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 1930

This log cabin on the Station grounds provides accommodation for visitors.

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DOMINION EXPERIMENTAL STATION, SUMMERLAND, B.C.

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

THE SEASON

The winter of 1929-30 was unusually severe, although the prolonged low temperatures were almost all confined to the month of January. This, however, was the coldest month on record at this Station, the mean temperature being 10·74° F., the average for January over a period of fifteen years being 24·03° F. February was warmer than the average. March was about normal, April slightly warmer, but cold night temperatures persisted throughout the months of May and June. Snow remained on the hills and plant growth was very slow. Although the summer months were cooler than usual with less sunshine, growth conditions were excellent, where satisfactory soil moisture conditions could be maintained. Snowfall during the winter, with the exception of one fall in December, was very light, and as this followed a dry year, the natural spring soil moisture was somewhat deficient. This condition, however, was relieved by some good rains in March, April, and May, followed by a very dry summer and autumn. The total precipitation for the year was 8·15 inches, the fifteen-year average being 9·10 inches. There was a scarcity of irrigation water during the late summer months and many orchards throughout the district suffered from want of moisture. During the greater part of August a heavy pall of smoke from forest fires hung over the valley, often obscuring the sun, and this undoubtedly in some degree detrimentally affected the ripening of fruits and vegetables.

Following is a summary of meteorological data for the year 1930, also average temperatures, precipitation, and sunshine over a number of years:—

METEOROLOGICAL RECORDS, 1930

1930	Temperature (°F.)						Precipitation						Evaporation
	Mean		Maximum		Minimum				Total precipitation		Sunshine		
	1930	Average 15 years	Highest	Mean Maximum	Lowest	Mean Minimum	Rain	Snow	1930	Average 15 years	1930	Average 14 years	
	°	°	°	°	°		in.	in.	in.	in.	hours	hours	in.
January	10·74	24·03	38	16·61	−6	4·87	.....	6·5	0·65	0·87	72·6	52·2	.....
February	34·87	29·01	56	42·25	13	27·50	0·06	1·5	0·21	0·52	119·1	98·3	.....
March	38·92	39·04	68	48·39	13	29·45	0·04	13·2	1·36	0·58	176·8	141·3	.....
April	51·81	47·51	71	63·03	32	40·60	0·97	.....	0·97	0·75	177·2	191·0	2·40 (23 days)
May	54·69	56·21	80	66·06	32	43·32	1·28	.....	1·28	0·73	205·8	231·1	3·97
June	60·71	63·27	87	71·40	44	50·03	0·85	.....	0·85	1·07	212·5	246·0	4·82
July	69·70	70·59	100	83·06	47	56·35	0·17	.....	0·17	0·60	339·9	325·1	6·24
August	69·52	68·82	93	82·22	48	56·93	0·42	.....	0·42	0·77	265·8	271·3	4·96
September	60·29	59·14	83	70·83	35	49·76	0·53	.....	0·53	0·73	190·9	203·1	2·83
October	50·46	48·34	79	63·19	24	37·74	0·92	.....	0·02	0·80	122·5	143·9	0·73 (11 days)
November	35·41	36·25	57	40·66	22	30·16	0·29	4·0	0·69	0·38	53·0	62·2	.....
December	29·69	27·75	44	34·39	13	25·00	.....	1·0	0·10	1·30	36·4	40·2	.....
Totals	.....	.....	.....	.....	.....	.....	5·53	26·2	8·15	9·10	1,972·5	2,005·7	.....

HORTICULTURE

APPLES*

Apple growing constitutes the major agricultural enterprise in the territory served by this Station. For this reason special attention is devoted to study of problems encountered in the production of this fruit. Experiments under way deal with breeding, propagation, cultural methods, fertilizers, irrigation practice, pruning, top-grafting, thinning, harvesting and storage. The extensive data recorded make it impossible to report complete details of each project each year. Accordingly the most important findings are summarized and brought to the attention of growers through the medium of short press articles. For the benefit of those who are interested in the methods by which this information has been secured a fairly comprehensive presentation of one or more individual projects is embodied in each annual report. In this way, tabulated data concerning cultural, thinning, pruning, harvesting, and breeding projects have already been published. Continuing this policy, the following pages are devoted to a discussion of the methods of procedure followed and results secured from apple storage experiments carried out during the past ten years.

APPLE STORAGE INVESTIGATIONS

(Project H. 29)

This project was started in 1921. At that time it was already apparent that rapidly increasing production of apples in the irrigation sections of British Columbia would soon necessitate storage of a portion of the crop. Men with foresight perceived that only by extending the marketing season could the additional tonnage be disposed of in such a way as to bring profit to the producer. It was also realized that storage of such a perishable product as apples would bring with it many new problems.

To assist in the solution of these problems this Station constructed a series of four storage chambers having a combined capacity of about 600 bushel boxes. Each chamber was equipped with separate ventilating flues. These chambers were used to determine the range of temperature and humidity which can be secured in non-refrigerated storage houses. The behaviour of British Columbia apples under these common storage conditions was ascertained and the data recorded were summarized in the annual report of this Station for 1923.

In 1925 a refrigerated storage house was constructed by the Kelowna Growers' Exchange. With the co-operation of the Dominion Fruit Branch and the provincial Department of Agriculture arrangements were made to compare the life of apples held in this refrigerated storage with the behaviour of similar lots of fruit held in three common storage houses. Extensive experiments involving several hundreds of boxes of apples were carried out and the results were checked during three successive seasons. The most important findings were presented in the 1925 and 1926 reports of this Station.

In the course of his investigations of the British Columbia fruit industry, Commissioner Sanford Evans became impressed with the desirability of extending the market season of British Columbia apples by the use of cold storage. He realized, as others had done, that if part of the heavy tonnage of autumn varieties could be kept in good condition through the winter season, the marketing position of British Columbia apple growers would be very greatly strengthened. Commissioner Sanford Evans also appreciated the fact that detailed information regarding the storage requirements and storage behaviour of apples

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

is necessary before intelligent use can be made of refrigeration. Accordingly, he conceived the idea of a large scale experiment which would draw attention to the important role of cold storage in modern marketing methods, and at the same time provide valuable data concerning the life history of British Columbia apples grown, packed, shipped, and stored under commercial conditions. Since this experiment not only furnishes confirmation of information published during the past nine years, but also contributes some new data and provides a good example of the methods of investigation employed, it is discussed at length below.—

CO-OPERATING AGENCIES

The apples used in this experiment were secured through the courtesy of the Associated Growers of B.C. Limited, Sales Service, Limited, and Mr. T. Abriel, President of the British Columbia Fruit Growers' Association.

The Canadian National and Canadian Pacific Railways provided free transportation of the fruit from the interior of the province to the coast.

The Pacific Coast Terminals at New Westminster furnished free storage space, and offers of similar facilities on the same generous terms were received from the Vancouver Ice and Cold Storage Company, the Mainland Cold Storage Company, the Victoria Cold Storage and Terminal Warehouse, and the Wilson Storage Company.

The Provincial Department of Agriculture provided the services of Messrs. H. Evans, B. Hoy and R. P. Murray to assist in examining the fruit as soon as it was placed in storage at Vernon, Kelowna and Penticton respectively. Similarly, this department furnished two inspectors, Messrs. G. E. W. Clarke and T. Anderson, to assist in examining the fruit during the storage period—a duty involving many days of painstaking observation under low temperature conditions.

The Fruit Branch of the Dominion Department of Agriculture delegated Inspectors J. W. Laidman, A. E. Henderson and W. T. Fleet to assist in examining the fruit at time of storage in Vernon, Kelowna and Penticton respectively, and Inspector Wm. Coell to assist in the extensive examinations carried out at New Westminster. The Fruit Branch also supplied thermographs to record the temperature conditions encountered by the fruit while in transit from the interior of the province to the coast, and instructed Transportation Specialist G. F. Clingan to install the thermographs and make detailed records regarding loading and shipping conditions.

The Summerland Experimental Station permitted the writer to supervise the entire project, analyse the data secured and prepare the report.

SOURCE AND CHARACTER OF THE FRUIT

It was realized at the outset that the storage life of apples is influenced not only by variety but also by the conditions under which the fruit is grown. Accordingly, the material used in this experiment included several varieties secured from various districts in the interior of the province. Thus 50 boxes of Wealthy were secured from Salmon Arm, and fifty boxes of Rome Beauty were obtained from Nakusp. Two hundred boxes of Delicious and an equal amount of McIntosh and Jonathan were secured from each of the Vernon, Kelowna and Penticton districts. Two thousand boxes of Newtown were obtained from Penticton and 200 boxes of this variety were secured from Oyama and Kelowna. One hundred boxes of Newtown were secured from Summerland and Kaleden.

In order to ascertain the influence of grade and size on the keeping quality of the fruit, a range of grades and sizes of each variety from each source was secured whenever possible. In all cases, the fruit was selected from stock which had been subjected to the regular commercial grading, packing and handling processes.

STORAGE TREATMENT

The fruit from Salmon Arm, Oyama and Vernon was assembled at Vernon and placed in cold storage as soon as possible after being packed. The apples obtained from Kelowna were placed in cold storage at that point. The fruit from Nakusp, Summerland, Kaleden and Penticton was placed in cold storage at Penticton, with the exception of 750 boxes of Newtown which were shipped to New Westminster in a ventilated car immediately after they had been packed. The cold storages at Vernon, Kelowna and Penticton are operated by the Associated Growers of British Columbia, Limited. These storages are cooled by indirect refrigeration of the air circulation type. Temperatures approximately 32° F., and relative humidities ranging between 80 and 90 per cent are maintained.

Early in November, the fruit assembled at Vernon, Kelowna and Penticton was loaded into refrigerator cars and shipped under refrigeration to New Westminster. On arrival at Westminster most of the apples were placed in a 32° F. storage room cooled by indirect refrigeration. Representative lots of each variety were placed in a similar room which was held at a temperature of 36° F. In both rooms a relative humidity between 80 and 90 per cent was maintained.

LOADING AND TRANSIT CONDITIONS

Loading of the fruit in the cars and bracing of the loads was carried out according to usual commercial practice. With the exception of 750 boxes of Newtown shipped in a ventilated refrigerator car without ice, all fruit was forwarded from the interior points to the coast in refrigerator cars fully iced at point of shipment. A period of four or five days elapsed between date of loading in the interior and date of unloading at New Westminster.

Two thermographs were placed in each car at time of loading, one at the floor level near the bulkhead, and the other in the centre of the car in the top layer of boxes. The records secured from these thermographs indicate the temperature conditions experienced by the fruit were not in any way unusual. In the cars shipped from Vernon and Kelowna, the temperatures at the floor level ranged from 54 to 34° F. with an average of about 36° F. In the upper part of the car the temperatures ran about two degrees higher than on the floor level. In the two refrigerator cars shipped from Penticton, temperatures on the floor level near the bulkhead ranged from 44 to 28° F. with an average of about 32° F. The thermographs placed in the middle of the cars recorded temperatures from three to six degrees higher than those recorded near the bulkhead.

In the ventilated car shipped from Penticton, temperatures recorded on the floor level ranged from 66 to 46° F., with an average of about 50° F. In the centre of the car the temperatures ran about two degrees higher than they did near the bulkhead.

METHODS OF RECORDING DATA

On the day that apples are picked they are commonly somewhat too hard in texture and acid in flavour to suit most tastes. As the ripening process continues they become sweeter, softer, less acid and more attractive in flavour, finally reaching what might be termed the "eating ripe" stage. This in turn is followed by an "over-ripe" condition often characterized by mealiness, flesh discoloration and the development of disagreeable flavour. The rate at which these changes take place differs with the variety and with the storage conditions to which the fruit is subjected. The most easily measured change which takes place in apples as they mature is the softening of the flesh. During recent years several mechanical devices for measuring the firmness of the flesh have been developed. With the type of pressure tester used in this investiga-

tion a rounded metal point $\frac{7}{16}$ of an inch in diameter is forced to a depth of $\frac{5}{16}$ of an inch into the peeled flesh of the fruit. The pressure required to perform this operation is recorded in pounds.

To secure a comprehensive record of the hardness of the fruit at the time it was placed in storage, pressure tests were made on fruit from ten boxes of each variety from each source. The boxes were selected to provide a range of grades and sizes. Three pressure tests were made on each of ten apples from each box and the results averaged. Record was also kept of the highest and lowest pressure recorded for each box. Similar pressure determinations were made on fruit from the same boxes at bi-monthly intervals during the storage period.

The commercial life of apples is often terminated by factors other than the normal ripening processes. The stage of maturity at which the fruit is picked may render it susceptible to physiological diseases, mechanical injury may lay it open to fungal attack, or unfavourable storage conditions may bring about premature death.

In order to secure accurate information as to the specific causes of deterioration in the fruit included in this experiment a very thorough inspection was made at the time the apples were placed in storage, careful records being kept of maturity, diseases, insect and mechanical injuries, sizing, trueness to grade, wrapping, and general character of pack. This systematic examination was carried out with ten boxes of each variety from each source.

When the fruit was removed from storage even more detailed observations were recorded, special attention being paid to the development of shrivelling, scald, spotting, bruises, skin punctures and rots. Cutting tests were carried out to ascertain the prevalence of breakdown and flesh discoloration. The cut fruits also provided material for determination of flavour, texture, and maturity as judged by actual taste.

The number of specimens affected with shrivelling, scald, bruises, etc., was recorded. Furthermore, the severity of the injury on each fruit was classified as "slight," "moderate," or "excessive."

"Slight" indicated that the injury was apparent to the trained eye of the inspector but not likely to be noticed by the general public.

"Moderate" injuries were those readily apparent but not considered sufficiently serious to prevent sale of the fruit at a reduced price.

"Excessive" injuries were those considered sufficient to render the fruit unsaleable.

While this classification is admittedly of an arbitrary nature, it insured a record of the relative severity of the injuries and defects in the various lots of fruit.

STORAGE LIFE OF MCINTOSH

The general condition of the McIntosh secured from Vernon, Kelowna, and Penticton at time of storing and at bi-monthly intervals during the storage period, as indicated by pressure tests, is shown in table 1. Each figure is the average of pressure determinations made on 100 apples.

TABLE 1.—CONDITION OF MCINTOSH AS INDICATED BY PRESSURE TESTS

District	Average hardness in pounds—32° F. storage			
	Sept. 25–27	Dec. 2	Feb. 10	April 8
Vernon	12·5	10·5	9·1	7·7
Kelowna	11·8	10·3	9·2	7·6
Penticton	14·1	11·7	9·6	8·2

It will be noted that the fruit secured from Penticton was harder than that from Vernon and Kelowna at time of storage and also at the December, February, and April inspections. Reference to the storage records reveals the fact that the Penticton McIntosh were reduced to a temperature of 32° F. within two days of being packed, whereas the fruit from Kelowna and Vernon was held at packing house temperatures for about a week before being placed in cold storage.

The full significance of the information presented in table 1 becomes apparent when it is considered in conjunction with the data set forth in table 2.

TABLE 2.—INFLUENCE OF DELAYED STORAGE ON LIFE OF MCINTOSH

Days delay before storing at 32° F.	Hardness when removed from storage	Days life after removal from storage
1	12·0	54
8	10·9	40
15	10·1	29
22	9·5	21
60	8·2	3

The information presented in table 2 was secured from 25 boxes of McIntosh grown at the Summerland Experimental Station. This fruit was all picked and packed on September 26. It was then divided into five similar lots of five boxes each. One lot was placed in a 32° F. storage the next day. Three lots were held in the packing house (where the temperature ranged from 68 to 50° F., averaging about 57° F.) for 8, 15 and 22 days respectively before being placed in cold storage. The fifth lot was held at a temperature of 60° F. The hardness of all lots was determined on November 25. They were then removed to a ripening room maintained at a temperature of 60° F. The apples were examined at frequent intervals to ascertain the number of days required to reach the overripe condition. This condition was considered to have been reached when the fruit averaged 8 pounds in hardness. Specimens having a hardness of less than 8 pounds were found to have lost the crisp texture and delicate flavour characteristic of prime McIntosh.

The data set forth in table 2 suggest that McIntosh kept at a temperature of 60° F. cannot be expected to remain in prime eating condition for more than two months. Furthermore, fruit which was delayed for three weeks at packing house temperatures and then placed in cold storage for five weeks became overripe in about three weeks after removal to a temperature of 60° F. Assuming that a period of about three weeks at temperatures approximating 60° F. is required to deliver apples from storage through the regular wholesale and retail channels, to the consumer, it would have been inadvisable to hold these apples longer in cold storage. On the other hand, the lot which had been placed in cold storage the day after picking was still quite hard and immature when removed on November 20. This fruit could probably have been held for another three months in storage and still delivered to the consumer in prime eating condition.

The figures presented in table 2 suggest that it is inadvisable to hold McIntosh in storage after they have ripened to a hardness of 9½ to 10 pounds as measured by the pressure tester. It may be well to remark that McIntosh having this hardness are in excellent eating condition. On this basis, the data incorporated in table 1 indicate that the Vernon and Kelowna McIntosh should have been removed from storage during December or early January, whereas the

Penticton fruit could have been marketed in good condition during February. Thus, a delay of a week in placing the Vernon and Kelowna fruit in cold storage reduced its possible commercial life by at least a month.

The data presented in table 1 indicate that McIntosh softened materially between February 10 and April 8. This softening was accompanied by other changes within the fruit. No serious flesh discoloration or shrivelling were recorded at the February inspection but significant percentages of the fruit were affected by these troubles by April 8. Data substantiating this statement are shown in table 3.

TABLE 3.—CONDITION OF McINTOSH AS INDICATED BY INJURIES AND DEFECTS

District	Percentage defects April 8—32° F. storage						
	Breakdown	Browning	Bruises	Punctures	Rots	Scald	Shrivelling
Vernon	5	28	10	15	2	0	5
Kelowna	0	28	2	8	2	3	7
Penticton	0	0	8	7	1	0	9

For simplicity only injuries classified as "excessive" (for definition of term see text under "Methods of Recording Data") are included in the tables unless otherwise specified. The information presented in table 3 was secured by examining ten apples from each of ten boxes from each district. Two types of flesh discolorations were observed. In one the flesh became soft and mushy and turned a dark brown colour. This type is very similar in appearance to the disorder called "Jonathan Breakdown". Accordingly it is recorded as "breakdown" in table 3. The McIntosh variety appears to be quite resistant to this type of injury.

The other type of flesh discoloration was lighter in colour than breakdown and had little effect on the hardness of the fruit. It was accompanied by the development of mealiness, undesirable flavour and disagreeable odour. This second type has been observed to develop more rapidly at living room temperatures than it does in cold storage. In table 3 this second type of flesh discoloration is recorded as "browning". It will be noted that 28 per cent of the McIntosh from Vernon and Kelowna showed browning to a marked degree on April 8.

The high percentage of McIntosh affected with serious bruises and skin punctures is evidence that commercial handling practices resulted in material injuries to this variety. The comparatively thin skin and brittle texture of the McIntosh render it especially liable to skin punctures and bruises. It is evident that special care must be taken in the picking, grading, packing and handling processes in order to prevent high percentages of McIntosh reaching the consumer in a damaged condition.

In spite of the prevalence of skin punctures there was a relatively small percentage of McIntosh affected by rots, which is evidence that the conditions in cold storage discouraged the activity of rot-producing organisms. A few specimens of McIntosh from one district showed scald but this variety appears to be remarkably resistant to skin diseases.

Shrivelling of apples is due primarily to loss of moisture through the lenticles in the skin, thus the high humidity maintained in the storage rooms tended to prevent the development of this trouble. Nevertheless, shrivelling occurred to a serious extent in a small percentage of the McIntosh from each district. In some cases it followed mildew or mechanical injury, and it was

more prevalent in Cee grade fruit than in the Fancy or Extra Fancy grades. Data bearing on this point are presented in table 4.

TABLE 4.—INFLUENCE OF GRADE ON STORAGE LIFE OF McINTOSH

Grade	Percentage defects April 8—32° F. storage						
	Breakdown	Browning	Bruises	Punctures	Rots	Scald	Shrivelling
Extra Fancy	4	13	8	7	1	0	4
Fancy	1	14	5	10	2	0	3
Cee grade	0	29	7	13	2	3	14

In the above table, the data from table 3 have been rearranged to show the percentage of injuries and defects in the fruit from each grade. It will be noted that most of the shrivelling occurred in the Cee grade fruit. It is also apparent that there was more scald and flesh browning and less breakdown in the Cee grade than in the Extra Fancy and Fancy grades.

These differences in the behaviour of the grades are doubtless due to the stage of maturity at which the fruit was picked. McIntosh do not usually develop much red colour until they are ready to pick with the result that the Extra Fancy and Fancy grades do not contain many specimens which have been picked in an immature condition. The low colour requirement of the Cee grade, on the other hand, permits a good deal of prematurely picked fruit to qualify for this grade. Shrivelling, scald and browning appear to be characteristic of fruit which has been picked too soon, whereas breakdown is usually confined to fruit which has been left too long on the trees.

Size also has an important influence on the storage life of McIntosh. This statement is substantiated by the information tabulated below.

TABLE 5.—INFLUENCE OF SIZE ON STORAGE LIFE OF McINTOSH

Size	Percentage defects April 8—32° F. storage						
	Breakdown	Browning	Bruises	Punctures	Rots	Scald	Shrivelling
88–113	5	32	11	15	5	3	0
125–150	0	14	7	9	0	0	8
163–198	0	10	2	6	0	0	13

In table 5 the same data presented in tables 3 and 4 have been rearranged to show the influence of size on the prevalence of injuries and defects in McIntosh. It is evident that more breakdown, browning, bruises, punctures, rots and scald occurred in the large than in the medium and small sizes, while shrivelling was more pronounced in the small than in the large fruit.

All injuries and defects referred to above can be accounted for by growing conditions, harvesting procedure, or handling practices. Thus they are not due primarily to storage treatment. Nevertheless, the development of some of them may be materially influenced by the storage conditions to which the fruit is subjected. Data of interest in this connection are furnished in table 6.

TABLE 6.—INFLUENCE OF STORAGE TEMPERATURE ON LIFE OF McINTOSH

Storage temperature	Condition and percentage defects April 20					
	Hardness	Breakdown	Browning	Rots	Scald	Shrivelling
60° F.	6·5	0	35	18	0	45
36° F.	7·8	0	22	9	0	4
32° F.	8·2	0	28	2	0	6

The data incorporated in table 6 were secured by storing comparable lots of fruit at 60°, 36°, and 32° F. respectively. All lots were examined on April 20 to ascertain hardness and percentage of defects. It will be noted that the fruit held at 32° F. was materially harder than that held at 60° F. and slightly harder than that held at 36° F. Flesh browning, rots and shrivelling were more prevalent in the fruit held at 60° F. than that held at 36° and 32° F. No scald nor breakdown developed at any of the three temperatures. It is readily apparent that cold storage retarded the softening of the fruit and development of flesh browning, rots and shrivelling.

Information bearing on the behaviour of McIntosh after removal from cold storage was presented in table 2. Additional data are to be found in table 7.

TABLE 7.—BEHAVIOUR OF McINTOSH AFTER REMOVAL FROM 32° F. STORAGE

Date examined	Condition and percentage defects					
	Hardness	Breakdown	Browning	Rots	Scald	Shrivelling
April 8	7·8	2	18	2	1	7
April 15	7·5	2	22	4	3	12

The above data were secured by removing thirty boxes of McIntosh from the 32° F. storage room and holding them at a temperature of 60° F. for a week. Ten apples from each box were examined before and another ten apples from each box after the 60° F. treatment. The data recorded indicate that the fruit softened slightly, and some development of flesh browning, rots, scald, and shrivelling took place during the week. This behaviour is similar to that observed when McIntosh which have never been placed in cold storage are subjected to a temperature of 60° F. for a week. Taken in conjunction with the data shown in tables 2 and 6, this information indicates that McIntosh which have been held in cold storage do not ripen any faster on removal than does fruit of this variety which has never experienced low temperature conditions. It was noted, however, that very little yellowing took place in the skin of the MsIntosh held at cold storage temperatures, with a result that on removal from storage they appeared less mature than they really were. This probably accounts, at least in part, for the popular impression that apples ripen very rapidly after removal from cold storage. It also emphasizes the importance of removing apples from cold storage before they have reached an advanced stage of maturity.

STORAGE LIFE OF JONATHAN

A similar procedure to that outlined for McIntosh was carried out with the Jonathan obtained from Vernon, Kelowna, and Penticton. The condition of the fruit at time of storing and at bi-monthly intervals during the storage period, as indicated by pressure tests, is shown in table 8.

TABLE 8.—CONDITION OF JONATHAN AS INDICATED BY PRESSURE TESTS

District	Average hardness in pounds—32° F. storage			
	Oct. 9-20	Dec. 3	Feb. 11	April 10
Vernon	14·9	13·4	11·9	10·3
Kelowna	13·0	12·5	11·0	9·4
Penticton	15·1	13·2	11·8	10·4

A study of the data embodied in table 8 reveals that the Kelowna Jonathan were materially softer at time of storing and throughout the storage period than were those from Vernon and Penticton. This is probably accounted for by the fact that there was a delay of about two weeks between harvesting and cold storage of the Kelowna Jonathan. Inspection at time of storage also indicated a wide variation in maturity of the Kelowna Jonathan, thus apples having a hardness of 17 and 12 pounds respectively were found in the same box. The significance of this observation becomes apparent when it is borne in mind that Jonathan with a hardness of 12 pounds have reached the eating ripe stage and cannot be expected to remain in this condition for longer than three or four weeks at living room temperatures. The advanced stage of maturity of some of the Kelowna Jonathan when placed in storage was reflected in their subsequent behaviour. By February 11, 29 per cent of these apples tested 10 pounds or lower in hardness. By the time a Jonathan has softened to 10 pounds it has usually become meally in texture and lacking in flavour. Jonathan spot and breakdown were also more prevalent in the Kelowna Jonathan than in those from Vernon and Penticton. Data in support of this assertion are furnished in table 9.

TABLE 9.—CONDITION OF JONATHAN AS INDICATED BY INJURIES AND DEFECTS

District	Percentage defects April 10—32° F. storage						
	Bruises	Punctures	Rots	Scald	Shrivelling	Spot	Breakdown
Vernon	4	12	1	1	0	7	3
Kelowna	6	1	2	3	1	14	10
Penticton	7	8	1	2	2	4	2

It will be noted that there were fewer bruises and skin punctures in Jonathan than in McIntosh. Nevertheless there was more mechanical injury than is advisable in a variety used largely for dessert purposes. The percentage of specimens affected with rots, scalds, or shrivelling was very small, but a significant proportion of the fruit showed spotting of the type commonly called "Jonathan spot." These spots are dark brown or black in colour and often enlarge to a diameter of one-eighth of an inch or more. The injury is usually confined to the skin, but it spoils the appearance of the fruit and in this way materially reduces sales value. The spotting was observed to increase in severity after the apples were removed from storage. Evidence substantiating this statement appears in table 10.

TABLE 10.—BEHAVIOUR OF JONATHAN AFTER REMOVAL FROM 32° F. STORAGE

Date examined	Percentage fruit showing Jonathan Spot			
	Slight	Moderate	Excessive	Total
April 10	25	11	8	44
April 16	21	16	30	67

The data secured above were secured from thirty boxes of Jonathan removed from 32° F. storage to a 60° F. room on April 10. They indicate clearly that until an effective preventive for Jonathan spot is devised, extended storage of this variety is inadvisable even though the fruit may retain its crispness and flavour for a long period.

Susceptibility of Jonathan to breakdown adds another element of uncertainty to storage of this variety. While low temperatures retard the development of breakdown, they do not prevent it. This statement is borne out by the data embodied in table 11.

TABLE 11.—INFLUENCE OF STORAGE TEMPERATURE ON JONATHAN BREAKDOWN

Storage treatment	Percentage fruit showing breakdown			
	Nov. 19	Dec. 17	Jan. 15	Feb. 18
Cold 32° F.	0	6	11	14
Common 50-32° F.	8	10	11	12

These data were obtained by placing comparable lots of Jonathan in cold storage maintained at 32° F. and in common storage where the temperature ranged from 50° F. in October to 32° F. in January and February. It will be noted that a good deal of breakdown had developed in common storage by November 19, whereas no breakdown was observed in the 32° F. storage on this date. However, by January 15, just as much breakdown had developed in the fruit held at 32° F. as in that which was held in common storage. The danger of cold storing apples which are susceptible to breakdown lies in the fact that this disease is likely to develop very rapidly after the fruit is removed from storage to higher temperatures.

Experiments carried on by the Summerland Experimental Station during the past eight years indicate that susceptibility to Jonathan breakdown can be very largely prevented by harvesting the fruit at the proper stage of maturity. Nevertheless the heavy losses experienced in the past have so destroyed the confidence of fruit distributors in the keeping quality of this variety that rapid movement of Jonathan into consumption appears to be advisable.

STORAGE LIFE OF DELICIOUS

The rate at which Delicious softened in 32° F. storage is indicated by the data arranged in tabular form below.

TABLE 12.—CONDITION OF DELICIOUS AS INDICATED BY PRESSURE TESTS

District	Average hardness in pounds 32° F. storage			
	Oct. 12-16	Dec. 3	Feb. 11	April 9
Vernon	15·7	14·4	11·4	10·3
Kelowna	17·3	15·7	12·1	11·0
Penticton	17·4	15·3	12·0	10·6

In interpreting the figures presented in table 12, it should be borne in mind that Delicious having a hardness of 10 to 12 pounds are in excellent eating condition.

The rate at which Delicious softened was materially influenced by storage temperature. This statement is substantiated by the data embodied in table 13.

TABLE 13.—INFLUENCE OF STORAGE TEMPERATURE ON LIFE OF DELICIOUS

Storage temperature	Average hardness in pounds			
	Oct. 16	Dec. 3	Feb. 11	April 9
60° F.	16·1	9·5	9·0	8·2
36° F.	15·5	14·0	10·5	9·6
32° F.	15·7	14·4	11·4	10·3

The above information was secured by storing three comparable lots of Delicious at 60°, 36°, and 32° F. respectively. It is apparent that the fruit held at 60° F. ripened very rapidly. In fact it was mealy in texture and insipid in flavour by December 3. The Delicious held at 36° F. had reached the mealy stage by April 8, whereas the lot held at 32° F. was still in good eating condition on that date. Even the Delicious held at 32° F. should have been marketed before April 9, for most of them were mealy after being held for six days at 60° F. Judging by pressure tests, the Delicious stored at 32° F. could have been marketed to advantage during February or early March.

The Delicious is comparatively resistant to breakdown, skin punctures, bruises, rots, scald, spotting and shrivelling. The almost complete absence of these defects at the April examination is shown in the following table:—

TABLE 14.—CONDITION OF DELICIOUS AS INDICATED BY INJURIES AND DEFECTS

District	Percentage defects April 9—32° F. Storage						
	Bruises	Punctures	Rots	Scald	Shrivelling	Spot	Breakdown
Vernon	2	3	2	0	0	0	0
Kelowna	3	2	2	3	0	0	0
Penticton	1	3	1	0	0	0	0

This characteristic freedom from blemishes has no doubt contributed largely to the popularity of Delicious with fruit distributors and consumers. In order that this popularity may be maintained care should be taken to ensure arrival of Delicious at the consumer's table before mealiness develops. The fact that Delicious matures very rapidly at living room temperatures makes it especially important that this variety be placed in cold storage as soon as possible after harvesting. Only in this way can Delicious be delivered to the consumer in prime eating condition over an extended season.

Another important observation regarding Delicious was revealed by cutting tests made at the April examinations. It was found that the difference in quality between the Extra Fancy and Cee grades was greater with this variety than with any other variety included in this experiment. The flesh of Cee grade Delicious tended to be greenish in colour and lacking in that full rich flavour characteristic of Extra Fancy Delicious in their prime. This greenish flesh colour and deficiency in flavour were also observed in a high percentage of the Delicious from Vernon and suggest that this fruit was picked too early, from the standpoint of quality. As Delicious is used almost entirely for dessert purposes, it is especially important that this variety be picked at the proper stage of maturity to ensure full development of quality.

STORAGE LIFE OF NEWTOWN

The average hardness of Newtown from five sources at time of storing and at intervals during the storage period is shown in table 15.

TABLE 15.—CONDITION OF NEWTOWN AS INDICATED BY PRESSURE TESTS

District	Average hardness in pounds—32° F. Storage			
	Oct. 18-24	Dec. 3	April 8	June 12
Oyama	22·3	19·3	15·9	13·6
Kelowna	20·2	20·1	15·7	13·5
Summerland	20·7	20·5	15·5	13·4
Penticton	20·3	19·9	15·1	12·9
Kaleden	19·9	19·1	14·4	12·6

Attention is drawn to the fact that Newtown were kept in storage until June 12, two months later than the other varieties in this experiment. There was little difference in hardness of the apples from the various districts either at time of storage or during the storage period. The Newtown is a comparatively hard apple and is in good eating condition when it offers a resistance of 13 pounds as measured by the pressure tester. Accordingly it is evident from the data in table 15 that Newtown from all five districts were ripe enough to eat when removed from 32° F. storage on June 12. Additional data regarding their condition at this time are shown in table 16.

TABLE 16.—CONDITION OF NEWTOWN AS INDICATED BY INJURIES AND DEFECTS

District	Percentage defects June 12—32° F. Storage						
	Bruises	Punctures	Rots	Shrivelling	Scald	Browning	Breakdown
Oyama	5	10	7	0	0	7	2
Kelowna	2	2	0	0	24	0	3
Summerland	1	8	4	0	4	0	0
Penticton	0	4	3	0	5	1	2
Kaleden	1	7	5	0	0	32	3

The figures incorporated in table 16 suggest that Newtown is very resistant to bruising and shrivelling. The percentage of skin punctures and rots, however, was comparatively high, indicating the need for more careful handling.

Scald had already developed to a serious extent by June 12 in the Newtown from Kelowna. This is no doubt largely accounted for by the fact that the Kelowna Newtown were wrapped in plain wraps, whereas oiled wraps were used on the fruit from the other districts. It may be well to mention, however, that in other experiments carried out at the Summerland Station oiled wraps have proved only partially effective in the control of scald on Newtown.

What appear to be two distinct types of flesh discoloration were observed in Newtown. In one type, designated "browning" in this report, the injury was confined largely to the core and the flesh immediately adjacent thereto. The affected tissue turned brown in colour and the fruit developed undesirable flavour but remained firm. Browning had developed to a serious extent in Newtown from Kaleden by June 12.

The other type of flesh discoloration, designated "breakdown" in this report, affected the tissue between the core and the skin. In the advanced stages, this type appeared much like breakdown in the Jonathan, the flesh

becoming soft and mushy. Breakdown had developed to a serious extent in a small percentage of Newtown from all districts except Summerland by June 12.

The percentage of Newtown showing scald, browning, and breakdown to an "excessive" degree increased materially after the fruit was removed from storage. The extent of these troubles on June 24 is indicated in table 17.

TABLE 17.—BEHAVIOUR OF NEWTOWN AFTER REMOVAL FROM 32° F. STORAGE

Date examined	Condition and percentage defects						
	Hardness	Bruises	Punctures	Rots	Scald	Browning	Breakdown
June 12	13·2	3	7	4	7	8	2
June 24	11·7	2	10	7	20	52	13

The above data were secured by examining twenty apples from each of twenty-five boxes of Newtown at time of removal from 32° F. storage, and by examining a similar number of apples from each of the same boxes after they had been held for twelve days at a temperature of 55° F. It will be noted that by June 24 the combined development of scald, browning, and breakdown was sufficient to render a high percentage of the fruit unsaleable. This is ample evidence that these Newtown should have been removed from storage and placed on the market before June 12. The hardness and condition of the fruit on April 8 indicated that it would have been advisable to remove these Newtown from storage not later than the 1st of May.

It is of interest, however, to note that even by June 24 comparatively little scald and breakdown had developed in small-sized Newtown. Information bearing on this point is tabulated below.

TABLE 18.—INFLUENCE OF SIZE ON STORAGE LIFE OF NEWTOWN

Size	Condition and percentage defects June 24						
	Hardness	Bruises	Punctures	Rots	Scald	Browning	Breakdown
96	10·4	4	7	6	23	74	22
125	11·6	0	10	8	22	62	5
163	12·3	6	9	6	8	32	3

The percentage of both browning and breakdown was also materially influenced by transit and storage conditions. Data relative to the effect of temperature on development of browning in Newtown are presented in table 19.

TABLE 19.—INFLUENCE OF TEMPERATURE ON BROWNING OF NEWTOWN

Transit Temperature	Storage temperature	Percentage fruit showing browning June 24			
		Slight	Moderate	Excessive	Total
68°–50° F.	36° F.	37	24	15	76
68°–50° F.	32° F.	38	26	27	81
48°–28° F.	32° F.	16	26	44	86

The above figures were secured by examination of representative boxes from two carloads of Newtown grown in the Penticton district. This fruit was packed

within a few days of picking. It was then segregated into two similar lots of 750 boxes each. One lot was shipped immediately without refrigeration to New Westminster. The other lot was placed in 32° F. storage at Penticton and held there until early in November, when it was shipped under refrigeration to New Westminster. On arrival at New Westminster part of the first car was placed in a 36° F. storage room and part in a 32° F. storage room. All of the carload shipped under refrigeration was placed in 32° F. storage at New Westminster.

On June 12, ten boxes from each lot, similar in size and grade, were removed from storage. They were held at a temperature of 55° F. until June 24 when they were carefully examined.

It will be noted that the total number of apples affected by browning was not materially influenced by transit and storage temperatures, but the development of the injury in individual fruits was more severe with the lot transported under refrigeration and stored at 32° F., than was the case with the comparable lot shipped without ice and stored at 36° F.

The influence of temperature on breakdown was even more striking and is indicated by the data tabulated below.

TABLE 20.—INFLUENCE OF TEMPERATURE ON BREAKDOWN OF NEWTOWN

Transit temperatures	Storage temperatures	Percentage fruit showing breakdown June 24			
		Slight	Moderate	Excessive	Total
68°–50° F.	36° F.	0	2	3	3
68°–50° F.	32° F.	1	2	15	18
48°–28° F.	32° F.	7	3	18	28

The figures embodied in table 20 were obtained by examination of the same fruit which provided the data presented in table 19. It is readily apparent that low transit temperatures and storage at 32° F. favoured the development of breakdown in Newtown. In fact, the evidence suggests that the breakdown was, to a large extent, caused by holding the fruit at a lower temperature than is desirable. This unfavourable reaction of Newtown to 32° F. storage suggests that it may be advisable to store this variety at a slightly higher temperature.

STORAGE LIFE OF WEALTHY

Further investigation is necessary in order to ascertain the storage possibilities of Salmon Arm Wealthy. Several weeks elapsed between the date the fruit of this variety was picked and the date it was placed in 32° F. storage. Accordingly, it is not surprising that Wealthy were fully ripe when examined on December 2. This variety appears to be resistant to scald, breakdown and spotting, but subject to shrivelling, bruising and flesh browning.

STORAGE LIFE OF ROME BEAUTY

The Rome Beauty from Nakusp were still in good eating condition on April 8, but they were recorded as over-ripe after being held for a further six days at 60° F. Pressure tests revealed that these Rome Beauty from a non-irrigated district were comparatively hard throughout the storage period. They were resistant to shrivelling, scald, breakdown, browning and bruises, but the flesh was somewhat woody in texture.

The over-ripe condition in Rome Beauty is usually characterized by mealiness and the development of brown spots originating at the lenticels in the skin. The result of this experiment and other storage tests carried out with Rome Beauty indicate that prompt cooling and storage of this variety at 32° F. make it possible to deliver a satisfactory product to the consumer in March.

STORAGE LIFE OF GRIMES GOLDEN

While no samples of Grimes Golden were included in this particular experiment, attention is drawn to the peculiar storage requirements of this variety as revealed by investigations conducted at Summerland.

What appear to be three distinct forms of breakdown have been observed in Grimes Golden. These have been designated the "Jonathan", "core" and "soggy" types of breakdown.

In the "Jonathan" type of breakdown, the injured areas are indefinite in outline and the affected flesh becomes brown in colour and mushy in texture.

In the "core" type of injury the brown discoloration is confined to the core area. The flesh remains edible but the flavour is impaired.

In fruits affected with "soggy" breakdown sharply defined areas lying midway between core and skin become brown, but remain comparatively firm. They range in size from small pits to wide bands which sometimes encircle the core.

Information concerning the influence of storage temperature on these three types of breakdown was secured from fifteen boxes of Grimes Golden picked from three individual trees on October 4. From each tree five boxes of apples similar in size and grade were packed immediately after picking. Of each five boxes one was placed in 32° F. storage on October 4, one on October 11, one on October 18, and one on October 28. The fifth box of each lot was kept in a ripening room maintained at 60° F. During the period between harvesting and storage the various lots were held in the Experimental Station packing house in which the temperature averaged about 60° F.

On January 8 all lots were removed to the 60° F. ripening room and 20 apples from each box were cut to ascertain the development of breakdown. Again on January 22, January 30 and March 20, twenty apples from each box were cut and examined. The data recorded on January 8 are summarized in table 21.

TABLE 21.—INFLUENCE OF STORAGE TREATMENT ON BREAKDOWN IN GRIMES GOLDEN

Storage treatment	Percentage of fruit showing breakdown January 8		
	"Jonathan" type	"Core" type	"Soggy" type
Immediate storage at 32° F.	0	0	0
60° F. for 7 days then 32° F.	0	0	10
60° F. for 14 days then 32° F.	0	0	45
60° F. for 24 days then 32° F.	0	0	0
60° F. continuous	13	18	0

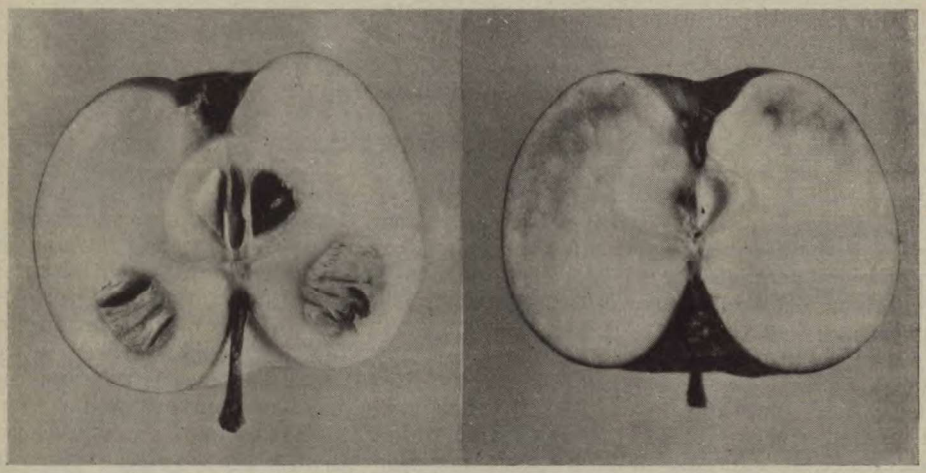
It will be noted that development of the "Jonathan" and "core" types of breakdown was delayed by low temperature storage. Subsequent examinations revealed that these types of breakdown eventually developed to about the same extent in all lots regardless of storage treatment.

The susceptibility of Grimes Golden to "soggy" breakdown was very materially influenced by storage treatment. A large percentage of the fruit which had been delayed at a temperature of 60° F. for two weeks before being placed in 32° F. had developed this type of injury by January 8. There was also some "soggy" breakdown evident in the fruit which had been delayed one week before being cooled to 32° F. After removal to the ripening room these two lots showed a slight increase in the number of specimens affected with "soggy" breakdown, but this disease did not develop in the lots stored immediately at 32° F., held continuously at 60° F., or delayed for 24 days at

60° F. before being cooled to 32° F. It is noteworthy that similar results were secured with the fruit from each of the three trees included in the experiment.

From the above data it is evident that storage of Grimes Golden at 32° F. after a delay of from one to two weeks at packing house temperatures is very likely to render the fruit susceptible to "soggy" breakdown. The peculiar relation of delayed storage to this disease doubtless accounts, at least in part, for the observation of commercial storage operators that, in the same storage room, some lots of Grimes Golden develop the disease while others do not. Unless this variety can be chilled to 32° F., immediately after picking, it should be held at temperatures of 36° F. or higher. In this connection it may be well to remark that the golden colour does not develop at low temperatures.

Grimes Golden is also especially susceptible to storage scald but commercial control of this disease can be secured by wrapping the fruit in oiled paper shortly after harvest.



Two types of breakdown. In "soggy" breakdown of Grimes Golden (left) the injured areas are sharply defined. This type of breakdown can be avoided by proper attention to storage temperature. In Jonathan breakdown (right) the affected areas are indefinite in outline. This type can be prevented by harvesting the fruit at the right stage of maturity.

SUMMARY OF RESULTS

The most important findings of this experiment from the standpoint of commercial storage practice may be briefly summarized as follows:—

1. The commercial life of apples is influenced by the soil and climatic conditions under which they are grown, by the stage of maturity at which they are picked, by the treatment they receive in the packing house, and by the promptness with which they are cooled as well as by the conditions under which they are stored.
2. Even within one variety subjected to similar treatment throughout the growing, harvesting, packing and storage periods, keeping quality is materially influenced by size and grade.
3. Provided growing, harvesting and packing house treatment have been such as to result in delivery of the fruit to the storage house in good condition shortly after it is picked, the commercial life of McIntosh can be extended to February by storage at 32° F.
4. Similarly, prompt cooling and storage of good quality Delicious and Rome Beauty at a temperature of 32° F. make it possible to deliver these varieties to the consumer in prime condition in March.

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5. Susceptibility of Jonathan to breakdown and Jonathan spot introduces an element of uncertainty in long storage of this variety.
6. Storage of Grimes Golden and Newtown at 32° F. sometimes results in low temperature injury.
7. More attention should be paid to harvesting apples at the proper stage of maturity to ensure full development of quality and maximum storage life.
8. Greater care in the handling of apples all along the route from orchard to retailer is most desirable in order that the fruit may be delivered to the consumer in an unblemished condition
9. Apples should be removed from storage as soon as they reach prime eating condition to ensure distribution to the consumer through the regular channels of trade before deterioration sets in.
10. Cold storage is not a cure-all but intelligent use of refrigeration makes it possible to furnish prime apples to the consumer over a much longer period than would otherwise be possible.

STONE FRUITS*

APRICOT VARIETY EXPERIMENT

(Project H-334)

Apricots are more sensitive to climatic conditions than are other tree fruits and are therefore grown to a very limited extent in Canada, being found in commercial orchards only in the southern fruit growing areas of British Columbia. At the Summerland Experimental Station fifteen varieties of apricots are included in the stone fruits orchard. Of the better known varieties twelve trees of each were planted, and of the new varieties, as they have been introduced, at least two of each have been added. All apricot trees have appeared thrifty and adaptable to the location except where adverse environmental conditions may have brought about local injury. The various varieties have exhibited characteristic habits of growth some of which are not satisfactory in the choice for a good commercial tree. Most of the varieties have reached the bearing stage and produced fruit. Results of growth and cropping over a period of more than twelve years, would establish the fact that apricots may be grown successfully in the Southern Okanagan.

The choice of variety may be the determining factor in the success of any fruit enterprise. Regarding the nomenclature of varieties of apricots there exists considerable confusion. As a general rule, the packing houses recognize two groups of varieties for their purposes: the large ones and the small ones. It is believed that some variety names of apricots have been confused for years, and propagation has been carried on under the incorrect name for so long that correct varietal description becomes difficult. For purposes of trial the varieties of apricots at this Station, will, for the present, be accepted as named.

Current recommendations for planting suggest the following three varieties: Wenatchee Moorpark, Blenheim and Tilton. These varieties seem to satisfy the market requirements but they have some faults.

Wenatchee Moorpark.—This apricot has been the most productive, giving, in the first four years of production, double the yield of Blenheim and fifty per cent more than Tilton. It is the largest in size which is in its favour, but it ripens a little unevenly, becoming soft on one cheek before fully coloured. It must therefore be picked just before the green breaks to yellow. There is not

* 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.

much difference in the quality of equally ripe apricots of the better varieties, apart from the texture of the flesh, which is a little too soft in the Wenatchee Moorpark.

BLENHEIM has a reputation for quality but if not well grown and the fruit thinned there are often too many small ones. It resembles Royal, being almost round, pale yellow sometimes with reddish blush. The flesh is firm and with the Royal these two varieties are considered the best for canning and drying. The Blenheim tree on good soil is inclined to make long willowy branches unless cut back judiciously. It has not proved to be an early heavy producer at this Station but grows into a tree of large size and great strength after about ten years of age. A Blenheim tree fifteen years old yielded over 200 pounds of apricots this season, when the crop was considered a partial failure in most orchards.

TILTON.—The planting of this variety has not been encouraged because the fruit was considered too small and the public favour was for the large size Moorpark. The Tilton has given over 30 per cent greater production than the Blenheim, and by thinning the crop, fruit of equal size has been obtained. The Tilton apricot is distinctly different from others, in that it has a more oblong shape, uneven surface, and becomes coloured before it begins to soften. It is the latest to ripen and should be the best shipping apricot, if well grown to gain size. The tree is more compact than any of the others under test.

The Hemskirke and Montgamet varieties have appeared perfectly hardy and have produced satisfactory crops but the fruit is considered inferior in quality and inclined to go mushy. The Kaleden ripens early but is soft in texture. The tree is less hardy than others and a shy bearer. The Peach apricot likewise does not bear well. The Amber makes a weak tree, producing light crops of fruit of medium quality. Six varieties not included in the above list have not as yet produced sufficient fruit to establish their order of merit. In addition to these, over one hundred seedling apricot trees, grown from the best of the commercial varieties, are about to come into bearing and to be tested for their individual qualities worthy of propagation.

The earliest variety to ripen at this Station has been Wenatchee Moorpark followed by Blenheim, Royal and Tilton, in the order given. Only about ten days elapse between the first and last pickings. Usually the weather is quite hot at this time—the last week of July—and the fruit ripens rapidly as soon as it is mature. This necessitates careful and quick handling and there is a tendency to pick very green fruit to gain more time and to prevent bruising. Experiments conducted during the past three seasons have all demonstrated the fact that apricots when picked green never develop a satisfactory quality but become shrivelled and dry. Furthermore, it was found that Blenheim, Royal and Tilton apricots could be picked when half coloured, be shipped to prairie markets and held for one week without bruises or spoilage. This probably represents the extreme examples and it is therefore advised that for commercial shipments the apricots should be picked when just turning to the yellow colour. The nature of the variety must be considered but the requirements call for a medium sized apricot with firm flesh and uniform ripening.

CHERRY VARIETY EXPERIMENT

(Project H-35)

Various new varieties of sweet cherries have been grown at this Station and many of these have commenced to bear fruit. There is little difference in tree growth to indicate any preference, or any marked improvement over the standard varieties already well known, but several trees have produced fruit which is very promising.

The Bing and Lambert hold first place as dark sweet cherries for home or market and at present are the only varieties recommended for planting in the Okanagan valley. As a pollinizer for these two varieties the Deacon cherry has proved efficient and being of good commercial quality is now recommended for that purpose. It has been found satisfactory to plant one pollinizer as every third tree in every third row.

The standard commercial varieties of sweet cherries now being grown throughout the fruit areas of British Columbia are most attractive, carry well to market and are of excellent quality. They are usually very productive except in a few locations where spring frosts may destroy some of the blossoms. Sweet cherry trees, however, have not always been reliable for long life. After about ten years of production trees may suddenly die without any apparent cause. The weakness may be in the root stock or in soil and cultural conditions. It may be inherent in the variety. Varieties of prolonged hardiness and high commercial qualities combined are to be desired and have yet to be determined.

The Bing cherry ripens a week to ten days earlier than Lambert. To extend the cherry season it would be a decided advantage to have a variety earlier than Bing and one later than Lambert, providing they were of equal quality. The tendency to pick cherries before they are ripe, in an attempt to supply an early market has often resulted in a weakened market for later varieties. It would be well to have varieties definitely established as to the proper stage of maturity and season to harvest.

The following are the best of the newer varieties which have fruited at this Station.

Seneca.—It is the first to colour and so attracts the birds, with the result that few whole cherries have reached maturity. Early ripening is the chief recommendation for this variety. It is worthy of trial for home use or local markets.

Giant.—Trees under this name were obtained from three different sources and upon fruiting proved to be of three different fruit characteristics. A tree which apparently is true to description produced cherries a little larger than Bing and a little earlier than Lambert. They were firm, dark and of excellent quality. This tree resembles the Bing and may prove to be but a strain of that variety. It has been tested as a pollinizer for Bing, Lambert and Royal Ann but was found to be ineffective. Another tree under this name produced fruit which ripened with Lambert but was softer and not to be recommended. Another so-called Giant cherry produced fruit smaller than Bing and must therefore be discarded.

160133 (Vineland).—Trees of this variety have made rapid growth and have ripened fruit a few days earlier than Bing. The cherries resemble the Bing, large sweet and juicy, and yet firm. The flavour is distinctive and excellent.

160140 (Vineland).—Cherries on these trees also ripened a little before the Bing. They were more round in shape and more sprightly in flavour than Bing, and with long stems, dark flesh; firm, juicy and good.

Lyons.—This is an early cherry of promise. Fruits ripened on the young trees about July the first. They were dark red with paler red flesh, small pit, long stem, inclined to be soft.

Big K.—This is of the Lambert type and season. It is good but has not appeared better than Lambert.

Victor.—There is not much difference in this cherry from that of Royal Ann. On the young trees the fruit may have been a little larger and probably ripened earlier. It is of excellent quality.

PEACH VARIETY EXPERIMENT

(Project H-322)

The peach growing areas of British Columbia will always be restricted to the limited extent of favourable locations. Peaches are more exacting in their requirements of climate and site than are most other fruits and it is therefore reasonable to expect the supply will never get far beyond the domestic market requirements. At the Summerland Station over fifty varieties of peaches are being grown in an attempt to select those best suited for the climatic conditions and most profitable to grow. Peaches cannot be held in storage to advantage and therefore to extend the peach season it is necessary to have various varieties that will ripen in sequence over as long a period as possible. Hardiness of tree, productiveness, time of ripening and quality of fruit are characteristics of utmost importance.

Peach breeding—insect proof cages used in cross pollination studies in the breeding of new varieties of peaches.

The leading commercial varieties now being grown for the markets are: Rochester, J. H. Hale and Elberta. The Rochester peach is ready to harvest about the middle of August. The tree is hardy of bud, productive and comparatively early in ripening its fruit. The J. H. Hale and Elberta come in about three weeks later. The J. H. Hale is a large showy peach, firm enough to carry well in shipping, but the tree is rather small and inclined to be weak and therefore not as popular with growers as the marketing qualities of the fruit would warrant. Elberta has been a favourite commercial variety for so long that it is held somewhat as a standard for comparison. The trees make strong vigorous growth and at the same age as J. H. Hale produce heavier crops. The Elberta peach softens slowly enough to allow shipping to more distant markets. Its popularity has therefore created a demand in new varieties for peaches of the Elberta type.

The Vedette peach has been recommended by this Station as a variety to fill the gap between Rochester and Elberta. It is ready to harvest ten days before Elberta and at a time when the markets are not supplied with peaches. The Vedette originated at the Vineland Station, Ontario, and has been repeatedly praised for its beauty and quality. It is a good commercial sort of the Elberta type and has taken first place as a free-stone canning peach.

A demand for cling-stone peaches for the canning factories has been evident within recent years. Canning factories want the firm, yellow flesh of the cling-stone because it retains a clean-cut appearance after mechanical peeling and processing. Ten cling-stone varieties, popular for canning elsewhere, have been tested but so far none has proved worthy of recommendation. Most of them are too late and are not sufficiently productive. Tuscan Cling has given the best results this year, having produced on one tree, six years old, 320 pounds, while the best Elberta tree produced 325 pounds, and J. H. Hale 253 pounds. The Tuscan peaches were ready to harvest on August 30, when they were picked and delivered to a local cannery. The peaches were large, very well coloured and made a most satisfactory canned product. Pelora Cling was also very satisfactory to the cannery but the fruit was not ready until more than two weeks after Tuscan.

The above results while promising do not indicate the advisability of recommending the planting of cling-stone peaches in commercial orchards. However, there remains ample proof that peaches of this type may be produced profitably in the peach growing areas of British Columbia and it is quite probable that a satisfactory cannery peach may be developed which will fill the need when canneries are prepared to take commercial crops of peaches of the cling-stone type. It should be remembered that the cling-stone is not a suitable dessert variety, and at the present time the markets are not well supplied with first-class dessert peaches.

The progress in breeding and selection of peaches gives promise for a good yellow flesh cling-stone variety which will ripen early in the season. This breeding work includes crosses and selections for both canning and dessert varieties to be tested as rapidly as the new seedling trees come into bearing.

PLUMS

(Project H-48)

Plum growing is receiving very little encouragement and experience has shown that poor quality, immature, small-sized miscellaneous varieties in most cases fail to pay expenses. The question naturally arises as to whether plums of any variety can be grown in the irrigated districts of British Columbia at a profit.

Of all tree fruits, plums are represented by the greatest diversity of variety adaptable to the widest range of climate, and moisture and soil conditions. Plums of one sort or another have been grown in every recognized fruit district and in many sections of the country not considered suitable for fruit. The plum is therefore looked upon as being rather common. However, the large size, attractive plums of the best quality can only be produced in the most favourable fruit sections and under suitable methods of culture. At the Summerland Station over sixty varieties are being grown including the best plums obtainable, and it has been found that some of these attain a degree of perfection not possible in other parts of the country. It is therefore reasonable to assume that the most select varieties of plums may be successfully produced in the Okanagan valley.

There seems to be less need for new varieties of plums than for a selection of the best plums already established and the elimination of inferior sorts. Improvements in culture, harvesting and marketing of selected varieties should

rapidly increase market demands. The profitableness of plum growing depends upon many of the same factors influencing fruits of various kinds. But success with plums will be influenced a good deal by the variety grown, the size, the season of ripening, and upon the state of maturity and quality of the fruit as displayed upon the markets. In an attempt to supply an early market, or to insure the fruit passing through the channels of trade without damage, plums have been harvested too green, and before the development of full size, colour and sweetness. This practice has undoubtedly mitigated against the popularity of this fruit. It has been found that some varieties actually improve in keeping and shipping qualities by first ripening to a fuller sugar content.

Among the plums of the European or Domestica group are to be found the best general purpose varieties, suitable for dessert, canning, jam making and drying into prunes. As a general rule, they should acquire full colour and size before picking.

In the Japanese group are varieties restricted to a dessert market only and best when eaten fresh. Some often ripen early and are very beautiful in large size, bright colouring and often with a deep, juicy, red flesh. They should be picked when the colour is just beginning to form.

Although a number of varieties may be recommended for planting, it does not follow that it would be advisable to set out plum orchards at the present time. Some growers are satisfied that their plums, which show a lower cost of production, yield a profit, while others declare there is no market for plums regardless of costs. However, many trees are being retained and from time to time new trees are being planted. Recognizing that the plum market is so often sluggish, it is well to emphasize the importance of stimulating sales with a choice product, well graded and attractively packed.

The following varieties have grown successfully at this Station and while most of them are well known, they are mentioned here for possessing qualities of commercial value.

ITALIAN PRUNE sometimes shipped as blue plums, but should be distinguished for its peculiar rich quality. When well ripened on the tree, it is good for dessert, canning or jam, as well as for making most satisfactory prunes.

REINE CLAUDE.—This name belongs to a very old variety but has often been used to distinguish others closely related and also as the name of the group of "green gage" plums. The name "Green Gage" was given to the Reine Claude when it was first introduced into England from France by the Gage family. In "Plums of New York" the name Reine Claude has been retained as being the original title. This variety has been one of the most profitable plums in Eastern Canada and has been noted for its high quality for both dessert and canning. A serious fault is the small growth and general weakness of the tree and being subject to overbearing it is susceptible to winter injury. At this Station the tree has been thrifty and vigorous although making its characteristic small growth. It is a regular cropper of fine fruit ripening late and appears quite adaptable to the Okanagan conditions.

BAVAY.—This variety is often called Reine Claude Bavay but is said to be a seedling of the Reine Claude from which it differs by being a more vigorous tree, with larger fruit of different flavour.

SILVER PRUNE is inclined to overbear and therefore requires careful attention to spur-pruning and thinning of the crop. It has been called the largest, handsomest and best of the yellow plums, but it cannot be grown successfully in Eastern Canada where it is known as Golden Drop. It reaches its perfection in the West and has been entirely satisfactory at this Station. The large yellow fruits ripen late and are very firm, sweet and of good flavour. They are excellent as a dessert plum or for canning, jam or drying. The dried prunes are large and attractive in every way.

PEACH PLUM is a favourite with some growers because of its early season and easy handling. It has been advisable to thin this variety and prune carefully to obtain large and uniform fruit. Pruning and culture should aim to stimulate growth of new fruiting wood.

SHROPSHIRE DAMSON. This is the best of the Damsons and is easy to grow and requires very little attention in the "Dry Belt" of British Columbia. A general demand for blue Damson plums will assure a market for a limited supply of this variety.

Among the Japanese plums the following are noted but several others are also worthy of attention. Any of these make very attractive dessert plums if grown to large size and properly graded.

BEAUTY is ready to pick about the end of July, as the fruit takes on a pale red colour. It has medium size, heart shape, attractive deep red colour when ripe, and fair to good quality.

BECKY SMITH.—This is a low spreading tree, very productive. The fruit ripens first week of August and has an attractive appearance and a very delicious flavour. It always needs thinning.

DUARTE.—This tree is upright, free growing, rather open and with small leaves. It is a dessert plum, heart-shaped, with red skin covered with dots and all red flesh. It should be grown to large size to be sold for eating out of hand.

PRUNE VARIETY EXPERIMENT

(Project H-576)

Prunes have been grown to supply two distinct requirements: the fresh fruit trade and the dehydrator. In British Columbia it is a question whether either supply has received a fair trial for the most satisfactory results. The fresh fruit trade has received prunes so green as to "sour" the market, and growers have never catered to a dehydrator in a commercial way. In any case, prunes should be mature enough to have developed the full, sweet, characteristic flavour. For dehydration prunes must have the maximum of sugar content before harvesting. This usually requires a week or two longer on the trees than for the best quality fresh fruit. Prunes are unlike other plums in that they develop sufficient sugar, as they ripen, to allow them to be dried, or dehydrated, successfully without removal of the pit. It is this high sugar content that distinguishes them as prunes. It is therefore necessary to have prunes fully developed in flavour and sugar before they can rightly be classified as such. An unripe prune might better be called a plum.

There are, at present, two distinct variety classes in the dried prune trade: the sweet and the tart-sweet. The Petite is representative of the sweet class and the Italian may be considered as a tart-sweet prune. This difference is not due to any material increase of sugar in the Petite, but to an increase of malic acid in the Italian prune. The Italian prune, when mature and properly ripened, is therefore a very distinctive fruit with a full rich flavour and exceptional food value, whether used in the fresh state or canned; made into jam or dried. However, this variety ripens a little late in the season and does not always develop its best qualities unless favourably located and properly cared for. Early soil in warm locations promotes earliness of ripening, and warm weather during the ripening period aids the formation of sugar.

In seeking for prune varieties of greater commercial value to the growers of British Columbia, the Italian has been selected as a standard from which to grade improvement. It has proved its worth and hardiness to some extent.

At this Station an orchard of eighteen varieties of prunes was set out in 1926. Quality of fruit, yields, adaptability and tree characteristics have been

recorded. The following four varieties have produced fruit very similar in appearance and quality and may be considered together: Petite, Date, Imperial Epineuse, Mammoth French. All of these ripened fruit from September 10 to September 25. The fruits were small, long oval, somewhat necked, and the colour pale purple, rather insipid. The flavour was rich, juicy and decidedly sweet, but lacking in attractiveness. Some of the trees have exhibited weaknesses for this climate. Dried prunes of these varieties wer equite satisfactory, but all of the smaller size, grading no larger than 50/60. They were all classed as sweet prunes.

YAKIMA prune has not proved worthy of the high placing first given it. The fruit is large and ripens early in September but is not uniform in ripening or size. As a dried prune it is not satisfactory. The tree is extremely upright in growth.

HALL produced large blue fruits of fine quality and firm texture, ripening with the Italian and resembling it in some respects. It has not been tested as a dried prune but its sweetness and firm texture combined with large size indicate suitable qualities for dehydration. However, the tree has not proved hardy to winter in the present site on sandy soil. This variety is worthy of further trial, and should be replanted on a more suitable site.

HUNGARIAN prune produced heavy crops of medium to large fruit, too soft in texture and low in quality. The tree spurs readily but makes insufficient new wood.

STANDARD prune fruit was ripe about a week earlier than Italian and resembled that variety. It is a medium to large, blue prune, with yellow flesh when ripe. The quality is good but lacks that sprightly rich flavour of the Italian and is somewhat softer. It dries to a satisfactory product of medium size and quality. The trees show rather weak growth and very little new wood.

SILVER prune when ripe in the first week of October produced fruits of a golden yellow colour, large, firm, sweet and attractive. They shipped well as far as Manitoba and were very favourably received. The dried prunes of this variety were large grading in the 30/40 size and good in quality and appearance. The colour of the dried product was deep brown to black. Silver prunes tend to bear very heavy crops and would require judicious pruning and possibly thinning to ensure size and to protect the tree from overbearing. Growth has been thrifty and quite satisfactory.

MONARCH has made unsatisfactory growth and shows lack of vigour although producing a heavy set of fruit. The prunes were low in quality and a poor colour when dried.

ITALIAN prunes in this orchard were harvested on September 30. Part of the crop was shipped as fresh ripe prunes and the balance dried, with satisfactory experimental results. The Italian prune is well known in the fruit-growing areas of British Columbia and it is quite probable that it will not be replaced by any other variety. The most desirable improvement in the Italian would be a little more size and earlier ripening before the cool fall weather. Warm weather during the ripening period promotes sugar formation and the size might be increased by a change in pruning and cultural methods on suitable soil.

It appears evident from these tests that too many varieties of inferior quality are being grown. Some have so little to recommend them, that wherever found they should be replaced by more satisfactory sorts. If this variety test experiment should find no more than varieties that should be eliminated from the orchards of British Columbia, it would prove worth while. But newer varieties not well known and not yet introduced to the fruit growers are also being compared with established sorts and their merits determined.

CHERRY POLLINATION EXPERIMENT

(Project H-673)

Within recent years much more attention has been given to the value of certain varieties of fruits over others. The early plantings of fruit trees in British Columbia included a wide range of varieties and it has been a matter of time to eliminate those which have proved unprofitable to grow or unsatisfactory to market. The problem of efficient pollination has developed as the variety number has been reduced.

The two previous reports from this Station outlined this particular experiment and gave tabulated report of the results obtained. The work was again conducted in 1930, to confirm those results and to obtain knowledge of the pollinizing efficiency of a new variety known as Giant Cherry. The true origin and identity of the Giant has not been well established, there being three variations under the same name in the Station orchard. The best of these resembles the Bing to such an extent that it is thought to be but a strain of Bing with a little greater size. Pollen from these better trees was used in the experiment and it appears significant that the Giant does not efficiently pollinize Bing. If this new variety is but an improved strain of Bing there seems no advantage in using any other name as it will undoubtedly be marketed as a Bing cherry.

The technique employed in this experiment was the same as in previous years. Pollen was collected from unopened blossoms of the varieties required. Branches were selected on trees of the varieties to be pollinated, which would give from 100 to 200 emasculated blossoms. All blossoms that were open, and immature blossoms, were cut off, and the large, closed blossoms were emasculated. Pollen was applied the same day where possible. On each tree a branch of emasculated blossoms was left unpollinated as a check. The results are set forth in the following table.

TABLE 22.—CHERRY POLLINATION TEST 1930

Pistil variety	Pollen variety	Number blossoms pollinated	Number of fruits set	Percentage set
Royal Ann	Deacon A	134	15	11·1
"	Black Tartarian	129	5	3·8
"	Check	105	1	0·9
"	Deacon B	108	26	24·0
"	Giant	170	0	0·0
Bing	Deacon A	118	6	5·0
"	Giant	129	0	0·0
"	Deacon B	131	48	36·6
"	Check	110	0	0·0
"	Black Tartarian	148	32	21·6
Lambert	Deacon A	106	46	43·4
"	Deacon B	135	75	55·5
"	Black Republican	80	51	63·7
"	Giant	110	2	1·8
"	Black Tartarian	126	11	8·7
"	Check	138	3	2·1

The results of this experiment are consistent with the findings from similar work conducted in the state of Washington by E. L. Overholser and F. L. Overley in the same year. Comparing the percentage of set from Deacon pollen with the normal set of fruit, it is safe to conclude that the Deacon cherry is an efficient pollinizer for the three standard commercial varieties Bing, Lambert and Royal Ann (Napoleon). The Deacon cherry is a satisfactory market variety, better than Tartarian, and tests have shown that it efficiently pollinized itself by the standard varieties.

Results obtained from pollen of the Giant variety prove it to be useless on Bing and Royal Ann, which is further indication that it may be a variation of Bing and not a true variety. On Lambert it was very weakly efficient which has been found true also of Bing.

MATURITY AND SHIPPING TEST FOR PRUNES, 1930

(Project H-621)

This experiment as conducted in 1929 was continued in 1930 with certain additional tests and a more extended questionnaire into market conditions and requirements. Mr. F. W. L. Keane of Penticton co-operated in this work and supplied several shipments of prunes. The Penticton Co-operative Growers assisted by providing cold storage space and shipping facilities.

The following outline of procedure was used as a basis for the investigation: To determine the best time at which Italian prunes may be harvested for the market as fresh fruit, in order to gain the maximum size and weight in crop, and quality and attractiveness of product on the market.

The first commercial shipment of fresh prunes were picked August 21 to 22, and sent out through the packing houses in the week of August 23. Other shipments followed until the crop was cleaned up. The first picking for this experiment was made September 14 when the following grades were packed at Penticton, and placed in cold storage, temperature 32° F., on the following day.

Lot A—Ripest from trees, with stems.....from tops of trees
Lot B—Green from trees, with stems.....from bottom of trees
Lot C—Ripest from trees, without stems.....from tops of trees
Lot D—Green from trees, without stems.....from bottom of trees

These were to be held in cold storage for three weeks. It was afterwards decided to hold them only 15 days and then ship to consignees, arranged for in each of the three prairie provinces. These were to be left unpicked until the storage prunes were shipped. On September 30, the prunes from storage were sent out, and included with each shipment were packages of prunes fresh picked on that date, September 30, both with and without stems.

At the Experimental Station three pickings were to be made from September 15 to 30 and shipped direct by express to the same prairie points. These pickings were made and forwarded on the following dates: September 15, 20 and 27.

On the 30th of September prunes were picked, packed and delivered to the Co-operative packing house where they were placed in a carload of apples being sent to a commercial house in Manitoba.

All packages were standard for prunes. The fruit was not sorted or graded after picking. Paper lining was used in some of the boxes. Packages were sent to horticultural workers at Dominion Experimental Stations and at the University of Saskatchewan. The questionnaire sent out called for the following information: Date of arrival; condition of package on arrival; general appearance of the fruit; number seriously bruised; number spoiled; flavour—sour, medium, sweet, good, etc.; keeping quality in days estimated after arrival; was packing slack, too tight, or satisfactory? is the paper-lined box more attractive or of greater protection? when would the consumer prefer to have these prunes? how would they be used? would consumer wait until these later dates in order to have the tree-ripened prunes?

The argument that " prunes must go out in the mixed cars of fruits and vegetables early in the season, or not at all " was stated, and information on this question was asked for. And finally a question called for information regarding the demand for prunes and the supply and quality on the local prairie markets.

The first shipment of Italian prunes was from the Experimental Station orchard, September 15. This was followed by two other shipments picked September 20 and 27. All of these packages arrived by express at the several points in due time and in good condition. These were examined upon arrival and part of each lot held to test keeping quality. The following table is a summary of the reports.

TABLE 23.—SUMMARY OF REPORTS FROM RECEIVERS OF PRUNES AT PRAIRIE POINTS

Date picked and shipped	Condition on arrival	General appearance of fruit	Any bruised	Any spoiled	Flavour	Keeping in days	Packing
Sept. 15.....	O.K.....	Good, dull, medium size, good	None	None	Medium, hard, sour	12, 11, 10	
Sept. 20.....	O.K.....	Very good, medium, large, good	None	None	Medium, all moderately sweet	10, 8, 10	All satisfactory. Very fine looking and admired by dealers who saw them
Sept. 27.....	O.K.....	Very good, medium, large, good	None	None	Medium, sweet, sweet	14, 8 after one week looked good for another	

The above table is made up from reports received and includes the different opinions in reply to questionnaire. Some of the prunes were kept until it was thought advisable to use them before loss from spoilage. The number of days show the different length of time various lots were kept. It is noticeable that prunes picked on the later date, September 27, were reported very good, medium to sweet and kept even longer than the earlier pickings.

The prunes picked September 14 and placed in cold storage were removed from storage on the 30th and shipped to the prairies. Some of the crates from storage were slack upon arrival at market points. Fresh picked prunes shipped at the same time were reported as very satisfactory, in the pack, which would indicate shrinkage in storage.

TABLE 24.—COLD STORAGE PRUNES, PICKED SEPT. 15, SHIPPED SEPT. 30

Lot	Arrived	Appearance	Bruised	Spoiled	Flavour	Remarks
A. Ripe, stems.....	O.K.	Fair to good	None	None	Medium	
B. Green, stems.....	O.K.	Fair	"	"	Little sour	All could be kept short time owing to what appears to be breaking down of the flesh near the pit.
C. Ripe, no stems	O.K.	Fair to good	"	"	Poor, medium sweet	
D. Green, no stems..	O.K.	Fair	"	"	Somewhat sour, poor quality	

Prunes picked from the same orchard and shipped on September 30 arrived in good condition with good general appearance, large, dark, a few shrivelled slightly in packages of prune without stems. One report listed six bruised and five spoiled in a no-stem package, and thought they were riper than those with stems. The flavour of this entire shipment was reported as sweet and excellent. These reports would suggest there is no advantage in picking prunes early and

holding them in cold storage. Prunes left on the trees until the shipping date of September 30, were far superior in quality above the storage prunes, carried well to destination, and kept in good condition for two weeks after arrival. There appeared to be very little, if any, advantage in keeping the stems on.

To further test the possibilities of shipping ripe prunes, two crates were packed September 30 and enclosed in a carload of apples being loaded by the local packing house for dealers in Winnipeg. These were reported on as arriving in a ripe to over-ripe condition, the quality and flavour being very good. They were also examined by a fruit inspector who thought they were more or less on the ripe side and would need to be firm-ripe for that market. However, the prunes were considered large and of an appearance to command a premium price.

A difference of opinion was offered with regard to paper-lined boxes. Red coloured paper was preferred in Manitoba, white paper in Saskatchewan and in Alberta paper was not considered of any advantage. It was the unanimous opinion that prunes should arrive on the market before the end of the canning season. The first week of October was mentioned, for a supply for dessert and canning. Dealers stated that the demand was earlier but they could handle some after October 1. In the past season some dealers had requests for prunes ten days after the last were sold. All agreed the consumer would wait for high-class tree-ripened prunes as soon as the quality was known and the supply assured. It was ascertained that most dealers were afraid of ripe fruit of any kind—an attitude formed from bitter experience. However, the attractive appearance, flavour, and keeping quality of the experimental shipments surprised some dealers, but they are still skeptical about attempting to handle ripe prunes.

Investigations have been conducted in the prune growing sections of Washington, Idaho and Oregon in an attempt to devise some practical means of determining the best stage of maturity at which prunes should be harvested. A sugar test, acid test and colour shade, have all been discarded as not satisfactory. The pressure test, as used for pears, came nearest to solving the problem. The variation in the maturity of prunes makes the pressure test impracticable for general use. A pressure of 12 to 15 pounds, using an average from thirty or more fruits was found by C. C. Vincent of Idaho to be best for long shipments. It was found that softer fruits, below 12 pounds pressure, ripened too quickly.

Pressure tests were made on the first pickings for this experiment but the results were so inconsistent with the above findings, and so variable that they were discarded. Prunes picked September 30 showed a pressure test of 6 pounds but carried well as far as Manitoba and kept 9 to 12 days.

Increase in size and weight of prunes during the ripening period has been recorded by several investigators, showing a little greater percentage increase in weight than in volume. It has yet to be determined when harvesting should commence, and the limit to which prunes may be left on trees for best results. The ripening period will vary in different orchards and somewhat on different trees. Evidence from these picking and shipping tests show that prunes at a much more mature stage of ripeness and of far superior quality than the commercial pack, may be marketed successfully. Picking dates for this experiment commenced about three weeks after the regular commercial harvest and extended over a period of two weeks. The average gain in weight was 20 per cent. The gain in quality was greatly appreciated by both dealers and consumers.

Breakdown, as shown by a browning next to the pit, was more evident in storage than in prunes left on the trees. Prunes were picked on three dates, four and six days apart, and held in common storage. They were all examined on the same day after the last picking had been in store two weeks. The first picking showed exactly three times more breakdown than the last. Breakdown also occurred in the cold storage prunes as shown in table 24.

Storage of any kind does not appear to be favourable to prunes. Short period cold storage may be beneficial and may be advisable to steady the market. Prior to September 15 the quality was not fully developed. After this date the period of picking could extend over two weeks but the uneven ripening of the fruit suggests the advisability of grading for ripeness at picking time which may mean two pickings.

It is significant to note that a special fresh fruit committee of the Pacific Northwest Advisory Board decided to do all possible to minimize shipments of fresh fruits from Oregon and Washington in an immature condition. "It was agreed that the principal offender was prunes and that there was a growing tendency to ship prunes too green, in an effort to get the early high prices."

PRUNING EXPERIMENT

(Project H-577)

A young prune orchard has been pruned, since planting, after a definite system. The trees have completed five years' growth and the following table shows the apparent size of the trees, and the average yield of fruit in the past season. In each variety a certain number of trees were "long pruned" and an equal number "short pruned". As a modification of these two systems an equal number received "short" and "long" pruning in alternate years.

TABLE 25.—INFLUENCE OF PRUNING ON TREE GROWTH AND YIELD OF FRUIT
(Ten Varieties of Prunes)

System of pruning	Average trunk diameter	Average yield in pounds
Long pruned every year	4·1	27·4
Alternate, long and short pruned	3·9	15·7
Short pruned every year	3·7	15·3

Results show a consistent relationship between tree growth and crop yield. In experimental pruning of store fruit trees during the first five years of growth, the "long pruning" system has resulted in trees of greater size, as indicated by trunk diameter and observed spread of branch. With regard to fruit production, the above table shows an average of almost double the yield in favour of "long pruning". It has been observed that the "long pruned" trees carry the fruit more evenly distributed up and down the main branches and the greater size provides more bearing surface. The thinning out of branches, which is a part of this system, allows more light to the centre of the tree and encourages the formation of fruit buds close in.

Alternating the type of pruning has not gained much advantage over the "short" system. By cutting back and "heading in" every other year, a dense new growth of shoots and suckers were produced, which had to be thinned out severely the following year, when the tree was being "long" pruned. The denser growth materially shaded the inner part of the tree at time of fruit bud formation and the cutting back checked tree development.

It is typical of most prune trees to develop rather dense masses of spur wood, as successive heavy crops of fruit are produced. This condition, it has been observed, tends to inhibit the growth of new wood and the old spur wood becomes less productive of high-class fruit. The "long pruning" system, as described in previous reports, has produced trees of a little greater size and earlier bearing, but the individual growth habits of some varieties require a cer-

tain amount of cutting back at times, usually into two-year wood. After production of several years has slowed down the growth of new wood, the prune trees seem to require some cutting back and a thinning out of the fruit spurs, with the object of stimulating new shoots into extended bearing surfaces. Some varieties have required this treatment much sooner than others. In all cases it has been found that the soil and cultural practices have a direct influence on the amount and type of pruning required.

WALNUTS

(Project H-351)

Following a very severe winter of long-continued cold it was expected that walnut trees would show injury if at all sensitive to low temperatures. The grove of seedling trees showed no ill effects except that two trees, standing on gravelly subsoil, died out during the season. A large cherry tree close by and on the same ridge also died. Several sweet chestnut trees, of the Japanese, the European and the Chinese varieties, planted in 1928 having made rather slow growth, were killed by winter freezing. A tree of Bowe's English Walnut was also killed. It had produced in former seasons a few nuts, small in size and late in ripening. This variety made a slow compact growth with dark green foliage, attractive in appearance but producing very inferior nuts. Examination of the root system indicated that the injury occurred below ground. The Franquette trees all appeared quite thrifty, made satisfactory growth and produced some large, fine thin-shelled nuts of excellent quality. The terminal tips of new growth on most of the walnut trees were winter-killed, but this is to be expected as the terminal new growth usually goes into winter in a soft, sappy condition.

The seedling English walnut trees produced an average of 31 pounds per tree at 14 years of age, the highest for one tree being 53 pounds. The nuts ripened well and were of fine quality. They were harvested on October 8 by shaking from the trees and picking up at once. The nuts shelled out readily from the shucks and after being spread on trays in a dry loft for approximately a month they were ready for use.

Two varieties of Japanese Walnuts have been grown, which resemble the Heartnut in appearance of tree but the true Heartnut has a thinner shell, more easily cracked. The kernel in either case is rich in quality and flavoured like the butter nut. The Japanese Walnut seems to thrive on a more sandy soil than favoured for the English Walnut. They are apparently more hardy and may be grown farther north. The trees make fairly rapid growth very open branching but the large light green leaves give a most ornamental appearance. The Heartnut is to be recommended of the Japanese varieties and would be a valuable addition to any home grounds, where soil and space are suitable. A deep soil of loamy nature and natural drainage has been found best for any of the walnuts.

PLANT BREEDING AND VEGETABLE PRODUCTION*

From the standpoint of the vegetable grower, conditions were somewhat unusual. Following a severe winter, the spring opened with bright sunny days. Ice was late in leaving the lake and as a result there was a combination of warm days and cool nights. Late spring frosts caused some damage and delayed planting.

* 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.

While soil temperatures were actually higher than in the preceding three seasons, heat-loving plants such as tomatoes, eggplants and peppers made very slow growth until July. This was probably due to the low night temperatures. Under such conditions the use of plant protectors proved advantageous. These crops made good growth in the latter part of the summer and total yields were high.

Early tomatoes were frequently rough. Some tomato breakdown was noted but the total loss was not great. A similar breakdown in cantaloupes caused considerable loss to growers of this crop. Autumn conditions were excellent for seed crops.

GENETICAL STUDY OF COLOURS IN ASTERS

(Project H-263)

The order of dominance of colour in asters has been previously reported from this Station (Annual Report 1929, page 49). Three distinct colour series were arranged in order of dominance as purple, red, and albino or white. Within each series occurs a wide range of varying shades. Further studies have been directed towards ascertaining the relation of these shades towards each other. Two colour pairs were studied in 1930, mauve and lavender, shellpink and white.

MAUVE VS. LAVENDER.—A foundation strain of Early Wonder Lavender gave 12 lavender and 4 mauve plants. Individuals of each colour were selected and the progeny tested to the second generation. Eight lavender strains of this generation gave three pure strains, totalling 120 plants, while the remaining five strains gave 150 lavenders, 19 mauves, and 4 other colours. Six mauve strains of the same generation were tested. One of 40 plants was a pure mauve. The remaining five segregated into 40 lavender and 142 mauve plants. From these tests it is evident that mauve is dominant to lavender. The occurrence of 19 mauves and 4 other colours in the lavender strains is indicative of some natural crossing.

SHELLPINK VS. WHITE.—In a foundation plot of the variety Shellpink Queen of Market, both shellpinks and white plants were noted. Individual selections from these were also tested out to the second generation with the following results in 1930:—

—	White	Shell	Others
1929 shell from 1928 white in 1927 shell	26	89	1
1929 white from 1928 white in 1927 shell	102	5	3
1929 shell from 1928 shell in 1927 shell	0	197	26
1929 white from 1928 shell in 1927 shell	64	4	6

The shell strains appearing in the white strains segregated on Mendelian lines. All white strains were recessives. No whites occurred in the shell strains from shell parents. Shell pink therefore is dominant to white. The occurrence of 26 other colour rogues in 223 tests, and 9 shell pinks in 175 tested whites is further evidence of natural crossing. The percentage of natural crossing is approximately the same as has occurred in the four previous seasons, that is, 9 to 11 per cent.

RELATION OF SOIL REACTION TO COLOUR OF FLOWER.—A strain of plants was observed in 1929 which may best be described by the colour Phlox Pink as given in Ridgeway's colour charts. This colour is almost on the border line between a pale red and a pale purple. A slight change in the colour either way would give a pink shade or a pale purple. Two hundred and thirty-eight plants of this strain were tested in 1930. These gave 208 true phlox pinks, 18 lavender, 6

mauve or light purple and 6 old rose (deep pink). The soil was tested for acidity with a LaMotte-Morgan soil testing outfit where these rogues occurred and it was noted that where the pink rogues appeared the soil acidity had increased and where the purple rogues appeared the alkalinity had increased over the average test of the whole plot. It would appear that the soil reaction influences the colour of blooms to some extent. Further tests will be made to verify this conclusion.

ZINNIA BREEDING EXPERIMENT

(Project H-261)

A foundation plot of zinnias was planted in 1929 for the purpose of ascertaining whether seed of this flower could be produced commercially in the Okanagan. Individual selections were made from this plot and planted in 1930. The progeny was very badly mixed showing that much natural crossing took place. For seed growing zinnia varieties can be kept pure only by properly isolating each strain. The zinnias produced seed freely and this flower offers possibilities as a seed crop if properly handled.

The fusarium disease again caused high losses. Some plants were killed early in July. Others lived until September and some plants affected with the disease even survived the whole season and produced some seed. These were stunted, however, and easily detected. Selections were made with the hope of developing disease resistant strains.

CANTALOUPE FERTILIZER EXPERIMENT

(Project C-157)

Hales Best cantaloupes were seeded in hotbeds April 19 and transplanted to the field June 11. Each plot consisted of five plants and the test was made in duplicate. The fertilizers were applied by hand and worked into the soil just before the plants were set out. This was the third successive season that cantaloupes had been grown on the same plots with the same fertilizers applied at the same rate. Barnyard manure was applied at the rate of 10 tons per acre to half of the plots each year 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. The yield from the plots which received no manure was very low, showing that commercial fertilizers alone would not maintain the yield. However, commercial fertilizers gave increased returns when used with manure. The average weight per melon is used as a basis for calculating returns.

TABLE 26.—TEST OF FERTILIZERS WITH CANTALOUPES

Fertilizer used	Rate of application per acre	Average weight of each cantaloupe			Increase over checks per melon		
		1929	1930	Average	1929	1930	Average
	lb.	lb.	lb.	lb.	lb.	lb.	lb.
Checks no fertilizer and no manure	.....	1·45	1·71	1·58	.....	.....	.....
No fertilizer but manure	.....	1·74	2·00	1·87	0·29	0·29	0·29
Sulphate of ammonia without manure	112½	1·74	1·83	1·78	0·29	0·12	0·21
Sulphate of ammonia with manure	112½	2·20	1·97	2·08	0·75	0·26	0·50
Nitrate of soda without manure	150	1·68	1·76	1·72	0·23	0·05	0·14
Nitrate of soda with manure	150	1·88	1·80	1·84	0·43	0·09	0·26
Superphosphate of lime without manure	500	2·21	1·77	1·99	0·76	0·06	0·41
Superphosphate of lime with manure	500	1·86	1·87	1·86	0·41	0·16	0·28
Muriate of potash without manure	150	1·66	1·97	1·81	0·21	0·26	0·23
Muriate of potash with manure	150	1·87	1·89	1·88	0·42	0·18	0·30
Complete fertilizer without manure	781	1·76	1·89	1·82	0·31	0·18	0·24
Complete fertilizer with manure	781	2·10	1·92	2·01	0·65	0·21	0·43

TOMATO FERTILIZER EXPERIMENT

A test similar to the cantaloupe fertilizer experiment was made with tomatoes. Plots were the same size, were handled in the same way and given the same application of fertilizers and manure. The results for total yield are given in table 27 and the comparative earliness as shown by yield of ripe fruit picked before Labour Day is given in table 28. The soil in this block is a light sandy loam with a small percentage of silt.

TABLE 27.—FERTILIZER EXPERIMENT, TOTAL YIELD

Fertilizer used	Rate of application per acre	Yield per plant				Increase per plant over checks				Rank
		1928	1929	1930	Average	1928	1929	1930	Average	
	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	
Checks, no fertilizer, no manure	.....	27·35	13·38	13·37	18·03	.....	.....	.....	.....	
No fertilizer but manure	.....	35·37	22·96	25·32	27·88	+ 8·02	+ 9·58	+ 11·95	+ 9·85	3
Sulphate of ammonia without manure	112½	22·80	16·00	16·25	18·35	− 4·55	+ 2·62	+ 2·88	+ 0·32	10
Sulphate of ammonia with manure	112½	39·90	17·37	28·45	28·57	+ 12·55	+ 3·99	+ 15·08	+ 10·54	1
Nitrate of soda without manure	150	29·45	13·15	18·40	20·33	+ 2·10	− 0·23	+ 5·03	+ 2·30	8
Nitrate of soda with manure	150	35·50	20·92	26·42	27·61	+ 8·15	+ 7·54	+ 13·05	+ 9·58	4
Superphosphate of lime without manure	500	25·60	15·10	13·67	18·12	− 1·75	+ 1·72	+ 0·30	+ 0·09	11
Superphosphate of lime with manure	500	25·65	25·43	24·32	25·13	− 1·70	+ 12·05	+ 10·95	+ 7·10	5
Muriate of potash without manure	150	34·45	12·14	10·65	19·08	+ 7·10	− 1·24	− 2·72	+ 1·05	9
Muriate of potash with manure	150	20·35	19·15	22·75	20·75	− 7·00	+ 5·77	+ 9·38	+ 2·72	7
Complete fertilizer without manure	781	38·78	16·42	18·50	24·57	+ 11·43	+ 3·04	+ 5·13	+ 6·53	6
Complete fertilizer with manure	781	35·70	19·85	28·44	28·00	+ 8·35	+ 6·47	+ 15·07	+ 9·96	2

TABLE 28.—FERTILIZER EXPERIMENT, YIELD FOR EARLINESS

Fertilizer used	Rate of application per acre	Yield per plant				Increase per plant over checks				Rank
		1928	1929	1930	Average	1928	1929	1930	Average	
	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	
Checks, no fertilizer, no manure	.....	15·12	3·99	5·76	8·29	.....	.....	.....	.....	
No fertilizer but manure	.....	11·15	4·11	6·95	7·40	− 3·97	0·12	1·19	− 0·89	6
Sulphate of ammonia without manure	112½	12·70	4·44	5·60	7·58	− 2·42	0·45	− 0·16	− 0·71	4
Sulphate of ammonia with manure	112½	12·65	2·72	7·35	7·57	− 2·47	− 1·27	1·59	− 0·72	5
Nitrate of soda without manure	150	14·80	3·70	6·10	8·20	− 0·32	− 0·29	0·34	− 0·09	3
Nitrate of soda with manure	150	11·90	3·65	6·36	7·30	− 3·22	− 0·34	0·60	− 0·99	7
Superphosphate of lime without manure	500	16·35	4·86	4·92	8·71	1·23	0·87	− 0·84	0·42	1
Superphosphate of lime with manure	500	12·25	3·90	8·87	8·34	− 2·87	− 0·09	3·11	0·05	2
Muriate of potash without manure	150	11·50	3·63	3·95	6·36	− 3·62	− 0·36	− 1·81	− 1·93	10
Muriate of potash with manure	150	9·85	2·95	6·25	6·35	− 5·27	− 1·04	0·49	− 1·94	11
Complete fertilizer without manure	781	10·88	3·10	6·50	6·83	− 4·24	− 0·89	0·74	− 1·46	8
Complete fertilizer with manure	781	11·35	3·00	5·72	6·69	− 3·77	− 0·99	− 0·04	− 1·60	9

A study of tables 26, 27, and 28 will show that with cantaloupes and tomatoes the use of commercial fertilizers alone without manure will not maintain yields. The humus in the soil becomes depleted. The soil will not take up and hold sufficient water to produce a satisfactory crop unless this humus is restored.

The use of commercial fertilizers with manure gave increased returns. Superphosphate gave increased earliness with tomatoes. Potash appears to delay ripening, and the manure also delayed ripening to some extent. On soils similar to that on this plot a complete fertilizer with barnyard manure should give increased returns.

TOMATO BREEDING

To meet the present requirements of the tomato growers of the Okanagan, the ideal tomato must possess the following characters: Earliness, firm flesh with no tendency to crack, suitability for semi-ripe trade and also for canning, and preserving, a low water and seed content, good colour, smoothness without ribs, disease resistance and high yielding capacity (only if combined with earliness). In other words, it must be a dual purpose tomato. For several years intensive individual selection has been made to secure a good dual purpose tomato. All selections are tested in triplicate progeny tests and the best retained for further testing and reselection.

Each season, all strains under test are ranked in descending order for total weight of ripe fruit produced. For comparison as to earliness, they are ranked in descending order for the weight of ripe fruit produced before the end of August. The rankings for total yield and earliness of each strain are added together and the sums rearranged in ascending order. By this method the early maturing heavy yielding strains are determined.

Seventy-one strains were tested in 1930. The strain ranking first for earliness and total yield combined was a Summerland selection of Earliana. The strains of Earliana, Avon Early and John Baer ranking first in each class and also sixteen of the first ranking twenty-five strains were Summerland selections. Thirteen of these sixteen selections were made in 1929 indicating that progress is being made by this method.

However, many of these heavy-yielding, early-maturing strains throw a high percentage of rough fruits during the early part of the season. It has also been noted that the same plants producing rough fruits early in the season will later produce fruits free from any sign of roughness. Attention is now being directed towards ascertaining the cause of this condition and finding a possible remedy.

Inheritance of Locule Number.—In the 1929 report of this Station it was pointed out that much of the roughness in the Earliana variety appeared to be closely related to the number of locules or seed compartments and the completeness of fertilization. If any locule is not fully fertilized it fails to develop properly. The greater the number of locules the greater the danger of faulty fertilization. Selections were made in 1929 to ascertain whether the number of locules is hereditary. These selections were four fruits containing five, six, eight and eleven locules respectively. Three hundred and seventy fruits of the progeny of these selections were studied. Many of these, as shown in table 29 had more than 12 locules.

Table 29.—Number of Locules

Fruits examined	Number of plants	Locules in parent	Fruits with more than 12 locules
100	10	5	41
90	9	6	53
90	9	8	50
90	9	11	28

From this table it may at once be seen that plants do not breed true for number of locules. However, the fruits selected may not have been pure lines for this character.

Ten fruits were examined from each of 37 plants.

267 fruits were rough and had locules without seeds;
5 fruits were rough but had no locules without seeds;
95 fruits were smooth and had locules without seeds;
3 fruits were smooth and had no locules without seeds.

From this it is evident that barren locules or imperfect fertilization is responsible for a large percentage of the rough fruit. The occurrence of 95 fruits that were smooth and still had barren locules shows that in spite of imperfect pollination smooth fruits may be secured under good growing conditions.

Of the 370 fruits examined, 172 or 46·5 per cent had more than twelve locules, a number greater than any of the original selections. Of these 172 fruits, 152 were rough. When the cause of this increase in locule number is learned, another important cause of roughness in the Earliana variety will be known.

Yellow or Bronze Tops on Tomatoes.—Under certain conditions, tomatoes fail to ripen evenly, but produce a large number of fruits with bronze green tops which turn red very slowly or may be yellow when the rest of the fruit is red. The colour of tomatoes is due to two pigments, lycopersicin (red) and carotin (yellow). These have the same chemical composition but differ slightly in physical properties. The red pigment will develop very slowly at temperatures over 82° F. while the yellow pigment will develop normally at this temperature. In periods of very hot weather when fruit ripens rapidly the red pigment does not have time to develop in that part of the fruit most exposed to the sun and the bronze tops result. High temperature is the chief cause of this condition. Low acidity in the fruit may also contribute to the poor development of the red pigment. An attempt will be made to ascertain whether low acidity is hereditary or due to soil and climatic conditions.

Comparison of Varieties of Tomatoes for Earliness and Total Yield.—For five years a large number of strains of Earliana, Avon Early and John Baer have been tested at this Station. Table 30 gives the summary of the results for these tests.

Table 30.—Comparison of Varieties of Tomatoes for Earliness and Total Yield

Variety	Number of strains tested	Earliness			Total yield		
		Average of all per plant	Highest strain per plant	Lowest strain per plant	Average of all per plant	Highest strain per plant	Lowest strain per plant
Earliana	198	14·94	19·86	9·93	26·54	32·96	19·72
Avon Early	70	14·80	18·20	11·94	25·84	30·41	21·61
John Baer	84	9·46	11·82	7·30	22·19	27·49	17·94

It will be seen that the Avon Early and Earliana are so much alike that they may be classed together as one type. The John Baer variety is later than the Earliana and being later under Okanagan conditions where frost usually cuts off the plants while still in full production, this variety also gives a lower total yield than the Earliana.

BEANS.—A four year plan is followed with this project. The first year a foundation plot is set out from which individual selections are made. These are increased the second year and tested in triplicate progeny tests the third year. The highest yielding strains are multiplied the fourth year.

The following table shows the varieties under test and the progress made with each.

TABLE 31.—PROGRESS IN BEAN BREEDING

Variety	Number of strains ready for		
	Multiplication	Progeny trial	Increase
Rogers Stringless Refugee	2	4	4
Keeneys Stringless Refugee	0	4	4
Round Pod Kidney	1	3	3
Pencil Pod	1	4	4
Wardwell Kidney	1	4	4

GOLDEN BANTAM CORN.—A foundation block was set out in 1927 and selections made which were tested by the ear to the row method in 1928. The four best ears were planted for mass selection the following year. A number of ten-rowed ears were found and individual ears were again selected for ear to the row tests in 1930. No strain entirely free from ten-rowed ears has yet been found. One strain gave 113 ears with 8 rows, one ear with 10 rows and 29 ears with other numbers of rows. This strain will be used for a foundation block for further breeding.

DAVIS PERFECT CUCUMBER.—Individual selections made in 1928 were tested in 1929 and the best strain used for a foundation in 1930. From this selections are ready for testing.

HALES BEST CANTALOUPE.—This variety was originally a cross between one of the larger type of muskmelons and a Western Netted Gem cantaloupe. Several undesirable characters appear frequently. These are evidently recessives and until these are removed no strain is ready for increase.

HARRIS EARLIEST PEPPER.—It has not been generally recognized that peppers cross-fertilize very readily and sufficient care has not been taken by seed growers to keep varieties pure. No commercial strain of this variety so far tested at this Station has been pure. An effort is being made to obtain a pure line by selection. As a number of characters are involved this will require several years before any strain will be ready for multiplication. To prevent crossing it has been necessary to discontinue all variety testing of peppers.

RADISH.—Selection with Icicle and Scarlet Turnip White Tip varieties has been discontinued for the present and attention concentrated on the Scarlet Globe variety. Several individual selections were isolated and seed saved. This is ready for progeny testing.

ONIONS.—Some pure strains of Yellow Globe Danvers were obtained by bagging the seed heads with Glassine paper bags. A foundation plot of the Ebenezer variety was planted. Onion maggot caused very severe damage but a few bulbs were secured for seed.

PAPER MULCH EXPERIMENT

(Project H-685)

We are again indebted to the Sidney Paper and Roofing Company for supplying the paper used in these experiments and also to the Canadian Pacific Railway Company for transporting the paper free of charge.

Experimental trials of mulch paper were made with eggplant, peppers, tomatoes, cucumbers, onions and spinach and a test on a commercial basis was made with cantaloupes.

EXPERIMENTAL TRIALS.—Each plot consisted of two rows of 36-inch paper, two rows of 18-inch paper, and two rows without paper. The rows were 30 feet in length and 4 feet apart. The seed bed was carefully prepared. The paper was then laid upon it and by means of a hand plough the edges were covered with soil to hold them in place. An irrigation furrow was made along each edge of the paper.

The seeds of eggplants, peppers, tomatoes and cucumbers were started in the greenhouse and the plants were transplanted to the plots, setting a row down the centre of the strip of paper. The seeds of onions and spinach were seeded in the open in rows 19 inches apart. As soon as the young seedlings appeared above ground, paper was placed between the rows covering the ground except about one inch on either side of the row. The paper was held in place by wooden slats fastened down with wire staples. The irrigation furrows were made before placing the paper.

Onion maggot destroyed the onion crop, the damage being 100 per cent with the paper and 80 to 90 per cent where no paper was used. No appreciable differences were found in the spinach crop. Slight burning of early leaves in contact with the paper was noticed just after a shower following the laying of the paper. The use of paper mulch with onions and spinach is not recommended. The method of holding the paper down with soil over the edges proved quite satisfactory and gave increased returns with the heat-loving crops as follows:—

TABLE 32.—PEPPERS

Width of paper used (inches)	Number ripe fruits on 36 plants	Number green fruits on 36 plants	Total number of fruits	Weight ripe fruit	Weight green fruit	Total weight of fruit
				lb.	lb.	lb.
36	340	188	528	42½	23½	66
18	296	172	468	37	21½	58½
No paper	244	172	416	30½	21½	52

TABLE 33.—EGG PLANT

Width of paper used	Harvested from 26 plants	
	Number	Weight
		lb.
36 inches	161	322
18 inches	115	230
No paper	96	192

TABLE 34.—TOMATOES

Width of paper used	Yield of ripe fruit from 18 plants	
	Weight before Sept. 5	Total weight
	lb.	lb.
36 inches	127½	535¼
18 inches	98½	420½
No paper	108¼	384

TABLE 35.—CUCUMBERS

Width of paper used	Number fruits harvested from 18 plants	
	Number before August 1	Total number
36 inches	63	440
18 inches	68	338
No paper	36	402

COMMERCIAL TEST OF CANTALOUPES.—Four plots were laid out each consisting of eight rows 180 feet long and four feet apart, and containing approximately one-eighth of an acre per plot. In plot one, paper 36 inches wide, and in plot three, paper 18 inches wide was used. Plots two and four had no paper. By means of a hand plough the edges of the paper were covered with soil and irrigation furrows made along each edge. Holes four and one-half feet apart were cut along the centre of the paper for setting out plants. The edges of these openings were sealed down with soil. The seeds were started in flats in hotbeds and transplanted when danger of frost was over. The following table gives the yields in number and weight of fruits on each plot.

TABLE 36.—RESULTS OF CANTALOUPE TEST

—	1 36-inch paper		2 No paper		3 18-inch paper		4 No paper	
	Count	Weight	Count	Weight	Count	Weight	Count	Weight
		lb.		lb.		lb.		lb.
Before Sept. 1	392	893	443	900	697	1,428	429	864
Average weight		2·27		2·03		2·05		2·01
Total	1,960	4,427½	1,156	2,348	1,509	3,083	1,445	2,852½
Average weight		2·26		2·03		2·04		1·97

Recording soil thermometers were placed beneath the mulch paper and in the open plots and maximum and minimum temperatures recorded at 9 a.m. and 5 p.m. daily. These were taken at a uniform depth of 12 inches. In each case the daily maximum temperature occurred after 5 p.m. and the minimum about or shortly after 9 a.m. showing notable "lag" behind air temperatures. No appreciable difference between temperatures beneath the mulch and in the open could be detected at this depth. Surface readings might be different and temperatures should be taken near the surface next season.

The mulch paper gives increased yields with the heat-loving crops. Whether its use will be economical depends upon the price at which it is sold. In 1930 growers living near the International boundary were able to purchase paper in the United States, pay duty on it, and lay it down at their homes at a considerable saving on the price quoted by the Canadian firms. One grower used a paper mulch for cantaloupes in 1929, left it down all winter and again planted a crop of cantaloupes on the same ground in 1930 and secured a good crop. This method materially reduces the cost of the paper for each crop and it is planned to give it a trial at this Station in 1931 with the commercial test block used last season. The cost may also be reduced by using three-foot strips of paper with three-foot spaces between them. The plants are set in staggered rows near each edge of the paper. This method allows for cultivation between the strips and fertilizers may also be applied. The perforations in the paper are unnecessary. In fact, they are a detriment as they permit evaporation of moisture otherwise retained. No difficulty was experienced with irrigation. The moisture spread beneath the 36-inch paper as well as beneath the 18-inch paper. One less irrigation was required with the 36-inch paper than in the other three plots. Weeds were negligible in plot one, and very few grew in plot three. Plots two and four without paper were quite weedy at the close of the picking season.

HORTICULTURAL PRODUCTS*

The work in Fruit Products is a continuation and expansion of the work which has been carried on under the Dehydration Committee for a number of years. This work was previously carried on at Penticton and transferred to this Station in 1929, and the work is still financed and generally supervised by the Dehydration Committee of the federal Department of Agriculture, but now comes immediately under the supervision of the Superintendent at Summerland.

APPLE JUICES

(Project H-720)

Investigation has been commenced on several juice products and the possibilities of commercial development appear very promising. To date the experiments have been limited to cider of the English type, sterilized fresh cider, apple brandy and liqueurs. Analytical data on the varieties experimented with are given in table 37.

TABLE 37.—RESULTS OF ANALYSES

Variety	Date pressed	Specific gravity	Total sugars	Possible alcohol by volume	Alcoholic content in cider of these varieties by volume	Total acidity (calculated as malic)
				%	%	%
Jonathan	Nov. 25, 1930	1,058	12·6	7·62	3·23	0·392
Grimes Golden	"	1·058	12·6	7·62	3·23	0·322
Delicious	"	1·057	12·4	7·51	3·12	0·252
Winesap	"	1·056	12·15	7·35	3·12	0·438
Newtown	"	1·055	11·95	7·24	3·12	0·365
Staymen Winesap	"	1·054	11·75	7·09	3·12	0·354
Rome Beauty	"	1·053	11·50	6·93	2·63	0·277
Wagener	"	1·050	10·70	6·49	2·47	0·334
Winter Banana	"	1·050	10·70	6·49	2·47	0·369
McIntosh	"	1·049	10·45	6·30	2·47	0·344

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

CIDER—LOT No. 1.—Five gallon kegs of juice from each of the varieties listed in table 37 were fermented in a room of 60° F. The fermentation commenced in 3 to 4 days in each case and continued very rapidly, most of the juices being down to a specific gravity of 1·032 seven days after fermentation commenced. The juices from these kegs were strained through cheesecloth, bottled, returned to the 60° chamber for 4 days. They were then placed in a cool room of 35° F. However, these samples continued to ferment and the specific gravity dropped as low as 1·009. A terrific pressure of carbon dioxide gas was developed in the bottles and the cider was not a palatable drink.

LOT No. 2.—As the juices dropped to a specific gravity of 1·036 they were removed to the cooler chamber. The temperature at this time varied from 36 to 37° F. and was not sufficiently cold to completely inhibit fermentation. After a week the juices had fallen to specific gravities varying from 1·015 to 1·020. Sufficient cane sugar was added to bring the specific gravity back to 1·035 and the temperature of the chamber raised to 53° F. Fermentation commenced slowly and as the juices dropped to a specific gravity of 1·032 they were filtered through Seitz No. 3 films and bunged up tightly in kegs. Fermentation to develop a " head " on these samples was very slow in commencing. Without the carbonic acid gas these ciders are sweet in flavour and rather flat.

LOT No. 3.—This sample was made up of juices of Jonathan, Delicious, McIntosh and Stayman Winesap. The ciders were fermented at temperatures varying from 36 to 40° F. The fermentation had progressed sufficiently in three weeks for the juices to be filtered and bottled. The second fermentation is also progressing slowly in these samples although the temperature is sufficiently high.

It is planned to hold these ciders from the sweet winter varieties and to blend them with ciders from the more acid summer varieties.

STERILIZED FRESH JUICES.—Fresh Jonathan juice was fined with tannic acid and gelatin and passed through the prefilter and later through the sterilizing films. The bottles for this experiment were washed thoroughly, stoppered with cotton batting and sterilized in a steam retort at 15 pounds pressure for 30 minutes. The caps were sterilized in weak sulphurous acid and were later washed with boiled water. The filter was back sterilized with live steam for 15 minutes. A small tube leading from the filter was used for filling the bottles. They were immediately capped and no spoilage has yet been noted in the samples. The apples used were quite mature and this may account for a flatness in the flavour of the juice. It is felt that this product would be greatly improved by carbonating.

BRANDIES, LIQUEURS, ETC.—Samples of apple brandy and liqueurs made from apple alcohol, were prepared for the Fruit Products Committee of the British Columbia Fruit Growers' Association. This work was a check on that of the previous year carried on with the assistance of Frenchmen who were originally in the distilling industry in France. Last season's operations checked the yield of the previous year which summarized is 100 25-ounce bottles of 50 per cent alcohol (by volume) per ton of apples. There are now sufficient quantities of brandy from each variety for ageing purposes and the project is completed as far as the local laboratory is concerned.

APPLE SYRUP AND CONCENTRATED FRUIT JUICES.—Equipment for the manufacture of these products has been purchased recently and will be used as soon as fresh fruit is available. Concentrated loganberry juice has been prepared and an attempt is being made to introduce this product in Eastern Canada for use in carbonated drinks.

Clarification of Apple Juice.—A gallon and a half of Jonathan juice, strained through cheesecloth and passed through the Seitz filter will completely clog one No. 3 film. If the juice is allowed to drain through two feet of washed sand, the capacity of a filter is increased five times. A 40-gallon barrel half filled with sand and with a tap on the side at the bottom is quite efficient for the sand filtering. It also serves very well for handling fined juice. Formerly juice treated in this manner was allowed to stand until the precipitated material settled to the bottom, the clear juice was then drained from the top. This method, however, is unsatisfactory as a great deal of the sludge mixes with the juice and makes close separation difficult. By passing the fined juice through the sand filter, juice wastage was avoided and the sludge can be discarded with the top half inch of sand. Sixty gallons of such juice has been passed through a single filter pad without complete clogging. As four pounds of powdered gelatin and a pound of tannic acid will fine at least 1,000 gallons of juice, and cost about the same as eight filter pads, the reduction in cost by fining is very apparent.

Effect of Moisture on Colour of Dehydrated Apples

(Project H-721)

Five fifty-pound samples of dehydrated apples have been used in this experiment. Sample No. 1 was dehydrated to 23·5 per cent moisture, while numbers 2, 3, 4 and 5 were dehydrated to 20, 17, 14 and 12 per cent moisture respectively. Each sample was packed in four tight cases. In three or four weeks all samples except No. 1 will be resulphured and processed to the moisture tolerance. The colour of the various samples will be compared at regular intervals. Any changes in the moisture content will also be noted. It is expected that the apples which have been held at 23·5 per cent moisture since they were first dehydrated will be darker after the storage period. The temperature of the storage is the same as that of an unheated warehouse.

Sun Drying of Apricots versus Dehydration

(Project H-722)

Sun drying of apricots was carried on in 1930 with three specific objects. First, to determine the minimum amount of sulphur necessary to maintain a good colour; secondly, to determine the relationship between the length of exposure to direct sunlight and colour; and third, to determine the merits of sun drying of apricots versus dehydration. Varieties used were Royals, Moorpark and Blenheim.

Part I, Minimum Sulphur.—Five equal lots were prepared from each variety. Lot 1 was not sulphured. The remaining samples were sulphured for 3½ hours at a temperature of 85 to 90° F. Lot 2 was sulphured at the rate of 2 pounds of sulphur per ton of fruit, and lots 3, 4 and 5 at the rate of 4, 6 and 8 pounds of sulphur per ton of fruit respectively. Half of each sample was sun dried and half was dehydrated, the average temperature in the dehydrator being 140° F. and the time 16 hours. The sun dried fruit was dried three days in the direct sunlight and was stacked with the trays staggered. The heat during the drying period averaged 87° F. during the day and 62° F. at night. After five days in the stack the fruit was dry enough to be taken off the trays. The colour resulting in each sample is tabulated in table 38.

TABLE 38.—AFFECT OF AMOUNT OF SULPHUR ON COLOUR OF DRIED APRICOTS

Lot No.	Sulphur per ton	Colour of dehydrated fruit	Colour of sun dried fruit
	lb.		
1	0	Dark brown	Dark brown.
2	2	Brown	Brown.
3	4	Light brown	Brownish orange
4	6	Light yellow	Good, rich orange.
5	8	Yellow	Good, rich orange.

The samples from this experiment will be analysed for sulphur dioxide and further data will be obtained thereby. It is expected that the dehydrated fruit will show a lower sulphur content in each lot than the sun dried as much of the sulphur is volatilized during dehydrating by the high temperature. Sulphur dioxide is needed in the fruit to preserve the colour and the vitamine content, but too much is objectionable.

PART 2, LENGTH OF EXPOSURE TO DIRECT SUNLIGHT.—A second lot of apricots of the same varieties were sulphured, using sulphur at the rate of six pounds to the ton and placed in the sun to dry, the object being to determine the effect of the length of exposure to direct sunlight on the colour of the product. Apricots were exposed two, three, four, five and six days. The average temperature was 85° F. for the period. Those exposed for two and three days developed an attractive orange colour, whereas the longer exposures caused "burning" and an undesirable darkening to take place. The sample exposed for six days was exceedingly dark and unattractive. There was little difference between the Royal and Blenheim, the Moorpark being much the darkest of the three.

PART 3, DEHYDRATION VERSUS SUN DRYING.—The third lot of apricots were sulphured similarly to those in Part 2. These were divided into two batches —one was placed directly in the dehydrator where a temperature of 135 to 140° F. with a relative humidity of 12 to 15 per cent was maintained, while the other batch was started to dry in the sun. After two days this fruit was also placed in the dehydrator, where the drying was completed. The object of this test was to ascertain the improvement in colour with the minimum exposure to the direct sunlight. This latter procedure resulted in a very nicely coloured product much better in appearance than that which had been dehydrated entirely.

The costs of handling are quite high, but this factor is partly offset by the reduction in the dehydrating time. From a colour standpoint the sun-dried apricot has a decided advantage over the dehydrated, and where only relatively small lots of apricots are available for drying the former appears to be the most practical.

A STUDY OF THE RIPENING OF ROYAL ANN CHERRIES FOR CANNING

(Project H-724)

As Royal Ann cherries turn red while their sugar content is relatively small and before a stage is reached that would develop maximum quality in the canned article, an endeavour has been made to ascertain when the cherries have reached the peak of quality for canning. Tests on the fresh fruit included taking the Balling degree of the extracted juice, and the volume and weight. The experiment was started at the period when growers usually pick their entire crops and was continued until the fruit on the bottom of the tree was considered ripe. Samples were taken every third day at the beginning and end of the season and

every day during the peak. Three samples were picked at each time, number 1 from the bottom branches, number 2 from half way up the tree, and number 3 from the top. A check was thus obtained of the relative maturity of the cherries on the tree in these three general positions. Duplicate tests were made on each sample. Three number 1 tall cans were canned from each lot. Forty per cent syrup was used throughout and a uniform process entailing a five-minute steam exhaust and a cook of twelve minutes. The canned samples were opened after six months' storage and examined and the following tests made: Balling degree of syrup, acidity, average volume per cherry, weight of 50 cherries, and the average number of cherries per can.

RESULTS OF HYDROMETER* TESTS ON EXTRACTED JUICE.—The results for the three periods, July 9 to 14, 15 to 19, and 21 to 29, have been averaged together and are given in table 39.

TABLE 39.—AVERAGE BALLING DEGREE OF JUICE EXTRACTED FROM ROYAL ANN CHERRIES

Sample No.	July 9-14	July 15-19	July 21-29
Number 1	12·9° B.	15·26° B.	19·3° B.
Number 2	15·4	17·8	19·5
Number 3	17·4	19·5	19·5

It may be noted that in table 39 juice from the fruit on top of the tree had a Balling degree of 17·4 at the commencement of the experiment, while the juice from fruit on the bottom of the tree was only 12·9° Balling. The former, however, increased to 19·5 in the period of July 15 to 19, and did not increase further during the season. The latter increased to 15·26 during July 15 to 19 and to 19·5 during July 21 to 29, thus indicating that if the cherries on the bottom of the tree are left after the tops are picked, that they will develop as much sugar as those on the higher branches. From the quality of the canned samples it would appear that a Balling degree of 17·5 to 18·5 gave the best results, the higher sugar development being associated with a "browning" or breakdown on the skin of the cherries. It is wise to emphasize from these results the necessity of making at least two pickings of Royal Ann cherries, one in which the top fruit is picked and the latter about two weeks later to harvest the fruit on the lower branches. The advantage of leaving the fruit on the lower branches to ripen after the tops are picked is shown in the increase in weight, wherein sample No. 2 increased 46·1 per cent, and sample No. 1 35·7 per cent. The volume increase was 35·3 per cent for sample No. 1 and 11·2 per cent for sample No. 2.

CANNED SAMPLES

REDUCTION IN STRENGTH OF SYRUP, ACIDITY, ETC.—A 40 per cent syrup was used on all fruit canned. On the greenest samples the syrup was reduced in the canning process to 27·24° Balling, while on the ripest fruit it remained as high as 31·21° B. As a correlation between the strength of the syrup after canning and the maturity of the fruit, an arbitrary standard of about 28·75 to 29·00° B. appears quite reasonable. However, the sugar development will vary a little with the different seasons.

The total acidity of the syrup in the canned fruit dropped from 0·429 per cent (calculated as malic acid) in the greenest sample, to 0·347 per cent in the

* Hydrometers graduated in Balling degrees are used for testing sugar syrup. For intance, a syrup of 30° Balling is 30 per cent sugar. In this experiment the same instrument has been used with fresh fruit juice to indicate its sugar content. Readings, however, in fresh fruit juice are only relative as other soluble solids are present.

ripest. This reduction in acid together with the increased sugar, improves the flavour a great deal. The average number of cherries required to fill a number 1 tall can was reduced 20 per cent by allowing the fruit to ripen.

PRACTICABILITY OF THE HYDROMETER TEST.—Although the averaged readings indicate the relative ripeness of the fruit there are inconsistencies between individual readings on the same sample. The average of several tests is thus necessary. A common cause of error is the rapid thickening of the juice to form a soft jelly. If this forms before the test is made, the hydrometer will remain at any point it is placed. Other tests offer possibilities and a check will be made on these before any recommendation is made.

CAUSE OF CHERRY SWELL

(Project H-725)

No analytical chemical apparatus has been available until very recently with which to investigate this problem. Sample cans of the spoiled cherries are being forwarded from the Kelowna canneries for analysis and a check up will be made in the spraying schedule of the orchards from which the canneries obtained their cherries.

MARASCHINO CHERRIES

(Project H-726)

The packing of Royal Ann cherries in a bleaching solution of sulphurous acid, alum and slaked lime has possibilities as an outlet for a portion of this crop. Cherries put up in this manner are known as sulphured stock and are used for making maraschino and candied cherries. At present the stock for these products in Western Canada is imported from France and Italy. In the United States the importations of European cherries have been largely replaced with sulphured Royal Anns and an endeavour is being made to encourage the same step here.

Experiments were started during the 1930 season and both whole and pitted cherries were packed. Some difficulty resulted from not being able to procure compressed sulphur dioxide until the cherries were a little past their prime condition for this use. The results indicate that it is better to sulphur the whole cherries and to pit them afterwards as "browning" results in the fresh fruit after it is pitted and before it is sulphured which remains as a blemish. Also, if a small amount of alum and slaked lime are used as hardening agents, the cherries stand up better after the pitting operations. The bleaching solution used was made up as follows:—

Sulphurous acid	1·5 per cent
Slaked lime	4 pounds to a 40-gallon barrel
Alum	½ pound to a 40-gallon barrel.

Some of these cherries have been made up into maraschino for demonstration purposes and have given very gratifying results. However, as the original fruit used was not of prime quality it was considered better to defer more thorough work until next season when supplies of both equipment and material will be ready when the fruit starts to ripen.

CANNING OF FRUITS AND VEGETABLES

(Project H-727)

The purpose of this project is to can the varieties of fruit and vegetables that are grown in the Okanagan, using a range of different cooks and exhausts and thus to determine the process that gives the best quality. Opportunity is

also provided to compare the canning quality of varieties as well as testing new ones that are grown on the Station. Three cans from each sample of each variation in cook and exhaust were processed. All varieties of fruits and vegetables were harvested at their peak of quality to facilitate fair comparison.

PEACHES, APRICOTS AND PEARS.—A water exhaust at 190 to 200° F. was used for these fruits. The cook was in boiling water. Table 40 lists the variations used, while table 41 gives the exhaust and cooks which produced the best quality.

TABLE 40.—VARIATIONS OF EXHAUSTS AND COOKS USED WITH PEACHES, APRICOTS AND PEARS

Name	Size of can	Exhaust variation	Cook variation	Average temperature of syrup entering can	Average temperature at centre of can after exhaust
Peaches—					
J. H. Hale	2½	10″-13″	12″-17″	134° F.	172° F.
Elberta	2½	10″-13″	12″-17″	134° F.	172° F.
Rochester	2½	10″-13″	12″-17″	134° F.	172° F.
Vaughan	2½	10″-13″	16″-19″	138° F.	168° F.
Valiant	2½	10″-13″	16″-19″	138° F.	168° F.
Vanity	2½	10″-13″	16″-19″	138° F.	168° F.
Vedette	2½	10″-13″	16″-19″	138° F.	168° F.
Tuscan Cling	2½	10″-13″	18″-21″	133° F.	156° F.
Apricots—					
Blenheim	2	4″-7″	11″-14″	76° F.	160° F.
Tilton	2	4″-7″	11″-14″	76° F.	160° F.
Moorpark	2	4″-7″	11″-14″	76° F.	160° F.
Blenheim	2½	6″-9″	13″-16″	73° F.	165° F.
Tilton	2½	6″-9″	13″-16″	73° F.	165° F.
Moorpark	2½	6″-9″	13″-16″	73° F.	165° F.
Pears—					
Bartlett	2	6″-9″	14″-17″	128° F.	163° F.
Flemish Beauty	2	6″-9″	14″-17″	128° F.	163° F.
Dr. Jewell	2	6″-9″	14″-17″	128° F.	163° F.
Bartlett	2½	6″-9″	16″-19″	135° F.	162° F.
Flemish Beauty	2½	6″-9″	16″-19″	135° F.	162° F.
Dr. Jewell	2½	6″-9″	16″-19″	135° F.	162° F.

TABLE 41.—EXHAUSTS AND COOKS GIVING MAXIMUM QUALITY IN PEACHES, APRICOTS AND PEARS

Variety	Size of can	Exhaust	Cook
Peaches—			
J. H. Hale	2½	10″	15″-17″
Elberta	2½	10″	14″-16″
Rochester	2½	8″	14″
Vaughan	2½	10″	14″-16″
Valiant	2½	10″	14″-16″
Vanity	2½	10″	12″-15″
Vedette	2½	10″	12″-15″
Tuscan Cling	2½	10″	16″-18″
Apricots—			
Blenheim	2	5″-6″	12″
Tilton	2	6″-7″	12″
Moorpark	2	6″-7″	12″
Blenheim	2½	7″-8″	15″
Tilton	2½	8″-9″	15″
Moorpark	2½	6″-7″	14″
Pears—			
Bartlett	2	8″	15″
Bartlett	2½	9″	16″

COMPARISON OF VARIETIES FOR CANNING

PEACHES

J. H. Hale.—This variety holds its shape well but it is inclined to be a little light in colour. The flavour is fair to good and the flesh slightly coarse.

Elberta.—This peach is inclined to mush very quickly after a certain stage of maturity. From a canning standpoint it is the poorest of the varieties tested at this Station. The flavour is satisfactory but the appearance of the canned product is not good even with the most carefully handled fruit.

Rochester.—Only a small quantity of this variety was available for canning but it would appear from the samples packed that it is not a good canner.

Vedette, Valiant, Vaughan, Vanity.—This group was originally propagated by the Experimental Station at Vineland, Ontario, and have only recently been tested at Summerland. The flavour, colour and firmness is good in each case. The Vedette, however, has its good qualities more pronounced than the other members of the group, and appears to be the best suited to the conditions of the Okanagan.

Tuscan Cling.—This is the only cling variety that may offer commercial possibilities. During the last two seasons the young trees on this Station have borne crops which have ripened before both Elberta and J. H. Hale. When canned, this variety has a bright golden yellow colour and the juice is absolutely clear. It does not have as much flavour, however, as the Vineland varieties.

APRICOTS

Blenheim and Tilton.—Both of these varieties are of very good quality for canning. They ripen evenly, and are of good shape, colour and flavour. When canned they hold together well and are not inclined to mush. From the canning standpoint, Blenheim, Tilton and Royal varieties are of practically equal quality.

Moorpark.—Apricots of this variety are flat shaped and ripen somewhat unevenly. Unfortunately they have a very soft flesh which mushes easily when canned. Their flavour is attractive and a fairly good canned product can be obtained if the fruit is carefully handled and the process relatively short.

PEARS

Canning tests showed that Flemish Beauty and Dr. Jewell were positively unsuitable for commercial canning. Both varieties had a flat flavour, poor colour, and a rough fluffy surface. A further objection was caused by their numerous sand cells. The Bartlett, on the other hand, produces a very high quality canned product and the canning of this fruit could be further developed to offset the large annual importations.

MATURITY OF ITALIAN PRUNES FOR CANNING

This project was outlined to determine the quality of canned prunes resulting from prunes canned at various stages of maturity. The fruit was separated by the flotation method as mentioned in Project 730 on prune dehydration. Three grades were canned, (1) those floating in a 20° solution of calcium chloride, (2) those floating in a 35° solution, and (3) those floating in a 50° solution. These may be designated as Lots Number 1, 2 and 3. All samples were canned in Number 2½ plain cans, exhausted in water at 185° F. to 190° F. for 6 to 9 minutes and cooked 13 to 16 minutes. The temperature of the syrup entering the can averaged 150° F. and the temperature at the centre of the can

before capping was 165° F. No marked difference was noted in the various cooks and exhausts of samples in the same grade, but it would appear that the cook could be reduced for the riper fruit. Probably a 6-minute exhaust and 12-minute cook would be sufficient.

TABLE 42.—CANNING QUALITY AS DETERMINED BY MATURITY OF PRUNE

Lot number	Strength of syrup	Strength of syrup after canning	Colour of syrup	Flavour
	%	°B.		
1	40	23·8	Clear, light purple	Poor.
2	40	24·3	Purple	Good.
3	40	29·0	Clear, deep purple	Very good.

It may be noted in this table that the strength of the syrup after canning, commonly known as the "cut out" increases in strength from 23·8° Balling in Lot 1 to 29° Balling in Lot 3, thus indicating the sugar development as this fruit matures. At the same time the flavour has developed from "poor" to "very good". It is regrettable that Italian prunes have been widely canned in an immature state throughout the Okanagan when by allowing this fruit to ripen it becomes of very fine quality. As the Italian prunes are now canned they are merely red plums of no distinct flavour. When this fruit is at full maturity, greater difficulty is encountered from cracking of the individual fruits which slightly deters from the appearance. It would be a wise policy to place more emphasis on flavour, and sweetness, and to pay less attention to keeping the individual fruits absolutely whole.

ROYAL ANN CHERRIES

Full details of the canning investigation carried on with this fruit are given in Project H-724. Number 2 and 2½ plain cans were used and a water exhaust of 190 to 200° F. The best results were obtained with an 8-minute exhaust for number 2 cans and a 15-minute cook, and a 10-minute exhaust and 20-minute cook for 2½'s.

TOMATOES

Tomatoes from thirteen strains being tested in the vegetable gardening department were canned. The object of this experiment was more in the way of determining the qualities of these several strains for canning rather than trying to decide on an individual exhaust and cook. The exhaust, however, was varied from 9 minutes to 12 minutes, and the cook from 17 minutes to 20 minutes. No pronounced difference was noted in the samples of these variations but it is felt that a 9-minute water exhaust at 190° F. to 200° F. and a 17-minute cook is sufficient. All samples were canned in number 2½ plain cans.

The criticisms in table 43 summarize the experiments from a canner's standpoint. The merits of these strains from a cultural viewpoint will be found in the report of Mr. W. M. Fleming on page 38.

TABLE 43.—SUMMARY OF CANNING TESTS ON TOMATO STRAINS

Strain number	Variety	Juice	Flesh	Core	Colour	Placing	Total score points
45	John Baer	Medium thick	Stands up well	Medium	Strong, dark red	1	285
71	Vernon Special	Medium thick	"	Trace to medium	Medium, dark red	2	258
43	Alacrity Earlibell	Medium thick	Remains reasonably whole	Medium	Medium, dark red	3	245
1	Earliana	Watery to medium thick	Stands up well	Medium	Medium, dark red	4	224
67	Clarks Special A	Medium	Remains reasonably whole	Medium	Light, dark red	5	218
44	John Baer	Watery	Inclined to break up	Trace	Light, dark red	6	215
69	Sundial	Medium	Remains reasonably whole	Trace	Strong, light red	7	212
33	Avon Early	Watery to medium	" "	Medium to large	Strong, light red	7	212
2	Earliana	Medium	" "	None	Strong, light red	9	207
3	Herald	Watery	" "	Medium	Medium, light red	10	193
18	Alacrity Hipper	Watery	Inclined to break up	Medium	Strong, light red	11	185
68	Clarks Special D	Watery	Stands up well	None	Strong, light red	12	180
70	Worden	Medium thick	"	Medium	Medium, light red	13	179

NOTE.—Varieties listed as dark red have sufficient colour for choice quality. All shades of light red were graded as Standard.

STRING BEANS

The varieties listed in the following table were canned in number 2 cans with a 3- to 5-minute exhaust and 20-minute cook at 240° F.

TABLE 44.—CANNING TESTS OF STRING BEAN VARIETIES

Variety	Colour	Flavour	Strings	Remarks
Pencil Pod Wax	Uniform	Good	None	This is the best wax bean tested, very tender.
Wardwell Kidney Wax	Not uniform.	Fair.	None	Flat shape, tough, large for canning.
Round Pod Kidney Wax	Uniform	Good	None	Pods slightly flattened.
Hodson Wax	Pale	Fair	Some strings.	Seeds inclined to turn pink, pods slightly flattened.
Stringless Green Pod	Good	Good	None	The best green bean, round and tender.
Masterpiece	Fair	Fair	Some strings.	This bean needs a longer cook as it has a tendency to be tough.
Bountiful	Good	Good	Excessive	Large flat bean.
Early Red Valentine	Fair	Fair	Slight	Round pod, tender.
Roger Refugee	Light	Fair	Trace	Round pod, tendency to curve, tender.
Keeney Refugee	Light	Fair	Trace	Round pod, tendency to curve tender.

With the exception of Pencil Pod Wax, it would be wise to increase the cook at least 5 minutes at 240° F.

CANNING DEMONSTRATION.—It is planned to more closely co-ordinate the canning projects of this Station with the established industry. With this object in view, a cutting demonstration was held in the fruit products laboratory on February 28, 1931. Fifteen of the valley canners were present and appeared very pleased with the work now undertaken. After the cutting of samples, discussion took place on ways in which the laboratory can assist and work with the industry. It was felt that an annual cutting demonstration of experimental and commercial packs, would be of mutual benefit to all concerned.

CANDIED FRUITS
(Project H-728)

The making of candied fruit and fruit candy attracts a great deal of interest and holds large possibilities of development. At present one firm is considering making this product commercially while several small operators make a few hundred pounds a year in the home. The object of this project was to candy the varieties of fruits most commonly used for candying to determine the merits of the individual varieties. The fruits and varieties used are as follows:—

Apricots.....Tilton, Royal, Moorpark.
Peaches .....Yellow St. John, J. H. Hale, Vaughan.
Pears .....Bartlett, Flemish Beauty.

The candying process used entailed a preliminary boil in water or weak syrup to soften the fruit and render it receptive to the syrup. The length of this step depends on the texture of the fruit and one may conclude that this boil is finished when the whiteness has left the boiling fruit.

After the preliminary boiling the fruit was placed in enamel pans and covered with a 25 per cent syrup. The strength of this syrup was taken the next day with a hydrometer and sufficient sugar was added to raise the strength 5 degrees. During the first four or five boilings it was found wise to add the

fruit after the syrup had been strengthened and to give it a three-minute boil. This was very necessary during the hot weather to prevent fermentation. The strengthening of the syrup was continued until it was 65 per cent. At this stage the fruit was left in the syrup for two weeks and was then removed, washed in 30 per cent syrup and dried on tinned wire trays.

Generally speaking, the varieties that are good for canning are good for candying. Soft fruit breaks up even with the most careful handling and consequently the best fruit is needed for this product.

Tilton and Royal apricots gave very good products while the Moorparks mushed badly. Small Yellow St. John peaches were candied whole. They held together well and had good flavour. J. H. Hale and Vaughan, on the other hand, required an unusually long preliminary boil to render them receptive to the syrup but did not mush. No advantage results from candying large peaches as the individual pieces are too big and when they are cut their appearance is spoiled. The Bartlett pear is much superior to the Flemish Beauty in every way for candying.

For those who are short of time in the summer months and who wish to candy fruit, it is a good policy to can the fruit and to candy it later in the year. Very excellent candied fruit has been made this way and by following this practice candied fruit can be made as an "off season" product.

FRUIT RIPENING WITH ETHYLENE

(Project H-729)

Wenatchee Moorpark apricots are not a good canning variety as they ripen unevenly and turn soft. A sample of this fruit was picked when the light colour first appeared and was subjected to a mixture of ethylene gas and air of a concentration of one part in 5,000. The temperature was held between 70 and 80° F. with a relative humidity of 55 to 60 per cent. The chamber was opened and thoroughly aired every 12 hours and again charged with the gas. A check sample was held under similar conditions but was not gassed. After 48 hours both samples were opened and compared. No appreciable difference was noted in the colour between the ethylene treated sample and the check. Fruit form both samples was canned and it was found that the treated fruit broke down more than the untreated. The flavour was poor and it would appear that there was no sugar development during the ethylene treatment. It is doubtful if this method of ripening Wenatchee Moorpark apricots is practical but additional tests will be made.

DEHYDRATION AND GRADING OF ITALIAN PRUNES

(Project H-730)

Although prune dehydration has been carried on to determine the relative merits of any varieties that can be grown in the Okanagan, the major activity now centers on the dehydrating of the Italian variety. Hardiness, heavy bearing habits, good size, and flavour are its main desirable qualities, but unfortunately it is the latest prune to mature.

Full maturity is not reached until the latter part of September and early October and at this date the weather is sometimes dull. Seasons of this type tend to prevent the normal sugar development and a larger percentage of the prunes are unsuitable for dehydrating than is found in the crops ripening in bright weather. Thus a prune with the good qualities of the Italian but ripening earlier in the season when the sunlight can be relied upon, would have a decided advantage. A bud sport of the Italian has been found which reaches full maturity by the end of August. This is being propagated at this Station and may be of the desired type. Other factors such as soil, irrigation, shade, and general health of the trees also have considerable bearing on the quality of prunes that are produced.

In order to study the influence of these cultural conditions, two blocks of prunes were selected for experiment in 1930. These may be designated as blocks Number 1 and Number 2. Both orchards were in vetch cover crop and had had similar applications of nitrate of soda. The water supply was quite adequate in each case and the general vigour of the trees was good. The trees in each block were well spaced. No. 1, however, was located on deep, heavy clay loam, while block No. 2 was located on a sandy loam with a great deal of gravel in the subsoil. And whereas the branches and foliage of the trees on block No. 1 were quite thick, the trees on block No. 2 were well pruned and open.

Two-year-old Italian prune orchard planted specifically to obtain data on the cost of production and other information on the dehydration of prunes on a semi-commercial basis.

The fruit on both blocks was allowed to mature until it fell on the ground and was then gathered for dehydrating. One exception occurred in block No. 1 as many prunes were still on the trees as late as October 22. These were shaken off and 69 per cent of this lot were unfit for dehydrating. The fruit on block No. 2 was all harvested by October 9.

The prunes were separated by the flotation method wherein the green fruit floats and the ripe sinks in solutions of calcium chloride of various strengths. This method has already been described in the 1929 annual report of this Station. However, the sugar development was not as high as last year and it was necessary to use weaker solutions of calcium chloride. The 55° and 40° solutions (Salometer scale) were reduced to 50° and 35° respectively. It was also deemed advisable to use a third solution of 20° which would separate the very greenest grade. The prunes which floated in this solution were not considered sufficiently sweet for dehydrating. The strength of this solution was arbitrarily started at 25° and was reduced one degree at a time until a final strength of 20° gave the separation desired. In the following tables the prunes floating in the various solutions are designated as "Floaters" and those sinking in the last solution as "Sinkers".

TABLE 45.—HARVESTING DATES AND GRADES OF ITALIAN PRUNES

Date	Lot No.	Weight	Percentage of total crop	Percentage by weight			
				20° F.	35° F.	50° F.	50° S.
		lb.					
Block No. 1—							
Sept. 23	1	244	2·60	33·6	61	5·3	0·0
" 26	2	101	1·08	36·1	53·4	10·4	0·0
" 29	3	194	2·06	22·4	66·4	11·0	0·0
Oct. 3	4	879	9·36	19·2	68·2	12·6	0·0
" 7	5	3,696·75	39·37	13·7	67·8	18·2	0·0
" 11	6	1,370·00	14·59	19·9	38·0	41·9	0·0
" 15	7	1,168·75	12·44	25·64	28·6	36·28	9·3
" 22	8	1,736·50	18·49	69·3	15·2	15·5	0·0
Total	.....	9,390·00	Average....	29·98	49·86	18·97	1·16
Block No. 2—							
Sept. 23	1	57·5	8·6	0·0	33·04	56·5	10·43
" 29	2	305	45·69	7·7	39·83	42·62	9·83
Oct. 5	3	98·75	14·79	6·58	38·22	38·22	16·96
" 9	4	206·25	30·89	8·24	40·60	44·73	6·4
Total	.....	667·50	Average....	5·63	37·92	45·52	10·90

No appreciable difference was noted in the drying ratio of the same grades from block No. 1 and block No. 2. The drying ratios may be summarized as follows:

35° "floaters" ..... 4·43 : 1 moisture content of 18 per cent.
50° " ..... 4·05 : 1 " " "
50° "sinkers" ..... 2·6 : 1 " " "

When packed, 31·25 per cent of the "35° floaters" graded 50 to 60 to the pound and 68·75 per cent were larger and graded 40 to 50 to the pound. The "50° floaters" and "50° sinkers" all graded 40 to 50 to the pound. This separation of the slightly immature prunes from the fully matured greatly improves the quality of the "pack" in two ways. First, the fruit in each grade is uniformly sweet; and, secondly, the smaller sizes are avoided. The problem that naturally arises is, "What can be done with the fruit that is unsuitable for dehydrating?" During the past season an attempt was made to use this grade of fruit as a base for an unspiced prune and apple butter. The product was quite tasty and should find a good market if made commercially. The formula used was as follows:—

225 pounds prunes,
75 pounds cull apples,
65 pounds sugar.

The apples were crushed and boiled with the prunes until both fruits were pulpy. This stock was then passed through a finishing machine to remove skin, core and pits and was returned to the kettle and boiled till it would fall in sheets from the mixing paddle. The sugar was then added, and after a short boil the product was canned. This is one possible product from the greener prunes that has possibilities and further investigation will be carried on.

VARIETY TESTS OF PRUNES FOR DEHYDRATING.—Table 46 gives results obtained by dehydrating several varieties of prunes that are being tested on this Station. Besides the Italian, the French Petite, Mammoth French, and Date, offer the greatest possibilities but unfortunately the trees are frail and the fruit does not attain a sufficiently large size in this climate.

TABLE 46.—QUALITIES OF PRUNE VARIETIES TESTED FOR DEHYDRATING

Variety	Date of ripening	Size of fruit	Texture
French Petite	Sept. 13-23	Small	Good.
Mammoth French	Sept. 12-23	Small to medium	Good.
Date	Sept. 12-23	Small	Good.
Italian	Sept. 23-Oct. 15	Medium to large	Good.
Silver	Oct. 1-10	Large	Good.
Yakima	Sept. 6-12	Extra large	Good.
Monarch	Sept. 11-23	Medium	Poor.
Standard	Sept. 12-22	Medium	Very soft.

Variety	Sweetness	Flavour	Appearance
French Petite	Good	Good	Good.
Mammoth French	Good	Good	Good.
Date	Good	Good	Good.
Italian	Good with earlier part of crop	Good	Good.
Silver	Fair to good	Fair to good	Fair.
Yakima	Fair	Fair	Good.
Monarch	Poor	Poor	Poor.
Standard	Poor	Poor	Poor.

TOBACCO*

THE SEASON

A complete record of the season for the Summerland Station is given in the meteorological section on page 3 of this report. The temperature and precipitation records apply to the Summerland Station only. All temperature readings are Fahrenheit.

THE SEASON AT THE SUMMERLAND STATION

April was approximately 4 degrees warmer than the 14-year average, whereas May and June were 2 and 3 degrees cooler. During these months, the lowest temperature, 32 degrees, just freezing, was recorded on April 11, and again on May 7. The highest temperatures were recorded on April 22, 71 degrees, May 14, 80 degrees, and June 15, 87 degrees. During these spring months precipitation was above the average, and sunshine was below normal.

Steam sterilized semi-hot beds having glass and cold frame cotton covers were used. Seed was sown on April 10, and germination required from 10 to 14 days. The glass covered beds required 40 days to produce plants of transplantable size which were ready for transplanting May 20, whereas the cold frame cotton covered beds required from 47 to 55 days, and were ready for transplanting May 30. The steam sterilized seed beds were free of weeds and disease.

Although June was 2 degrees cooler than the 14-year average, growth was well advanced, quite up to normal. Soil moisture was plentiful, and satisfactory transplanting and growing conditions prevailed.

Flea beetles (*Epitrix subcrinita* Lec) were numerous during the entire season and were especially destructive to young tobacco plants in the field. Immediately after transplanting and also later in the season it was necessary

* The work in this Division is under the charge of Mr. A. J. Mann, Tobacco Specialist, who has been entirely responsible, under the superintendent for this work and has prepared this section of the report.

to spray this pest with nicotine sulphate dust. In some small areas, cut worms were numerous and necessitated replanting to the extent of from 50 to 75 per cent. Tobacco horn worms and bud worms were not very troublesome this mid-summer. On the whole, no outstanding insect damage occurred this season.

Mosaic was first observed for the season on June 22, on the Warne variety. This disease, although active during the summer, was not as severe as last season. In 1929, 50 per cent of the Summerland Station tobacco crop was affected with mosaic, whereas this season, only 5 per cent was affected. In 1929, 30 per cent of a three-acre bright flue-cured crop was severely affected with drought spot or sun burn (?), whereas this season, 63 per cent of a four-acre bright, flue-cured crop was affected. This disease was more prevalent and was more severe on plants grown on sandy soil than on plants grown on sandy loam. Furthermore, this injury was more severe on plants having small, thin leaves. Other than these two diseases, mosaic and sun burn (?), no other outstanding diseases affected the 1930 tobacco crop at the Station.

The summer months of July and August were dry and with temperatures about normal. Light northerly breezes prevailed. Duing July and early August evaporation was approximately 0·25 of an inch per day. The highest temperature for the season, 100 degrees, occurred on July 13. Irrigation commenced in early July and four medium irrigations were applied during the season. Plants made rapid growth and varieties of Turkish, cigar leaf and the earlier plantings of Warne were ready to top during the week of July 20 to 26. Burley was ready to top on August 8. All types of tobacco which were under test matured in good season and were harvested under favourable weather conditions. During the autumn and early winter months, the weather was quite favourable for air curing tobacco. No Burley leaf, however, was entirely cured before December 20.

The season at Summerland may be summarized as follows:—

With the exception of a 50-mile an hour gale, which occurred on June 16, the season was characterized by the absence of strong winds. The last frost of spring occurred May 7, 32 degrees, and the first frost of autumn on October 12, 30 degrees. It should be noted that these temperatures were recorded on high bench land having free air drainage. A steady pall of smoke hung over the valley from August 6 to 26. During this time, on some days, the smoke was so dense as to obscure visibility across the lake, a distance of approximately two miles. The pall partially cleared between August 26 to 29, after which the smoke became more dense and continued until September 8. The season was about normal as to temperature from March to November, while the rainfall was above normal from March to May, followed by unusually light rains extending to the end of November, and considerable cloudy weather. The season was favourable for growing and curing the different types of tobacco tested.

THE SEASON IN THE DISTRICT OF KELOWNA AND VERNON

Transplanting of Burley commenced May 21, extending to the middle of June. On the whole, earlier planting, approximately ten days, would have been more favourable for maximum crop production. Although the season was favourable for transplanting tobacco, only a patchy, uneven and late stand of plants was established. This unsatisfactory stand of plants was due, in a measure, to the ravages of wire worms and cut worms and to transplanting on land having variable and unfavourable areas of soil. With the exception of 1 per cent of the Burley crop which was very late, the balance of the crop made rapid growth and 90 per cent was harvested by September 20. The season was quite favourable for the production of quality Burley.

THE SEASON IN THE SUMAS DISTRICT

Tobacco seed of the variety Warne was sown on April 2 in semi-hotbeds having glass and cold frame cotton covers. These beds produced plants of transplantable size on May 15. On April 26, an emergency seeding of Warne was sown in a heated greenhouse, which produced plants of transplantable size on June 5. These hothouse-raised plants were far too tender to adequately withstand the effects of late transplanting during the hot days of mid-June. Fifty-seven per cent of the Sumas crop was transplanted between May 18 and June 6, and 43 per cent between June 7 and June 26. This later transplanting was much too late to secure maximum yield and quality commensurate with the earliness of the Sumas season. In a number of small areas, blow-sands were especially active during June. These shifting sands depressed growth and materially lowered the yield and general quality. In some areas, flea beetles were numerous and destructive to the young plants in the field. On the whole, the crop was comparatively free of troublesome insects. Last season, in a 75-acre crop, less than twelve plants were affected with mosaic, whereas this season, in a 175-acre crop, approximately 2 per cent was affected with mosaic. In general, the Sumas crop did not make the characteristic mid-summer growth of thriving tobacco plants. In late July and early August growth was depressed, plant tissue hardened and plants headed short. Approximately 25 per cent of the crop was immature and 50 per cent only topped to eight leaves; 57 per cent was topped between July 20 and August 10, and 43 per cent between August 12 and August 22. Favourable weather prevailed during harvesting, extending from late August to early October. Fifty-seven per cent of the crop was harvested by the split stalk method and 43 per cent was primed. Ninety per cent of the crop was harvested by September 30. The first autumn frost of the season occurred long after all tobacco was harvested.

Late frosts extended into May. The rainfall was below average in most months. There was an abnormal amount of cloudy weather in October and November. The 1930 Sumas season was favourable for growing and curing bright flue-cured tobacco, there being indications that the depressed growth heretofore mentioned was due to untimely cultural practice and also to unsuitable soil areas.

NOTE.—No meteorological records are taken in the tobacco area of the Sumas district.

CROP CONDITION AND ACREAGE STATISTICS

THE OKANAGAN BURLEY CROP

The Burley crop, consisting of approximately 8 acres, received fairly satisfactory cultural care, and was harvested in early season. Half this crop, 4 acres, was grown without irrigation. Care was exercised to secure a thorough cure in the barn. Under Okanagan Valley conditions, especially that of irrigation, the crop was low in yield, approximately an average of 1,300 pounds per acre. In most instances, the cured leaf was of excellent bright colour, but light of body. The burn was medium free with white ash. A tang suggesting paint oil, characteristic of the aroma of past season's Okanagan Valley Burley, was also noticeable this season in portions of the crop. The general quality was fair to good. Determined by the actual selling price, the farm value of this crop averaged 17 cents per pound. The range in value per pound was 16 to 20 cents. An important factor which depressed the value was harvesting before the crop attained maturity.

THE SUMAS BRIGHT FLUE-CURED CROP—NON-IRRIGATED

This crop, consisting of 175 acres, was patchy, uneven in growth and maturity and low in yield. Untimely cultural treatment between transplanting and topping, a period of approximately fifty days, severely decreased the yield and quality of 50 acres, or 29 per cent of this crop. Late transplanting of small, tender plants, to the extent of 43 per cent of the crop, also depressed yield and quality. On August 22, approximately 25 per cent of the crop indicated maturity in the bottom leaves only. During late July and early August, some large areas of sandy soil appeared too open and coarse and dry to sustain normal plant growth. In other large areas growth suggested an under-nourished and semi-starvation condition, which was characterized by restricted, narrowed and not fully developed leaf, especially the lower portion of the leaf. Further, in other areas, the leaf indicated a yellowing and hardening condition instead of ripening. There were also areas in this crop which suggested magnesium starvation. The plants affected were characterized by having tough, leathery, small, dark leaves which were corrugated inward at the edges and without elasticity.

The average yield per acre was estimated at 373 pounds. The farm value of the crop was determined by the price realised on the local market. There being a keen demand for this crop, there was a ready sale at 30 cents per pound, barn run.

TOTAL CROP ESTIMATES FOR ALL DISTRICTS AND ESTIMATED CROP AREA, YIELD PER ACRE, PRODUCTION AND FARM VALUE FOR THE YEARS 1929 AND 1930

Of the total acreage planted, 8 per cent was not harvested. This crop loss consisted of 7 per cent due to general neglect and 1 per cent to frost injury. Two per cent of this loss was located in the Okanagan and 6 per cent in the Sumas.

The total crop area for Burley was 10 acres, compared with 25 acres for the previous year, a decrease of 15 acres or 60 per cent. The lowest price realized per pound was 16 cents, the highest 25 cents, and the average 18 cents. The production was estimated at 12,400 pounds, and valued at $2,237.

The total crop area for bright flue-cured tobacco was 179 acres, compared with 25 acres for the previous year, an increase of 154 acres, or 616 per cent. The lowest price realized per pound was 28 cents, and the highest 30 cents. The production was estimated at 66,600 pounds, and valued at $19,898.

The total crop area for 1930 of Burley and bright flue-cured tobacco was 189 acres, compared with 96 acres for the previous year, an increase of 93 acres or 97 per cent. This increased acreage may be attributed to the past year's successful manufacturing and marketing of British Columbia grown leaf. The yield per acre was 419 pounds, compared with 876 pounds for the previous year, a decrease of 456 pounds, or 52 per cent. This decreased yield per acre may be largely attributed to 95 per cent of this year's crop being bright flue-cured tobacco, instead of the heavier yielding types, such as Burley and cigar leaf, which were mainly planted last year. The total production was 79,167 pounds, compared with 84,108 pounds for the previous year, a decrease of 4,728 pounds, or approximately 6 per cent. The crop was valued at $22,249, as compared with $17,569 for the previous year, an increased value of $4,780, or 27 per cent. This increased value may be attributed to growing approved types and varieties, to modern and adequate buildings to cure the crop, and to a rational scheme of growing, manufacturing and marketing British Columbia tobacco by an enterprising Vancouver business firm.

TABLE 47.—ESTIMATED AREA, PRODUCTION AND FARM VALUE OF ALL TYPES OF TOBACCO GROWN IN BRITISH COLUMBIA, 1925 TO 1930

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	96	876	84,108	17 569
1930	189	419	79,167	22 349

TABLE 48.—ESTIMATED AREA, TYPE OF TOBACCO AND YIELD PER ACRE IN BRITISH COLUMBIA, 1925–1930

Year	Burley		Bright flue-cured		Cigar leaf		Other types	
	Area	Yield	Area	Yield	Area	Yield	Area	Yield
	acres	lb.	acres	lb.	acres	lb.	acres	lb.
1925	5	1,100	0	0	5	1,100	0	0
1926	15	1,351	0	0	40	1,175	0	0
1927	160	1,200	20	500	180	1,000	0	0
1928	16	1,330	7	900	53	1,330	40	1,400
1929	25	800	25	700	4	1,100	42	1,000
1930	10	1,240	179	373	0	0	0	0

TABLE 49.—ESTIMATED AREA, PRODUCTION, AND FARM VALUE OF BRITISH COLUMBIA'S 1930 TOBACCO CROP—BY FARMS

Type	Acreage	Production	Farm value per pound
		lb.	cts.
Burley	1	2,000	25*
Burley	1	600	20
Burley	1½	1,300	20
Burley	2	3,000	18
Burley	2	3,000	17
Burley	1	700	17
Burley	1	1,000	16
Burley	1	800	16
Bright flue-cured	4	4,100	28*
Bright flue-cured	75	22,500	30
Bright flue-cured	100	40,000	30

*Experimental Station crop.

It should be noted that the figures recorded in tables 47, 48 and 49 are estimates only. They are based on periodic inspections of the crop during the growing, curing and grading seasons, analyzing representative samples of cured leaf, and to the co-operation of buyers and manufacturers of British Columbia leaf.

PRESENT STATUS OF THE BRITISH COLUMBIA TOBACCO INDUSTRY

In comparison with the past three years, 1927 to 1929, when the majority of growers were unable to dispose of their crop at a price even approaching the cost of production, this season there was a satisfactory market within the province for all merchantable tobacco produced. Furthermore, there was a shortage of approximately 100,000 pounds of British Columbia crop to meet local manufacturers' requirements. This encouraging change in the status of the

industry in this province was largely due to the growing of approved types and varieties only, and especially to a rational scheme of manufacturing and marketing British Columbia tobacco.

Early in the season the Okanagan Valley growers had on hand approximately 58,000 pounds of unsold past season's crop. This unsold leaf consisted of approximately 30,000 pounds of Burley and 28,000 pounds of cigar leaf. In October, 10,000 pounds of this old Burley stock was purchased at an average price of 16 cents per pound for trade requirements within the province. Owing to unsatisfactory farm storage conditions, approximately 33 per cent of the entire old stock shows considerable wastage, to the extent of being of doubtful merchantable quality. The balance of the old stock, approximately 50 per cent, deteriorated in storage to the extent of being rated only poor to fair in general quality. On the whole, these unsold stocks of past season's crop are variable as to variety, grade, quality, pack, moisture content and disease carried. Although British Columbia's tobacco interests endeavoured to salvage as much as possible of this old stock, only 17 per cent was purchased and absorbed by the local trade in 1930. This low percentage of salvaged tobacco was due to three factors, namely: (1) too much leaf of the old stock being of doubtful merchantable quality, (2) too much leaf being of a type unsuitable for trade requirements, (3) grower's value of leaf being too high commensurate with quality. In all probability, a large portion of this old stock will yet be purchased, but at a price far below the cost of production. The balance, consisting of practically unmerchantable leaf, might better be utilized in fertilizing the land than left rotting in the sheds while waiting for quality price, long deferred, and which will never materialize.

Probably the outstanding need for the economical handling of British Columbia tobacco is the establishment of a raw leaf processing plant. Unless hard pressed for stocks, manufacturers would much prefer to not purchase ungraded and unpacked tobacco. In order to justify the risk of purchasing ungraded and unpacked tobacco, buyers often purchase crops at prices which are not equitable to the grower. Furthermore, ungraded and unpacked tobacco of doubtful quality appropriates much valuable warehouse space and until conditioned represents no definite factor as to grade, quality and moisture content. In many tobacco barns may be found miscellaneous lots of ungraded and unpacked tobacco which often carry as high as 20 per cent excess moisture. To the manufacturer, such tobacco stocks are very undependable and unsatisfactory sources of supply; and, too, the wastage of leaf is considerable to the grower, especially with barn storage during summer. If British Columbia's tobacco industry is to expand to any considerable extent a raw leaf processing plant is necessary in order to reduce wastage of tobacco in storage on the farm, also to promote a more equitable basis for growers to sell their raw leaf and further to develop stability and confidence in the industry in the standardization of dependable known stocks as to grade, quality, moisture content and pack, and thus enlighten and strengthen the way for orderly growing and marketing.

In the planning for a 175-acre bright, flue-cured crop for the Sumas, courage was renewed and confidence strengthened. It was a bold step forward and entailed considerable capital expenditure in the purchase of land and kilns. The venture was fraught with many difficulties and uncertainties for this type of tobacco had never before been grown in this area. The results more than justified the boldness of the project. An analysis of representative samples of the cured leaf demonstrated the entire crop to be of fair merchantable tobacco, and further indicated that with improved growing and curing practice that leaf of satisfactory grade and quality may be expected of the more desirable tobacco soils of the Sumas district. Of the future, much depends on maintaining satisfactory sales, however, factory production and sales give promise of less difficulties than the field production of a dependable supply of desirable leaf.

TABLE 50.—NUMBER OF DISTRICTS AND GROWERS PRODUCING TOBACCO IN BRITISH COLUMBIA, 1925-1930

Year	Districts	Growers
1925	8	8
1926	1	20
1927	20	123
1928	8	28
1929	2	2
1930	5	10

TABLE 51.—BRITISH COLUMBIA'S TOBACCO CROP CAPACITY AS DETERMINED BY NUMBER OF KILNS AND CURING BARNS IN THE PROVINCE IN 1930

Burley and cigar leaf tobacco, air-curing barns		Bright flue-cured tobacco, kilns	
Number	Crop capacity	Number	Crop capacity
	acres		acres
34	130 to 170	21	105 to 126

The range in capacity of from 130 to 170 acres varies in proportion to the heaviness of yield. For heavy yielding Burley, the capacity is approximately 130 acres. There is kiln capacity for 105 acres of a normal, bright, flue-cured crop, when harvested by the split stalk method, or 126 acres when primed. In past season, inadequate curing barn space commensurate with amount of crop harvested severely depressed the progress of British Columbia's tobacco industry. Curing was retarded, wastage in weathered and diseased leaf was increased and general quality was lowered.

EXTENSION WORK

Throughout the season, numerous tobacco conferences, interviews and inspections were attended to attempt in assisting in developing a rational viewpoint of orderly growing and marketing and in giving timely suggestions and recommendations on practical growing and curing problems. The significance of some phases of this service are briefly summarized.

(1) Orderly growing and marketing characterized the 1930 crop, which was produced and marketed strictly to local manufacturers' requirements.

(2) Success was achieved in the complete elimination of unsuitable types and varieties as compared with 1929 when 70 per cent of the Sumas crop comprised unknown and unfavourable sorts of tobacco in so far as the Canadian trade was concerned.

(3) Seed of approved types and varieties was supplied to all tobacco growers in the province.

(4) Eight thousand surplus plants were distributed to growers who were short of plants.

(5) Timely assistance was given in estimating probable crop yield with the view of reducing to a minimum this season's capital expenditure in kiln construction.

(6) Irrigation experience brought to bear on a Sumas cultural problem in August materially lowered the cost of production.

(7) Expediting the harvesting of the Sumas crop before rain by suggesting the risk of waiting for sunshine and additional maturity which at the time was doubtful of being secured.

(8) Stressing the immediate need and demonstrating the method of reducing excess moisture of baled tobacco in storage.

(9) Assistance was given in examining old and new Burley stocks resulting in the purchase of 17,000 pounds of tobacco at very satisfactory prices.

(10) Kilns of approved type were constructed according to plans and information supplied.

(11) Co-operation was practised by manufacturer, grower and Department, resulting in a better understanding and appreciation of each other's viewpoint problem and the value of recommended cultural practice.

(12) In company with Dr. N. T. Nelson, Chief of the Tobacco Division, a survey was conducted of the British Columbia tobacco industry and valuable impressions obtained for the planning of the 1931 crop.

GRADE AND QUALITY OF THE COMMERCIAL BRIGHT, FLUE-CURED TOBACCO CROP AT SUMAS

COMPARISON OF THE SUMAS BRIGHT, FLUE-CURED CROP, 1929-1930

The 1929 Sumas crop which the growers called bright, flue-cured tobacco did not resemble this type of tobacco either when growing in the field or when cured. The leaf had no resemblance to bright, flue-cured tobacco as produced at Summerland, Southwestern Ontario, United States, Nyasaland, Rhodesia, and South Africa. The leaf was dark brown in colour, heavy in body and resembled Quebec cigar filler leaf. Thus in the light of the 1929 crop it may be said that bright, flue-cured leaf was first grown in the Sumas in 1930.

COMPARISON OF THE SUMAS AND ONTARIO BRIGHT, FLUE-CURED CROP, 1930

To more intelligently understand the general quality and value of the 1930 Sumas crop, a brief comparison of the Sumas and Ontario crops for 1930 is first presented. The Ontario season was extremely dry and unfavourable for the production of high quality tobacco as compared with a favourable season in the Sumas. The Sumas crop, however, was materially depressed in yield and quality through untimely cultural care and inexperience in the culture of the crop in the Sumas environment.

The top price for a small percentage of the Ontario bright, flue-cured leaf was 40 cents per pound. The general average of the better grades realized approximately 31 cents per pound.

The commercial valuation of the Sumas leaf was from 33 to 35 cents per pound and was based on the determinations of two bright, flue-cured tobacco experts of the Dominion Experimental Station, Harrow, Ontario. The grade index valuation as determined by the Chief of the Tobacco Division and by the British Columbia Tobacco Specialist was from 30 to 31 cents per pound, or approximately the same valuation as the average run of the better grades of the 1930 Ontario crop.

QUALITY EVALUATION OF THE SUMAS BRIGHT, FLUE-CURED CROP, 1930

Unevenness of growth, size of leaf, maturity and also unfavourable curing conditions within the kiln caused a condition of leaf known as "sponging" which materially dulled the colour and gloss and lowered the general quality of the cured leaf.

In body the leaf was light and almost ideal for cigarette tobacco. The smoke was rated mild and the aroma sweet and agreeable. The leaf colours were characterized with a slight greenish cast along the veins and with cold pumpkin-yellow colours.

The *primed leaf* which comprised 43 per cent of the Sumas crop, graded as follows:—

The lemon and orange grades were practically all cutters of good quality. In colour, the orange grade was more of a lemon orange and the red grade was

really dark orange. As compared with the split stalk portion of the crop, the primed leaf was more uniform in general quality and graded a higher percentage of fine cutters suitable for high grade cigarette tobacco. Further, the primed leaf contained less prominent veins. The aroma, however, was sharper and not as agreeable. The grade index valuation of the primed leaf was 30 cents. The commercial valuation was approximately 35 cents per pound.

The *split-stalk leaf,* which totalled 57 per cent of the Sumas crop, graded as follows:—

The leaf contained considerable dust, soil, and thistle down. The lemon leaf graded 60 per cent cutters and 40 per cent leaf filler. The orange and red grades contained good quality leaf filler more suitable for pipe than cigarette tobacco. As in the primed section of the Sumas crop, there was no true red leaf. The aroma was rated very agreeable and good in grain and maturity. The grade index valuation was 31 cents. The commercial valuation was approximately 33 cents per pound.

The general trend of the 1930 Sumas bright, flue-cured crop was a medium size thin leaf of cutter grade and quality.

TABLE 52.—MECHANICAL ANALYSES OF LAND WHICH PRODUCED BRITISH COLUMBIA'S BRIGHT FLUE-CURED CROP IN 1930

District	Soil No.	*Loss on ignition	Coarse gravel	Fine gravel	Coarse sand	Medium sand	Fine sand	Very fine sand	Silt	Clay	Soil classification
		%	%	%	%	%	%	%	%	%	
Sumas	5	1·82	0	0·81	4·83	18·87	60·12	12·89	1·36	1·12	Fine sand
Sumas	6	3·56	0	0·18	0·67	1·52	43·03	49·22	3·30	2·08	Fine sand
Sumas	7	2·49	0	2·32	3·44	7·06	52·32	30·98	2·03	1·85	Fine sand
Summerland	8	3·68	0	3·69	6·58	8·12	24·11	33·32	16·17	8·01	Fine sand
Summerland	9	3·91	0	2·79	7·25	10·66	28·20	29·41	14·75	6·94	Fine sand
Summerland	10	2·08	0	3·35	17·46	21·95	33·45	13·13	6·58	4·08	Fine sand

*Loss on ignition indicates amount of organic matter in the soil.

In exposed areas, soil number 5 is a drift sand. During late May and June, the drifting sand irritated the young plants and depressed growth. On this land the crop was patchy, uneven, backward in growth and maturity and yielded less than 300 pounds per acre.

Soil numbers 6 and 7 produced a normal crop of quality leaf and yielded 800 pounds per acre.

Soil number 8 and 9 was unsatisfactory for the production of quality leaf. Growth was too rank and too long sustained, resulting in nearly 50 per cent of the crop being green and immature at harvest. The yield was from 2,300 to 2,400 pounds per acre.

Soil number 10 produced a normal crop of quality leaf and yielded 1,400 pounds per acre.

It should be noted that the Sumas land was non-irrigated, whereas Summerland land was irrigated.

EXPERIMENTAL WORK

TOBACCO LEAF QUALITY EVALUATION

Prior to 1928 no definite attempt was made to classify the cured leaf into commercial type grades and values and place on a numerical basis. This lack of a numerical standard on which to determine grade and quality depressed the interpretation of results. During the past three years, 1928-1930, under the direction of Dr. N. T. Nelson, a workable system for determining grade, quality and price values on a numerical basis was evolved. This quality evaluation is determined as follows: After stripping, the tobacco from each plot is assorted

into commercial grades, prices are assigned to each grade and the average value per pound determined. This computed average price per pound is termed the "Grade Index" and is used as such in this report. The "grade index" is therefore based on the percentages of assorted grades and the relative commercial value of each grade.

Owing to the limited space allotted to tobacco in this report, some results of bright flue-cured leaf only are discussed.

THREE-YEAR SUMMARY OF BRIGHT FLUE-CURED TOBACCO EXPERIMENTS CONDUCTED AT SUMMERLAND, 1928-30

CULTURAL SUMMARY OF EXPERIMENTS.—Seed is sown in steam sterilized soil in glass covered semi-hot beds about the first of April and transplanted to the field about the end of May. Bench land consisting of sandy soil is used and in some seasons irrigation is required before being transplanted to tobacco. The practice is to conserve the natural soil moisture and delay irrigation as late as possible, preferably for several weeks after transplanting. Owing to inadequate irrigation facilities no attempt is made to determine the exact water requirement for tobacco. Irrigation experience in the culture of tobacco indicates frequent and medium irrigations as being the most suitable for maintaining normal plant performance. A medium irrigation is usually applied in about ten hours and the frequency of application is from three to five irrigations, depending on the character of the season and on the water holding capacity of the soil. The crop is topped during late July and harvested during early September. From the seed bed to the cured leaf the crop is grown well within season.

THE EFFECT OF SOIL ON YIELD AND QUALITY.—The soil class, a fine sand, designated by actual mechanical analysis is representative of large areas of soil in this district. The variable plant performance of this type of tobacco in growth, maturity, yield and general quality when grown in this area under similar cultural treatment, indicates extreme variableness of environment within this area and within this soil class.

Sandy soil containing 4 per cent silt and 3 per cent clay and yielding 1,100 pounds of cured leaf per acre, was too light of body to sustain normal plant growth, especially during periods of high winds and peak temperatures. Notwithstanding the application of frequent irrigations, tobacco growing on this type of soil suffered from the effects of blow sand, wilting, sunburn and depressed growth.

Sandy soil containing 7 per cent silt and 4 per cent clay and yielding 1,400 pounds of cured leaf per acre sustained a more normal growth and yielded a higher quality leaf.

Sandy soil containing 16 per cent silt and 8 per cent clay and yielding 2,100 pounds of cured leaf per acre was entirely unsatisfactory for the production of bright flue-cured leaf of a grade and quality as desired by the trade. The leaf was too large and too heavy in body and too uneven in maturity to produce the desired quality in this type of tobacco. Furthermore, 30 per cent of the leaf was green and immature at harvest. The larger portion of the leaf "sponged" and cured a tawny-olive and buffy-brown colour instead of a bright leaf of lemon and orange colour.

PHYSIOLOGICAL DISORDERS.—An injury affecting bright flue-cured tobacco to the extent of 47 per cent of the crop, three-year average, and which somewhat resembled sun-burn, was probably the major factor depressing the quality of cured leaf. The injury is not apparent until after the crop is cut and sometimes not until the leaf is being cured in the kiln. The injured areas are fairly well distributed throughout the leaf but more so from the middle of the leaf to the tip. After the leaf is cured, the base colour of the injured areas is tawny-olive

with blotches of dull citrine whereas the normal leaf is brighter in the prevailing colours of yellow ochre and antimony yellow. These diseased areas are brittle and on handling often separate from the normal leaf tissue.

Experiments with different treatments of fertilizers, irrigation and harvesting were conducted to determine whether Drought spot was the cause of the trouble. The results obtained indicate that sun-burn may be the cause of the injury. Further test, however, will need to be conducted to substantiate this theory. In the meantime, growers should beware of sun-burn injury by piling bright flue-cured tobacco immediately after cutting similar to the practice of

A bright flue-cured tobacco leaf affected with an injury resembling sun-burn.

piling cigar leaf or Burley. The piles should be made so that the butts of the plants face towards the sun. Should the maximum temperature reach 80 degrees Fahrenheit caution should be exercised to protect cut tobacco from undue exposure to the sun.

Other physiological disorders affecting this crop were mosaic, 4 per cent, and Frenching, 2 per cent.

General Quality Tests.—The three-year test yielded no first-class leaf of any grade and none of wrapper quality. In burn and aroma the quality was consistently excellent. The leaf was variable in the characters which determine the general quality. Furthermore, the leaf was too large and too coarse in body, rib and vein to cure a high percentage of bright leaf of good or above good grade quality. The seven quality factors which were used in determining

the grade index value are excellent, very good, good, medium, fair, poor and very poor. The general quality rating was medium. The general quality rating when based on a scale of 1-10 was 6 for cigarette tobacco and 10 for pipe tobacco. Manufacturers consider the Summerland bright flue-cured leaf as being more suitable for pipe tobacco. The three-year average grade index value was 16·6, although commercially the leaf realized an average price of 21 cents per pound.

The significance of grading and determining the evaluation of quality is illustrated in the accompanying table 53 where quality and value are expressed on a numerical basis.

TABLE 53.—BRIGHT FLUE-CURED TOBACCO YIELD AND QUALITY, SUMMERLAND 1928-30

Year	Soil classification—fine sand								
	Silt 4% | Clay 3%			Silt 7% | Clay 4%			Silt 16% | Clay 8%		
	Acre yield	Grade index	Acre value	Acre yield	Grade index	Acre value	Acre yield	Grade index	Acre value
	lb.	cts.	$	lb.	cts.	$	lb.	cts.	$
1928	1,257	17·0	231	1,260	13·0	164	2,248	12·0	272
1929	1,021	16·6	169	1,267	16·9	214	1,805	16·3	293
1930	1,312	19·5	257	1,895	24·0	459	2,381	14·0	332
3-year average	1,197	17·7	218	1,474	18·0	279	2,145	14·1	299

Although sandy soils, numbers 8 and 9, carrying a fairly heavy proportion of silt and clay, record the highest average acre value, this should not be an inducement to grow bright flue-cured tobacco on these heavier soils. The extremely high yield and low grade index value indicate a large percentage of low-grade leaf, which in years of large production, may be difficult to sell, especially as low grades of bright flue-cured tobacco and burley enter into similar lines of tobacco manufacture, thus competing with each other.

Resistant B1193XX, a variety of Burley susceptible to tobacco leaf drop.

Judy's Pride, a variety of Burley resistant to tobacco leaf drop.

TOBACCO LEAF DROP INVESTIGATION AT KELOWNA

During the season of 1930 this project was continued in the district of Kelowna and also at the Summerland Station. As this project is still in progress, brief mention only will be made of results which are of direct practical value to the Kelowna burley growers.

This investigation included tests for varietal susceptibility or resistance. Of the eight burley varieties tested Judy's Pride, a variety of erect habit of growth, showed marked resistance to leaf drop. This variety is also outstanding in yield and quality. Judy's Pride is therefore recommended as being a suitable variety of burley for Kelowna, and especially for the low land characteristic of the district.

SUMMARY

The season, irrigation, soil, insect pests, and diseases and their relation to the growing and curing of tobacco are reviewed.

Crop conditions for 1930 are summarized and compared with the previous year, 1929. This comparison includes yield, quality, and farm value of the Okanagan burley and of the Sumas bright flue-cured crop. The increased crop value of 27 per cent may be attributed to orderly growing, manufacturing and marketing.

The estimated acreage, type of tobacco, yield per acre, production and farm value of British Columbia's tobacco crop for the years 1925 to 1930 are included.

The estimated acreage, production and farm value of British Columbia's 1930 tobacco crop, by farms, are tabulated.

The status of the British Columbia tobacco industry in 1930 shows the significance of orderly growing and marketing commensurate with specific trade requirements.

A satisfactory market existed for all merchantable leaf produced in the province in 1930.

In order to reduce wastage of tobacco in farm storage and to inspire the confidence of the trade in raw leaf stock, timely processing to a standardized pack of known moisture content is suggested.

The number of districts and growers producing tobacco in the province during 1925 to 1930 are tabulated. In 1927, 123 growers, the majority being inexperienced in the culture of tobacco and located in twenty widely separated districts, was not conducive to orderly production of quality leaf as desired by the trade.

British Columbia's tobacco crop capacity as determined by the number of kilns and curing barns in the province in 1930 is recorded. In past seasons, inadequate curing barn space commensurate with amount of crop harvested severely depressed the progress of the industry.

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

The grade, quality and value of the Sumas bright flue-cured crop are summarized and values compared with Ontario's crop. The general trend of the 1930 Sumas bright flue-cured crop was a medium size, thin leaf of cutter grade and quality. The grade index valuation was from 30 to 31 cents per pound, or approximately the same valuation as the average run of the better grades of the 1930 Ontario crop.

The mechanical analysis of land which produced British Columbia's bright flue-cured crop in 1930 is tabulated. The soil class, a fine sand, shows extremely variable soil conditions. These soils yielded from 300 to 800 pounds and from 1,400 to 2,400 pounds per acre. The most ideal soil for this type of tobacco was that producing from 800 to 1,400 pounds of cured leaf per acre.

Brief mention is made of the evaluation of quality on a numerical basis which was of outstanding value in determining the quality and value of the 1930 experimental and commercial crops.

Irrigation experience in the culture of tobacco indicates frequent and medium irrigations as being the most suitable for maintaining normal plant performance. A medium irrigation is usually applied in about 10 hours and the frequency of application is from 3 to 5 irrigations, depending on the character of the season and of the water holding capacity of the soil.

An injury affecting bright flue-cured tobacco and which somewhat resembled sun-burn was probably the major factor depressing the quality of the cured leaf, to the extent of 47 per cent of the crop, three-year average.

The general quality rating of the Summerland bright flue-cured tobacco was medium. The quality rating when based on a scale of one to ten, was six

for cigarette tobacco and ten for pipe tobacco. The three-year average grade index value was 16·6, although commercially the leaf realized an average price of 21 cents per pound.

Manufacturers consider the Summerland bright flue-cured leaf as being more suitable for pipe tobacco.

The significance of evaluation of quality on a numerical basis is illustrated by expressing quality in tobacco in final terms of value per pound and per acre.

Unless associated with a high grade index value, high acre value may indicate low grade tobacco which in years of large production may be difficult to market at a price above the cost of production. Unsuitable soil conditions materially depress the grade index value of this type of tobacco.

Judy's Pride, a variety of Burley which is practically resistant to Tobacco Leaf Drop, is recommended to Kelowna Burley growers.

ANIMAL HUSBANDRY

DAIRY CATTLE

Good progress can be reported in building up the Jersey herd which at the end of the year numbered twenty-six head of females, all ages. Close culling, based mainly on Record of Performance tests, has eliminated those families and individuals which were not breeding consistently. At the same time, much thought and study was given to maintenance of good breed type.

Of major interest in the herd as at present constituted are five females of the so-called Sunflower family, 75 per cent or better full blooded sisters, who will have an average official R.O.P. test of approximately 620 pounds of fat in 305 days. These cows are of excellent type, being smooth, wide-rumped,

Jerseys on rotated pasture—the milking herd at the Station pasturing on alfalfa and mixed grass.

straight-backed, fine shouldered and deep barreled matrons, with uniformly excellent udders. These cows represent one of the main foundations on which the herd is being constructed. A 75 per cent full brother has been located and will be used in a line-breeding experiment with these females.

The senior herd sire, Hamlet's You'll Do (Imp.) —38570— has now nine daughters in the herd, and they give promise of developing into deep, strong, good-uddered cows. These daughters will all be tested as they freshen. Hamlet's You'll Do is by You'll Do's Volunteer —5920—, out of a tested daughter of Fern's Oxford Noble 2nd —5297—. As a junior herd sire, a son of Oxford Sultan of Oxford —23234— out of Glamorgan Arizona's Babe —22698— is being used. The dam of this bull has a five-year-old 365-day record of 724 pounds of fat, and is by Dreaming Sultan (Imp.) —258757A—, and is a cow of exceptionally good type and conformation. This young bull gives promise of developing into an excellent individual. He is being used lightly and his progeny will be carefully watched and developed, and if they turn out satisfactorily the bull will be used more heavily later on. This policy of testing unproven herd sires before committing the destiny of the herd to fate by using unproven bulls is being rigidly adhered to.

TABLE 54.—PRODUCTION AND COST FIGURES ON ALL COWS IN HERD FOR CALENDAR YEAR 1930—JANUARY TO DECEMBER

Name of cow, and registration number	Age of cow	Days in milk	Total milk for year	Average per cent fat	Pounds butter-fat for year	Value of butter-fat at 40 cents per pound	Value of skim-milk at 25 cents per cwt.	Total value of product for year	Amount and value of meal	Amount and value of silage	Amount and value of roots	Amount and value of hay	Pasture charge	Total cost of feed	Feed cost per pound butter fat	Feed cost per 100 lbs. milk	Profit (value of product minus feed cost)
			lb.		lb.	$	$	$	lb.	lb.	lb.	lb.	$	$	cts.	$	$
Calgarth Starlight—17479	10	343	12,141	5·7	692	276 80	28 75	305 55	3,849	4,160	6,995	3,045					
									$79 23	$10 40	$17 48	$15 22	10	132 33	19·1	1 09	173 22
Sunflower May—20894	8	296	11,756	5·2	612	244 80	27 86	272 66	3,647	3,310	7,130	2,940					
									$75 07	$8 27	$17 82	$14 70	10	125 86	20·5	1 07	146 80
Sunflower Nora—23397	8	313	8,792	6·1	536	214 40	20 64	235 04	3,113	4,160	5,815	3,045					
									$64 08	$10 40	$14 53	$15 22	10	114 23	21·3	1 30	120 81
Sunflower Maidie—23392	7	293	10,720	6·4	686	274 40	25 08	299 48	3,564	4,160	8,470	3,045					
									$73 36	$10 40	$21 17	$15 22	10	130 15	19·0	1 214	169 33
Sunflower Rubylet—50071	7	334	10,622	5·2	557	222 80	25 16	247 96	3,374	3,845	6,930	3,035					
									$69 45	$9 61	$17 32	$15 17	10	121 55	21·8	1 144	126 41
Sunflower Flora—23404	6	363	12,585	5·6	708	283 20	29 68	312 88	4,046	3,810	9,250	3,045					
									$83 28	$9 52	$23 12	$15 22	10	141 14	19·9	1 12	171 74
Radio Phawnee—35074	3	319	6,849	6·8	463	185 20	15 96	201 16	3,020	4,120	8,540	3,045					
									$62 16	$10 30	$21 35	$15 22	10	119 03	25·7	1 74	82 13
Summerland Velveteen—32363	3	315	8,155	5·2	423	169 20	19 33	188 53	3,060	3,730	5,745	3,045					
									$62 99	$9 32	$14 36	$15 22	10	111 89	26·5	1 37	76 64
Totals	.....	2,576	81,620	.....	4,677	1,870 80	192 46	2,063 26	27,673	31,295	58,875	24,245					
									$569 62	$78 22	$147 15	$121 19	80	996 18	.....	.....	1,067 08
Average	.....	322	10,202·5	5·73	584·6	233 85	24 05	257 91	3,484	3,912	7,359	3,030					
									$71 20	$9 77	$18 39	$15 15	10	124 52	21·3	1·220	133 39

NOTE.—Meal in 1930 actually cost $41.17 per ton average, based on the delivered cost over the year of the various ingredients of the grain mixture fed, which consisted of bran, ground oats and oil meal in the general proportions of 2-2-1, with the addition at various seasons of either 1 part corn meal or 1 part barley. However, for the greater part of the year only the plain mixture was fed. Silage and roots were valued at $5.00 per ton, cull apples were substituted for mangles during October and November at the same value per ton delivered. The hay was alfalfa at a valuation of $10.00 per ton loose in the barn. This was fed liberally and at an estimated weight of 15 pounds per cow per day. Pasture was charged at the rate of $2.00 per month per cow. The values for butterfat and skim-milk are arbitrary. No value has been placed on manure produced, nor on offspring, nor has labour been charged.

Table 54 gives the production and cost figures on the eight cows in milk in the herd during the year which completed the entire calendar year in the Station herd. Twelve cows were milked during the year, but some were either disposed of or records lost. Therefore, only those cows are included in this table on which it was possible to obtain figures of costs of feed and production for the full year. The average production was high and can be attributed to the excellence of the individuals and also in part to the fact that no heifers were brought into milk in time to be included in this table for 1930.

TABLE 55.—RECORDS IN HERD COMPLETED DURING 1930 UNDER THE CANADIAN RECORD OF PERFORMANCE

Name and registration number	Age at commencement of test	Number of days on test	Pounds of milk	Pounds of fat	Average per cent fat	R.O.P. number
	years		lb.	lb.	%	
Calgarth -17479-	8	305	13,338	711	5·33	1838 A
Sunflower Maidie -23392-	7	305	9,955	582	5·85	1976 A
Sunflower Rubylet -50071-	7	305	10,270	538	5·24	2137 A
Sunflower Flora -32404-	6	305	12,351	700	5·67	1985 A
Sunflower Fay -23405-	6	305	10,577	640	6·05	1937 A
Summerland Aviator Violet -29508-	3	305	7,505	460	6·13	1984 A
Radio Phawnee -35074-	3	305	6,242	404	6·47	1983 A
Summerland Velveteen -32363-	3	281	7,745	407	5·26	1936 A
Summerland Leonette -32365-	3	365	10,603	569	5·37	3194

Table 55 gives the list of official records completed in 1930 under the Canadian Record of Performance for Jerseys. All females in the herd are regularly placed on official test and milked three times daily. The importance of consistent official testing cannot be over-emphasized at this time, as a breeder in this way can not only obtain reliable information on production capabilities on which to base his breeding operations, but also regular testing produces records on the herd and on individuals which are of inestimable value in any sales program. This is particularly true in reference to the disposal of males, as the buying public is becoming increasingly cognizant of the value of official records of production in selecting herd sires for either pure-bred or grade herd breeding.

SWINE

The breeding herd of Berkshire swine at the end of the year consisted of twelve mature sows, eight gilts bred for spring farrowing, and four boars. In addition, eight litters farrowed in the fall were on hand in the feed lots being carried for progeny test under the Advanced Registry Policy for Swine. The twelve mature sows all had either completed a progeny test under this scheme or had a litter going through at the close of the year. In future all breeding stock used on the Station will be either qualified under the Advanced Registry scheme, or will be in process of approval. Complete records as yet are only available on three matrons and no observations are possible on the herd as a whole from this Advanced Registry work. Excellent data are being secured and the policy of breeding only from approved sows will be rigidly adhered to.

The completion during the year of permanent farrowing pens and yards and of a central feed house and yards very materially assisted in conveniently and efficiently handling the swine herd. Considerable difficulty had been experienced in the past with parasites due to poor housing and yard arrangements which did not permit of adequate sanitary precautions being observed. A farrowing shed of the open-front, shed-roof type, adequate in pen size, was erected of a size sufficient to handle twelve sows during farrowing time. This house has

good drainage, concrete floors and small concrete exercising yards with a convenient arrangement of alleys and gates which facilitates the necessary disinfection and sanitation necessary to ensure clean, worm-free conditions for farrowing sows. The sows are carefully washed and placed in a clean, disinfected pen preparatory to farrowing, and are changed weekly thereafter to clean pens and yards, until the litter is weaned. The results in respect to worm-free litters under this system have been very gratifying.

A central feed house was also erected with feed alley and feed trough space for ten separate lots of feeder pigs. From this house yards radiate in three directions, and housing for the feeders is provided in portable, individual houses at the far end of each yard. These yards are in duplicate and one yard is rested and cultivated while the other yard is in use, in order to minimize the danger from worm infestation as far as posisble.

POULTRY*

The year under review was average from the standpoint of weather conditions for egg production and hatching results. The pullets were raised, as in the other recent years, in an orchard adjoining the plant, and in consequence went into the laying quarters in the fall of 1929 in splendid shape. During a damp spell of weather shortly after the New Year a slight epidemic of colds broke out which was soon cleaned up by the aid of Epsom salts and a strong disinfectant. The average production of these pullets, while under that of the previous two years, was still well over 200 eggs a bird.

Incubation and rearing results were very satisfactory, especially for White Wyandottes which is the breed kept exclusively on this Station. The average fertility for the season was 85 per cent, while hatchability of fertile eggs was just over 70 per cent. No trouble was experienced with pullorum, proof of the great value of blood testing all breeding stock, and rigid culling in conjunction. Slightly better than 97 per cent of the chicks hatched were alive at three weeks, at which age they are more or less safe from common chick ailments.

Although the nature of the ground is rocky and the poultry plant so located as to preclude cultivation and the growing of crops to sweeten the land, trouble due to ground contamination has been kept at a minimum. Rearing the chicks on clean fresh ground away from the main plant and constant disinfection has prevented intestinal parasites getting any hold on the birds, which are confined to the laying sheds from the time they are first put in in the fall until late in the following summer, when they are winding up their first laying year.

The 1930 crop of pullets, now well into their first year's production, came into the sheds in very fine condition, and from present indication should surpass those of the previous year. The mild winter of 1930-31 has been a great help to production although it has caused an accompanying decline in egg prices.

Egg size in the flock has been considerably increased until it is now the exception to find a pullet with a small sized eggs average, whereas several years ago it was more the opposite.

Available details of some of the experiments now being conducted on the Station plant follow.

CORN VERSUS NO CORN FOR LAYING PULLETS

(Project P-170)

This experiment is being conducted in conjunction with other branch farms of the Dominion system to determine if or to what extent corn may be economically eliminated from the poultry ration.

*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.

During the past year the test was carried on for eleven months with four pens of fifteen birds each, all pens being as near as possible alike. Two pens, used as controls, were fed cracked corn in different proportions to the other grain mixture ingredients, plus ground corn in the mash, while in the other two pens barley was substituted for the corn, on a pound for pound basis.

In order to take care of the vitamine A deficiency which might result from the removal of the yellow corn, fresh alfalfa in summer and alfalfa hay in winter was fed to all four pens.

It was not found convenient to mate up these pullets to obtain data on fertility, hatchability and viability, but results given by these same birds as yearlings will be published in the report for 1931.

Details of grain and mash feeds were:—

Pen 1—Grain: 200 pounds cracked corn, 200 wheat, 100 whole oats. Mash: 100 pounds each bran, shorts, cornmeal, pulverized oats and beef scrap

Pen 2—Grain: 100 pounds cracked corn, 100 wheat, 100 whole oats. Mash: Same as in Pen 1.

Pen 3—Grain: 200 pounds whole barley, 200 wheat, 100 whole oats. Mash: 100 pounds each of bran, shorts, barley chop, pulverized oats and beef scrap.

Pen 4—Grain: 100 pounds whole barley, 100 wheat, 100 whole oats. Mash: Same as in Pen 3.

In the following table the figures have been reduced to a basis of one bird, and the production calculated on a bird day basis.

TABLE 56.—RESULTS WITH CORN VS. NO CORN FOR LAYING PULLETS

Pen No.	Production per bird	Value of eggs	Feed per bird	Value of feed	Profit per bird over cost of feed
		$	lb.	$	$
1	196·2	4 73	98·9	2·21	2 51
2	194·5	4 50	99·0	2 14	2 35
3	189·5	4 26	98·2	1 94	2 31
4	173·1	4 18	100·5	1 96	2 22

It will be noted that the pens fed a ration containing cracked corn produced more heavily than the other two. The "Value of Eggs" column has been figured out from egg grades and the market prices for those grades each month. Slightly larger eggs were given by the first two pens.

Three deaths occurred which might be directly attributable to the high fibre content of the grain rations in pens 3 and 4, and in the latter some difficulty was experienced with enlarged crops due to poor digestion of fibre.

NOTE.—This experiment is being continued with five new pens of pullets. Two of the pens are being fed as Pens 1 and 2 above, but the fibre content of the grain ration has been considerably reduced in the remaining three. The grain ration in these latter is as follows: Pen 3: 300 wheat, 100 whole oats, 100 barley. Pen 4: 100 cracked corn, 100 wheat, 100 barley. Pen 5: 300 wheat, 100 barley.

After three and a half months of test the two pens without corn or cornmeal are ahead of the corn pens. The health of all birds is excellent, so that there should be some interesting data to publish in the next report. From present indications it appears that corn may be elminated and barley substituted, provided the fibre content of the grain ration is kept low.

COMPARISON OF RESULTS FROM GIVEN MATINGS IN DIFFERENT YEARS

Unfortunately it is impossible to predict just what fertility, hatchability, etc., may be expected from a given mating. Also the egg production, egg weight, etc., from the pullet progeny of that mating. If this were possible, great changes in the poultry industry might readily be looked for.

However, once a mating has given satisfactory results, it should be possible to duplicate those results, if the same male and female are again mated in a subsequent year.

Seeing that it cannot be foreseen until a trial mating has been made, it is of value to know how closely the results of the first year may be duplicated in a later year. In addition, it is useful to know just where the second mating may fall down, so that any weaknesses that might develop may be forestalled.

The following table presents the results of seven matings each of which were repeated in two different years.

TABLE No. 57.—RESULTS FROM SEVEN MATINGS

Mating		Year	Fertility	Per cent fertile hatched	Number of pullet progeny	Average			
Male	Female					Age at sexual maturity	Body weight	Egg weight per doz.	Production eggs
			%			days	lb. oz.	oz.	
L 62	J 211	1928	94	78	7	168	5 15	25·15	240·7
		1929	100	77	3	157	4 10	23·64	233·0
L 62	K 31	1928	91	39	5	182	6 5	25·22	231·0
		1929	95	45	1	169	5 13	23·82	232·0
L 62	K 256	1928	92	83	5	169	5 11	24·09	268·0
		1929	90	68	2	172	5 8	22·90	220·0
T 514D	H 303A	1925	100	79	6	226	5 8	24·90	207·0
		1927	100	67	1	164	5 6	23·32	189·0
T 514D	J 6	1926	85	86	1	173	5 7	23·82	173·0
		1927	77	83	5	189	4 15	22·77	188·0
G 3	F 156	1923	88	93	3	213	5 6	25·50	206·0
		1924	78	83	1	164	5 5	23·58	207·0
G 3	F 290	1923	67	77	1	202	5 4	26·60	156·0
		1924	73	73	1	183	5 4	24·33	174·0

The increased age of the male and female does not appear to create much variation in fertility or hatchability, but it might be noted here that it takes longer to obtain fertility in the second year than in the first. There may be a slight relationship between the matings at the age at which the first egg is laid, although five instances point one way and two the opposite. This of course might be due to seasonal rearing conditions.

In body weight of the progeny there seems to be a marked relationship, the pullet progeny of the second year mating being lighter in six cases, and the same as the first in the other.

Egg weight appears to be greatly influenced. So much so that it would be advisable to continue only those matings that gave large egg size in the first year.

No great changes in average egg production were noted, although the records from which this table was made up show a wider range in production the first year than in the second.

Summarizing the above it appears that both body weight and egg size of the progeny are decreased when repeating old matings possibly due to an increase in the age of the male.

MANGELS VERSUS TURNIPS

(Project P-95)

Subsequent to the receipt of inquiries as to the comparative merits of mangels and turnips for winter feeding to laying pullets, it was decided to carry out a test with locally grown mangels and turnips.

In this district it is possible to grow an especially fine mangel which is readily consumed by poultry but the extreme heat during the growing period, and necessary artificial irrigation, tends to make the turnip stringy and water-cored, so that the birds are liable to refuse parts of it.

Taking into consideration the fact that these conditions were apparent in this experiment, where no great difference was shown in the egg production of the two pens, it is safe to assume that the advantage depends upon the quality of the mangel or turnip in the locality where its use is contemplated.

The wide margin of difference between the two profits after cost of feed was due partly to the turnips being worth so much more than the mangels. Had these been the same price, then the comparative profits would have been more in keeping with the comparative egg production. Another contributing factor, in a lesser degree, was the earlier egg production in the mangel pan which therefore reaped the benefit of the higher egg prices obtaining during the first half of the winter.

In the following table the results have been worked out on the basis of one bird, although it might be remarked here that no deaths occurred during the course of the experiment from November, 1929, to April, 1930, inclusive.

TABLE No. 58.—MANGELS VS. TURNIPS

Feed under experiment	Eggs laid per bird	Value	Feed consumed per bird	Cost	Profit per bird over feed cost
		cts.	lb.	cts.	$
Mangels	116·7	304·8	57·9	134·0	1 70
Turnips	113·0	283·5	55·8	149·9	1 33

BEST KIND OF LITTER

(Project P-75)

During the eleven months, November, 1929 to September, 1930, inclusive, three pens of twenty pullets each were used under this project to ascertain the comparative merits of peat moss, straw, and alfalfa hay as litters.

The peat moss used was a product of British Columbia, emanating from New Westminster, and is supposed to surpass the imported moss which has been on the market for years. Cost and high freight charges to the interior of the province seem to be strong arguments against its more general use, but when the cost of labour necessary for changing the other litters more frequently is considered the comparisons in this regard are more equalized.

In this experiment the prices charged for the three litters were: Peat moss, $57 per ton; straw, $12.60 per ton; alfalfa, $28 per ton.

The following table shows the details of the experiment worked out on a per bird basis:—

TABLE No. 59.—RESULTS FROM DIFFERENT KINDS OF LITTER

Type of litter	Eggs laid per bird	Feed per bird	Litter used per bird	Value of eggs laid	Cost of feed per bird	Cost of litter per bird	Percentage fertile	Percentage fertile hatched	Per centage total hatched	Percentage chick mortality to 3 weeks of age	Profit per bird over cost of feed	Profit per bird over cost of feed and litter
		lb.	lb.	$	$	cts.	%	%	%	%	$	$
Peat moss	194·9	92·8	12·7	4 71	2 17	33·2					2 53	2 20
Straw	196·8	96·0	20·0	4 67	2·24	12·6	81·3	71·0	57·7	4·2	2·43	2 30
Alfalfa	208·5	92·8	16·0	4 88	2 17	22·4	84·9	71·2	60·4	3·4	2 70	2 48

The figures in the foregoing table point towards the value of alfalfa hay as a litter when compared with straw or peat moss. The alfalfa pen showed better results in number and value of eggs laid, fertility, hatchability and viability of resultant chicks as well as profit per bird over cost of feed and litter. This is quite a consideration, taken as a whole, in favour of alfalfa. The birds in this pen consumed large amounts of alfalfa leaves taken from the litter.

The peat moss proved to be an ideal litter during damp weather because of its absorbent qualities and from the standpoint of flock health during the winter months its use is to be recommended if it can be procured readily, and at a reasonable cost. This treatment with the addition of alfalfa leaves daily should prove more advantageous than either peat moss or alfalfa hay alone. The latter holds the moisture during damp weather. It was found that the peat became dusty, during the summer months notwithstanding the fact that it was sprinkled with water occasionally. For this reason, it might not be recommended as a summer litter, when either straw or alfalfa would be more desirable.

It was not possible to obtain hatching results from the peat moss pen, but as the experiment is being conducted for another year, although under slightly changed conditions, it is hoped that full results may be given in a succeeding annual report.

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