CANADA
DEPARTMENT OF AGRICULTURE
EXPERIMENTAL FARMS SERVICE

EXPERIMENTAL STATION
SUMMERLAND, B. C.

AND

EXPERIMENTAL SUBSTATION
EAST KELOWNA, B. C.

T. H. Anstey, Ph. D., Superintendent

PROGRESS REPORT 1949 - 1953

Improved pie fillings provide outlets for more fruit.

Published by authority of the Rt. Hon. James G. Gardiner,
Minister of Agriculture, Ottawa, Canada.

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EXPERIMENTAL STATION, SUMMERLAND, B.C.

and

EXPERIMENTAL SUBSTATION, EAST KELOWNA, B.C.

PROGRESS REPORT
1949 - 1953

Introduction

The previous Progress Report issued for this Station was for the years 1937-48, inclusive.

The Experimental Station, Summerland, was established forty years ago to serve the agricultural industry of the Okanagan and other southern interior valleys of British Columbia. During this period the Station has pioneered many new agricultural developments, both in the field and in the processing plant. In the early days the Station was actively engaged in research on several phases of agriculture, including livestock, poultry, tobacco, and cereals, as well as horticultural crops. Today emphasis is placed on horticultural crops, particularly tree fruits and vegetables, with some work being done with dairy cattle and forage crops.

The Experimental Substation, East Kelowna, was established in 1931 to study the boron problem, and since the solution of this problem in 1935, the larger part of the work at the Substation has centred on other nutritional and irrigation studies. However, the Substation is also used as a hardiness testing Station for new fruit varieties.

Staff

The passing on March 26, 1953 of Dr. R. C. Palmer is recorded with deep regret. Dr. Palmer joined the Station in 1921 and was Superintendent from 1932 until his death. He made outstanding contributions to the agriculture not only of the Okanagan but of Canada and was recognized by an honorary D. Sc. from the University of British Columbia and a Fellowship in the Agricultural Institute of Canada.

Additions to the staff in the past five years include M. McGibbon, Vegetable Nutrition; Miss D. Britton, Home Economist; and T. H. Anstey, Superintendent. Several retirements have occurred, namely, H. Smith, Station Foreman; J. Aitken, Herdsman; W. May, Vegetable Plotsman; D. Strachan, Orchard Foreman; and A. Calvert, Bookkeeper, who have been replaced by G. Ryman, D. Younghusband, A. Simpson, B. Pelham, and J. Baillie, respectively.

The Grower and the Research Worker

Agriculture has an ever changing pattern. New problems continually arise and different methods of solving old problems are developed. It is the responsibility of the agricultural research worker to develop methods of solving problems and the responsibility of the agricultural extension worker to put these solutions into the hands of the grower. Therefore, a close liaison must be maintained between the research worker and the extension worker on the one hand, and between the extension worker and the grower on the other hand.

In the Okanagan, the Okanagan Agricultural Club brings together all agricultural research workers and extension workers for the purpose of standardizing recommendations, providing a clearing house of information concerning new problems, and co-ordinating in general terms the experimental work being done in the Southern Interior of British Columbia.

The Club was formed at a meeting of the Federal and Provincial agricultural workers at Vernon on September 1, 1921. One of its first problems was the drafting of a spray calendar for tree fruits, and the elimination of uneconomical varieties of fruit then being grown in the Okanagan. Both these subjects still come up for annual review as do many other different problems. The actual work of the Club is usually performed by one or other of several committees, the Club as a whole confirming or modifying the committee work. The standing committees include the spray, fruit maturity, plant nutrition, fruit varieties, vegetable and seed, livestock and field crops, reclamation, and tomato investigation committees. Problems that cannot be handled by one of these committees are turned over to special committees appointed for the purpose.

Membership in the Agricultural Club includes all technical agricultural workers in the Okanagan area employed by the Governments of Canada and British Columbia. In order that a free discussion of all products and practices may take place, industry is not invited to attend Club meetings. Representatives from industry are frequently present in committee meetings and their advice and help have always been appreciated.

Since the formation of the Club in 1921, recommendations made to growers have been on a uniform basis, problems have been quickly attacked and, frequently, quickly solved, thus giving the grower confidence in the research and extension facilities at his service.

Regional Reference Library

A Regional Reference Library was established at Summerland in 1950 to service the Experimental Station and Laboratories of Plant Pathology and Entomology. This library has been of inestimable value to the research workers at Summerland in supplying an up-to-the-minute service of scientific literature. In all fields of research it is essential for the workers to be intimately acquainted with the work of similar workers throughout the world, in order that duplication of effort will not retard progress. This exchange of knowledge is most readily brought about through the use of books and technical journals. The field of agricultural research is no exception, and research workers must devote some of their time to a constant review of the published literature within their fields. This is most readily done when adequate library facilities are available.

The services of the Summerland Regional Reference Library have been made available to other research units of the department at Saanichton, Victoria, and Agassiz, B.C.

Meteorological Data

The growth of both plants and animals is markedly influenced by weather. How growth rate, maturity, yield, and quality are influenced by changes in weather conditions can be determined only by measuring both the weather and the condition of the plant or animal. For this reason, workers in agriculture are keenly interested in meteorological data.

Weather records have been taken at the Summerland Station for 38 years. Tables 1 to 4 give the summarized data. During the past 5 years under review, the outstanding feature of the weather was the record cold winter

of 1949-50 when −22°F. was recorded on January 25, 1950. This, and similar low temperatures occurring that winter, caused widespread damage to fruit trees throughout the fruit growing areas of British Columbia (see later sections of this report). With respect to temperature, the other outstanding feature was the cool weather experienced in June 1953 when the mean maximum was 11·9° lower than average. Frost-free days, as shown in Table 3, were fewer than average for 1949 and 1950, about average for 1951 and 1952, and greater than average for 1953 when an early spring and an open fall gave 191 frost-free days.

With the exception of 1949, when 15·99 inches of precipitation were recorded, Table 2 shows that rain and snowfall for the 5-year period, 1949-53, were about average at 10·94 inches. While lack of precipitation is not usually a serious consideration in the Okanagan where ample irrigation water is available, excessive rain or hail can cause serious damage if occurring during the growing season. In 1953, scab and hail damage was serious to the apple and peach crops in some of the fruit growing districts.

Table 1.—Summaries of Monthly Temperature, Precipitation, and Sunshine Data, Experimental Station, Summerland, B.C. 1916-1953 (38 yr.)

Month	Temperature					Precipitation					Sunshine				
	Highest		Lowest		Mean	Highest		Lowest		Mean	Highest		Lowest		Mean
	°F.	Yr.	°F.	Yr.	°F.	in.	Yr.	in.	Yr.	in.	Hr.	Yr.	Hr.	Yr.	Hr.
January	57	1920	−22	1950	25·7	2·31	1937	0·33	1931 1948	·94	77·9	1937	21·0	1931	48·2
February	62	1932	−16	1936	29·4	2·28	1937	0·03	1920	·76	156·8	1928	43·6	1931	87·6
March	68	1930	3	1951	39·2	2·73	1932	0·07	1923	·67	189·8	1941	100·1	1926	140·6
April	84	1926	14	1951	48·2	2·23	1948	0·03	1924	·74	261·0	1951	117·9	1953	186·7
May	91	1936	29	1922	56·5	2·43	1942	0·06	1920	·93	377·8	1947	170·5	1942	237·9
June	101	1925	35	1943	63·4	2·66	1947	0·16	1940	1·26	338·6	1940	149·7	1931	235·9
July	104	1941	40	1952	70·1	2·47	1950	0·02	1929	·82	370·1	1917	234·2	1918	312·4
August	98	1920	43	1946	68·2	2·98	1948	0·15	1925	·82	344·2	1939	213·2	1926	271·6
September	93	1950	25	1926	59·8	2·39	1941	0·01	1928	·79	268·5	1918	121·4	1941	197·2
October	82	1947	15	1935	48·6	3·70	1945	0·07	1952	·89	205·5	1936	78·3	1950	136·6
November	61	1941	2	1921	36·7	2·57	1927	0·07	1936	·96	96·5	1929	40·2	1947	58·3
December	60	1932	−9	1924	29·2	5·18	1949	0·10	1930	1·34	65·6	1947	19·6	1925	40·8
Yearly Totals	.....	.....	.....	.....	.....	.....	.....	.....	.....	10·92	.....	.....	.....	.....	1,953·8
Monthly Means	.....	.....	.....	.....	47·9	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

Data recorded in co-operation with the Meteorological Division, Department of Transport.

Table 2.—Precipitation Records, Experimental Station, Summerland, B.C.

Monthly and Annual Precipitation Records 1949–1952 inclusive with 36-year means.

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Snow-fall*	Total annual rainfall	Precip-itation
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
1949	0·70	2·06	1·09	0·95	0·59	0·51	1·34	1·11	0·71	0·38	1·37	5·18	77·12	8·28	15·99
1950	0·90	0·73	0·96	1·27	0·37	0·83	2·47	0·86	0·56	1·78	1·76	1·40	34·90	10·40	13·89
1951	1·16	1·10	1·03	0·24	1·15	0·70	1·43	1·32	0·21	2·51	0·77	1·60	41·40	9·08	13·22
1952	1·97	0·65	0·53	0·60	0·78	2·23	0·79	0·58	0·36	0·07	0·24	0·52	30·50	6·27	9·32
1953	1·98	0·56	0·52	0·92	0·89	1·83	0·38	2·43	0·26	0·77	0·59	0·75	24·30	9·45	11·88
36-Year mean	0·98	0·75	0·67	0·74	0·92	1·26	0·86	0·77	0·76	0·93	0·96	1·34	41·64†	8·69†	10·94

*Snow is converted to water equivalent by formula: 10 inches snow equals 1 inch water.
†Five-Year mean.
NOTE: Annual precipitation records prior to 1949 may be obtained from the 1937–48 Report of this Station.

Table 3.—Frost Records, Experimental Station, Summerland, B.C.

Frost: 32°F. or lower. Killing Frost: 28°F. or lower.

Year	Last frost in spring		First frost in fall		No. of frost-free days	Last killing frost in spring		First killing frost in fall		No. of Crop days
	Date	Temp.	Date	Temp.		Date	Temp.	Date	Temp.	
		°F.		°F.			°F.		°F.	
1949	May 5	32	Oct. 8	27	155	Mar. 31	26	Oct. 8	27	191
1950	Apr. 29	32	Oct. 1	32	154	Apr. 7	28	Nov. 9	20	216
1951	Apr. 24	31	Oct. 17	30	175	Apr. 23	28	Oct. 25	28	185
1952	May 5	29	Oct. 28	32	175	Apr. 10	26	Nov. 2	26	206
1953	Apr. 15	30	Oct. 23	30	191	Apr. 10	28	Nov. 18	24	222
36-year average	Apr. 25		Oct. 19		177	Apr. 5		Oct. 30		207
Shortest Season	May 6/19	31	Oct. 4/19	30	150	Apr. 27/48	28	Oct. 17/28	26	172
Longest season	Apr. 4/42	32	Oct. 13/42	32	221	Mar. 14/41	26	Nov. 20/41	26	249

	Earliest and latest frost dates 1916–1953		Earliest and latest killing frost dates 1916-1953	
	Date	Temp.	Date	Temp.
Latest spring frost	May 24/18	31	Apr. 27/48	28
Earliest last spring frost	Apr. 4/42	32	Mar. 12/40	26
Earliest fall frost	Sept. 24/26	25	Sept. 24/26	25
Latest first fall frost	Nov. 11/44	31	Nov. 28/34	28

Table 4.—Summary of Evaporation Data, Experimental Station, Summerland, B.C.

1924-1953, omitting 1927, 28, 29, 34, 39 (25 years)

Month	Mean evaporation	Extreme evaporation			
		Maximum	Year	Minimum	Year
	in.	in.		in.	
June	4·71	6·17	1940	2·41	1945
July	5·91	7·94	1924	2·99	1945
August	4·74	5·70	1952	2·02	1948
September	2·95	3·97	1935	1·86	1941

Animal Husbandry

J. E. Miltimore

The Jersey herd at Summerland is not large enough for detailed experimental work, but some information of general interest regarding the herd and its performance will be presented.

The herd rates well from a production standpoint as indicated by some recent lifetime records in Table 5. Cows from this herd rank third, fourth, eighth, and thirteenth in longtime records for butterfat in Canada. In longtime milk production for Jerseys in Canada, cows from this herd place second, fifth, seventh, and thirteenth. For a herd averaging eighteen milking cows this is a creditable showing even when consideration is given to the relatively favorable environmental conditions under which the herd is kept. The animals are not forced for production and are milked twice daily.

In the last five years 32 bulls have been sold or leased to breeders and 27 breeding females have been sold.

Sires used in the Summerland herd during recent years are listed in Table 6. The performance of these sires, in terms of their daughters' production, is indicated in the table, though the number of daughters is too small for an accurate evaluation of the various sires.

The herd average production of milk and butterfat is shown in Table 7. The data indicate the level of production that can be maintained with good summer pastures, normal methods of winter feeding, and twice-per-day milking. The data also indicate the annual fluctuations in herd averages that occur in herds under uniform management. Included in these herd averages are production records for all first-calf heifers as no females are culled until after their first lactation unless they are abnormal.

The data in Table 8 emphasize the fact that level of production is important in the economy of milk production. The feed cost of milk production was considerably lower for the higher producing animals than for those of lower production.

Table 5.—Lifetime total production to date of milk and butterfat by some of the higher producers in the Summerland herd.

Name of cow	Number	Pounds of milk	Pounds of butterfat	Number of lactations
Summerland Standard Flo	79,669	133,194	7,856	13
Calgarth Starlight	17,479	143,011	7,757	12
Summerland Hamlet Starlight	53,426	126,036	6,621	13
Summerland Standard Glow	84,594	113,141	6,307	12
Summerland Floson's Paeony	128,187	89,616	5,175	9
Summerland Favorite Sparkle	97,525	88,975	4,946	10
Summerland Floson's Freesia	128,190	91,955	4,839	9
Summerland Twinkling Estralita	154,801	79,821	4,286	7
Summerland Favorite Twinkle	97,520	71,586	4,206	9
Summerland Lady Estelle	104,415	58,825	3,612	5

Table 6.—Average mature equivalent milk and butterfat production of dams and their daughters by respective sires, considering females tested at Summerland.

Number of Sire	No. of pairs	Mature equivalent production				No. of pairs	Average classification	
		daughters		dams			daughters	dams
		milk lb.	fat lb.	milk lb.	fat lb.			
102854	9	10,465	610	10,251	602	6	85·8	82·5
104339	3	10,593	596	9,915	607	3	82·5	85·0
110760	9	11,248	631	10,366	612	9	85·6	85·3
104594	1	11,872	706	10,575	614	1	87·5	87·5
109186	6	9,763	498	10,237	598	6	82·5	85·0
199008	1	11,956	670	10,619	649	2	82·5	85·0
115550	5	9,839	554	11,127	653	4	85·0	88·4

102854—Summerland Floson.
104339—Babbacombe Standardbearer.
110760—Summerland New Year Star.
104594—Summerland Pandora Mercury.
109186—Spring Vista Mercury Glory.
199008—Summerland Twinkling Mercury.
115550—Lady Florence's Star Blend.

Table 7.—The Summerland Jersey Herd production data of milk and butterfat, with costs, length of lactations, age and number of records during a 5-year period, 1949-53, inclusive.

—	Year of record					5-year average
	1949	1950	1951	1952	1953	
Herd average yield of milk (pounds)	9,290	8,849	8,880	9,130	8,636	8,957
Herd average yield of butterfat (pounds)	550	515	504	490	477	507
Average feed cost per 100 pounds of 5·66 per cent milk (dollars)	1·57	1·66	1·69	2·04	1·82	1·75
Average lactation length (days)	332	321	321	320	329	325
Number of individual records	19	15	18	18	19	18
Number of heifer records	6	3	7	6	4	5
Average age (months)	65	55	55	46	56.	55

Table 8.—Economic significance of high and low milk producers, illustrating that cows of high dairy merit are more profitable than cows of lower dairy merit.

—	Cows in group	Average age	Average lactation milk yield	Average cost of all feed	Av. feed cost /100 lb. milk	Value of milk produced at $4.00/cwt.
	No.		lb.	$	$	$
High producers	6	6 yr., 10 mo.	10,569·3	168·77	1·59	422·77
Low producers	6	7 yr., 4 mo.	8,473·2	144·76	1·73	338·93
Difference			2,096·1	24·01	·14	83·84

Field Husbandry

J. E. Miltimore

In a 3-year trial, application of nitrogen fertilizer to pastures during the growing season has proved economical. Ammonium nitrate applied at 100 pounds per acre in June and again in August increased the yield over the check plots sufficiently to pay for the fertilizer and the cost of application. In Table 9, dry-matter yields have been converted to tons of hay per acre, using the average dry-matter content of hay at this Station as 90 per cent. A plant separation analysis of the last three cuttings in 1953 indicated that legumes comprised 25 per cent of the forage from the control plots, whereas only 18 per cent of the total dry-matter yield consisted of legumes in the plots receiving additional nitrogen.

Table 9.—Applications of additional nitrogen fertilizer to pastures in June and August result in economical increases in yield of forage.

	Yield in tons of hay			
	1951	1952	1953	Average
Additional nitrogen	4·38	4·36	5·31	4·68
Control	3·98	4·01	5·12	4·37

Results were not statistically significant as there were only 2 treatments.

In fertilizer trials in the Salmon River Valley, ammonium phosphate (16-20-0) was applied either in the spring or in the fall at 200 to 400 pounds per acre. The 3-year trend favored fall application even on irrigated plots. Significant results were obtained in 1953. The check plot that received no fertilizer had a significantly lower yield. Table 10 records the yields for this trial.

Table 10.—Pasture response to fertilizer and irrigation yields, expressed as pounds of dry matter per acre.

Year	200 lb. 16-20-0 (spring)	200 lb. 16-20-0 (spring) + irrigation	200 lb. 16-20-0 (fall) + irrigation	Check (no fertilizer) (no irrigation)
1951	4,066	6,292	6,679	3,727
1952	6,244	7,672	7,648	5,106
1953	6,340	7,091	8,300	5,469
Ave	5,883	7,018	7,542	4,767

A 3-year irrigation trial in the Salmon River Valley has shown increases in yield from irrigation to be 49 per cent, 23 per cent and 13 per cent for the years 1951 to 1953 respectively. Significant results were obtained in all cases. Table 10 records the yields for this experiment.

Pastures at Summerland are divided into one-acre fields to give greater control of grazing. This type of management is particularly desirable if pasture growth has become tall and rank.

Unchopped grass-alfalfa silage has been successfully stored in a horizontal silo using tractor-mounted buck rakes, although the silage was stored too far from the buildings to be self-fed. However, a co-operator in the Salmon

Arm area was highly successful in self-feeding long brome alfalfa silage from a five-foot-high stack. The operator made a cut two feet wide across the stack and peeled back the top spoilage. The animals then ate the silage in the two-foot strip, right down to the ground, without further cuttings. Wastage was almost negligible and there was an appreciable saving in time and labor.

Tree Fruit Breeding, Varieties and Rootstocks

A. J. Mann and F. W. L. Keane

Apple

Recent planting recommendations have reduced the list of apple varieties to four, namely, McIntosh, Delicious, and Winesap, with Golden Delicious as a pollinizer. This list is very restricted and each variety has certain defects. McIntosh is subject to pre-harvest drop and core flush in storage; Delicious is subject to mealiness if storage is delayed; Winesap is not high in dessert quality; and Golden Delicious requires special care in harvesting and packing.

The Station has approached the problem by a breeding project which began in 1924, and by a variety testing experiment under which promising varieties from other apple breeders are grown for evaluation. Of the 407 varieties grown for test, no distinctly new variety has emerged to replace any of the present commercial kinds. On the other hand, red strains have been outstandingly successful, and Summerland McIntosh, Starking Delicious, and Seeando Winesap have superseded the original varieties in new plantings.

The apple breeding experiment has involved the planting of 6,030 seedlings, of which 3,332 are at present being grown. Earlier plantings had one outstanding result—the development, naming, and introduction of Spartan. This variety, while it showed in some seasons a slight tendency to breakdown of the fruit from young trees under vigorous growing conditions, nevertheless promises to be an important variety for the more northern districts, where it provides a much needed alternative to McIntosh.

The very severe winter of 1949-50 emphasized the necessity of hardy framework stocks if Delicious and other comparatively tender varieties are to be grown north of Kelowna. In earlier work the Station distributed for test in northern areas about 10,000 trees of hardy framework stocks. While most of these stocks withstood very low temperatures, many developed undesirable tree characteristics. The crabapples were unsuitable for growing a satisfactory Delicious tree, while Hibernal developed structural weaknesses in limb and crotch under heavy crops. On the other hand, Canada Baldwin was strong in tree structure and hardy at Kamloops. It is, however, very susceptible to crown rot. This defect can be overcome by budding Canada Baldwin on a crown-rot-resistant rootstock such as Antonovka seedling, at a sufficient height so that Canada Baldwin will be well above ground level in the orchard.

The apple industry of this region has been based on full-sized trees, propagated on seedling rootstocks and spaced at least 35 feet. Such trees were satisfactory when labor was cheap. Now that labor conditions have changed, there is growing interest in the potentialities of smaller trees. To meet this need the Station has tested various dwarf and semi-dwarf apple rootstocks developed by the East Malling Research Station in England. Of these, Malling II is recommended as a tree about two-thirds standard size, which requires a spacing of 20 to 25 feet. A somewhat smaller tree may be grown on Malling VII, but the Station has not had this rootstock under test long enough to make definite recommendations. Spacing of 15 to 18 feet for Malling VII might be tried. A true dwarf tree, 8 feet in height, may be grown on Malling IX rootstock, spaced 8 by 15 feet, but requiring support. Under good growing conditions, trees on Malling II, Malling VII, and Malling IX may be expected to produce as high yields per acre as trees on seedling rootstocks.

Apricot

The apricot industry has been based on Wenatchee Moorpark, Tilton, Blenheim, and Royal, the last two varieties being indistinguishable. Wenatchee Moorpark is a fresh-fruit variety while Tilton and Blenheim are canning apricots. Wenatchee Moorpark has good characteristics but has been so heavily planted in recent years that it has now been removed from the recommended planting list. There is demand for additional supplies of canning apricots, but neither Tilton nor Blenheim are entirely satisfactory from the grower's viewpoint. Tilton is outstandingly tender in tree, while Blenheim requires rather more than average conditions of soil and culture, and if it lacks these conditions it tends to be a biennial bearer and to produce small fruit of uneven maturity. Moreover, severe winters and spring frosts have emphasized that even varieties as hardy in tree as Wenatchee Moorpark and as bud-hardy as Tilton were unable to produce profitable crops in certain seasons.

Variety testing at the Station has included varieties from outside sources but so far none of them show outstanding promise. In the apricot breeding project, 3,526 seedlings have been planted and 2,362 have been brought to fruiting age and evaluated. From the earlier years of this work, one seedling only was outstanding and this was introduced in 1946 under the name Reliable. During more recent years the project has produced 17 seedlings of promise. These, however, will require further testing before a final choice can be made. The breeding project is now being extended still further by the introduction, as parents, of varieties from other apricot growing regions of the world. In addition, the 1949-50 freeze resulted in the discovery of hardy seedlings in this area. These have been propagated for use as parents.

No sooner had Reliable been introduced as a commercial variety than an unexpected defect became apparent. It was found that the peach rootstock, which has been generally used for the older varieties during many years, was unsuited to Reliable and also to the other new varieties, Perfection and Riland. Trees in their early years in the orchard were susceptible to breakage at the bud union. This weakness made it necessary to remove Reliable from the recommended list and to initiate experiments with various rootstocks for the newer apricot varieties. These experiments already indicate that various plum stocks, as well as peach, are unsuitable for Reliable. Apricot is the only rootstock for Reliable which so far has not shown susceptibility to breakage at the bud union.

Cherry

Since 1916 this Station has obtained for test 135 varieties of cherry. So far, none has proved superior to Bing, Lambert, or Royal Ann.

Cherry breeding began in 1936 and from the first group of seedlings a selection was made that has shown resistance to cracking. This selection was named Van and has since become a recognized commercial variety. Van is as hardy in tree and in bud as Lambert, and hardier than Bing, and has shown resistance to little cherry disease of the Kootenays. Van has replaced older varieties as a pollinizer for Bing and Lambert. It is a vigorous tree when young and is early bearing and productive.

Later introductions have stressed earliness in combination with other good characteristics, both Sam and Star being at least a week earlier than Bing. Cherry breeding is still very active and 936 seedlings are now growing in the Station's orchards.

Rootstocks for cherry do not present the same urgent problem as for apple and apricot, but the Station has introduced two seedling rootstocks of merit—Gold and Mazzard 1681.

The cherry industry is concerned about the desirability of obtaining for commercial nurserymen sources of budwood which would be true-to-name

and certified free from virus diseases. To meet this problem a cherry orchard was established at the Station in 1952. In co-operation with the Plant Pathology Laboratory, Summerland, certified budwood from this orchard eventually will be distributed. The orchard contains standard and newer varieties as well as kinds suitable for rootstock purposes, and the planting includes imported virus-free strains.

Peach

The peach industry of this area is based largely on Valiant, Vedette, and Veteran. These were developed and named by the Horticultural Experiment Station, Vineland, Ontario, and were introduced to British Columbia by the Summerland Station about 25 years ago . Although the three "V's" are still satisfactory, the industry needs varieties that will lengthen the harvesting and marketing season at both ends. With this in mind the Station has brought in for test 176 varieties and, of these, Redhaven from Michigan has emerged as an outstanding early firm peach.

The Summerland Station's own peach breeding project has been comparatively small, but two promising varieties, Spotlight and Solo, have been introduced. The former is a competitor of Redhaven while Solo is a firm peach in Veteran season.

Pear

In contrast to other fruits, there appears to be no urgent need for pear variety improvement. Bartlett is firmly established and generally satisfactory on the fresh fruit market and for canning. Nevertheless, this Station conducts a pear variety experiment under which 122 varieties have been brought in for test. At present only two new varieties appear worthy of special mention. These are the Max Red sport of Bartlett, which is very attractive when ripe, and the California Pound which shows resistance to fireblight and appears to be less susceptible than Bartlett to core and flesh breakdown when held slightly past its ripe stage.

Plum

The only varieties that are now recommended for planting are the early strains of Italian prune. In the past, variety tests were conducted with 144 kinds of plum and the results of these tests are available, should the industry decide in the future that the planting of additional varieties is desirable. June Blood, Reeves, and Yakima are promising varieties in addition to the old established Peach plum.

The best known early strains of Italian prune are De Maris, Greata, and Richards. These appear to have originated separately in different districts, but detailed experiments have failed to find any characteristics by which they can be distinguished easily from one another, and in most commercial plantings of early Italian the identity of the strain has been lost. Several other early strains that have appeared in growers' orchards are also under test. The early strains mature their fruit two to three weeks earlier than Italian, and in consequence produce a more acceptable product for the market. It should be recognized by growers of the regular strain of Italian that in this area there is barely sufficient length of growing season to mature the crop in a favorable year, and that in average seasons a proportion of immature and unmarketable fruit may be expected on heavily laden trees of mature age.

Experiments are in progress to compare Italian with its early strains in respect to hardiness, vigor, productivity, fruit shrivel, and freedom from disease.

Descriptive Sheets

The Station has available for distribution 56 mimeographed sheets describing in detail the characteristics of varieties and stocks.

Winter Injury

The winter of 1949-50 was the most severe experienced in this region since records have been taken. Temperatures dropped to −40°F. in the coldest fruit growing districts and as low as −24°F. in the apricot and peach areas. These temperatures caused very severe and widespread damage: thousands of trees were killed outright and hundreds of acres of additional orchards were damaged more or less severely. For the horticulturist, the occasion provided a unique opportunity to compare the hardiness in tree and in bud of a large number of varieties. Such comparison was undertaken by the Station on a large scale in 1950. Several thousand trees in 206 commercial orchards were examined, many of them a number of times during the season. On the Station, also, stone fruit injury was very severe and much additional information was obtained from the detailed examination of 928 trees. In all comparisons, great care was taken to select trees of comparable age and vigor growing under similar conditions in the same orchard. At the end of the season, the resulting data regarding the hardiness of 65 varieties were compared with information provided by 7 District Horticulturists of the British Columbia Department of Agriculture.

The detailed results of the investigation are too lengthy for this publication but they are available on request. However, the influence of variety and age of tree on winter injury are of particular interest and these data are presented.

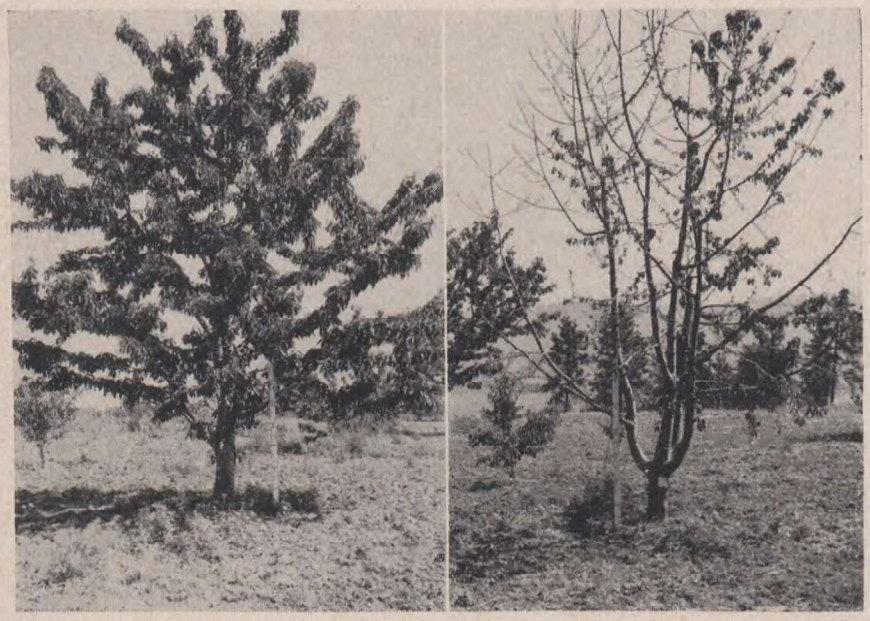
Apple.—With respect to tree injury the apple varieties examined can be placed in five groups: Crimson Beauty, Duchess, Haralson, Hyslop, Transcendent, and Yellow Transparent proved very hardy; in the next group were McIntosh, Red Astrachan, Snow, Spartan, and Wealthy; more seriously injured than these were Delicious, Jubilee, Rome Beauty, and Winesap; still more tender were Golden Delicious, Grimes Golden, Jonathan, and Spitzenburg; the most tender group consisted of Newtown and Stayman.

Apricot.—The most interesting feature of winter injury of apricot was that the varieties grouped themselves quite differently with respect to bud hardiness and tree hardiness. With respect to fruit-bud survival, Reliable, Rose, and Tilton were hardiest; next in order came a group comprising Blenheim, Old Moorpark, and Riland; more severely injured than these were Leslie, Perfection, and Wenatchee Moorpark; the most bud-tender of the varieties examined was Kaleden. With respect to tree injury the least injured group was Kaleden, Reliable, Riland, Rose, and Wenatchee Moorpark; next in order was Perfection and next to Perfection was Old Moorpark; the most tender group consisted of Blenheim, Leslie, and Tilton.

Cherry.—In fruit-bud hardiness Lambert, Royal Ann, Star, and Van were in the group with least injury; these were followed by Bing, Black Tartarian, and Deacon; Black Republican and Sparkle were more tender than any of the foregoing varieties. In tree hardiness, Lambert and Van were best (Figure 1); next in order was Star; Bing, Deacon, and Royal Ann were somewhat less hardy; the most severely injured group consisted of Black Republican, Black Tartarian, and Sparkle.

Peach.—Results with this fruit were less clear-cut than with apple, apricot, and cherry. In general, however, the varieties appeared to place themselves in four groups with respect to fruit-bud hardiness. The best group included Halehaven, Muir, Superior, and Vedette; next were Fisher, Redhaven, Rochester,

and Veefreeze; more severely injured were Elberta, Golden Jubilee, Red Elberta, Spotlight, and Veteran; the most tender group consisted of Glamar, J. H. Hale, Solo, Valiant, and Vanguard. In tree hardiness there were four



Van cherry Cherry seedling S-9-10

Fig. 1.—Comparative hardiness of 2 cherry seedlings of the same age in the same orchard. Seedling S-9-10 was practically killed by the low temperatures of the winter of 1949-50, whereas the original tree of the Van variety was uninjured and bore a full crop in 1950. (Photos taken on Summerland Experimental Station 1950.)

groups also. In the first group were Fisher, Halehaven, Mikado, Redhaven, Solo, Spotlight, Superior, Vedette, and Veteran; Valiant was somewhat less hardy than these; still less hardy were Golden Jubilee, Rochester, and Vanguard; in the most tender group were Elberta and J. H. Hale.

Pear.—In fruit-bud hardiness there were three varieties in the first group —Anjou, Flemish Beauty, and Winter Nelis; these were followed by Clapp Favorite and Lincoln; the least hardy group consisted of Bartlett, Bosc, and Clairgeau. In tree hardiness also, Anjou, Flemish Beauty, and Winter Nelis were in the first group; Old Home appeared also to belong to this group, although its responses were rather variable; the second group consisted of Bartlett, Bosc, Clairgeau, Clapp Favorite, and Lincoln; Farmingdale was more severely injured than any other variety examined.

Plum.—In fruit-bud hardiness Quackenboss and Red Coat were best; in the next group were Italian prune and its early strains, De Maris and Greata; less hardy than these were Bradshaw and Peach plum; the most severely injured group consisted of June Blood and Santa Rosa. In tree hardiness Quackenboss and Red Coat were again in the first group, and Italian and its early strains in the second group; Bradshaw, June Blood, and Peach plum comprised the third group; Santa Rosa was the most tender variety examined.

Influence of Age of Tree and Amount of Crop on Winter Injury

Peach trees over 12 years old were much more tender than younger trees (Figure 2). On the other hand many apricot trees 10 to 30 years old were as hardy or hardier than trees from one to 9 years of age. Young sweet cherries up to about 15 years of age were hardier than either peaches or apricots, but old cherry trees were in many instances very severely injured, and trees over 35 years were often killed even in favored areas. Young Italian prune trees up to 10 years of age proved hardier than old trees of this variety. Pear trees under 10 years of age were not noticeably hardier than older trees of the same variety. In the coldest areas apple trees over 20 years old were much less hardy than younger trees.

Usually those trees that bore heavily in 1949 were much more susceptible to injury than those that did not bear heavily that year. This was particularly noticeable in apples.

Fig. 2.—Example of greater hardiness in 1949-50 of young, as compared with older, Elberta peach trees. The 2-year-old tree in the centre is alive and healthy, whereas the 10-year-old trees have been completely winterkilled. (Photo taken at Osoyoos, B.C., June 1950.)

Fruit Thinning, Harvesting and Storage

D. V. Fisher and S. W. Porritt

The research program of this Section is concerned with devising practical and economical methods for producing fruit of high quality, handling it correctly at harvest, and storing it under the most suitable conditions. The problems studied involve pruning, fruit thinning, fruit size increase, maturity standards, harvesting, pre-cooling, and storing. In addition, careful study has been given to the use of hormones for preventing pre-harvest drop. This Section also affords a consulting service to commercial packing houses in the planning and equipping of fruit packing and cold storage warehouses.

Physiological Condition of Apples Entering Storage

Measurement of respiration rate in terms of carbon dioxide production is one of the most useful scientific methods for measuring the physiological condition of apples. At high storage temperatures or under stimulating conditions, respiration rate is intense, whereas at low temperatures respiration rate is greatly reduced. Equipment for measurement of respiration intensity is shown in Fig. 3.

As apples mature on the tree their respiration rate approaches a minimum level, following which a rather rapid ascent in respiratory intensity occurs. This ascent in rate of respiration takes place at or near the time at which most varieties are in prime picking condition, and is known as the climacteric rise. There is some disagreement among scientists as to whether apples should be picked just before the start of the climateric rise or during that rise.

The onset of this rise in respiration near time of maturity may be accelerated by the influence of gases produced by ripe fruit. This stimulatory effect of volatiles from ripe fruits is fairly easily demonstrated at room temperatures, but considerable doubt exists as to whether the physiological activity of fruit that has not started its climacteric rise may be stimulated by ripe fruit volatiles under cold storage conditions. Storage operators, desirous of providing optimum conditions in fruit storages, have shown keen interest in the subject, particularly since manufacturers claim that activated carbon "air purifiers" prolong keeping life of apples in cold storage by removing gases causing ripening.

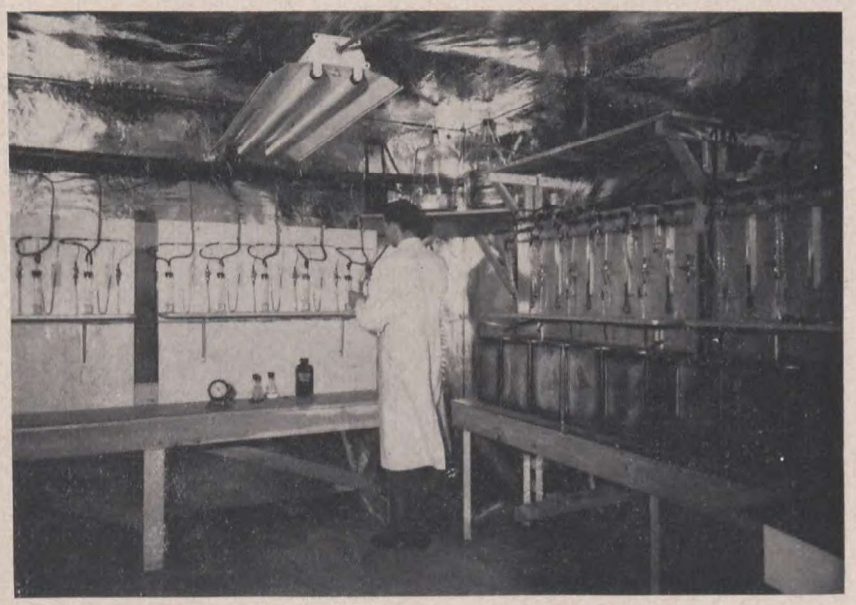


Fig. 3.—Respiration measurements used in evaluating storage life of apples require special equipment and exacting procedures.

Tests have been conducted during two seasons to determine the physiological condition of apples entering cold storage, that is, whether they are pre-climacteric, climacteric, or post-climacteric in condition. These data shown in Table 11 indicate that about 45 per cent of the samples of 7 different

varieties of apples taken from commercial packing houses at the time of entering storage were pre-climacteric, about 31 per cent were climacteric and in 24 per cent of the samples the climacteric was definitely over.

These data are important since they indicate that under commercial conditions a large proportion of the crop is entering storage in a climacteric or post-climacteric condition and is, therefore, incapable of being stimulated by gases from other ripe fruit. At the same time this identical fruit is producing volatile gases capable of stimulating the respiration of other pre-climacteric fruit. Having established the fact that there is a considerable volume of climacteric and post-climacteric fruit entering storage that is capable of producing sufficient volatiles to stimulate the ripening of less ripe fruit if the temperature conditions are favorable, the question arises as to whether the use of activated carbon air purifiers under cold storage conditions (32°F.) can lengthen the keeping life of apples by removing stimulating volatiles from the storage atmosphere.

Table 11.—Physiological condition of apples entering storage as determined by respiratory activity

Year	Total samples	Pre-climacteric	Post-climacteric	Climacteric
1952	40	18	9	13
1953	53	24	13	16

Two years' experimental work, in which eight leading varieties of apples were stored at 31·5°F. with and without carbon, have failed to demonstrate any measurable improvement in keeping life as a result of the air purification. The information derived from this experiment, while of a negative nature, has been sufficiently convincing to the British Columbia industry to discourage any packing house operators from investing in air purification equipment.

As a further check of the commercial significance of ripe fruit stimulating the ripening of less ripe fruits at 32°F., an interesting experiment was conducted in 1953. Volatiles from ripe McIntosh were passed over enclosed samples of pre-climacteric (unripe) McIntosh held at 32° and 36°F., in comparison with similar McIntosh not receiving volatiles. Stimulation of ripening did not result from the exposure of unripe McIntosh to the vapors from the ripe fruit. This finding is in agreement with work conducted elsewhere with other varieties and further explains why carbon air purification cannot reasonably be expected to lengthen storage life of fruit.

Chemical Thinning of Different Fruits

Chemical thinning of apples has proved to be a great time and money saver and is now standard practice for most apple growers. The experimental program on chemical thinning conducted by this Station has been the basis for recommendations to the industry. Chemical thinning for apples is accomplished at full bloom with the sodium salt of dinitro-ortho-cresol, or a week after full bloom using the hormone material, naphthalene acetic acid.

Chemical thinning tests have been conducted both with the conventional hand gun type of sprayer and also the newer concentrate type sprayer. However, since most growers use the concentrate type of machine, greater emphasis in experimental work has been placed on spraying by this method. In general, Elgetol or Krenite (20 per cent active ingredient) are recommended for dinitro blossom thinning at the rate of 15 pints per acre. With hand gun

machines, this amounts to approximately 1½ pints of this material in 100 gallons of water. Since varieties such as Delicious and Rome Beauty tend to be overthinned with dinitro materials at 15 pints per acre, the concentration recommended for these varieties is only 10 pints per acre. Thinning should be performed only in dry weather, and if there is any suggestion of rain, concentrations should be reduced by 25 per cent. Application of dinitros during rainy periods has frequently caused overthinning and severe leaf burning.

Hormone thinning with naphthalene acetic acid should be done between 5 and 10 days after full bloom, preferably around 7 days. If the spray is applied later than 10 days there is a tendency for fruit size to be reduced at harvest. This material should not be applied to varieties ripening earlier than McIntosh and its use should be regarded as somewhat hazardous since in one season some very severe cases of overthinning and leaf stunting were reported, particularly with the Delicious and Stayman varieties. Hormones have proved successful for growers in most seasons but the fact that there is a hazard involved in their use, leaves some question as to their desirability for thinning purposes. Recommendations for use of regular brands of spray thinning materials are given in Table 12.

Chemical thinning with dinitros does not always remove sufficient fruit, and in damp seasons may cause moderate to severe leaf burning. However, new leaves soon replace other damaged ones without serious injury to tree or crop. By removing a proportion of the fruits at bloom time, the tree is enabled to size up at 15 to 20 per cent greater crop than it would otherwise. Nevertheless, with certain varieties and in certain seasons some hand thinning following the June drop may be necessary.

Table 12.—Recommended concentrations of dinitro and hormone-type materials for spray thinning apples.

Material	Amount to use		When to apply
	Per acre* or Per 100 gal. water		
Dinitro materials			
Elgetol	15 pints	1·5 pints	95% bloom open or at first petal fall.
Krenite	15 pints	1·5 pints	
Naphthalene acetic acid† type hormone materials			
App-L-Set		6—7·5 oz. powder	5 to 10 days after full bloom preferably nearer 5 days.
Fruit Fix		24—30 oz. liquid	
Fruitone		12—15 oz. powder	
Kling-Ol		1—1·25 oz. liquid	
Parmone (CIL)		4·75—6 oz. liquid	
Parmone (Dupont)		6—7·5 oz. liquid	
Stafast		12—15 oz. powder	
Stop Drop		4·75—6 oz. liquid	

*for purposes of computing quantities where concentrate spray applications are used. Application of hormones by concentrate spray machines not recommended.

†do not apply hormone sprays to Delicious or Stayman.

Chemical thinning for other fruits has not proved to be so satisfactory as for apples. Neither dinitros nor hormones have been found to thin pears successfully. With peaches, dinitro-ortho-cresol (Elgetol) is ineffective in warm dry seasons and causes drastic overthinning and leaf burning when applied during a rainy season. Elgetol, however, has shown considerable promise for thinning prunes. Experiments under way with another material known as DN 289 or Elgetol 318 (dinitro secondary ortho butyl phenol) are showing rather promising results for thinning apricots, peaches, and prunes, but further data on timing and cencentration will be necessary before safe recommendations can be released to the grower.

Fig. 4.—Peach blossom thinning in the balloon stage using the wire claw. Approximately 70 per cent of the flowers should be removed. One man can thin a tree in 20 to 25 minutes.

Hand Blossom Thinning of Stone Fruits

Since recommendations for chemical thinning of stone fruits cannot safely be made at the present, labor-saving hand blossom thinning procedures are a subject of great interest to growers. Many peach growers are thinning peaches by hand in the balloon stage, removing 70 per cent or more of the blooms. However, for apricots and peaches the most effective method for thinning is by the use of an instrument developed by the Station made by attaching two 10-inch lengths of 5/32-inch 19 strand galvanized wire rope to form a brush or claw. Thinning with a wire claw is best performed during the ballon stage as shown in Fig. 4, although with apricots the thinning season may be extended to fall of petals. With apricots and peaches a mature, full-bearing tree may be thinned in 25 minutes, with usually a few minutes additional hand thinning required later for peaches.

Precooling of Soft Fruits

Cherries, apricots, peaches, and prunes represent an important part of the fruit production of the Interior of British Columbia. Since a large part of the crop is marketed hundreds and thousands of miles beyond the point of production, condition of fruit upon arrival at market is of prime importance to the grower. A tendency in the past has been to pick the fruit somewhat immature in order to ensure delivery in sound condition at the market. This method has not always produced the best results, since immature harvesting has been used as a substitute for precooling of properly matured fruit.

The Experimental Station has conducted numerous tests on precooling of stone fruits. These tests have always demonstrated that fruit may be picked firm and yet fully mature, and when given proper precooling, may be shipped

satisfactorily to distant markets. Thus, in the seasons of 1948 and 1949, respectively, carload shipments of precooled and non-precooled apricots and peaches were sent to the Winnipeg market. Wenatchee Moorpark and Kaleden apricots of T, M, and O[1] maturities representing one experimental shipment from Oliver and Vedette, Veteran and Valiant peaches of pink wrap[2] maturity from Penticton comprised the other shipment. The precooled fruit was harvested and packed the day prior to shipment and temperature reduced to 42°-45°F. before carloading. Each carload included similar non-precooled fruit packed and shipped the same day that it was received.

Destination reports by federal inspectors at time of unloading the cars indicated that precooled fruit, even of O maturity, arrived on the Winnipeg market in fully satisfactory condition. Data covering the peach shipment are given in Table 13. In fact, these reports indicated that there was very little apparent change in ripeness from the time the fruit was loaded into the car.

The results of these and other experiments conducted by the Summerland Station were of very material assistance to British Columbia Tree Fruits Limited in formulating a policy of precooling for handling all stone fruits shipped in the 1953 season. The regulations drawn up were based upon Experimental Station findings and required that fruit be cooled to at least 50°F. before shipment.

Table 13.—Experimental refrigerator carload shipments of precooled and unprecooled peaches to the Winnipeg market. Fruit of "pink wrap" maturity shipped August 22 and examined August 27, 1949.

Car Number	Contents	Fruit temp. when shipped	Temp. of fruit on arrival		Condition of peaches		
			Top of car	Bottom of car	Firmness	Decay	Bruising
		°F.	°F.	°F.			%
N.R.C. 6527.	Hot pack peaches....	65	46	40	Hard to firm ripe; mostly firm ripe..	Nil	1
C.P. 285595..	Precooled peaches...	42	43	39	Hard to firm ripe; mostly hard.....	Nil	1

Mouse Control in Orchards and Cold Storage Warehouses

Mice, particularly the meadow mouse, *Microtus pennsylvanicus,* and the deer mouse, *Peromyscus maniculatus,* annually cause serious loss to fruit growers from fall and winter girdling of the trees at or near ground level. These two species are shown in Fig. 5. In years when mouse population reaches epidemic proportions, the rodents may even be transported into cold storage in boxes of apples and cause damage to fruit during the winter cold storage period.

There has been considerable interest in the use of repellents to prevent mice from attacking the trunks of orchard trees. Accordingly, mice of four different species were fed on apples, green feed and grains, a diet similar to that which they might receive in their natural habitat. Periodically, small limbs of fruit trees painted with various repellent materials were placed in the cages along with untreated limbs. By painting the bark of some of the pieces with repellent

[1] T means minimum harvest maturity with just a tinge of yellow skin color showing.
M means average harvest maturity with a greater showing of yellow color.
O means maximum maturity at which fruit can be picked and still avoid excessive wastage due to bruising in handling.

[2] Pink Wrap refers to peaches wrapped in pink wraps. These peaches are fully mature but still firm in texture. In condition they are designated as "firm ripe".

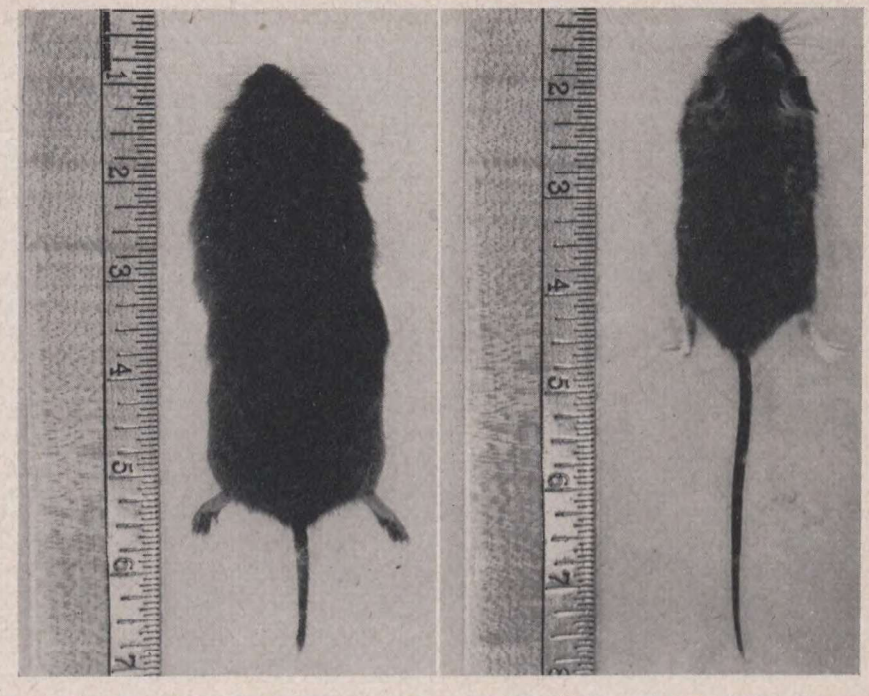


Fig. 5.—The meadow mouse, *Microtus pennsylvanicus* (left), and deer mouse, *Peromyscus maniculatus* (right), appear to be the only mouse species causing tree damage in Okanagan orchards.

and leaving the remainder untreated, it was possible to observe which mice fed on the bark and the effectiveness of the repellent. The materials used and results obtained are presented in Table 14. These tests showed that only meadow and deer mice ate bark.

Table 14.—Effectiveness of various materials used as repellents for mice.

Repellent	Active material	Reaction of mice to treated bark
Lead paint	White lead	Bark eaten readily by deer mice and meadow mice.
Tre-Tex	Synthetic resin, sulphur, aloes	Bark eaten readily by deer mice and meadow mice.
Lepidan	Recipe from Vildt Biological Station, Denmark. Active substance not named.	Bark eaten readily by deer mice and meadow mice.
Z.A.C.	Zinc diethyldithiocarbamate cyclohexyeamine.	Bark eaten to some extent by deer mice and meadow mice.
Z.I.P.	Same as Z.A.C. plus polyethylene disulfide	Repellent effective when applied as heavy coating.

Applications of lead paint, Tre-Tex, and Lepidan were ineffective in preventing mice eating bark. The material Z.A.C. discouraged the mice to some extent and Z.I.P., when applied as a thick coating, served to prevent mice from chewing the bark. However, the last two preparations are fairly readily washed from the bark and therefore would soon

become ineffective under the moist conditions in orchards during the fall and winter. It was concluded from this experiment that repellents, at present available, are not the answer to commercial orchard control of mice.

Complete success, however, was encountered in the eradication of the meadow mouse in commercial fruit cold storage warehouses. Fumigation tests with carbon monoxide and methyl bromide showed that, without damage to fruit, cold storages could be successfully rid of mice by use of either material. Carbon monoxide from the exhaust fumes from one 60-horsepower gasoline engine killed mice within 4 hours in an air space of 100,000 cubic feet. Chemical tests showed that mice were killed within 3 hours by 0·07 per cent of carbon monoxide at 32°F. At room temperature, however, approximately double this concentration was required. A rapid colorimetric test was correlated satisfactorily with more accurate chemical determination of carbon monoxide. With methyl bromide, similar killing was produced within 4 hours, using $\frac{1}{4}$ pound of the chemical per 1,000 cubic feet.

2,4,5-TP. as a Stop-Drop Spray

Loss of apples from autumn winds has always presented a serious menace to Okanagan apple growers, as shown in Fig. 6. For a number of years orchardists have reduced the premature dropping of apples by use of various hormone preparations containing naphthalene acetic acid, napthalene acetamide, or salts of these materials. While satisfactory results have been obtained with these sprays in many instances, it is also well known that they frequently prove unreliable under other circumstances. Napthalene acetic acid sprays become effective within 48 hours of application but last only from 9 days to 2 weeks.

In the last 3 years a new hormone material, 2,4,5-trichlorophenoxy propionic acid, for preventing apple drop has been placed on the market. This material is marketed under the trade name of Color-Set. Experiments conducted at the Summerland Experimental Station and elsewhere have shown

Fig. 6.—Losses from windfalls at harvest may be reduced to negligible amounts by the use of the new preharvest stop-drop spray, 2,4,5-TP.

that this material is uniformly and highly effective in preventing premature dropping of McIntosh and Delicious apples. The material is applied as a spray and takes about a week to become effective, but prevents drop on sprayed trees for at least three weeks following application. No adverse effects on rate of ripening or keeping life of sprayed apples have been detected where the spray was applied at the proper time and fruit picked at ideal maturity. Contrary to advertised claims, this hormone appears relatively ineffective in promoting red color development in apples, except on varieties earlier than McIntosh in which both increased color and accelerated maturity are reported.

McIntosh and Delicious should be sprayed not earlier than two weeks before intended date of picking, since early spraying may lead to accelerated ripening. A good rule-of-thumb date for spraying McIntosh in the Okanagan area is September 7. The material has been satisfactorily applied as a dilute spray at 15 parts per million of water at 900 gallons per acre, or as a concentrate spray at 150 parts per million of water to 90 gallons per acre. The material may also be applied with semi-concentrate sprayers at in-between concentrations. Regardless of the method of application, the grower should use eight 4-ounce bottles of Color-Set per acre of mature trees. Extensive tests over the past two seasons indicate that on McIntosh sprayed with 2,4,5-TP. dropping has been reduced to one-quarter to two-fifths the amount occurring on unsprayed trees as shown in Table 15.

Table 15.—Influence of Color-Set on dropping and firmness of McIntosh at harvest

Year of test	Number of orchards	Average number of windfalls		Average firmness at harvest	
		Sprayed	Check	Sprayed	Check
		boxes per tree	boxes per tree	lb.	lb.
1952	13	1·9	4·9	14·69	14·19
1953	10	·7	3·3	15·77	15·54

Hormone Sprayed Trees Must not be Picked Later than Normal Date of Maturity

Any hormone stop-drop spray is intended only to prevent premature fruit dropping. These sprays must not be used to hold apples on the tree beyond their normal date of maturity. If the harvesting of hormone-sprayed trees is delayed, accelerated ripening and early breakdown of fruit in storage may be expected. It is therefore very important for the grower to harvest his hormone-sprayed trees at the regular date of maturity for the variety.

Vegetable Crops

L. G. Denby

During the period since the War, the vegetable and related industries served by the Summerland Station have undergone considerable change. The vegetable seed industry, which was of importance during the War years, has declined sharply with the return of European seed producers to competitive world markets. The advent of pre-packaging of fresh vegetables has had a marked influence on the varieties grown. Ever increasing competition from other areas coupled with higher costs of production, packing, and shipping has necessitated revision of cultural methods for some crops, and the utilization of

improved methods of irrigation and of insect and weed control. These rapidly changing conditions within the vegetable industry have necessitated corresponding changes in the emphasis of work being conducted on the Summerland Station.

Variety Trials

During the past five years, variety trials have been conducted with all types of vegetables grown for commerce and for home gardens within this region. As a result of the trials, some revision has been made in the list of varieties recommended for planting in the Okanagan Valley. The present list is as follows:

Asparagus:	Mary Washington, Martha Washington
Bean-bush:	Round Pod Kidney Wax, Cherokee Wax, Logan, Rival, Tenderlong 15, Topcrop
Bean-pole:	Blue Lake 231
Beet:	Detroit Dark Red
Cabbage-early:	Golden Acre, Viking Small Early
Cabbage-fall:	Danish Ball-Head, Bonanza
Cantaloupe:	Hales Best 36, Hales Best 55
Carrot:	Nantes, Nancy, Imperator (improved), Red Cored Chantenay
Cauliflower:	Snowball
Celery:	Utah 15
Citron:	Red Seeded, Green Seeded
Corn:	Miniature, North Star (early), Barbecue, Carmelcross, Seneca Golden, Golden Bantam, Seneca Arrow, F. M. Cross, Iochief, Ioana, Erie, Flagship, Huron
Cucumber:	(late) Marketer
Egg plant:	Black Beauty
Lettuce:	Pennlake, Imperial 44, 55; Great Lakes 428, 659, 407
Onion:	Fall planted—Early French (Walla Walla Sweet) Spring planted—Yellow Globe Danvers (strains), White Portugal (pickling)
Parsnip:	Hollow Crown, Guernsey
Peas:	Woodruff's Topper, Wando, Victory Freezer (Robson), Perfected Freezer (Rogers), Onward (Improved Milestone), Lincoln (Homesteader)
Pepper:	King of the North, Vinedale, California Wonder, Pimento, Hungarian Paprika
Potatoes:	Warba, Netted Gem
Pumpkin:	Sugar Pie, Connecticut Field
Squash:	Green Hubbard, Golden Hubbard, Table Queen, Sweetmeat
Swede Turnip:	Laurentian
Tomato:	Earliana 498, Stokesdale 4, Gem, Pritchard, Valnorth on trial basis—fresh market only. Hybrids on trial basis only
Vegetable Marrow:	Whitebush, Long Green Trailing

Tomato Breeding

The results of the tomato yield trials conducted over the past five years indicate that possibly no tomato variety, bred for conditions elsewhere, will replace existing varieties in the Okanagan. Those varieties in use at the present time are not ideal, by any means. However, it now appears that the most practical approach is to breed new varieties here in the British Columbia

Interior—varieties which will be tailored specifically to meet local requirements. An intensive program, designed to accomplish these aims, was initiated in 1951 and is now well under way.

It is now known that Verticillium wilt constitutes one of the greatest hazards to the production of high yields of top quality tomatoes in this region. In 1953, therefore, work was begun, in co-operation with the Summerland Plant Pathology laboratory, to develop new tomato varieties and new strains of existing varieties resistant to this disease. The initial crosses have been made and testing and backcrossing operations have begun.

Yield trials indicate that if there were hybrid tomatoes which had been tailored specifically to meet the requirements of this region, higher yields could be expected. This conclusion has given rise to a third aspect of the tomato breeding program, in which prospective parents are being studied with a view to determining which would be most likely to result in the development of F_2 hybrids best adapted to local conditions. It is intended that the factor for resistance to Verticillium wilt will ultimately be incorporated in these hybrids.

Tomato Yield and Quality Investigations

For many years, tomato growers, shippers and processors in the Okanagan and adjacent valleys have been concerned over poor yields and fluctuating quality of tomatoes—the most important vegetable crop in this region.

In 1950 concerted efforts were initiated to bring together all interested parties, to pool their knowledge of the situation and to work together to solve the problems relative to this industry. The result was the formation of the Tomato Investigations Committee (Okanagan Agricultural Club) which concerns itself, through various sub-committees, with aspects pertaining both to research and to extension.

Breeding Hybrid Onions

Although yields of hybrid onions may not be much greater than those of open pollinated varieties, they have proved to be more uniform in maturity, size, shape, and appearance than are true-breeding lines.

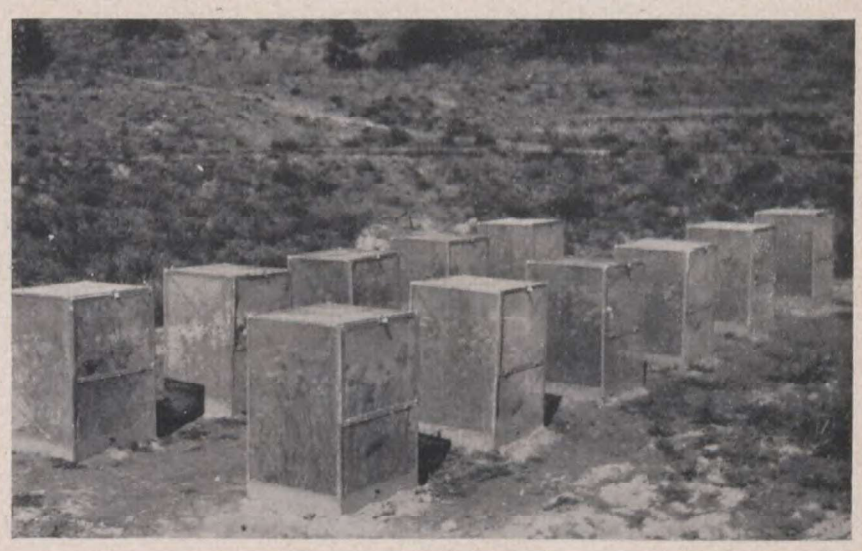


Fig. 7.—A view of the cages in which onion crosses are performed.

In 1950 a hybrid onion breeding program was initiated at Summerland to develop hybrid onions to suit Okanagan conditions. Work is progressing favorably towards the development of specific inbred lines for ultimate use as pollen parents for the hybrids. Crossing is accomplished by house flies which are reared for the purpose and placed in isolation cages with the flowering plants of the two lines to be crossed, as illustrated in Fig. 7.

To date, six hybrids have been developed on an experimental scale. Of these, three show considerable promise. A comparison between these three and three commonly grown commercial varieties is presented in Table 16. Hybrid No. 1 is promising as a possible fall and early winter (short storage) type to be compared with Sweet Spanish. Hybrids No. 5 and No. 6 are promising as winter storage onions, for which Yellow Globe Danvers is commonly produced at present.

Table 16.—Comparison between three Summerland onion hybrids and three commercial varieties.

Variety	Maturity at harvest	Average weight per bulb	Loss of weight in storage
	%	oz.	%
Summerland Hybrid No. 1	85	9·1	23·1
Summerland Hybrid No. 5	81	7·4	11·5
Summerland Hybrid No. 6	79	6·5	7·4
Yellow Globe Danvers 55	15	4·7	9·5
Yellow Globe Danvers 33	33	6·3	14·8
Sweet Spanish Riverside	30	7·7	64·9

Foundation Seed and Verification Trial Work

Experimental Stations across Canada co-operate with the Canadian Seed Growers' Association to develop and maintain lines of vegetable seed of high genetic purity that are used as the basis for commercial production of Registered and Certified seed. These high standard parent lines are called Foundation Stocks.

Table 17.—Quantities of Foundation Seed produced at Summerland 1949-53

Kind	Variety	Seed produced
		lb.
Bean	Round Pod Kidney Wax	35·0
	Stringless Green Pod	35·0
	Giant Stringless Green Pod	85·0
	Masterpiece	106·0
Carrot	Chantenay 37 (long)	46·0
	Imperator (large top)	25·0
Citron	Green Seeded	9·0
Muskmelon	Hales Best	9·0
Onion	Southport Red Glove	25·5
Pepper	California Wonder	0·5
	King of the North	2·5
	Hungarian Paprika	0·2
Pumpkin	Connecticut Field	24·0
	Sugar Pie	7·0
Tomato	Longred	9·7
	Stokesdale 4	4·0
Watermelon	Klondyke	10·5

As a part of the same program, each seed stock is tested at several Stations during the year following its production for purity and trueness to type. These trials are known as Verification Trials, and are extensive.

The quantities of Foundation Seed produced by the Summerland Station during the past five years are listed in Table 17.

In addition to the seed listed in Table 17, the following stocks have been purified and Foundation Seed will be produced beginning in 1954:

Bean—Rival; Cherokee Wax
Carrot—Nancy
Cucumber—Cubit
Onion—Mountain Danvers

Plant Nutrition, Soils and Irrigation

J. C. Wilcox, J. L. Mason and M. McGibbon

Headquarters for the experimental work on plant nutrition, soils, and irrigation are at the Summerland Station; however, much of the field work is conducted at the Kelowna Substation. Other field work is carried out at the Summerland Station and in orchards and fields throughout the Southern Interior of British Columbia. All laboratory work is done at the Plant Nutrition, Soils and Irrigation Laboratory on the Summerland Station.

Orchard Irrigation and Cover Crops

Sprinkler Irrigation.—Until 1945 tree fruits in the Southern Interior of British Columbia were irrigated almost entirely by the furrow or rill method. Following the Second World War, improved types of sprinkler equipment became available, resulting in an upsurge of interest in this method of irrigation. Most growers have now changed over from furrows to sprinklers.

Fig. 8.—Cultivated soil on slopes is often subject to severe erosion by heavy rains. On the left is shown a sandy soil prepared for planting out vegetables, badly eroded by one heavy rain. On the right is a hay field on the same slope, showing no erosion.

This rapid change-over to sprinkler irrigation has necessitated a complete re-examination of irrigation problems at the Summerland Station. First, it was necessary to compare carefully the respective advantages of the furrow and sprinkler methods. The furrow method costs somewhat less to install, is more flexible as to times of water application, and less likely to spread

plant diseases. On the other hand, the sprinkler method requires less water, less labor, causes less soil erosion, keeps the soil more uniformly wetted, and promotes better growth and yield with certain crops. Sprinkler irrigation is recommended wherever there is evidence of soil erosion and wherever the soil is sandy. However, it is not recommended that vegetables or other row crops be planted on slopes subject to erosion, even where sprinkler irrigation is used, as heavy rains or melting snow can cause severe erosion on bare ground.

A comprehensive investigation has been made of the water requirements for sprinkler irrigation of tree fruits in the main soil types in the Okanagan Valley and in adjacent areas. Requirements for other crops have also been studied, to a lesser degree. Two methods have been used in conducting these investigations: (a) Irrigation tests have been made on apples, alfalfa, grasses, small fruits and vegetables, and the actual amounts of water required have been measured. (b) The consumptive use of water has been measured. This includes both the water used by plants and that evaporated from the surface of the soil.

The results of these investigations can be summarized briefly as follows: (a) More water is used out of the first foot of the soil than out of the second foot, more out of the second foot than out of the third foot, and so on down to the greatest depth of rooting. A typical example is given in Table 18. (b) There is a wide variation in rates of consumptive use of water by different crops. This is illustrated by the data in Table 19. (c) More water is required in the southern part of the Okanagan Valley than in the northern part. This is due in part to the fact that there is less rainfall in the southern part, but even more to the longer seasons. (d) More water is required in hot weather than in cool weather. (e) More water is needed on sandy soils that require frequent irrigation than on heavy soils that require only infrequent irrigation. It was found that the maximum safe irrigation interval in the heat of the summer provided a suitable basis on which to make irrigation recommendations for tree fruits. In the 1937-48 Progress Report from this Station, preliminary recommendations were made on this basis. At that time it was suggested that the peak monthly requirements should vary from a low of 6·0 inches with a 30-day soil to a high of 12·0 inches with a 5-day soil. The extensive investigations conducted since that time have confirmed these recommendations.

Table 18.—Percentage of available moisture left in soil at Tree 1A in Croll plot, July 27, 1951*

Depth	Available moisture left in soil at following distances from trunk:		
	5 feet	10 feet	15 feet
feet	%	%	%
0–1	1·0†	5·9	12·7
1–2	5·1	12·4	24·8
2–3	7·8	12·3	23·4
3–4	26·4	36·9	51·5
4–5	39·6	40·6	59·6
5–6	68·4	68·9	64·8
6–7	78·3	86·4	88·7
0–7	32·4	37·6	46·5

*This was a large McIntosh tree in a deep silt soil. The soil had been allowed to dry down to the point where transpiration from the leaves was reduced.

†Each figure represents the percentage of the available moisture range that remained in the soil at the time of sampling. A figure of 0·0 per cent would represent the wilting point and 100·0 per cent would represent the field capacity for moisture.

Table 19.—Consumptive use of water in Salmon Arm and Grandview Flats districts, 1951

Kind of crop	Consumptive use period	Rate of consumptive use per day
		inches
Salmon Arm		
Apples (1)	June 11—June 21	0·32
	July 17—Aug. 10	0·26
Apples (2)	June 12—June 25	0·32
	July 21—Aug. 14	0·14
Strawberries	June 15—July 10	0·07
	July 12—Aug. 13	0·07
Alfalfa	July 13—Aug. 9	0·15
	Aug. 13—Sept. 6	0·07
Grandview Flats		
Alfalfa	July 6—Aug. 2	0·23
	Aug. 6—Sept. 1	0·23
Barley	July 9—July 23	0·20
	July 25—Aug. 6	0·02
Corn	June 23—July 26	0·11
	July 28—Aug. 31	0·17

Establishing an Irrigation Schedule.—In the course of the experimental work on irrigation and soil moisture, much help has been obtained from the use of different types of equipment developed to assess the soil moisture situation without taking soil samples. Chief among these have been soil moisture tensiometers and electrical resistance blocks. A procedure was developed at this Station, using gypsum electrical resistance blocks, to determine when to start an irrigation and when sufficient water has been applied. This procedure proved so useful in experimental work that it was believed to show good promise for extension work as well. In 1952 it was tested for this purpose in the Summerland district, and in 1953 in the Summerland and Penticton districts. Although some weaknesses in the procedure have been revealed, it has proved to be very useful for giving advice to individual growers. The British Columbia Department of Agriculture are now using the method in a limited way. Briefly, the procedure is as follows:

1. Gypsum electrical resistance blocks are placed at a shallow depth in the soil (usually 6 to 9 inches, depending on the crop), and at suitable depths below this.
2. An irrigation is started when the shallow blocks show that the soil at that point is approaching the wilting point.
3. The irrigation water is measured as it is applied.
4. Irrigation is stopped when the wetting front has reached the lowest block that shows substantial drying of the soil.
5. At the end of the season, recommendations are drawn up covering irrigation interval, amount of water required, and suitable rates of application.

Orchard Cover Crops.—Major stress in connection with cover crops has been placed on comparisons of perennial legumes and grasses. Furrow irrigation was discontinued on the Substation in 1948, a sprinkler irrigation system was installed in the spring of 1949, and an entirely new series of cover crop plots planted. Records have been taken on catch, persistence, effects of tree shade, competitive effects of other grasses and weeds, and effects on orchard operations. Records have also been taken in grower orchards. The cover crops tested can be classified for possible usefulness roughly as indicated in Table 20.

Table 20.—Tentative classification of perennial grasses and legumes in accordance with their usefulness as orchard cover crops

Classification	Grasses	Legumes
Showing good promise	Smooth brome Kentucky blue Red Top Creeping bent Creeping red fescue Alta fescue	Ladak alfalfa Rhizoma alfalfa Ladino clover New Zealand white clover
Doubtful	Orchard grass Tall oat Timothy Chewing's fescue Reed canary Creeping wild rye	Birdsfoot trefoil Wild white clover
Poor	Perennial rye Russian wild rye Blue wild rye Crested wheat	Sainfoin Strawberry clover Alsike Lespedeza

Some persist well without mowing and interfere little, if at all, with orchard operations, among such being Kentucky blue grass, red top grass and creeping red fescue. Some require mowing because they grow tall, such as brome grass, alta fescue, orchard grass, tall oat grass and alfalfa; while some require mowing in order to persist, such as the three white clovers noted. The lespedeza strains tried thus far have not been sufficiently hardy.

Tree-Fruit Nutrition

Fertilizers for Tree-Fruits.—At the beginning of the 5-year period covered by this report, considerable knowledge on fertilizers for tree fruits had already been collected. It was known that no response of apple trees to phosphate and potash fertilizers had been found in the Interior of British Columbia, even though soil tests revealed large differences in available nutrient content between orchards. On the other hand, it was known that definite responses were obtained from nitrogen and boron.

Fertilizer Tests.—The effects of the application of phosphate and potash fertilizers on the yield of McIntosh apples under British Columbia Interior conditions have been tested on soils low in available phosphate and potash.

One experiment was carried out on the East Kelowna Substation. No increase in yield was obtained even after 6 years of application of these fertilizers. Another experiment was carried out in the W. A. Steuart orchard at West Summerland. As in the Substation experiment, no effect of phosphate or potash on yield was found, even after 6 years of application.

The results of these experiments are in agreement with results of numerous other experiments carried out over a period of many years in the British Columbia Interior. No clearly proved response to phosphate or potash has ever been found with tree fruits.

During the course of the Substation and Steuart experiments, numerous analyses of the leaves were made by chemical and spectral analytical methods for phosphorus, potassium, and magnesium. In general, application of phosphate and potash fertilizer did not increase the amount of phosphorus or potassium in the leaves. In both the Substation and Steuart experiments, the analyses of magnesium in the leaves showed that yields were higher when higher levels of magnesium were present. Further evidence of magnesium deficiency is the frequent occurrence of deficiency symptoms on the leaves of apple trees in this area. Methods of applying magnesium to the soil and to the leaves

need testing to determine whether they will increase yields and leaf magnesium content. As an interim measure, magnesium sprays to the foliage are being used.

In 1950, apple fruits from both the Substation and Steuart experiments were graded for colour. The fruits were classified in three grades: high color—fruits over 40 per cent red color; medium—15 to 40 per cent; low—less than 15 per cent. There was no clear effect of phosphate or potash fertilizer on color of apple fruits. The percentage of fruits in each color grade is shown in Table 21.

Table 21.—Color of apples from fertilizer experiments

Treatment	Percentage of fruits in color grade		
	high	medium	low
Steuart			
Check	24	37	39
Phosphate	21	35	44
Potash	24	38	38
Phosphate and potash	23	33	44
Substation			
Check	22	34	44
Phosphate	14	33	53
Potash	17	33	50

Leaf Nutrient Survey.—Experience gained in conducting fertilizer experiments has brought about continuous improvement in the methods of choosing locations for such experiments.

Early experiments were located wherever suitable blocks of uniform trees of one variety could be found. At the start of these experiments, chemical tests of the soils for available nutrients revealed wide differences in nutrient content between locations, before any fertilizers were applied in the experiments. Despite these differences, no effects of phosphate or potash on yield of apples were found.

Some of the locations that tested lowest in soil nutrient content were used for later experiments but, here again, no effect of phosphate or potash on yield was found. During the course of this later set of experiments, large numbers of leaf analyses for nutrient content were made. Since the leaf is the tree's factory for the manufacture of carbohydrates, it is essential that it be kept in top working condition. To maintain optimum health, certain levels of nutrients are required. These levels must be established by experiments to determine what amount of each nutrient is associated with maximum yields. The experiments are more likely to produce results if they are located in areas known to have the lowest leaf contents of nutrients. Accordingly, a leaf nutrient survey was initiated to locate such areas.

Although the survey is not yet complete, some interesting findings have already resulted. The levels of nutrients found have been compared with critical levels established in many fruit growing areas. The general levels of nitrogen are a little higher than optimum for best color and quality combined with adequate yield. The optimum is considered to be 2·0 per cent; the mean level found was 2·2 per cent. The potassium and phosphorus levels found are both satisfactory; the magnesium levels are below the critical level of 0·20 to 0·25 per cent in 40 per cent of the orchards. The deficiency is being treated at present by summer sprays of 20 pounds of magnesium sulphate per acre. Methods of applying magnesium to the soil are being tested.

The nutrient contents of the leaves from the survey were also classified according to soil type. The only soil type markedly low in nutrients was rubble, which is composed of coarse material deposited at the mouths of creeks. Only a very small percentage of orchards are located on this soil type. The phosphorus and magnesium contents of leaves on rubble were low, although the potassium level was average, as shown in Table 22. It is planned to use this rubble soil for further experiments on the effect of phosphorus and magnesium.

Table 22.—Effect of soil type on nutrient content of leaves of apple trees

Soil type	Nutrient content of leaves		
	Phosphorus	Potassium	Magnesium
	%	%	%
Rubble	·159	1·41	·188
Loamy sand	·181	1·32	·258
Gravelly sandy loam	·187	1·44	·229
Sandy loam	·191	1·28	·228
Silt loam	·181	1·35	·261
Clay	··275	——	·304

Leaf Nitrogen Level and Fruit Storage Quality.—Experiments designed to test differences in storage quality of McIntosh apples grown in different districts have been carried on for several years at this Station. Storage quality was evaluated by pressure tests, taste tests, and incidence of core flush.

The Plant Nutrition Section co-operated in these experiments in 1951 by analysing leaf samples collected from the same trees used for storage tests of fruit to check the relationships between nutrient levels in the leaves and fruit storage quality. It was found that high nitrogen levels in the leaves were accompanied by a high percentage of fruits having core flush. High core flush indicates poor storage quality. A marked difference was found between districts in the amount of core flush in the fruits, but there was also a marked difference between districts in the amount of nitrogen in the leaves. When the core flush values were adjusted by statistical methods to a uniform nitrogen level, there was little residual difference between districts. The values found are shown in Table 23. Moderate applications of nitrogen are essential to fruit production in this area, but growers should avoid excessive vigor in trees if they wish to produce fruit of high quality.

Table 23.—Relation between nitrogen in leaves and core flush in fruit of McIntosh apple

District	% nitrogen in leaf	% core flush in fruit	% core flush adjusted for nitrogen in leaf
Salmon Arm	2·1	12	10
Vernon	2·0	7	8
Kelowna	1·8	8	15
Summerland	2·1	17	14
Penticton	2·3	32	18

Deficient levels of magnesium and manganese were also found in the leaves, as shown in Table 24. These deficiencies are being corrected with nutrient sprays.

Table 24.—Magnesium and manganese content of McIntosh apple leaves

District	% magnesium in leaf	% trees below critical level	p.p.m.* manganese in leaf	% trees below critical level
Salmon Arm	0·22	40	36	16
Vernon	0·23	32	33	12
Kelowna	0·20	64	23	48
Summerland	0·22	64	37	28
Penticton	0·24	44	48	0

*p.p.m. = *parts per million.*

Methods of Sampling and Analysis.—The major part of the work involved in fertilizer research goes directly into the operation of experiments and the analysis of leaf and soil samples from these experiments. However, in order to make sensible recommendations from the results of experiments, a further body of information on factors affecting the nutrient levels in leaves and soils is essential.

Methods of sampling leaves have been studied carefully, with consideration of the factors causing variation in nutrient levels. Methods of extracting nutrients from soils have been investigated. For the neutral to alkaline soils in the area served by this Station, the carbon dioxide method of soil extraction is used. A new shaking machine has been developed on which flasks containing a mixture of soil and distilled water are swirled, while carbon dioxide is bubbled through the mixture. This extraction method has been studied intensively for the effect of factors found responsible for variation in nutrient levels. Methods of chemical and spectral determination of nutrients have been adapted. Standard chemical methods of analysis are too time-consuming and consequently too expensive for our purpose; therefore rapid, accurate methods of analysis and equipment for use with these methods have been developed for determination of many nutrients. These improved methods are useful for both soil and leaf analysis.

Fruit and Vegetable Processing

F. E. Atkinson and C. C. Strachan

Primarily, the purpose of the Laboratory has been to help the farmer by getting more fruits and vegetables processed in various forms. A qualified team of investigators has been organized to conduct research and study its application to commercial factories. Assistance is also given with quality control, analysis of inspectors' samples for the Marketing Service, and demonstration of the use of processed products by the ultimate consumer.

Freestone Peach Blancher

The usual type of freestone peach blancher on continuous preparation belts has been redesigned to leave only sufficient headspace for halved peaches to pass through on the belt without touching any of the equipment. Inserting 3 half-inch nipples at the cool end to admit a large amount of steam at this point, helps to maintain the entire blancher at 206 to 208° F. The peaches are wetted before they enter the blancher by a fine spray of cold water and are chilled again as they emerge from the blancher. Usually, 20 to 25 seconds at 206 to 208° F. is sufficient for the Vee varieties of peaches. The advantages

of the redesigned blancher are (1) more effective blanch, (2) saving in space, and (3) saving in steam. Four commercial units have been modified according to these specifications.

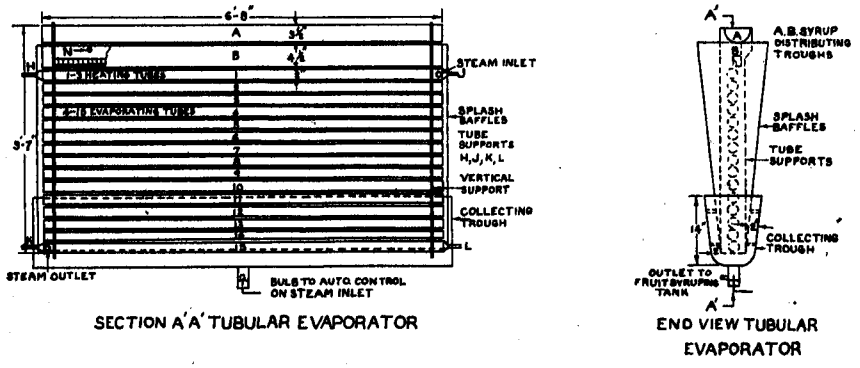
Canned Fruit Pie Filling

The product being packed under this project is a canned ready-to-use fruit pie filling containing approximately 80 per cent fruit. Fruits being used include apples, apricots, peaches, and prunes. In 1953 most of the fillings were made on a semi-commercial scale by private companies and have received market testing. It would appear that there is a good future for these products which are also suitable for making other items such as various pastry dainties, jellied desserts, fruit-flavored ice cream, etc.

Experiments have been conducted to determine the relative merits of various types of thickeners. The scope of this project has included preparation of samples in the Processing Laboratory, making of pies and other products in the Home Economics kitchen, and demonstrations to the public.

Candied Fruit

British Columbia has been a large supplier of candied fruit for the bakery trade. In particular, this product provides an outlet for sweet cherries and zucca melons. About 1940 this Laboratory developed a system of candying fruit in large tanks in which the syrup was pumped from the tank over an evaporator where the syrup was evaporated, heated, and returned to the syruping tank. The system evolved was satisfactory, but recent requests were for a system with more capacity and requiring less labor. Various types of evaporators were studied and tested and the two most promising built as small commercial units. These included (1) a cascading tray evaporator and (2) a tubular wall-type evaporator. Each evaporator was loaned to commercial factories for testing, the tubular wall-type, as illustrated in Fig. 9, being selected as most satisfactory.



SECTION A'A' TUBULAR EVAPORATOR

END VIEW TUBULAR EVAPORATOR

Fig. 9.—A tubular evaporator which has the advantage of (1) large capacity (2) even distribution of syrup and simplicity of operation. The top trough A eliminates the surge from the syrup as delivered from the pump. This syrup drains through 7 holes into trough B. This in turn is equipped with a special set of weirs that cannot clog and which distribute the syrup evenly to the heated tubes. Either hot water or steam under low pressure is used in the tubes.

Syrup tanks also have been studied in relation to simplification of operation and labor, and a design has been recommended in which stainless steel tanks are used with perforated pipes in the bottom for both steam and syrup. These tanks may be equipped with trays which hold the fruit, or a false bottom may be located above the steam and syrup pipes. In this case the fruit is placed

loose in the tank. By having the tank equipped with the perforated steam pipe it is possible to do the leaching and dyeing in the tank without any transfer of fruit being necessary. Where fruit is held in perforated trays it may be loaded into the tank and removed mechanically with a minimum of labor. The development of this type of tank, with the evaporator, makes possible the use of a closed system for candying fruit which reduces labor charges very materially and enables the process to be controlled automatically to a large extent.

Opalescent Apple Juice

Opalescent apple juice developed by the combined efforts of Mr. R. P. Walrod, General Manager of B.C. Fruit Processors Limited, and the Fruit and Vegetable Processing Laboratory, has been subjected to further investigation during the period under review. Opalescent juice constitutes about 40 per cent of the British Columbia pack of apple juice and in 1953 was valued in excess of $750,000. This juice is opalescent in color, is always fortified with ascorbic acid (vitamin C), and retains a high degree of the fresh flavor of the apples from which it is made. In the original process, ascorbic acid was sprayed on the apples as they were milled to prevent oxidation during the pressing operation, and the juice was further fortified just prior to pasteurization before canning. Practically all the ascorbic acid applied during the milling operations was lost, which meant that considerable expense was being entailed to prevent oxidation at this stage. In 1949 the Laboratory devised methods of milling apples in nitrogen or carbon dioxide gases and showed that oxidation could be controlled satisfactorily by the use of these gases. However, it was impossible to simulate laboratory conditions on a commercial scale because of the difficulty in sealing the mill and the very much shorter milling time. Various other antioxidants and methods were tried to prevent darkening of the juice. The most encouraging results were obtained when eating-ripe McIntosh apples of 32° F. were milled, pressed, and pasteurized within a period of 4 minutes. This points to the need of a continuous press for apple juice products.

Canned Pickled Cherries (Cherry Olives)

A home packed pickled cherry, locally known as a cherry olive, is a popular product throughout British Columbia. An effort has been made to establish a commercial process so that pickled cherries could be manufactured in larger quantities. Results indicate that a very satisfactory canned pickled cherry can be made by curing the cherries in a pickling solution of sugar, vinegar, salt, and water at 40° F. for about 6 weeks and later canning these by conventional canning methods in lacquered cans. Tests so far completed do not indicate that the container would last more than one year, and if longer container life cannot be guaranteed, this product would be adaptable to packing in glass.

Removal of Gas from Prepared Apple Tissue

Prepared apple slices or sectors contain a large amount of gas that must be removed before the pieces can be canned satisfactorily. Various processes have been used to accomplish this.

The vacuum process, results of which are shown in Fig. 10, was re-investigated by the Laboratory and found to be very efficient for preparation of solid-pack canned apples, syrup-packed canned apples, or apples to be made into pie filling. However, the original method of running cars of prepared apple into horizontal retorts was too cumbersome. This was modified by having a steel plate located on the floor to which permanent vacuum and steam lines

were attached from the under side and on which plate a basket of prepared apple of possibly 800 to 1,000 pounds could be placed with a lift truck. A steel bell-jar would be lowered over this basket and come to rest on a rubber gasket in the stainless steel plate. A vacuum treatment of 27½ inches could then be given for 3 to 5 minutes, the vacuum being finally released by steam. This equipment required considerable manipulation. A later idea, which is being modified and used on a commercial basis, is to use stainless steel cylinders 18 inches in diameter and 36 inches high in a vertical position with the tops and bottoms quickly removable. Each of these cylinders would hold about 170 pounds per batch and could be charged 6 times an hour, thus taking care of over 1,000 pounds. Five such units operating together would handle over 5,000 pounds per hour, which is sufficient for a small factory. The cylinders would be fed by a belt and the discharge end would either deposit the prepared apples on a lower belt or into a water conveyor.

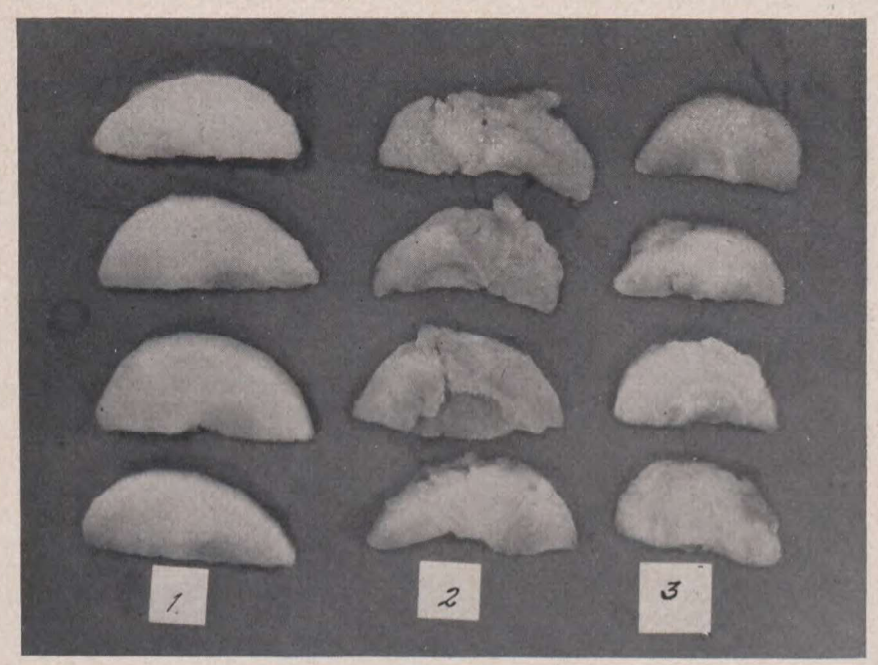


Fig. 10.—Effect of pretreatment on apple sectors. All samples steam blanched 3 minutes at 208°F. (1) Vacuum treatment. (2) No vacuum or brine treatment. (3) 2 per cent salt brine 16 to 18 hours.

The sectored, syrup-packed, canned apples referred to in the foregoing are another product that is made possible by the use of the vacuum procedure. Highly flavored apples such as Jonathan, at their peak of quality, can be peeled, cored, sectored, vacuum treated, and the sectors placed in cans, syruped, capped, and processed as with other canned fruit. When this process is used the sectors retain their original shape without sloughing, are firm, and have a fine delicate flavor.

Quality of Prunes for Canning

The development of an important market for canned Italian prunes depends largely on quality. The quality of Okanagan prunes varies in individual orchards, between orchards, and between districts. It has been estab-

lished through observation and experimentation that to develop a high quality canned product, prunes should be matured to the point where they have a crisp amber flesh free from the pit, and have a minimum total soluble solids of 17 per cent.

Methods of separating good quality from poor quality prunes have entailed (1) brine flotation and (2) size grading. In separating the prunes into quality grades by flotation, a 5 per cent salt brine was used. Prunes that floated in this brine were considered too immature to be used for canning. In most seasons this method is satisfactory but it may be too severe. All the prunes that sink are of suitable quality for canning, but in some seasons there is a large air cavity around the pit in a good quality prune which causes it to float. Thus, there is the possibility of too many good prunes being discarded with the poor ones. Neither is size grading entirely satisfactory, but it appears to be the best approach at the present time. In 1949 a block of 250 boxes from several growers was graded into sizes of 1¼ inch and larger (No. 1), 1⅛ to 1¼ (No. 2), and less than 1⅛ inches (culls). Refractometer readings were taken on representative samples of fruit from these grades, which showed the No. 1 prunes contained 17·63 per cent total soluble solids, No. 2 prunes 14·02 per cent total soluble solids, and culls 11·57 per cent. Thus, the 1¼-inch minimum size for No. 1 for canning appeared to be the breaking point.

Harvesting Bartlett Pears for Canning

In this study Bartlett pears harvested by the Harvesting and Storage Section at a maturity stage indicated by pressures as low as 13·7 pounds on a pressure tester and stored in the normal manner, were canned in the Fruit and Vegetable Processing Laboratory. It would appear from the experiments conducted so far that Bartlett pears with pressures as low as 14·5 pounds are satisfactory for canning, although they may have a shorter storage life. This permits leaving the fruit on the trees for as long as 12 days after the usual harvest period. As there is an increase in weight exceeding 2 per cent per day, a worthwhile increase in tonnage can be obtained by the grower. However, it would not be practical for the grower to endeavor to leave all his pears on the tree until the lower pressure test is obtained.

Preparation of Salad Pack Cherries

Canned fruit salad and fruit cocktail have become important items on the canned food market. The common difficulty experienced with dyed cherries used for salad pack is that the red dye may disappear gradually from the cherry and the dyed cherry may discolor the fruit adjacent to it. Detailed procedures have been developed by the Laboratory for overcoming these difficulties. Cherries prepared according to these recommendations retain their color, with a very slight discoloration apparent at the point of contact with adjacent fruit.

Jam Manufacture

Although jam is an old-established product there are still many requests for information on quality control and methods of manufacture. Consequently, the Summerland Laboratory has undertaken a project of manufacturing jam from Okanagan tree fruits and British Columbia Coast berries, using a variety of conditions. Information so obtained will be available to jam manufacturers and will help in controlling the quality of their products.

Heat Penetration of Tomatoes

In order to provide information on the effect of duration and temperature of processing on the percentage drained tomato solids, wholeness, and color, an experiment was undertaken using various processes. Tomatoes were processed in 20-, 28- and 105-ounce cans at 210, 230, 240 and 250°F. The quality of the pack resulting from this experiment was very encouraging. Seventy-five per cent of the canned product contained over 65 per cent drained tomato solids, placing it in the Fancy grade for this product. The remainder of the samples graded a good Choice, containing at least 60 per cent drained tomato solids. No differences in condition, color and wholeness of fruit could be attributed to the process, yet in all instances heat penetration was sufficient for commercial sterilization.

Co-operative Project on Survey of Factors Affecting Quality and Yield of Canning Tomatoes

This work has been carried on co-operatively with the Plant Nutrition Section, the Provincial Department of Agriculture and the Plant Pathology Laboratory. In the preliminary studies of 1952 the Fruit and Vegetable Processing Laboratory made determinations on soluble solids and ascorbic acid content of numerous samples. No correlation could be established between soluble solids and ascorbic acid content or between either of these two factors and firmness or quality of fruit. In 1953, samples from plots in Cawston, Kelowna, Vernon, and Kamloops were canned by the Fruit and Vegetable Processing Laboratory staff. The general result of these tests indicated distinct improvement in quality of samples canned by the staff as compared with quality of commercial samples obtained in each factory.

Spoilage of Tomatoes by *Clostridium pasteurianum*

This is a serious spoilage organism that has caused several outbreaks of spoilage in Flemish Beauty pears and one in canned tomatoes. Results of sterilization tests on canned tomatoes indicate that:

1. At a pH of 4·0 to 4·15, can centre temperatures of 190°F. are sufficient

2. In the pH range of 4·3 to 4·5 can centre temperatures must be increased to 200°F. in order to control spoilage.

3. Tomatoes with a pH above 4·5 require a heavier process—which has not been determined—or acidification with citric acid. Tests so far indicate that up to 0·2 per cent acid may be used with 2·0 per cent sugar without seriously affecting the flavor.

Schools

Schools for mold counters from factories making tomato juice, tomato ketchup, and puree, and schools for Marketing Service Inspectors located in Alberta and British Columbia have been organized and conducted by Laboratory personnel. Talks are given on sanitation and technical aspects of processing, so that the inspectors will be more familiar with the processes used in the factories they inspect.

Each year assistance has been given in organizing the Short Course for canners sponsored by the Canned Foods Association in British Columbia, and two or more speakers take part in the program.

Ornamentals

N. May

The last Progress Report of 1937-1948 devoted much space to various ornamentals suitable for growing in Okanagan gardens. The work of testing new plants and varieties of plants has continued and the gardens in which these tests are made have been a source of great enjoyment to the general public. The following are a few comments on some of the more recent introductions. The reader is referred to the previous reports for details on culture.

Annual Flowers

Seed source of annuals is important for those wishing to grow the best. It has been found that varieties with the same names from several sources are not always identical. The following list of varieties found to be "excellent" at Summerland will act as a guide to gardeners when making purchases. While seed sources have not been listed, these will be given upon inquiry.

Antirrhinum—Brilliant Crimson, Bright Cerise, Bright Orange, Bonfire, Colossal Mixed, Pink Bedder, Scarlet Bedder, Scarlet Queen, Skyscraper, and Yellow Bedder.

Aster—Kirkwell (dark blue and rose pink), Scarlet Queen, California Giants (crimson), Golden Sheaf, Princess Elizabeth, and Princess Margaret.

Marigold—African Lemon, Naughty Marietta, Tangerine, Rusty Red, and Sunkist.

Petunia—All Double Salmon, Ballerina, Comanche, Dream Girl, Dwarf Elk's Pride, Selected Elk's Pride, Sonata (double white), and Tango.

Miscellaneous—Scarlet Glory and Carmine Queen Eschscholtzia; Violet Queen Alyssum.

Herbaceous Perennials

Hardy Chrysanthemums—There have been several English types tested on the Station over the past 5 years that, while not fully hardy, are suitable for Okanagan conditions. The better varieties include Corncob, Doreen Monte, Dorothy Wearing, Judith Anderson, Moonbeam, and Volcano. Of the newer hardy varieties originating on this continent, the following have done well at Summerland: Golden Carpet, Hidatsa, Marjorie Mills, and Red Cloud.

New Half-Hardy Perennials—Venidio-Arctotis "Sutton's Triumph" is a bigeneric hybrid, with the two South African plants, Venidium and Arctotis, as parents. In general appearance it resembles Gerbera. In color it defies description, the nearest suggestion being endless gradation, shades and blendings on a mixed theme of old rose, tawny port, copper, and light sherry. Venidio-Arctotis requires greenhouse propagation, sowing early in March.

Flowering and Ornamental Shrubs

The following ornamental evergreens were planted during the spring of 1952:

Chamaecyparis Ellwoodi
Chamaecyparis erecta viridis
Chamaecyparis forsteckensis
Chamaecyparis Lawsoniana knowfeldiana
Juniperus chinensis Obelisk
Juniperus japonica San Jose
Juniperus virginiana Burki
Juniperus virginiana Hilli
Picea albertiana conica
Picea Ohlendorffi
Picea pygmaea

All the above shrubs are in a healthy growing condition and are suitable for planting under Okanagan climatic conditions.

Climbing Vines and Deciduous Shrubs

Buddleia Davidi Empire Blue
Buddleia Davidi Orchid Beauty
Buddleia Davidi Peace
Calycanthus floridus
Clematis Hybrid Grace
Clematis tangutica
Lonicera Scarlet Trumpet var. Dropmore

None of the above varities of climbers or deciduous shrubs has suffered any winter injury since being planted out in 1952.

Roses

The roses on the Station suffered severe winter injury during the winter of 1949-1950. It was observed that this injury was more severe where the subsoil consisted of gravel and sand. Consequently, the beds were excavated to a depth of 2 feet, a layer of rotted manure placed to a depth of 8 inches and the remainder of the beds filled with fresh topsoil and replanted to various varieties of Hybrid Tea and Floribunda roses budded on *Rosa canina* and *Rosa multi-flora Japonica*. After planting, a mulch of Douglas fir planer shavings 4 inches deep was applied to half the roses in each rootstock group. During the spring and summer all beds received two dressings of ammonium nitrate.

The result of the mulch was very noticeable, the growth being more vigorous and the blossom period of the bushes extended by 6 weeks, as compared with the check portions of the beds.

During the winter of 1953-54 three roses budded on *Rosa multiflora* rootstock were winter killed. There was no winter killing on roses budded on *Rosa canina* rootstock. From observations made during the past 2 years, the following varieties of roses were outstanding for productivity and quality of blossoms:

Hybrid Tea

Red:
- Charlotte Armstrong
- Christopher Stone
- Crimson Glory
- Ena Harkness
- General MacArthur
- Rouge Mallerin

Pink:
- Eternal Youth
- Good News
- McGredy's Pink Picture
- Show Girl
- The Doctor

White:
- Abol
- Edel
- McGredy's Ivory
- Rex Anderson

Yellow:
- Lady Mandeville
- Lowell Thomas
- McGredy's Yellow
- Mme. Marie Curie
- Speck's Yellow
- Spungold

Bicolor:
- Commando
- Fiesta
- Mme. Henri Guillot
- Peace
- Sutters Gold
- Saturnia

Floribunda

Red:
- Alain
- Frensham
- Red Ripples

Pink:
- Fashion
- Pinocchio

Yellow:
- Goldilocks

List of Research Subject Matter

Animal Husbandry	Costs of rearing Jersey cattle Breeding Jersey cattle Control of tuberculosis and contagious abortion in cattle
Field Husbandry	Agricultural meteorology Fertilizers and irrigation for pastures Tractor operation costs
Forage Plants	Species and variety tests
Horticulture	
Pomology	Tree fruit breeding and varieties Tree fruit rootstock and double-working Identification of nursery stock Tree fruit thinning, harvesting, and storage Rodent extermination in orchards and warehouses Physiology of fruit in storage
Vegetables	Variety trials of vegetables Tomato breeding for Verticillium wilt resistance Vegetable foundation seed production Temperatures in relation to vegetable growth
Soils and Irrigation	Irrigation of orchards and vegetables Root growth studies Soil management studies. Fertilizer and nutrition of tree fruits and vegetables
Fruit and Vegetable Processing	Canning tests of fruits and vegetables Juice investigations of fruits and vegetables Freezing fruits and vegetables Jam, glacé and pickle manufacture Chemical analysis of fruit and vegetable products
Ornamentals	Testing new varieties

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