DOMINION OF CANADA

DEPARTMENT OF AGRICULTURE

DOMINION EXPERIMENTAL FARMS

EXPERIMENTAL STATION

SUMMERLAND, B.C.

REPORT OF THE SUPERINTENDENT

W. T. HUNTER, B.S.A.

FOR THE YEAR 1929

Meteorological station, showing, left to right, rain gauge, evaporation tank, wind recorder, sunshine recorder and thermometer screen, also floral clock to the right of the building.

Printed by authority of the Hon. Robert Weir, Minister of Agriculture, Ottawa, 1930

TABLE OF CONTENTS

DOMINION EXPERIMENTAL STATION, SUMMERLAND, B.C.

REPORT OF THE SUPERINTENDENT, W. T. HUNTER, B.S.A.

THE SEASON

The early part of the winter of 1928-29 was moderate, but early in the new year weather of unusual severity set in. For 27 days, January 19 to February 14 inclusive, the minimum temperature recorded at this Station did not rise higher than 11 degrees above zero. As a result of this prolonged cold spell, the southern end of Okanagan lake was frozen over and ice remained in the lake until late in March. The influence of the lake was distinctly noticeable in early spring temperatures. April opened with moderately warm days and cold nights. The temperature on the morning of April 6 dropped to 22 degrees F. The last spring frost recorded was on the morning of April 18 when the temperature reached 30 degrees F. The average temperature for April was about one and a half degrees lower than the average for this month over a fourteen-year period. Temperatures recorded in May and June were not in any way exceptional. The precipitation during these spring months was a little lower than usual and after June the rainfall was exceedingly light resulting in the lowest yearly precipitation on record, viz., 6·76 inches. July, August and September were very hot and dry and for days at a time a heavy pall of smoke from forest fires, hung over the valley. There was a great scarcity of irrigation water; flood water in the spring had been negligible and creeks dried up long before their normal period. Crops, more especially late harvested crops, suffered considerably, and in many apple orchards the fruit withered on the trees. The fall continued dry. In December there was a good snowfall but during the remainder of the winter the precipitation was light and it is feared that there will again be water shortage during the season of 1930.

The following table gives a summary of the meteorological data for the year 1929, also the average mean temperatures and precipitation over a period of fourteen years, and average sunshine for thirteen years.

TABLE I.—METEOROLOGICAL RECORDS, 1929

1929	Temperature (°F.)						Precipitation				Sunshine (hours)	
	Mean		Maximum		Minimum		Rain	Snow	Total precipitation			
	1929	Average 14 years	Highest	Mean Maximum	Lowest	Mean Minimum			1929	Average 14 years	1929	Average 13 years
							in.	in.	in.	in.		
January	16·69	24·98	36	21·84	−9	11·55	0·00	6·0	0·60	0·89	53·6	50·6
February	20·44	28·59	46	29·57	−2	11·32	0·00	5·5	0·55	0·54	131·8	96·7
March	42·27	39·05	62	51·68	25	32·87	0·55	0·0	0·55	0·53	139·8	138·6
April	45·78	47·20	78	56·53	22	35·03	0·21	0·5	0·26	0·74	215·1	192·1
May	58·20	50·32	87	70·60	35	45·90	0·16	0·0	0·16	0·69	259·7	233·0
June	63·10	63·45	84	73·40	45	52·80	1·02	0·0	1·02	1·09	205·7	248·6
July	70·14	70·66	98	83·61	44	56·68	0·02	0·0	0·02	0·63	361·1	324·0
August	71·16	68·77	95	83·32	46	59·00	0·64	0·0	0·64	0·80	297·8	271·7
September	58·93	59·06	85	69·40	39	48·46	0·23	0·0	0·23	0·75	207·1	204·0
October	50·50	48·19	75	59·90	29	41·10	0·81	0·0	0·81	0·79	179·2	145·6
November	36·45	36·31	56	43·00	16	29·90	0·36	0·0	0·36	0·94	96·5	62·9
December	29·64	27·61	51	33·87	8	25·41	0·01	15·5	1·56	1·38	24·8	40·5
Totals	.....	.....	.....	.....	.....	.....	4·01	27·5	6·76	9·77	2,172·2	2,008·3

HORTICULTURE

APPLES*

Over thirty projects in the culture, harvesting, and storage of apples and pears are now being carried on at this Station. A complete account of the purpose, methods of procedure, and results secured from these projects would occupy far more space than has been allotted to pomology in this publication. The character and scope of the major lines of pomological investigation have been outlined in previous reports. Growers in the territory served by this Station are, therefore, well acquainted with the general nature of the work which is being carried on. Accordingly it seems desirable at this time to state in greater detail the progress made with a few individual projects. For this reason the following pages have been devoted to a discussion of improvement work with apples and harvesting investigations with pears.

APPLE IMPROVEMENT

Project H. 22

Climatic conditions prevailing in the interior valleys of British Columbia are exceptionally favourable for the production of high quality fruit. The comparative excellence of apples grown in this territory is manifested by the many awards received for British Columbia fruit at Imperial and International Fruit Shows. This superiority in quality is the primary factor which has made possible the extremely rapid growth of an industry which now involves an annual turnover of several million dollars.

Nevertheless, there is still plenty of room for improvement in the quality of a large proportion of the crop shipped from this province. Furthermore, increasingly keen competition from oranges and other fruits of southern origin makes it imperative that British Columbia orchardists redouble their efforts to supply a superior product to the consumer. With this in mind a special study has been made of the various factors which influence fruit quality. Broadly speaking, improvement in the quality of apples may be expected from two main sources; first, from the modification of environmental factors such as cultural methods, harvesting procedure and storage conditions; second, from the development of new varieties and strains.

The comprehensive investigations which are being carried on with a view to enhancing the quality of apples through modification of environmental conditions have received a good deal of attention in the annual reports of this Station for 1925, -26, -27, and -28. Very little mention has previously been made, however, of the efforts which are being put forth to secure improvement through breeding and the use of bud mutations.

APPLE BREEDING

If the apple is to continue to hold its position as the king of all fruits, varieties must be developed which combine productivity with attractive appearance, high quality and adaptation to commercial handling. McIntosh, Delicious and Winesap owe their present popularity to the fact that they approach nearer to this ideal than do the hundreds of varieties which they have superseded. Nevertheless, each of our present day commercial varieties possesses serious weaknesses. McIntosh drops freely from the tree even before it has reached optimum picking maturity. Furthermore, the thin skin and soft texture of this variety render it particularly susceptible to skin punctures and bruises during picking, grading and transportation processes. Worst of all,

* This section of the report has been prepared by R. C. Palmer, Chief Assistant to the Superintendent.

it remains in prime eating condition for a comparatively short time. Delicious also has a limited storage life, for it soon goes mealy unless kept at low temperatures. Winesap keeps for a long time but is not particularly high in quality and can only be grown to advantage in very limited areas.

On the other hand, these three varieties possess between them many desirable characteristics which, if they can be combined in one variety will result in a super-apple more attractive to the consumer and more profitable to the producer than any of the parents. From the McIntosh might come hardiness, vigour and structural strength of tree together with that appetizing aroma and delicate flavour so popular with the consuming public. The Delicious might contribute regularity of bearing, a skin highly resistant to bruises, punctures and disease, and that crisp juicy flesh which is characteristic of this variety at its best. Add to these the attractive appearance and prolonged storage life of a well-grown Winesap and you would have a fit candidate for supremacy in the realm of fruit.

It was with the hope of producing varieties of this calibre specially adapted to the climatic conditions of British Columbia that an apple breeding project was begun at this Station in 1924. Each year since that time the work has been continued and extended till now over 1,600 seedlings have been set out in their fruiting positions and many more are still in nursery rows. In all but a few cases these seedlings are the result of controlled crosses, both parents being known. In addition to McIntosh, Delicious and Winesap, the following varieties have been used as parents: Newtown, Golden Delicious, Jonathan, Vanderpool Red, Spitzenburg, Melba, Grimes Golden, and Rome Beauty. McIntosh has been used either as the male or female parent in many of the crosses as the results secured from breeding work at the Central Experimental Farm and at the New York Experiment Station have shown that this variety passes on its good qualities to a high proportion of its seedlings. In spite of this careful selection of parentage it is confidently expected that most of the resulting seedlings will prove inferior to their ancestors. However, if only one out of a thousand seedlings inherits a majority of the good qualities without the weaknesses of the parents the benefit to apple growers in this province will undoubtedly be sufficient to pay the cost of this project many times over.

The introduction of superior varieties produced by the breeding methods outlined above, is necessarily a very slow process. From five to fifteen years are required to bring the seedlings into bearing. The characteristics of the fruits must be observed over a further period of several years before an intelligent selection of the most promising seedlings can be made. These selections must then be propagated by budding or grafting and the resulting trees raised to full bearing age to determine their vigour, hardiness and productivity. The fruits must be submitted to shipping and storage tests to find out how they are likely to withstand commercial handling. Every possible care must be taken to eliminate all selections which have inherited serious weaknesses no matter how many good qualities they may possess. Even after a selection has been obtained which shows such outstanding promise as to justify giving it a name, and introducing it to commerce, many years must elapse before producers and consumers become fully acquainted with its merits.

BUD MUTATIONS IN THE APPLE

With the above facts in mind, a good deal of attention has been given to the possibility of effecting more rapid improvement of our present commercial varieties by taking advantage of bud mutations or sports. Ornamental horticulture has been greatly enriched by bud mutations, a great deal of valuable landscape material having originated in this way. The bud selection investigations carried out by A. D. Shamel and his associates with citrus fruits in California are undoubtedly worth millions of dollars to commercial growers.

The value of the work with citrus fruits lies largely in the elimination of unproductive and low-quality strains, but the results of extensive propagation tests indicate that mutations which are superior to the original varieties both in yielding ability and in fruit characters have also been isolated. It does not necessarily follow that the same can be done with apples. In fact, attempts made by several experimental stations to develop more productive strains of apples by selecting buds from individual high-producing trees have given negative results. The problem is greatly complicated by the fact that the productivity of apple trees is very materially influenced by rootstock, by soil conditions, and by cultural treatment. These factors make it very difficult to detect mutations affecting yield. Nevertheless, an experiment carried on at the Central Experimental Farm, Ottawa, has demonstrated that there are strains of the Wealthy variety which differ in productive capacity.

It is mutations affecting colour of fruit, however, which show most immediate promise of proving valuable to the apple industry. In several striped varieties branches have occurred on which the apples, while similar in other respects to those on the rest of the tree, develop solid red colour over their entire surface. These bud mutations have been propagated by nurserymen with the result that it is now possible for growers to plant red strains of Delicious, Rome Beauty, Northern Spy, Gravenstein, Winesap, Stayman, Duchess, Baldwin, Spitzenburg, and several other varieties.

It is claimed that these new red strains not only develop more colour but also colour earlier in the season than do the varieties from which they sported. Furthermore, the red colour is said to develop irrespective of exposure to sunlight. To test the validity of these contentions scions of the new strains have been secured and top-worked on bearing trees in comparison with the original striped varieties. In the case of Delicious, the extensive advertising given to two red strains, Starking and Richared, has stimulated close observation on the part of horticulturists, growers and nurserymen, with the result that several more red sports of this variety have now been found. It is quite possible that these strains may differ in colour development. Accordingly, they are being compared both by top-working old trees and by growing young trees of each strain in a test orchard. Four red strains of Delicious, in addition to Starking and Richared, are now included in these trials. Propagating material of these strains has been secured through the courtesy of Mr. R. Turner of Salmon Arm, Mr. H. Evans of Vernon, and Mr. A. S. Towgood of Oyama.

The results secured at this Station and elsewhere leave no doubt that these new strains represent a decided advance from the standpoint of colour development. Since commercial grades are based largely on percentage of red colour, it is altogether probable that these new strains will ensure a greater proportion of high-grade fruit. The earlier development of red colour will also be of material advantage with such varieties as Jonathan and Stayman which become susceptible to internal breakdown when left on the trees until they reach an advanced stage of maturity. Furthermore, it is confidently expected that the red strains will prove resistant to storage scald. On the other hand, there is a possible disadvantage in early colouring. The popularity of red apples is undoubtedly due in some measure to the fact that high quality is commonly associated with red colour. Extensive harvesting experiments have shown that the quality of many of our apples is poor when they are picked too early in the season. Thus Delicious of the old striped type, picked before they have developed good colour, are usually inferior in quality to specimens of the same variety left on the tree till they have attained Extra Fancy colour. Similarly "C" grade Delicious picked from the shaded parts of a tree are seldom as good in quality as are high colour specimens which have received their full quota of sunshine. Will specimens of the new strains develop full red colour before sugar development and other chemical changes have progressed to the stage

necessary to produce high quality? Will specimens in shaded portions of the tree develop Extra Fancy colour but only "C" grade quality? If so, the ultimate effect of these new strains on the popularity of red apples and on the apple industry as a whole may not be altogether favourable.

All things considereded, however, it seems probable that with proper attention to harvesting maturity, the red strains will make it possible to produce apples which are more attractive in appearance and as good or better in quality than the varieties from which they originated.

BUD MUTATIONS IN THE MCINTOSH APPLE

It has long been a matter of contention among horticulturists and fruit growers as to whether there are distinct "stripe" and "blush" strains of McIntosh. Some have claimed that there are in reality at least two "varieties" of McIntosh differing markedly in colour development. Others have been equally emphatic that both striped and blushed fruits can often be picked from the same tree. Careful observation of the fruit produced by thirty-five McIntosh trees in the orchard at this Station during the past five years indicates that there are two distinct strains but that bud sporting from one to the other takes place quite frequently.

Forty McIntosh trees were planted in 1916. Fourteen of these were secured from the Kaleden Nursery, fourteen from the Coldstream Nursery, and twelve from the Riverside Nursery. These trees were planted in two rows, seven trees from Kaleden, seven from Coldstream, and six from Riverside being set in each row. The trees were planted thirty feet apart in the row and the two rows were separated by five rows of other varieties. Half of each row has been cover cropped with alfalfa, the other half with hairy vetch. The modified leader system of pruning has been practised on the 1st, 5th, 6th, 7th, 11th, 15th, 16th and 17th trees in each row. The 2nd, 3rd, 4th, 12th, 13th and 14th trees have been trained to central leader type and the remainder have been pruned to open centres. Every year since the first fruits were borne thinning has been practised according to the following plan. The first and 11th trees in each row have been left unthinned. The 2nd, 5th, 8th, 12th, 15th, 18th trees have been thinned heavily. Moderate thinning has been practised on the 3rd, 6th, 9th, 13th, 16th, and 19th trees, while the remaining six trees have received light thinning. For convenience the trees in one row have been numbered from 1 to 20 and those in the other row from 21 to 40. By 1925, five of the original trees had died. These were numbers 9, 25, 26, 28, and 31. In that year the remaining 35 trees were carefully examined just before picking time to secure information regarding the colour characteristics of the fruit. The observations recorded are set forth in Table 2.

TABLE 2—Colour Strains of the McIntosh Apple

Tree number	Colour of fruit	Number of mutations	Colour of fruit on mutant branches	Source of tree
1	Stripe			Kaleden.
2	Stripe			Kaleden.
3	Stripe			Kaleden.
4	Stripe			Kaleden.
5	Blush	2	Stripe	Riverside.
6	Blush			Riverside.
7	Stripe			Riverside.
8	Stripe			Coldstream.
10	Blush	6	Stripe	Coldstream.
11	Blush	3	Stripe	Coldstream.
12	Blush	3	Stripe	Coldstream.
13	Stripe			Coldstream.
14	Blush	3	Stripe	Coldstream.
15	Stripe			Riverside.
16	Blush	1	Stripe	Riverside.
17	Blush	2	Stripe	Riverside.
18	Stripe			Kaleden.
19	Stripe			Kaleden.
20	Stripe			Kaleden.
21	Doubtful	2	Stripe or blush	Kaleden.
22	Stripe			Kaleden.
23	Stripe			Kaleden.
24	Blush	1	Stripe	Kaleden.
27	Stripe			Riverside.
29	Stripe			Coldstream.
30	Blush			Coldstream.
32	Blush	1	Stripe	Coldstream.
33	Blush			Coldstream.
34	Blush			Coldstream.
35	Stripe			Riverside.
36	Blush			Riverside.
37	Stripe			Riverside.
38	Stripe			Kaleden.
39	Doubtful			Kaleden.
40	Stripe			Kaleden.

It was found possible to divide the trees into two main groups—one producing apples distinctly striped with red colour and the other producing apples on which the red colour was laid on in the form of a blush rather than in stripes. There were 19 trees in the stripe group, fourteen in the blush group, and two trees, Nos. 21 and 39, of doubtful classification.

Some growers have reported that their McIntosh bear blushed fruits one year and striped the next. With the possible exception of tree No. 39, this certainly has not been the case on the trees in the orchard under observation. At the first inspection tree No. 39 was classified in the blush group, but each year since that time this tree has produced striped fruits. It seems altogether probable that an error was made in the original classification and that tree No. 39 has in reality always produced striped apples. It is true, however, that colour development is materially influenced by environmental as well as by inherent factors. Thus in seasons when the sun is obscured by smoke, colour development is often slow, even on trees of the blush type. Similarly, on trees carrying a very light crop, the fruit often develops poor colour due to shading and possibly also to the nutritional conditions existing within the tree. Likewise, under ideal conditions for colour development, trees of the stripe strain sometimes produce fruit of quite high colour, the stripes tending to merge together giving an effect not unlike that found on the fruit from blush trees. Nevertheless, the two strains are sufficiently distinct to have been readily identified by many horticulturists and growers who have visited this station during the past five years.

Further evidence that there are two distinct strains which can be propagated has been secured from a top-grafting experiment. In the spring of 1926,

three scions from a stripe and three from a blush tree were top-grafted on six main limbs of a McIntosh tree which had previously produced striped apples. In 1929 these grafts bore a crop and in each case the fruits had the same colour characteristics as the apples on the trees from which the scions had been taken; that is to say, scions from the stripe tree produced striped apples and scions from the blush tree produced blushed apples, even though they were all grafted on the same stock.

From a study of the data presented in table 2, it is evident that the colour strains are not localized in any one part of the orchard nor are they peculiar to the trees from any one nursery, though it should be noted that of the 14 trees secured from the Kaleden Nursery, 11 are of the stripe strain.

The two facts of greatest scientific interest and practical importance brought out by the above investigation are the remarkable frequency with which colour mutations have occurred in this block of McIntosh and the apparent tendency of the variety to sport from the blush to the stripe strain rather than in the reverse direction. Thus, although only 35 trees have been under observation, a total of 24 bud mutations were identified at the first examination and several more have been observed since that time. Furthermore, these sports have, with the possible exception of those on tree No. 21, taken the form of stripe branches on blush trees. Of the four main scaffold branches which constitute the framework of tree No. 21, two produce blushed and two produce striped apples. It is therefore impossible to determine with absolute certainty which two branches constitute the original tree and which two are bud mutations. However, in view of the fact that no other blush mutations have been observed it seems highly probable that the original whip of tree No. 21 was of the blush strain and that two buds on this whip mutated to the stripe type.

Special attention is drawn to the fact that of the 14 trees of the blush strains, 9 have produced one or more branches bearing striped apples, leaving the comparatively small number of 5 trees which have borne only blushed apples. On the other hand, not a single branch bearing blushed fruit has been observed on any one of the 19 trees in the stripe group.

If this condition is general in commercial orchards, and there is good grounds for believing that such is the case, it is evident that unless special precautions are taken in propagating nursery stock, the percentage of trees producing only blushed apples will rapidly diminish. Conversely, the percentage of striped apples will rapidly increase with a consequent greater proportion of low-grade fruit. Already there are McIntosh orchards in which it is difficult to find a tree producing blush type apples.

The Dominion Government grading rules specify 65 per cent solid red colour in Extra Fancy McIntosh. This means that practically no fruit from stripe trees can be shipped in this grade. Until recently the Fancy grade called for 25 per cent solid red colour, but on account of the increasing percentage of striped fruit, of otherwise good quality, which could not meet this requirement, this ruling was revised in 1929 to permit apples showing 35 per cent clear striped colour in the Fancy grade. Even under this new ruling, the proportion of "C" grade fruit will undoubtedly be much greater from stripe than from blush type trees. With these facts in mind, propagating material from trees which have produced only blushed apples has been supplied to commercial nurserymen.

The frequency with which colour mutations have been observed to appear in the McIntosh suggests that mutations affecting other less noticeable characters may also be occurring. In an attempt to determine whether there is any correlation between colour strains and yield or size of tree the production of each of the above 35 trees over the past 10 years has been totalled and the trunk diameter of each tree determined. These data are presented in table 3, the trees being arranged in groups according to their colour characteristics.

TABLE 3.—McINTOSH COLOUR STRAINS—YIELD AND SIZE OF TREES

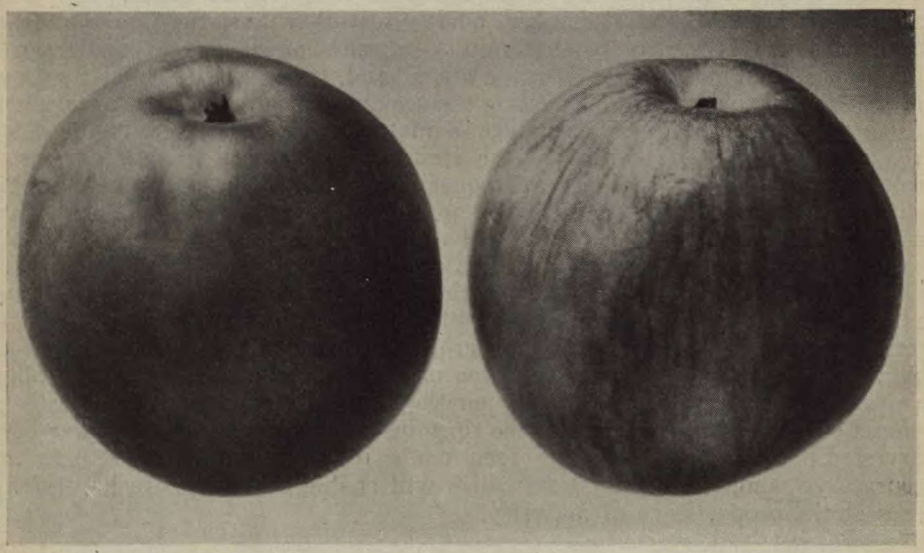
Tree number	Yield	Circumference in inches	Tree number	Yield	Circumference
Blush group			*Stripe group*		
	lb.			lb.	in.
34	2,519	36	1	2,789	31
6	2,347	35	13	2,521	34
33	2,271	37	20	2,153	33
36	1,866	31	2	2,131	31
30	951	24	4	2,062	33
			19	1,914	35
Average	1,991	32·6	7	1,875	33
			15	1,845	37
			37	1,836	30
Mutating group			35	1,768	30
			23	1,698	31
			3	1,661	32
12	2,475	40	40	1,442	29
14	2,418	37	38	1,355	33
11	2,379	28	8	1,349	32
5	2,216	33	22	1,304	31
32	2,012	39	18	1,252	35
10	2,003	32	29	1,080	27
21	1,918	29	27	1,016	23
2	1,917	32			
17	1,768	32	Average	1,752·9	31·6
16	1,571	31			
Average	2,067·7	33·3			
Doubtful group					
39	883	26			

As will be noted from the information set forth in table 3, the trees in the stripe group average slightly smaller and have produced somewhat lower average yields than the trees in the other two groups. The small number of trees and the wide range of yields and sizes within each group, however, make it very doubtful whether these averages have any real significance especially in view of the fact that both yield and size of tree have undoubtedly been materially influenced by the cultural pruning and thinning methods employed on the individual trees. Variation in root stocks, in soil conditions, and in moisture supply have no doubt also affected yield and size of trees. Accordingly the only inference which it seems safe to draw from the data presented in table 3, is that no one group shows marked superiority over the others from the standpoint of productivity or size of tree.

Repeated harvesting experiments have likewise shown greater differences in maturity between individual trees within each group than between the groups as a whole. The date when apples reach optimum picking maturity is influenced very materially by the amount of crop carried by the tree. As a general rule, trees carrying a light crop mature their fruit earlier than do those which are heavily laden. This fact doubtless accounts for much of the difference in ripening date between individual trees in a given season. It is quite possible, however, that mutations involving time of maturity have occurred. In fact, an early maturing strain of McIntosh has been reported in Michigan.

It has been observed that losses from dropping are often more serious with some trees than others. This may be due entirely to local environmental conditions, but it is also conceivable that mutations involving attachment of the fruit to the spur may be at least partly responsible for the fact that apples hang longer on some trees than on others. If such be the case, it should be possible to select a strain of McIntosh which hangs longer to the tree.

Extensive storage tests have failed to reveal any consistent superiority of either striped or blushed fruit from the standpoint of quality. Flavour and storage behaviour are greatly modified by amount of crop and by stage of maturity at which the fruit is picked. Blushed and striped fruits picked at the same stage of maturity from individual trees carrying about the same amount of crop and growing under the same conditions, have proved remarkably similar in flavour, texture and storage life. Some growers are of the opinion that the striped fruits are commonly softer in texture and shorter lived than are fruits of the blush strain. Extensive pressure records made with an accurate mechanical pressure tester do not support this contention. Nevertheless, it is quite in the realm of possibility that within the colour strains mutations affecting quality of fruit as well as size and productivity of tree may be occurring.



Two strains of the McIntosh apple. Note that on one specimen the red colour takes the form of a "blush" while on the other specimen distinct "stripes" are evident.

The strongest argument which has been advanced against the possibility of materially improving apples by bud selection is the extreme rarity with which bud mutations have been considered to occur. The comparatively large number of colour mutations which have been found during the past ten years indicates that bud mutations may occur with far greater frequency in the apple than has hitherto been considered to be the case. Very recently it has been found that the rate at which mutations occur in barley, tobacco and several other plants can be very materially accelerated by the use of X-rays. Experiments are now under way to ascertain whether the same holds true of apples.

The use of bud mutations has certain advantages over breeding as a method of improving apples. Breeding produces entirely new varieties with a whole host of unknown characteristics. Each seedling must be tested over a long period of years to ascertain its good and bad qualities. Mutations, on the other hand, commonly affect only one characteristic at a time. Thus, a mutation which caused McIntosh to hang longer to the tree would in all probability affect the fruit and tree in no other respect. The resulting variety would still retain all the well known tree and fruit characters of the McIntosh.

Bud mutations have already given highly coloured strains of several important commercial apples, and the observations reported above indicate that rigid bud selection is necessary to keep the McIntosh from degenerating

into a striped apple. It is impossible to prophesy what improvements in the apple will be brought about by bud selection during the next century, but sufficient progress has already been made to justify a thorough search for bud mutations. It is also evident that any apparent mutations which are found must be subjected to very careful propagation trials in order to test their validity and ascertain whether they have any commercial value.

PEARS

PEAR HARVESTING INVESTIGATION

(Project H. 414b)

Commercialization of the fruit industry has drawn attention to the fact that the stage of maturity at which the pear is harvested has a very great influence on the size, appearance and quality of this fruit at the time it reaches the consumer. Too early picking results in pears of small size, unattractive appearance and poor quality. On the other hand, fruits which are left too long on the tree fail to develop that melting texture and delicate flavour characteristic of pears harvested at the proper stage of maturity. Furthermore, undue delay in harvesting shortens the life of the fruit and sometimes results in reduced yield through loss of windfalls. Frequent complaints that British Columbia pears have arrived on the market in an immature or overripe condition are sufficient evidence that there is a good deal of room for improvement in the harvesting practices followed by British Columbia pear growers.

This project was begun in 1926 with the object of securing accurate information regarding the influence of harvesting practices on the yield, quality, and storage life of the varieties of pears grown commercially in the Dry Belt of this province. A careful study has been made of the changes which take place in pears as they approach maturity on the tree. Detailed records have been secured concerning the progress of the ripening process after the pears have been harvested. A special effort has been made to ascertain whether there are accurate yet simple maturity tests which will enable the grower to harvest his pears at the proper stage of maturity.

Methods of Procedure—Pear Harvesting Experiments

As a first step in carrying out this project a study was made of the literature on the subject. A great deal of valuable information was gathered from experimental work conducted in the States of Washington, Oregon and California. Care has been taken to keep fully informed of the findings reported by investigators working in these States during the past four years. In fact, the rapid progress made with this project is due in no small measure to the ready co-operation and generous assistance received from officials of the United States Department of Agircutlure.

The general procedure followed in carrying out the actual experiments has been to select several representative trees of each variety and to make pickings from these trees each week for a period beginning a week or two before and extending well beyond the customary harvesting season for each variety. Some of these trees are located in the Experimental Station orchards, but a good deal of the fruit used has been obtained from commercial growers. This has made it possible to secure information concerning pears grown under quite a wide range of conditions.

At time of harvest careful notes have been made of the maturity of the fruit as indicated by size, hardness, seed colour, skin colour, and ease of separation from the spur. The pears have then been placed in a storage room where a temperature of from 60 to 65 degrees F. and a relative humidity of

about 80 per cent has been maintained. At frequent intervals during the storage period the specimens have been examined and a record kept of the dates when they reached eating maturity and when they became overripe. Detailed notes have also been made regarding flavour, texture, shrivelling and storage diseases.

Experimental Data—Pear Harvesting Experiments

The information collected during the past four years is too extensive to be published in entirety in this brief report. However, an endeavour has been made to include sufficient data to indicate the detailed nature of the records which have been made. In this way it is hoped to give the grower an insight into the care which is taken to insure accuracy in the results reported. Typical examples of data concerning several important changes which take place in pears as they approach picking conditions have been arranged in tabular form to show the rate at which these changes occur in ten important commercial varieties. Additional tables are presented to indicate the influence of maturity at harvest time on quality, length of ripening period and length of time the fruit remains in edible condition. In order to facilitate comparison of the various sets of data, all information embodied in the tables has been taken from records made in 1929. Essentially similar data were secured during the three previous years.

DATES OF PICKING AND SIZE OF PEARS

In order that pears may be harvested to best advantage due attention must be paid to the influence of picking date on yield. An indication of the increase in yield due to growth during the last few weeks that the fruit remains on the tree has been secured by measuring ten marked pears on each tree each week. The fruits have been calipered to the nearest 32nd of an inch through the widest diameter at right angles to a line extending from stem to calyx. The figures presented in Table 4 show the increase in diameter of ten important varieties during the harvest season. Each figure represents the average of measurements made on at least thirty specimens. For the sake of simplicity the averages are shown to the nearest tenth of an inch.

TABLE 4.—INCREASE IN SIZE OF PEARS DURING HARVEST SEASON

Variety	Average diameter at each picking date.								
	Aug. 5	Aug. 14	Aug. 20	Aug. 27	Sept. 3	Sept. 9	Sept. 18	Sept. 25	Oct. 3
Clapp	2·4	2·6	2·8	3·0	.....	.....	.....	.....	.....
Bartlett	2·2	2·4	2·5	2·6	2·8	2·9	.....	.....	.....
Flemish	.....	2·4	2·5	2·7	2·9	.....	.....	.....	.....
Bosc	.....	.....	.....	2·5	2·6	2·6	2·7	2·7	2·8
Howell	.....	.....	.....	.....	2·9	3·0	3·1	3·2	3·2
Duchess	.....	.....	.....	.....	2·7	2·8	2·9	3·0	3·1
Clairgeau	.....	.....	.....	.....	2·9	3·0	3·1	3·1	3·2
Anjou	.....	.....	.....	.....	2·6	2·7	2·8	3·0	3·1
Comice	.....	.....	.....	.....	2·5	2·6	2·7	2·7	2·8
Nelis	.....	.....	.....	.....	.....	.....	.....	2·3	2·4

The data presented in table 4 show conclusively that the pears continued to increase in size at a fairly uniform rate when left on the trees until quite late in the season. Growth was most rapid in the early varieties, Clapp Favourite, Bartlett, and Flemish Beauty, but all varieties made quite substantial increases in size during the latter part of the season. The extent to which these increases in size influence yield becomes apparent when it is borne in mind that the volume of a sphere 3 inches in diameter is over 50 per cent greater than the volume of a sphere 2·6 inches in diameter. While pears are not perfectly spherical in shape

their volumes undoubtedly bear a very similar relation to their diameters. On this basis most varieties made sufficient growth during the last month that they remained on the trees to give a 50 per cent increase in yield. Accordingly a few boxes of windfalls under a tree does not necessarily indicate a net loss in yield, as the growth made in a week or two by the fruits remaining on the tree may easily result in greater tonnage than would have been secured had the whole crop been harvested early. Nevertheless, there eventually comes a time with each variety when the loss from windfalls exceeds the gain from growth. It is obviously advisable to harvest the crop before this occurs.

DATES OF HARVESTING AND EASE OF PICKING PEARS

The loss from windfalls depends largely on the firmness with which the pears are attached to the spur. In an attempt to record changes in degree of attachment as the season advanced, ease of picking at each harvest date was noted as hard, moderate, easy, or very easy. "Hard" signified that the pear could only be removed from the spur by the use of both hands. "Easy" indicated that the fruit could be easily removed by a slight upward twist. The term "moderate" was used to express a degree of attachment intermediate between hard and easy. When the fruit come off so easily that there was danger of serious loss from windfalls this fact was noted by use of the term "very easy." Data secured in this way have been incorporated in table 5.

TABLE 5.—CHANGES IN EASE OF PICKING PEARS DURING HARVEST SEASON

Variety	Ease of removal at each picking date								
	Aug. 5	Aug. 14	Aug. 20	Aug. 27	Sept. 3	Sept. 9	Sept. 18	Sept. 25	Oct. 3
Clapp	E	E	V	V	.....	.....	.....	.....	.....
Bartlett	M	M	E	E	V	V	.....	.....	.....
Flemish	.....	E	E	V	V	.....	.....	.....	.....
Bosc	.....	.....	.....	H	M	M	E	E	V
Howell	.....	.....	.....	.....	H	H	M	E	V
Duchess	.....	.....	.....	.....	H	H	M	M	V
Clairgeau	.....	.....	.....	.....	M	M	E	V	V
Anjou	.....	.....	.....	.....	M	E	E	V	V
Comice	.....	.....	.....	.....	H	H	H	M	E
Nelis	.....	.....	.....	.....	.....	.....	.....	M	E

NOTE.—"H" indicates hard, "M" indicates moderate, "E" indicates easy, "V" indicates very easy

It will be observed that with all varieties there was a progressive weakening of the degree of attachment as the season advanced. This indicates that ease of picking has value as a maturity test. It should be noted, however, that Clapp Favourite, Flemish Beauty, and Anjou could be picked easily quite early in the season. The comparatively weak attachment of these varieties to the tree has sometimes been reflected in heavy losses from windfalls.

DATES OF PICKING PEARS AND CHANGES IN SEED COLOUR

In order to ascertain at what stage of maturity pear seeds turn from white to brown, cutting tests have been made on several specimens of each variety at each picking. The progress of the colouring has been recorded by use of the terms, "white," "part brown," and "brown." Table 6 shows data gathered by this procedure.

TABLE 6.—CHANGES IN COLOUR OF PEAR SEEDS DURING HARVEST SEASON

Variety	Colour of seeds at each picking date								
	Aug. 5	Aug. 14	Aug. 20	Aug. 27	Sept. 3	Sept. 9	Sept. 18	Sept. 25	Oct. 3
Clapp	W	W	W	W	.....	.....	.....	.....	.....
Bartlett	W	W	W	W	W	W	.....	.....	.....
Flemish	.....	W	W	W	W	.....	.....	.....	.....
Bosc	.....	.....	.....	W	W	W	P	P	B
Howell	.....	.....	.....	.....	W	W	W	P	B
Duchess	.....	.....	.....	.....	W	W	P	P	B
Clairgeau	.....	.....	.....	.....	W	W	P	P	B
Anjou	.....	.....	.....	.....	W	W	P	P	B
Comice	.....	.....	.....	.....	W	P	P	B	B
Nelis	.....	.....	.....	.....	.....	.....	.....	P	B

NOTE.—"W" indicates White, "P" indicates part brown, "B" indicates all brown.

It will be noted that with the early varieties no brown colouring was evident on the seeds before the fruit had fallen or been picked from the trees. Obviously seed colour is of no value as a maturity test for these early varieties. In the later sorts, however, brown colouring appeared while the fruit was still on the tree. It seems probable therefore, that changes in seed colour may be useful in ascertaining when these late varieties have reached proper harvesting maturity.

DATES OF PICKING PEARS AND CHANGES IN SKIN COLOUR

As pears approach maturity on the tree certain changes in appearance of the fruit can be observed. The lenticles become corked over and appear as more or less conspicuous "dots." Some varieties such as Bosc and Winter Nelis take on a russet appearance, while others such as Bartlett and Anjou develop a characteristic waxy finish. These changes in the "dots," russeting and wax development are readily apparent to the trained observer, but their progress is not easy to measure. It is possible, however, to record with a fair degree of accuracy, the changes in colour of the skin between the dots. In noting these changes in skin colour use has been made of the colour chart mentioned in the Apple Harvesting Investigations published by this Station in 1927. This chart is made up of three colour plates showing varying tints of green and yellow, and numbered 1, 2, and 3, in order of increasing intensity of yellow colouring. Copies of this chart can be secured free of charge by application to this Station. The colour plates used are identical with plates 2, 3, and 4 on the colour chart devised by the United States Bureau of Plant Industry. These charts make it possible to record quite a wide range of colour. For instance, a colour between stage 1 and stage 2 may be designated, $1\frac{1}{2}$, and a cipher may be used to indicate that the skin colour has not yet progressed to stage 1. Data secured by use of the colour chart are presented in table 7. All colour comparisons were made in daylight in the shade.

TABLE 7.—CHANGES IN COLOUR OF PEARS DURING HARVEST SEASON

Variety	Colour of skin at each picking date								
	Aug. 5	Aug. 14	Aug. 20	Aug. 27	Sept. 3	Sept. 9	Sept. 18	Sept. 25	Oct. 3
Clapp	0	1	1	$1\frac{1}{2}$	.....	.....	.....	.....	.....
Bartlett	0	0	1	1	$1\frac{1}{2}$	2	.....	.....	.....
Flemish	.....	0	0	0	1	.....	.....	.....	.....
Bosc	.....	.....	.....	0	0	1	1	$1\frac{1}{2}$	2
Howell	.....	.....	.....	.....	$1\frac{1}{2}$	2	2	$2\frac{1}{2}$	$2\frac{1}{2}$
Duchess	.....	.....	.....	.....	0	0	1	1	$1\frac{1}{2}$
Clairgeau	.....	.....	.....	.....	0	1	1	2	2
Anjou	.....	.....	.....	.....	0	1	$1\frac{1}{2}$	2	2
Comice	.....	.....	.....	.....	1	$1\frac{1}{2}$	$1\frac{1}{2}$	2	2
Nelis	.....	.....	.....	.....	.....	.....	.....	1	1

NOTE.—Figures indicate degree of yellowing as compared with colour plated on chart described in text.

It is evident from the data set forth above, that there is a gradual development of yellow colour in the skin of the pear. This suggests that changes in skin colour may prove helpful in determining when pears are ready to be picked.

DATES OF PICKING PEARS AND CHANGES IN HARDNESS

The development of mechanical pressure testers has made it possible to secure a fairly accurate record of changes in firmness during the last few weeks that pears remain on the tree. The pressure tester used in these experiments was designed by the United States Department of Agriculture and is described in United States Department of Agriculture Circular No. 350. With this type of tester a rounded metal point $\frac{5}{16}$ of an inch in diameter is forced to a depth of $\frac{5}{16}$ of an inch into the peeled flesh of the pear. The pressure required to perform this operation is recorded in pounds on a scale. Three readings have been made on each specimen and each figure in table 8 represents the average of tests made on at least 10 pears. For simplicity the pressures are shown to the nearest half pound.

TABLE 8.—CHANGES IN HARDNESS OF PEARS DURING HARVEST SEASON

—	Average hardness in pounds at each picking date								
	Aug. 5	Aug. 14	Aug. 20	Aug. 27	Sept. 3	Sept. 9	Sept. 18	Sept. 25	Oct. 3
Clapp	17½	15½	14½	13½	.....	.....	.....	.....	.....
Bartlett	20	18½	17½	15½	15	14	.....	.....	.....
Flemish	.....	15	14	13	12	.....	.....	.....	.....
Bosc	.....	.....	.....	15	14	13	12½	12½	12
Howell	.....	.....	.....	.....	16	16	15½	15½	14½
Duchess	.....	.....	.....	.....	11½	11	10	9½	9
Clairgeau	.....	.....	.....	.....	14½	13½	13½	13	12
Anjou	.....	.....	.....	.....	14½	13½	13½	13	13
Comice	.....	.....	.....	.....	11½	11	10½	10½	9½
Nelis	.....	.....	.....	.....	.....	.....	.....	15½	15

NOTE.—Figures indicate pounds pressure required to force a 5/16 of an inch point 5/16 of an inch into the peeled flesh of the pear.

It will be noted from the information incorporated in table 8 that there was an appreciable softening of the flesh in all varieties as the season advanced, but changes in hardness were much more pronounced in the early varieties than in those maturing later. This indicates that the pressure tester is likely to prove more useful as a maturity test with the early than with the late varieties.

It may be well to emphasize the fact that care must be taken in using the pressure tester if satisfactory results are to be secured. There is sometimes a difference of two pounds in the hardness of individual pears picked from the same tree on the same day. Even the same specimen may be a pound or so harder on one side than on the other. It is obviously necessary to make tests on several specimens and to average the results in order to secure a fair indication of the hardness of the crop as a whole. In making pressure tests it is also important to avoid specimens affected with sun scald, black end, or other deformity. Such injuries commonly render the pears much harder than normal.

DATES OF PICKING PEARS AND DEVELOPMENT OF QUALITY

"Quality" is a very comprehensive term which it is difficult to define. Appearance, flavour, texture, sugar content, acidity, and aroma are all involved in that combination of characteristics termed "quality." Accordingly it is not easy to devise a scale which will provide an accurate measure of quality. However, it is considered that at least a fair record of the comparative excellence of the different samples has been secured by designating them "good," "fair," or "poor" in quality. All specimens having satisfactory commercial quality for the

variety have been recorded as "good." Those in which the quality was so inferior as to materially reduce their sale value have been classed as "poor." The word "fair" has been applied to fruit intermediate in quality between the above grades. The following table is an example of data secured in this way.

TABLE 9.—DATES OF PICKING PEARS AND DEVELOPMENT OF QUALITY

Variety	Quality of fruit from each picking								
	Aug. 5	Aug. 14	Aug. 20	Aug. 27	Sept. 3	Sept. 9	Sept. 18	Sept. 25	Oct. 3
Clapp	F	G	G	G	.....	.....	.....	.....	.....
Bartlett	P	F	G	G	G	F	.....	.....	.....
Flemish	.....	P	F	G	G	.....	.....	.....	.....
Bosc	.....	.....	.....	P	F	G	G	G	F
Howell	.....	.....	.....	.....	P	F	G	G	F
Duchess	.....	.....	.....	.....	P	F	G	G	F
Clairgeau	.....	.....	.....	.....	P	F	G	G	F
Anjou	.....	.....	.....	.....	P	P	F	G	G
Comice	.....	.....	.....	.....	P	P	F	G	G
Nelis	.....	.....	.....	.....	.....	.....	.....	P	P

NOTE.—"G" indicates good, "F" indicates fair, "P" indicates poor.

From a glance at table 9, it is at once apparent that time of picking has exerted a profound influence on the development of quality in all the varieties studied. Very early picking has invariably resulted in poor quality. With varieties such as Bartlett and Bosc which hang well to the tree it is also possible to delay picking so late that fruit of inferior quality results. Since other considerations often make it desirable to pick pears as soon as they are ripe enough to ensure good quality it is important that some means be devised for determining when harvesting of each variety may safely be begun.

The calendar date when any variety reaches satisfactory picking maturity is influenced by climatic and seasonal weather conditions, by cultural treatment, and by local peculiarities of each orchard. In the course of this investigation it has been found, however, that the relative dates of maturity of the different varieties in a given orchard are remarkably constant year after year. Thus in each of the four years for which harvesting records are available Flemish Beauty have been ready to pick about a week later than Bartlett. Similarly, good quality has developed each year in Bosc picked 3 weeks, Clairgeau 4 weeks, Anjou 5 weeks, and Winter Nelis 7 weeks after Bartlett. This suggests that if simple and reliable maturity tests can be devised for the Bartlett satisfactory picking dates for other varieties in the same orchards may be arrived at by picking them so many weeks or days later than Bartlett.

DATES OF PICKING PEARS AND LENGTH OF RIPENING PERIOD

The number of days which a pear requires to reach eating condition after being picked has a very important bearing on the distance to which it can be shipped. It is now well known that rate of ripening is influenced very materially by temperature conditions. The nearer to the freezing point the pears can be kept the slower will they ripen. Given uniform storage conditions however, the length of the ripening period differs with the variety and also the stage of maturity at which the fruit is picked. Evidence supporting this statement is to be found in table 10, the data presented having been secured by storing pears of each variety from each picking at 60 to 65 degrees F., and recording the number of days required to bring these pears to the eating ripe stage. It may be well to mention that there is often a difference of a day or two in the ripening date of individual specimens picked from the same tree on the same day. Nevertheless, the figures presented in table 10 give a very fair indication of the comparative number of days required to ripen pears of each variety and each picking.

TABLE 10.—DATES OF PICKING PEARS AND LENGTH OF RIPENING PERIOD

Variety	Number of days from date picked till date eating ripe								
	Aug. 5	Aug. 14	Aug. 20	Aug. 27	Sept. 3	Sept. 9	Sept. 18	Sept. 25	Oct. 3
Clapp	16	14	11	7	.....	.....	.....	.....	.....
Bartlett	.....	19	16	12	10	9	.....	.....	.....
Flemish	.....	32	28	24	21	.....	.....	.....	.....
Bosc	.....	.....	.....	.....	25	23	22	19	15
Howell	.....	.....	.....	.....	.....	26	23	19	12
Duchess	.....	.....	.....	.....	.....	30	26	22	14
Clairgeau	.....	.....	.....	.....	.....	33	24	19	16
Anjou	.....	.....	.....	.....	.....	.....	48	45	44
Comice	.....	.....	.....	.....	.....	.....	45	43	40
Nelis	.....	.....	.....	.....	.....	.....	.....	.....	52

The most important findings exemplified in table 10 are the comparatively short time which elapsed between picking date and eating ripe date with the Clapp Favourite and Bartlett varieties, and the fact that the ripening period was rendered even shorter by late picking. Thus, Bartletts picked on October 20 reached the eating ripe stage in 14 days while those picked on September 9 required only 9 days to become ripe enough to eat. It is obvious that unless refrigerating facilities are available these early varieties must be rushed very rapidly into consumption if they are to reach distant consumers in prime eating condition. It is also apparent that the later the pears are picked the faster they must be moved to market. It should be borne in mind however, that while early picking lengthens the time between picking date and the day when the fruit must be delivered to the consumer, too early picking is undesirable because of the adverse effect that it has on yield and quality.

DATES OF PICKING PEARS AND LENGTH OF LIFE

The number of days that pears remain in prime eating condition is also an important factor in ensuring a satisfied customer. Data bearing on this point are shown in table 11. This information has been secured by recording the number of days which elapsed between the eating ripe and overripe condition. The terms "eating ripe" and "overripe" are admittedly of an arbitrary nature, but as all records were made by the same observer the figures are at least comparatively accurate.

TABLE 11.—DATES OF PICKING PEARS AND LENGTH OF LIFE

Variety	Number of days pears remained in prime eating condition								
	Aug. 5	Aug. 14	Aug. 20	Aug. 27	Sept. 3	Sept. 9	Sept. 18	Sept. 25	Oct. 3
Clapp	4	3	3	3	.....	.....	.....	.....	.....
Bartlett	.....	5	4	4	5	4	.....	.....	.....
Flemish	.....	5	5	4	4	.....	.....	.....	.....
Bosc	.....	.....	.....	.....	13	13	12	11	12
Howell	.....	.....	.....	.....	.....	6	6	5	5
Duchess	.....	.....	.....	.....	.....	7	8	6	6
Clairgeau	.....	.....	.....	.....	.....	7	8	7	8
Anjou	.....	.....	.....	.....	.....	.....	13	12	12
Comice	.....	.....	.....	.....	.....	.....	10	8	8
Nelis	.....	.....	.....	.....	.....	.....	.....	.....	12

It will be observed that Clapp Favourite, Bartlett and Flemish Beauty remained in good eating condition for a very short time. This fact, together with the short ripening period is undoubtedly chiefly responsible for the heavy losses often sustained in marketing these early varieties. Similarly, the comparatively long period which Bosc and Anjou remain in satisfactory dessert

condition is no doubt largely responsible for the popularity of these varieties with fruit distributors and consumers. It is noteworthy that date of picking exerted comparatively little influence on the length of period that the fruit remained in an edible condition.

RECOMMENDATIONS FOR HARVESTING PEARS

While it would be advisable to continue investigations of the type outlined in the preceding pages for several more years before attempting to make definite recommendations, it is felt that the urgent need for information on this subject justifies the following brief suggestions at this time. No claim is made that these recommendations will prove infallible but they are based on extensive investigations carried on at this Station and a careful study of similar experiments conducted elsewhere. Accordingly it is confidently expected that they will prove a useful harvesting guide to pear growers in the territory served by this Station.

HARVESTING THE CLAPP FAVOURITE

The rapidity with which ripening progresses in the Clapp Favourite makes it especially important that this variety be harvested at the proper stage of maturity. Picking a week too early results in a product of very poor quality and often means a loss of 20 per cent in tonnage, while picking a week too late shortens the ripening period to such an extent that the fruit is overripe by the time it reaches the consumer. When Clapp Favourite is ready to pick it has a glossy appearance easily recognized by those familiar with the variety. It is readily removed from the spur by an upward twist and has a skin colour similar to plate 1 on the maturity colour chart which can be secured by application to the Summerland Experimental Station. The most reliable maturity index for the Clapp Favourite, however, is the pressure test. Excellent results have been secured by picking this variety when it registered a hardness of from 16 to 14, these figures representing the number of pounds pressure required to force a rounded metal point, $\frac{5}{16}$ of an inch in diameter, to a depth of $\frac{5}{16}$ of an inch into the peeled flesh of the fruit. When harvested at the proper stage of maturity the Clapp Favourite is superior in flavour and texture to several more popular varieties. It should be borne in mind, however, that even with the best of treatment this variety ripens very rapidly and remains in prime eating condition for only a very few days.

HARVESTING THE BARTLETT

It is not without reason that the Bartlett is grown more extensively than all other varieties combined in many commercial pear sections. The trees thrive under a wide range of soil and climatic conditions. They come into bearing early and produce heavy crops year after year. The fruit, when properly ripened, is attractive in appearance and good in quality. Modern pre-cooling and cold storage facilities make it possible to deliver fresh Bartletts to the consumer over quite a long period. Furthermore, the Bartlett is well adapted to canning. It is obviously important, therefore, to harvest this popular variety at a stage of maturity which will ensure satisfaction to the consumer, and profit to the producer.

As the Bartlett approaches maturity on the tree, several changes take place which may be used in determining the most satisfactory time to pick the crop. The dull green colour of the skin is replaced by a yellow tinge, similiar to plate 1 on the colour chart. The dots become quite prominent and the whole pear takes on a waxy finish. There is no appreciable change in seed colour but

there is a distinct loosening of the pears from the spur with the result that they can be easily removed with a slight lifting motion. Perhaps the most significant change, however, from the standpoint of maturity tests is the softening of the flesh. As measured by the $\frac{5}{16}$-inch pressure tester, the fruit softens at the rate of about $1\frac{1}{2}$ pounds a week. Bartletts picked when they register over 20 pounds on the tester seldom ripen satisfactorily, their appearance being marred by shrivelling and their flavour by astringency. Harvesting the fruit when it has a hardness of about 18 pounds commonly results in excellent quality without materially shortening the ripening period. It is inadvisable to delay picking till the pears are softer than 16 pounds as this procedure is likely to result in fruit of impaired quality and short storage life.

It is often worth while to make two pickings of the Bartlett. Pressure tests indicate that there is seldom much difference in hardness between large and small pears on the same tree. Nevertheless, there is often sufficient spread in the picking season to permit leaving small pears on the tree for a week or ten days after the large sizes have been picked, thus securing additional tonnage and greater uniformity in size.

HARVESTING THE FLEMISH BEAUTY

The Flemish Beauty is grown on account of admirable tree characters rather than for excellence of fruit, for at its best this variety cannot be considered a high quality pear. While the Flemish Beauty takes longer to ripen than the Bartlett it remains in good eating condition for an even shorter time. Furthermore, the tendency of growers to harvest the Flemish Beauty early for fear of loss from wind has resulted in the shipment of large quantities of prematurely harvested fruit which never ripens properly. Add to this the fact that cold storage facilities now make it possible to supply prime Bartletts all through what used to be the Flemish Beauty season, and the waning popularity of this variety with fruit distributors and consumers needs no further explanation.

These facts will doubtless bring about a great reduction in the acreage planted to Flemish Beauty in the future. It may even pay to top-graft or pull out trees of this variety. In the meantime, however, growers who have a large tonnage of Flemish Beauty pears to market will doubtless be well advised to plan their harvesting procedure so as to permit this variety to develop all the quality of which it is capable even at the expense of some slight loss in windfalls.

Flemish Beauty are seldom ready to pick until at least a week after Bartlett. At this time the fruit leaves the spur quite easily, has a skin colour close to plate 1 on the colour chart and a hardness of from 13 to 11 pounds. Two pickings of Flemish Beauty are usually justified.

HARVESTING THE BEURRÉ BOSC

The high quality of the Bosc is well known to connoisseurs. This variety has a fairly long harvest season. That is to say, pickings can be made over a period of several weeks without seriously injuring the quality of the fruit. Nevertheless, premature picking gives a shrivelled product of poor flavour, and unduly late harvesting renders the pears susceptible to early decay.

Bosc hang well to the trees so that there is seldom much loss from windfalls even though picking be delayed till quite late in the season. Seed colour is not a satisfactory maturity test as Bosc are often ready to pick when the seeds are still white in colour. Neither is skin colour of much value in determining the proper time to pick Bosc for the russeting characteristic of this variety com-

monly obscures the yellow colouring of the fruit. The pressure tester has proven very useful in harvesting Bosc, the fruit having a hardness of 14 to 12 pounds when ready to pick. It is also worthy of note that Bosc reach picking maturity about three weeks after Bartlett.

HARVESTING THE HOWELL

While the Howell is not a particularly high quality pear it can be picked over a fairly long season with satisfactory results. Yellowing of the skin is usually well advanced—about stage 2 on the colour chart—with this variety before it is ready to pick. Ease of picking is a fairly reliable maturity index, the pears remaining firmly attached to the spur until ready to harvest. Howell usually reaches desirable maturity about a month after Bartlett. The pressure tester is of less value with this variety than with those which mature earlier as the changes in hardness are less pronounced. Howell picked with a hardness of about 15 pounds have developed good quality.

HARVESTING THE DUCHESS D'ANGOULÊME

When well grown and properly ripened Duchess have a richness of flavour and a tenderness of flesh which would hardly be expected from the somewhat coarse outward appearance of this variety. Too often, however, these good qualities are lost by improper harvesting practice. For best results, Duchess should be picked about a month after Bartlett. At this time the fruit can be harvested with moderate ease, the seeds usually show some browning and the skin colour is close to plate 1 on the colour chart. Hardness is not a very reliable maturity index for the Duchess as this variety softens slowly during the last month on the tree. However, the fruit usually registers a pressure of 9 or 10 pounds at picking time.

HARVESTING THE BEURRÉ CLAIRGEAU

Clairgeau, like Flemish Beauty, is grown more on account of vigour, hardiness and productivity of tree than because of high quality in the fruit. Nevertheless when harvested at the proper stage of maturity, the pears are so handsome in appearance that they command a good price in spite of a disappointing flavour and texture. The fruit hangs well to the tree during the early part of the season but drops freely after a certain stage of maturity is reached. This fact must be taken into consideration when harvesting the Clairgeau. Good results have been secured by picking the fruit a month later than Bartlett. As a general rule satisfactory quality results from harvesting Clairgeau when some browning of the seeds is evident, the skin colour is between stages 1 and 2 on the colour chart and the fruit has a hardness of from 14 to 12 pounds.

HARVESTING THE BEURRÉ D'ANJOU

Anjou is deservedly popular with fruit distributors and consumers. The bright clear skin and smooth contours of the fruit make this pear most attractive to the eye. The interior characters of properly ripened Anjou are equally pleasing, for the flavour is superb and the flesh firm but tender and very juicy. Furthermore, Anjou keeps well and remains in perfect eating condition for many days even at fairly high temperatures.

It is a great pity therefore that the quality of this excellent variety is so frequently injured by premature harvesting. The explanation lies, of course, in the fact that the fruits are easily blown from the tree even before they have reached proper harvesting maturity. In this connection attention is drawn to the fact that, under favourable growing conditions, Anjou increase in diameter at the rate of about $\frac{1}{10}$ of an inch a week. This is equivalent to an increase in

tonnage of more than 10 per cent each week that the fruit is permitted to remain on the tree. It is obvious, therefore, that delayed picking does not necessarily result in reduced yield even though an appreciable proportion of the crop is blown off. Loss from wind is greatly influenced by local conditions of aspect and exposure. Accordingly every grower must weigh the various factors involved and decide what harvesting procedure is best suited to his own location. It should be borne in mind, however, that Anjou picked less than five weeks after Bartlett seldom develop full quality. As a rule when this variety is ready to pick the seeds show some browning, skin colour is between stages 1 and 2, and the fruit has a hardness of 12 or 13 pounds.

HARVESTING THE DOYENNÉ DU COMICE

There is a good deal of confusion regarding the identity of Comice. During the course of this investigation no less than five distinct varieties have been encountered under this one name. The true Comice is a high quality winter pear ripening about the season of Anjou. Distinctive characteristics are the peculiar shape of the fruit suggestive of a pyramid with the stem at the apex, a very small stem cavity, and a reddish blush which commonly appears on one cheek as the pears approach maturity.

Comice adheres firmly to the tree until ready to pick. Fruits gathered before the seeds are fully brown seldom develop the exquisite flavour and fine-grained juicy flesh for which this variety is famous. Skin colour is also well advanced by picking time, best results being secured when the pears are left on the tree till they have reached stage 2 on the colour chart. Comice is a comparatively soft pear having a hardness of from 11 to 9 pounds when in satisfactory picking condition.

HARVESTING THE WINTER NELIS

Winter Nelis is another variety which suffers greatly from being harvested too early. When properly matured it has a rich aromatic flavour and a tender luscious flesh which do much to counterbalance the small size and unattractive appearance of the fruit. When picked too soon, however, this pear is poor in quality and often very astringent.

The seeds are commonly quite brown in Winter Nelis before the fruit is ripe enough to harvest. The skin colour is usually masked by russeting. Fruits picked when they register a hardness of more than 15 pounds seldom ripen properly. When in proper harvesting condition this variety is easy to pick. Good results have been secured by delaying the harvest of Winter Nelis till seven weeks after Bartletts have been gathered.

STONE FRUITS*

CHERRY VARIETY EXPERIMENT

(Project H. 35)

In the fruit growing areas of the "Dry Belt" of British Columbia there are three varieties of sweet cherries of recognized commercial importance, viz., Royal Ann, Bing and Lambert. These three varieties have become so well established that no consideration is given any others for planting except it be for pollenizing purposes. There are a few other varieties grown which have proved a detriment to the trade and should therefore soon disappear from the orchards.

The Bing, Lambert, and Royal Ann, are intersterile and each requires pollen from other varieties that they may set fruit. It has been customary to plant one

* The work in this division is under the charge of Mr. J. E. Britton, B.S.A., assistant to the Superintendent, who has been entirely responsible, under the Superintendent, for this work and has prepared this section of the report.

tree of Black Tartarian or Black Republican in every nine, or plant a pollenizer as the third tree in every third row. This has proved satisfactory in securing a good set of fruit on all standard varieties but the fruit of the pollenizer has not been of equal commercial value. However, there appears to be a place for one or two varieties of earlier season than Bing if of high commercial value. A dark-coloured cherry is preferred, and if in addition to its market and productive qualities, it proves to be an efficient pollenizer for the present standard sorts, it will be to that extent, more desirable.

In this project the object has been to ascertain varieties of sweet cherries best suited to the climatic conditions and of high commercial value. The additional advantage of a variety that will fill an important place on the market and at the same time act as a pollenizer for Bing, Lambert and Royal Ann, is also being tested. As the newer varieties come into bearing they will be tested as pollenizers. All sweets overlap in bloom sufficiently to make this possible.

Twenty-five varieties of sweet cherries are being grown including the better known commercial sorts and two trees each of sixteen promising new varieties, not yet tested at this Station. Following are brief descriptions of those which have fruited:—

GIANT.—This variety fruited this year and showed many desirable qualities. The tree is vigorous and well formed. The quality resembles Lambert but is larger. It is firm, of excellent quality and appearance and ripens about the same time as Lambert. Its pollenizing ability and whether the fruit cracks easily or not is yet to be tested. The fruit is larger and quite distinctive from other varieties.

BIG K.—This is a large dark red cherry of the Lambert type and season, of good quality, requiring further testing.

SENECA.—Seneca is the earliest sweet cherry of all, ripening about the middle of June. The fruit resembles Black Tartarian but is probably of better quality. It appears well worth further consideration because of its earliness and should have further testing to prove its adaptability to the "Dry Belt" of British Columbia.

VICTOR.—Victor, ripe fruit resembling Royal Ann, was picked the last week of June. The fruit was firm and of good quality, and the tree appears vigorous and thrifty.

PEACH VARIETY EXPERIMENT

(Project H. 322)

To ascertain varieties of peaches best suited to the climatic conditions of British Columbia this experiment is in progress. Some of the old well known varieties of peaches such as Crawford and Yellow St. John have not proved profitable enough to the grower. Under conditions of the "Dry Belt" of British Columbia some of the newer varieties including J. H. Hale and Elberta have been more extensively planted. As every variety of fruit seems to have some quality yet to be desired so Elberta might be a little earlier and J. H. Hale be a more robust tree. Among investigators and plant breeders the search goes on, for new and improved varieties. As new varieties are introduced they are immediately secured by this Station and given trial under the climatic and cultural conditions of the Okanagan Valley.

From the standpoint of the market requirements new varieties of peaches are carefully tested, bearing in mind the hardiness of the plant and commercial value.

Several newer varieties have been under test during recent years and some of popular favour in other countries have been tried out here.

VEDETTE.—Originated at the Experimental Station, Vineland, Ontario, as a seedling of Elberta. It has done remarkably well at the Summerland Station producing very attractive fruits, splashed with red and maturing about three weeks ahead of Elberta. Trees planted in 1924 produced an average of 143 pounds in 1928 and 175 pounds in 1929. The fruit is more globular than Elberta and with more colour. It is of high quality and in canning experiments has retained its shape well and has been pronounced of excellent flavour.

VALIANT.—Also originated at the Vineland Station as seedling of Elberta. The trees averaged 120 pounds of peaches in 1928 and 135 pounds in 1929, and matured the fruit one week later than Vedette. The peaches are large, well coloured, more globular than Elberta and shipping tests show this variety to carry well and declare it to be of excellent quality both for canning and dessert. The tree is a vigorous grower of rounded shape, but has shown some weakness of wood by badly splitting.

VAUGHAN.—This is another introduction from Vineland. It ripens with Valiant about August 28 and is a firm, yellow-fleshed free-stone of large size and good quality. The tree is a strong grower and appears to be quite hardy. It averaged 175 pounds in 1929, five years after planting. The fruit is somewhat variable in size, rather dull coloured and more pubescent than either of the other two.

MIKADO.—This is a yellow-flesh free-stone peach of excellent quality and early ripening. It is a vigorous well shaped tree apparently hardy. It appears to be one of the best early yellow peaches, ripening fruit about August 1.

PLUM VARIETY EXPERIMENT

(Project H. 48)

The status of plums upon the market is rather uncertain. All other fruits seem to hold a definite and well recognized place, but with plums it is difficult to anticipate the consumers' wants. There seems to be no particular season to place plums prominently before the buying public and more often than not this fruit must compete with sorts firmly established on the markets and in the minds of the buyers. At times the markets have been barely supplied and again glutted with numerous varieties. Poor returns to the grower have often resulted in trees being neglected and low-grade fruit produced. One obvious reason for this lack of popularity in a fruit which could be made very attractive is, too many varieties.

Varieties in plums are more evident as such than in most fruits and yet not as well known. A few varieties selected for productiveness, quality, attractive apearance, hardiness of tree, shipping qualities and possibly with consideration for the season of ripening may encourage greater production of plums with better standards in packing and marketing.

This experiment in progress at the Summerland Station has included over sixty varieties of plums. The first consideration has been to ascertain varieties best suited to the climatic conditions of the Okanagan Valley. Following which they must be productive of high quality fruit for market purposes. Varieties of plums are sought that may be recommended for fairly extensive plantings in the Okanagan Valley to help round out the fruit season and make a profit to the grower.

A few of the more promising varieties tested are here described, but further trial should be made before definite recommendations would be advisable.

The trees in this test have been planted from time to time as different varieties were included. They are therefore of various ages and the average yields per tree are not given. With so many varieties present, effective pollination is assured and heavy production commonly the case. Thinning of the fruit to

prevent tree breakage and to give larger plums has often been necessary. In previous reports the following varieties have been recommended: Duarte, Peach, Bradshaw, Climax, Green Gage (Reine Claude) and Damson. There is none of outstanding merit to add to this list at this time except it be "Becky Smith" a plum of the Japanese type ripening in the first week of August. This fruit is attractive and of delicious flavour, except next to the pit. The tree thrives well at Summerland and produces a crop each year, which should be thinned to gain size and prevent breakage of the tree.

Duarte is a variety of promise for the fresh fruit trade. The tree makes fairly strong growth, well shaped and with heavy production. The plums are somewhat heart-shaped, dull red skin and red flesh. The fruit must be thinned to obtain uniformity and size. It has been found that all plums require careful attention to culture, pruning, spraying and thinning in order to obtain high quality fruit.

PRUNE VARIETY EXPERIMENT

(Project H. 576)

The Italian prune is at present the chief commercial variety grown in the "Dry Belt" of British Columbia. This variety has become well known in the fresh-fruit state, and recent experimental work in dehydration has proved its worth as a product suitable for drying. However, there is considerable difference of opinion as to its profitableness to the grower. Some maintain that it does not pay to grow prunes while others have received most satisfactory returns per acre. Two factors have mitigated against the popularity of this fruit. The one is the fact that in many cases it has been planted on the poorer soil of the orchard and generally neglected. On the other hand prunes have been harvested before the fruit has matured sufficient sugar content and best quality. For dehydration purposes the fruit must have a high sugar content before a quality product is possible. Warm weather during the ripening period hastens the development of sugar, but the cool nights of early Fall delay this ripening process. Earlier ripening of the Italian prune would be a decided advantage in its favour.

This experiment was commenced in 1926 to investigate various varieties of prunes with the object of finding a variety of special commercial value under Okanagan conditions. A small orchard was planted with six trees of each of selected varieties of possible commercial importance. Yields and quality of the fruit as well as the hardiness and adaptability of the tree are considered.

The trees have made good growth and produced a light crop in 1929. Several of the varieties have been recorded as follows:

Date prune, Imperial Epineuse, Petite and Mammoth French, have all produced fruit very similar in appearance. These four varieties are doubtless strains or variations of the well known Agen prune of French origin. They are all of good quality, sweet and juicy, but lack size and attractiveness for the fresh fruit market or for dehydration. They ripened from September 22 to October 1.

Hungarian prune, ripened in September, was medium to large and rather soft.

Yakima prune was ripe early in September, dark blue colour, large size and very fair quality. The tree grows very upright and may be difficult to control.

Standard prune, ripened fruit the last week of September, very similar to the Italian prune, sweet, juicy and good.

Hall is a large, blue, yellow-fleshed plum of good quality and fine appearance. It was introduced by the New York Agricultural Experiment Station and highly recommended for its handsome appearance and fine flavour. It ripens with the Italian prune and should be tested for dehydration.

Experimental dehydration of prunes in British Columbia and the favourable results from shipping prunes fully ripe is contributing toward greater interest in this particular fruit. It is believed that if prunes of exceptional quality both fresh and dried can be placed on the markets, that the demand will soon exceed the present production. It seems reasonable to expect that a variety or strain may be obtained with all the desirable qualities of the Italian prune; a little more size; earlier season; and a little higher sugar content. Further investigations are necessary before definite recommendations for commercial plantings should be made.

WALNUT VARIETY EXPERIMENT

(Project H. 351)

In 1917 a grove of seedling walnut trees was planted at this Station. The trees were propagated at the Sidney Experimental Station from a walnut tree found on Vancouver Island which produced thin-shelled nuts of good quality.

A few nuts were harvested in 1922 and a gradual increase in crop produced until 1929 when the average yield per tree amounted to 20 pounds. The highest yield on any one tree was 56 pounds. This average yield is not a safe indication of production because the trees are planted only twenty feet apart and therefore crowding and shading has materially interfered with normal growth and production.

There has been more or less serious freezing back of new wood on several occasions and also winter or spring killing of buds. However, there is ample proof that good thin-shelled walnuts may be grown in the Okanagan Valley, but indications do not point to the advisability of planting out commercial walnut groves.

There is a common impression that walnut trees are difficult to start and very slow growing. Contrary to this belief walnut trees grow quite rapidly and some begin bearing early. The better trees are usually slower in growth but in a matter of ten years or so the walnut presents a tree of beauty, growing into greater charm for many years to come and producing an ample supply of good nuts for family use. And so it might become a real family tree providing beauty, shade, nuts, and tradition. A walnut tree in England is 200 years old and has an annual average yield of 800 pounds of nuts.

During the past five years some trees of known variety have been added to the grove, namely, the Franquette, an important commercial sort in Oregon and California. The Franquette is known to succeed well in Utah, where winter temperatures frequently reach below zero. The Franquette trees are doing well at this Station but it will require time to determine their bearing possibilities. The absolute minimum temperatures of winter seem to have very little effect on the trees when they are fully dormant. Severe frosts are more likely to kill back the new shoots and spring frosts to kill the fruit buds.

A careful comparison has been made of the nuts from the seedling trees and in most respects they have been found to be remarkably uniform. However, certain trees have produced nuts with extremely little variation and with qualities very close to the standard commercial requirements.

From results obtained thus far with seedlings and standard varieties of walnuts there seems to be sufficient evidence that good quality walnuts may be grown successfully in the Okanagan Valley where the peach and sweet cherry succeed. However, this does not suggest the advisability of planting commercial groves. On the contrary, it is very doubtful whether a large planting of walnuts would pay.

In the growing of seedling walnuts variation may be expected as with seedling apples. It is therefore advisable to plant standard varieties or graft

or bud on black walnut stocks. Walnut trees should be planted on the home grounds where space and soil are suitable, bearing in mind that one tree will occupy a space of about sixty feet within fifteen to twenty years.

In the commercial nut growing districts of Oregon and California the walnuts are washed and dried as soon after harvesting as possible. The drying has been successfully accomplished through the regular prune drier, with forced circulation of air, employing low temperatures of about 100 degrees F. The washing removes dust and foreign materials from the shell and quick drying prevents the growth of moulds. Folowing this treatment it is customary to bleach all walnuts intended for the regular commercial trade. The cleaned nuts are dipped for a few minutes into a bleaching solution, then washed and dried again slowly. At the Summerland Station, where careful harvesting has been possible it has seldom been necessary to wash the nuts or force dry them. As the outer husk begins to split open, allowing the nuts to fall, they may be shaken from the trees and picked up at once. If the clean nuts, with all husks removed, are then spread in shallow boxes or trays, in a dry place, they will become ripened and ready for use within a month or so. For experimental purposes, half of the 1929 crop was washed, bleached and dried in the dehydrator. It was found that the nuts so treated were not in any way improved over those left to dry in boxes. No moulds were found in either lot. In a climate of greater humidity mould growth may necessitate the washing and quick drying process.

PEACH BREEDING EXPERIMENT

(Project H. 619)

Many varieties of peaches of recognized commercial value in various peach growing districts have not proved satisfactory in the Okanagan Valley. Varieties that satisfy the market requirements must also be productive and hardy. There is a demand for superior quality in all fruits and the object of this experiment is to find that combination of desirable qualities in new varieties of peaches, that will prove profitable to grow in British Columbia.

One of the most urgent needs is for a canning peach of distinctive merit. The commercial cannery calls for a peach of good yellow-coloured flesh, firm enough to retain its shape after canning, without frayed edges to the cut pieces. The nearest to these requirements is found in the Tuscan Cling, but at Summerland it is not a reliable producer of profitable crops. The cannery usually calls for cling-stone varieties chiefly because in these is found the firm flesh sometimes designated as "rubber flesh". Most of the varieties of cling-stone peaches have been under trial at this Station but none has proved satisfactory. They have all been shy bearers and ripen fruit too late for the best quality.

In the peach breeding work an attempt is being made to combine the cling-stone qualities with those of earliness and productiveness. The following reciprocal crosses were made in 1929, with these objects in view:—

Tuscan Cling x Early Elberta.
Tuscan Cling x J. H. Hale.
Tuscan Cling x Vedette.

The small number of fruits secured was rather disappointing but the seeds have been planted to augment the present number of seedlings under observation.

It has been found that a higher percentage of promising new varieties have resulted from open pollinated Elberta blooms; this variety having many desirable qualities of commercial value. It may be reasonable to expect similar results from open pollinated bloom of other varieties possessing desirable characteristics. Seeds have therefore been collected from a white-flesh cling-stone peach of the firm-flesh type, which is very early and in many ways suitable except for the white flesh. This tree produces an abundance of large showy.

blooms thought to be self-sterile and appears to be hardy and productive. It is situated close by a number of standard yellow-fleshed varieties including Elberta. Seeds from this tree have been planted and promising seedling material may be looked for.

A peach block of seedling trees was set out this year with nursery trees previously produced from the following crosses:—

Rochester x Selfed.
Rochester x Tuscan Cling.
Rochester x Phillips Cling.

As soon as these young trees commence to bear they will be discarded or retained as their merits seem to dictate.

PEACH PRUNING EXPERIMENT

(Project H. 534)

The practice of "long pruning" was strongly recommended to fruit growers a few years ago. The advocates of this new system claimed particular advantages with stone fruits. It was supposed to bring young trees into bearing much earlier and to develop a greater fruiting surface, distributed over the framework of the tree. Thus the yield of fruit would be increased and the cost of pruning reduced.

As opposed to the old method of pruning, commonly in vogue, "long pruning" appeared very simple. It required just a thinning out of branches, to establish and maintain a strong tree and to allow the sunlight to reach the inner, main limbs. Varieties, soil and cultural condition, or the age of the trees, were not especially considered. Results have indicated decided advantages in this system of pruning but also point to possible necessity for modifications to suit the requirements of the variety and conditions of growth.

To test the effect of "long pruning" on bearing peach trees, an experiment was commenced in 1925 with a block of Early Crawford trees which had already produced five crops of peaches. The trees were divided into three groups each to receive a system of pruning as follows: (1) "Short pruned" every year; to receive heavy heading back of all new growth. (2) "Short pruned" every other year and "long pruned" in the alternate year. (3) "Long pruned" each year; to receive a thorough treatment of thinning out and no cutting back.

After four years the trees exhibit distinct effects of the various treatments of the pruning. The "short pruned" trees have produced dense growth of new wood at the outer circumference of the tree to the exclusion of fruit wood on the lower main branches and inside limbs. The alternate yearly treatment has produced a somewhat more fruitful tree but still lacking in an equitable distribution of fruiting wood. Trees that have received an annual thinning out of branches as required and a cutting back only into older wood, have produced new wood throughout the centre of the tree and an apparent strengthening of fruit buds on the lower inner branches.

A record of the yields of peaches for the four-year period of this experiment is decidedly in favour of the "long pruned"' trees.

TABLE 12.—INFLUENCE OF PRUNING ON YIELD OF PEACHES

Method of pruning	Average yield per tree for four years' period
	lb.
Long	411·7
Alternate, long and short	246·0
Short	114·0

With peach trees it may become necessary, sooner or later to restrict the height of the tree and to force the development of bearing wood on the lower branches. A continued "long pruning" practice without cutting back may produce too extensive a growth, but the system calls for a cutting back into old wood as occasion seems to indicate. At the same time, the heavier crops produced on the "long-pruned" trees tend to hold the extensive wood growth in check and thus tend to keep the tree in balance. However, it has been observed that in time it may become necessary to give more severe cutting in order to force the growth of new fruiting wood.

PRUNING YOUNG PEACH TREES.—The peach pruning experiment with young trees, as outlined in the 1928 report is still in progress. The three varieties: Elberta, J. H. Hale, and Tuscan Cling, have produced another crop and a further report on their growth and yield may now be considered. The general cultural conditions have been continued and the trees have all made satisfactory, thrifty growth. The short pruned trees produced a dense mass of new shoots, so shading the fruit that it was a week later in ripening and poorly coloured. Trunk diameter measurements do not indicate the increased growth that might be expected in the "long-pruned" trees, but allowance should be made for the heavier crops produced on these trees during both 1928 and 1929. This would naturally check tree growth but it should also be observed that the trees are well grown for their age. A larger bearing surface has been developed on the trees receiving the less severe pruning and the trunk diameter measurements indicate the tendency toward this system producing bigger trees.

The following table gives data for comparison of the three varieties and the three different systems of pruning. The figures represent the average trunk diameter at the close of the fifth growing season.

TABLE 13.—INFLUENCE OF PRUNING ON TRUNK DIAMETER OF PEACHES

Method of pruning	Average trunk diameter		
	Elberta	J. H. Hale	Tuscan Cling
	in.	in.	in.
Long	6·3	5·2	5·27
Intermediate	5·7	5·55	5·65
Short	6·0	4·9	5·25

In 1929 many of the trees carried a heavier crop than usual. The fruit was thinned moderately and was of large size, mostly well coloured. On the "short-pruned" trees particularly of the J. H. Hale variety the crop was light, the fruit was very large, but later in ripening and with very little colour. The average yield in pounds per tree as set forth in table No. 14 indicates an advantage for "long-pruned" trees, but it should be remembered that some modifications may be very desirable with certain varieties or under certain cultural conditions. The J. H. Hale variety has produced a larger average crop under the intermediate system of pruning. This variety is, under general conditions, a comparatively small growing tree, and it is quite possible that a certain amount of severe cutting will force an increased growth of fruiting wood and a little greater bearing surface.

TABLE 14.—INFLUENCE OF PRUNING ON YIELD OF PEACHES

Method of pruning	Average yield per tree		
	Elberta	J. H. Hale	Tuscan Cling
	lb.	lb.	lb.
Long	86·5	43·0	10·2
Intermediate	52·1	61·0	6·9
Short	20·2	15·5	2·0

Some growers have found it advantageous to "head back" the higher limbs in the centre of "long-pruned" peach trees, cutting to two-year wood, after four or five heavy crops have been produced. This should be followed by light pruning and thinning out as required, and as practised in the "long" system.

APRICOT PRUNING EXPERIMENT

(Project H. 533)

The pruning of the apricot tree has presented a somewhat different problem from that with other tree fruits. Under irrigation in the Dry Belt of B.C. with favourable soil and culture, young apricot trees make tremendous annual growth. The practice of "long-pruning" as suggested by a thinning out of branches and not cutting back or shortening was first amply demonstrated with apricot orchards in California. Results of experimental work showed that trees which had been pruned lightly, with a thinning out of branches only, showed greater growth before coming into bearing, started to produce earlier, and due to the greater size and increased bearing surface, produced satisfactory crops before the "short-pruned" trees had begun to bear. Experiments conducted in England, Germany, West Virginia and Oregon, with regard to the influence of light pruning on tree growth, gave similar results, under widely varying conditions. The lightest possible cutting, compatible with a well formed, strongly branched tree, produced plants of greater size and sturdiness.

This pruning experiment with three varieties of apricots, namely, Wenatchee Moorpark, Blenheim and Tilton, has been described in detail with regard to procedure in the Station report of 1928. Careful records have been made from which the following information is compiled. The major consideration has been the response of these varieties to different pruning treatments as evidenced by first; the total growth and sturdiness of the tree up to bearing age, and second; the amount of crop produced by the end of the fifth growing period. While two extreme methods of pruning have been used an intermediate system was also adopted for information as to the possible advisability of modifying the two extremes.

All the trees in the experiment have made strong growth. From measurements of the annual twig growth it would appear that the "short-pruned" trees have increased in size more rapidly than the others. However, it has been well established that a simple measurement of the trunk circumference of the tree is a more reliable indication of its total development. Measurements were therefore made of trunk diameter at six inches from the ground. These measurements indicate that larger trees have actually resulted from the less severe pruning. Figures in the following table represent the average trunk diameter of each variety under each system of pruning at the close of the fifth growing season.

TABLE 15.—INFLUENCE OF PRUNING ON TRUNK DIAMETER OF APRICOTS

Method of pruning	Average trunk diameter		
	Moorpark	Blenheim	Tilton
	in.	in.	in.
Long	5·48	5·78	5·55
Intermediate	4·80	5·40	5·38
Short	5·30	5·48	5·48

It will be noted that greater size of tree has been produced by "long pruning," and a variation from the rule appears with the other two systems. This variation may be expected from the time trees begin to bear, from the fact that a heavy crop of fruit tends to reduce vegetative growth. Bearing this in mind, and from general observations, in the orchard, the measurements obtained seem to be a reliable guide. Probably the greatest claims made for the "long" system of pruning is that trees bear earlier and, because of increased size, produce more fruit in the first few years. Thus the orchard is said to bring in an earlier return and at the same time the work of pruning is reduced. It has been found that "long pruning" has involved less labour than the "short" system, and has given a greater yield of fruit. The total amount of fruit produced up to and including the fifth season's crop, is represented by figures in the following table. The average total yield per tree of each variety under each system of pruning is set forth.

TABLE 16.—INFLUENCE OF PRUNING ON YIELD OF APRICOTS

Method of pruning	Average total yield per tree		
	Moorpark	Blenheim	Tilton
	lb.	lb.	lb.
Long	65·8	30·1	45·9
Intermediate	61·0	24·3	33·9
Short	61·5	10·4	28·6

The yields of fruit as set forth in the above table would suggest that "long pruning" is to be recommended for young apricot trees, but conditions within the orchard indicate the advisability of a modified system, especially with some varieties. The Moorpark and Blenheim trees have produced excessively long, limber branches, by "long pruning." The intermediate pruning has developed a more compact type, more representative of a satisfactory commercial tree. The habit of growth peculiar to the variety seems to call for a modification of the pruning practice. As the trees bear heavier crops of fruit, less thinning out is required in the "long pruned" trees, but a heading back into older wood tends to place the crop on spurs and short twigs lower down on the main and lateral branches, which, of course, is desirable.

PRUNE PRUNING EXPERIMENT

(Project H. 577)

Experimental results and observations in the behaviour of prune trees have led to the belief that trees of this fruit should receive very light pruning and practically no heading back during the growth of the young tree prior to fruit bearing. There seems to be no hard and fast rule to follow because there are many other cultural factors besides pruning, all contributing to the structure of the tree. Very seldom is it possible to have a tree grow exactly as the pruner

desires. At times it becomes necessary to "cut back" a branch of vigorous growth in order to dwarf it in comparison with the one chosen to be the leader, thereby improving the form and sturdiness of the tree and insuring a stronger union of limb and trunk.

To determine the effect of the system known as "long pruning" and a modified system of the same method, this experiment was planned, with an adequate number of trees to be "short pruned" as a check. A block of prunes was set out in 1926, containing six trees of each of the following varieties: Hungarian, Imperial, Epineuse, Petite, Burton, Double Saratoga, Sugar Prune, Mammoth French, Standard, Silver Prune, Italian and Date. Two trees of each variety have been "long pruned"; two have been "short pruned" one year and "long pruned" the next; two "short pruned" every year.

"Long pruning" has consisted in first selecting desirable main branches as well distributed as possible on the central leader, and allowing these to grow without pruning off any of the terminal growth. All laterals were thinned out by removing those not wanted. Heading was done only where necessary to cut back to a lateral to dwarf the branch growth and avoid a bad crotch.

The "short-pruned" trees received what might be called "heavy heading" and thinning out. Long terminal shoots were headed back about one-half. Long vegetative shoots were removed entirely and laterals were thinned out to prevent crowding.

Fruit production has not been sufficient to show comparative yields but tree growth and form have been recorded. Measurement of the diameter of the trunk has been used as a reliable method to indicate total growth. These measurements have, therefore, been taken at the end of the fourth growing season and the results are briefly summarized in the table giving the average of 20 trees under each system.

TABLE 17.—INFLUENCE OF PRUNING ON TREE GROWTH

System of pruning	Average trunk diameter
	in.
Long pruned every year	3·46
Alternate, long and short pruned	3·31
Short pruned every year	3·05

From these results it may be concluded that a system of "long pruning" should develop trees of greater size in the first five or six years. However, it has not been demonstrated that this system can profitably be continued indefinitely after production commences. Observations indicate that there may be no advantage in "short pruning" the trees in alternate years, but it is highly probable that after heavy production some trees will require a severe heading back accompanied with a thinning out of spur wood, and improved soil fertility to ensure crops of well sized fruit.

Alternate "long" and "short" pruning of trees in this experiment has been included to shed light on the effect of sudden changes of method with respect to the formation of new wood growth. New wood is looked upon as fruit-bearing wood and fruit spurs.

APRICOT MATURITY AND SHIPPING TEST

(Project H. 621)

Apricots in British Columbia were produced this year to the amount of approximately 90,000 twenty-pound crates. Apricots seem to be receiving greater attention than formerly. Shipments reported amounted to 68,854 packages, while the canneries used as many as 18,200 packages. Growers and

shippers have been continually reminded that apricots must be sufficiently ripe, well graded for size and stage of maturity and a No. 1 pack in order to satisfy the market's demand. Greater care is being exercised in the packing houses to ensure a better product reaching the market, but there is much confusion of opinion as to varieties and the stage of maturity when they may be best picked.

A shipping test made with four varieties in 1928 has been continued with slight modification of procedure. The same varieties were used, namely, Wenatchee Moorpark, Blenheim, Royal and Tilton. Fruit was picked from normal trees of the variety and graded for ripeness according to colour. Apricots that were fully coloured but still firm in texture were classed as "firm ripe" and those only half coloured were termed "half and half." This provided only two grades, but as the quality of apricots improves as they ripen on the tree it was important to find how far and how well these riper grades could be carried to market. Some guide as to the hardness of the fruits at time of packing was obtained by use of a pressure tester as described in the previous report. This tester recorded the number of pounds pressure required to force a $\frac{5}{16}$-inch point $\frac{5}{16}$ of an inch into the unpealed flesh. The average of a number of tests was used.

The fruit on being graded was packed in baskets and assembled—two baskets of each grade—in the standard four-basket crate. These were shipped at once by express to consignees at various distances from point of shipment. A questionnaire similar to that used in the previous year was enclosed in each package requesting information regarding the condition of the fruit upon arrival at destination and its various qualities in use. Check lots of all grades were placed in common storage cellar where the temperature averaged about 65 degrees F. and the relative humidity ranged between 70 and 80. These lots developed full colour and good flavour, and by comparison with the fruit shipped they required about twice the length of time to become overripe.

The following information has been gleaned from reports and the questionnaire sheets returned.

Wenatchee Moorpark picked at the "half and half" stage of colour arrived in good condition at the farthest destination, requiring four days in transit. The amount of bruising was small (from five to eight being seriously bruised in the two baskets) and did not increase materially in the longer shipments. Five days after packing they were found to be "firm ripe", of good quality, medium juicy. Fruit of this variety picked "fully coloured" was soft ripe upon arrival at three to four days after shipping, thirteen to fourteen were bruised in the two baskets. The quality was good three days after picking but loss by bruising was serious. The shortest shipping distance only was satisfactory with this grade. To a destination requiring only one day they arrived firm ripe of very good quality and practically no bruising.

Blenheims picked at the "half and half" stage of maturity carried well to destination requiring three to four days with practically no bruising. They arrived almost firm ripe. At four days after arrival they were still good and had improved in quality. This variety shipped fully coloured arrived after two days in perfect condition and of very fine quality.

Royal apricots were shipped when "half and half" coloured and showing a pressure test of 12 pounds. Arriving at destination in two days, they were too green and hard for use. After being held for one week in a common storage cellar they were much improved in appearance and were in prime condition and quality.

Tilton apricots were shipped "half and half" ripe, and almost fully coloured. As this variety remains firmer after becoming completely coloured it was allowed to ripen to an eight pound pressure before picking and packing.

They were two days in transit and arrived firm, slightly green, good condition, and kept one week before ready for eating. Quality was good. The Tilton apricots retained their firmness for a longer period after being coloured than did any other variety used in this project.

The delicate nature of this fruit makes it difficult to handle so that it may reach the consumer in good condition and at its best stage of quality. The high temperatures prevailing during the apricot shipping season help to hasten the maturity of the fruit and shorten the marketing period. The reports indicate that improved quality of apricots picked fully or half coloured is appreciated but the riper fruit becomes badly bruised in transit and often partly spoiled. Two requirements for improvement seem to be suggested: Precooling and shipment under refrigeration, and an improvment in packing and handling to minimize bruising.

MATURITY TEST FOR PRUNES

(Project H. 621)

British Columbia shipped 159,350 packages of prunes in 1929. A regulation was in force to the effect that prunes were not to be shipped unless hard ripe, well coloured and not less than 1⅛ inches in diameter, stones to be free from the flesh of the fruit. Shipping commenced on August 23 and reached the peak on September 10. The main variety grown is the Italian prune and in most cases it has been harvested before the true flavour and full sugar content have developed. It has generally been conceded that this immature state was necessary to allow the fruit to successfully pass through the packing houses and its regular channels of trade. Evidence goes to show that well ripened, fully flavoured prunes, seldom reached the consumers in the most important markets. The ripe Italian prune in the fresh state was not known.

To determine the most advanced stage of maturity at which prunes could be picked and shipped to different market centres and to discover their action and response to such shipments, this experiment was commenced.

On September 16, about one week after the peak of the prune shipment had passed through the packing houses, Italian prunes were picked at this Station and packed in the standard package, tree run, without sorting or grading. These were shipped to market centres on the prairies and at Vancouver. One week later prunes were again picked and shipped to the same consignees. On October 1 a third shipment was made. One week later, the prunes still on the trees were considered ready for dehydration, as at this time it was estimated that sufficient sugar had developed in the fruit to ensure a good dried product. This was about six weeks after Italian prunes were being picked for shipment as fresh fruit. During that time the fruit on the trees increased in size, improved in colour, and developed a rich, sweet flavour.

Reports from the various centres receiving the ripe prunes all agreed that the fruit arrived in excellent condition, kept well after arrival, and even improved with keeping. The unanimous opinion was that the first crate was good, the second better, and the third (shipped October 1) the best of all.

The following comments were received regarding the condition and qualities of these prunes:

"In regard to Italian prunes, would say that the last box to arrive; namely, the one received October 5, is the highest flavour of any prunes we have encountered."

"There are a few fruits somewhat bruised. However, we would sooner have a few bruised than be deprived of the sweetness of flavour that characterized the October shipment."

"The third case was distinctly the best."

"Toward the end of the week, in the heat of the office, the prunes were sweeter to taste than when they arrived at first."

"I handed them to visitors to sample, who thought them superior to what they could buy in the stores."

"The third crate of Italian prunes arrived October 4—one man expressed the opinion that prunes at that state of ripeness were a delicacy."

"Some of the prunes are in the office now." (Oct. 10)—"They are in excellent marketable state, neither shrivelled nor split."

"Everyone that has tasted the prunes in the three crates sent, expressed the opinion that they were the best they have ever tasted, and by comparison the last crate was best of all."

"Regarding the three cases of prunes, we held these in the cooler until a couple of days ago." (Dated October 17).

"The third case is much the best of all three."

"The third case was much the sweeter and most attractive."

"We do not consider it too ripe from a strictly business standpoint." etc.

This experiment deals with the shipping and marketing of the riper prunes. They have been most favourably received. One fruit dealer, greatly impressed with high quality of the prunes, thought that in spite of quality the earlier prunes would bring the most money. He stated that the market for prunes in the early season is better than the later market. It seems reasonable to assert that the consumer does not, as yet, know the quality of prunes that can only be obtained on the "later market."

The grower, in his primary interest of harvesting a good crop, should also be quick to recognize the increased tonnage and improved appearance when the prunes are picked from four to six weeks later than has been customary.

CHERRY POLLINATION EXPERIMENT

(Project H. 673)

This project, to discover, if possible, a cherry of high commercial value, to act as a pollinizer for the three sweet cherries; Bing, Lambert, and Royal Ann, has been continued as outlined in the 1928 report.

The Deacon was the most promising variety in 1928 and it has been with particular attention to this variety that the experiment has been continued. The Deacon cherry has not been widely planted and is very little known. However, a few trees have been located in three different commercial orchards in the South Okanagan. In every case the owner speaks very highly of the qualities of this particular cherry. The trees produce heavy crops and are ready to harvest just after Bing and before Lambert. The fruit resembles both of the varieties mentioned and may be marketed as Lambert. It is more sprightly in flavour than Bing and when once tried for canning is apparently the choice of all. The fruits are usually smaller than Bing, partly due to the very heavy set. The limited tests made so far on its shipping qualities indicate that it has given complete satisfaction to the Trade. With such strong recommendations, together with its promise of a pollinizer for Bing, Lambert and Royal Ann, the Deacon is worthy of further investigation, with the possibility that it will replace the less desirable Black Tartarian and Black Republican.

While a number of varieties may have been apparently satisfactory in supplying pollen for the chief commercial sweet cherries, it has not been definitely determined whether certain trees were more efficient in this respect than others. Observations have pointed to the fact that within a variety there exists odd trees of outstanding superior qualities. It is to be expected that a sweet cherry of good commercial value and the power to fertilize our leading varieties should include trees of superior fertilizing ability. Accordingly it is

with this in view that this experiment is carried on. Individual trees of proven value may be found from which propagating material would ensure stocks known to be effective as pollinizers.

The project commenced in 1928 was continued in the spring of 1929, following essentially the same technique of procedure as outlined in the previous report. Pollen was collected from trees of Black Republican, Deacon, and Windsor, and used on two trees of each of the following varieties: Royal Ann, Bing, Lambert. In each case a number of emasculated blossoms were left unpollinized as a check on the efficiency of the technique employed.

The work of emasculating and pollinizing the blossoms extended over five days. The weather was characterized as cold and windy and bees were not working on the bloom, except for very short intervals of calm and sunshine. The low set obtained on the Royal Ann trees may have been caused by the more advanced stage of the blossoms which necessitated discarding all of the early bloom which were open, and using the late-opening weaker blossoms. This result might also suggest the advisability of pollinizing the pistils soon after emasculation as well as on the following day.

TABLE 18.—CHERRY POLLINATION TEST 1929

Pistil variety	Pollen variety	Number of blossoms pollinated	Number of fruits set	Percentage set
Royal Ann, Tree No. 1	Republican	401	22	5·5
" "	Deacon	552	33	6·0
" "	Check	161	0	0
Royal Ann, Tree No. 2	Republican	531	42	8·0
" "	Deacon	630	11	1·7
" "	Deacon	358	12	3·3
Bing, Tree No. 1	Republican	122	94	77·0
"	Deacon	316	181	57·2
"	Check	133	0	0
Bing, Tree No. 2	Republican	156	47	30·0
"	Deacon	314	21	6·6
"	Check	376	1	0·2
"	Check	76	0	0
Lambert, Tree No 1	Deacon	547	227	41·5
"	Windsor	180	38	38·0
"	Deacon	180	91	50·5
"	Check	76	1	1·3
Lambert, Tree No. 2	Republican	504	371	73·6
"	Deacon	177	157	88·7
"	Check	379	3	0·7

The results show that Deacon pollen is effective on Bing, Lambert and Royal Ann. The variation in results may have been due to some of the pollinizing having been done at unfavourable periods.

FERTILIZERS FOR STONE FRUIT ORCHARDS

(Project H. 579)

Production and soil fertility are closely related in all orchards. To develop and maintain a high rate of production requires careful cultural practices, but the basic requisite is a fertile soil. Orchards have been planted over a wide range of soil types and the problem of economically promoting increased production has often become evident soon after the trees begin to bear fruit.

An experiment was established in 1925, to ascertain the most economical method of maintaining soil fertility in a stone fruit orchard. A three-acre orchard of apricots and peaches was set out on land of a sandy-loam nature sloping gently toward the north. The soil has a depth of one to three feet over a gravelly sub-soil. The orchard has been divided into one-acre blocks, each receiving a distinct fertilizer and cultural soil treatment. The first block has

received an annual application of 600 pounds of complete fertilizer, consisting of 150 pounds nitrate of soda, 150 pounds sulphate of potash, and 300 pounds superphosphate of lime, with clean cultivation. The second block has received an annual application of 10 tons of barnyard manure, followed by clean cultivation. The third block was seeded to hairy vetch which was allowed to grow as a cover crop and was disked in once a year.

The trees have completed the fifth growing season and two crops of fruit have been recorded. The following table sets forth the average yield of peaches in pounds per tree for the two years, under each system of culture.

TABLE 19.—INFLUENCE OF CULTURAL PRACTICE ON YIELD OF PEACHES

Cultural practice	Average yield per tree for two years, 1928–1929		
	Tuscan	J. H. Hale	Elberta
	lb.	lb.	lb.
A. Clean cultivation and addition of commercial fertilizer	1·2	34·0	37·3
B. Application of 10 tons of barnyard manure per acre	18·5	97·1	161·0
C. Vetch cover crop	4·5	59·2	77·7

Apricots have also been recorded in a similar manner and the average production per tree of each variety in the two years is given in the table following.

TABLE 20.—INFLUENCE OF CULTURAL PRACTICE ON YIELD OF APRICOTS

Cultural practice	Average yield per tree for two years, 1928–1929		
	Moorpark	Blenheim	Tilton
	lb.	lb.	lb.
A. Clean cultivation and addition of commercial fertilizer	45·0	12·6	24·2
B. Application of 10 tons of barnyard manure per acre	60·4	29·5	48·0
C. Vetch cover crop	26·0	10·0	13·8

Observations of tree growth in each block, indicate larger trees among those which have received barnyard manure. In order to ascertain the influence of cultural practice on the total amount of tree growth a record was made of trunk diameter of each tree, six inches from the gound level, at the close of the fifth growing season. The results of these measurements are considered a fairly reliable indication of total vegetative growth and are compared in the table below.

TABLE 21.— INFLUENCE OF CULTURAL PRACTICE ON GROWTH OF TREE

Cultural practice	Average trunk diameter					
	Tuscan	J. H. Hale	Elberta	Moorpark	Blenheim	Tilton
	in.	in.	in.	in.	in.	in.
A. Clean cultivation and fertilizer	4·53	4·33	5·03	4·43	4·91	4·84
B. Barnyard manure	4·98	4·95	5·87	4·97	5·73	5·47
C. Vetch cover crop	4·88	4·62	5·45	4·35	4·89	4·72

It may be observed that peach trees have produced greater size and greater production of fruit on the vetch cover crop, block C, compared with clean cultivation and fertilizers, block A, while on the other hand, apricots show greater size and production with clean cultivation and fertilizers in block A. Prior to planting this orchard, the land was in alfalfa for three years. It would appear that sufficient humus remained in the soil to promote a thrifty growth of the young trees; and that apricots making more vigorous growth received the benefit of the organic matter and commercial fertilizer while the young trees in vetch received no benefit from same until several crops of vetch had decayed. Observations of soil and trees after five years' treatment show the following results:

Block A. (Fertilizers and clean cultivation).—The soil is entirely depleted of humus and has a gritty harsh texture. The trees do not appear thrifty and begin to lack vigour. Winter injury has been noticed.

Block B. (Manure and clean culivation).—A liberal supply of humus is evident and the soil texture is friable and retentive of moisture. The trees appear very thrifty.

Block C. Vetch cover crop.—Five crops of vetch have been worked into the soil and its texture and humus content is well maintained. The trees have a healthy vigorous appearance.

The following table shows the total yield of fruit from each acre block up to five years after planting. This does not indicate possible returns from the same acreage, since six varieties have been used and three types of pruning practised. The results are for comparison of soil treatment, and include fruit produced in three different picking seasons.

Table 22.—Total Yield of all Fruit from Planting to End of Fifth Growing Season

Blocks (one acre each)	Apricots	Peaches	Total crop
	lb.	lb.	lb.
Block A (fertilizer)	1,422	1,167	2,589
Block B (manure)	2,329	5,090	7,419
Block C (vetch)	759	2,356	3,115

Results in growth and vigour of trees, and in crop returns are very much in favour of the use of farm yard manure. The availability and cost of manure, must, however, be considered. It is altogether likely that a combination of all three treatments would be more economical and produce satisfactory results. A vetch cover crop appears the most economical, but it seems advantageous to include at least some manure when possible, and an occasional application of commercial fertilizer. In this experiment the fertilizer block evidently suffered from lack of humus and cover.

VEGETABLE GARDENING*

As may be seen by a reference to The Season—Meteorological Records at this Station for 1929 given in the opening pages of this report the winter was cold and spring was late. Open seeding of vegetables was delayed and crops started in the greenhouse were not set out as early as usual. Cool season crops such as radish and lettuce made good growth. Heat loving crops such as tomatoes, peppers and eggplants made very slow growth until the second week in July. In August the mean temperature was the highest for this month ever

* The work in this Division is under the charge of Mr. W. M. Fleming, M.S.A., assistant to the superintendent, who has been entirely responsible, under the superintendent, for this work, and has prepared this section of the report.

recorded at this Station. The precipitation for the year was the lowest on record and the supply of irrigation water was curtailed. As a result of scanty foliage and shortage of water, crop yields were reduced and sunscald or similar troubles were prevalent. Harvesting conditions, particularly for seeds, were ideal throughout the autumn season.

Table 23 shows the average daily maximum and minimum temperatures throughout the months of April, May and June for 14 years as recorded at this Station for the same months of 1929. It may be noted that April and the first week in May were colder than the average. The balance of May was warmer than the average. In June the days were colder as shown by lower maximum temperatures but the nights were warmer as shown by higher minimum temperatures.

An examination of average maximum temperatures as given in table 23 shows that a period of warm days may be expected regularly in the latter part of April but average minimum temperatures show that a period of cold nights follows in the first part of May. A sharp rise in temperatures usually occurs in the second week in May. Cantaloupes, tomatoes, and eggplants should be ready to set out when this warm weather in May arrives.

SOIL TEMPERATURES IN RELATION TO TIME OF PLANTING CANTALOUPES

(Project H. 638)

This experiment was repeated along the same lines as in the two preceding years. Results further confirm previous findings. Cantaloupes are heat-loving plants and give best results when they are able to make rapid continuous growth after starting. Strong, sturdy plants set out May 11 and May 18 gave practically as much early fruit as plants set out April 27.

No frost was experienced after the test was started this season but six plants not properly hardened off set out May 4 without protection were so chilled the same night by a minimum temperature of 35 degrees that none survived. Plants set out without protection April 27 came through safely but made slow growth. Plants set out April 27 and protected with Glassine gave the earliest melons in the test. The soil temperature reached 50 degrees at a depth of 24 inches on April 26 and never dropped below that point later.

It would appear from three years' tests that cantaloupes may safely be set out as soon as the soil temperature reaches 50 degrees at 24 inches. Each year, however, occasional low air temperatures have retarded the growth of unprotected plants even if no frost is recorded and some type of protection is necessary. Glassine and Hotkaps have proved satisfactory for this purpose. Glassine gave distinctly better results than Hotkaps in 1929, while in previous years the returns were about equal.

Transplanted plants again produced an earlier crop than open seeded plants. Well rooted plants held back until soil and air temperatures are ideal will give as early and economical crops as plants set out earlier and requiring protection.

SOIL TEMPERATURE STUDIES

Soil temperatures at depths of six, twenty-four and thirty-six inches have been recorded from April 20 to September 15 in each of the years 1927, 1928 and 1929 and also at depths of twelve and eighteen inches for the years 1928 and 1929. In 1927, temperatures were recorded three times daily at 9 a.m., 1 p.m. and 5 p.m. A daily range as great as 16 degrees was noted at 6 inches between 9 a.m. and 5 p.m. At 24 inches and 36 inches the daily range is seldom more than one degree. At 18 inches the temperature also fluctuates very little so that soil temperature studies at 18, 24 or 36 inches may be used as a basis for determining optimum planting dates with various crops.

TABLE 23.—MAXIMUM AND MINIMUM TEMPERATURES AT SUMMERLAND, B.C.

Fourteen years' average daily Maximum temperature at Summerland

Months	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
April.....	52	51	51	52	53	55	54	56	59	59	58	57	57	56	57	59	57	56	55	58	58	58	61	61	63	68	64	62	63	61	....
May.....	63	63	61	62	65	65	66	67	67	67	67	70	72	72	69	69	68	70	70	70	71	70	69	68	66	68	69	69	67	68	70
June.....	70	70	74	75	75	72	74	72	72	70	71	75	73	74	74	77	75	74	76	76	79	76	76	78	80	81	78	79	79	80	....

1929 daily Maximum temperatures at Summerland, B.C.

April, 1929.....	52	59	50	47	43	48	42	46	50	49	49	51	53	54	57	57	55	58	59	60	61	67	67	68	70	78	68	68	50	60	....
May, 1929.....	63	62	62	61	61	61	63	65	69	72	76	79	74	67	70	64	68	76	82	84	83	87	82	72	64	64	67	75	74	71	70
June, 1929.....	59	61	68	77	82	81	81	72	70	78	73	80	69	70	68	64	65	63	69	68	75	75	80	84	81	76	76	79	81	81	....

Fourteen years' average daily Minimum temperature at Summerland

April.....	32	33	33	35	35	32	34	33	37	38	38	36	36	36	36	37	39	36	36	37	38	39	37	38	39	41	43	40	41	39	.....
May.....	40	41	41	41	41	41	43	42	43	43	44	45	46	45	47	48	47	48	48	47	49	47	47	45	46	44	47	45	46	45	46
June.....	49	49	47	50	51	52	51	53	51	50	50	49	52	51	51	52	53	51	53	51	56	55	53	55	55	57	56	55	54	56	....

1929 daily Minimum temperatures at Summerland, B.C.

April, 1929.....	26	33	35	25	28	22	34	29	32	28	35	28	37	39	33	38	35	30	36	45	38	37	41	35	38	47	46	44	42	35	....
May, 1929.....	38	49	42	35	42	37	40	42	44	44	47	49	53	44	39	50	38	44	47	58	53	56	54	49	49	43	46	46	47	48	50
June, 1929.....	50	50	50	52	53	58	58	57	57	57	54	50	57	55	53	50	48	45	50	45	51	52	49	54	58	53	52	58	50	57	....

Table 24 shows the minimum and maximum temperature recorded at each depth and the date on which it occurred.

TABLE 24.—MINIMUM AND MAXIMUM SOIL TEMPERATURES AT VARIOUS DEPTHS

—	Year	Depth in inches				
		Six	Twelve	Eighteen	Twenty-four	Thirty-six
Minimum	1927	40·00			47·75	47·00
Date		April 21			May 3	May 3
Minimum	1928	44·00			45·00	44·25
Date		May 1			April 20	April 20
Minimum	1929	50·00	50·00	48·00	46·50	44·00
Date		April 22	April 22	April 22	April 22	April 22
Maximum	1927	76·00			74·00	70·00
Date		July 25			July 26	July 27
Maxmum	1928	84·00	77·00	76·00	74·00	70·50
Date		July 24	July 25	July 28	July 27	July 27
Maximum	1929	76·50	76·50	74·50	72·50	69·50
Date		July 31	Aug. 1	Aug. 1	Aug. 2	Aug. 9

Table 25 shows comparative temperatures at twenty-four inches at regular intervals for three seasons.

TABLE 25.—WEEKLY SOIL TEMPERATURES AT TWENTY-FOUR INCHES

Date	1927	1928	1929	Date	1927	1928	1929
April 22		46·00	46·50	July 3	66·00	64·50	66·50
April 29	49·00	50·00	52·50	July 8	66·00	65·00	66·00
May 1	48·50	49·50	52·00	July 15	67·25	69·75	69·50
May 8	51·50	54·00	53·50	July 22	72·00	70·00	69·50
May 15	55·00	58·00	57·00	July 29	73·00	74·00	70·00
May 22	53·75	64·25	60·50	Aug. 1	72·50	73·00	72·00
May 29	55·50	63·50	59·25	Aug. 8	71·50	71·00	72·00
June 1	58·50	60·00	59·00	Aug. 15	68·25	68·00	71·50
June 8	64·00	59·50	62·00	Aug. 22	67·00	68·00	68·50
June 15	63·25	61·50	62·50	Aug. 29	65·50	66·75	66·25
June 22	67·50	64·50	61·00	Sept. 1	63·25	67·00	66·50
June 29	66·00	66·25	64·50	Sept. 8	58·50	66·00	64·00
				Sept. 15	58·25	63·00	64·00

The soil temperature in April 1929 was warmer than in the two previous years. In May it was warmer than 1927 but cooler than 1928. June and July were both colder than the same months of 1927 and 1928. August 1929 was warmer than in 1927 or 1928. September was about equal to 1928 and warmer than 1927.

CANTALOUPE FERTILIZER EXPERIMENT

(Project C. 157)

Hales Best cantaloupes were seeded in hotbeds May 1 and transplanted to the field June 7. Each plot consisted of five plants and the test was made in duplicate. The fertilizers were applied by hand just before the plants were set out. The following table shows results obtained for 1929. This was the second year in succession the cantaloupes were grown on the same plots with the same fertilizers. Barnyard manure was applied at the rate of 10 tons per acre to half the plots in both years and ploughed under. The complete fertilizer used consisted of sulphate of ammonia 56 pounds, nitrate of soda 75 pounds, superphosphate 500 pounds, and muriate of potash 150 pounds per acre.

TABLE 26.—TEST OF FERTILIZERS WITH CANTALOUPES

Fertilizer used	Rate of application per acre	Average weight of each melon	Increase over checks per melon
	lb.	lb.	lb.
Checks no fertilizer and no manure	.....	1·45	
No fertilizer but manure	.....	1·74	0·29
Sulphate of ammonia without manure	112½	1·74	0·29
Sulphate of ammonia with manure	112½	2·20	0·75
Nitrate of soda without manure	150	1·68	0·23
Nitrate of soda with manure	150	1·88	0·43
Superphosphate of lime without manure	500	2·21	0·76
Superphosphate of lime with manure	500	1·86	0·41
Muriate of potash without manure	150	1·66	0·21
Muriate of potash with manure	150	1·87	0·42
Complete fertilizer without manure	781	1 76	0·31
Complete fertilizer with manure	781	2·10	0·65

VENEER BANDS VS. FLATS FOR STARTING CANTALOUPES

This experiment was planned to test the merits of veneer bands of different sizes for starting cantaloupes as compared with the use of greenhouse flats. The veneer bands resembled berry hallocks without bottoms. Three sizes were used: a standard, 3 by 3 inches, a deep pint $4\frac{3}{8}$ by $4\frac{3}{8}$ by 2 inches, and a shallow pint $5\frac{1}{4}$ by $5\frac{1}{4}$ by $1\frac{5}{8}$ inches. Three seeds were planted in each band in a hotbed on April 8 and later thinned to one plant per band. On the same date seeds were started in flats and spaced 2 by 2 inches 3 by 3 inches, and 4 by 4 inches.

A good deal of difficulty was experienced from ammonia fumes from the highly nitrogenous manure used for the hotbed. A second planting of both bands and flats was made May 1. Both lots were set out in duplicate in the field May 31 in rows 15 feet long, 6 plants per row. The following table shows the yields obtained.

TABLE 27.—TEST OF VENEER BANDS VS. FLATS FOR STARTING CANTALOUPES

Container	Spacing	Date started	Number of fruits	Total weight of fruits in pounds	Total	Average weight	Grand total	Grand average weight
						lb.		lb.
Band	3″ x 3″ x 3″	April 8	99	184·75	.....	.....	.....	.....
Band	3″ x 3″ x 3″	May 1	54	137·75	153	2·11	.....	.....
Band	$4\frac{3}{8}$″ x $4\frac{3}{8}$″ x 2″	April 8	84	171·50	.....	.....	.....	.....
Band	$4\frac{3}{8}$″ x $4\frac{3}{8}$″ x 2″	May 1	87	176·75	171	2·04	.....	.....
Band	$5\frac{1}{4}$″ x $5\frac{1}{4}$″ x $1\frac{5}{8}$″	April 8	88	176·00	.....	.....	.....	.....
Band	$5\frac{1}{4}$″ x $5\frac{1}{4}$″ x $1\frac{5}{8}$″	May 1	61	123·50	149	2·01	473	2·05
Flat	2″ x 2″	April 8	67	132·50	.....	.....	.....	.....
Flat	2″ x 2″	May 1	73	150·50	140	2·02	.....	.....
Flat	3″ x 3″	April 8	94	173·25	.....	.....	.....	.....
Flat	3″ x 3″	May 1	102	182·50	196	1·82	.....	.....
Flat	4″ x 4″	April 8	53	108·00	.....	.....	.....	.....
Flat	4″ x 4″	May 1	70	132·25	123	1·95	459	1·92

The advantage is slightly in favour of the bands but the difference is insignificant. The smaller veneer band 3 by 3 inches takes up much less space in the greenhouse or hotbed than the two larger bands. When the grower is experienced and efficient, satisfactory and more economical crops can be started in flats. The inexperienced grower may probably find fewer losses in transplanting by the use of bands. Their cost is not great (less than one half cent per band).

PAPER MULCH EXPERIMENT

(Project H. 685)

In this experiment we are indebted to the Sidney Paper and Roofing Company for supplying the paper and to the Canadian Pacific Railway Company for their keen interest in the test as shown by transporting the paper free of charge.

To ascertain the merits of paper mulch as compared with the ordinary dust mulch resulting from clean cultivation eighteen varieties of vegetables were grown with and without paper mulch.

The seeds of beets, carrots, beans, cucumbers, cantaloupes, spinach, lettuce, onions, corn and potatoes were seeded in rows and the paper was applied as soon as the seedlings appeared above ground. Pepper, eggplant, tomatoes, celery, cabbage and cauliflower were started in the green house and planted out June 10. The rows were thirty feet long and spaced either 19 inches or 37 inches apart. Six rows of each vegetable were planted. Two had paper on both sides, two had paper on one side only of the row, and two rows had no paper on either side. The paper was fastened down with slats of wood held in place by wire staples pushed into the soil to a depth of eight to ten inches. Irrigation furrows were made before the paper was put down.

Peppers gave increased yields of 106 per cent, eggplant, 107 per cent, beets, 109 per cent, tomatoes, 25 per cent, and cabbage, 23 per cent with paper. Carrots, beans, spinach, lettuce and potatoes gave no appreciable increase. The yield of onions under paper was only one third of that in rows without paper. With cucumbers and cantaloupes the paper was blown off several times and plants were damaged by whipping of the torn paper so that results are not reliable. Corn was destroyed by pheasants and cauliflower by bushrats. Celery failed to mature in all cases through lack of moisture after irrigation ceased. Irrigation furrows left under the paper proved unsatisfactory. They harbour mice, allow wind to get under the paper and tear it loose and permit greater evaporation of water. Irrigation is difficult to carry out because the furrows silt up beneath the paper.

The mulch paper has been used successfully by applying 18 inch strips and by means of a small hand plough covering the edges with soil to hold them down. The plants are set in holes cut down the centre line of the paper. An irrigation furrow is run along each side of the paper. Eighteen inch strips of paper placed 4 feet apart at 1929 prices cost without labour charges approximately $70 per acre.

One year's results are insufficient to draw any definite conclusions from the test. The heat loving plants generally gave increased yields with paper mulch, also the paper seemed to have the effect of retaining soil moisture to a greater degree than the dust mulch. It would be necessary to get increased returns greater than the cost of the paper to make its use economical with commercial crops. Further tests are necessary before it can be recommended for general use.

TOMATO VARIETY EXPERIMENT

(Project H. 211)

For several years individual selections of tomatoes have been made and tested in triplicate against strains of seed of the same varieties sold commercially. The best of the selections each year are retained for further testing. The same practice was followed in 1929. The plants were started in the greenhouse March 21 pricked out once April 15, and set in the field May 27 in rows 15 feet long of five plants each. Fruit ripening before September 1 was used as a

basis for comparing maturity of the different strains. Very little yellows was found but to eliminate all losses from comparisons the yields are given on the basis of a single plant.

Table 28 shows the earliness and total yield of all strains tested.

Tables 29 and 30 show a summary of all strains of Earliana, Avon Early and John Baer tested at this station during four years and give the relative merits of these three varieties for maturity and total yield.

TABLE 28.—TOMATO VARIETY EXPERIMENT

(Average yield per plant in pounds—tests in triplicate)

Variety	Source of seed	Ripe in August	Total yield	Rank for earliness	Rank for total yield
		lb.	lb.		
Earliana Sd. 7474	1928 selection	12·72	20·18	1	17
Earliana Sd. 6901	1927 selection	12·36	23·86	2	3
Alacrity x Hipper Sd. 6890	1927 selection	12·08	22·36	3	7
Avon Early Sd. 7491	1928 selection	12·08	21·42	4	8
Earliana Sd. 7471	1928 selection	11·80	23·50	5	5
Earliana Sd. 7476	1928 selection	11·78	20·48	6	16
Avon Early	Ferry 1929	11·62	19·22	7	20
Avon Early Sd. 7492	1928 selection	11·60	18·17	8	28
Earliana Sd. 6895	1927 selection	11·60	24·10	9	2
Avon Early	Burrell 1928	11·29	20·71	10	14
Earliana	Ferry 1929	11·19	21·19	11	9
Earliana Sd. 7472	1928 selection	11·13	28·73	12	1
Earliana	Burpee 1929	11·11	19·11	13	21
Earliana Sd. 6898	1927 selection	10·98	20·83	14	13
Alac x Earlibell Sd. 7470	1928 selection	10·95	18·35	15	25
Earliana Sd. 7472	1928 selection	10·88	22·58	16	6
Earliana Sd. 7473	1928 selection	10·83	18·87	17	22
Earliana Sd. 6896	1927 selection	10·80	23·70	18	4
Earliana	Ferry 1928	10·67	21·17	19	10
Canadian Sd. 7480	1928 selection	10·42	17·50	20	37
Avon Early Sd. 6904	1927 selection	10·38	16·38	21	45
Avon Early	Steele Briggs 1929	10·38	17·59	21	35
Earliana Sd. 7477	1928 selection	10·37	18·17	23	28
Earliana Sd. 7475	1928 selection	10·28	20·15	24	18
Special Early 498	Morse 1929	10·25	20·50	25	15
Earliana Sd. 7479	1928 selection	10·25	18·18	25	27
Alacrity Sd. 6887	1927 selection	10·20	20·90	27	11
Earliana	Steele Briggs 1929	10·15	17·70	28	34
Special Early 498 Sd. 7481	1928 selection	9·95	17·98	29	31
Earliana Sd. 7478	1928 selection	9·90	18·30	30	26
Earliana	Steele Briggs 1928	9·75	20·85	31	12
Avon Early Sd. 7489	1928 selection	9·62	17·98	32	31
Avon Early	Haven 1929	9·54	18·36	33	24
Avon Early	Burrell 1929	9·52	16·12	34	48
Earliana	Haven 1929	9·45	18·65	36	23
Avon Early Sd. 6905	1927 selection	9·37	17·37	36	39
Earliana Sd. 6628	1925 selection	9·30	14·50	37	65
Avon Early	Vaughan 1929	9·15	17·51	38	36
Earliana Sd. 7486	1928 selection	8·85	15·48	39	57
Avon Early Sd. 7490	1928 selection	8·85	15·58	39	54
Earliana Sd. 7483	1928 selection	8·73	15·53	41	56
Earliana (Sparks)	Burrell 1929	8·55	16·15	42	47
Earliana Sd. 7484	1928 selection	8·40	14·77	43	63
John Baer Sd. 7488	1928 selection	8·15	15·55	44	55
Earliana	James 1929	8·05	17·05	45	40
John Baer Sd. 7494	1928 selection	8·03	15·43	46	58
Earlibell Sd. 7482	1928 selection	7·98	15·18	47	60
Earliana Sd. 7487	1928 selection	7·98	11·22	47	73
John Baer Sd. 7493	1928 selection	7·88	14·85	49	62
Earliana	Moore 1929	7·53	18·08	50	30
John Baer	Moore 1929	7·37	17·03	51	41
John Baer	Moore 1928	7·36	15·79	52	52
Avon Early	Haven 1928	7·33	14·43	53	66
John Baer Sd. 7497	1928 selection	7·30	15·80	54	51
John Baer	Graham 1929	7·13	16·67	55	43
John Baer	Burrell 1929	7·08	15·22	56	59
John Baer Sd. 7500	1928 selection	7·05	16·22	57	46
John Baer	Rice 1928	6·92	14·95	58	61

TABLE 28.—TOMATO VARIETY EXPERIMENT

(Average yield per plant in pounds—tests in triplicate)

Variety	Source of seed	Ripe in August	Total yield	Rank for earliness	Rank for total yield
		lb.	lb.		
John Baer Sd. 7495	1928 selection	6·87	13·13	59	71
Earliana Sd. 7485	1928 selection	6·83	14·33	60	67
Earliana Sd. 6603	1925 selection	6·73	16·53	61	44
John Baer	Bolgiano 1929	6·67	17·47	62	38
John Baer	Bolgiano 1928	6·57	16·00	63	49
John Baer Sd. 7499	1928 selection	6·55	13·62	64	70
John Baer	Dreer 1929	6·45	20·05	65	19
John Baer	Ferry 1929	6·13	13·63	66	69
John Baer	Rice 1929	5·97	17·03	67	42
John Baer	Steele Briggs 1929	5·69	17·77	68	33
John Baer	Vaughan 1929	5·50	16·00	69	49
John Baer Sd. 7496	1928 selection	5·38	14·75	70	64
John Baer	Graham 1928	5·20	13·67	71	68
John Baer Sd. 7498	1928 selection	4·97	11·73	72	72
Atlantic Prize	Palmer 1929	4·84	15·66	73	53

TABLE 29.—COMPARISON OF DIFFERENT VARIETIES OF TOMATOES FOR TOTAL YIELD

Year tested	Number of strains tested	Average of all strains per plant	Highest strain per plant	Lowest strain per plant
Earliana				
		lb.	lb.	lb.
1929	37	19·10	28·73	11·22
1928	38	36·49	42·13	29·25
1927	46	24·77	30·20	19·65
1926	45	20·87	26·93	16·53
Average		25·31	32·00	19·16
Avon Early				
1929	13	17·76	21·42	14·43
1928	12	37·60	39·67	33·95
1927	11	26·12	33·17	22·61
1926	22	20·07	23·80	17·27
Average		25·39	29·51	22·06
John Baer				
1929	22	15·56	20·05	11·73
1928	8	30·09	36·19	23·80
1927	14	22·24	30·58	19·10
1926	19	16·40	19·60	13·87
Average		21·07	26·61	17·12
Summary				
Earliana	166	25·31	32·00	19·16
Avon Early	58	25·39	29·51	22·06
John Baer	63	21·07	26·61	17·12

TABLE 30.—COMPARISON OF DIFFERENT VARIETIES OF TOMATOES FOR EARLINESS

Year tested	Number of strains tested	Average of all strains per plant	Highest strain per plant	Lowest strain per plant
		Earliana		
		lb.	lb.	lb.
1929	37	10·02	12·72	6·73
1928	38	25·91	33·59	21·77
1927	46	16·05	20·64	10·75
1926	45	12·87	17·27	5·93
Average		16·21	21·05	11·29
		Avon Early		
1929	13	10·06	12·08	7·33
1928	12	26·01	29·55	22·25
1927	11	17·53	23·08	15·10
1926	22	11·73	16·00	7·93
Average		16·33	20·18	13·15
		John Baer		
1929	22	6·65	8·15	4·97
1928	8	17·33	21·71	14·39
1927	14	12·24	14·36	10·14
1926	19	6·40	7·80	4·87
Average		10·65	13·15	8·59
		Summary		
Earliana	166	16·21	21·05	11·29
Avon Early	58	16·33	20·18	13·15
John Baer	63	10·65	13·15	8·59

TOMATO FERTILIZER EXPERIMENT

(Project H. 388)

Earliana tomatoes Summerland No. 6896 strain were planted in the greenhouse March 21 and set out in the field June 7 in rows four feet apart, the plants being five feet apart. Records were taken throughout the season on five plants in each plot. All plots were in duplicate. The test was made on the same plots as in 1928, the same fertilizers being used on identical plots. Barnyard manure was applied to half the plots at the rate of ten tons per acre just before ploughing, and fertilizers were spread by hand and disked in. The complete fertilizer used consisted of sulphate of ammonia, 56 pounds, nitrate of soda, 75 pounds, superphosphate, 500 pounds and muriate of potash, 150 pounds per acre. For purposes of comparison, both 1928 and 1929 results for total yield are shown in table 31.

The effect of the different fertilizers on earliness is shown in table 32. This records all ripe fruits picked before September 1 each year. All results are given on the basis of a single plant. Four check plots were used which received

neither commercial fertilizers nor barnyard manure. The average of these four plots was used as a basis for comparisons. Further tests are necessary before definite conclusions may be drawn.

TABLE 31.—FERTILIZER EXPERIMENT TOTAL YIELD

Fertilizer	Rate of application per acre	Total yield per plant 1928	Total yield per plant 1929	Average total yield per plant	Increase over checks 1928	Increase over checks 1929	Average increase over checks
	lb.	lb.	lb.	lb.	lb.	lb.	lb.
Checks no fertilizer, no manure	.....	27·35	13·38	20·35	.....	.....	.....
No fertilizers but manure	.....	35·37	22·96	29·14	+8·02	+9·58	+8·79
Sulphate of ammonia without manure	112½	22·80	16·00	19·40	−4·55	+2·62	−0·95
Sulphate of ammonia with manure	112½	39·90	17·37	28·63	+ 12·55	+ 3·99	+ 8·28
Nitrate of soda without manure	150	29·45	13·15	21·30	+ 2·10	− 0·23	+ 0·95
Nitrate of soda with manure	150	35·50	20·92	28·21	+ 8·15	+ 7·54	+ 7·86
Superphosphate of lime without manure	500	25·60	15·10	20·35	− 1·75	+ 1·72	0·00
Superphoaphate of lime with manure	500	25·65	25·43	25·53	−1·70	+ 12·05	+ 5·28
Muriate of potash without manure	150	34·45	12·14	23·29	+ 7·10	− 1·24	+ 2·94
Muriate of potash with manure	150	20·35	19·15	19·74	− 7·00	+ 5·77	− 0·61
Complete fertilizer without manure	781	38·78	16·42	27·60	+ 11·43	+ 3·04	+ 7·25
Complete fertilizer with manure	781	35·70	19·85	27·77	+ 8·35	+ 6·47	+ 7·42

TABLE 32.—FERTILIZER EXPERIMENT YIELD BEFORE SEPTEMBER FIRST

Fertilizer	Rate of application per acre	Yield per plant in August 1928	Yield per plant in August 1929	Average yield per plant in August	Increase over checks in 1928	Increase over checks in 1929	Average increase over checks
	lb.	lb.	lb.	lb.	lb.	lb.	lb.
Checks no fertilizer, no manure	.....	15·12	3·99	9·55	.....	.....	.....
No fertilizer but manure	.....	11·15	4·11	7·63	− 3·97	+ 0·12	− 1·92
Sulphate of ammonia without manure	112½	12·70	4·44	8·57	− 2·42	+ 0·45	− 0·98
Sulphate of ammonia with manure	112½	12·65	2·72	7·68	− 2·47	− 1·27	− 1·87
Nitrate of soda without manure	150	14·80	3·70	9·25	− 0·32	− 0·29	− 0·30
Nitrate of soda with manure	150	11·90	3·65	7·77	− 3·22	− 0·34	− 1·78
Superphosphate of lime without manure	500	16·35	4·86	10·60	+ 1·23	+ 0·87	+ 1·05
Superphosphate of lime with manure	500	12·25	3·90	8·07	− 2·87	− 0·09	− 1·48
Muriate of potash without manure	150	11·50	3·63	7·56	− 3·62	− 0·36	− 1·99
Muriate of potash with manure	150	9·85	2·95	6·40	− 5·27	− 1·04	− 3·15
Complete fertilizer without manure	781	10·88	3·10	6·99	− 4·24	− 0·89	− 2·56
Complete fertilizer with manure	781	11·35	3·00	7·17	− 3·77	− 0·99	− 2·38

TOMATO BREAKDOWN

During the season of 1928 in one part of the district a breaking down of ripe tomatoes became so prevalent that it was decided to make this breakdown the subject of a special investigation.

As soon as the trouble was reported in 1929, a comprehensive survey was made of the situation. Tomatoes showing signs of breakdown were found on all types of soil, sand, gravel or clay loam, on land well watered and land where irrigation water was scarce, where barnyard manure had been applied heavily, lightly or not at all, on new land that had never grown tomatoes, on land where no tomatoes had been grown for ten years and on land that had four successive crops of tomatoes, where commercial fertilizers had been applied heavily, lightly, and none at all, on land practically neutral and on land distinctly alkaline. It was found in Earliana, John Baer, Landreth, Bonny Best and Pink tomatoes. More breakdown occurred on light soils where the plants had made rather scanty top growth. There seemed to be a correlation between fruits showing breakdown and fruits ripening unevenly with green or yellow tops. No organism that might cause the breakdown could be discovered. The trouble appeared to be physiological in nature rather than due to the presence or absence of some soil constituent.

A possible explanation may be found in the fact that the crop throughout the valley was later than usual in being set out. It made slow growth in June and there was little foliage to protect the fruits from the hot sun in July. The breakdown appeared to be closely related to sunscald. When fruits ripen unevenly the yellow or bronze tops on the fruit are due to the failure of the red pigment lycopersicin to develop at high temperature. This is more noticeable when vine growth is small and in varieties with small much dissected leaves. It was noted that in several parts of the district tomato plants were set out and immediately irrigated. The irrigation water at that time was very cold. The plants accordingly received a check that further retarded top growth. It is suggested that in order to encourage a strong sturdy vine growth the ground be irrigated, if this be possible, a few days previous to planting and that further irrigation be withheld until the plants are firmly established.

PLANT BREEDING

Some progress has been made in the development of elite stock seed of those varieties of vegetables allotted to this Station by the Canadian Seed Growers' Association.

Each year, individual plants of Rogers Stringless Refugee, Wardwells Kidney, Round Pod Kidney, and Pencil Pod beans are selected. The following year the seed of each of these is multiplied to furnish a reserve stock of seed. The third year these selections are tested against commercial stocks of the same varieties and the best retained for further breeding.

A highly selected strain of Golden Bantam corn is being developed. From a foundation block in 1927 individual ears were selected and planted in an ear to the row test in 1928. The four best strains were planted in 1929 and individual ear selections made from these for further testing.

Further selections of Earliana, Avon Early, and John Baer tomatoes were made. It was noted that much of the roughness in the Earliana variety appears to be closely related to the number of locules or seed compartments. If all the seeds in each locule are fertilized the locules develop normally and the fruit is smooth. If any locule is not fully fertilized that locule does not develop properly and a rough tomato is the result. The greater the number of locules the greater is the liability to roughness. A variation in the number of locules in

different fruits of the same strain was noted and selections were made to ascertain whether the locule number is a hereditary character that can be used to improve the strain.

At the request of the Canadian Seed Growers' Association the Ebenezer onion will be substituted for Yellow Globe Danvers at this Station. Selections of Davis Perfect cucumbers made in 1928 were tested and the most promising strain saved for further testing. The prolonged drought provided a very severe test for the drought-resistant strains of alfalfa grown without irrigation. A very small quantity of seed was obtained from a few plants for further trials.

Further work is necessary with Hales Best cantaloupes, Harris Earliest pepper, Scarlet Turnip, White Tip, Icicle and Scarlet Globe radishes, and Sugar pumpkins before any seed will be ready for distribution.

FLORICULTURE*

ASTER VARIETY EXPERIMENT

(Project H. 263)

A preliminary report on this experiment was made in 1928. Tests have been continued along the same lines as in preceding years chiefly with the object of obtaining additional data where numbers tested previously were too small to indicate definite colour relations.

Segregations in the second and third generations again show clearly that natural cross-fertilization occurs. The proportion of crosses again proved to be approximately 10 per cent. A study was commenced to ascertain if possible what insects are responsible for the crossing. A list of insects visiting the aster blooms was prepared. It will be necessary to carry on this study for several years. These lists of insect visitors will then be compared with similar lists prepared in other parts of the country where crossing is not supposed to occur. In the meantime isolation of different varieties is the only method of preventing the natural crossing.

A further study of the inheritance of colour suggests that there are three distinct colour series in the aster: a Purple, a Red, and an Albine or White series. The red series is dominant to white but recessive to the purple. Each series contains a wide range of varying shades whose relation to each other is difficult to determine. In this purple series, violet, dark purple, medium purple, light purple, red purple, dark rose, mauve, lilac and lavender; and in the red series, dark red, light red, deep pink, shell and flesh are being studied. No true blue aster has been observed. The behaviour of whites suggests that colour is due to the presence of two or more complementary factors. The presence of the disease " aster yellows " affects the colour of the blossom. When present in a slight degree the blossom is of a paler shade than that of the healthy plant of the same strain. An unsuccessful attempt was made to change the colour of the blossom by changing the soil from slightly alkaline to a distinctly acid reaction.

A study of the colour of the stem is also of importance to seed growers. It has been observed that a light purple and a dark mauve resembled each other in colour very closely. The former has a dark stem, the mauve has very little colour in the stem. The two strains behave very differently genetically. Any plant varying to a noticeable degree from type in the amount of pigmentation of the stem should be rogued out before blooming.

* The work in this division is under the charge of Mr. Alfred Horuby, head gardener, under the Superintendent.

Although weather conditions were ideal for seed formation, the late varieties, Crego Giant and California Giant, did not mature satisfactory yields of seed. These varieties are not suitable for seed production under Southern Okanagan conditions.

ZINNIA VARIETY EXPERIMENT

(Project H. 261)

Twelve strains of zinnias were planted as a foundation breeding block. All strains proved to be badly mixed showing that natural crossing had been taking place in the fields in which these were originally grown. A wide variation in type of flower was noticed. Seed was saved from individual plants to ascertain whether this variation in type might be eliminated by careful selection. A fusarium was prevalent in this block. The losses from this disease ranged from 28 per cent in a magenta strain to 63 per cent in a crimson strain. The disease appeared in certain strains soon after planting and continued to make its appearance throughout the season suggesting that it spread in some manner from plant to plant. This organism is being studied by the Dominion Field Laboratory of Plant Pathology at Summerland.

Increasing interest is being taken in flower culture in the Okanagan district more particularly in perennials, bulbs, and rock plants. This interest has to a great extent been stimulated and developed by the numerous local Horticultural Societies. Accordingly, the work in this Division of Horticulture at this Station has been gradually and judiciously expanded to meet the increasing demand for information and advice.

BULBS

A test of spring flowering bulbs, particularly of the different varieties and types of tulips, is in progress. Darwins were used in the formal beds, but owing to lateness in blooming their use is not recommended in beds which are to be planted later to summer flowering plants. An earlier flowering tulip is much to be preferred under these circumstances. A test of Okanagan grown tulip bulbs versus imported Dutch bulbs was inaugurated and the local stock were equally as good in quality of bloom and general strength as the imported bulbs. This test will be continued.

Narcissi with the exception of the hyacinths were badly winter killed, and have again proven unsuitable for open planting under local soil and climatic conditions.

ROSES

A new trial of roses was made by planting upwards of 150 varieties of climbing roses, hybrid teas, hybrid perpetuals, and various rose species.

A portion of land triangular shape and measuring 360 feet at right angles, and flanked by a pergola to take care of the climbing roses and trials of other climbers.

At the inside base of the pergola, two long beds were prepared for the hybrid teas, a lawn was laid down in the area of the triangle, in the centre of the lawn four beds were cut out, and planted with four varieties to colour, viz: white, crimson, pink, and yellow.

Excavation was made along side of the rockery walk to the depth of two feet, and a dry wall erected; in front of this wall two beds were prepared, and planted with rose species.

The weather was very cold and dry at time of planting followed by an unusual dry summer. These conditions did not allow the roses to make the growth expected under normal conditions but as a quantity of rose stocks were bought and a number of them budded it is hoped to make good all vacancies.

The twelve outstanding varieties of roses that made good growth during the year and give promise of all round satisfaction are:

Dame Edith Helen,	Los Angeles,
Pauls Lemon Pillar,	Lord Charlemont,
Frau Karl Druschki,	Admiration,
Rev. F. Page Roberts,	Golden Ophelia,
Hoosier Beauty,	Mrs. Jas. Shearer,
Lady Willingdon,	Isobel.

Most of the rose species did remarkably well and will produce ample material for budding purposes.

All the tenderer varieties and species were prepared for winter by mounding around the plants with earth to a depth of eight or more inches. Tender climbing varieties were protected by laying on the ground and covering.

PERENNIALS

The collection of hardy perennials was augmented to some extent by the addition of a considerable number of new varieties. The main perennial border was reset and planted drift fashion, and the spaces filled with annuals. A wealth of bloom combined with a good colour scheme added much to the popularity of this border. The showing of hardy early flowering chrysanthemums in particular was outstanding. Peonies were only a qualified success in the trial beds and conditions were evidently too dry for this plant. The iris border gave a good show. Hardy fall asters gave wonderful results and a large and representative collection of these is being gathered together.

ANNUALS

These were planted in beds six feet wide and in mass formation and made a mass of colour throughout the summer. Asters, zinnias, annual statice, phlox drummondi, stocks, verbenas, petunias, and carnations, gave excellent displays. Petunias especially were a mass of bloom and are a sure standby in the way of flowering under dry belt conditions.

LANDSCAPING

Considerable improvement was made to the grounds of the Station during the year. In addition to the rose garden which was set out, new lawns were laid around some of the buildings and the paths in the main lawn were filled in and seeded down. A considerable number of new varieties of trees and shrubs were planted out for test purposes and improvement of the landscape.

HORTICULTURAL PRODUCTS*

As 1929 was the first year of operation of the horticultural products department at this Station, the report is necessarily of a progressive nature. This work on fruit products is a continuation and expansion of the work which has been done under the Dehydration Committee for a number of years. This is an expansion of the lines of work previously done at Penticton and the work is still financed and generally supervised by the Dehydration Committee of the Federal Department of Agriculture but is now immediately under the supervision of the Superintendent at Summerland. In the four major lines of activity —dehydration, sun drying, canning, and fruit juice—many worthwhile and interesting facts have been learned, but it remains for future seasons to cor-

* The work in this division is under the charge of Mr. F. E. Atkinson, B.S.A., expert in Horticultural Products, who has been entirely responsible, under the superintendent, for this work, and has prepared this section of the report.

roborate this work before these facts may be referred to with definite and binding statements. The past season was an exceptionally fine one from a climatic standpoint, thus bringing about unquestionable quality and ideal conditions for harvesting.

DEHYDRATION

Approximately 1,200,000 pounds of dried apricots and over 20,000,000 pounds of dried prunes are imported annually from the United States alone, while oftentimes our Canadian growers of these fruits have a surplus. Owing to this situation experimental work has been undertaken at this Station to determine the suitability of locally grown apricots and prunes for drying. Factors such as the quality of the dried fruit, the annual yield, and the hardiness of the tree have been considered with each variety. Variations in the fruit caused by different soils, exposures, and cultural practices have also been noted.

DEHYDRATION OF APRICOTS

SUITABILITY OF VARIETIES.—The dehydration of apricots has been carried on during the 1929 season with varying degrees of success depending upon the variety. Royal, Blenheim, and Tilton due to their qualities of ripening uniformly and the even texture of their flesh made satisfactory dehydrated apricots while Moorparks made a poor quality. This was due to the fact that Moorparks ripen very unevenly, the ripe side often mushing into a "slab" and the green side turning an undesirable olive green colour. In this connection sun drying offers advantages, as even these slightly immature fruits develop a rich reddish colour. Further work will be done on sun drying Moorparks before definite recommendations can be made.

MATURITY OF APRICOTS FOR DRYING.—Fruit for drying is left on the tree until the latest time when it can be picked, pitted and placed on the trays without mushing. It is very desirous that full colour and flavour be developed in the fruit before it is picked.

PICKING AND HANDLING APRICOTS FOR DRYING.—Owing to the ripeness desired every precaution is used in picking and handling this fruit to prevent bruising or mashing. Fruits that are bruised and mashed produce "slabs" (shapeless pieces) which are the lowest grade.

CUTTING.—The fruit as soon as received from the orchard is cut and the halves laid on trays with the pit cavity up. It is imperative to guard against careless cutters slipping the pit out of the fruit and tearing it in half. Even the best fruit handled in this manner makes only a very low-grade product.

TRAYING.—The ideal situation is to have the apricots as close together as possible without touching. Little is gained by crowding as the apricots stick together when they start to dry and pull one another into undesirable shapes. Full trays are loaded on cars and run into sulphur chambers.

SULPHUR CHAMBERS.—The sulphur houses in use at the Station are of double thickness board construction with building paper between the boards. Each chamber is just large enough to comfortably accommodate one car of trays. There are many more elaborate plans for the sulphur chambers but the aforementioned is the simplest and is sufficient for local needs at the present time. Whatever the type, it is essential that the sulphur chamber be practically air tight to prevent leaks during sulphuring.

SULPHURING.—Before sulphuring it is advisable to slightly moisten the fruit to improve its ability to absorb the sulphur fumes. A mistlike spray has given good results at this Station. Seven pounds of sulphur per green ton has

been used with satisfactory results. The sulphur should be a grade free from arsenic and dry enough to burn easily. If difficulty is encountered in causing complete combustion of the sulphur, three to four per cent of powdered sodium or potassium nitrate aded to the sulphur will overcome this difficulty. The simplest method of burning the sulphur is to place it in a shallow tin plate, supported at least an inch above the floor. The sulphur may be ignited with burning shavings or with hot coals. Apricots for dehydrating are exposed for one hour.

Operations in Dehydration of Apricots.—Upon removal from the sulphuring chambers the trays were placed in the dehydrator where the air was heated to 135° F. while a relative humidity of 15 per cent was maintained. The temperature never exceeded 150° F. at any time to avoid caramelizing the sugars. The apricots were sufficiently dried when they would not remain in a ball when squeezed in the hand. Apricots that crack when pressed have been dried too much. This dried fruit is next placed in clean wooden bins where it cures until the end of the season.

Processing.—In California where this industry is extensively developed the dried fruit is sold by the grower to a processing and packing company. Here the apricots are sorted, graded, resulphured and steamed to a definite moisture content (around 22 per cent). While the fruit is still hot it is pressed into paper lined cases.

DEHYDRATION OF ITALIAN PRUNES

Experimental work to determine the qualifications of Okanagan grown Italian prunes for dehydration have been carried on at this Station during the past season with very encouraging results.

Maturity of Prunes for Drying.—Wherever possible the prunes were allowed to drop on the ground. Odd trees began to drop during the week of September 16-23 but the main crop did not commence to drop freely until the first week of October. A good quality of dehydrated prunes can be made only from fully mature fruit. The last prunes for the Station dehydrator were gathered October 20. At this date only a few were still on the trees, and these were separated and canned.

Separation of Prunes into Quality Grades.—As a prune is coloured for six weeks before it is ripe it is impossible to separate the different maturities by hand. By allowing all the fruit to drop, the maximum maturity is obtained, but as all the fruit that drops does not contain an equal amount of sugar, the necessity arises for a method of separation that will divide the prunes into lots according to their sugar content. *This separation has been effected with solutions of calcium chloride, one of 40° (Salometer scale) and the other of 55° S. Thus three grades are obtained, those that float in the 40° tank being designated as No. 1 Floaters, (3rd quality); the sinkers which are conveyed to the 55° S. tank are separated into No. 2 Floaters (2nd quality); and No. 2 sinkers (1st quality). The dry away for prunes of the first grade varied from 4-1 to 5·5-1, the second grade averaged 3-1, while the third grade dry away ranged from 2·25 to 2·5-1. It is felt that if locally grown prunes are allowed to fully mature and the greenest separated and canned, that a dry away of 3-1 can be relied upon with a safe margin. There is a need of further investigation to determine the practicability of using other concentrations of calcium chloride from both the canning and dehydration standpoint.

*A great deal of work has been done on this method of separation by Professor E. H. Wiegand and D. E. Bullis of the Oregon Experiment Station. Details of their work is contained in Oregon Station Bulletin number 252.

Lye Dipping.—After separation into quality grades the prunes were lye dipped. The solution used for this was maintained at a temperature just below boiling. It contained just sufficient lye to slightly check the skins when the fruit was immersed for a period of 2 to 4 seconds. Too much lye caused unnecessary damage by cracking the skin and destroying the skin pigments. Dried prunes that were subjected to strong lye were dull and did not possess the dark shiny black colour of those dipped in the weak solution.

Washing.—The prunes were thoroughly washed in fresh cold water and trayed. This step is of much importance as the calcium chloride and lye adhere to the skin and if not removed an undesirable greyish film is deposited on the dry fruit. Neither calcium chloride nor lye are injurious to humans in the quantities present on the fruit but as it is easily removed it is much more desirable to do so and thus obtain the brighter colour.

Operations in Dehydration of Prunes.—The trayed fruit was then placed in the dehydrator where the temperature ranged up to 165° F. The relative humidity was maintained between 15 to 25 per cent, eighteen per cent relative humidity being the most desired percentage. The drying times vary with the type of dehydrator.

Curing and Packing.—The prunes were stored in bins where the moisture content was equalized between the individual fruits until packed. Upon removal from the bins, they were graded, processed in boiling water for 3 minutes and packed in wax-paper lined cases.

Increased Yield.—Keane of Penticton* has estimated the increased yield of prunes allowed to remain on the tree until late in September at "least 30 per cent over their weight at the time of fresh prune shipments." The fruit on a block of prune trees in the orchard of E. Foley-Bennet, Penticton, was purchased by the Dehydration Committee. The yield on this block was 30 per cent by weight higher than on a similar number of trees growing under identical conditions and from which the fruit was picked for fresh fruit shipment early in September.

DEVELOPMENT OF PRUNE AND APRICOT ORCHARDS FOR DEHYDRATION

Osoyoos Orchard.—This five-acre orchard was set out in the spring of 1928, on a ten-acre block of land loaned to the Committee by the Provincial Department of Lands for trial orchards of prunes and apricots for dehydration purposes. The block was fenced, and flumed for irrigation by the Committee. Four acres was set to apricots; three acres being planted to Tiltons and one acre to Royals, both of which are excellent drying and canning varieties. The remaining one acre was set two-fifths to Italian prunes and three-fifths to Petite prunes.

The Royal apricots did not make a good start as the stock was poor, and was replaced and replanted in the spring of 1929. The entire orchard has made fairly good growth. A cover crop of vetch has been started and one crop disked in in 1929. Development and growing costs are being recorded on this orchard.

Summerland Orchard.—A four-acre orchard of Italian prunes was set out at the Experimental Station in the spring of 1928. This orchard is adjacent to the dehydration plant and has made splendid growth. Complete development and other costs are being recorded. The Osoyoos orchard is being developed with a cover crop of vetch while the Summerland orchard is being fertilized and intercropped with ground crops such as mangels.

* F. H. and F. W. L. Keane, "Prune Experiment 1929." Penticton Co-operative Growers.

SUN DRYING

Sun drying of apricots was carried on at this Station with very gratifying results during the 1929 season. The point of interest now is whether or not sun drying would be practical every year.

Operations in Sun Drying.—The preparation of the apricots up to the sulphuring is the same for both dehydrated and sun dried. Sun dried however, are sulphured for four hours while dehydrated are sulphured only one hour.

After the four hour sulphuring period the trays were laid in rows on the ground in a locality free from dust and where the fruit was never shaded. Two to four days was required to develop sufficient colour after which the trays were stacked in the shade where the remainder of the drying took place. When the fruit was dried to a rubbery consistency it was scraped from the trays into curing bins. Here it remained until the end of the season. The processing is usually the same for sun dried apricots as for dehydrated.

Climatic Factors in Sun Drying (*a*) Precipitation.—A review of the precipitation during the apricot sun drying period of from July 25 to August 15 for the last fourteen years, 1916-1929 inclusive, is as follows:—

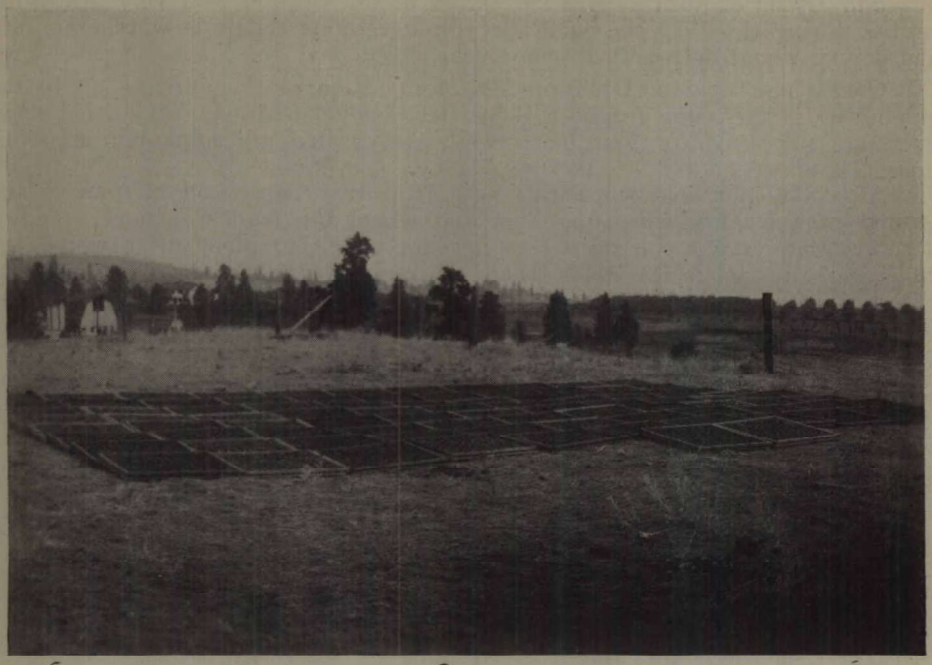
Table 33.—Precipitation during Apricot Sun Drying Period

Date	Number of rains	Year of rain	Total precipitation
			in.
July 25	2	1918, 1921	0·17
" 26	2	1918, 1921	0·33
" 27	3	1916, 1917, 1922	0·22
" 28	2	1916, 1917	0·05
" 29	1	1917	0·14
" 30	.....	.....	.....
" 31	2	1919, 1926	0·10
Aug. 1	2	1918, 1928	0·08
" 2	1	1918	0·17
" 3	2	1919, 1929	0·07
" 4	2	1919, 1927	0·10
" 5	.....	.....	.....
" 6	.....	.....	.....
" 7	2	1917, 1918	0·31
" 8	3	1916, 1918, 1923	0·58
" 9	1	1917	0·01
" 10	1	1918	0·43
" 11	3	1918, 1921, 1922	0·12
" 12	4	1919, 1922, 1924, 1927	0·75
" 13	2	1922, 1928	0·29
" 14	4	1918, 1924, 1925, 1926	0·07
" 15	3	1918, 1922, 1926	0·17
" 16	2	1922, 1924	0·10

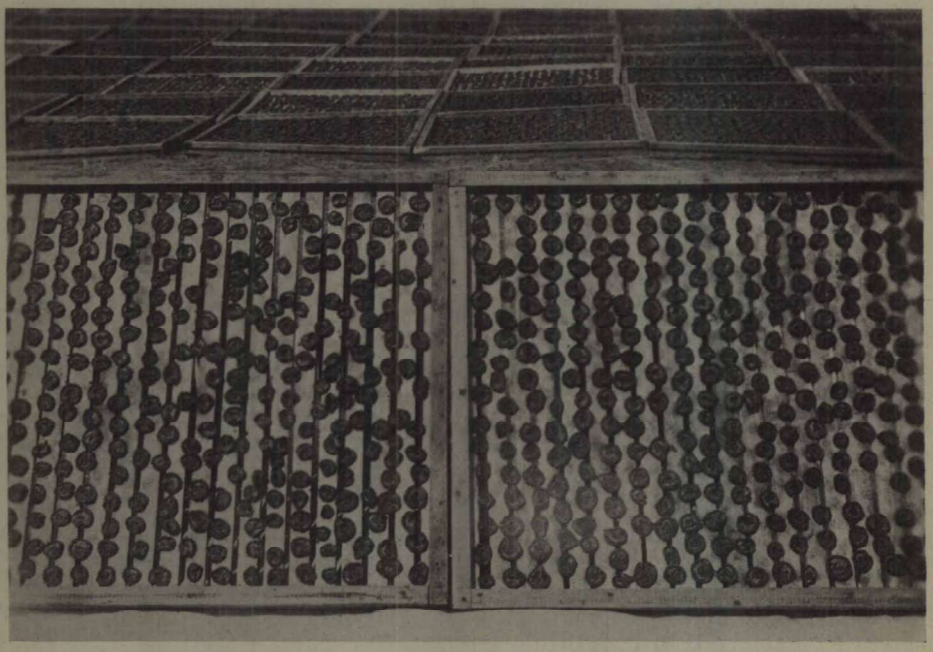
It is noticeable in the above table that the precipitation is extremely light. During light showers of this type the trays of fruit could be stacked in a shed or covered with a tarpaulin. It is taken for granted that sun drying will be on a small scale for the first few years in which case the trays could be quickly gathered in case of an impending storm. The average precipitation for this period over the fourteen years is 0·3035 inch. It will be noted that showers after August 12 appear heavier and more numerous. This is not serious, however, as the bulk of the crop can be dried before this date.

(*b*) Average Maximum Temperature.—The average maximum temperatures for this period are graphically illustrated on page 57.

It will be noticed that 1929 exceeds the records of the previous years with an average maximum of 88·1 degrees F., and that only two drop below 80 degrees F., namely 1916 and 1918. Both of these years were quite wet at this period. It will be interesting to determine how low the average maximum can drop for this period and yet maintain sun drying as a practical operation.

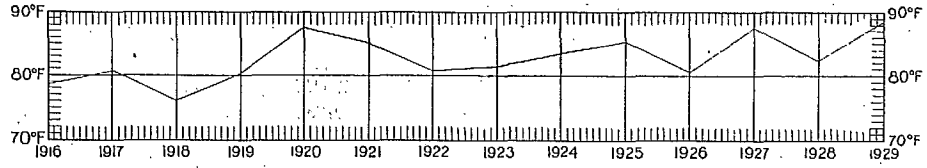


An experimental lot of apricots drying in the sun.



A close-up of two trays of sun-dried apricots.

(*c*) Hours of Sunlight.—The long hours of sunlight are a very favourable factor in making for drying efficiency. The average hours of sunlight for the period of July 25 to August 15, for the last fourteen years has averaged ten hours of sunshine per day.



Future work will prove or disprove the adaptability of the Okanagan Valley climate for sun drying on a large scale. At present, however, it is felt that growers could make a start in a small way by utilizing apricots that have become too ripe for fresh fruit shipment, or fruit for which a definite worthwhile price has not been offered.

CANNING

A small canning line was installed during the 1929 season with which to make tests on new varieties of fruits and vegetables grown at the Station and also to determine the most suitable "cooks" and "exhausts" for the fruits commonly grown in the valley. It is felt that rather an irregular schedule of cooks has been followed by the commercial canners, thus lowering the grade of the product. The proper maturity of the fruit for best canning quality is also a factor needing consideration.

MATURITY TESTING

Picking of fruit at the proper stage of maturity is a problem of great economic importance in the Okanagan Valley. Difficulty is being experienced with Royal Anne cherries, apricots, peaches and Italian prunes, the general tendency being to pick all fruit before it has reached prime condition for canning.

Because of this situation work was undertaken on Royal Anne cherries. This year's tests, however, were confined to fruit grown on the local Station and merely serve as a foundation for future work. The Oregon Experiment Station* found that Royal Annes with juice at a balling degree of 20 per cent, produced a good quality of canned product. This was the lowest balling degree that was recommended. In the local work it was found that it was a week after the cannery in Penticton started canning Royal Annes before those on the Station were ripe enough according to this test. During all this time the fruit had a wonderfully good appearance and would have been picked by commercial growers. It might be found that 20 degrees balling is not the most practical degree for our conditions and it is hoped that more detailed work may be done during the coming season.

APRICOT COOKS

During the past season commercial canners experienced difficulty from apricots "mushing" during the usual cook of 15 minutes for number two cans of Royal and Blenheim apricots. Tests in the Station plant showed that number 2's were completely sterilized if exhausted to 160° F. at the centre of the can and cooked in boiling water for only 7 minutes. This was the minimum cook used. The fruit held up very well, each piece was clean cut, and the syrup was perfectly clear. The fruit was not as tender as desired, however, and it is

* Oregon Station Bulletin No. 247, by H. Hartman and D. E. Bullis.

therefore better to recommend the 8 or 9 minute cooks. Even the 10 minute cooked contained mushed specimens. It is to be noted that this cook is for a rotary cooker where each can gets a similar cook or for open tanks of boiling water where the cans are not crowded together. If the cans are in large iron crates where heat penetration to the centre of the crate is slow, the cook will necessarily be increased. In the interests of a high quality standard pack it is advisable to use a rotary cooker.

VARIETY TESTING OF PEACHES FOR CANNING

As present varieties of clingstone peaches are not commercial in the Okanagan, the problem of producing a hard-fleshed freestone peach has attracted considerable attention for some time. This problem is of great economic importance as peaches have been grown in this section for 25 years and the pack is still of very inferior quality.

The characteristics desired in a prime canning peach are as follows: firmness of flesh, maintaining definite edges after being cooked and not "sluffing off," clear syrup, deep golden colour, absence from red about the pit, good flavour, and a round shape.

During the 1929 peach season, the seedling varieties of Vedette, Vaughan and Valiant were canned as well as Tuscan Cling, Elberta, and J. H. Hale. The latter two varieties are already commercial and provided a comparison by which to judge the seedlings.

The results are very gratifying. The Vedette approaches the ideal described above, and both the other two varieties are better than either J. H. Hale or Elberta. Elberta is the poorest of the group and yet the greatest acreage is planted to this variety.

The following process details were used in canning the samples in this experiment:—

Syrup	55° Balling.	
	Size of Can	Time
Exhaust	Number 2's	5 minutes at 212°
	Number 2½'s	6 minutes at 212°
Cook	Number 2's	11 minutes at 212°
	Number 2½'s	13 minutes at 212° (very short).

BEVERAGE WORK

Investigation was undertaken this year to determine a commercial beverage that could be made from the cull apples of the Okanagan. Considerable attention was given to wine yeast, fermentation technique, and the length of the fermentation period. More detailed information on this work will be given after further investigations.

TOBACCO*

THE SEASON

April opened with moderately warm days and cold nights. The temperature on the morning of the 6th, dropped to 22 degrees F. Half an inch of snow fell on the 7th. Frost and cold winds prevailed until April 18, when the last frost was recorded. The mean temperature for the month was 45·78 degrees F., the average for April over a period of 14 years being 47·20 degrees F. There were very light showers at intervals throughout the month with a total precipitation of 0·26 of an inch. The 14-year average precipitation for this month being 0·74 of an inch. Sunshine was considerably above the average, there being recorded 215·1 hours, the average for 13 years being 192·1 hours.

* Prepared by A. J. Mann, B.S.A., Tobacco Specialist for B.C.

On the whole, the weather during April was cold and backward. Seed beds were not sown until April 11, and germination required from 8 to 17 days. Early May was only moderately warm. The mean temperature for the month was 58·20 degrees F., which is nearly 2 degrees F. above the average. A total precipitation of ·16 inches was recorded, the average being 0·69 of an inch. On light sandy soils irrigation was necessary before planting. The steam sterilized seed beds produce healthy plants and free of weeds. From 41 to 49 days were required for the first plants to reach transplantable size and on the whole, the seedling plants were not ready for transplanting until after the first of June. The month of June was about an average one both for temperature and precipitation. A maximum temperature of 84 degrees F. was recorded on the 24th. Rains fell about the 16th and the total precipitation for the month was 1·02 inches, the average for June being 1·09 inches. The weather was favourable for transplanting which was general during the first week of June and completed before the middle of the month. In 1927, 1928 and again this year, flea beetles were numerous and destructive to young tobacco plants in the field. To protect the young plants from the ravages of this pest, it was necessary immediately after transplanting to spray with nicotine sulphate dust. Cutworms were not very troublesome this season. For almost a month after transplanting, wire worms necessitated considerable replanting. Notwithstanding irrigation being applied previous to transplanting, soil moisture was not plentiful and a second irrigation was needed in early July. In general, however, good stands of plants were established. July was hot and very dry. The highest temperature of 98 degrees F. was recorded on July 30. The mean temperature was 70·14 degrees F., the average being 70·66 degrees F. Only one very slight shower with a precipitation of 0·02 of an inch was recorded on the 6th, the average being 0·63 of an inch. During this month all tobacco plots received two irrigations and plots which were located on light sandy soil received three irrigations. The tobacco horn worm, a pest which has been very destructive to tobacco plants in July during the past four years, was not numerous this season. August this year was the hottest month, the mean temperature was 71·16 degrees F., the average being 68·77 degrees F. The highest temperature of 95 degrees occurred on August 10. A precipitation of 0·56 of an inch was recorded on the 23rd, this being the only one for the month. Inadequate soil moisture conditions during August and September retarded the normal maturing of the leaf. Commercial and experimental tobacco crops were thin, patchy and late. Harvesting under favourable weather conditions extended from late August until late September. The autumn was characterized by dry, bright weather and the absence of strong winds. The first frost, 3 degrees, was recorded on October, 29. The extreme dry weather during the late summer and autumn was not favourable for the proper curing of tobacco. The leaf dried too quickly and a considerable amount of leaf cured with undesirable green and mottled colours. After June the season was abnormally dry and there was an unusual amount of high barometric pressure and a tendency for dry winds from the north. From June to November the season was not normal and not favourable for the production of quality leaf tobacco.

The first natural partial case of tobacco leaf for the season occured on November 16-17 when rainy weather prevailed. The first natural complete case of tobacco leaf for the season occured on November 29 when a thick blanket of fog covered the valley for about 12 hours.

CROP CONDITION AND ACREAGE STATISTICS

On the whole, the 1929 British Columbia commercial tobacco crop was thin, patchy, uneven, backward in growth and maturity, free of disease in the field and also in curing barn. The crop was low in yield and only fair in general quality. In most instances, the cured leaf was of desirable body and texture and of medium free burn with white ash.

The thirty-acre Sumas crop which was called Bright flue-cured tobacco did not resemble this type of tobacco either when growing in the field or when cured. It had no resemblance to Bright flue-cured tobacco as produced at Summerland, or in Southwestern Ontario, United States, Nyasaland and Rhodesia. The leaf was dark brown in colour and heavy in body and resembled Quebec cigar filler leaf.

Other types of tobacco not known to the Canadian trade were produced to the extent of fifty acres. These unknown types were poor in general quality and had undesirable green, dark green, red and mottled colours.

Some good quality *air-cured Burley was produced. Samples of this were carefully tested for grade and quality. The results were as follows:—(1) Bright leaf, number one grade, 37 per cent; (2) Red leaf, number one grade, 45 per cent; (3) Red leaf, number two grade, 18 per cent. It should be noted that the samples contained no tip or lug leaf but leaf only from the middle of the plant. The air-cured Burley was very good in general quality. The leaf was smooth and desirable in body texture and colour.

Two samples of Sumas cigar leaf of the variety Connecticut Havana 38 were tested for grade, quality and value. These samples contained leaf only from the middle of the plant and were fairly typical of the general quality of the Sumas cigar leaf crop. These tests were based on Quebec's 1929 commercial grades and prices. The average value per pound of the first sample was 24·8 cents and of the second sample 19·8 cents. The average value of the two samples was 22·3 cents per pound. For a comparison of values, samples of Ontario grown cigar leaf of the same variety and of leaf from only the middle of the plant were tested. The average value of the Ontario samples was 29·3 cents per pound or 7·0 cents more per pound than the Sumas leaf. Notwithstanding this increase in value, the Ontario samples were graded only fair in quality of leaf. This comparison of values indicates that there is need for considerable improvement in the general quality of the Sumas cigar leaf.

This season's tobacco crop was approximately 17 per cent less in acreage than last year, 1928. No commercial acreage was produced in the Okanagan Valley this season. In the Sumas district there was an increase in acreage of approximately 60 per cent. In table 34 are presented the estimates of acreage, yield per acre, production and farm values of the British Columbia tobacco crop for the years 1925 to 1929. The estimates were based on a survey of the crop in the field just previous to harvesting, the condition of the crop when curing in the barn and by testing the grade and quality of the cured leaf. The estimated farm values of the crop were based on tobacco marketing conditions and prices which prevailed each season.

TABLE 34.—ESTIMATED AREA, PRODUCTION AND FARM VALUE OF TOBACCO IN BRITISH COLUMBIA, 1925-29

Year	Area	Yield per acre	Production	Farm value
	acres	lb.	lb.	$
1925	10	1,100	11,000	2,200
1926	55	1,225	67,000	14,070
1927	360	1,305	470,000	86,760
1928	116	1,415	164,200	32,840
1929	100	878	87,850	16,700

PRESENT STATUS OF THE BRITISH COLUMBIA TOBACCO INDUSTRY

From the standpoint of the individual tobacco grower in British Columbia the years 1927 and 1928 were most disappointing. After spending time and money to the production of the crops he found himself unable to dispose of the

* Air-cured to distinguish from that portion of the Burley crop which was flue-cured.

cured leaf at a price even approaching the cost of production. At the time of writing, February, 1930, a portion of the 1927 and 1928 crops still remains unsold.

Having no raw leaf tobacco purchasing organizations and processing plants in the province, the growers were dependant on eastern tobacco companies in purchasing their crops. With plentiful sources of dependable supply in the East where tobacco of desirable type and quality can be readily obtained, it is obvious that eastern tobacco buyers and manufacturers were not interested in developing the tobacco industry in new unproven districts in British Columbia located several thousand miles from their processing plants. Moreover, the tobacco was of variable grade and of low quality. These conditions of grade and quality were to be expected when the tobacco crops were produced by inexperienced growers in small lots over a widely scattered acreage in districts having extremely variable conditions of soil, moisture and climate. Furthermore, the volume of each grade and the total volume of all grades were far too small for economical processing or for establishing uniform desirable stocks. The important factor of continuity of supply was uncertain and prices asked by the growers were far too high to successfully compete with quality leaf produced by experienced growers located in established tobacco districts in close proximity to eastern tobacco buying, selling and manufacturing organizations. The prices asked, however, from the growers standpoint were not too high when their high costs of production were considered. However, these production costs were too high to secure economical returns. These high costs of production were to be expected when the tobacco crops were grown on high priced land, usually under irrigation and by high priced inexperienced labour.

Briefly, such were some of the reasons why British Columbia tobacco growers failed to successfully sell their 1927 and 1928 tobacco crops. Nevertheless, enough good quality tobacco was produced to convince interested people that British Columbia can produce tobacco of desirable quality when grown under suitable soil and cultural conditions.

In 1929 field progress was made in that the tobacco acreage was located in a small area in one district and under one central management. However, the improvement in the quality of leaf was not commensurate with the advantages named. Some of the reasons for not attaining the desired quality of leaf were as follows: (1) failure to produce sturdy seedling plants in season; (2) growing too large an acreage during the initial stages, before experience and information had been secured on the particular tobacco cultural and curing problems of the district; (3) growing unsuitable types of tobacco to meet the exacting requirements of the trade; (4) growing too many types of tobacco and thus giving less care and attention to the more worth while types where profits might be expected; (5) growing tobacco on unsuitable soil, which may result in almost complete failure, especially with Bright flue-cured tobacco; (6) inadequate curing barn space and equipment; (7) rough handling of the crop by inexperienced labour. Nevertheless some good quality tobacco was produced, due to careful husbandry on certain fields.

After the experience of trying to sell the 1927 and 1928 tobacco crops in the East, the British Columbia tobacco interests believe that if the industry is to be placed on a sound basis that it is necessary that the raw leaf be processed and manufactured within the province. In 1929 this idea gathered momentum with a number of business men and resulted in interesting a well know enterprising Vancouver business firm, who for years have been favourably known for their agricultural activities throughout the province. As a result of this firm's extensive business organization coming to the aid of this new industry, confidence was strengthened, credit was stabilized and finally a small but well equipped tobacco factory was established, where the unsold crops produced in the past

two seasons are now being manufactured into medium priced pipe and cigarette mixtures. Reliable reports of satisfactory sales have been received. The future of the industry appears to be more promising now than it has been for several years. However, to measure to this promise, there must be a sincere united effort of the growers to produce a dependable supply of desirable leaf as required to maintain a factory production of satisfactory blends or mixtures which meets the approval of tobacco users.

EXTENSION WORK

With the commercial tobacco acreage located in one district and under one management in 1929, fewer requests for information on the various phases of tobacco culture, curing and marketing were received than in former years when the acreage was widely scattered throughout the province.

During August, in company with Dr. N. T. Nelson, Chief of the Tobacco Division, Ottawa, W. T. Hunter, Superintendent of the Summerland Station, tobacco meetings and conferences were attended and addressed at Vancouver, Sumas, Summerland, Kelowna and Vernon. These meetings represented growers, growers' associations, boards of trade, bankers, provincial agricultural officials, and interested business men. At these meetings, an attempt was made to develop a viewpoint which would ultimately help to establish the industry on a more conservative and rational basis. Samples of cured leaf from British Columbia, Western Ontario and United States were placed on the table and discussed and compared as to grade and quality. The cured leaf in stocks in Vancouver and in the Okanagan Valley, growing tobacco crops, curing barns, equipment and tobacco soils were examined. Recommendations for next seasons' tobacco operations were given to the growers.

As opportunity would permit throughout the season, timely practical demonstration and cultural information were given to the growers in the field. On the whole, there was not much time available for extension work, the major season's effort being directed on definite tobacco experiments located at the Summerland Station and in the district of Kelowna.

EXPERIMENTAL WORK

During the initial stages of tobacco experimental work in British Columbia, yearly changes and modifications have been necessary to meet the rapidly changing problems confronting the industry in this new field. In a mountainous province like British Columbia there is an extremely wide diversity of cultural and environmental conditions. For instance, in some tobacco districts in the province from one to four irrigations per season are necessary to sustain a tobacco crop to maturity whereas in other districts a tobacco crop can be successfully grown without irrigation. The tobacco plant is very sensitive to its environment and slightly unfavourable conditions may have a marked influence on the performance of the plant, especially in its work of producing leaf of desirable quality. This performance may be even more marked according to the cultural treatment received by the plant such as time and amount of irrigation, distance apart of planting, time and height of topping, time and number of suckerings and time of harvesting.

Five years, 1925 to 1929, commercial and experimental results in the culture of tobacco in various southern parts of the province have demonstrated that high yields can be produced. This high yield, however, has not been consistently associated with quality. After sorting the cured leaf for determination of grade and quality, it is quite obvious that there is need for more definite information on different cultural and curing treatments and of their effect on the quality of cured leaf.

Leaf analysis for the determination of grade and quality is the most important phase in the interpretation of results of the majority of tobacco experi-

ments conducted at this Station. Until last year, 1928, no definite attempt was made to classify the cured leaf into commercial type grades and place on a numerical basis. This lack of numerical standard on which to determine grade and quality depressed the interpretation of results. The ravages of wireworm and physiological diseases, seasonal and environmental disturbances have materially retarded the progress of establishing this commercial type grade and numerical standard. However, to accurately interpret the results of our tobacco experiments over a period of several years, a workable grade and quality standard must be evolved.

Irrigation and fertilizer experiments were initiated but inadequate irrigation facilities and variable soil conditions revealed possibilities of too much experimental error to justify the completion of these exacting projects. Judging from past experience it is doubtful whether accurate duty of water and fertilizer experiments can be determined at this Station with the present equipment and allotment of land. Owing to these unfavourable soil and water relations, irrigation and fertilizer experiments have been abandoned.

FIELD EXPERIMENTS CONDUCTED IN THE OKANAGAN VALLEY

General Varietal Test

This experiment was begun in 1925 to determine the types and varieties of tobaccos which are most suitable to grow in these southern interior irrigated valleys. The tests have been conducted on soils which varied from sand to clay and which included bench land, low land, irrigated and non-irrigated land. All varieties tested were cured and then shipped to the Tobacco Division, Central Experimental Farm, Ottawa, to determine the quality of the cured leaf.

Kelowna 1929

In the district of Kelowna, two types of tobaccos which include nine varieties, were tested on low, level, silty-loam land. The plants were supplied from the Summerland Station and transplanted on June 4. While the plants were small it was necessary to protect them from injury by flea beetles with nicotine sulphate dust spray. During the season the plots received two irrigations. In normal seasons this particular area of low land usually requires no irrigation to sustain crops to maturity. No frosts, hailstorms, or severe windstorms were recorded.

Tobacco diseases were prevalent this season. The variety Greenwood recorded 28 per cent slight rust. The Burley varieties averaged 33 per cent mosaic. Of the Burley varieties, the lowest percentage of plants affected with mosaic was 12 and the highest 64 per cent. Owing to the unusually dry season and the severe infestation of mosaic, the varieties made only fair growth and gave only a medium yield. All varieties were topped and harvested in good season. The yield per acre and the percentage assorted grades of cured leaf and the general quality of the varieties tested are presented in table 35.

TABLE 35.—BURLEY VARIETY TESTS—BENVOULIN, KELOWNA, B.C., 1929

Variety	Yield of cured leaf per acre	Percentage of assorted grades (middles only)				Relative general quality
		Bright No. 1	Bright No. 2	Red No. 1	Red No. 2	
	lb.					
Halley's Burley	2,060	0	64	0	35	5
Broadleaf Burley	1,929	0	16	0	84	8
Stoner Burley	1,919	0	50	0	50	2
Station Standup Burley	1,902	0	54	0	44	4
Kelly's Burley	1,843	0	91	0	9	1
Standup Resistant Burley	1,815	0	47	0	53	7
Judy's Pride Burley	1,758	0	77	0	21	3
Resistant B1193XX Burley	1,724	0	51	0	49	6

Single plots—25 plants per plot.
See 1928 Summerland station report, page 38.

These Burley varieties produced no wide variation in quality in the various grades of leaf and no number one grade of bright leaf. The lug and tip grades are not included in the accompanying table. In the lug grade, all varieties were only fair in quality. With the tip grade, the varieties graded from poor to fair in quality.

In the leaf grades, Broadleaf and Standup Resistant, were poor in quality. The other varieties were only fair in quality. On the whole, the leaf was leathery and heavy in body and had variable dull green colours. Kelly and Judy's Pride had the most neutral aroma. The other varieties had a peculiar smell similar to that of paint and oil. This season's leaf was more like Ontario Burley than the 1928 crop.

During the past five years results have often shown that high yield is not always associated with high quality. For instance, in this test, Kelly which graded first in general quality graded fifth in yield.

Summerland, 1929

Five types of tobaccos, which included twenty-one varieties, were tested on irrigated sandy loam bench land. The seed was sown on April 11 in semi hot beds under glass and cotton. The plants were transplanted on June 5 to June 10. The cultural care of the plots included three hoeings, four cultivations, four irrigations and two suckerings.

In 1928, drought spot or flannel in the Bright flue-cured plots, 26 in number, averaged 48 per cent. This season, 1929, drought spot in 36 plots, averaged 30 per cent. This is a decrease of 18 per cent as compared with last year. In the varietal and cultural test plots, the percentage mosaic was as follows: lowest 30, highest 91, average 66 per cent. In these same plots, the precentage frenched plants were as follows: lowest 2, highest 18, average 2·3 per cent. All plants affected with frenching were in the Burley varieties only. One Greenwood plant was affected with Curly dwarf. Sunscald was slightly prevalent with all varieties. There were no diseases of tobacco during the curing of the leaf in the barns. Owing to the large amount of mosaic the plots produced only medium yield and fair quality of leaf. Harvesting commenced on August 20 and was completed on September 16. Air curing of tobacco was completed by the end of November. The yield per acre and the percentage assorted grades of cured leaf and the relative general quality of the tobaccos tested are presented in table 36.

TABLE 36.—BURLEY VARIETY TESTS—SUMMERLAND, B.C. 1929

Variety	Yield per acre	Percentage assorted grades (middles only)				Relative general quality
		Bright No. 1	Bright No. 2	Red No. 1	Red No. 2	
	lb.					
Resistant B1193XX Burley.	1,843	0	0	0	100	8
Broadleaf Burley.....	1,570	0	20	0	80	6
Standup Resistant Burley..	1,508	0	28	0	71	4
Judy's Pride Burley.....	1,508	31	51	9	27	1
Kelly's Burley.....	1,438	0	0	0	95	3
Halley's Burley.....	1,407	0	44	0	54	2
Station Standup Burley....	1,407	0	23	0	75	5
Stoner Burley.....	1,321	0	20	0	79	7

Average of duplicate plots.
See 1928 Summerland station report, Page 38.

The lug and tip grades are not given in the accompanying table. Of the various varieties, the lug grades were thin and papery and only fair in quality. The tip grades varied from poor to fair and to good in quality.

In the leaf grades, Judy's Pride was outstanding in that it was the only variety to grade a percentage of Bright number one leaf and Red number one leaf and the highest percentage of Bright number two leaf. Halley's Burley was again high in general quality.

Both the 1928 and 1929 results show that high yield is not always associated with high quality. Last year the variety of Burley which ranked first in general quality was fifth in order of yield and yielded 234 pounds less than the highest yielding variety. This year, 1929, the Burley variety which ranked first in general quality was fourth in order of yield and yielded 355 pounds less than the highest yielding variety.

The entire 1928 and 1929 Summerland Station burley leaf was purchased by an enterprising Vancouver firm and used for blending with British Columbia grown tobacco from other sections of the province.

The firm's report on the general quality of the Summerland Station Burley was as follows: In colour, the leaf graded 30 per cent bright and 70 per cent red. The aroma was medium and body medium heavy. The smoking quality of leaf was mild.

During a period of five years, 1925-29, the average yield of cured leaf of Burley at the Summerland Station was over 2,000 pounds per acre. This high yield is associated with large leaf and stem and mid-rib. The stemming of the Summerland Burley at the Vancouver factory yielded 44 per cent stem. It is difficult to believe this high percentage of stem unless one associates large yield with large leaf and stem. To the manufacturer, this high percentage of stem represents an approximate loss of fifteen cents per pound on the stem portion of the leaf. The exact loss will depend on the purchase price of the leaf and the method in which the stems are utilized as a by-product. From these figures it is quite obvious that varietal and cultural practice should aim to produce leaf with a minimum of stem.

EFFECT OF SPACING AND MATURITY AT HARVEST ON YIELD AND QUALITY OF BURLEY, GREEN RIVER, AND CIGAR TOBACCO

Manufacturers and leaf dealers suggested that the 1925 British Columbia cigar leaf was too heavy bodied and that the Burley and Green River types were too thin of leaf. Accordingly in 1926, two experiments were initiated to determine the effect of yield and quality of different spacings of plants within the row and of the number of days after topping and harvesting.

These spacing and harvesting experiments were conducted at Kelowna and Summerland and were continued in 1927, 1928 and 1929. In the spacing experiments, all rows were spaced 36 inches apart and the distance within the rows varied from 18 inches to 36 inches.

A general summary of the four years' test, 1926-1929, is herewith presented.

Effect of Spacing on Yield and Quality of Burley tobacco, Variety Station Standup, Kelowna and Summerland, 1926-1929

The close spacing of 24 inches yielded leaf lighter in body, more uniform in colour, finer in texture and higher in yield, grade and general quality than the wider spacing of 30 and 36 inches. The 24, 30 and 36-inch spacings yielded respectively 2,242, 2,118, and 1,825 pounds of cured leaf per acre. The 36-inch plot yielded leaf which was heavy and coarse in body, dark in colour, and poor to fair in general quality. The 30-inch plot was intermediate in general quality.

Effect of Spacing on Yield and Quality of Green River tobacco, Variety Greenwood, Kelowna and Summerland, 1926-1929

The intermediate spacing of 30 inches within the row gave a higher yield and a higher grade and quality of leaf than the 24 and 36-inch spacings. The 24, 30, and 36-inch spacing yielded respectively 2,261, 2,106, and 1,854 pounds of cured leaf per acre.

Effect of Spacing on Yield and Quality of Cigar Tobacco, Variety Connecticut Havana 38, Kelowna and Summerland, 1926-1929

The 18-inch spacing yielded leaf which was brighter and more uniform in colour, smoother in texture and with less body and higher in general quality than the 22 and 26-inch spacings. The 18, 22, and 26-inch spacings yielded respectively 1,683 1,653, and 1,503 pounds of cured leaf per acre.

A field of Bright tobacco on bench land under irrigation, thirty-five days after planting. Note the two irrigation furrows between each row. When the plants are small this method of irrigation saves time and ensures a thorough distribution of water within reach of the young plants.

Effect of Maturity at Harvest on Yield and Quality of Burley Tobacco, Variety Station Standup Kelowna and Summerland, 1926-1929

Burley tobacco harvested 28 days after topping, yielded leaf which was bright in colour and more desirable in body, texture and general quality than leaf harvested 21 and 35 days after topping. The 21, 28 and 35 days after topping yielded respectively 1,878, 1,904 and 2,199 pounds of cured leaf per acre.

Effect of Maturity at Harvest on Yield and Quality of Green River Tobacco, Variety Greenwood, Kelowna and Summerland, 1926-1929

Greenwood tobacco harvested 40 days after topping yielded leaf more desirable in size, body, stretch, gum, colour and in general quality than leaf harvested 20 and 30 days after topping. The 20, 30 and 40 days from topping to harvesting, yielded respectively 1,959, 2,160 and 2,248 pounds of cured leaf per acre.

Effect of Maturity at Harvest on Yield and Quality of Cigar Tobacco, Variety Connecticut Havana 38, Kelowna and Summerland, 1926-1929

Cigar tobacco harvested slightly on the immature side or between 15 to 20 days after topping yielded leaf higher in general quality than leaf harvested 25 days after topping. The earlier harvesting produced leaf which was brighter and more uniform in colour, with less body, smoother in texture and a higher percentage of binders. The 15, 20 and 25 days from topping to harvesting yielded respectively 1,656, 1,530 and 1,723 pounds of cured leaf per acre.

TESTS WITH BRIGHT FLUE-CURED TOBACCO CONDUCTED AT SUMMERLAND, 1928-29

As a result of requests for information regarding the culture of bright flue-cured tobacco, tests were initiated in 1928 to determine whether or not this type of tobacco of desirable quality can be grown on the light sandy irrigated lands of the British Columbia Dry Belt. These tests were conducted on two types of soil which are typical of large areas in this district, namely a medium fine sand and a sandy loam. These soil classes were designated by actual mechanical analysis. The experiments included studies of varieties, field production on an acre basis, effect of soil class on yield and quality of leaf, harvesting and curing problems, physiological diseases, analysis of leaf for grade and quality and the commercial value of leaf for blending with other types of British Columbia grown tobacco. Leaf in sufficient amount to fill five six-room kilns was harvested and cured. This amount of leaf afforded excellent opportunity to study the various aspects in the culture of bright flue-cured tobacco.

Varietal tests are being continued until enough data are secured to make accurate deductions.

Field production on an acre basis largely placed this part of the work on a commercial aspect and also lessened the chances of experimental error through the influence of variable conditions of soil and irrigation. The large fields also provided enough leaf to fill a kiln several times which was very necessary in the study of the curing of this type of tobacco.

Harvesting of bright flue-cured tobacco either by the priming or split stalk method was a real problem when inexperienced and indifferent labour was employed. Such labour was very costly in time and also in loss by damaged leaf.

The effect of soil class, namely a medium fine sand and a sandy loam, on yield and quality of leaf already shows some interesting results. The lighter soil, that is the medium fine sand, yielded a lower percentage of leaf in the less valuable grades and a higher percentage of leaf in the more valuable grades.

The medium fine sandy soil which appeared to have desirable physical characteristics for the culture of bright flue-cured tobacco proved inadequate to fully sustain this crop during peak temperatures. On this lighter soil the crop was affected by wilting, sunburn, and a disease which resembled drought spot and produced leaf of uneven maturity. The heavier soil, namely the sandy loam, proved too rich to produce leaf of desirable size, body and texture. This sandy loam yielded from 1,800 to 2,400 pounds of cured leaf per acre. This heavy yield contained a large percentage of leaf which was too large and coarse to properly cure in the kiln. This large leaf overlapped in the kiln and impeded free circulation of air between the tiers. This condition of reduced ventilation assisted in holding the desired humidity in the kiln during the earlier stages of curing. During the later stage of curing when it was imperative that excess moisture be quickly eliminated from the kiln, the impeded circulation of air between the tiers developed a condition of leaf which is known as "sponging," a curing defect which materially dulled the finish and darkened the colour of the leaf.

It should be noted that in the old established bright flue-cured districts of the United States and of southwestern Ontario, that the average yield per acre of this type of tobacco is approximately 800 pounds per acre and that 1,200 pounds is considered a large yield as grown to meet the exacting requirements of the trade.

A chart showing the approximate relationship of temperature and humidity to be maintained at different stages of curing was posted in the kiln and used as a guide. During the curing, the temperature and humidity in kiln was recorded each hour, day and night, and compared with the chart. These comparisons often revealed too low humidity which was verified by the condition of the leaf.

The application of wet sacks and water on the floor of kiln, the installation of a simple apparatus to facilitate a finer adjustment of ventilators in the ridge, closer spacing of plants on the lath and closer spacing of lath in the kiln may help to maintain a more suitable balance of temperature and humidity. This scheme of closer spacing of plants in the kiln particularly applies to small plants which have been grown on light sandy soil. At the stage of curing when much excess moisture must be eliminated from the kiln, too close spacing of plants might induce "sponging." Accordingly, before close spacing of plants in the kiln is practised, all factors which are likely to affect the humidity should be judiciously considered. Under normal conditions, the approximate spacing consists of six plants per lath and lath from six to eight inches apart in the kiln.

The Stations's tests indicate low humidity difficulties in curing bright flue-cured tobacco during dry seasons in the drier environments of the British Columbia Dry Belt. These environments particularly apply to bench lands that are naturally well underdrained and air-drained and practically free of dews.

Although the medium fine sandy soil revealed several undesirable characteristics in the production of bright flue-cured tobacco, yet tabulated results of leaf quality tests recorded a higher percentage of bright leaf in favour of the medium fine sandy soil as compared with the sandy loam.

During the past five years, 1925-1929, the culture of tobacco under irrigation has proved a fertile field for physiological diseases. During the past two years, 1928-1929, that bright flue-cured tobacco has been grown at this Station an average of 39 per cent of leaf was affected with a peculiar physiological trouble which resembled Drought Spot. This disease produced a thick, brittle, leathery leaf, with numerous spots of green, olive and bronze cast. The leaf too, was poor in general quality. In 1928, this disease was observed in the field just previous to harvesting the crop; in 1929, it was not observed until after the leaf had been cured. Unsuitable soil conditions, untimely and abnormal water relations and unbalanced nutrition and growth disorders may have caused this physiological disease.

On the whole, the two years' test produced leaf which was extremely variable in size, body, texture and maturity. A considerable portion of the leaf, especially that which was grown on loam, was too large and coarse to cure a high percentage of bright leaf. These two years' test yielded no first-class leaf of any grade and none of wrapper or cutter quality. The results indicate that even with judicious irrigation, that during peak temperatures, it is extremely difficult to sustain the tobacco plant in healthy condition when it is grown on the lighter sandy soils characteristic of the British Columbia Dry Belt. It should be noted that in other bright flue-cured districts, to produce the highest percentage of marketable bright leaf, it is necessary that the crop be grown on a light sandy soil.

An attempt was made to classify the cured leaf into commercial type grades. These results are given in tabulated form in table 37.

TABLE 37.—BRIGHT FLUE-CURED TOBACCO—YIELD AND QUALITY, SUMMERLAND, B.C., 1929

Soil type designated by actual mechanical analysis	Variety	Yield per acre	Percentage of assorted grades											
			Bottoms, lugs		Middles, leaf						Tips			
			M	F	L	O	D	M	G	F	D	M	G	F
		lb.												
Medium fine sand (1)	Warne	1,021	24	76	3	20	3	33	0	39	44	29	3	23
Medium fine sand (1)	Warne	1,267	12	88	5	24	4	28	0	38	32	39	6	23
Sandy loam (1)	Hickory Pryor	1,576	99	1	10	26	11	51	1	1	50	41	2	7
Sandy loam (2)	Bananza	1,887	53	46	0	3	0	69	0	27	0	18	52	29
Sandy loam (2)	Gold Leaf	1,951	62	37	0	6	0	67	0	25	24	39	0	35

(1) Averages of quadruplicate plots.
(2) Averages of duplicate plots.
Key to letters in table.
Leaf colours and grades.
L—Lemon.
O—Orange.
D—Dark orange or mahogany.
M—Mixed colours other than green.
G—Green.
F—Flannel or drought spot.

In the above table it will be noted that the lighter soil which is designated by actual mechanical analysis as a medium fine sand, yielded a lower percentage of leaf in the lug grade and a lower percentage of dark leaf in the leaf grade. Of the more valuable grades, the lighter soil yielded a higher percentage of bright leaf. The most outstanding difference in the effect of soil type on yield and quality is in the higher percentage of mixed colours, other than green, in the lug and leaf grades, and also of green leaf in the tip grade as recorded by the sandy loam in comparison with a medium fine sand. It should be noted that leaf of uniform bright lemon colour commands the top price.

COMMERCIAL TEST OF BRITISH COLUMBIA GROWN BRIGHT FLUE-CURED TOBACCO

During the season of 1929, an enterprising Vancouver firm initiated tests with British Columbia grown tobacco. These tests consisted of blending, manufacturing, packing and selling medium priced coarse and fine cut pipe and cigarette mixtures. Investigations in the Vancouver factory showed that the inclusion of a small percentage of Summerland bright flue-cured leaf with Sumas leaf improved the blend. Accordingly with a view of helping the British Columbia tobacco industry from a marketing and manufacturing standpoint, the entire Summerland Station's 1928 and 1929 bright flue-cured stocks were placed at the disposal of the firm for further experimentation. With these stocks of Summerland and Sumas leaf, the Vancouver firm succeeded in producing several blends of tobacco which have found ready sale throughout the province. The firm's report on the general quality of the 1928 and 1929 Summerland Station's bright flue-cured leaf is given in table 38.

TABLE 38.—MANUFACTURER'S ANALYSIS OF SUMMERLAND STATION'S 1928 AND 1929 BRIGHT FLUE-CURED TOBACCO

Colour	Body	Aroma	Smoking test	Smoke	Relative general quality on basis of 1 to 10, 10 is highest in scale of quality	
					Per cent crop	Quality
14 fine bright	heavy	sappy or	medium	medium	5	9–10
36 medium dark	.....	bitter	heavy	sweet	10	8
50 brown	.....	green	sharp	.....	30	5
					45	4
					10	2

The manufacturer stated that the relative general quality of the first fifteen per cent of leaf was of higher grade and quality than a similar percentage of Ontario bright flue-cured leaf which was in stock in Vancouver at the time the comparison was conducted.

OTHER TOBACCO PROJECTS IN ACTIVE PROGRESS

Project T. 84.—Tobacco leaf drop, to determine the environmental relations and the cause of this disease.

Project T. 26.—Tobacco seed production.

Project T. 1.—Tobacco seed-beds, tests with glass, glass cloth, celloglass and cold frame cotton covers as regards the effect on soil and air temperature within the seed bed, growth of plants also a comparison and price of covers and their durability.

Project.—Cultural tests with bright flue-cured tobacco, including height of topping, degree of suckering and maturity of harvest.

SUMMARY

The season, irrigation and destructive insects and their relation to the growing and curing of tobacco are included.

Crop conditions for 1929 and comparisons of British Columbia tobacco with tobacco grown in Ontario, Quebec and other countries are outlined. These comparisons show the importance of growing tobacco of suitable type and variety and of high quality.

The estimated acreage, production, and farm value of British Columbia's tobacco crop for 1925 to 1929 are presented.

The status of the British Columbia tobacco industry for 1929 shows some of the difficulties in developing a tobacco industry, in new unproven districts and without the support of purchasing organizations and processing plants.

Brief mention is made of extension work which was conducted throughout the season.

Results are given of general varietal tests which include five types of tobacco and twenty-one varieties. These tests were conducted at the Summerland Station and in the district of Kelowna. The tabulated quality tests of cured leaf show that high yield is not always associated with high quality. The majority of the varieties graded only fair in general quality. The varietal tests show that the irrigated lands of the British Columbia Dry Belt are fertile fields for the development of physiological diseases. The effect of these diseases on the growing crop materially depressed the general quality of leaf.

Of the Burley varieties, Halley's, Kelly and Judy's Pride are the most promising.

None of the cigar leaf varieties has proven to be outstanding by being better than the others. Over a period of five years the general quality has been only fair.

Planting Burley 24 inches apart in the row and cigar leaf 18 inches apart yielded a higher yield and a finer and higher grade of cured leaf than did the wider spacing.

Planting Greenwood 30 inches apart in the row gave a higher yield and a higher grade and quality of leaf than 24 and 36 inch spacings.

Burley tobacco harvested 28 days after topping yielded leaf which was brighter in colour and more desirable in body, texture and general quality than leaf harvested 21 and 35 days after topping.

Greenwood tobacco harvested 40 days after topping yielded leaf more desirable in size, body, stretch, gum, colour and general quality than leaf harvested 20 and 30 days after topping.

Cigar tobacco harvested slightly on the immature side or between 15 to 20 days after topping yielded leaf higher in general quality than leaf harvested 25 days after topping.

The preceding spacing and harvesting results are based on four years' tests which were conducted at the Summerland Station and in the district of Kelowna.

The difficulties of producing bright flue-cured leaf of high grade and quality are enumerated. Considerable improvement in grade and quality of leaf was attained in the second year of this test. The two years' test yielded no first-class leaf of any grade and none of wrapper or cutter quality. The results indicate that even with judicious irrigation and cultural care, that during peak temperatures, it is extremely difficult to sustain the tobacco plant in healthy condition when it is grown on the lighter sandy soils characteristic of the British Columbia Dry Belt.

Commercial type and grades of bright flue-cured leaf are given in tabulated form.

The effect of soil type on yield and quality of bright flue-cured tobacco, the lighter soil, namely, a medium fine sand, yielded a higher percentage of bright leaf in comparison with a sandy loam.

Commercial investigations show that the inclusion of a small percentage of Summerland bright flue-cured leaf with Sumas leaf improved the blend. This blend has found a ready sale throughout the province.

Some observations of commercial tobacco crops in the province for four years, 1926 to 1929, are herewith given.

Yearly, flea beetles continue to take heavy toll of young tobacco plants in the field. Timely spraying with a nicotine sulphate dust spray is essential if the young plants are to make rapid growth. For fuller information on the control of this pest, consult pamphlet Number 80, "The Cabbage Flea-Beetle and Its Control in British Columbia" by the Dominion Department of Agriculture.

Where wireworms are known to infest the land it is practically impossible to secure a satisfactory stand of plants. It is very doubtful as to whether it pays to plant tobacco on land infested with wireworms.

Types of tobacco which are known to the Canadian trade and of proven varieties are material aids in successful marketing.

Probably the major factor which is depressing the efforts of British Columbia tobacco growers to attain leaf of higher grade and quality is their failure to produce sturdy well hardened plants early in season. Many growers have been transplanting from 10 to 20 days too late for their particular season. Each grower should determine the earliest date in which it is safe to transplant tobacco under his particular soil and environment and then try to produce sturdy plants by that date. Early planting has a marked influence on the effects of all cultural and curing operations.

POULTRY*

INTRODUCTION

At the conclusion of 1929 the Station flock, consisting of White Wyandottes, numbered 436 birds, divided as follows: 5 adult males, 46 cockerels, 162 breeding hens, and 223 pullets.

The past year has brought continued success in all directions. Hatching results were the best on record, chick mortality down to the low figure of last year, rearing results very good, and the production of the pullets surpassed all former records.

The average production of the 139 pullets, which finished their first laying year during the past fall and early winter, was 233·94 eggs per bird, or approximately 3 eggs per bird better than the year previous. These birds had been bred from a breeding flock averaging 210 eggs per bird in their pullet year. This is a substantial increase which goes to prove the real value of pedigree breeding. In this flock of 139 pullets were three that laid more than 300 eggs apiece, and 42, or thirty per cent that laid 250 eggs or more.

Another result of the year's work has been the increase in size of eggs, also due to pedigree work and the elimination of breeding hens laying small sized eggs.

Fertility during the incubation season was especially good, 86·4 per cent being recorded. Hatchability was 73·4 per cent of fertile eggs. While these percentages may not seem high to poultrymen who keep White Leghorns, owners of White Wyandottes will appreciate the fact that they have a breed not given

* The work in this Division is under the charge of Mr. D. G. Denny, head poultryman, who has been entirely responsible, under the superintendent, for this work and has prepared this section of the report.

to high fertility as a general rule. Ninety-eight point two per cent of chicks hatched were alive when wing-banded at three weeks old, after which the only losses suffered were due to the depredations of hawks, or to the usual minor accidents.

Following this are details of experiments it has been possible to carry out successfully during 1929.

VARIATION IN PRODUCTION OF FIRST, SECOND, AND THIRD YEARS

(Project 60)

It is only natural that a hen will not lay as many eggs during her second year as she does during her first. In the second year she passes through a moult, besides which, in the majority of cases, there ensues a pause in production, possibly provided by nature to allow the bird to build up her strength and constitution weakened to some extent by the heavy production of modern breeds and strains of poultry.

In a few isolated cases it may be that hens have laid more eggs during the second year than during the first. Amongst all the birds under observation on the Station plant over a period of ten years, only one case of this has occurred, that being due to sickness during the pullet year and recovery to normal health later. Actually this bird laid 146 eggs in the pullet year and 206 in the second; incidentally she gave a number of high producers, which unfortunately laid small eggs. So that it is safe to say that this condition of more eggs in the second or subsequent years than in the first is only brought about by some abnormal variation in the health of the bird during the pullet year. It is interesting to note, that 28 per cent of the hens that completed their third year of laying, produced more eggs in the latter year than in the second. This is not due to sickness in the first or second years, but is no doubt solely due to individuality.

Unless birds are to be retained for breeding purposes it is doubtful whether it will pay to keep them through the second winter even although they have produced extraordinarily well previously. In British Columbia high prices for eggs are realized from September to December, after which they drop, notwithstanding the fact that in the Interior of the Province the severest climatic conditions usually prevail during January. The wisest procedure if no breeding is contemplated would be to market all pullets as they complete their first laying period.

A tabulation of the production, divided into yearly periods of all birds that actually completed two or three years of laying, has been made to ascertain the per cent variation in production from year to year. These records have been gathered during the past nine years.

TABLE 39.—PRODUCTION IN FIRST, SECOND AND THIRD YEAR

Number of birds	Eggs laid						Per cent decrease in production 1st to 2nd year	Per cent decrease in production 2nd to 3rd year	Per cent decrease in production 1st to 3rd year
	1st year		2nd year		3rd year				
	Total	Average per bird	Total	Average per bird	Total	Average per bird			
243.....	53,878	221·7	35,411	145·7	.....	.....	34·2	.....	.....
60.....	13,261	221·02	9,060	151·0	8,220	137·0	31·7	9·3	38·0

It will be seen that there is a 31 to 34 per cent decrease in production in the second year plus a further decrease of over 9 per cent in the third year. This decrease in production appears to vary just as much among high producers as among low producers.

STRAW VERSUS ALFALFA

(Project 73)

In the South Okanagan district of British Columbia where this Experimental Station is situated there are very few cereal crops grown, so that most of the straw used for litter and bedding of livestock must necessarily be imported. Other districts of Canada are no doubt similarly situated. But in this locality it is possible to grow three crops of alfalfa each season, and in order to test out the comparative values of this and straw this experiment was commenced.

Two pens of 42 pullets each were housed, handled and fed alike, except that one pen was littered down with alfalfa hay and the other with straw.

The results in the following table are worked out on the basis of one bird in order to create an easier comparison. The value of litter has not been reckoned at all, as it is assumed it is balanced by the enhanced value of the manure. Figures given cover the period of four months, December 1, 1928, to March 31, 1929.

TABLE 40.—RESULTS OF STRAW VS. ALFALFA TEST

Special litter	Total weight of feed per bird	Total value of feed	Eggs laid	Value of eggs	Feed cost per dozen	Profit per bird over cost of feed
	lb.	cts.		$	cts.	$
Straw	40·7	93	75·8	1 97	14·7	1 04
Alfalfa	37·5	86	80·7	2 09	12·6	1 24

In comparing the results it will be noted that the pen on alfalfa consumed over three pounds of feed less than the other pen, whereas if the amount of litter eaten by the birds had been considered it would in all probability have been found that they consumed more. It was found that the alfalfa leaves were taken in great quantities and that in a short time only the stalks remained. This necessitated the cleaning of the floors more frequently in this pen, in fact every two weeks where the birds were confined was not too often, compared with three weeks in the straw pen. With alfalfa litter the birds laid practically five eggs a bird more and the profit over cost of feed amounted to a difference of exactly twenty cents. This may not sound such a great deal, but it must be remembered that this is for only one bird, and if multiplied by the number of birds in the poultryman's flock would make an appreciable amount. From a standpoint of health, no data are available, as no sickness developed or deaths occurred during the progress of the experiment.

RELATION BETWEEN ANNUAL PRODUCTION, SIZE OF EGG, BODY WEIGHT, AND AGE FIRST EGG LAID

(Projects 202, 203, 204, 57 and 163)

The opinion has frequently been voiced that the age of a pullet at the date of her first egg determines to some extent her production for the first year, which may in turn affect the size of the egg laid.

In order to discover what relationship, if any, exists between these factors, in conjunction also with that of body weight, a tabulation has been made of 300 pullets raised on the Station during the past six years.

Unfortunately, it has been found impossible to include in the tables details of birds which were culled before termination of their laying year, as complete figures are not available for that reason. But it is significant to note in going over the incomplete records of these birds that where they were culled for laying small eggs they were among the pullets which matured earliest. Also, where birds were culled for low production the majority came from those in the category of slower maturing stock.

Records in the following tables have, of course, been made in trap nests. In the first group the class range for production is 25 eggs.

TABLE 41.—RESULTS OF EXPERIMENT

First year's production of eggs	Number of birds	Mean age to first egg	Mean egg weight per dozen	Mean body weight	
		days	oz.	lb.	oz.
Below 176	7	171·4	24·36	6	$3\frac{4}{10}$
176–200	54	198·7	24·70	5	$10\frac{4}{10}$
201–225	83	190·8	24·52	5	$14\frac{6}{10}$
226–250	101	185·2	24·15	5	$10\frac{5}{10}$
251–275	41	181·3	24·09	5	$10\frac{6}{10}$
276–300	7	167·0	23·69	5	$9\frac{4}{10}$
Over 300	7	170·3	23·21	5	$11\frac{1}{10}$

In this table it is of outstanding note that, except in one instance, the size of egg diminishes as production increases. Also there is a perceptible correlation between production and age at first egg, for eliminating the first category in the table, production decreases when the bird takes longer to mature. There is nothing significant about the body weight variations.

On the following group the class range for age at first egg is fifteen days.

TABLE 42

Age to first egg in days	Number of birds	Mean egg production	Mean egg weight per dozen	Mean body weight	
			oz.	lb.	oz.
140–155	19	229·4	23·96	5	15
156–170	82	233·4	24·16	5	$12\frac{3}{10}$
171–185	78	233·6	24·11	5	$14\frac{3}{10}$
186–200	39	218·1	25·14	5	$12\frac{2}{10}$
201–215	34	213·9	24·86	5	$8\frac{2}{10}$
216–230	31	219·9	24·86	5	$4\frac{2}{10}$
231–245	9	211·1	24·58	5	$15\frac{1}{10}$
246–260	6	225·7	24·68	5	$8\frac{3}{10}$
261–275	2	179·5	25·95	5	$3\frac{5}{10}$

Again in this table there appears to be a relation between age and production although in the class 246-260 days the average production of the six birds is the fourth highest in the table. This was due to the presence in this category of two high producing birds. There is no marked relation between age and egg weight, or between age and body weight.

In the next table the class range for egg weight is one-tenth of an ounce per dozen eggs.

TABLE 43

Egg weight per dozen	Number of birds	Mean egg production	Mean age to first egg	Mean body weight	
			days	lb.	oz.
20–21	6	243·7	171·5	5	$4\frac{3}{10}$
21–22	10	241·8	184·8	5	$6\frac{9}{10}$
22–23	26	234·1	176·3	5	7
23–24	56	224·6	176·6	5	$11\frac{4}{10}$
24–25	104	228·5	190·2	5	$10\frac{8}{10}$
26–27	28	219·3	187·8	6	$2\frac{2}{10}$
27–28	13	211·3	200·6	5	$13\frac{1}{10}$
28 and over	6	207·2	201·5	6	$1\frac{5}{10}$

This table shows a decided relation between egg weight and production. Looking at the problem in the light of averages, the more the bird lays, the smaller will be her eggs. Also the early maturing birds would appear to lay smaller eggs. There is shown in this table an influence of body weight on size of egg.

A summary of results shows that age to sexual maturity influences production, which in turn has a bearing upon size of egg. Therefore, age is at least indirectly related to egg size.

Body weight would also appear to influence egg size. In table 43, it will also be noted that body weight increases although somewhat erratically, in conjunction with an increase in the age at first egg. Again, it would appear that an inverse correlation exists between body weight and egg production.

FEEDS FOR FERTILITY, HATCHABILITY AND VIABILITY

(Project 104b)

It is the constant aim of all careful poultrymen to develop, or maintain, standards in the various phases of their work. So much of the year's success depends upon the number and quality of the chicks hatched each spring that any experiment along the above lines is important. Free range for breeding pens has long been recognized as most useful from a fertility standpoint. Throughout most of the Dominion of Canada it is impossible to provide range during the winter months, owing to climatic conditions, so poultrymen are forced to confine their birds, and face the question of what are the substitutes for range.

The results obtained on this Station over the past three years may make interesting reading to those poultrymen whose hatching records are unsatisfactory. Of course, it must be understood that disease, poor stock and faulty incubation are apart from this experiment. These conditions cannot be overcome by feeding methods.

Over the three years, 1927, 1928 and 1929, three methods of feeding, which it was thought would have a bearing on fertility, hatchability and viability, have been practised.

These methods were as follows:—

Year 1927.—Straw litter, mangels as green feed, no cod liver oil.

Year 1928.—Straw litter, mangels as green feed, cod liver oil during breeding season.

Year 1929.—Alfalfa litter, mangels as supplementary green feed, cod liver oil during winter and breeding season to both males and females.

The amount of cod liver oil fed was two per cent in the dry mash.

Results were as follows:—

TABLE 44.—RESULTS OF FEEDING EXPERIMENT

Year	Eggs set	Fertile	Per cent fertile	Hatched	Per cent fertile hatched	Per cent total eggs hatched	Per cent chick mortality to three weeks of age
			%		%	%	%
1927.....	399	290	72·7	205	70·7	51·4	7·3
1928.....	861	573	66·5	384	67·0	44·6	1·8
1929.....	1,337	1,156	86·5	848	73·4	63·4	1·8

It will be readily noted that, even with more eggs set and chicks hatched in 1929, the figures are much better than in the two preceding years. As a matter of fact, the 1929 figures are the best since the establishment of the poultry plant on this Station. The feeding and management as outlined under this year, is to be recommended, especially where alfalfa can be easily grown. But it is to be emphasized that the methods must be employed during the winter months preceding the breeding season, and the same treatment given to males as females.

INFLUENCE OF AGE AT FIRST EGG UPON BROODINESS

(Project 205)

It was shown in the Summerland Station report for 1928 that broodiness and production in White Wyandottes are more or less related, in that where high production prevails in a flock less broodiness will be encountered than in a flock of low producers. This will probably be the same with other breeds of poultry.

In making a study of broodiness in the flock of pullets, which concluded their first year of laying during the Fall of 1929, a rather remarkable table of figures has been evolved.

TABLE 45.—BROODINESS AND PRODUCTION

Age in days	Number of birds	Number of times broody first year									Per cent not broody
		0	1	2	3	4	5	6	7	8	
140–149.....	5		1	2	1	.....	.....	.....	1	.....	0·0
150–159.....	21	7	5	3	3	1	1	1	.....	.....	33·3
160–169.....	24	13	2	5	1	2	.....	.....	.....	1	54·1
170–179.....	24	15	3	2	1	1	1	.....	1	.....	62·5
180–189.....	15	10	2	.....	1	1	1	.....	.....	.....	66·7
190–199.....	13	9	1	3	.....	.....	.....	.....	.....	.....	69·2
200–209.....	8	4	.....	2	.....	.....	1	1	.....	.....	50·0

The class range for age, i.e., the number of days from hatching date to date of first egg, has been set at 10 days.

The last column presents a clear idea of the results of this tabulation. It will be seen that the earlier the birds matured in the Station flock, the more likely were they to show broody tendencies. In fact, as the age to maturity increases so the number of non-broody birds also increases with the sole exception of the last category where the percentage of non-broody birds was 50. The earliest birds in this flock commenced laying during August, and the last during November, so that a number of them had produced heavily by the time spring arrived. It may be that, having laid so heavily and for so long under varying climatic conditions peculiar to fall and winter these earlier maturing birds were more susceptible to what some poultrymen and investigators would term Nature's recuperative provision—broodiness.

BACILLUS PULLORUM INFECTION OF FOWL

(Project 191)

In accordance with the adopted policy of testing all adult females for bacillus pullorum disease prior to each breeding season, the blood samples of all mature female breeding stock consisting of 119 yearlings, and 44 older hens, were sent to the Dominion Pathologist for test on December 19, 1929. All these samples proved negative. No reactor to the disease has been found on the plant since January, 1928 when the last case was discovered and the bird culled, so that it may now be safely said that the flock is pullorum-free. The table below gives the results of all tests carried out to date.

TABLE 46.—TESTS FOR BACILLUS PULLORUM

Description	Test—March 1927			Test—January 1928			Test—November 1928			Test—December 1929		
	Number tested	Reactors	Percentage	Number tested	Reactors	Percentage	Number tested	Reactors	Percentage	Number tested	Reactors	Percentage
Adult females...	110	77	70·0	18	0	0·0	.....	.....	.....	44	0	0·0
Pullets, 1926....	265	199	75·1	24	1	4·2	.....	.....	.....	.....	.....	.....
Pullets, 1927....	.....	.....	.....	.....	.....	.....	79	0	0·0	.....	.....	.....
Pullets, 1928....	.....	.....	.....	.....	.....	.....	.....	.....	.....	119	.....	0·0
	375	276	71·9	42	1	2·2	79	0	0·0	163	0	0·0

These figures give a good idea of what may be accomplished in cleaning up pullorum disease by blood testing followed by good sanitation methods and care. Chick mortality has been reduced to a minimum through the elimination of all reactors in the breeding stock. Mortality in the chicks may be called normal, as 1·8 per cent would cover the losses that any poultry plant must suffer each season up to the time the youngsters are three weeks old.

By comparing the following table with the previous one it will be seen how chick mortality has been decreased.

TABLE 47.—CHICK MORTALITY

Year	Chicks hatched	Mortality in three weeks	Per cent alive at the end of three weeks	Remarks
1924.....	835	522	37·7	
1925.....	1,366	438	67·9	Chicks confined first month.
1926.....	953	69	92·7	
1927.....	205	15	92·7 *	*Breeding stock tested.
1928.....	384	7	98·2 *	
1929.....	848	15	98·2 *	

Chick mortality during the 1926 season was far below that of the two previous seasons, although at that time the breeding stock had not been tested. However, the disease was suspected and the newly hatched chicks were therefore confined to the brooder houses for the first month, even though the sheds had been moved to new ground. This in conjunction with the frequent changing of litter appears to have kept losses down.

With all disease outbreaks the main thing to remember is to adopt drastic sanitary measures, which is the first and most important step towards a cure.

OTTAWA: Printed by F. A. ACLAND, Printer to the King's Most Excellent Majesty, 1930.