fairly satisfactory. It is concluded and recommended that the optimum condition for lifting tulip bulbs is that stage of the leaves and stems before they are fully dead and brittle, but after the last trace of chlorophyll has gone and when the crop has reached its maximum size. If lifted earlier than at this recommended stage, the risk of shrinkage in size of bulb and the corresponding reduction in bulb quality and subsequent flowering, especially under greenhouse forcing conditions, is very marked. In addition, the bulb tunics may be too pale and too variable in colour to be acceptable by the trade.

The results also showed that in order to obtain the earliest and best greenhouse flowers commensurate with satisfactory quality of bulbs and flowers under field conditions, the crop should be lifted as recommended and the forcing sizes subjected to the treatment as outlined under (3). When for various reasons the bulbs are harvested later than the recommended stage which may happen due to delays and pressure of work, treatment (2), will give the most satisfactory results in regard to early greenhouse flowering. (See Fig. 7).

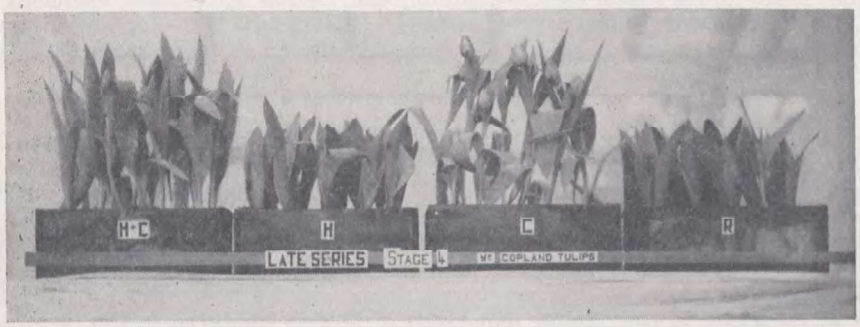


FIG. 7.—Illustrating the effect of four different bulb storage temperature treatments on greenhouse flowering of Wm. Copland tulips. The importance and major role of cold storage in regard to earlier flowering and added stem length is clearly demonstrated in the two treatments "C" and "H and C". When tulips are dug late (as above) treatment "C" is most satisfactory; when dug as recommended (see text), treatment "H and C" is most satisfactory.

NARCISSUS

Experimental work with narcissus has been confined to variety testing, comparison of stocks from various sources, and fertilizer trials, in conjunction with tulips. The fertilizer work has been summarized and recommendations based on the experimental data are referred to under the Plant Nutrition section of this report. The results from the variety tests are summarized in the following recommended list of varieties.

RECOMMENDED VARIETIES

(Key (F) and (x) explained on page 20)

Trumpet—Yellow or lemon-coloured trumpet, perianth of same shade or lighter (not white); xGolden Harvest; King Alfred, (F); Magnificance, (F);

xRembrandt; Van Waverens Giant; (white trumpet and perianth), Beersheba; xPenvose; Mr. E. H. Krelage; (yellow trumpet and whitish perianth), Victoria, (F); Weardale Perfection.

Incomparabilis—(Yellow shades with or without red colouring on cup)—xFortune; Helios, (F); xScarlet Elegance; Sir Watkin, (F); Killigrew, (F); (bicolour with white or whitish perianth and self-yellow, red-stained, or red cup); xCarlton, (F); Heyday; John Evelyn.

Barrii—(Yellow shades with or without red colouring on cup); Baths Flame; (white or whitish perianth and self-yellow red-stained, or red cup); Firetail; Lady Moore, (F).

Leedsii—Lord Kitchener; Tunis; Gertie Millar.

Triandrus Hybrids—Thalia.

Cyclamimius Hybrids—February Gold; March Sunshine.

Jonquilla Hybrids—Rugulosus; Trevithian.

Tazetta and Tazetta Hybrids—(Polyanthus varieties, chiefly for forcing in the greenhouse); Paper White, (F); Grand Soleil D'Or, (F); (Poetaz varieties); Elvira, (F); Jaune à Merveille; L'Innocence, (F); Medusa; Princess Yolande; Scarlet Gem, (F).

Poeticus—Actaea, (F); ornatus maximus, (F); Recurvus (Pheasant's Eye).

Double—Cheerfulness; Inglescombe; Irene Copland; Van Sion, (F, in pots).

Various Species—Narcissus Bulbocodium conspicuus (Hoop Petticoat); N. nanus; canaliculatus.

Comparison of Narcissus Stocks

The purpose of this project was to evaluate British Columbia grown stocks of narcissus in regard to their quality and season of flowering for greenhouse use. Results cover the five years, 1941-1945, and represent the stock of ten different growers from the two main producing areas in the province, namely, Vancouver Island and the Lower Fraser Valley.

Fig. 8.—A field of King Alfred daffodils in British Columbia. Narcissus, the crop to which daffodils belong, are a major bulb crop. In 1946 one-third of the total bulb acreage was in narcissus.

FIG. 9.—Hybrid Easter lilies growing on the Station for selection purposes.

FIG. 10.—A field of Easter lilies near Victoria.

Information obtained from the tests show that British Columbia narcissus are highly satisfactory for greenhouse purposes. Regarding the season of flowering, considerable difference was shown between the various stocks. In this regard a maximum difference of 22 days was noted and an average maximum of 12 days for the 5-year period. In general, but not without exception, Vancouver Island grown stocks were the earliest to flower.

Hyacinth

The experimental work with hyacinths has been concerned almost entirely with artificial propagation. About the year 1916 the first experiments of this nature were conducted at this Station. The results were published in the Station's bulletin 48, "Bulbs and Bulb Bloom". Not until 1942 was the experimental work renewed and intensified. Recent work has dealt mainly with the following phases of artificial propagation: methods of cutting; methods and materials in which callusing and incubating can be effected; hot-water treatment in relation to bulblet formation; methods of planting mother bulbs; amount and rate of development of bulbs. Results dealing with these and allied topics are available from the Station in the following publications: (1) "Promising New Methods Used in Propagation of Hyacinths" (2) "Hyacinth Bulb Production and Artificial Propagation."

Lilies

Propagating lilies from scales and seeds and testing of about 50 varieties has been the basis of the experimental work with this bulb crop. Considerable emphasis has been placed on Easter lilies (*L. longiflorum*) from the standpoint of commercial bulb production. Greenhouse tests with several varieties of Easter lilies indicate favourable results with locally produced bulbs and point to the desirability of expanding this phase of the work in order to assist in the development and establishment of British Columbia's Easter lily bulb industry. Information on the culture of Easter lilies, based on the results of experimental work at the Station, has been released in the mimeographed publication "Easter Lily Culture In British Columbia" which is obtainable from the Saanichton Station.

Fig. 11.—Croft Easter lilies grown from British Columbia bulbs. Plants are short and of uniform height. Flowers are noted for their great substance.

Gladiolus

About 30 varieties have been grown on the Station for test purposes. Data obtained are mainly concerned with flowering, rate of increase from planting various sizes and effect on growth of several preplanting dips. Information on varieties and cultural practices has been made available in a mimeographed publication "Gladiolus Culture in British Columbia" also obtainable on request to this Station.

Miscellaneous Bulbs

In this group there are kinds not already mentioned, which with the exception of bulbous iris are of minor economic importance. Based on the results from several years tests, the following kinds have been classified according to their suitability (hardiness, satisfactory rate of increase and ease of handling) for commercial flower and bulb production purposes under field conditions. Those suitable for cut flower purposes under field conditions are marked (F); those suitable for bulb production purposes are marked (B). Some are suitable for both purposes.

Excellent	*Promising*	*Unsatisfactory*
(1) Anemone coronaria (F, B) St. Brigid Monarch Giant Poppy Flowered Creagh Castle	Ranunculus (F, B)	Freesia (in variety) (suitable for greenhouse purposes only)
(2) Camas Leichtlinii (B) (Native species)		
(3) Colchicum Autumnale (B)		
(4) Crocus (in variety) (B)		
(5) Iris (bulbous) (F, B)		
(6) Muscari spp. (B)		
(7) Snowdrop (B)		
(8) Scilla spp. (B)		
(9) Tigridia (B)		

Shipping Bulbous Spring Flowers By Rail

This project was investigated at the request of the Canadian National Railways for information concerning the storage and shipping of spring flowers from the Victoria area to cities on the prairies. For this purpose there was solicited the co-operation and facilities of two local flower growers; the B. Wilson Co., Victoria, cold storage plant; the Canadian National Railways; a Winnipeg florist; and Professor E. T. Andersen, Horticultural Department, University of Manitoba, who acted as referee, and who made keeping tests under average living room conditions in Winnipeg of the shipments.

Included under this project was the handling of approximately one thousand dozen daffodil, tulip and iris blooms under various conditions of storage, packing and shipping over a two-year period.

The tests show that for best results in less than carload lot shipments, the flowers should be shipped as soon as the stems have stood in water for approximately 12 hours. A holding temperature of 36 degrees F., was shown to be satisfactory, and preferable to 45 degrees or higher when the flowers had to be held a few days for special markets such as those of Easter and Mother's Day. Safe limits for holding the flowers prior to shipping, to ensure reasonably

satisfactory condition on arrival in Winnipeg, were also determined, and were shown to vary with the kind, the variety, the year, and especially the pre-shipping treatment. Regarding moist or dry packs, daffodils indicated a slight preference for the latter whereas tulips and iris preferred the moist pack by a narrow margin. Waxing the stem ends of daffodils proved to be time-consuming and added a maximum keeping time of only one day in one lot of several shipments. Standard flower shipping cartons were shown to be satisfactory for less than carload lot and refrigerator car consignments. Daffodils in sealed cartons shipped as well and lasted just as long as those in ventilated cartons.

FIG. 12.—Daffodils in cool storage awaiting shipment from Victoria.
B.C. Government Photo.

VEGETABLE SEED CROPS[3]

FOUNDATION SEED PRODUCTION

In 1938 the value to the growers of vegetable seeds produced in British Columbia amounted to a little less than $50,000, while in the peak year of 1945 this value totalled almost $1,500,000. With this enormous increase it is of the utmost importance that the seed produced is of the highest purity and trueness to type. As the quality of seed produced by the growers largely depends upon that of the seed from which it is multiplied, it has been also essential to have an increased supply of high quality stock seed. The Saanichton Station took part in the special wartime stock seed production program of the Agricultural Supplies Board and shipped 2,401 pounds of stock seed of some 15 different vegetable varieties under this arrangement. Although stock seed work in vegetable crops was initiated at this Station in 1928, only 9 varieties were being worked with in 1936; in 1946, 25 varieties were being handled.

(3) Written by R. M. Adamson.

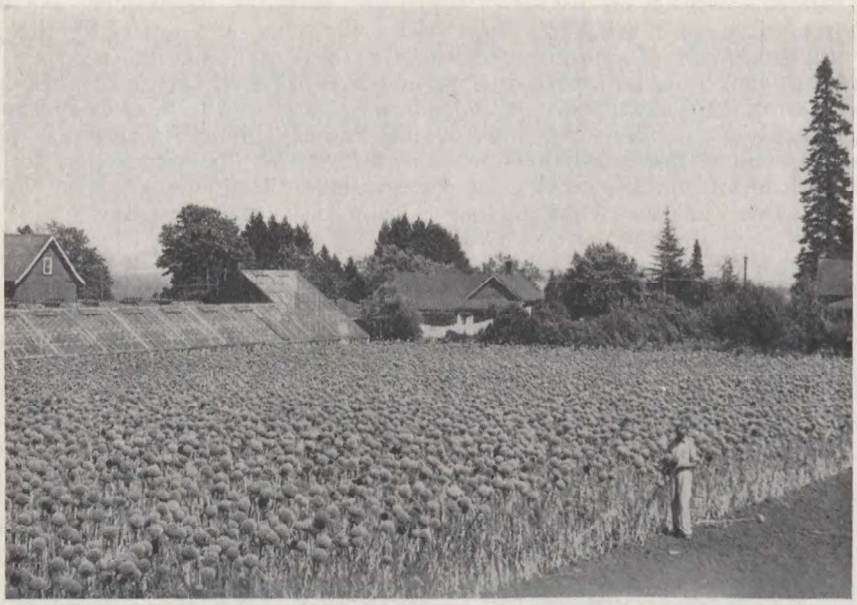


FIG. 13.—A seed crop of Musselburgh leek in flower. Photograph taken August 18.

PEAS

The time required to "process", or bring a variety up to acceptable foundation status has varied greatly, some varieties being easy to handle while others have proved difficult. The Lincoln pea, for example, was grown for the first time in 1944. The variety seems quite stable, and most strains are true to type. Little roguing was required on the stock grown, and it was accorded foundation status in 1945. The varieties Stratagem and Giant Stride, on the other hand, proved much more difficult. Variation was noted in these stocks, and comparative trials were made with a number of commercial samples to determine the best strains with which to make a start. The bulked line method of improvement was employed. In the first season approximately 50 of the best plants were saved from plots of not less than one-tenth of an acre. Seed of these was kept separate and the following year grown in small plots. These plots were examined closely and all off-type, weak or diseased plants discarded. Where definite off-types were found, the whole plot was eliminated. The remaining lines were again harvested separately, and seed sown again the next year in somewhat larger plots. Again the elimination process was repeated, and seed saved only from the best plants in the selected lines. This seed, when bulked, formed the basis for the stock which was finally accorded foundation status.

RADISH

Another example of the methods used in bringing vegetable varieties into registration as foundation stock is demonstrated by the experience with French Breakfast, one of three radish varieties grown for foundation seed at this Station. Work was first commenced in 1942 when a trial of all available radish strains was made. In this trial four showed sufficient uniformity and trueness to type to be worth further study. Selected roots of these four were planted in individual pots and grown in the greenhouse during the winter. Electric lights were used to give enough light to promote flowering and seed maturity during the "out-of-season"

period of reduced sunlight, seed from each plant being kept separate. Another strain test in the following season was made and selected roots planted in a cold frame. It was necessary to completely enclose it with factory cotton laid over light wooden supports to protect the flowers from chance contamination by insects which might have visited a field-grown plot of a different variety of radish. In order to obtain a good set of seed, pollination was done by hand, using a camel's hair brush. The seed thus obtained, together with the greenhouse-grown seed produced the previous winter, was tested in the field in the spring of 1914 and a selection made. This selected line traced back to one of the original greenhouse-grown selections. Roots of this line were saved from the strain test and planted into a cold frame which was again enclosed to give isolation. The seed produced was again tested against other strains, proved superior and was multiplied from selected roots to give rise to seed which on further testing proved to be uniform and true to type. Application therefore was made for foundation status for the seed and a sample submitted for verification in various trial grounds across Canada.

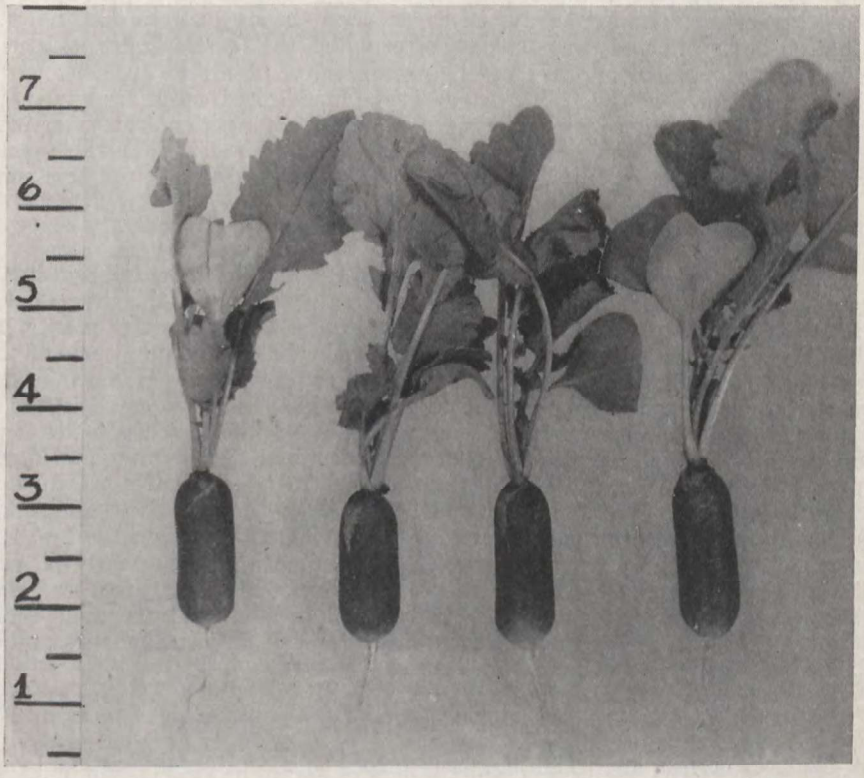


FIG. 14.—Selected roots of French Breakfast radish, showing the type used for replanting to produce foundation seed.

With this crop and many others, such as cabbage, beet, squash, tomato and onion, a policy of using mathematical formulas to describe shape has been adopted by the Horticultural Section of the Plant Breeders Committee of the Canadian Seed Growers Association, for foundation stocks. This Station has taken a part in evolving the method, which consists of defining the limits of tolerance for shape, between which limits the specimens shall be considered to

conform to varietal type, by means of a shape index. In the case of French Breakfast radish, for example, the limits of tolerance were set at 0·25 and 0·50. As the index is computed by dividing the equatorial by the polar diameter, a specimen with equal polar and equatorial diameters has a shape index of 1, long specimens such as most roots less than 1, and flat specimens more than 1. In recording data on these crops, use has been made of this system. It is felt that where differences in the shape of individual roots can be measured and reduced to mathematical expressions these can serve a useful purpose by eliminating errors arising from guesswork in the use and interpretation of descriptive adjectives.

Winter Squash

Another example of strain improvement is demonstrated by the work done on Banana Pink winter squash. In this case the nature of the plant, and the length of the growing season, do not permit the use of the greenhouse, and the quickest method of bringing a variety to a high state of purity and trueness to type is by the practice of inbreeding. Because of their large size, the male and female flowers are handled easily. They are tied the day before opening, hand pollination being effected the next day, after which the female flower is retied to prevent chance pollination by insects. At maturity, plants are selected on the basis of conformity of the fruits to good type, and selfed seeds are saved from such plants for resowing. By following this practice, no pollen from poor plants is introduced, good characters are intensified, and it is felt that the quickest possible advance is being made towards securing a true-to-type, uniform strain.

Spinach

A final example of methods being used at the Station in the improvement of vegetable seed stocks is spinach, a wind-pollinated crop. In this crop, the sex varies with the plant. There are male, female and hermaphrodite plants, with both male and female flowers being found in the latter. Within each of these three classes the nature of the plant varies so that there is a range from vegetative or leafy, good type plants, to plants which bear few small leaves and tend to run to seed prematurely. In general the latter inferior class tends to predominate in male plants, and if not thoroughly eliminated, it will tend to increase in proportion and lower the value of the stock. In two varieties grown at the Station, Bloomsdale Long Standing and Dark Green Bloomsdale, these undesirable conditions have been encountered. Strain trials have shown the best stock to start with, and from there the process of elimination of the early-blooming males has been practised in order to produce stocks of good type. Use of the greenhouse has permitted a crop of both varieties to be grown in a single season, one in the field and one in the greenhouse, thus saving time in the work required to bring the stocks up to foundation status.

Overwintering of Beet Stecklings in Pits

The beet crop is one which has been grown to a considerable extent by seed growers on the Island. Yields have varied widely, however, from roughly 250 pounds to 1,750 pounds per acre, and since the growing practices have lacked uniformity, it was felt that information as to the best cultural methods should be obtained. Since it had become increasingly apparent that any recommendation made must take into account economy of labour, the first tests outlined in 1941 consisted of a study of the methods of overwintering, and included plots which eliminated the usual topping operation. Shallow, non-ventilated field pits were utilized and proved so successful that their use was adopted in all succeeding tests. It was found that untopped stecklings or roots stored fully as

well as topped roots. Despite the greater space and covering required, the saving of labour in not having to perform the topping operation outweighed this disadvantage. The depth of soil covering was investigated and where less than 6 inches was used there was found to be the danger of frost damage. The 6-inch covering was found to give complete protection from 22 degrees of frost, and since the minimum temperature recorded at the Station has been only 23 degrees of frost, and that on only one occasion, this depth of covering is recommended as being adequate for the district. Pitting is usually done in November or early December when a light initial covering is given, with additional soil being added as the weather becomes colder. Where the depth of pit was varied, no appreciable difference was found from 6 to 15 inches. Deeper pits are not recommended because of the danger of heating. Any convenient width and length may be used. Four feet is a common width, but this may vary, depending upon the method of opening the trench, whether by hand, or by plough and scraper.

Field Overwintering of Beet Stecklings

The tests included an investigation of the possibilities of overwintering the roots in the field, with the object of saving the labour of lifting, pitting, and replanting. Successive sowings at monthly intervals from May 1 to August 1 were provided in this test, to determine whether age of the stecklings would be a factor in overwintering capacity. Earth protection was also provided by ridging as high as possible in the 27-inch spaced rows. This gave an approximate 3-inch thick covering over the crowns of the plants. It was found that none of the plots could withstand a frost of 19 degrees and it was, therefore, concluded that overwintering is too risky for standard growing practices. An alternative is to remove every other row in the fall, pitting the roots from these rows, thus leaving sufficient room around the remaining rows to give a safe depth of covering. The study of field overwintering of different sowings is being continued.

Succession Sowings of Summer Turnip

Summer turnip is a seed crop well adapted to the coastal area of British Columbia. As no experimental evidence was available to indicate the best time to sow seed of this crop, and varieties vary so greatly in maturity of the root, a test was outlined which included representative varieties ranging in season from first early to late. Seed of these varieties was sown at bi-weekly intervals from August 1 to September 15. Despite the wide range in season of root maturity, the evidence of two seasons indicated that for seed production, the most suitable sowing period is August 15 to September 1, for all except the early variety Shogoin. In sowings earlier than August 15, soil moisture was insufficient in one season to germinate the seed, so that results from this sowing were practically identical to those from late sowings. Where satisfactory germination was obtained from the early sowings, the larger, more mature roots resulting were prone to rot during the winter months. In one year there was evidence of rotting of the roots during the winter and no increase in seed yield from the early sowings over August 15 or September 1 sowings. Shogoin has been found difficult to grow satisfactorily, as under local conditions it is very weak stemmed and subject to disease. The summer turnip seed crop is very attractive to the California purple finch, a bird which gives considerable trouble in its attacks on small plantings.

Head Mutilation of Lettuce

While this seed crop is not of great importance on Vancouver Island at the present time, some varieties, notably of English type, have been grown commercially. Since this Station has been concerned with growing three varieties for

foundation seed purposes, the work serves to aid in the study of seed stocks as well as to make information available to growers. The tests have demonstrated that crop yields will vary according to the variety, time of sowing and time of harvesting. Yields have been greater from early field sowings and it is recommended that sowing be not delayed longer than the end of March. As sowing is delayed, there is more difficulty in obtaining vigorous seed stalk development. For seed production purposes, varieties may be grouped into the hard heading ones, which consist chiefly of New York and Imperial varieties and strains, and soft heading and leaf varieties. Tests have shown that in the first named class head mutilation is an aid in promoting more rapid emergence of seed stalks. The method of head mutilation found most desirable consisted of stripping the head to the core. This is done at time of prime edible maturity and is accomplished most readily early in the morning when the leaves are brittle. The operation consists of striking the top of the head sharply with the heel of the palm. This shatters the leaves close to their base. By twisting and lifting, the head and outer leaves may then be removed, leaving the core intact. Other methods tested included criss-cross scoring of the heads, and cutting the head in half horizontally.

FIG. 15.—Stripping heads of Great Lakes lettuce to promote seed stalk formation. Plants are rapped sharply on the head. Photograph taken June 6.

TIME OF HARVESTING LETTUCE SEED

Inasmuch as an appreciable amount of seed matures after cutting, before the plant becomes dry, it was found necessary to exercise careful judgment when harvesting so as to ensure ripening of a maximum amount of seed. If harvested too early many of the seed capsules dried up before maturing the seed, while if harvesting was delayed too long, much of the seed was released from the capsule and was lost either before harvesting or during the harvesting operation. The seed in the capsule is ripe when the pappus surmounting it has expanded or fluffed out as in the dandelion. When an appreciable amount of fluffing was seen, but before any seed had shattered, it was found by count of capsules on the

variety Hanson, that 15 per cent were ripe. An additional 15 per cent ripened in curing, or a total of only 30 per cent of the total potential seed yield. When the time of harvesting was delayed until the first sign of shattering could be seen, approximately 50 per cent of the seed was ripe. An additional 25 per cent ripened during the curing process for a total of 75 per cent of the total potential seed crop. Accordingly, it is recommended, as a guide in harvesting lettuce seed crops, which are subject to loss from shattering, that the plants be cut when the first signs of seed loss from this cause are detected.

FIG. 16.—A radish seed crop curing in field. Lettuce in background commencing to bloom. Photograph taken August 11.

CABBAGE, TIME OF SOWING

This seed crop is well suited to the climatic conditions of Vancouver Island and is of considerable commercial importance. Little information based upon experimental trials was available to growers in the coastal area, particularly as to the correct time to sow the various types, and for this reason tests were initiated with five varieties. These five included Golden Acre, an early round headed variety, Danish Ballhead, a late round head, Jersey Wakefield, an early pointed head, Perfection Drumhead, a maincrop savoy, and Flower of Spring, an early pointed head well adapted to fall planting, which is of local importance.

Up to the time of preparing this report it has appeared that the maincrop variety, Danish Ballhead, may fail to produce seed stalks the following season if sown later than July 1. For this variety May and June have been safer sowing times. The popular savoy variety, Perfection Drumhead, is somewhat looser heading, can be sown successfully over a longer period than Danish Ballhead, and is a vigorous seeder. Its best sowing date has been around June 1. Jersey Wakefield and Flower of Spring have been successful when sown between June 1 and July 1. The best time for Golden Acre has been in the latter part of July for commercial seed production. Although when sown at this time it will not head, seedstalks form readily in the spring. Earlier sowings have formed tight heads which tended to rot during the winter, but seed has been obtained from such sowings when the heads were removed. The decapitation practice has been followed in foundation seed work, when it has been necessary to produce heads in order to examine plants for trueness to type. It was also found possible in other varieties to obtain a seed crop from stumps. To prevent rot it was necessary

to decapitate by December 1, to permit the wounds to form a callus before the advent of cold weather. In the following season special care had to be exercised to prevent breakage of seedstalks in decapitated plants. Further studies with Golden Acre have shown that when plants were taken from the field to the greenhouse in mid-November, it required from five and one-half to eight and one-half times as long for such plants to bloom as when they are taken to the greenhouse in mid-February. This information demonstrates the need for a chilling period for plants which may be selected for growing to maturity in the greenhouse, and the information has proved useful in stock seed work with this variety. Cultural studies in seed production of cabbage varieties are being continued.

Summer Cauliflower, Economy of Seed Production

Much attention has been focused on the growing of seed crops of summer heading cauliflower, due to the fact that the crop is grown more satisfactorily on Vancouver Island than elsewhere in Canada, and also because the price has been so attractive. Shortly after the regular sources of supply were cut off by Nazi invasion of the Netherlands in 1940, the scarcity of cauliflower seed forced the price up to $15.00 a pound. Many have attempted to grow this crop, and along with the successes there have been also many failures. This Station demonstrated the feasibility of growing the crop and outlined a cultural method as early as 1930. The crop is a difficult one and usually uncertain even with experienced growers, until the seeds are harvested. Production costs are high, due to the expensive care given the seedlings, the necessity of watering, and spraying and dusting for control of disease and insect pests. A common practice at present is to transplant the seedlings twice, the second time into 4 by 4 by 3 wooden bands, growing the plants in these until ready for transplanting. Usually the plants are grown in a cool greenhouse, and hardened off later in cold frames.

With the grower's price dropping to half that of 1940, the necessity for reducing growing costs is apparent, and consequently tests have been designed to determine whether cheaper growing methods may be successfully applied. Previous trials have shown some fall sowings, overwintered in the field, to be promising. If it can be established that this is a feasible method, production costs would be greatly reduced. Other treatments in the experiment follow the current practice of spring planting, but aim to determine whether it is feasible to grow the plants over winter in cold frames without the use of wooden plant bands, or alternatively to grow the plants for a shorter period in a greenhouse without bands and the extra handling.

Tests of Late Cauliflower

Tests have shown that it is impractical under local conditions to grow seed of varieties of this late type. These varieties are of commercial importance in the district as a market crop, heading from October to December. In order for such plants to overwinter successfully, however, it is necessary to sow them in the late summer and plant them out in the fall so that they will head in the spring. This has been tried with the varieties Majestic and Autumn Giant. These conditions have been found to produce great variations in season of heading, and malformed heads, blindness, and "whiptail," a condition where plants produce long, slender, twisted leaves and abnormal heads. Under such conditions it is impossible to keep a stock properly rogued and seed yields are uncertain.

Time of Sowing Broad Bean

Tests with the popular Windsor broad bean variety have shown early (February) sowings to be more productive than later sowings. On the average they yielded 25 per cent more seed than March sowings and 95 per cent more

than April sowings. January sowings were also included, but in 1943 unusually severe frosts during the third week of the month, when a minimum of 10 degres F. was recorded, caused a complete loss. In the other two seasons in which this trial was run, the January sowing produced greater seed yields than the February sowings, but not by significant margins, and it is concluded that over a period of years February sowings would be most satisfactory.

Pole Beans, Staking versus Non-Staking

A test was undertaken with two pole varieties, Kentucky Wonder Green Pod, a snap or string variety, and the runner bean Best of All to determine whether a seed crop could be obtained by permitting the vines to trail on the ground, which would be comparable with the common staking practice. An additional treatment consisted of pinching back the growth at the fifth joint on unstaked plants. In three years' trial it was found that seed could be obtained satisfactorily by the non-staking method. Staked plots, however, yielded significantly more seed than unstaked. In Kentucky Wonder Green Pod, the average yield from staked plots was 2,114 pounds per acre compared with 1,569 pounds per acre from unstaked, or an increase of 34·7 per cent, and in Best of All the staked plots averaged 1,849 pounds per acre compared with 1,263 pounds per acre for the unstaked, or a 46·3 per cent increase. Pinching back of terminal growth on unstaked plants did not significantly affect the yield. While these results show that seed can be grown satisfactorily in the district if vines are allowed to run on the ground, the yields by so doing are decreased, and it therefore becomes a matter of deciding whether under the existing conditions the decreased yield would balance the added expense for stakes and labour.

VEGETABLE CROPS[3]

Variety Trials

While tests of the newer vegetable varieties at this Station have been curtailed in favour of a more intensive effort in seed production work, some trials have been carried out from time to time, including tests to determine the local adaptability of a crop, such as lima beans. From 1941 to 1946 utility trials were conducted, which tested the adaptation to the district of registered and certified seeds and their general merit in comparison with commercial stocks. These involved a fairly wide range of crops and varieties and included in the six years a total of 268 utility samples.

Lima Bean

During the years 1941 to 1944, tests were undertaken to determine the adaptation of the lima bean to Vancouver Island conditions. In addition to the purpose of experimentation, namely finding out the suitability of this crop for the home garden, there was found to be a steady demand for this crop in the quick freeze trade. In only one year of the four was a worth-while crop harvested. It was found necessary to delay sowing until late May or early June and it was apparent that in a normal season there is insufficient heat to produce vigorous growth. Pole varieties were entirely unsuited and of the dwarf varieties the small seeded "sieva" type, represented by such varieties as Henderson's Bush and Early Baby Potato, performed much better than the large seeded true lima. Of the varieties of the latter type, Improved Bush was found to be best adapted. Hotkaps were found to aid early growth and materially increased yields. It is concluded that commercial plantings of this crop cannot be recommended generally, although in favourable seasons and in

[3] Written by R. M. Adamson.

warm exposures, successful yields may be obtained. Where the home gardener wishes to grow this crop, some success may be achieved with early bush varieties.

Pepper

There is a small demand on the Victoria market for green peppers, which can be filled profitably by local production. Tests have shown that reasonably good returns may be expected of green peppers of the preferred California Wonder type but maturity is too slow for ripe peppers to be of any importance commercially. Yields of up to 3½ pounds of green peppers per plant have been obtained. Of the varieties tested, Oakview Wonder, an early variety of California Wonder type, was most satisfactory, and is now being grown commercially in the district.

Tomato

While this warm season crop is not naturally adapted to the Vancouver Island growing season with its cool nights, fairly successful crops can usually be obtained. Furthermore, since the tomato holds an important place in the diet, it is highly desirable to obtain information on the best varieties and cultural methods. The usual practice is to stake and prune tall varieties to a single stem as often ripening is too slow when no pruning is done and vines are allowed to trail. Since 1942 a number of dwarf varieties have been tested. The dwarf type, also called bush, self-pruning, self-topping or determinate, is grown widely on the Prairies and in the East, but has not gained wide favour on the Pacific coast. The plant has short-jointed stems, with a single leaf normally separating blossom clusters, compared with three in the typical staking variety. Each branch after growing a short distance usually terminates in a blossom cluster so that more fruit for a given amount of foliage is produced by these plants, than by unpruned, unstaked plants of the tall varieties.

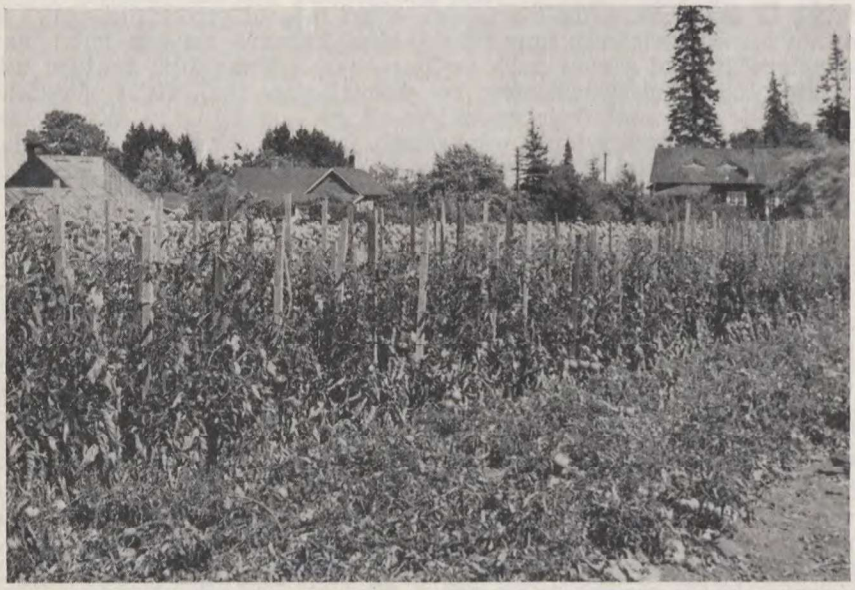


Fig. 17.—Trial of tomato varieties, showing dwarf varieties in the foreground and staking varieties in the background. Photograph taken August 17.

The potential yield is also much greater than in staked, pruned plants. The average of the better adapted dwarf varieties, in the period 1942-46 inclusive, has been 6·6 pounds of marketable fruit per plant, while the better staking varieties have produced 4·8 pounds.

While the dwarf varieties are now being grown to a considerable extent, they have been discriminated against because of roughness and small size. Because many of the fruits lie on the ground the fruit tends to become dirty and there is a greater danger of rot. Picking is also more difficult than with staked varieties. On the other hand, the higher yields, greater uniformity of ripening, earliness of maturity, and the saving in labour by elimination of staking and pruning are advantages which have recommended its use by many gardeners. The newer dwarf varieties show improvement in smoothness and size, while fruits can be kept off the ground and thus less subject to rot, by placing straw or light brush around the plant before the vines spread into the row.

As a result of the tomato variety trials the dwarf varieties Red Cloud and Early Chatham are currently recommended where a large quantity of fruit is required at a picking, as in canning and juicing. Large fruited staking varieties recommended are Scarlet Dawn and Stokesdale.

PLANT NUTRITION—HORTICULTURE[4]

Chemical Fertilizers

Plant nutrition involves the study of the food requirements of plants and how this food should be fed to be of the greatest benefit to the plants. All the mineral food requirements of a plant are taken in through the roots from the soil. The amount of each mineral food which a plant is able to extract varies with the type of soil. The soil therefore is extremely important in determining the fertilizer requirements of plants. A survey of the Vancouver Island soils has recently been completed. Many types of arable soils were located and mapped in all agricultural districts. In some areas different types of soil were found to be quite closely intermingled. Furthermore, in many cases an area of one soil type may, because of the rolling nature of the land or to poor drainage conditions, show considerable variability.

In other words, the soils of Vancouver Island are extremely varied, with soil differences showing up within short distances. As a result of this a large number of tests must be run for all important areas to obtain a true picture of the fertilizer requirements of different crops, so that reliable recommendations can be made. Fertilizer experimental work by this Station has been proceeding in this direction for a number of years. The fertilizer requirements of the soils have been determined by specific soil fertility tests, involving fertilizer treatments, which have been used in both greenhouse and field experiments. The field fertilizer tests contributing to the soil fertility picture include tests with tree fruits, small fruits, bulbs and vegetable seed crops. These tests have been augmented by field crop tests. All fertilizer treatments employed were designed to indicate the level of the three major plant foods which the soils require to produce their greatest yield.

For fertilizer applications to be of real value to the farmer, the resulting increase in yield must be sufficient to provide a worth-while net profit. It has been found that such high priced crops as strawberries, bulbs and certain vegetable seed crops, at times do not respond to fertilizers while under some conditions small increases result. As an example, the large number of fertilizer tests carried out with tulip and narcissus bulbs have shown that nitrogen, and to a less extent potash, produce increases in certain years, while in other years

[4] Written by H. W. Lawrance.

no benefit is obtained. Because of the value of the crop these small increases are profitable. Therefore, in the case of such crops, fertilizer recommendations are made on the assumption that the speculative value is worth while. Where economy in the cost of fertilizer is desirable, nitrogen is the most profitable element.

From a study of the results of all tests carried out up to and including 1946, recommendations, as shown in Tables 8 and 9, were made.

TABLE 8.—FERTILIZER RECOMMENDATIONS FOR SMALL FRUITS, VEGETABLES, VEGETABLE SEED CROPS AND BULBS*

Area	Soil	Fertilizer
Saanich, Victoria and Sooke	Clay and sandy loam.	8-10-5 at 1000 lb. per acre. Alternative for bulbs only, sulphate of ammonia at 400 lb. per acre.
Duncan	Clay and sandy loam (Upland) Delta and lowland soils.	As above. 16-20-0 at 500 lb. per acre to be reduced as low as 200 lb., according to manure used.
Alberni and Courtenay	Clay, loam and sandy loam.	6-30-15 at 500 lb. per acre
All areas	Peat and mucks.	0-12-20 at 600 lb. per acre, plus side dressing of ammonium sulphate at 100-200 lb. per acre. *or* 2-15-12 at 800 lb. per acre.

* The recommendation for bulbs includes those given for clay and sandy loam soils in the Saanich, Victoria, Sooke and Duncan areas only. When fertilizer is used with bulbs a fall application is recommended.

A comparison of the formula recommended shows that for both zones and soil types different fertilizers are recommended.

TABLE 9.—FERTILIZER RECOMMENDATIONS FOR TREE FRUITS

Area	Soil	Fertilizer
Saanich, Victoria, Sooke, Duncan and Nanaimo	Clay, sandy loam, and delta.	Ammonium sulphate at 400 lb. per acre (or 1 lb. to every inch of tree trunk diameter) *or* ammonium nitrate at 300 lb. per acre (or ¾ lb. to every inch of tree trunk diameter).
Alberni and Courtenay	Clay, loam and sandy loam.	16-20-0 at 400 lb. per acre (or 1 lb. to every inch of tree trunk diameter).

Time of Application

In cases where irrigation cannot be used, the date of application is normally quite critical, owing to the frequent occurence of dry weather in the late spring. Fertilizer should be applied during the first part of March for the southern part of the Island and during April for the northern part of the Island. In most instances this means a broadcast method of application. Most of the benefits from placing fertilizers at seeding time in bands or in the furrow for row crops may be lost owing to the lateness of planting dates and dwindling moisture supply.

Carnations

The use of sand cultures for growing carnations under glass has many good features. It does away with the trouble and difficulty of preparing soil and enables the grower to employ a specific fertilizer program with the assurance

that similar results could be expected in successive crops. The moisture supply is easily controlled, while drainage and growing conditions are good. However, with this methed there are many problems which can result in poor yields and quality, making the method unprofitable. From 1939-45 this Station made a thorough study of nutritional requirements and cultural methods with the hope of overcoming some of these problems. The following conclusions were drawn from the results of this work.

1. Coarse grades of sand appeared to be more satisfactory than fine grades.
2. No differences were noted between supplying nutrients in a solid or in a liquid form.
3. The optimum level of nitrogen was found to be in the range 1·0-1·5 lb. per 100 square feet for a 12-month period. Amounts greater than this are apt to be toxic and amounts less than this may increase the number of split calyxes.
4. Phosphorus produced no significant differences in yield or quality at rates ranging from 0·49 to 1·96 lb. P_2O_5 per 100 square feet for 12 months.
5. Potash was found to be very effective at 1·5 to 2 lb. K_2O per 100 square feet for 12 months.

This work showed that where sand may be obtained readily and cheaply, the sand method offers distinct possibilities on a commercial basis. The grower has a much greater control over the growing conditions of the plants. The quality of the crop is equal to soil-grown plants and the cost of production is not increased. The grower experienced in raising plants in soil should, however, gain experience with the sand culture method before changing over.

Paper Mulch

The value of mulch paper in the production of such heat-loving crops as melons and cantaloupes has long been recognized, and this practice has been in general use in this area for many years.

Fig. 18.—Clean cultivation vs. paper mulch in the production of muskmelons. Dominion Experimental Station, Saanichton, B.C.

Although it was a natural assumption that the beneficial effect was mainly due to a greater retention of heat it was not known whether other factors were involved. From 1935 to 1939 this Station carried out investigational work to determine the responsible factor or factors. The results of the first two years of this work were reported in the 1932-36 Summary Report.

It was found that mulch paper did not affect the populations of the beneficial soil organisms, nor did it affect the plant food supply contained in the soil. However, differences in soil temperatures and soil moisture indicated that physical changes in the mulched soil may be the most important of the factors responsible for the increased growth. The importance of the colour of the paper was demonstrated. If the paper was kept black throughout the season, both the soil temperature and air temperature surrounding the plants were raised to a more favourable level. The effects of other colours such as violet, indigo, blue, green, red, yellow and orange were determined. However, none proved to be more effective than black.

Sod Versus Clean Cultivation

In choosing the best orchard management practice, the production obtainable from the methods under consideration must be balanced against cost of upkeep and resulting effects on soil erosion.

Since 1941, this Station has compared the practices of clean cultivation and the maintenance of sod, so far as the yields of apples and pears were affected. Differences in growth and yield have been quite definite. The trunk circumference of apple trees under sod increased 7 per cent from 1941 to 1946, while the increase for trees under clean cultivation was 11 per cent. During the same period the clean cultivated apple trees showed a 39 per cent increase in terminal growth, and a 57 per cent increase in yield over that of the trees in sod. Although the differences were not quite so great, the pear tests also produced results in favour of clean cultivation. Trees were grown under conditions of very limited soil moisture from July to September inclusive.

Hay Mulch in Orchards

Summer soil moisture is the limiting factor for good yields of most crops on the Saanich peninsula. Normal summer rainfall is inadequate to maintain soil moisture at a satisfactory level during this period. Furthermore, the humus content of the soils of this area is quite inadequate to hold any worth-while portion of the winter and spring moisture for the use of the trees during the summer months. Any method of retaining or maintaining soil moisture may be expected to be beneficial to fruit production.

As a possible beneficial practice, a hay mulch was established in a pear orchard in 1942 to determine the effects on yield and growth. The mulch has been maintained yearly at about an 8-inch depth. The trunk circumference of the mulched trees increased 10 per cent from 1941 to 1946, while that for clean, cultivated trees was 8 per cent. For the same period, the mulched trees produced 54 per cent more terminal growth than the clean cultivated pear trees. The yield increase over the same period was 42 per cent in favour of the mulched trees.

FIELD HUSBANDRY[4]

Chemical Fertilizers

The following fertilizer recommendations as shown in Table 10 were evolved in a manner similar to that described under Plant Nutrition—Horticultural Crops.

[4] Written by H. W. Lawrance.

FIG. 19.—Pot test showing the indicator crop (oats) growing in a soil under test with seven fertilizer treatments (A-G) being compared with a check (H). This particular soil shows a beneficial effect from nitrogen. Pots C and H received no nitrogen. It can be seen that they support much less growth than do the remaining pots which received nitrogen. This soil does not show any response to phosphates or potash.

Hay, pasture, cereal and field crops generally respond very readily to the recommended fertilizer, and profitable increases are in most cases obtained.

TABLE 10.—FERTILIZER RECOMMENDATIONS FOR CEREALS, CORN, HAY AND PASTURE[1]

Area	Soil	Fertilizer
Saanich, Victoria and Sooke	Clay and sandy loam.	[2]Ammonium sulphate at 300 lb. per acre *or* Ammonium nitrate at 200 lb. per acre.
Duncan	Clay and sandy loam (Upland). Delta and lowland soils.	As above. 16-20-0 at 300 lb. per acre.
Alberni and Courtenay	Clay, loam and sandy loam.	6-30-15 at 200 lb. per acre
All areas	Peat and mucks.	2-15-12 at 300 lb. per acre.

[1] The above recommendations are for each crop in a rotation. Effective residual effects are rarely obtained from fertilizers on Vancouver Island.
[2] So far as hay and pasture is concerned, this recommendation applies to grass mixtures only.

TABLE 11.—FERTILIZER RECOMMENDATIONS FOR POTATOES AND ROOT CROPS

Area	Soil	Fertilizer
Saanich, Victoria and Sooke	Clay and sandy loam.	8-10-5 at 1000 lb. per acre.
Duncan	Clay and sandy loam (Upland). Delta and lowland soil.	As above. 6-30-15 at 500 lb. per acre.
Alberni and Courtenay	Clay, loam and sandy loam.	6-30-15 at 500 lb. per acre *or* 4-10-10 at 1000 lb. per acre.
All areas	Peat and mucks.	0-12-20 at 800 lb. per acre *or* 2-15-12 at 800 lb. per acre.

It is noted that nitrogen is the only fertilizer element recommended for such low-priced crops as cereals, corn, hay and pasture in the Saanich peninsula area. While phosphates and potash are included in the mixtures recommended for high-priced crops for the Saanich peninsula (see Plant Nutrition-Horticulture) these two elements have not generally produced any increases in yield in this area. While the lack of response to potash may be explained by the presence of adequate quantities of available potash in these soils, the lack of response to phosphates cannot be given a similar explanation. Certain of the soils of this area show a lack of available phosphates even following an application of phosphate fertilizer. This indicates a phosphate fixing power in the soil. Extensive tests have shown that large quantities of phosphates must be added to these soils before the fixing capacity is reached, thus leaving a quantity in available form. This fixation power is presumably responsible for the general lack of response to phosphates in the Saanich area.

The fertility tests have shown that the soils in the areas north of Saanich respond to phosphates. This response appears to increase from the southern part of the Island to the northern part with the greatest response to phosphates obtained in the Alberni and Courtenay areas. On the other hand, the nitrogen response tends to decrease from south to north. Fairly important responses to potash are obtained in the Duncan and more northern areas.

Time of Fertilizer Application

For cereals, corn and hay crops, the date of fertilizer application is very important, owing to the frequent occurrence of dry weather in the late spring. Fertilizers for hay crops should be broadcast during the first part of March for the southern part of the Island and during April for the upper part of the Island. For cereals it should be applied as soon as it is possible to get on the land. In the case of fall-sown cereals this means a broadcast application in the spring. However, in the case of spring-sown cereals when fertilizer application and seeding should both be carried out as soon as the land permits, the method of application may be either broadcasting or drilling in with the seed.

The time and method of application of fertilizer for corn is similar to that for hay. For the southern part of the Island, fertilizers should be broadcast during the first part of March, and cultivated in; during April, or as soon as the land permits, for the upper part of the Island.

Commencing in 1945 this Station has investigated the possibility of bringing about a better distribution of pasture through the application of fertilizers on different dates throughout the season. The data so far have shown that this is not effective; the very small summer precipitation being insufficient to bring any of the added fertilizer into solution for plant use. However, good yields can be well distributed throughout the spring period by dividing the recommended fertilizer application and applying half on March 1 and half on April 15. For the upper parts of the Island, dates of application should be delayed about four weeks.

Cost of Operating Tractor

During the period under review, tractors have gradually replaced horses for the operation of the farm machinery and as a means of motive power. In 1942 the first unit, a Ford with hydraulic hitch, was purchased together with a plough, disk, tiller, spring tine cultivator and weeder.

The average daily cost of operating this tractor over a period of 5 years was $9.99. During the same period, the comparative cost per acre of operating the various implements on a basis of 100 acres is given in the table which follows.

TABLE 12.—COST OF OPERATING TRACTOR IMPLEMENTS

Implement	Description	Comparative cost per acre on basis of 100 acres
		cents
Plough	Single 16" bottom	70
Double Disk Harrow	6' cut, 24-26" disks	37
Tiller	7', 9 tines	23
Cultivator	11 springs tines	29
Four Row Weeder	13' sweep	10

Ploughing cost, $4.67 per acre; disking, $1.01; cultivating with tiller, $1.03; cultivating with spring tines, $1.14; and weeding $0.57.

Tillage operations were conducted on many plots of less than one acre and may, therefore, be somewhat higher than under ordinary farm conditions.

Couch Grass Eradication

Considerable work was done in connection with the eradication of couch grass by cultural methods. The best results were obtained by ploughing the land in July, cultivating for the remainder of the summer with a spring-tooth harrow and growing a corn crop the following year. By this method the couch grass was reduced 87 per cent at the end of the first crop year as compared with a decrease of 45·68 per cent where fall ploughing and no summer cultivation was practised. It was also found that a hoed crop gave better control of couch grass than the use of a smother crop. Growing corn on the same land for three years in succession eradicated the couch grass but under the smother crop system 21 per cent of the couch grass was still alive at the end of this period.

Cost of Producing Crops

The growing of field crops has been greatly curtailed in recent years owing to the fact that no livestock other than poultry is kept at the Station. While average yields may not have changed to any great extent, the cost figures given in the tables which follow are not applicable to present day conditions. The comparative cost between crops is still true.

TABLE 13.—COST OF PRODUCING WHEAT, OATS AND FIELD PEAS

Crop	Period	Yield per acre	Average cost per acre
		bushels	$
Winter wheat	1937-40	29·2	45·80
Spring wheat	1937-42	27·9	42·82
Oats	1937-43	55·9	43·72
Field peas	1937	34·0	39·99

It may be seen from the above table that fall wheat is the most expensive and field peas the least expensive crop to produce on an actual acre basis.

Ensilage corn and potatoes referred to in the table below are grown extensively throughout the district, but owing to the low rainfall during the growing season, yields are usually much poorer than when these crops are grown under favourable climatic conditions. Ample rains in June and August of 1937, however, benefited both corn and potatoes and consequently the yields for that year were well above average.

TABLE 14.—COST OF PRODUCING ENSILAGE CORN AND POTATOES

Crop	Year	Yield per acre	Cost per acre	Cost per ton
		tons	$	$
Ensilage corn	1937	12·33	68·98	5·59
Potatoes	1937	10·46	131·44	12·57

The above figures show that it costs more than twice as much to produce a ton of potatoes than a ton of ensilage corn.

The yields of hay at Saanichton during the period 1937-42, varied from 4·46 tons to 1·86 tons per acre. The average yield was 3·15 tons. The heaviest crop was produced in 1938 at a cost of $7.30 per ton. The average cost per acre for the years 1937-43 was $36.72 and the cost per ton for the same period, $12.46.

The best crops of hay are generally produced during the second and third year after seeding; from the fourth year onward there is usually a sharp reduction in the yield, brought about by a decrease in the population of grass and clover due to the affect of drought and the encroachment of weeds.

A number of unusual crops such as serradella, crimson clover, fenugreek and lespedeza will grow quite well on Vancouver Island and produce good crops of seed. In 1937 the cost of producing seed from *Lespedeza stipulacea* was undertaken on an acre basis. The seed was sown in rows 22 inches apart at the rate of 10 pounds per acre. The crop was harvested on October 22, 138 days after seeding.

The following table gives the various costs that were involved.

TABLE 15.—COST OF PRODUCING LESPEDEZA SEED IN 1936

Item	Statement	Amount
		$ cts.
Use of land	Rent or interest on value of land plus taxes and upkeep	15.15
Share of manure	30% of 15 tons @ $1.50	6·75
Seed	10 lb. @ 10¢	1·00
Machinery	Total annual charge	2.85
Manual labour	87·5 hours @ 33¢	28.88
Horse labour	22 hours @ 10¢	2.20
Threshing and cleaning	952 lb. @ 1¢	0.52
	Total cost per acre	66.35

Yield of seed per acre— 952 pounds.
Yield of straw per acre—1294 pounds.

CEREALS[5]

Vancouver Island, especially in its southern areas, due to comparatively mild winters is well suited for growing winter cereals as well as the more commonly planted spring cereals. Fall-sown cereals, especially barley, outyield spring-seeded kinds by a wide margin. For this reason fall sowing wherever practical is recommended. Where fall sowing is contemplated there must be assurance that the land is well drained.

Winter Wheat

Almost all of the wheat grown on Vancouver Island is sown in the autumn. Seeding is usually done during the month of October. It may, however, be done

[5] Written by C. E. Jeffrey.

in September as soon as the fall rains begin or as late as the first week in November if soil conditions permit. The average date of seeding at this Station over a period of 33 years is October 7.

During the 10 years under review, 43 varieties of winter wheat have been subjected to comparative tests, none of which were found to be superior to the old standard variety, Sun, which averaged 42·4 bushels per acre. Marquis as the best spring wheat in the same period averaged 30·1 bushels. A cross made at Ottawa between Dawson's Golden Chaff and Ridit, and carried under the number 1968-18L, has proved quite promising in that it outyields Dawson's Golden Chaff, the most extensively planted variety, and does not shatter at harvest time. The average yield for this variety for 9 years, 1938-1946, was 37 bushels as compared with 40·9 bushels for Sun and 31·1 bushels for Dawson's Golden Chaff.

Sun is recommended as the best winter wheat for the southern area of Vancouver Island. Ripening the first week in August, it is the latest of the winter wheats. For the northern part of the Island, Dawson's Golden Chaff should be grown instead of Sun due to its increased hardiness.

In view of the mildness of the winter season and the importance of autumn seeding to utilize to the best advantage the low summer rainfall, Marquis, Thatcher and Cascade, three spring wheats, were sown in the fall along with Sun and Dawson's Golden Chaff as checks. Marquis and Thatcher proved poorer than Sun and Dawson's Golden Chaff but Cascade with an average of 48·5 bushels for two years outyielded Sun by 5·5 bushels per acre and Dawson's Golden Chaff by 10·8 bushels. Further tests will prove the merit of this variety for both fall and spring planting.

FIG. 20.—An increase plot of the new and promising Cascade wheat which has done well from both fall and spring seeding.

SPRING WHEAT

During the period under review, 32 varieties of spring wheat were tested for suitability and yield. Of these, 25 were soft white wheats of the type used for pastry flour and 7 were standard hard red varieties. Cascade, originated by the Cereal Division, Central Experimental Farm, Ottawa, headed all the varieties in respect to yield. In the hard wheat group, Marquis, for many years the best variety, outyielded Apex, Coronation, Garnet, Regent, Reward and Thatcher. In regard to the amount of crude protein produced per acre by

soft and hard spring wheats, the result of two years' analysis show that the higher yields of soft wheats more than compensate for their low percentages of crude protein.

Cascade and Marquis are the varieties recommended for spring seeding—a recommendation applicable to both the northern and southern parts of the Island.

Winter Barley

After many years of work it has been definitely established that the autumn seeding of barley is practical and profitable on the southern part of Vancouver Island, and it is now recommended that autumn seeding be practised in preference to spring seeding. Between 1937 and 1944 one hundred and forty varieties, collected from many parts of the world, were subjected to a preliminary study for winter hardiness. In 1944 there were selected from the above, sixteen varieties for testing in replicated plots. The results of this test, covering two years, indicated that there was no significant difference between the yields of the four leading varieties, Cape, Coast, Mariout B and Trebi. Because of its good showing in earlier tests, Trebi is still recommended as the best barley for autumn seeding.

For the best results winter barley should be sown during the last week of September. It requires a well drained loamy soil in a good state of fertility.

Spring Sown Barley

The spring seeding of barley is recommended for northern Vancouver Island, but in the south better yields can be obtained from fall seeding.

Of thirty varieties tested, Trebi with an average yield of 47·1 bushels and Plush with 41·9 bushels are recommended for the whole of the Island. Both are six-rowed varieties, the former rough awned and the latter smooth. Byng, a comparatively high yielder, is prone to lodge badly and cannot, therefore, be recommended. Hannechen, the best of the two-rowed type, has an average yield of 37·6 bushels per acre.

Winter Oats

If winter oats are to succeed on Vancouver Island they must be sown early in October. The highest yields are obtained when seeding is done between the third and ninth of October. Earlier sowings result in excessive autumn growth and, in sowings made after October 9, development is often severely checked by wintry weather. Good drainage is essential. Thirty-six varieties have been tested during the period under review. Of these, Winter Turf with an average of 68·2 bushels per acre is best suited to local conditions. Lee, which averaged 65·6 bushels, and Fulwin with 63·4 bushels, are two promising sorts. Of the three most important cereals, wheat, oats and barley, fall seeded oats have shown yield advantages over spring seeding about equal to that mentioned under winter wheat. In an occasional severe winter frost injury may result.

Spring Sown Oats

On Vancouver Island more land is devoted to spring-sown oats than to any other cereal. Seeding should be done as soon as the land is in a fit state for the preparation of the seed-bed. Victory, Erban and Ajax are the varieties recommended. Victory is a late maturing variety with medium strong straw. It is moderately susceptible to smut and stem rust. Erban matures one week earlier than Victory and is strong strawed and a good yielder. It does better than Victory or Ajax on medium light soil. Ajax matures about 10 days earlier than Victory and has a higher degree of stem rust resistance. The thin, narrow

kernels of Ajax lack the good appearance of Victory. Beaver is the most promising of the 40 newer varieties tested. It has been grown for five successive years and is worthy of extended trials on the basis of its very satisfactory performance.

Field Peas

Soil and climatic conditions are favourable to growing excellent crops of peas. Under field conditions yields as high as 54 bushels per acre have been obtained at this station. Chancellor, Stirling and Austrian Winter are the best varieties for spring seeding. For autumn sowing, Austrian Winter is the only variety that can be recommended. It is an excellent pea for hay and ensilage purposes. It is as winter hardy as common spring vetch.

Dry Shell Beans

Large yields of beans are not common on Vancouver Island; the highest obtained at Saanichton during a three-year test of 16 varieties was 36·6 bushels per acre while the average for all varieties was only 17·1 bushels. Early seeding is essential in order that the crop may ripen before the advent of fall rains. Great Northern and Corvette are the varieties recommended; the former is a medium-sized white bean of the kidney type and the latter a medium-sized pea type of bean. The recommendations cover all of Vancouver Island.

FORAGE CROPS[5]

Grass Seed Production

Evidence as to the possible success of a crop may often be determined by what has gone before and what can be seen in nature. Flower, vegetable, cereal and certain root crops such as mangel, turnip and sugar beet, had proved themselves in seed production before work was undertaken with grasses and legumes.

Fig. 21.—An orchard grass seed plot grown as sod. Orchard grass is the best pasture grass and produces good crops of seed grown in rows or turf.

(5) Written by C. E. Jeffrey.

Observations on the behaviour of some species of grasses and legumes growing wild and under controlled conditions indicated that good seed yields could be obtained. It was therefore arranged in 1942 to lay out a trial ground area in order to obtain information on seed production. During the five-year period under consideration some interesting results and differences in plant habit were discovered.

Taking wood meadow grass as one example, the yields since 1943, in which year 360 pounds per acre were harvested, have been steadily increasing, having risen to 702 pounds per acre in 1946. The normal habit for a grass is to reach a peak the first or second year after planting and then to decline. This is very typical of creeping red fescue and perennial rye. Another interesting and variable habit of different kinds is the effect of time of sowing on seed production. Orchard grass and creeping red fescue seeded in the fall will produce no crop the following year. On the other hand, perennial rye seeded in the fall will produce a large crop in both the first and second summers. Up to the present time, fourteen grasses have been grown for seed production, and based on yields obtained and prices received, seed production seems a reasonably profitable venture. Italian rye grass grown as a winter annual has yielded as much as 1253 pounds on an acre basis while quite a few of the species grown have produced less than 500 pounds per acre. A number of the species that have been tested in both sod and rows have yielded more from the rows. This latter method has a further advantage in that there can be better control of weeds and volunteer grasses.

Legume Seed Production

So far as legumes are concerned, much that has been said for grasses is applicable to clovers and other leguminous species. Tests have not been run with as many species of legumes as with grasses, but interesting results have been obtained. Crimson clover, for instance, grown as a winter annual in rows, has yielded as much as 936 pounds of seed per acre, while from sod plots it has produced only 514 pounds. Due to the value of this crop for early spring pasture or early hay and for its merit as a winter cover crop there appears to be good chances of an increasing demand for the seed.

Ladino clover has not given profitable yields when grown in sod areas with grasses. Heads of ladino clover tend to droop over and lie close to the ground, which makes harvesting difficult. While the methods adopted to date have not proved satisfactory there is reason to believe that when all the possibilities of growing this crop have been explored something worth while will result. Ladino clover seed is usually high priced as only low seed yields are obtained as a rule.

Birdsfoot trefoil, *Lotus corniculatus*, has proved a most interesting crop to grow. It ranks next to alfalfa for drought resistance, which puts it in an esteemed class as a forage crop. Its habit of growth under Saanichton conditions varies from that reported in certain areas where it has an indeterminate habit of growth. Under the conditions in such areas the unclipped plant grows continuously and while growing it produces blossoms which in turn produce seed. This undesirable growth habit results in a large amount of green matter and a rather low amount of ripe seed at any one time. Under Saanichton conditions the plant has specific habits notably, a period of growth which is followed by heavy bloom which results in a heavy set of seed. While only preliminary trials have been conducted there is every indication that yields of up to 400 pounds per acre can be expected. This is considerably in excess of yields obtained in the United States and Europe where the crop is rated quite highly for grazing purposes.

While there are no records of commercial areas of either grasses or legumes being grown for seed on Vancouver Island the preliminary trials that have

been conducted at this Station indicate that seed production on a contract basis could be undertaken with the more adaptable crops for which a known market exists.

Sugar Beet Production

In the 1932-36 report from this Station, reference was made to sugar beet seed production and of more especial interest was the tentative statement that trials had indicated that seed could be planted in July, allowed to winter over where grown, the stand thinned in the spring and a seed crop produced in the summer. In the period now under review this tentative statement was established as fact. It has further been established that with careful seeding no spring thinning is necessary. Other experiments have been conducted to determine the most suitable distances of planting between rows. Spacings have varied from rows six inches to thirty-six inches apart. The close spacing has been accomplished with a seed drill. Taken on the whole, the closer plantings have given the higher yields. Close planting has also resulted in less lodging. The commercial grade of seed has not been affected by distance of planting. The trend in results of all these experiments was to lower the cost of seed production and to show that this crop had definite commercial possibilities.

Fig. 22.—A plot area of sugar beet in early fall. The roots were wintered and produced seed "where grown". The mild climate of Vancouver Island makes this practice feasible with some vegetable and forage crops.

In farm practice hoed crops are often established to control weeds. Drill planting of sugar beet seed does not permit satisfactory weed control. In the final analysis, the distance apart of rows has to be determined by the equipment that is available for cultivation. While experimental plots of sugar beet seed had been produced for many years commercial crops were first produced on

Vancouver Island in the summer of 1941. No special problems were encountered in any phase of the cultural operations and commercial results were satisfactory. The seed, as with most other seed crops, has to be produced on a contract basis and firms interested in this crop were not interested in establishing field supervisors and placing harvesting, threshing and seed cleaning equipment unless there was a crop area of at least 100 acres. This acreage was never obtained on Vancouver Island with the result that the sugar beet seed producing area became firmly established in the Fraser Valley where annual production runs between 300,000 and 500,000 pounds.

Mangel Seed Production

The usual procedure when growing mangels for seed is to harvest the stecklings in the fall, store them in pits and replant them the following spring. Commencing in 1942, an attempt was made to reduce the labour required to produce mangel seed by wintering the plants where grown, thus saving the labour of lifting, pitting and replanting. The results obtained from seedings made at intervals of two weeks, between May 1 and September 1, showed the best time for seeding to be between June 15 and July 15. Earlier seedings produced large roots which were susceptible to frost injury, and seedings made after July 15 often failed to emerge before the coming of fall rains. Plants from sowing made after July 15 seldom became large enough to produce seed. In 1946 yields of over a ton of seed per acre were obtained from seedings made on June 15 and July 15, 1945. Results obtained during the period under review indicate that occasionally good yields of seed may be had from mangels wintered outdoors. However, severe winter killing may take place three years out of five, the crop being completely winter killed or not worth harvesting. It is suggested that mangels could be planted in rows 18 inches apart and every other row harvested and pitted in the fall and the remainder left in the field to winter. If winter killing was severe, the pitted stecklings would be available for spring planting. On the other hand, if the plants wintered outdoors survived, the pitted roots could be used for stock feed or for increasing the size of the seed plot. Mangel seed production offers good commercial possibilities and large amounts were produced during the war.

Turnips—Seed Production

Sown between July 1 and August 1, turnips can be relied upon to produce a good seed crop the following year provided soil moisture at the time of sowing is sufficient to ensure a good stand. Seedings made before July 1 are subject to severe attack by root maggots, resulting in thin patchy stands. Early seedings may also produce roots that are too large. Roots from 1 to 2½ inches in diameter winter better than those of larger size. Over a period of three years turnips sown on July 15 averaged 804 pounds of seed per acre, having an average weight of 52 pounds per bushel. Under very good conditions yields may be in excess of 1,500 pounds per acre. Turnip seed growing offers good possibilities but should only be undertaken on a contract basis. California purple finches often do considerable damage just before the seed is ripe, and premature harvesting must be done to save the crop.

Annual Pastures

During 1943. 1944 and 1945 considerable work was done with oats, spring and fall rye, sudan grass, Italian grass and crimson clover for summer pasture. The results obtained indicate that, owing to low rainfall, cereals and annual grasses cannot be relied upon to produce satisfactory amounts of herbage for summer pasturage. There was a decided decrease in yield after the middle of June and little or no growth was made during July and August.

Oats, seeded alone, produced a greater amount of green forage than any other pasture in the test, averaging 4·74 tons of green matter per acre as compared to 4·59 tons for a mixture of oats, fall rye and crimson clover, and 4·36 tons for oats and sudan grass.

Spring rye reached maximum production in May, oats in June and sudan grass in October. Italian rye is at its best in the spring following the year of seeding. In mild winters it will yield a small amount of herbage in November and December. Sudan grass sown early in May will germinate freely but its growth is usually checked by cool weather, from which check it never seems to fully recover. Seeding of this species should be deferred until June.

The best date to sow summer pastures was also investigated. A mixture of two bushels of oats and one bushel of fall rye was seeded on the first day of May, June, July and August. Yields from the May and June seedings did not differ greatly from each other nor did the July and August sowings, but the yield from the July and August plantings was considerably greater than that obtained from May and June seedings. Peak production from May 1 seeding was reached on June 14, six weeks after planting, when 51 per cent of the total yield was harvested. The June 1 sowing did not reach maximum production until September 28; prior to this date only 20 per cent of the crop was produced. Seedings made on July 1 and August 1 were also at their peak on September 28.

The season's total yield of green matter from each of the seeding dates was as follows: May 1, 2·45 tons; June 1, 2·78 tons; July 1, 4·40 tons and August 1, 4·87 tons.

From these results it is evident that oats and fall rye sown in May and June cannot be relied upon to give pasturage during the summer months, but when sown in August they provide a satisfactory amount of herbage for autumn grazing.

Seeding in July is not recommended because the seed usually remains dormant until the first rain in August, and emerges at the same time as the seed sown on August 1. Oat crops were in a fit stage to pasture about six weeks after sowing the seed, under conditions of normal germination.

Taken on the whole, annual pastures are not economical. They should only be contemplated in cases of emergency. They produce about one-third the herbage that can be expected from alfalfa or the best mixtures of grasses and legumes. A fall seeded grain crop (late August) will, however, grow quicker and produce more pasture than can be expected from sod areas which have dried out during the summer.

Grasses and Legumes for Hay and Pasture

Since similar grasses and legumes may be used for either or both hay and pasture, soil conditions affect the two crops in the same manner and management problems are similar. It is desirable, therefore, to discuss them under one heading. The difference between the two crops is essentially whether the crop is allowed to mature, in which case it is harvested by man or whether it is grazed off in a young tender stage by livestock. What is known for certain is that a given area in sod will produce more tons of dry matter per acre than will be produced in tons of dry matter from the same area in pasture; also the quality of the hay in protein and carotene content may be very much lower than that of the pasture grasses. In 1946, at this Station, alfalfa cut for hay and the aftermath clipped to correspond to pasturing, yielded more dry matter per acre than Golden Glow corn, which under Saanichton conditions is unexcelled. As pasture, alfalfa was 51 per cent better than perennial rye and 66 per cent better than orchard grass. Over and above this actual yield difference, grasses such as those mentioned produce about 75 per cent of their herbage by May 15, while alfalfa produces about 50 per cent of its herbage by that date and the balance from June to September inclusive, which is considered a very desirable

distribution. Alfalfa is highly recommended as both a hay and pasture crop or as a hay crop followed by pasture. Oddly enough this very valuable crop is not grown as extensively as it should be.

Ranking next to alfalfa for drought resistance is birdsfoot trefoil, *Lotus corniculatus*. This species has not been tested widely enough on Vancouver Island or in British Columbia to give it a proper rating as a forage pasture crop. It is grown extensively in the state of Oregon on logged-off lands and has received a lot of publicity in New York state. In Europe, the publications reviewed that deal with this crop are controversial. It is reported as succeeding where alfalfa fails. Where alfalfa thrives trefoil has no known merit. Seed should be inoculated before planting. It is worthy of much wider testing than it has received. One apparently limiting factor has been cost of seed. Yields obtained here from birdsfoot trefoil grown in experimental plots indicate that seed can be produced in satisfactory commercial quantities.

Ladino clover has in recent years received a lot of publicity. In limited trials here it has shown a lack of drought resistance. It is not equal in this respect to alfalfa, birdsfoot trefoil or red clover. It is resistant to the adverse conditions of saturated soils and, therefore, deserves a place in soils normally considered somewhat too wet for red clover. Under average conditions it is not equal to red clover in herbage production but it has the advantage of being perennial.

A promising new variety of grass is that known as alta fescue. Considering the limited conditions under which the grass has been tested, it has shown a marked degree of drought resistance. This variety is grown extensively in Oregon. While somewhat coarse in foliage, it merits extensive trial under a variety of conditions so that it may be effectively evaluated.

In a pasture mixture experiment which included three legumes and six species of grass, perennial rye and orchard grass had more value than crested dogstail, creeping red fescue, meadow fescue and tall oat grass. Perennial rye did not prove as persistent as orchard grass. Creeping red fescue has been the most aggressive of the six kinds planted and in the mixture displaced all other kinds. Orchard grass resisted the fescue species best but it too lost out in the long run. The trouble with creeping fescue is that it does not produce enough herbage to be favourably rated, but if density of turf is a prime consideration it cannot be surpassed.

Pasture and hay crops have to be considered from many points of view, such as the length of lay, the conditions of soil moisture and soil texture and whether the growing of hay or pasture is the primary consideration. The question of management to maintain production is closely related to moisture, grazing and fertility. These matters cannot be discussed here but they are fully dealt with in a mimeograph publication, "Hay and Pasture Crops for Vancouver Island", issued from this Station. A mimeograph sheet giving fifteen mixtures for hay and pasture crops of annual and perennial nature, for fall and spring planting under varying soil conditions, is also available.

Hybrid Corn

There is much to be said in favour of hybrids; they are, generally speaking, heavy yielders; they are less subject to lodging than the standard varieties, and they cover a wide range as to date of maturity. At Saanichton, however, the standard variety, Golden Glow, was equally as good as the top yielding hybrid strains—Canada 531, 606, 625, 645 and 676. The two last mentioned hybrids seldom reach the dough stage in time to escape early fall frost and cannot, therefore, be considered within the range of good ensilage corn for this district. Canada 531, 606 and 625 are suitable for planting in districts near the sea but for

inland localities where early frost is likely to occur, the planting of 606 and 625 should be avoided. Early Northwestern Dent and Wisconsin 240 are early maturing, low yielding sorts, the former requiring 108 days and the latter 113 days to reach the dough stage. Both will ripen seed in this locality, but the cobs which are carried from 18 to 24 inches above the ground are subject to considerable damage from pheasants. Considering varying dates of maturity, the following hybrids are recommended for ensilage:

(*a*) September 15 to September 30—Wisconsin 355.
(*b*) September 25 to October 10—Canada 531.
(*c*) October 1 to October 15—Canada 606.
(*d*) October 15 to October 20—Canada 625.

For soiling, Canada 645 is recommended, due especially to its increased vigour.

Golden Glow is recommended as the best of the standard varieties for ensilage. It is also the equal of any of the hybrids grown at this Station.

For husking, Wisconsin 240 or the Brandon strain of Early Northwestern Dent are suitable for the southern part of Vancouver Island.

Crows and pheasants often do much damage to the corn crop by digging up the seeds just as the young plants are emerging from the ground. Coating the seed with coal tar, before planting, will reduce bird damage to a minimum.

An effective method of thus treating seed corn is to first place the seed in a sack and immerse in water at a temperature of 112 to 115 degrees for 5 minutes—long enough to wet and warm all the kernels. After draining off the water the seed is placed in a pail or wash tub and two tablespoons of coal tar added to each thirty pounds of seed and the mixture stirred until all the seed is evenly coated with tar. The seed is then spread out to dry and is ready to sow in 24 hours. It may be sown with a drill or planter. Care must be taken to keep the temperature of the water, during the soaking period, within the prescribed limits, or the germination may be impaired.

Soybeans

Climatic conditions on Vancouver Island are not favourable for the production of soybeans. Long dry summers with comparatively cool nights tend to retard development and extend the date of maturity into the rainy season.

Manitoba Brown is the variety best suited to this locality as it matures early. The average yield, however, is only 12·8 bushels per acre. Goldsoy produces a heavier crop of beans but owing to late maturity, artificial drying is often necessary.

The growing of soybeans in this district is not recommended.

POULTRY[6]

The White Wyandotte breed of poultry was kept at this Station up to 1940, at which time the flock was transferred to the Dominion Experimental Station, Lacombe, Alta. In the final year of performance at Saanichton the Wyandottes laid an average of 218·8 eggs. This was a living bird average, for the entire flock. The average egg weight per dozen was 57·4 grams, and average body weight was 5·7 lb. per bird. Birds from the Station flock had been shown at World Poultry Congresses held in Spain, Canada, England, Italy and Germany.

Breeding and selection have been the main line of work undertaken with the Single Comb White Leghorn flock which was transferred here from the Experimental Station at Windermere, B.C., in October, 1940. The sires that have been used were of the Ottawa superior male line and such other sires as were raised

[6] Written by R. A. Sansbury.

here from within the flock. The Ottawa superior male line was the result of a special breeding project at Ottawa. While this strain produced satisfactory progeny it never attained outstanding merit.

The basis of selecting the female line was by choosing the best daughters from the outstanding families, based on good family egg production, low mortality, good egg weight and good body conformation. As well as considering the above, special attention has been given to the selection of individual birds within selected families in regard to head conformation and eye colour and condition. The type of head that has been set as a standard is one which would be called strong, which is expressed in moderate size, as opposed to smallness, and refinement, especially avoiding beefiness or coarseness.

In so far as the eye is concerned, two grades have been established. Grade one includes birds in which the pupil is bright, clear, distinct and perfectly round; the iris a solid reddish or light bay colour. The grade two birds show considerable variation in both the pupil and the iris. The undesirable iris varies chiefly in colour from reddish or light bay. It is generally a lighter colour which may consist of several shades, and in the most extreme cases may be an indistinct grey. The pupil, instead of being as described in grade one, often shows a blurring at the edge, or may spill over into the iris. The amount which spills over may vary from a dot to perhaps a third of the pupil. In extreme cases of pupil diffusion, blindness occurs and this is normally followed by death. The condition of the pupil is much more serious than the off-type colour of the iris and in most cases it has become quite apparent about the time birds commence to lay. This eye colour condition was described in Poultry Science, Vol. XXVI. No. 4, July, 1947. The following table details the performance of the two grades of birds, in their pullet laying year.

DATA ON EYE COLOUR OF GRADE I AND II BIRDS. YEARS 1942-46

	Number of birds		Mortality	Average number of eggs	
	Start	Finish		Total birds	Living birds
			%		
Grade I	538	503	6·5	224·8	231·7
Grade II	747	587	21·4	176·6	201·8

It is readily seen from the above table that grade two birds compare unfavourably with grade one birds in all respects. Eye colour is only one of the several features that have been used in selecting breeders. When applied also to selecting pullets for the laying houses, mortality may be reduced and egg production increased.

From 1942-46 the entire laying flock was entered in Record of Performance. The 1,283 birds placed on test averaged 199·6 eggs. The number of birds certified was 765. Fourteen males and 90 females passed the progeny test. Mortality was 11·7 per cent. The number of birds which failed to lay 200 or more eggs was 339 and 78 birds laid eggs which weighed less than 24 oz. per dozen.

Pasture and Dehydrated Substitutes

Apart from the breeding policy involved in rearing the flock, there have been three kinds of pasture on which the birds have been raised, namely grasses, cereals and alfalfa. During such periods as the birds were confined either as chicks or as laying pullets they were fed a dehydrated product comparable to the pasture on the range. This experiment was run over a four-year period and the following records were taken: mortality amongst chicks; their weight at the

time of going into the laying houses, age 138 days; the amount of feed consumed. During the spring, chicks were raised from pullets which in turn were raised and fed on the three different pastures or their substitutes. Records were taken on hatchability and livability to an age of three weeks. In none of the tests on chicks were there any significant differences and it was therefore assumed that type of pasture had no effect on hatchability or anything else during the early development of chicks.

The effect on pullets while in the laying houses was recorded through mortality, egg production, egg weight, body weight and feed consumption. In none of the tests on pullets were there any significant differences. It was therefore considered that the type of pasture so far as birds are concerned was immaterial. So far as the poultryman is concerned, ease of management, permanency and herbage produced are the main considerations. Under dry soil conditions there is no better plant than alfalfa to withstand drought. It is somewhat more difficult to maintain than grasses, as the latter, along with weeds, tend to displace it. Cereals lack permanency and to provide green herbage during the summer months more than one planting is needed. Considering the crops available and their ease of management, the following mixture is recommended: 1 lb. white Dutch and 1 lb. ladino clover, 4 lb. red clover, 4 lb. alfalfa, 4 lb. perennial rye, and 6 lb. orchard grass. This is sufficient for one acre and should produce enough herbage to reduce the amount of feed that has to be purchased.

ILLUSTRATION STATIONS[7]

On the Illustration Stations farm problems are studied in their local environment representing an extension of the comprehensive work carried on at the Experimental Farms and Stations. Illustration Stations are operated on privately-owned farms on the basis of a co-operative agreement entered into between the owner and the Dominion Experimental Farms Service. In British Columbia the present organization comprises 16 Illustration Stations serving the outlying areas surrounding the Dominion Experimental Farm at Agassiz and the Experimental Stations at Saanichton, Prince George and Summerland. The work conducted on Illustration Stations has been consistently broadened in scope and has progressed from the original purpose of disseminating experimental information by field and cultural demonstration to include crop testing and experiments of a fact finding nature.

The production of adapted varieties of cereals and forage is promoted on Illustration Stations in order that these farms may serve as sources of pure seed for farmers in surrounding districts. Livestock policies which are designed to promote the development of improved herds of cattle and swine as well as flocks of sheep and poultry from which neighbouring farmers may procure breeding stock are an integral part of Illustration Station activities. Farm management studies including farm planning and organization as well as farm home beautification are other projects designed to acquire information on the most economical methods of production and promote those features which contribute to financial effectiveness and also those which enhance the comfort and attractiveness of farm living.

The sixteen Illustration Station farms which constitute the district supervised from the Agassiz Experimental Farm are located throughout the southern part of the province including Vancouver Island as well as the Central Interior areas. The three of chief concern for this report are tributary to the Saanichton Experimental Station and are situated at Alberni, Duncan and Courtenay. All

[7] Written by R. M. Hall.

three follow a mixed farming program with revenues derived mainly from livestock and poultry sources. Cash crops such as potatoes are important to the farm economy of each Station and district served. Mangel seed production is a staple sideline on the Duncan unit and the sedimentary soil thereon is particularly well adapted to the growing of alfalfa. Reference will be made throughout this report to certain districts and where this is done it will relate to the work being developed in co-operation with the farmers listed below as operators of Illustration Stations.

Station	*District*	*Operator*
Alberni	Vancouver Island	Charles Chase
Courtenay	Vancouver Island	James Casanave
Duncan	Vancouver Island	Bert Young
Cloverdale	Fraser Valley	Theodore Kuhn
Hatzic	Fraser Valley	R. H. Owen
Armstrong	Southern Interior	W. B. McKechnie (Dr.)
Armstrong	Southern Interior	L. A. Johnston
Salmon Arm	Southern Interior	James Woodburn
Revelstoke	Southern Interior	Roley Hold
Lumby	Southern Interior	H. C. Catt
Osoyoos	South Okanagan	Walter Graf
Australian	Cariboo	Gordon Beath
Quesnel	Cariboo	Charles L. Ellison
Vanderhoof	Central Interior	J. H. Andros
Fort Fraser	Central Interior	William F. Clarke
McBride	Central Interior	A. E. Long

Systematic Layout, the Basis of Illustration Station Work

Rotations

Rotations are planned to meet the requirements for cereals and forage in livestock production and, where desirable, to allow for cash crops such as potatoes and seed crops. Soil building and the maintenance of soil fertility are more than catch phrases in the program mapped out to follow in a systematic rotation. Soils are generally low in organic matter, whether of light or heavy texture. This fact makes it necessary to give thought to soil improvement, the first step of which is to maintain a high proportion of the farm in sod crops. The average area thus cropped is over fifty per cent of the total that is under the plough on the fourteen stations for which records are available.

A farm map drawn to scale is the basis for planning the work. The necessary number of fields, more or less equal in size, are measured off. These should lie advantageously to the buildings for carrying out efficient operations. An extra field is allowed for on some stations over and above the number required for rotation work. This may be an extra pasture or hay field which can be brought into the rotation cycle if desired, replacing one that is taken out to be used for a similar purpose.

Five-Year Rotation: As already mentioned, potatoes are an important cash crop in the areas served by Illustration Stations on Vancouver Island. The hoed crop section in the first year of the rotation is manured at 16 tons per acre and supplemented with a complete fertilizer of which various mixtures have been used in experimental studies. Of these the concentrated mixture 6-30-15 is more commonly used at 400 pounds per acre. Seeding down with a grass and clover mixture follows in the second year of the rotation. At Alberni and Courtenay the mixture comprised red clover 8 pounds, alsike 4, orchard grass 8, and Italian rye 4 pounds per acre plus 75 pounds of oats. Timothy has failed in tests to give the yields that are obtained from orchard and rye grass on the Bainbridge and Merville soil series.

The third and fourth years in the rotation are clover and mixed hay, respectively. For the fifth year the mixed hay sod is winter ploughed and

cropped to coarse grain preparatory to hoed crops in another cycle of the rotation. The following table gives the average yields of the various crops that have been grown in this type of rotation at Alberni and Courtenay.

RESULTS OF FIVE-YEAR ROTATION

Crops	Alberni		Courtenay	
	Years grown	Average yield per acre	Years grown	Average yield per acre
Clover hay.....tons	19	2·68	22	2·41
Mixed hay.....tons	18	2·52	19	2·08
Cereal hay.....tons	5	2·26	4	1·88
Potatoes.....tons	22	8·00	23	10·08
Turnips.....tons	17	26·12	—	—
Mangels.....tons	16	28·10	—	—
Oats.....bu.	18	61·8	15	61·8
Barley.....bu.	1	43·0	4	30·2
Corn ensilage.....tons	7	13·60	17	15·22

Six-Year Rotation: The cropping sequence followed at Duncan includes alfalfa as the basic forage crop of which two and sometimes three cuttings are obtained in one season. Stands of alfalfa have been obtained from seeding with and without a nurse crop. The latter method proves most satisfactory on soils which are below average in tilth and in fertility. Ten to twelve pounds of alfalfa seed plus two pounds of timothy provides a dense sod and the resulting forage cures readily and is relished by all classes of livestock. Alfalfa is left down four years after which a crop of oats is taken off preparatory to potatoes or a seed crop in the sixth year. Here, too, farm manure is applied at 16 tons per acre in the hoed crop year and supplemented with 6-30-15 at 400 pounds per acre.

Barley (Trebi), sown in the fall, winters successfully and consistently outyields that sown in the spring. The average yield per acre of the major crops grown are as follows, with the number of years in brackets; barley 51·1 bu. (14), oats 73·4 bu. (11), fall wheat 35·1 bu. (13), mangel seed 1,640 pounds (5), alfalfa first year 4·35 tons (13), alfalfa second year 4·00 tons (11), alfalfa third year 4·06 tons (9), potatoes 7·99 tons (20), mangels 35·81 tons (8). Soil texture has improved and the yields of grain, forage crops and of potatoes have gradually increased on this farm over the years.

Soil Fertility Studies

Chemical fertilizers are used in the broad approach to soil fertility studies as supplementary to the use of farm manure in maintaining a satisfactory level of fertility, and in such quantities that will make good the original or acquired deficiencies of the most important plant food elements such as nitrogen, phosphorous and potassium. Every crop that is harvested removes permanently a certain portion of the total supply of these elements. It follows that it is just as important to feed crops as it is to feed livestock, and equally detrimental to starve either.

FARM MANURE

In addition to applying manure to the hoed crops at 16 tons per acre it has been shown by tests that under high rainfall conditions a further dressing of 8 tons per acre is beneficial when applied to the mixed hay sod. Results of tests conducted at Courtenay were as follows, check 1·30 tons per acre and manured plots 2·15 tons or an increase of 0·85 tons per acre the year applied.

CHEMICAL FERTILIZERS

Various mixtures have been used to supplement manure on the potato crop. Experiments conducted at Alberni, Courtenay and Duncan show that the greatest response in yield is from phosphates, followed by nitrogen, second, and lastly potash. The concentrated complete mixture 6-30-15 applied at 400 pounds per acre gave an average total yield of potatoes for the three stations of 13·24 tons per acre. The yield with the nitrogen left out was 11·89 and minus both nitrogen and potash 11·82 tons per acre. The average check yield was 5·59 tons per acre.

Two-year trials using muriate of potash versus sulphate of potash in a complete mixture on potatoes showed no significant difference in yields. The muriate of potash gave an average yield of 14·31 tons and sulphate of potash 14·71 tons per acre.

TIME OF APPLYING CHEMICAL FERTILIZERS

Where repeatedly dry summers occur tests show that greater yields of potatoes were obtained when chemical fertilizers were applied broadcast four to eight weeks before planting. The average yield for four years at the three points show but little preference in the time of application. Two months before planting gave 10·39 tons, one month before 10·50 tons, broadcast at time of planting 10·40 tons and applied in the drill at planting time 10·41 tons per acre. Check plots receiving manure at 16 tons and no chemical fertilizer averaged 7·33 tons per acre. The mixture used in this test was 3-10-8 at 1,000 pounds per acre. At Alberni results show a decided preference in favour of broadcasting the fertilizer one to two months before planting, the average increased yield being 3·34 tons per acre.

NITROGENOUS FERTILIZERS ON HAY LAND

Beneficial results were obtained through increased yields of hay from sulphate of ammonia broadcast in the spring on mixed hay sod at 200 pounds per acre. At Courtenay the check plot yielded 1·60 tons and the treated plot 2·25 tons per acre or an extra 0·65 tons of hay per acre for an investment of $5.00.

PASTURES

Chemical fertilizers have given increased yields of herbage where applied. Similar results are indicated in the accompanying table as were obtained from using chemical fertilizers on potatoes namely that phosphates exercise a dominant influence on yields followed by nitrogen and then potash. There is little or no difference whether the total amounts of phosphates and potash are applied every third year or one third annually. Courtenay, however, shows the higher yields from the latter method. The full rate annually gives a general increased yield at all three points in varying amounts, the least of which is obtained at Duncan.

The equivalent of 2-12-6 mixture is employed in this test applied at 1,000 pounds per acre. The closest concentrated mixture to this is 6-30-15 at 400 pounds per acre. In the case of plot four an equivalent amount of plant food is obtained in 10-20-10 at 200 pounds per acre.

EIGHT-YEAR AVERAGE YIELD OF GREEN HERBAGE

Treatment per acre equivalent of 2-12-6 @ 1000 lb.		Alberni	Courtenay	Duncan	Annual cost per acre
		tons	tons	tons	$
1. 100 lb. Amm. Sulphate, 600 lb. 20% Super, 120 lb. Mur. Pot	annually / every 3 years	14·04	17·81	11·23	6·70
2. 600 lb. 20% Super, 120 lb. Mur. Pot	every 3 years	12·23	15·40	13·12	4·20
3. 600 lb. 20% Super	every 3 years	11·87	12·30	11·70	3·00
4.*100 lb Amm. Sulphate, 200 lb. 20% Super, 40 lb. Mur. Pot	annually	13·45	21·52	11·75	6·70
5.*100 lb. Amm. Sulphate, 600 lb. 20% Super, 120 lb. Mur. Pot	annually	15·43	23·00	12·23	15·10
6. Check		6·75	7·83	5·92	Nil
Average rainfall April 1—July 31		10·83"	8·43"	6·55"	

* Results are for three years only.

Livestock

The cows milking on Illustration Stations showed an increase in 1946 of 21 per cent over the 1940-45 average. Eleven operators breed dairy stock, five of them having registered herds. Three operators are in beef production maintaining an average breeding herd of twenty-four females. Brood sows of Yorkshire breeding have increased 119 per cent in numbers since 1940. Improved management in feeding and sanitation has lowered the mortality rate for the same period from 20·4 to 13·0 per cent. Three of the operators each maintain a small flock of sheep. Breeding ewes have decreased in numbers from a five-year average of 20 (1941 to 1944) to 13 in 1946.

Increasing demands for poultry products is reflected in the gross receipts of $2,962.16 in 1939 to the 1946 high of $7,938.08. This is due in part to firmer prices and also to the number of the laying flock increasing from an average of 70 to 89 in the last five years. Moreover, the average production increased for the same period from 39·1 to 43·4 per cent.

To provide effective service, an Illustration Station, in addition to being a source of information to the community served, offers also a source for seed grain, potatoes and breeding stock. In the latter connection, the total numbers of livestock sold for breeding purposes in the last five years covered by this report are as follows: cattle 167, swine 177, sheep 81 and poultry 800.

Farm Organization and Business Studies

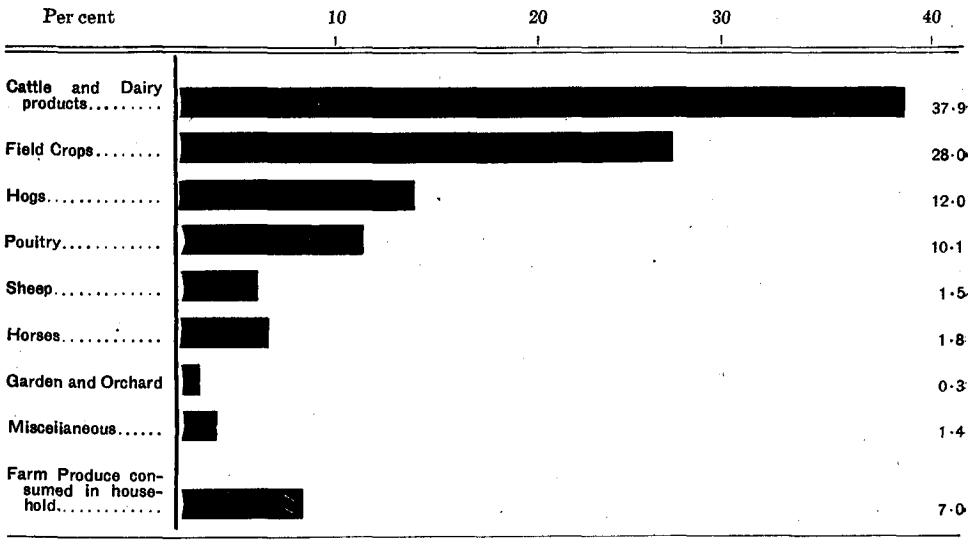
Preliminary studies were first undertaken in 1937 to ascertain the sources of revenue on farms operated as Illustration Stations in British Columbia. This initial step has since expanded to determine the financial progress made on each station annually in terms of labour earnings. The weekly report of farm revenue and expenditure filed by each operator is the basis for this study. An annual inventory is also taken, listing the acreage, kinds of crops grown and their yields, livestock, feeds and supplies, capital investment, and liabilities.

A summary statement of the sources of revenue is prepared each year as of December 31. The following graph shows this data as a five-year average.

Sales of cattle and dairy produce constituted the chief source of revenue during the five-year period, contributing upwards of 37·9 per cent. Field crops afforded the second highest source of farm revenue or 28·0 per cent. This was

SOURCES OF REVENUE ON ILLUSTRATION STATIONS IN BRITISH COLUMBIA

FIVE-YEAR AVERAGE



made up largely from clover seed crops, potatoes, alfalfa hay and seed grain. The year 1946 saw the highest revenue from cattle, 43·2 per cent, and the lowest field crop returns, 18·6 per cent.

The same year was also the peak period for both hogs and poultry of 13·7 and 11·3 per cent respectively. All livestock and poultry sources contributed 63·3 per cent of the average total revenue during the period under review. The interest in livestock is sustained only where adequate labour is available or where local outlets make livestock ventures attractive. Farm produce consumed in the household is considered as a source of revenue in this study and through the five-year period rendered an average contribution of 7·0 per cent. Farm and labour income and labour earnings are also ascertained. These studies permit a check on the production efficiency on the various station farms each one of which has its own type of organization and management problems.

FARM CAPITAL

Inventory records show that the average investment in land and buildings is 65·5 per cent of the total farm capital, livestock 20·0, and equipment 14·5 per cent. The average investment per acre of crop land is $184.12, and the average gross receipts per acre for the five-year period 1943 to 1947 were $68.21. Soil types, distance from market, and type of market all have a direct bearing on the nature of the program followed. The Alberni operator is adjacent to a good pay roll city and finds butter, cream, and poultry products in strong demand the year round. Fluid milk demands have caused a slight expansion in dairying, especially at Quesnel, McBride, and Armstrong. The lack of adequate labour in recent years has reduced the returns on capital investment to some extent. Even with this handicap the five-year average gross revenue per labour unit for fourteen stations amounted to $2,291.23. A survey of the results to date indicate that the annual gross receipts per acre of crop land should equal at least one-third of the investment per acre in order to provide a reasonable margin with which to meet living expenses.

A summary showing the average capital investment and gross revenue is given in the table that follows, as applied to fourteen stations in this supervisory district.

AVERAGE CAPITAL INVESTMENT AND GROSS REVENUE PER ACRE OF CROP LAND

Station	Land and buildings		Livestock		Machinery and equipment		Total capital	Investment per acre crop land	Gross receipts per acre crop land
	Amount	Per cent of total	Amount	Per cent of total	Amount	Per cent of total			
	$	%	$	%	$	%	$	$	$
Alberni	8,256 00	69·4	2,016 20	17·0	1,626 40	13·6	11,898 60	383 83	226 89
Courtenay	17,470 00	72·8	2,879 40	12·0	3,632 60	15·2	23,982 00	399 70	80 34
Duncan	8,712 00	68·9	1,805 50	14·4	2,112 25	16·7	12,629 75	168 40	101 05
Cloverdale	27,420 00	79·6	2,750 00	8·0	4,251 10	12·4	34,421 10	253 10	*51 44
Armstrong [1]	13,371 00	66·0	3,702 40	18·3	3,172 20	15·7	20,245 60	168 71	46 95
Armstrong [2]	3,925 00	52·2	2,912 00	38·8	677 00	9·0	7,514 00	187 85	*102 46
Salmon Arm	4,980 00	73·3	1,174 20	17·3	644 80	9·4	6,799 00	212 47	71 29
Revelstoke	6,945 00	74·3	1,062 60	11·4	1,318 60	14·3	9,326 20	274 30	83 13
Lumby	8,632 60	45·9	8,285 40	44·1	1,886 20	10·0	18,804 20	208 93	34 37
Australian	8,413 20	49·2	5,399 60	31·6	3,261 80	19·2	17,074 60	148 47	32 75
Quesnel	5,598 40	68·0	1,195 00	14·5	1,436 20	17·5	8,229 60	164 59	49 22
Vanderhoof	11,695 00	69·3	2,560 20	15·2	2,612 40	15·5	16,867 60	120 48	18 90
Fort Fraser	5,170 00	61·8	2,022 00	24·2	1,170 00	14·0	8,362 00	116 14	*27 65
McBride	7,556 00	51·4	4,417 60	30·0	2,723 80	18·6	14,697 40	97 98	28 55
Total	138,144 20	.....	42,182 10	.....	30,525 35	.....	210,851 65	.....	.....
Average	9,867 44	65·5	3,013 01	20·0	2,180 38	14·5	15,060 83	184 12	68 21

[1]. McKechnie [2]. Johnston * Two years only.

Field Days

The public is invited to attend the Annual Field Days held on the respective local Illustration Stations which usually take place during the growing season. These events are for the most part afternoon meetings, the programs of which are shared equally between field and livestock demonstrations. Splendid co-operation is given by both the Provincial Department of Agriculture officials and staff members of the University of British Columbia in making these events as informative as possible. A total of 89 Field Days has been held on the Illustration Stations in the Agassiz Supervisory District from 1939 to 1947. Prominent women speakers have also taken part when possible, leading discussions and giving demonstrations on some phase of Home Economics. This has proved to be an attractive feature and one that has always enhanced the value and broadened the contacts on these occasions.

EXPERIMENTAL PROJECTS

The following experiments are currently in progress at the Saanichton Station. The list is divided into two main sections, namely, horticulture and field crops. Some of the experiments are subdivided into numerous headings and the title does not, therefore, indicate all the work that is being done. For instance, in Variety Experiment under Bush Fruits, six different kinds are being tested.

Horticulture

Fruits, Nuts and Woody Plants

H-13	Strawberry Breeding
H-21	Strawberry Variety Experiment
H-490	Loganberry Breeding
H-793	Bush Fruits, Variety Experiment
H-815	Tree Fruits, Variety Experiment
H-827	Tree Fruits, Breeding
H-831	Tree Fruits, Different Methods of Grafting
H-834	Tree Fruits and Nut Pollination
H-836	Tree Fruits, Rootstock Trials
H-839	Tree Fruits, Thinning
H-840	Nuts, Variety Experiment
H-790	Ornamental Trees and Shrubs, Variety Experiment
H-885	Effect of Hormones on Plant Growth
H-943	Cascara Cultivation

Bulbs

H-797	Bulb Variety Experiment; Increase, Field and Greenhouse Flowering
H-925	Controlled Temperature on Bulbs Dug at Various Stages of Maturity
H-944A	(*a*) Rejuvenation of Forced Bulbs (*b*) Annual and Biennial Harvesting of Bulbs
H-944B	Various Methods of Planting Bulbs
H-944C	Forcing Bulbs Produced in Different Areas
H-944CA	Cool Storage, Date of Housing and Subdued Light in Forcing
H-944E	Soil Type on Increase, Flowering and Subsequent Forcing
H-944D	Fertilizer and Lime on Increase, Flowering and Subsequent Forcing
H-944F	Artificial Propagation of Hyacinth Bulbs: Scooping and Scoring
H-944FA	Artificial Propagation of Hyacinth Bulbs: Callusing
H-952	Mulches as Affecting Bulb and Flower Production
H-947	Storing and Shipping Cut Flowers
H-265	Co-operative Bulb Shipments and Forcing Tests

VEGETABLES

H-102	Corn, Variety Experiment
H-795	Leguminous Vegetables, Variety Experiment
H-802	Perennial Vegetables, Variety Experiment
H-803	Root Vegetables, Variety Experiment
H-804	Leafy Vegetables, Variety Experiment
H-805	Vegetable Vine Crops, Variety Experiment
H-806	Solanaceous Vegetables, Variety Experiment
H-808	Vegetables, Different Distances of Planting
H-818	Vegetable Seed Production
H-819	Vegetables, Different dates of harvesting
H-820	Vegetables, Different Dates of Sowing or Planting

NUTRITION

H-391	Strawberry Fertilizer Experiment
H-667	Orchard Fertilizer and Sod Culture
H-777	Nutritional Studies in Plant Growth
H-946	Rotation Experiment for Maximum Production
H-952	Organic Mulch for Horticultural Crops

FIELD CROPS

CEREALS

Ce-1	Spring Wheat, Variety Experiment
Ce-4	Winter Wheat, Variety Experiment
Ce-5	Oats, Variety Experiment
Ce-6	Barley, Variety Experiment
Ce-7	Field Peas, Variety Experiment
Ce-13	Production of Seed Stocks
Ce-66	Fall Sowing of Oats
Ce-67	Fall Sowing of Barley

FORAGE CROPS

Ag-1	Indian Corn, Variety Test for Ensilage Purposes
Ag-101	Seed Production in Forage Plants
Ag-255	Forage Crop Nursery
Ag-264	Grasses and Legumes for Hay
Ag-267	Grasses and Legumes for Pasture

FIELD HUSBANDRY

F-85	Lime Experiments
F-481	Green Manure, Cover Crops and Organic Matter
F-305	Meteorological Records
F-90	Cost of Operating Tractor
F-394	Canada Thistle Eradication
F-388	Chemicals for Weed Eradication

POULTRY

P-56	Pedigree Breeding for Egg Production
P-251	Pasture Crops and Dehydrated Substitutes
P-262	Maintenance of Egg Production in Early Hatched Pullets.

LIST OF PUBLICATIONS

The publications listed below have been written by members of the staff. They are essentially supported by facts and data obtained from experiments that have been planned and supervised by the writers. There have also been

prepared for distribution numerous mimeographed sheets on many other topics. The publications list issued by the Information Service, Dominion Department of Agriculture, Ottawa, and the one issued by the Provincial Department of Agriculture, Parliament Buildings, Victoria, likewise catalogue useful literature on a great variety of subjects.

Fruits and Woody Plants

The Cultivation of Tree Fruits
Nut Culture
Frameworking Fruit Trees
Pear Pollination
Plum Pollination
Cherry Pollination
Growing and Pruning Small Fruits
Ornamental Trees and Shrubs for Coastal Areas

Bulbs

Narcissus Culture in British Columbia
Tulip Bulb Culture
Easter Lily Culture in British Columbia
Cost Analysis of an Acre of Tulips
Hyacinth Bulb Production and Artificial Propagation
Promising New Methods Used in Propagation of Hyacinths
Gladiolus Culture in British Columbia
A Five-Year Forcing Experiment with B.C. King Alfred Daffodils and Four Varieties of Tulips
Bulbs and Bulb Bloom

Vegetables

Growing Cantaloupes with Mulch Paper
Vegetable Seed Crop Experiments
Vegetable Growing in the Coast Areas of B.C.

Plant Nutrition

Composting Waste Material
Fertilizer Recommendations for Vancouver Island
Green Manure Crops
Tillage, Fertilizer and Organic Matter in Relation to Seed Growing

Forage Crops

Hay and Pasture Mixtures for Vancouver Island
Hay and Pasture Crops for Vancouver Island

Miscellaneous

Results of Experiments 1932-36
Summary of Annual Reports for 1943, 1944, 1945 and 1946
Farming on Vancouver Island.

APPENDIX A

ANNUAL PRECIPITATION

DOMINION EXPERIMENTAL STATION, SAANICHTON B.C. 1914-1946

(INCHES)

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1914	8·47	3·21	1·26	1·63	0·28	2·14	0·13	0·14	1,97	3·63	8·20	1·21	32·27
1915	2·77	1·66	1·65	1·65	2,06	0·74	1·30	0·03	0·30	4·17	4·82	6·89	28·04
1916	5·52	5·49	4·85	1·52	0·73	0·55	1·72	0·32	0·66	2·01	3·18	6·59	33·14
1917	4·07	2·97	2,72	4·09	0·70	1·06	0·18	0·44	1·35	0·61	1·85	9·21	29·25
1918	3·75	4·78	4·68	0·21	0·44	0·45	0·96	1,41	0·16	2·73	3·34	6·86	29·77
1919	4·45	4·02	3·42	2·15	1·18	0·77	0·27	0·06	1·85	1·52	5·58	4·75	30·02
1920	3·28	0·61	2·87	1·45	1·24	1·17	0·67	2·52	2·96	4·03	3·32	3·68	27·26
1921	4·23	3·97	1·67	1·13	1·57	1·36	0·04	1·02	2·74	4·80	4·40	3·60	30·53
1922	1·85	1·80	1·20	0·71	0·54	0·27	0·00	0·92	1·96	2·21	1·47	9·07	21·68
1923	6·81	3·62	2·09	1·68	1·29	0·51	0·92	0·65	1·62	1·95	2·58	6·88	30·60
1924	3·05	6·00	0·47	1·08	0·16	0·33	0·31	0·77	3·12	3·35	5·50	4·61	28·75
1925	5·50	3·88	1·46	1·75	0·51	0·37	0·23	0·81	0·59	1·06	2·49	5·43	24·08
1926	3·90	3·21	0·85	0·93	1·60	0·25	0·08	1·09	0·66	3·91	3·93	5·77	26·20
1927	3·53	3·91	1·89	1·31	1·08	0·91	0·25	0·49	2·27	4·49	8·64	2·94	31·56
1928	5·75	0·33	3·49	2·38	0·77	0·84	0·76	0·47	0·68	4·42	1·98	3·27	25·14
1929	3·17	1·06	3·03	1·51	0·77	1·31	0·24	0·38	0·71	1·08	1·94	4·81	18·66
1930	1·63	6·49	1·46	2·09	1·52	1·03	0·03	0·66	0·78	5·05	1·28	1·07	22·49
1931	6·91	3·41	4·24	1·67	1·48	5·61	0·68	1·16	2·42	1·59	5·28	4·71	38·16
1932	4·27	4·96	5·22	1·71	0·28	1·02	2·86	0·98	0·47	2·93	7·10	4·89	36·69
1933	5·48	3·28	3·68	0·23	1·64	0·90	1·46	0·23	3·51	4·89	3·32	12·43	41·55
1934	7·65	2·06	4·29	0·82	1·35	0·44	0·55	0·95	1·55	2·59	4·46	8·29	35·00
1935	12·74	1·47	4·91	0·38	0·21	0·58	0·76	0·97	1·31	2·11	2·37	3·12	30·93
1936	6·55	3·66	2·58	0·76	1·55	1·77	1·24	0·86	1·50	0·68	1·64	7·43	30·22
1937	1·73	5·65	1·85	3·06	0·64	2·87	0·00	1·96	0·55	2·73	6·28	9·75	37·07
1938	3·45	1·79	3·90	1·50	0·82	0·03	0·32	1·10	1·42	3·06	1·80	7·50	26·69
1939	5·90	4·04	1·12	0·48	1·58	1·60	1·29	0·29	0·32	3·53	5·23	9·11	34·49
1940	3·59	3·91	4·17	2·24	1·14	0·16	1·50	0·38	1·94	3·87	3·52	4·84	31·66
1941	3·91	2·82	1·04	1·61	1·95	0·71	0·10	1·76	2·43	2·74	4·56	5·99	29·62
1942	0·97	1·87	1·20	1·43	1·64	1·43	0·71	0·25	0·32	1·39	5·35	6·06	22·62
1943	3·48	2·44	3·90	2·14	1·62	0·77	0·57	1·17	0·16	4·74	1·10	2·75	24·84
1944	4·97	2·62	1·13	0·90	1·72	0·70	0·07	0·37	1·19	3·24	3·46	1·50	21·37
1945	4·20	3·98	3·45	1·76	1·32	0·40	0·19	0·59	2·32	3·24	6·62	4·26	32·33
1946	5·39	4·55	3·55	3·00	0·38	3·40	0·97	0·15	0·58	2·31	3·86	4·19	32·33
Average 33 years...	4·63	3·32	2·71	1·54	1·09	1·10	0·65	0·72	1·41	2·93	3·96	5·56	29·56

APPENDIX B

THE OCCURRENCE OF FROST AND FROST-FREE PERIODS, DOMINION EXPERIMENTAL STATION, SAANICHTON, B.C., 1919-1946
(Freezing Temperature 32 degrees F., or lower)

Year	Spring frosts	Fall frosts	Frost-free periods
	Date of last frost in spring	Date of first frost in fall	Days frost-free
1919	April 14	October 25	193
1920	April 14	November 9	208
1921	April 20	November 19	212
1922	May 9	November 12	186
1923	March 21	November 30	253
1924	April 23	November 10	200
1925	March 23	November 4	225
1926	January 14	December 12	331
1927	April 20	October 30	192
1928	April 1	December 1	244
1929	April 9	November 11	216
1930	April 2	November 14	226
1931	April 18	November 16	212
1932	March 6	December 5	274
1933	April 10	November 27	231
1934	March 4	December 1	271
1935	April 3	October 29	209
1936	April 4	November 2	212
1937	March 18	November 14	241
1938	March 30	November 9	224
1939	April 4	October 25	203
1940	January 13	November 9	301
1941	February 24	November 12	270
1942	March 26	November 5	223
1943	March 20	December 10	264
1944	April 14	November 14	214
1945	March 14	November 5	225
1946	March 28	November 1	218
Average			231

Date of the latest spring frost on record—May 9, 1922
Date of the earliest fall frost on record—October 25, 1919 and 1939.
Shortest frost-free period on record—186 days.
Longest frost-free period on record—331 days.

APPENDIX C

DATES OF FARM OPERATIONS

DOMINION EXPERIMENTAL FARM, SAANICHTON, B.C., 1916-1946

31-YEAR AVERAGE

——	Earliest	Latest	Average
Seeding Wheat (Spring)	March 12	May 9	April 16
Seeding Oats	March 24	May 7	April 14
Cutting Wheat (Spring)	July 21	August 30	August 8
Cutting Oats	July 15	August 30	August 3
Cutting Wheat (Winter)	July 6	July 31	July 15
Picking Bartlett Pears	August 2	September 22	August 28
Seeding Wheat (Winter)	September 21	October 28	October 7

OTTAWA
EDMOND CLOUTIER, C.M.G., B.A., L.Ph.,
KING'S PRINTER AND CONTROLLER OF STATIONERY
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