DOMINION OF CANADA
DEPARTMENT OF AGRICULTURE
DOMINION EXPERIMENTAL FARMS

EXPERIMENTAL STATION

SUMMERLAND, B.C.

REPORT OF THE SUPERINTENDENT

W. T. HUNTER

FOR THE YEAR 1923

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EXPERIMENTAL STATION, SUMMERLAND, B.C.

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

FOR THE YEAR 1923

THE SEASON

The season of 1923, throughout the Okanagan district, was favourable to agriculture and horticulture. There was an average snowfall during the winter 1922-23, and by the middle of February the ground was clear. Some severe temperatures were experienced about February 12-15. March was dry and moderately warm. Work on the land started on March 19 and seeding on March 27. During the months of April, May, and June the precipitation was exceptionally heavy for this district and in consequence all seeding got away with a good start and hay crops were heavy. Stone fruits, especially cherries, suffered somewhat from this unusual rainfall, but apples were a heavy crop and of good quality. Fine weather prevailed during harvest, and grains and roots were gathered in good condition. No severe weather was experienced until the end of December. Snow fell at this time and about 15 inches lay on the ground throughout January, when a thaw came, all snow going in a couple of days. The ground was bare during the remainder of the winter, with moderate temperatures prevailing and a fair amount of sunshine.

EVAPORATION

To obtain data on the amount of evaporation from an open water surface, a tank six feet square by two feet deep with a vernier was installed for recording variations in rise or fall as small as one-hundredth of an inch. The following figures give the average daily evaporations for the summer months: April, 0·13 inch; May, 0·14 inch; June, 0·15 inch; July, 0·24 inch; August, 0·16 inch; September, 0·14 inch; October, 0·7 inch.

ATMOSPHERIC RELATIVE HUMIDITY

The atmospheric relative humidity was taken every morning at nine o'clock, during the summer months, the averages being as follows: April (16 days), 60 per cent; May, 59 per cent; June, 73 per cent; July, 62 per cent; August, 60 per cent; September, 59 per cent; October, 70 per cent.

TABLE 1—SUMMARY OF WIND RECORDS, 1923

1923—Month	Total mileage for month	Greatest mileage in 24 hours	Maximum velocity	Average velocity	Prevailing direction
January	7,653	542	40	10·3	South
February	5,202	537	31	7·7	South
March	4,912	307	32	6·6	South
April	5,440	453	40	7·6	South
May	4,965	277	25	6·7	North
June	4,807	223	20	6·0	North
July	6,051	355	30	8·1	North
August	5,369	240	22	7·2	Southwest
September	6,367	347	34	8·8	Southwest
October	6,500	412	37	8·7	Southwest
November	5,997	449	39	8·3	Southwest
December	10,467	1,084	57	14·1	Southeast

TABLE 2—RECORDS ON TEMPERATURES, PRECIPITATION AND SUNSHINE FOR THE YEAR, 1923

Month	Temperature F.			Precipitation			Average per month for past 8 years 1916-23inclusive	Total Sunshine
	Mean	Highest	Lowest	Rainfall	Snowfall	Total		
	°	°	°	Inches	Inches	Inches	Inches	Hours
January	29·83	44·0	2·0	0·79	2·80	1·07	0·92	64·2
February	24·93	46·0	−7·0	–	2·60	0·26	0·61	106·2
March	39·08	63·0	19·0	–	0·70	0·07	0·60	170·9
April	48·30	76·0	32·0	1·29	–	1·29	0·87	216·7
May	55·29	78·0	31·0	0·93	–	0·93	0·73	215·2
June	62·50	92·0	44·0	3·37	–	3·37	1·25	228·8
July	70·83	96·0	50·0	1·24	–	1·24	0·77	366·9
August	70·50	90·0	53·0	1·29	–	1·29	0·79	296·4
September	60·58	81·0	37·0	0·56	–	0·56	0·18	264·7
October	49·11	74·0	26·0	0·81	–	0·81	0·76	193·0
November	39·35	56·0	28·0	0·43	0·60	0·49	0·87	54·5
December	30·61	47·0	−7·0	0·66	13·20	1·98	1·26	48·7
Total for year	–	–	–	11·37	19·90	13·36	–	2,226·2
Average for 8 years	–	–	–	7·12	30·90	10·21	–	2,048·9 (7 year average)

ANIMAL HUSBANDRY

HORSES.—No breeding work with horses is conducted at this Station, and only sufficient work stock is kept to meet the requirements of the farm in this direction.

BEEF CATTLE.—Feeding experiments with beef cattle conducted during the previous winter, in an endeavour to test the comparative value of corn vs. sunflower silage in the ration showed very little advantage in either silage. However, the addition of roots to the ration proved of considerable advantage inasmuch as it lowered the cost per pound of gain.

SHEEP.—The flock was reduced during the year by the disposal of all the Suffolks and grade Oxfords. Only the registered Cheviots were retained. The flock numbers about fifteen at present and is headed by the shearling ram recently imported from Scotland, "Stormproof," an animal with exceptional promise.

SWINE.—The herd of Berkshire swine, which is being developed along bacon-type lines, was materially augmented by a splendid young boar, "Ottawa Model," bred at the Central Experimental Farm, Ottawa, which was secured this year for this Station. This is a large deep-bodied animal, particularly smooth and fine at the shoulders. No experimental feeding was conducted this year with swine, and close selection for bacon-type individuals in the young herd made up the activities in this department.

FIELD HUSBANDRY

The season's very unusual precipitation of 8·68 inches from April to September inclusive, combined with a plentiful supply of irrigation, was exceptionally favourable for all field crops. Wheat, barley, corn, sunflowers, sorghum and sudan grass yielded well.

SEVEN-YEAR ROTATION

A seven-year rotation, consisting of one year in North Western Dent corn and Russian Mammoth sunflowers for ensilage, one year in Marquis spring wheat and five years in alfalfa is under test. Alfalfa is seeded in the third year in this rotation on a firm seed bed, without a nurse crop, and at the rate of twelve pounds of Turkestan seed per acre. In the fifth year of alfalfa, the third cutting is ploughed under. During the winter, manure is applied at the rate of ten tons per acre and in the spring ploughed in preparation for corn and sunflowers. This rotation is giving satisfactory results, particularly in improving the soil. The growing of alfalfa for five years provides an economical and practical method of increasing the two most important constituents needed in the semi-arid soils of southern British Columbia—humus and nitrogen.

ALFALFA—YIELDS OF HAY

The various alfalfa fields are widely located on the Station and include all the different types of soils typical of the Okanagan Valley from coarse gravel to silt loam. A gravelly loam would be the average. The general topography of the land is high, slightly rolling and with all aspects. In comparing the amounts of irrigation and yields of alfalfa for this year it should be borne in mind that this season's precipitation was unusually heavy. The rate of irrigation in acre inches for the season was 31.0; the number of acre inches of water per ton of alfalfa was 9.86 and the average yield per acre was 3 tons, 282 pounds. Accompanying tables give the yields of hay for 1923 and the average for 1917-1923.

A comparison of the table giving the average yields of hay and amounts of water applied for seven years show very variable irrigations. The results so far in the irrigation of alfalfa are no criterion as to the minimum amount of water needed on the average soil of this district commensurate with economical yields. In the past, the amount of water that could be spared for the crop largely influenced the irrigation received.

TABLE 3—ALFALFA—YIELDS OF HAY, 1923

Area of Field	Year of seeding	First cutting		Second cutting		Third cutting		Total yield per acre, 1923
		Date	Yield	Date	Yield	Date	Yield	
Acres			tons lb.		tons lb.		tons lb.	tons lb.
1·33	1918	June 20	3 1,115	July 30	2 580	Sept. 19	2 307	6 32
2·46	1922	July 4	5 360	Aug. 17	1 900	Sept. 29	3 800	4 1,184
1·43	1918	June 28	2 1,160	July 30	1 1,500	Sept. 19	1 620	3 1,888
2·33	1922	June 28	4 500	July 30	1 1,600	Sept. 19	1 1,360	3 635
3·68	1923	June 30	3 1,750	.....	.....	.....	.....	1 106
Average yield per acre	.....	.....	.....	.....	.....	.....	.....	3 282

TABLE 4—ALFALFA—AVERAGE YIELD OF HAY, 1917-23

Year	Average yield per acre	Irrigation	
		Rate of application in acre-inches	Acre inches of water per ton of hay
	tons lb.	acre-inches	acre-inches
1917	3 1,115	3·36	10·22
1918	4 1,830	41·80	8·50
1919	2 1,507	21·65	7·86
1920	2 1,616	21·49	7·65
1921	4 264	11·22	2·71
1922	2 412	2·43	1·10
1923	3 282	31·00	9·86
Average for 7 years	3 717	23·71	6·84

CORN AND SUNFLOWERS—COMPARATIVE TESTS FOR ENSILAGE

North Western Dent corn and Russian Mammoth sunflowers were grown on land which had been in alfalfa the previous year. The type of soil is very variable, grading from coarse gravel to rich loam. Considerable grading was done on this bench which delayed seeding until June. Irrigation was timely. The rate of application in acre-inches for the season was 22.49. The results are here tabulated.

TABLE 5—CORN AND SUNFLOWERS—COMPARATIVE TESTS FOR ENSILAGE

Variety	Date of seeding	Date of cutting	Height	Yield per acre 1923
			feet	tons lb.
North Western Dent	June 9 ..	Sept. 18...	8	8 1,758
Russian Mammoth	June 9...	Sept. 18...	7	5 967

In comparing the yields of North Western Dent corn and Russian Mammoth sunflowers, it should be noted that the corn was grown on richer soil than the sunflowers.

CORN AND SUNFLOWERS—FOUR YEAR AVERAGE 1920-23

North Western Dent corn and Russian Mammoth sunflowers have been grown for four years. The average yields in the accompanying table have been obtained during that time.

TABLE 6—CORN AND SUNFLOWERS—COMPARATIVE TESTS FOR ENSILAGE—FOUR-YEAR AVERAGE

Year	Average Yield per acre—1920–1923	
	Corn—North Western Dent	Sunflowers—Russian Mammoth
	tons lb.	tons lb.
1920	10 0	12 1,000
1921	16 740	11 0
1922	10 864	20 1,407
1923	8 1,758	5 967
Average	11 840	12 843

Four years tests with corn and sunflowers have consistently demonstrated that corn has greater drought resistance than sunflowers. Sunflowers have more frost resistance than corn and can therefore be grown with less risk of damage by frost at lower temperatures and in higher and lower altitudes where frost pockets are likely to exist.

MARQUIS WHEAT IN THE ROTATION

Marquis wheat is seeded after corn and sunflowers in the second year of the seven-year rotation. The crop was sown on good loam soil on April 4, and cut July 24. Soil moisture was plentiful throughout the season. The rate of irrigation in acre-inches was: May, 4·83; June, 7·75; total, 12·58. The stand of wheat was exceptionally good and yielded at the rate of 38 bushels and 22 pounds per acre.

YIELD OF MARQUIS WHEAT IN SEVEN-YEAR ROTATION—THREE-YEAR AVERAGE

Marquis wheat has been grown under field conditions for three years with the average results tabulated here.

TABLE 7—MARQUIS WHEAT—THREE-YEAR AVERAGE

Year	Number of days maturing, 1921-23	Yield per acre, 1921-22	
	days	bush.	lb.
1921	113	25	50
1922	76	12	0
1923	111	38	22
Average	100	25	24

SOWING MANGELS

AUTUMN VERSUS SPRING SEEDING

An important factor in the early development of the mangel crop in the Dry Belt is to seed early in the spring just as soon as the soil is in a workable condition so as to secure good germination and early growth on the natural moisture in the soil. With late seedings there is often not enough moisture in the soil to germinate the seeds until irrigation is available which is usually in late spring. With this fact in mind, a plot of mangels was seeded November 24, 1922, with the object in view of ascertaining whether late autumn or early spring seeding would give the better germination and development. The one year's results would seem to indicate very markedly that autumn seeding is a failure, owing to practically all the roots in 1923 running strongly to seed and being unfit for stock food.

EARLY VERSUS LATE SPRING SEEDING

A comparison of early versus late spring seeding of mangels gave an increased yield per acre of 4 tons, 104 pounds, green weight, in favour of early seeding. Dates of seeding were April 4 and April 28. This work is being continued.

HORTICULTURE

The territory served by the Summerland Experimental Station is largely devoted to the production of horticultural crops. Consequently the work of the Station is planned primarily to be of assistance to growers of fruits and vegetables. Since the Station is located in an irrigated region, special attention is paid to a study of problems associated with irrigation. Until recently the efforts of the Station have been directed almost entirely to investigating the factors of production. A determined effort has been made to secure reliable information concerning the methods whereby large yields may be obtained at the lowest possible cost.

While there is still much to be learned concerning the problems of production, the trend of commercial agriculture has seemed to indicate that the producer is in need of assistance in the marketing as well as in the growing of his crops. For this reason the scope of the activities of this Station has lately been widened to include some work in the storage of fruits. It is probable that as the fruit industry develops in this province, storage will come to play an increasingly important part in the successful marketing of the fruit crop.

The experiments under way in the Horticultural Division of this Station are so extensive that it has not been possible to present the results of all of them in detail in this report. Consequently it has been decided to omit any mention of a large number of experiments for which the data are as yet incomplete. An attempt has been made to give fairly full information concerning the results of a relatively few projects which it is thought may be of particular interest and value to growers at this time.

APPLE ORCHARD CULTURAL EXPERIMENTS

These orchards were planted in 1916. The main purpose of the experiments conducted in this orchard is to secure information as to the most economical method of bringing up a young orchard and of maintaining it when it reaches bearing age. In addition, the orchards are laid out in such a way as to serve as a test of varieties, systems of pruning, and methods of thinning.

The six orchards included are all located on the same bench. Each orchard is two acres in area. There is a wide variation in the character of the soil and subsoil on different parts of the bench, but no one orchard has a monopoly of all the good or bad soil. The character of the soil ranges from a sandy loam underlaid with coarse gravel, to a fine silt having a clay subsoil.

The permanent trees were planted thirty feet part, and were filled one way. Yellow Newtown, Rome Beauty, McIntosh Red, Grimes Golden, and Delicious were used as standards; while the fillers employed were Jonathan, Wagener, Duchess, Yellow Transparent and Cox Orange.

The following methods of cultivation were adopted:—

No. 1. Continuous Clean Cultivation.—No manure or commercial fertilizers have been applied. A soil mulch has been established after every irrigation and after every rain during the growing season.

No. 2. Alfalfa Cover Crop.—For the first five years, the alfalfa was cut and disked each time it flowered. In subsequent years one-half of the orchard has been disked each spring and one-half left undisked.

No. 3. Soiling Crops and Hairy Vetch.—During the first five years soiling crops of peas, oats and vetch were grown, cut, fed, and the manure returned. In subsequent years hairy vetch has been left uncut and has been reseeded by disking in August after the seed ripened.

No. 4. Red Clover and Alfalfa Sod Mulch.—During the first five years three crops of red clover were turned under, since when the orchard has been carried on under the Alfalfa Sod Mulch system.

No. 5. Vegetable Intercrops and Vetch.—Vegetable intercrops are grown in every other panel; vetch in alternate panels, disked in to provide nitrogen and humus. Manure is applied each year to the vegetable panels.

No. 6. Farm Rotation.—Three years clover, one year roots, one year grain. Manure is applied before the root crop.

The methods of cultivation employed are presented in detail in the report of this Station for the year 1922. A fairly full discussion of the effect of the various methods of cultivation on the economical culture of a young orchard is also given in the 1922 report. It is considered pertinent, however, to present at this time a preliminary statement concerning the economical effect of three of the cultural methods on the maintenance of an orchard after it reaches bearing age. While the orchards at the Station are not yet in full bearing, it is hoped that the following discussion and tabulated data may prove of interest to growers.

The three methods of orchard management concerning which there is most contention in the irrigated sections of this province at the present time are clean cultivation, alfalfa cover crop, and vetch cover crop. The results of applying these methods of cultivation to the experimental orchards at the Station are presented in the following paragraphs.

In an endeavour to determine the effect of each method of cultivation on the economy of orchard operation attention has been paid to: 1. Yield and quality of fruit produced. 2. Growth and vigour of trees. 3. Texture and fertility of soil. 4. Water requirement. 5. Cost of operation. 6. Prevalence of orchard pests.

EFFECT OF CULTURAL METHODS ON YIELD AND QUALITY OF APPLES

The yield of fruit produced by individual trees has been recorded each year. From these figures the yield per acre has been calculated. The yield in boxes per acre for 1921, 1922, and 1923 and the average yield for the three years is shown in the accompanying table.

TABLE 8—THE EFFECT OF CULTURAL METHODS ON YIELD OF APPLES

Method of cultivation	Yield in boxes per acre (48 trees, planted 1916)			
	1921	1922	1923	Average for three years
	boxes	boxes	boxes	boxes
Clean cultivation	46·1	51·6	184·0	93·9
Alfalfa sod mulch	41·6	56·5	131·5	76·5
Hairy vetch	67·4	83·4	371·4	174·0

It will be observed that the orchard in which vetch is being grown as a cover crop has each year produced the largest tonnage of fruit. The alfalfa orchard has produced the least fruit of the three, except in 1922 when its production exceeded that of the clean cultivated orchard by a few boxes. From the set of fruit in the spring of 1924, it seems probable that the alfalfa orchard will in this year yield considerably more than the orchard under clean cultivation.

These results suggest that while clean cultviation may induce early fruiting, the tonnage of marketable fruit produced over a number of years is

likely to be greater where alfalfa is used as a cover crop. Hairy vetch cover cropping has already demonstrated its superiority over clean cultivation as a means of securing large yields.

With regard to the effect of cultural methods on the quality of fruit produced, sufficient data have not yet been secured to justify a definite statement. In an attempt to obtain reliable information with regard to this question, a keeping-quality experiment was carried out with the 1923 crop. Six boxes of apples of each variety from each orchard were wrapped, packed and nailed up as for shipment. Fruit from separate individual trees was packed in each box. These apples were then stored in the basement of the packing house. At the time when the several varieties were on sale at fruit stands the boxes were opened and the fruit carefully examined. It was found that there was as much difference in the quality of fruit picked from different trees grown in the same orchard as there was between that from trees grown under the different methods of cultivation. While cultural methods doubtless have a considerable effect on the quality of fruit produced, there are evidently other factors which influence the character of the fruit to as great, if not greater, extent. As the trees become more mature it should be possible to secure more definite information in this connection.

EFFECT OF CULTURAL METHODS ON GROWTH AND VIGOUR OF TREES

Although the Experimental Station orchards are only eight years old the influence of cultural methods on the growth and vigour of the trees is already quite pronounced. In 1921 and each subsequent year, measurements of the trunk diameter and average twig growth of every tree were made at the close of the growing season. From these figures the average trunk diameter and twig growth for each orchard have been calculated.

The accompanying table shows the average trunk diameter at the end of the growing season in 1921, 1922, and 1923.

TABLE 9—THE EFFECT OF CULTURAL METHODS ON TRUNK DIAMETER OF APPLE TREES

Method of cultivation	Average trunk diameter in inches per tree		
	1921	1922	1923
	inches	inches	inches
Clean cultivation	3·79	4·47	5·01
Alfalfa sod mulch	3·64	4·31	5·01
Hairy vetch	4·16	4·84	5·66

It will be noted that with regard to growth, as indicated by trunk diameter, the vetch orchard is again in the lead. Furthermore a study of the data presented in Table 2 reveals the fact that in 1921 the trees in the alfalfa orchard were considerably smaller than those under clean cultivation. By 1923, however, this difference had been overcome and the trees in these two orchards were about equal in size. The comparatively large growth made by the trees in the alfalfa orchard since 1920 is further emphasized by the data presented in the next table, which shows the average twig growth for the seasons 1921, 1922 and 1923.

TABLE 10—EFFECT OF CULTURAL METHODS ON TWIG GROWTH OF APPLE TREES

Method of cultivation	Average twig growth in inches per terminal shoot		
	1921	1922	1923
	inches	inches	inches
Clean cultivation	28·3	18·8	26·6
Alfalfa sod mulch	29·1	19·8	30·0
Hairy vetch	26·7	19·5	29·3

It is evident, from a survey of the data set forth in the preceding table that during each of the years 1921, 1922 and 1923 the trees in the alfalfa orchard made the greatest, while the trees grown under clean cultivation made the least, terminal growth.

The effect of cultural methods on the vigour of the trees is also evident in the colour and luxuriance of the foliage. The dark green colour and increased size of the leaves on the trees in the cover crop orchards as contrasted with the smaller and lighter coloured foliage of the trees grown under clean cultivation is apparent to the most casual observer.

" These results suggest that while clean cultivation stimulates growth for the first few years, the stimulus soon disappears unless measures are taken to replenish the supply of nitrogen and humus in the soil. The use of alfalfa as a cover crop, on the other hand, while it may for the first few years exert a dwarfing effect on the trees, is likely, when thoroughly established, to result in a great stimulation of growth. It appears possible, by the use of hairy vetch, to secure a strong vigorous growth in the trees without incurring any preliminary check while the cover crop is becoming established.

EFFECT OF CULTURAL METHODS ON SOIL TEXTURE AND SOIL FERTILITY

It is difficult, without resorting to detailed chemical and biological analysis, to determine accurately the effect which cultural methods exert on the fertility of the soil. Growth and yield of fruit produced are indirect evidence of this effect. The ability of the soil to absorb and retain moisture can, however, be taken as a fairly accurate index of its texture and physical condition. The amount of irrigation water applied to each orchard on the Station is carefully measured and a record is kept of the time required to apply the water.

The table following shows the average number of hours required to apply one acre-inch of water to the several orchards in 1921, 1922 and 1923.

TABLE 11—EFFECT OF CULTURAL METHODS ON THE ABILITY OF SOIL TO ABSORB MOISTURE

Method of cultivation	Time in hours required to apply one acre inch of water		
	1921	1922	1923
	hours	hours	hours
Clean cultivation	16·2	19·1	15·4
Alfalfa sod mulch	8·0	6·1	7·0
Hairy vetch	8·9	7·1	5·6

The figures incorporated in this table show that more than twice the time was required to apply an acre-inch of irrigation water to the clean-cultivated orchard than was required to apply the same quantity of water to the orchards where cover crops were grown. While factors other than the ability of the soil

to absorb water (such for instance as the checking of the flow of water caused by the cover crop lodging in the furrows) may have contributed to this result, yet careful observation seems to justify the statement that the growing of cover crops has markedly increased the power of the soil to absorb water quickly. Furthermore, actual examination of the soil after an irrigation has disclosed the fact that the lateral spread of the water from the furrows through the soil is greater in a given time where cover crops have been grown than where the soil has been clean-cultivated. Even a superficial examination shows that clean cultivation has practically destroyed the granular structure of the soil, while the incorporation of humus, consequent upon the growing of cover crops, has greatly improved its physical condition. On a small section of the clean-cultivated orchard which is relatively steep, considerable soil washing has taken place, while in locations where there is a clay subsoil, alkali is making its appearance. No difficulty with soil washing or with alkali has been experienced in the cover-crop orchards.

As to the comparative value of alfalfa and hairy vetch as soil builders, there is apparently no very great difference. The deeper root system of the alfalfa is of advantage in breaking up a heavy subsoil, and it is also probable that this crop brings up plant food from a greater depth than does vetch. No essential difference has been noted in the texture or fertility of the soil in the two orchards at the Station.

From these observations it is evident that, under the conditions which exist at this Station, the practice of continuous clean cultivation is having an injurious effect on the physical condition of the soil. The growing of cover-crops, on the other hand is resulting in an improvement in the power of the soil to absorb and retain moisture. With regard to soil fertility, the small size and light colour of the foliage on the trees grown under clean cultivation suggests depletion of the nitrogen supply, while the luxuriant foliage found on the trees in the cover-crop orchards indicates an abundance of this essential element.

EFFECT OF CULTURAL METHODS ON AMOUNT OF IRRIGATION WATER REQUIRED

The irrigation water applied to each orchard is carefully measured through a Miners' Inch Box. Since there has seldom been more water available than was necessary, only just enough water has been applied to keep the trees in good growing condition. The amount of water applied in 1921, 1922 and 1923 and the average for the three years is shown in table 12.

TABLE 12—EFFECT OF CULTURAL METHODS ON AMOUNT OF IRRIGATION WATER REQUIRED

Method of cultivation	Amount of water applied in acre inches			
	1921	1922	1923	Average for three years
	inches	inches	inches	inches
Clean cultivation	6·3	7·0	5·6	6·3
Alfalfa sod mulch	31·7	30·4	27·4	29·8
Hairy vetch	21·2	24·8	25·8	23·9

A study of the information tabulated in this table makes it clear that the growing of permanent cover crops entails the use of a great deal more water than is necessary where clean cultivation is practised. This demand of the cover crops for extra water is, to a certain extent, compensated by the fact that they increase the moisture-holding capacity of the soil and also hold the snow which blows or washes off clean-cultivated areas. In this way more of the

natural precipitation is utilized in a cover-crop orchard than is the case where clean cultivation is practised. Furthermore, as has been shown in table 11, the growing of cover-crops makes it possible to apply double the quantity of water in a given time. These factors probably explain the contention of some growers that they can grow cover crops without using more irrigation water than in practising clean-cultivation. The results secured at this Station indicate that where due attention is paid to the prevention of run-off, where water is applied only when necessary and in the proper amounts to prevent unnecessary loss through percolation, and where cultivation is practised after every irrigation, it is possible to maintain trees in good growing condition under clean-cultivation with considerably less water than is required where cover crops are grown. The fact that the cover crops transpire an enormous quantity of water makes such a condition inevitable. Nevertheless, reference to table 12 will reveal the fact that it has not been necessary to apply an excessive amount of water to the cover crop orchards. Even with the alfalfa, which has made the heaviest demands on the moisture supply, the average amount applied has been less than two and a half acre-feet per season. The average annual application found necessary with the permanent vetch cover crop has been about two acre-feet.

From this discussion it is apparent that although cover crops entail the use of more water than is necessary under a system of clean cultivation, yet they can be grown without the use of more water than is supplied by most irrigation systems in this province.

EFFECT OF CULTURAL METHODS ON COST OF OPERATION

A record has been kept of the various cultural operations performed on each of the orchards. Since the cost of the routine operations of thinning, pruning, spraying, irrigating, etc., does not vary greatly in the several orchards, the cost of the actual cultural operations only is embodied in table 13. In this table the number of hours of team labour expended on each orchard during 1923 are set forth. The labour used in 1921 and 1922 was essentially the same as in 1923.

TABLE 13—EFFECT OF CULTURAL METHODS ON COST OF OPERATION

Method of cultivation	Team labour required in hours per acre					Cost per acre at 80 cents per hour
	Cultivation	Harrowing	Disking	Furrowing	Total	
	hours	hours	hours	hours	hours	$ cts.
Clean cultivation	18	9	.....	4	31	24 80
Alfalfa sod mulch	.....	.....	8	1	9	7 20
Hairy vetch	.....	.....	6	2	8	6 40

Examination of the figures presented in table 13, shows the excessive cost of operation involved where clean cultivation was practised. This orchard was cultivated and harrowed both ways six times during the year. This frequency of cultivation was found necessary to the maintenance of an efficient soil mulch. In the alfalfa orchard, a thorough disking was given in the spring, the ground being gone over twice each way. In the autumn the disc was run over the alfalfa again to knock it down in order to facilitate picking. This practice of flattening the alfalfa down in August also reduces the danger of fire and encourages the rotting of the cover crop during the winter. The heavy disking in the spring, while not essential under all conditions, helps to incorporate the rotting vegetable matter with the soil, thickens up the stand of alfalfa, and kills many weeds.

The vetch was disked thoroughly in August after it was sufficiently mature to ensure reseeding. Disking at this time makes picking easy and allows the new seeding to become well established before winter sets in. It was found necessary to plough out new furrows in the spring. The disking of the vetch has been dispensed with by some growers, but it is doubtful whether the omission of this procedure will meet with the best results over a period of years. Where the trees are closely planted and a heavy crop makes disking in August impossible, the crop can be successfully reseeded by disking as early as possible the following spring.

The relative cost of operation is a variable factor due to the many possible modifications of each method of cultivation. Where clean cultivation is practised faithfully and systematically, however, it is likely to result in a considerably higher labour cost than is the case where cover crops are grown. With either alfalfa or vetch the cost of operation can be reduced to a very low figure.

EFFECT OF CULTURAL METHODS ON THE PREVALENCE OF ORCHARD PESTS

Notes have been made every year with regard to the prevalence of insect pests and fungus diseases in the cultural orchards. Neither insects nor fungus diseases have been observed to be more serious under any one system of cultivation. The recommended sprays for Blister Mite, Powdery Mildew, Aphids and Codling Moth have been applied systematically with the result that none of these pests have caused any serious injury in any of the orchards.

Mice have become quite a menace in the alfalfa cover-crop orchard. As yet, no trees have been lost through girdling. This is probably due largely to the fact that a clear space three feet in all directions from the trunk of each tree has been maintained at all times. The number of mice has also been reduced to some extent by poisoning with strychnine. Nevertheless, there is a very real danger, in cover-crop orchards, from mice and other rodents, such as moles and gophers. In a number of orchards in the Okanagan Valley trees in full bearing have been completely girdled by mice. In other orchards the work of moles and gophers has rendered the uniform distribution of irrigation water practically impossible. Rodents are seldom troublesome in clean-cultivated orchards. Where a hairy vetch cover crop is grown their destruction by trapping or poisoning will be facilitated by repeated disking of the cover crop over a period of a month or two. In the case of a serious infestation, it may be advisable to disc the vetch early in June, keep clean-cultivated until the middle of August and then reseed. This procedure has the added merit of reducing the amount of irrigation water required during the hot, dry months of June, July and August. Under the alfalfa sod-mulch system the control of rodents is more difficult, and in some cases has necessitated the ploughing up of the cover crop. This practice is not desirable because of the injury it usually does to the root system of the trees. Alfalfa, unlike hairy vetch, is not killed out by frequent disking. On the other hand, it throws up a new succulent growth which makes a heavy demand on the moisture supply.

These observations suggest that, so long as the trees are maintained in a healthy condition and the recognized control measures for the common insect pests and fungus diseases are applied, the method of cultivation does not seriously influence the prevalence of these orchard pests. Rodents, on the other hand, are often quite troublesome where cover crops are grown. With hairy vetch a slight modification of the method of cultivation effects relief, but with alfalfa they are a real menace.

SUMMARY

The advantages and disadvantages of the three methods of orchard culture discussed in the preceding paragraphs may be briefly summarized as follows:—

Clean Cultivation

Advantages:—

1. Encouraged early fruiting.
2. Required minimum amount of irrigation water.
3. Ensured freedom from rodent injury.

Disadvantages:—

1. Produced lower yield than vetch cover-cropping.
2. Promoted less growth and vigour than cover-cropping.
3. Injured the physical condition and reduced the fertility of the soil.
4. Resulted in a high cost of operation.

Alfalfa Sod Mulch

Advantages:—

1. Promoted increased yields after first few years.
2. Stimulated growth and vigour after first few years.
3. Improved physical condition of the soil and increased the supply of humus and nitrogen.
4. Resulted in low cost of operation.

Disadvantages:—

1. Was associated with low yield for first few years.
2. Checked growth of trees for first few years.
3. Necessitated use of relatively large amounts of irrigation water.
4. Was conducive to the increase of rodent pests.

Hairy Vetch Cover Crop

Advantages:—

1. Produced largest yield of fruit.
2. Induced strong growth and vigour in trees from the start.
3. Improved texture of the soil and resulted in an increase in the supply of humus and nitrogen.
4. Required less water than alfalfa.
5. Resulted in low cost of operation.
6. Adapted to control of rodents.

Disadvantages:—

1. Used more water than clean cultivation.

RECOMMENDATIONS

While it is impossible to make definite recommendations from the results of an experiment which has been conducted for so short a time, it seems advisable and justifiable to offer a few suggestions which may possibly be helpful to growers.

It is already apparent that the continuous practice of clean cultivation is likely to result in an impoverished condition of the soil, and consequently in reduced vigour and lower yield. However, the fact that clean cultivation reduces the amount of necessary water and ensures freedom from rodent injury suggests that this method of culture may sometimes be practised for a year or two with beneficial results. This would most certainly be the case in the event of a serious water shortage. Where insufficient water is available for the growing of cover-crops, or where rodents have become very plentiful, the additional cost of operation associated with clean culture may be justified for one or two years.

The temporary set-back which trees so often receive when the alfalfa sod mulch system is first started may to a large extent be overcome by taking care to see that the soil is never allowed to dry out during the year or two that it takes the alfalfa to become fully established. For the first two years the alfalfa roots are feeding at about the same level as the tree roots, and in the event of a water shortage the trees are sure to suffer. For the same reason it is important to have the soil in good condition for absorbing and retaining moisture. It is difficult to get soil which is in poor physical condition to take up enough water to supply both the trees and the alfalfa. Where the subsoil is relatively impervious, alfalfa will eventually break it up and improve its moisture-holding capacity to a greater extent than will hairy vetch.

Of the three methods discussed the hairy vetch cover-crop system is by far the most adaptable, and the safest. It is comparatively easy to establish. The seed, being relatively large, does not require as finely prepared a seed bed as does alfalfa. Sowing at thirty pounds to the acre with a drill usually results in an excellent stand, provided there is a fair amount of moisture in the soil. The hairy vetch cover crop is easy to maintain. Disking in August after the seed is ripe has never failed to ensure a good catch at this Station. When occasion arises, hairy vetch is comparatively easy to destroy. Frequent disking will reduce the soil to a state of clean cultivation. This fact is of great importance in the control of weeds and rodents, and in the conservation of moisture in a dry year. Cover-cropping with hairy vetch can be modified to suit almost any condition found in the irrigated fruit sections of this province. Where water is scarce, the vetch can be sown in August and disked under the following June, before the dry months of summer set in. When there is not sufficient moisture in the autumn it may be sown first thing in the spring. When sown at this Station in March, a good supply of humus is ready to turn under by July 1. When there is a heavy load of fruit on the trees and it is impossible to disc the vetch in August, it may be left and reseeded by disking at the earliest opportunity the next spring. Seeding of hairy vetch in May, June or July is to be avoided as seeding at that time results in a heavy demand on the moisture supply during the hottest months of the year. Furthermore, hairy vetch sown in the early summer seldom ripens seed the same year, and is frequently killed out the following winter, so that reseeding by disking cannot be effected.

All in all hairy vetch seems to be particularly well adapted for use as a cover crop in the irrigated orchard sections of this province. It can be made to produce practically the same beneficial results as the alfalfa sod mulch system and is attended with less danger of causing injury to the trees.

APPLE—VARIETY TESTS

The cultural apple orchards at this Station were laid out so as to serve as a variety test of ten of the most important commercial apples which are grown in the Dry Belt of British Columbia. In addition to these plantings, two trees each of a large number of varieties of lesser commercial importance, and two trees each of a number of seedling and cross-bred apples originated at Ottawa were planted in 1916. These plantings already exceed five acres and are being added to as new and promising varieties are developed. The object of this work is to secure information regarding the yielding ability, quality, hardiness and disease resistance of these varieties when grown under Okanagan conditions.

The yields produced during the last three years by the trees in the cultural orchards are shown in table 14. A hundred and twenty trees of each variety are included in the experiment, the yields have been calculated on the basis of fifty trees to the acre.

TABLE 14—VARIETY APPLE YIELDS—1921-1923

Average Yield in Boxes per Acre (50 trees, planted 1916)

Variety	1921	1922	1923	Average for three years
	boxes	boxes	boxes	boxes
McIntosh	73·8	146·0	179·1	133·0
Jonathan	55·2	83·5	228·6	122·4
Wagener	81·7	16·5	193·4	97·2
Duchess	64·0	66·2	154·0	94·7
Grimes Golden	18·6	80·1	237·1	78·6
Rome Beauty	23·1	59·9	135·0	72·7
Yellow Transparent	69·5	30·5	105·6	68·5
Cox's Orange	25·1	64·4	84·0	57·5
Yellow Newtown	17·6	14·6	73·0	35·1
Delicious	4·7	5·2	72·1	27·3

It will be noted that the average yields per acre of all varieties are relatively low. This is largely accounted for by the fact that the trees of most varieties carried their first real crop in 1923. McIntosh and Jonathan have given the largest crops to date, while Newtown and Delicious have, as yet, given only a very small yield. Wagener gave a good crop in 1921 and 1923, but carried only a few fruits in 1922. From indications in the spring of 1924, the year will see another light crop in this variety, which is a notorious biennial bearer.

The filler varieties, Jonathan, Wagener, Yellow Transparent, Cox Orange, and Duchess, have not, as a whole, produced enough fruit to date to justify their existence. These trees are already crowding the standards, so that it has been decided to remove most of them without further delay.

The varieties of apples which it appears advisable to use in new plantings in the Okanagan Valley are:—

Districts North of and including Kelowna.—McIntosh, Delicious, Rome Beauty.

Districts South of Kelowna.—Delicious, Rome Beauty, Stayman, and Winesap in favoured sections.

The MELBA, a McIntosh seedling originated at the Central Experimental Farm, is worthy of extensive trial in the Okanagan Valley. This apple is much like the McIntosh in tree characteristics, making a sturdy well-balanced framework. The fruit is spaced uniformly over the tree. In season, the apple is a few days later than the Yellow Transparent and keeps as long as the Duchess. The quality is far superior to these varieties, both from a desert and a culinary standpoint. The fruit is attractive in appearance, the colour being pale yellow washed and splashed with bright carmine. A limited quantity of scion wood of this variety can be obtained from this Station during the dormant season.

In sections of the Okanagan Valley north of Penticton, difficulty is experienced in getting the WINESAP to produce large fruit. Some work has already been done at this Station in an attempt to increase the size of the fruit through manuring and enriching the soil with chemical fertilizers. It is planned to continue this work in 1924, and to set out an additional acre of Winesaps in order to make it possible to try out the effect of various systems of pruning and thinning on the size of the fruit. Winesaps are being grown successfully at Penticton and can be recommended for the Osoyoos district.

A sufficient number of trees of the RANIER apple have been ordered for 1924 planting to give this variety a thorough test under Okanagan conditions. While this apple is being greatly advertised its future cannot be predicted, and careful trials are necessary to determine its possible commercial value.

APPLE THINNING EXPERIMENT

The thinning experiment begun in 1921 was continued in 1923. The object of this experiment is to obtain information regarding the effect of various degrees of thinning on the yield and grade of fruit produced, and on the bearing habit of the tree. A hundred and twenty trees of each of ten of the most important commercial apples grown in the Dry Belt of British Columbia are included in this experiment. The trees were set out in 1916 and consequently most varieties are not yet in full bearing.

Thirty-six trees of each of the varieties in the cultural apple orchards are thinned heavily, thirty-six moderately, and thirty-six lightly, and twelve are left unthinned.

Heavy thinning consists of the removal of all but one apple to a spur, and the spacing of the remaining apples one to every eight or ten inches of bearing surface over the tree.

Moderate thinning involves the removal of all but one apple to a spur and spacing of the fruit one to approximately every six inches of bearing wood.

In *light thinning* not more than two apples are permitted to remain on a spur and the fruit is spaced one to about every four inches of bearing wood.

In 1923 the fruit from every tree was harvested separately and graded into Extra Fancy, Fancy, C Grade and Culls. Only six varieties produced sufficient fruit in 1923 to give the various systems of thinning a fair test. The results secured with these varieties are shown in table 14.

TABLE 14—APPLE THINNING EXPERIMENT, 1923

Variety	Grade	Average yield in pounds per tree			
		Heavy	Medium	Light	Check
McIntosh	Fancy and extra fancy	72·1	54·5	85·4	146·1
	C. grade	28·8	27·6	85·4	38·6
	Culls	13·1	11·9	23·0	74·0
	Total	114·0	94·0	149·0	258·7
Jonathan	Fancy and extra fancy	147·1	142·8	174·2	191·1
	C. grade	3·7	7·0	8·5	9·5
	Culls	4·8	5·3	7·7	19·5
	Total	155·6	155·1	190·4	220·1
Rome Beauty	Fancy and extra fancy	87·7	69·9	76·1	94·0
	C. grade	8·0	7·2	7·5	11·6
	Culls	9·3	7·4	8·5	8·1
	Total	105·0	84·5	92·1	113·7
Grimes Golden	Fancy and extra fancy	150·6	119·9	143·9	277·1
	C. grade	4·1	3·5	3·9	12·1
	Culls	20·3	18·2	25·5	30·5
	Total	175·0	141·6	173·3	319·7
Duchess	Fancy and extra fancy	35·0	36·2	47·2	45·5
	C. grade	73·0	62·4	75·1	60·5
	Culls	12·1	12·2	16·9	53·8
	Total	120·1	110·8	139·2	159·8
Wagner	Fancy and extra fancy	85·2	104·5	132·4	133·6
	C. grade	8·3	12·3	22·1	38·3
	Culls	18·9	17·2	14·7	27·3
	Total	112·4	134·0	169·2	204·2
Average of 6 varieties	Fancy and extra fancy	96·2	87·9	109·8	132·0
	C. grade	20·9	20·0	26·2	28·4
	Culls	13·0	12·0	16·0	35·5
	Total	130·1	119·9	152·0	195·9

These results may be summarized as follows:

Heavy and *Moderate thinning* reduced the amount of cull and C grade fruit, but also reduced the yield of Extra Fancy and Fancy grades.

Light thinning resulted in the production of a relatively large amount of Extra Fancy and Fancy, without materially increasing the amount of cull or C grade fruit.

Unthinned trees produced the largest quantity of marketable fruit, but the percentage of culls and C grade was relatively high.

In interpreting these results it should be borne in mind that the trees in this experiment are still young, are making vigorous growth, and are exceptionally well provided with healthy foliage. While light thinning may be expected to give good results on young trees which are carrying an abundant supply of healthy foliage it is altogether probable that after trees come into full bearing, more severe thinning will be found of advantage.

Up to the present time no marked influence of thinning on the bearing habit of the tree has been noted. Wageners have developed the biennial bearing habit regardless of the degree of thinning practised. It appears that with this variety at least heavy thinning alone cannot be expected to induce annual bearing. It seems probable that with other varieties as well thinning must be accompanied by such factors as uniform conditions of the soil moisture and an adequate supply of humus and nitrogen in the soil in order to promote regular bearing.

APPLE PRUNING EXPERIMENT

Pruning experiments have been conducted on all the trees in the cultural apple orchards. One-third of the trees of each filler variety have been pruned lightly, one-third very lightly, and one-third practically not at all. One-third of the standard trees have been pruned central leader type, one-third modified leader, and one-third open centre. The object of these experiments is to obtain information as to the effect which various degrees and methods of pruning have on the time when trees come into bearing, the size and vigour of the trees, and the yield and grade of fruit produced. Unfortunately the location of the trees with reference to the source of irrigation water makes accurate comparison of the various types of pruning impossible. The trees nearest the source of water are, in most cases, larger than those at the far end of the irrigation run. Since this increase is undoubtedly due, at least in part, to a difference in moisture supply, a presentation of the figures showing the growth and yield secured would be likely to be misleading.

General observations indicate that the heavier the trees were pruned the slower they were to come into bearing. This suggests that where early fruiting is desired, as with filler trees, pruning should be on the light side.

With regard to the methods of pruning tested out on the standard trees, it has been found possible to develop strong, well-built trees of each of the types, central leader, modified leader and open centre. The central leader trees are, however, tending to get out of reach even at this early date. This is especially true of such strong-growing varieties as the Delicious. The open centre trees are developing into smaller trees than the other types. The modified leader type appears to be the most desirable. With this type it will usually be found more satisfactory to guide the tree rather than to attempt to force it into assuming any stereotyped shape.

APPLE, DATES OF PICKING EXPERIMENT

The quantity of apples which arrive on the market in an immature or over-ripe state is ample proof that there is need for more information on the correct time to pick apples so that they may reach the consumer in perfect condition.

The exact calendar date when apples are ready to harvest varies from year to year according to seasonal conditions. Furthermore, there are other factors such as the nature of the soil, the method of orchard culture, the age and condition of the tree, all influencing the maturity of the fruit. Even on the same tree all the apples do not ripen at the same time. It is manifestly impossible, therefore, to set a calendar date as the proper time to pick any particular variety. Nevertheless, it is considered that by carrying on a picking-date experiment over a number of years it should be possible to determine approximately the date at which picking may safely be started, and the length of time over which it is desirable to extend the harvesting of each variety. Furthermore, it is possible that by making careful notes at picking time a simple test may be devised whereby the grower can determine whether or not his fruit is ready to harvest.

In order to secure reliable information in this connection an experiment in dates of picking has been carried on at this Station for the past four years.

In 1923 three peach boxes of each variety of apples in the cultural apple orchards were harvested every three days throughout the picking season. The pickings were made from the same trees each time. These apples were stored in the basement of the Horticultural Building, where the temperature ranged from 30° to 60° F. and the relative humidity from 75 to 85 per cent. Notes were made of the seed colour and the ground or undercolour of the fruit at picking time. Ten apples on each of the trees in the experiment were labelled with tinfoil tags, and at each picking these apples were measured with calipers, and a note made of the percentage of the surface of the fruit which was coloured. In this way it was possible to secure accurate data regarding the increase in size and colour which took place, and also to estimate the percentage of the crop blown off by wind.

The apples were examined several times during the winter, and notes made as to the amount of shrivelling, scald, Jonathan spot, bitter pit, and breakdown. A record was also kept of the flavour, firmness, and percentage of marketable fruit. It is impossible to include the complete tables of results in this brief report. The following paragraphs give a general idea of the results secured to date.

Pickings of *Wealthy* were made on September 1st, 6th, 10th, 13th, 17th, 21st, 24th and 28th. During that time the colour increased from an average of 25 to an average of 63 per cent. The average diameter of the fruit increased from 3.21 inches to 3.39 inches. Over 50 per cent of the crop had fallen from the trees by September 28th. Apples picked before September 10th shrivelled badly and were poor in flavour. Ten per cent of the crop had blown off by September 17th. By that date the undercolour had changed from green to light yellow and the seeds were light brown in colour.

Cox Orange were picked every three days from September 1st to 28th. The average colour on September 1st was 23 per cent and on September 28th, 59 per cent. The average diameter increased from 2.7 inches on September 1st to 2.8 inches on September 28th. Over 20 per cent of the crop had fallen by September 28th. Apples picked previous to September 13th showed excessive shrivelling by December 3rd. Fruits picked after the middle of September developed a better flavour and remained firmer in storage than did those picked earlier. Bitter pit was excessive on the fruit from two of the trees, but did not appear to be influenced by date of picking. The undercolour commenced to change from green to light yellow about September 10th. Seeds changed from light to dark brown about September 15th.

McIntosh Red were harvested every three days from September 1 to September 28. During that time the average colour increased from 27 per cent to 68 per cent, and the average diameter from 2.9 inches to 3.05 inches. Over 20 per cent of the fruit was blown off by September 28. Excessive shrivelling had occurred by December 3 on apples picked before September 10. Fruit picked after September 15 developed better flavour and held up longer in storage than did fruit harvested earlier. Practically all the fruit picked between September 15 and 28 was still marketable on January 9. On most trees the under colour had changed to light yellow by September 17. Seeds were partly white on most trees until September 13.

Jonathan were picked twice a week from September 17 to November 1. The colour increased in that time from 38 per cent to 84 per cent, and the average diameter from 2.81 inches to 2.98 inches. By November 1 approximately 20 per cent of the fruit had fallen. Apples picked previous to October 4 failed to develop a good flavour and shrivelled excessively by April 1. Practically all apples picked after October 8 were marketable on April 1. Most

apples picked after October 20 were badly water-cored. Under colour was observed to be changing from green to yellow on most apples by October 4. Seed colour changed from light to dark brown about the same time.

Grimes Golden were picked from September 17 to October 25. During that time an increase in diameter from 2·18 inches to 3·12 inches was recorded. By October 15 over 30 per cent of the fruit had fallen. Excessive shrivelling occurred by January 8 on a large number of the apples picked previous to October 1. The flavour of these early-picked fruits was poor and they soon went soft in storage. A good percentage of the apples picked between October 1 and October 20 were still marketable on April 7. Under colour was observed to be changing to light yellow the first week in October, and seed colour remained light brown until about October 10.

Wagener were gathered twice a week from October 1 to November 8. During that time they made an average increase in colour of 42 per cent and an average increase in diameter of 0.16 inches. There were practically no windfalls. By January 9 slight shrivelling and some scald had occurred on a large number of the apples picked previous to October 8. By April 4 most of the fruit picked before October 15 showed excessive scald. A high percentage of the fruit picked after October 20 was still in good marketable condition on April 4. These apples were firmer and of better flavour than apples picked at an earlier date. Many of the apples picked after October 25 were badly water-cored. The under colour changed to light yellow in most cases between October 10 and 15, and the seeds turned from light to dark brown about October 20.

Rome Beauty were harvested twice a week from October 1 to November 8. During that time they took on an increase in colour of about 28 per cent and made an average increase in diameter of 0.19 inches. About 5 per cent of the crop had fallen by November 8. By April 4 a number of the apples picked prior to October 15 showed some scald and shrivelling. Practically all the apples harvested after October 15 were still marketable on April 4. The under colour was observed to change to light yellow between the 15th and 20th of October. The seeds changed from light to dark brown between October 20 and 25.

Yellow Newton were picked twice a week from October 1 to November 8. During that time they increased in diameter about 0.12 inches. About 7 per cent of the apples had fallen by November 8. By April 4 slight shrivelling was apparent in a number of the apples harvested before October 15. Apples picked after that date developed better flavour and remained firmer in storage than did those harvested earlier. Practically all the apples, regardless of date of picking were still in marketable condition on April 4. Under colour commenced to change to light yellow about October 15. Seeds turned from light to dark brown about October 10.

SUMMARY OF RESULTS

These results may be summarized as follows, under the conditions of this experiment:

1. Apples of all varieties continued to increase in size until they fell from the trees, or in the case of the winter varieties as late as November 8.

2. Apples continued to take on more colour until quite late in the season for the variety.

3. Only a small percentage of most varieties fell or were blown from the trees before the fruit was sufficiently mature to insure good colour, size and quality for the variety.

4. Apples kept best when picked between the following dates:—

Wealthy.—September 10 to 24.

Cox Orange.—September 15 to 28.

McIntosh Red.—September 15 to 28.

Jonathan.—October 1 to November 1.

Delicious.—October 4 to November 1.

Grimes Golden.—October 1 to October 20.

Wagener.—October 15 to November 8.

Rome Beauty.—October 15 to November 8.

Yellow Newtown.—October 15 to November 8.

5. The most reliable indication of the time when apples are ready to pick was found to be the under colour or ground colour of the fruit. When the under colour changed to a light yellow most varieties were ready to harvest.

6. The colour of the seeds at the time when apples were ready to pick ranged from partly white in the case of McIntosh Red to dark brown in the case of Yellow Newtown.

RECOMMENDATIONS

While these results show that apples increased in size and colour until quite late in the season, it is not to be inferred that it is advisable to leave the apples on the trees as late as possible. On the contrary it will frequently be found good practice to pick the fruit as soon as it is sufficiently mature to ensure good keeping quality. In determining the time to pick his apples the grower should bear in mind that early varieties such as Wealthy must be sold before the later varieties come on the market, that varieties such as McIntosh and Grimes Golden are easily blown off after they are mature enough to pick, and that the winter varieties may be injured by frost if left too long on the trees.

In interpreting the results of this experiment and attempting to apply them to the solution of his own picking problems, the grower should give due weight to the fact that the trees from which these apples were picked are young and vigorous. It is altogether probable that the fruit matured considerably later than it would do on older trees or on trees of less robust constitution. Consequently the dates given in the summary of results cannot be taken as applying directly to conditions other than those under which this experiment has been conducted. They do, however, form a rough guide which the grower can modify to suit his own conditions.

It is hoped that the changes in under colour will be found to provide a reliable indication of the state of maturity of the fruit, and that growers will find this simple test a practical method of determining the proper time to pick their fruit. Any grower interested in this question will be welcomed at this Station during the picking season, and given a practical demonstration of the stage of maturity at which apples should be picked.

APPLE STORAGE EXPERIMENTS

It seems certain that the relatively brief harvest season, and the perennial shortage of refrigerator cars will always necessitate the holding of a considerable portion of the apple crop of this province in local storage houses for a period varying from a few weeks to a few months. While cold-storage houses would undoubtedly be the most efficient means of holding this fruit, the expense of construction is almost prohibitive. It seems possible that common

or air-cooled storage may be made to serve the purpose. In order to secure reliable information as to the efficiency of common storage as a means of prolonging the period of usability of our apples a number of experiments are being carried on at this Station.

The equipment used is relatively simple, the storage space consisting of four concrete cellars each with a separate ventilation system. These cellars constitute the basement of the packing house and are almost entirely below ground. The ceilings are insulated, but there is no insulation of walls or floors. While these cellars are so simple in construction that any grower could duplicate them, yet they are particularly well adapted to the work in hand. It is considered that the efficiency of common storage depends primarily on insulation and ventilation. These cellars are designed to test out the importance of these factors as a means of prolonging the life of apples grown and stored under British Columbia Dry-Belt conditions. The object of the work is to find the cheapest and most satisfactory means of delaying the maturity of our apples during the time that they are unavoidably retained in the regions of production. While it is recognized that temperature is the main factor which influences the efficiency of common storage, other factors such as humidity or moisture content of the air, the maturity of the fruit at picking time, the effect of delayed storage, the type of package in which the fruit is stored, and the cultural conditions under which it has been grown, have all been taken into account in planning the investigations. While it is impossible, in this report, to present the plan of each experiment in detail or to discuss fully the results secured to date an attempt will be made to outline a few of the more important lines of investigation, and to stress a few of the results which it is hoped may prove of special interest to growers at this time.

VENTILATION VS. NO VENTILATION

The object of this experiment is to secure reliable data as to the influence of ventilation on the storage life of apples.

In one of the storage cellars in the basement of the packing house the ventilators were kept tightly closed throughout the entire storage season. In another of the cellars they were opened at night and closed during the daytime every day until the outside temperature became so low that there was danger of freezing. The ventilators were then opened for a time during the day and closed at night. In each of these cellars maximum and minimum thermometers were placed, and the readings were taken every day. A daily record was also kept of the relative humidity or amount of moisture in the air. In each of these cellars five orchard boxes of each of the varieties in the cultural orchards were stored. The apples were stored unwrapped. Care was taken that in each case apples of the same quality, picked from the same tree on the same date were stored in each cellar. These apples were examined at intervals during the winter and notes were made of the percentage of fruit which was marketable and rotten; the amount of shrivelling, scald and Jonathan spot; the firmness of the fruit; and the development of flavour. A record was also kept of the loss in weight under the two conditions of storage.

The results may be briefly summarized as follows:—

1. The mean temperature was an average of 2° F. lower in the ventilated than in the non-ventilated cellar. The average mean temperature of the ventilated cellar from August 5, 1923, to March 31, 1924, was 50° F., ranging from 63° F. in August to 30° in January.

2. The relative humidity in the ventilated cellar averaged 80 per cent and in the non-ventilated cellar 88 per cent.

3. The apples remained in prime condition from two to four weeks longer in the ventilated cellar.

4. There was more loss through fungus rots in the non-ventilated cellar.

5. Shrivelling was more pronounced in the ventilated cellar.

6. Scald was quite serious on Grimes Golden, Wagener and Yellow Newtown in the non-ventilated cellar, but had not developed to any extent by March 31st in the ventilated storage. Jonathan spot was not apparently influenced by ventilation, as it occurred to about the same extent in both cellars.

7. The flavour was quite noticeably superior in the ventilated fruit.

8. The loss in weight through evaporation was more rapid in the ventilated cellar.

CONCLUSIONS.—While it would be premature to draw any definite conclusions from one season's work, the results to date suggest the following general statements.

1. In a cellar where the walls and floor are not insulated it is very difficult to lower the temperature of the air within the cellar below that of the surrounding soil or air outside the cellar walls even though ventilators are opened only during the night or cooler portions of the day. So long as the cellar is below ground level and the ceiling, doors, etc., are properly insulated there is little danger of freezing the fruit even though zero temperatures are experienced outside. Provision should be made, however, for heating the cellar in an emergency.

2. In a closed, unventilated cellar the relative humidity tends to remain higher than is generally considered desirable for the storage of apples. This high humidity favours the growth of fungus rots, but decreases the tendency of immature fruit to shrivel. The relative humidity may be kept up to 80 per cent in a ventilated cellar by sprinkling water on the floor. With this much moisture in the air there is little danger that appreciable shrivelling will occur in fruit which is picked at the proper stage of maturity.

3. Ventilation reduces the tendency of apples to develop storage scald.

4. The storage life of apples may be prolonged for a period of from two to four weeks by thorough and systematic ventilation of the storage cellar.

IMMEDIATE VS. DELAYED STORAGE

The object of this experiment is to secure information as to the effect of holding apples for a time in the orchard or in the packing house before placing in storage.

Four boxes of apples were picked on October 7 from each of six trees of Jonathan and six trees of Grimes Golden. One box from each tree was placed immediately in a ventilated cellar, one in a non-ventilated cellar, one on the main floor of the packing house, and one left out in the orchard. The boxes left on the packing floor and in the orchard were removed to the cellars on November 15. The apples left in the orchard were protected from the direct rays of the sun and placed so that there was a free circulation of air on all sides of the boxes. A daily record was kept of the temperature and humidity in each storage location.

The apples were examined twice during the winter, and careful notes were made of their condition. A brief summary of the results follows:

1. The average mean daily temperature in the several storage locations from October 15 to November 15 was:

Ventilated cellar	46·4° F.
Non-ventilated cellar	48·9° F.
Orchard	44·2° F.
Packing floor	47·4° F.

2. The average relative humidity from October 15 to November 15 in the several locations was found to be:

Ventilated cellar	83·4%
Non-ventilated cellar	91·7%
Orchard	77·7%
Packing floor	78·8%

3. Practically all apples, no matter where stored, were still in good marketable condition on January 10th.

4. By April 10 Jonathan spot had developed to a considerable extent on that variety, but no correlation was observed to exist between the number of apples affected and the method of storage.

5. When examined on April 10 no appreciable difference in flavour or firmness was evident between apples stored at once in a ventilated cellar, and apples left in the orchard or on the packing floor, for a month before storing.

6. Shrivelling had occurred by April 10 on a number of those apples which had been delayed for a month in the orchard or on the packing floor.

7. Flavour was noticeably poorer in the fruit stored at once in the non-ventilated cellar.

8. Scald developed to a much greater extent in the Grimes Golden which were stored immediately in the non-ventilated cellar. Up to that date no scald had appeared on the Jonathans.

RECOMMENDATIONS.—In interpreting these results the grower should bear in mind that this experiment has been conducted for only one season. As has been stated the mean temperature between October 15 and November 15, 1923, was lower in the orchard than it was in either the closed or ventilated cellar. This was probably due to the fact that the temperature of the cellars was kept up by absorption of heat from the soil which surrounds their walls. The low humidity of the air in the orchard and on the packing floor as compared with that in the cellars would explain the tendency of the delayed storage fruit to shrivel. In the case of water-cored fruit this loss of moisture would undoubtedly improve the keeping quality of the fruit, but where fruit is picked before reaching proper maturity it would be a disadvantage. The fruit used in this experiment might, with advantage, have been left on the trees another week. It should not be inferred from the results of this experiment that fruit can be left out in the orchard with impunity. Due regard must be had to possibility of loss through freezing if the apples are left too long in the orchard. Care must be taken to shelter the fruit from rain and from the direct rays of the sun. Nevertheless these results suggest that under certain conditions it may be preferable to store the fruit for a time in the orchard rather than to rush it into crowded and badly-ventilated packing houses, where conditions would be much similar to the non-ventilated cellar used in this experiment.

INFLUENCE OF CULTURAL METHODS ON KEEPING QUALITY

This experiment was undertaken to secure information regarding the effect which cultural conditions exert on the keeping quality of apples.

Five boxes of each of the fall and winter varieties of apples from each of the cultural apple orchards were picked at the height of the picking season for each variety. Each box was picked from a separate tree and a record kept of the tree number, date of harvest, and the condition of the fruit at picking

time. The apples were wrapped, packed and nailed up as for shipment. They were then stored in a ventilated cellar, until the time when each particular variety was on sale at fruit stalls. The boxes were then opened and the fruit carefully examined. Detailed notes were made of the condition of the fruit, and of the number and grade of apples in each box.

The results recorded are too extensive to be presented in tabular form in this report. Much interesting information was brought to light, but in the main the results seemed to show that there was just as much difference in the keeping quality of fruit from individual trees grown under the same cultural conditions as there was between fruit from trees grown under the various cultural methods practised on this Station. Throughout the whole of the storage experiments carried on at this Station, there has been found to be a remarkable difference in keeping quality in fruit from individual trees, even when these trees are growing under apparently similar conditions. This fact makes it very evident that in order to secure accurate results in storage experiments it is most important to take the apples, which are to be subjected to the various tests, from the same individual tree.

While cultural methods undoubtedly have an influence on the keeping quality of fruit, this experiment has not been carried on long enough to permit of a fair comparison of the effects produced by growing apples under such systems as clean cultivation, alfalfa sod mulch and vetch cover cropping. It seems probable that there are so many other factors involved that the effects of cultural methods will always be greatly modified by other local conditions such as the nature of the soil and the distribution of irrigation water.

WRAPPED VS. LOOSE APPLES

During the last few years there has been a good deal of contention as to whether it is preferable to store apples wrapped or loose. This experiment was planned to secure reliable data on this question.

Of each of the winter varieties of apples grown in the cultural apple orchards five boxes were wrapped, packed and nailed up as for shipment. Keystone sulphite wraps were used. Five comparative boxes, picked from the same trees on the same date were stored loose in orchard boxes. These boxes of apples were placed side by side in a ventilated cellar. The apples were examined twice during the winter and careful notes made of their condition.

In general the results showed that the effect of wrapping on the storage life of the apple is dependent on the condition of the fruit when picked, on the humidity of the air in the storage room, and on the ventilation of the storage room. Under the conditions of this experiment, wrapping reduced the tendency to shrivel, but increased the tendency to scald. There was not a great deal of difference in the amount of fungus rot which occurred.

RECOMMENDATIONS.—It would be premature to attempt to make recommendations from one year's results but the work already done seems to justify the following suggestions which it is hoped may prove helpful.

1. Where fruit is immature when picked, and is of a variety subject to shrivelling it may either be wrapped to retard loss of moisture, or it may be stored loose in a cellar where the atmospheric moisture is relatively high. With varieties such as Grimes Golden and Wagener which tend to scald it seems preferable to store such immature fruit without wrapping or to use oiled wraps, of which more is said elsewhere in this report.

2. Where fruit is picked at the proper stage of maturity, good results may be expected from storing either loose or wrapped.

3. Where fruit is over-mature, or water-cored when picked, it is probably better to store loose and to provide plenty of ventilation and not too high an atmospheric moisture.

GENERAL PROCEDURE

Within recent years the possibility of using a wrap impregnated with oil has attracted much attention. The claim made for the oiled wrap is that it prevents storage scald and prolongs the life of the apple.

In order to secure first-hand information as to the effectiveness of oiled wraps experiments have been carried out at this Station for the past two years.

In 1923 two boxes of each of the winter varieties of apples grown in the cultural apple orchards were packed in oiled wraps and two comparative boxes picked from the same trees on the same date were packed in sulphite wraps. Various brands of oiled wraps were used.

These apples were examined twice during the winter. It was found that the oiled wraps did actually delay the ripening process to quite an appreciable extent. Furthermore, while they did not in all cases completely prevent the appearance of storage scald, they did reduce it to a practically negligible factor. These experiments, and many others which have been carried on elsewhere seem to indicate clearly that the oiled wrap is a commercial proposition which has come to stay. It should be found of especial value in connection with the storage of such varieties as Wagener, and Grimes Golden which are particularly subject to scald; and with such varieties as the Yellow Newtown and Winesap which are kept in storage for a relatively long time.

JONATHAN BREAKDOWN INVESTIGATION

On account of the very serious losses suffered in 1922 through breakdown of the Jonathan apple, growers became very insistent in their demand for an investigation of this problem. The matter was taken up by the Dominion Horticulturist who outlined an experiment to be conducted in co-operation with the Dominion Fruit Branch and this Station.

The object of the experiment was to secure information regarding the cause of Jonathan Breakdown and more particularly to find some means of preventing it.

From previous investigations and the statements of growers and shippers it was considered that breakdown might be associated with one or more of the following:—

1. Maturity of the fruit at picking time.
2. Size of the fruit at picking time.
3. Methods of storage and shipment.
4. Age and vigour of trees.
5. Type and fertility of soil on which the trees were growing.
6. Cultural treatment under which trees were growing.
7. Methods of pruning and thinning.
8. Irrigation practices.
9. Climatic and seasonal conditions.

Accordingly the experiment was planned in such a way as to find out the amount of breakdown which occurred when apples were:—

1. Picked when at various sizes and stages of maturity.
2. Subjected to various storage and transportation conditions.
3. Picked from trees of various ages and degrees of vigour.
4. Picked from trees growing on soils of various types and degrees of fertility.
5. Picked from trees growing under various methods of cultivation.
6. Picked from trees subjected to various degrees of pruning and thinning.
7. Picked from trees subjected to various irrigation practices and situated at various distances from the source of irrigation water.
8. Picked from trees growing in various districts.

GENERAL PROCEDURE

In 1923, apples were picked every three days for a period of six weeks, extending from September 17 to October 27. The apples were picked from orchards in Vernon, Okanagan Centre, Kelowna, and Summerland. The pickings were made from the same trees each time, and the trees were selected so as to provide a wide range of age and vigour of tree; type and fertility of soil; cultural, pruning and thinning methods; and irrigation practice. Notes were made of the state of maturity of fruit when picked.

The apples were wrapped, packed and nailed up as for shipment. Each wrapper was numbered in such a way as to designate the tree from which the apple wrapped in it was picked. Each box was numbered so as to designate the date of picking. Half of these apples were eventually sent to Ottawa, and half were sent to this Station. The results recorded at Ottawa are being published in full in the report of the Dominion Horticulturist.

PROCEDURE FOLLOWED AT SUMMERLAND

Four examinations of the fruit were made, during the first week of December, January, February and May, respectively. At each inspection cutting tests were made to determine the percentage of breakdown which had occurred in the fruit picked on each date from each tree in the experiment. Caliper measurements were made of all apples in the experiment. A note was made of the percentage of red colour on every apple in the experiment. A record was kept of the prevalance of shrivelling and of Jonathan spot in each sample. Notes were also made of the relative flavour and firmness of the fruit from the various trees and picking dates.

SUMMARY OF RESULTS RECORDED AT SUMMERLAND

It is not possible to include in this report a complete statement of the observations recorded at this Station. It is considered advisable, however, to state briefly a few of the findings which it is hoped may prove helpful to growers.

1. Practically no breakdown occurred in apples picked before October 15.
2. With each successive picking after that date the amount of breakdown increased.
3. Most of the apples picked before October 1 were poor in flavour and developed softness and shrivelling relatively quickly in storage.
4. By October 1 the undercolour on most apples had changed from green to light yellow.
5. By October 15 the undercolour of practically all apples had changed to clear yellow.
6. A high percentage of the apples which broke down were highly coloured.
7. A high percentage of the highly coloured apples did *not* break down.
8. A high percentage of the apples which broke down were large.
9. A high percentage of the large apples did *not* break down.
10. By December 1 four times as much breakdown had developed in apples stored in a non-ventilated cellar as was the case with the duplicate lots stored in a cellar which was ventilated every night.
11. By January 1 there was practically no difference in the amount of breakdown which had occurred in the ventilated and non-ventilated cellars.
12. There was practically no increase in the number of apples affected by breakdown in either cellar after January 1.
13. Some trees produced a high percentage of breakdown apples.
14. Some trees produced no breakdown apples whatever, even in the latest pickings.
15. Breakdown occurred in apples from trees of various ages from 9 to 18 years. No younger or older trees were included in the experiment.

16. There were trees of various ages from 9 to 18 years, the fruit from which failed to develop any breakdown whatever.

17. Breakdown occurred on trees with sickly foliage, trees with medium sized leaves, and trees with large robust foliage.

18. There were trees with large, trees with medium, and trees with small-sized leaves, from which fruit failed to develop any breakdown whatever.

19. There were trees of weak, fair and strong vigour each of which produced apples which broke down.

20. There were trees of various degrees of vigour from which no breakdown apples whatever were picked.

21. Breakdown occurred in apples from trees bearing various kinds of crop from light to heavy.

22. There were trees bearing various types of crop from light to heavy which produced no breakdown apples.

23. Breakdown occurred on trees which were unthinned, thinned heavily and thinned lightly.

24. There were trees on which various kinds of thinning, from none at all to heavy, were practiced, which produced no breakdown fruit whatever.

25. Breakdown occurred in the fruit from trees growing in various types of soil from heavy clay to light sand.

26. There were trees growing in various types of soil from clay to sand, from which no breakdown apples whatever were picked.

27. Breakdown occurred in apples from trees which received during the season from 2 to 8 irrigations.

28. From 2 to 8 irrigations had been supplied to each of a number of trees none of which produced any breakdown apples whatever.

29. Breakdown occurred in apples from trees situated at various distances along the irrigation run from 40 to 300 feet from the source of water.

30. There were trees situated at various distances along the irrigation run from 40 to 300 feet from the source of water, from which trees no breakdown apples were picked.

31. Breakdown occurred in trees growing under clean cultivation, alfalfa cover crop, and vetch cover crop.

32. There were trees growing under clean cultivation, vetch and alfalfa, the fruit from which did not develop any breakdown whatever.

33. Breakdown occurred in fruit from trees in each of the four districts in which picking was carried on.

34. There were trees in three of the four districts, the fruit from which did not develop any breakdown whatever.

CONCLUSIONS

In view of the somewhat contradictory and involved nature of these results it is manifestly impossible to draw definite conclusions, especially as the work has been carried on for only one season. Some attempt at interpretation of the results does, however, seem justifiable and advisable. In brief, these results suggest that a large number of factors may be involved in bringing about the condition of decay known as Jonathan Breakdown. In the light of our present knowledge it is impossible to single out any particular one of these factors as the cause of the trouble. While over-maturity of the fruit at picking time has been shown to be conducive to breakdown these results indicate that it is by no means the only factor involved. The same may be said of over-size of fruit at picking time. The development of breakdown can apparently be delayed, but not prevented by providing good storage conditions. While breakdown has not been found to be exclusively associated with any particular age or condition of vigour in the trees, it is by no means certain that these factors

do not exert some influence on the fruit tending to promote or prevent the occurrence of breakdown. The same may be said of soil, cultural methods, pruning, thinning, irrigation, and local district conditions. It appears probable that a number of these factors are involved, and that it is their combined influence associated with seasonal conditions that makes for serious losses from breakdown one year, and comparative freedom from the trouble in another.

From the growers' standpoint the most important information brought out by this experiment is the fact that breakdown can be practically prevented by picking the fruit before it reaches a certain stage of maturity. It is difficult to find a simple method of determining this condition of maturity in the orchard, but it is hoped that the changes in undercolour may be found to be a reliable guide to the correct time to pick the Jonathan, as well as other varieties of apples.

STONE FRUIT ORCHARD CULTURAL TESTS

The variety stone fruit orchard is divided into two blocks each approximately three acres in area. One of these blocks is being carried on under the alfalfa sod-mulch system, and the other is being cover cropped with hairy vetch. The relative merits of these two methods of culture have been found to be much the same with stone fruits as with apples. The vetch has been found to be much the same with stone fruit as with apples. The vetch has been found to require considerably less water than the alfalfa. It has an added advantage in that it is out of the way at picking time, while the alfalfa interferes seriously with the work of harvesting. The trees in the alfalfa orchard suffered seriously from drought and winter injury while the cover crop was better established. The vetch has given excellent results from the start. Consequently it is considered that there is sufficient justification for recommending vetch in preference to alfalfa for use as a cover crop in stone fruit orchards.

It is planned to set out an additional six acres of peaches and apricots in 1924. The object of this new planting is to secure information regarding the inter-relation of cultural methods, distance of planting, amount of water, and methods of pruning.

STONE FRUIT VARIETY TESTS

Approximately six acres are devoted to the testing of varieties of peaches, plums, apricots and cherries. The orchards have been planted in such a way as to facilitate the carrying on of experiments in thinning, pruning and cultural methods. New varieties of stone fruits which are introduced from time to time are being included in the variety tests. Several new cherries of the Lambert type, and said to extend the season of this variety, have been recently procured from California. A number of new and promising plums have been obtained from the same source, as have also several of the more popular varieties of clingstone peaches grown in California.

A number of trees planted in 1916 are now bearing good crops. A statement of the average yields produced by some of the more important varieties during the past three years follows.

PEACH VARIETY TEST.—Twelve trees each of six varieties of peaches were planted in 1916. The average yield produced by these trees during 1921, 1922 and 1923 is indicated in Table 15.

TABLE 15—PEACHES—AVERAGE YIELDS, 1921-1923

Variety	Number of trees	Average yield in pounds per tree			
		1921	1922	1923	Three-year average
Hale Early	8	41·0	286·5	109·6	145·7
Rochester	10	36·8	119·0	138·6	98·1
Muir	12	30·0	134·5	117·2	93·9
Triumph	10	96·6	57·0	98·6	84·0
Yellow St. John	9	29·0	75·0	64·4	56·1
E. Crawford	12	2·6	91·5	56·2	50·1

It will be noted that the Rochester and the Muir, two varieties which are not yet grown on a commercial scale in this province, have given a relatively high average yield.

The Rochester is a yellow-fleshed, freestone peach of the Crawford group, ripening about the season of the Yellow St. John. Storage and shipping tests of these two varieties, showed the Rochester to have keeping and shipping qualities equal to the St. John. The fruit is of high-class desert quality, having a melting flesh and an excellent flavour. In appearance this peach is attractive, though it is highly pubescent and does not take on as much colour as the Yellow St. John. A possible weakness in the Rochester is that it ripens over a comparatively long season, necessitating several pickings.

The Muir is a yellow-fleshed freestone peach ripening about the season of the Early Crawford. The tree appears to be quite hardy and is a vigorous grower. A weakness of the variety is that the fruit is a dull yellow in colour with heavy pubescence. This variety is grown extensively in California for dehydration.

The Rochester and the Muir merit more extensive trial in the Okanagan Valley. Bud-wood of these varieties can be obtained from this Station.

PLUM VARIETY TEST.—The average yield per tree of a number of varieties of plums planted in 1916 is shown in Table 16.

TABLE 16—PLUMS—AVERAGE YIELDS, 1921-1923

Name of Variety	Number of trees	Average yield in pounds per tree			
		1921	1922	1923	Three-year average
Duarte	2	111·0	52·0	152·5	105·1
Peach Plum	12	81·4	127·0	105·2	104·5
Pond	5	42·6	145·0	76·0	87·8
Wickson	12	88·0	127·5	42·0	85·8
Burbank	10	94·0	85·0	61·4	80·1
Imperial Gage	2	45·0	87·5	102·5	78·3
Climax	2	73·0	82·5	(removed)	77·7
Columbia	2	70·5	47·5	114·0	77·3
Yellow Egg	5	44·0	114·0	51·7	69·5
Damson	2	70·0	30·0	65·5	55·1
Santa Rosa	11	16·6	81·0	63·4	53·6
Bradshaw	2	.....	42·5	93·5	44·0
Green Gage	2	.....	55·0	40·0	31·6

The Duarte, a Japanese plum introduced by Luther Burbank, has given the highest yield over a three-year period. This plum is very similar to Santa

Rosa and follows that variety in ripening season. The fruit is large, conical in shape, and purple-crimson in colour. The flesh is yellow with a shade of scarlet, is fragrant, and has a spicy flavour. This variety has been found to be an excellent pollenizer for Wickson. It is deserving of further trial in the Okanagan Valley.

CHERRY VARIETY TEST.—Table 17 shows the yields produced by a few of the more important commercial varieties of cherries grown in the Okanagan Valley. All the trees were planted in 1916.

TABLE 17—CHERRIES—AVERAGE YIELDS, 1921-1923

Name of Variety	Number of trees	Average yield in pounds per tree			
		1921	1922	1923	Three-year average
Olivet	12	54·0	86·5	81·0	73·8
Royal Anne	6	24·8	66·0	75·8	55·5
Lambert	6	30·6	28·0	77·8	45·4
Black Tartarian	12	10·4	7·0	35·6	17·6

The Olivet is a semi-sour cherry, excellent for home use but too soft to make a good shipper. It can be grown successfully as far north as Vernon. The tree comes into bearing early, but is commonly short lived. Black Tartarian is a sweet cherry of second quality, but is grown extensively as a pollenizer for Royal Anne, Lambert and Bing. The latter two varieties are recommended for commercial planting in the southern Okanagan.

APRICOT VARIETY TEST.—The figures presented in Table 18 indicate the average yield for the past three years of several varieties of apricots planted in 1916.

TABLE 18—APRICOTS—AVERAGE YIELDS, 1921-1923

Name of Variety	Number of trees	Average yields in pounds per tree			
		1921	1922	1923	Three-year average
Wenatchee Moorpark	10	48·3	107·0	58·8	71·4
Montgamet	2	61·0	49·0	58·5	56·2
Hemskirke	2	26·0	44·0	74·0	48·0
Blenheim	8	45·6	62·5	34·7	47·6
Royal	10	67·1	6·0	59·3	44·1

The Wenatchee Moorpark is a large apricot of attractive appearance. The fruit tends to ripen unevenly, so that care must be exercised in picking. The Montgamet and Hemskirke are too soft to be good shippers. Royals tend to run small unless heavy thinning is practised, and on this Station the variety has developed the biennial bearing habit. The Blenheim, the Moorpark and the Tilton are varieties which can be recommended for Okanagan conditions.

STONE FRUITS—CULTURAL EXPERIMENTS

THINNING

The thinning experiments which have been carried on for several years past were continued in 1923. In general the results secured indicate that with peaches, plums and apricots which are heavily loaded, thinning is not only advisable, but is absolutely necessary in order to secure a high percentage of marketable fruit. This is especially true of such varieties as the Triumph and Rochester peach, the Burbank plum and the Royal apricot, all of which tend to crop heavily and to run very small if left unthinned.

PRUNING

The question of the relative merits of the "long" and "short" methods of pruning peaches and apricots appears to be worthy of investigation under our local conditions. It is planned to set out a new peach and apricot orchard six acres in area in 1924 for the purpose of securing information as to the effect of methods of pruning when practised on varieties, growing under various cultural methods, and planted at various distances apart. Some work has already been done in connection with the variety test orchards set out in 1916. The results of this work to date, suggest that the type of pruning which will give the largest yields of marketable fruit at least cost is inter-related with and dependent upon other factors such as variety, soil fertility and distribution of irrigation water. The essential factor seems to be that the pruning should be sufficiently severe, so that in conjunction with the other orchard practices and conditions, it will assist in prodoucing a moderately strong new growth.

VEGETABLES

The work with vegetables in 1923 consisted of: variety testing of all the common vegetables; experiments in cultural methods with the common vegetables; vegetable improvement with tomatoes and cantaloupes; experiments to determine the irrigation requirments of tomatoes; and tests of seed potatoes from various sources.

There is not space in this report to publish a statement of the results of the variety tests and tests in cultural methods. Since the tomato is grown to such a large extent in the southern Okanagan Valley special attention has been paid to experimenting with this crop. Out of fifty varieties tested, four—John Baer, Earliana, Avon Early and Bonny Best—have been selected for comparative trial on a large scale in 1924. It is also planned to carry on an extensive variety test with cantaloupes in 1924, using the varieties Hoodoo, Hearts of Gold, Pollock 10-15, and Perfecto. These varieties appear to be those most likely to achieve commercial importance in this valley. Work is being carried on with tomatoes and cantaloupes in an attempt to develop superior strains of these vegetables. To date the attempts at vegetable improvement have been restricted to selection, followed for a comparative test of the progeny of individual selections. This has resulted in the isolation of distinct strains of these vegetables. It is probable that actual breeding work with vegetables will be started in the near future, when still further improvement is to be expected.

IRRIGATION OF VEGETABLES

A detailed account of an experiment in the irrigation of truck crops was given in the 1922 report. This experiment was continued in 1923, with tomatoes only. It was considered that by using one type of vegetable only in the plots set aside for this work, more accurate results would be secured.

The object of the experiment as it is now being carried on is to ascertain the most economical irrigation practice for tomatoes. Information is being sought with regard to the most advantageous:—

1. Amount of irrigation water to apply per season.
2. Time to apply it.
3. Frequency with which to apply it.
4. Amount to apply at each irrigation.

The project is located on a fertile sandy loam soil with a subsoil of coarse sand about two and a half feet below the surface. No barnyard manure or commercial fertilizers have ever been applied to this soil. Since 1920 a crop of truck vegetables has been grown on it every other year, and a vetch crop grown and turned under in the alternate year.

PROCEDURE.—In 1923, four plots, each one-twentieth of an acre in area, were planted to Earliana tomato. The plants were set out on May 29 and were spaced three and a half feet apart each way. The land was ploughed in the fall of 1922, disced and harrowed in the early spring of 1923, and irrigated about a week before planting. Irrigation water was applied by the furrow method as shown in table 19.

TABLE 19—IRRIGATION OF TOMATOES—WATER APPLIED, 1923

Date when water was applied	Rate at which water was applied, in acre-inches			
	Plot A	Plot B	Plot C	Plot D
	acre-inches	acre-inches	acre-inches	acre-inches
May 25-26	2	3	3·6	4
June 27-28	2	3	3·6	4
July 11-12	2	3	3·6	4
July 25-26	.....	3	3·6	4
August 8-9	.....	.....	3·6	4
August 22-23	.....	.....	.....	4
Total water applied per season	6	12	18·0	24

TABLE 20—IRRIGATION OF TOMATOES—YIELDS PER PLOT, 1923

Date of picking	Yield in pounds per plot (1/20 acre)			
	Plot A	Plot B	Plot C	Plot D
	lb.	lb.	lb.	lb.
August 13	40	61	44·5	33·5
August 21	166	155	132	129
August 31	199	143	125	126
September 10	398	276·5	145·5	170
September 26	348·5	305·5	223	252·5
Total yield per plot	1,151·5	941	670	711

From examination of the data presented in Tables 19 and 20, it is apparent that plot A, which received the least amount of water, produced the largest crop; and that plot B, which received water at the rate of only 12 acre-inches per acre during the season, produced a larger crop than did either plots C or D, which received respectively 18 inches and 24 inches of water.

CONCLUSIONS.—In attempting to interpret these results it should be borne in mind that the 1923 season was characterized by unusually heavy rains in June, which doubtless had a great deal to do with the large yields produced by the plots which received the smaller amounts of irrigation water. The results do suggest, however, that it is quite possible, under certain conditions, to apply too much water to tomatoes. A more detailed discussion of this question is not possible in this report. Any grower who is particularly interested in the irrigation of truck crops is referred to the 1922 report of this Station, in which report the results of a three-year irrigation experiment are summarized and certain recommendations made.

POTATOES

While potatoes do not appear likely to attain the importance of a major crop in the southern Okanagan, yet a sufficient quantity is grown to justify a certain amount of experimentation with this vegetable. A limiting factor in the production of potatoes in the southern Okanagan is the prevalence of diseases such as Mosaic and Leaf Curl. Previous experiments conducted at this Station have indicated that potatoes raised from locally-grown seed usually suffer more from these diseases than do potatoes grown from seed imported from cooler districts. The maturity of the seed has also been found to influence the vigour and productiveness of the plants. An attempt is being made by the Provincial Department of Agriculture to control some of the more important potato diseases by seed certification. The low average yield of potatoes in the southern Okanagan caused largely by so-called "running out" diseases made it seem desirable to carry out experiments to determine the influence of source of seed, maturity of seed, and seed certification, on the crop produced. These experiments have not been carried on long enough to make conclusive statements possible. Nevertheless the results secured this year are considerered to be of sufficient interest to justify their presentation in detail in this report.

LOCAL VS. IMPORTED SEED.—Forty-three varieties of potatoes were grown in uniform single test plots on gravelly loam soil which had grown a hay mixture of peas, oats and vetches the previous year. They were planted on the level on May 14 and dug on September 26. The rate of application of irrigation water, in acre-inches, for all varieties was as follows: May 0.92; July 5.96; August 2.98; total for the season, 9.86 acre inches. The unusual cool, showery season was favourable to potato development. The yields obtained are given in table 21. The seed of those varieties designated "1923" was obtained direct from Invermere in the spring of that year. The remainder of the seed was grown at Summerland, having been received from the source indicated in table 15 in the spring of 1922.

Fifteen varieties of potatoes from seed raised at this Station for three years were grown under the same conditions as the variety tests of imported seed. Throughout the season, practically all varieties lacked vigour and health as compared with seed obtained from other districts. Leaf-roll, Mosiac and other diseases were very prevalent. The yield produced are shown in table 22.

TABLE 21—POTATOES, TEST OF VARIETIES—IMPORTED SEED

Variety	Source of Seed	Average Yield per Acre, 1923			
		Marketable		Unmarketable	
		bush.	lb.	bush.	lb.
Early Northern	Invermere, 1923	832	20	220	0
Jones White	" 1923	825	0	253	0
Early Six Weeks	" 1923	817	40	264	0
Blue Snyder	" 1923	788	20	326	20
Irish Cobbler	Stonehouse, Kelowna	686	48	129	12
Ashleaf Kidney	Dominion Experimental Station, Lacombe	673	12	83	18
Morgan Seedling	" " " Lethbridge	612	0	103	42
Gold Coin	" " " Lacombe	581	24	66	18
Reeves Rose	" " " Lethbridge	571	12	95	12
Irish Cobbler	" " " Kapuskasing	567	48	83	18
Sutton Abundance	" " " Lethbridge	561	0	66	18
Bermuda Early	" " " Invermere	557	20	25	40
Wee McGregor	" " " Lacombe	552	30	49	18
Gold Coin	" " " Lethbridge	540	26	102	0
Carter Early Favourite	" " " Lacombe	528	40	120	0
Country Gentlemen	" " " "	528	42	127	30
Epicure	" " " "	504	54	113	54
Irish Cobbler	" " " Lethbridge	498	6	56	6
Early Eureka	" " " Lacombe	482	48	129	12
Green Mountain	" " " "	476	0	119	0
American Wonder	" " " "	476	0	119	0
Duke of York	" " " "	472	36	73	6
Table Talk	" " " Lethbridge	436	54	166	38
Factor	" " " "	426	42	78	12
Early Ohio	" " " Lacombe	426	42	93	30
Dalmeny Beauty	" " " Lethbridge	425	0	197	12
Early Ohio	" " " Kapuskasing	396	6	62	54
Green Mountain	" " " "	396	5	54	24
Wee McGregor	" " " Lethbridge	396	6	105	24
Sir Walter Raleigh	" " " Invermere	387	36	61	12
Early Hebron	" " " Lacombe	382	30	212	30
Empire State	" " " Lethbridge	346	48	159	48
Duchess of Norfolk	" " " Lacombe	341	42	158	6
Early Canadian	" " " Kapuskasing	338	18	62	54
Irish Cobbler	" " " Lacombe	334	54	91	48
Bussby Mammoth	" " " "	331	30	170	0
Houlton Rose	" " " "	307	42	204	0
Green Mountain	Stonehouse, Kelowna	299	12	44	12
Green Mountain	Bell, Kelowna	289	0	76	30
King Edward VII	Dominion Experimental Station, Lacombe	273	42	163	12
Table Talk	" " " "	255	0	183	36
Jersey Royal	Guinett, Chilliwack	166	36	90	6
Early St. George	Clarke, Chilliwack	119	0	117	18

TABLE 22—POTATOES—TEST OF VARIETIES—LOCAL SEED

Variety	Source of Seed	Average Yield per Acre, 1923			
		Marketable		Unmarketable	
		bush.	lb.	bush.	lb.
Raleigh	Dominion Experimental Station, Summerland	244	48	40	48
King George	" " " "	232	54	122	24
Dalmeny Beauty	" " " "	204	0	73	6
Majestic	" " " "	192	6	95	12
Great Scott	" " " "	187	0	108	48
Edsel Blue	" " " "	158	6	93	30
Factor	" " " "	149	36	52	42
Kerr Pink	" " " "	120	42	61	12
Early Ohio	" " " "	119	0	51	0
Jersey Royal	" " " "	102	0	44	12
Morgan Seedling	" " " "	102	0	35	42
Table Talk	" " " "	100	18	130	54
Empire State	" " " "	72	0	32	0
Irish Cobbler	" " " "	68	0	35	42
Gold Coin	" " " "	51	0	23	48

From a study of the data presented in tables 21 and 22 the decided decrease in yield which has followed the use of seed grown year after year under southern Okanagan conditions is clearly apparent. It will be noted that seed imported direct from Invermere in 1923 gave a larger yield than seed which had been grown one year at the Summerland Station.

The results of this experiment indicate the importance of securing seed from cooler districts for use in the southern Okanagan.

BRITISH COLUMBIA CERTIFIED SEED.—These potatoes were grown under the same field conditions as the variety tests of local and imported seed. The results are given in the table 23.

It will be noted that although two varieties of the certified seed were grown at Kelowna, the yields from these varieties were considerably greater than the yields secured from the local Summerland-grown seed. This suggests that, even in the southern Okanagan, where the tendency of the seed to deteriorate is very great, the yields may be kept up, at least to some extent, by the rigid rogueing and inspection associated with seed certification.

TABLE 23—POTATOES—BRITISH COLUMBIA CERTIFIED SEED

Variety	Source of Seed	Average Yield per Acre, 1923			
		Marketable		Unmarketable	
		bush.	lb.	bush.	lb.
Green Mountain	Stonehouse, Kelowna	671	30	183	36
Jersey Royal	Guinett, Chilliwack	640	54	125	48
Early St. George	Clarke, Chilliwack	465	48	280	30
Green Mountain	Bell, Kelowna	258	12	105	24

MATURE AND IMMATURE SEED.—These varieties were grown under the same field conditions as the variety tests. The mature seed came from tubers that were planted May 10, 1922, and the immature seed from tubers that were planted June 27, 1922. All varieties of the mature and immature seed were dug on October 16, 1922. A comparison of yields from mature and immature seed is given in table 24.

The decrease in yield where mature seed was used is remarkable, and suggests that the use of immature seed may be a means of retaining vigour and yielding capacity in potatoes grown in the warmer districts of this province.

TABLE 24—POTATOES—YIELDS FROM MATURE AND IMMATURE SEED, 1923

Variety	Source of Seed	Average Yield per Acre, 1923							
		From Mature Seed				From Immature Seed			
		Marketable		Unmarketable		Marketable		Unmarketable	
		bush.	lb.	bush.	lb.	bush.	lb.	bush.	lb.
Early St. George	Clarke, Chilliwack	119	0	117	18	681	42	137	19
Jersey Royal	Guinett, Chilliwack	166	36	90	6	584	48	124	6
Green Mountain	Bell, Kelowna	289	0	76	30	382	30	95	12
Green Mountain	Stonehouse, Kelowna	299	12	44	12	340	0	86	42

ORNAMENTAL GARDEN

The ornamental garden of this Station is justly famous. Parties come from all over British Columbia and from the States to the south to admire the profusion of flowers, and to picnic on the spacious lawns. One of the chief objects in carrying on this work with ornamentals is to stimulate interest in the beautification of home grounds. A very wide variety of annual and perennial flowers, and shrubs of all sorts are being tried out, with a view to determining which thrive to best advantage under the conditions experienced in the southern Okanagan.

Lists of roses and tulips which have been found most satisfactory were published in the 1922 report of this Station. Of the numerous annual and perennial flowers which have been found to do well here selections of ten of the best and most easily grown are given below.

List of Annuals, Seed of Which Can be Sown Outside

Alyssum, Brachycome (Swan River Daisy), Clarkia, Dimorphotheca (African Daisy), Leptosiphon, Mignonette, Nasturtium, Phlox Drummondii, Schizanthus, Shirley Poppy, Salpiglossis, Tagetes.

List of Annuals, Seed of Which Should be Started in a Hotbed

Antirrhimum, Asters, Canna, Celosia, Lobelia, Nemesia, Nicotiana, Petunia, Salvia, Verbena.

List of Hardy Perennials

Arabis, Aubretia, Columbine, Delphinium, Heuchera, Iris, Pyrethrum, Oriental Poppy, Shasta Daisy, Pæony.

The above does not provide by any means a complete list of the flowers which may be grown with success under Okanagan conditions. They are merely suggestive of the types which the amateur is likely to find most satisfactory and easy to grow, and which should find a place in every home garden throughout the Okanagan Valley.

CEREAL HUSBANDRY

Varieties of spring wheat, oats and barley have been tested at this Station for the last eight years in duplicate one-sixtieth acre plots on light silt-loam and gravelly loam soils.

The accompanying table gives the varieties tested and the average yields and number of days maturing.

TABLE 25—SPRING WHEAT—AVERAGE YIELD AND NUMBER OF DAYS MATURING

Variety	Number of years grown	Average number of days maturing	Average yield per acre	
	Years	Days Maturing	bush.	lb.
Huron, Ottawa 3	8	88·6	29	6
Marquis, Ottawa 15	8	88·4	28	36
Pioneer, Ottawa 195	8	88·9	27	0
Red Fife, Ottawa 17	8	90·6	24	28
White Russian	8	93·4	23	11
Ruby, Ottawa 623	6	86·3	23	53
Prelude, Ottawa 135	4	88·1	20	58
Burbank	3	94·0	34	0
Kubanka, Ottawa 37	2	102·0	46	30
Kitchener	2	101·0	50	0

TABLE 26—OATS—AVERAGE YIELD AND NUMBER OF DAYS MATURING

Variety	Number of years grown	Average number of days maturing	Average yield per acre	
			bush.	lb.
Daubeney, Ottawa 47	8	88·4	61	31
Victory	8	88·9	55	21
Banner, Ottawa 49	8	88·6	50	25
*Liberty, Ottawa 480	5	88·5	38	6
Gold Rain	2	99·0	92	7
Iowa 103	2	91·5	64	14

*Liberty, Ottawa 480 (hulless variety) figured at 34 pounds per bushel.

It is worthy of note that Daubeney, Ottawa 47, is the highest yielding and earliest maturing variety in the average of eight years test. Banner, Ottawa 49, and Victory also rank high.

TABLE 27—BARLEY—AVERAGE YIELD AND NUMBER OF DAYS MATURING

Variety	Number of years grown	Average number of days maturing	Average yield per acre	
			bush.	lb.
O. A. C. 21	8	86·3	43	35
Early Chevalier, Ottawa 51	8	84·6	40	0
Charlottetown	6	90·2	30	6
Hulless	4	87·0	34	44
*Himalayan, Ottawa 59	3	88·0	52	24
Gold	2	98·5	87	9
Plumose	2	104·0	48	1
Chinese, Ottawa 60	2	98·0	47	39

*Himalayan (Hulless variety) figured at 48 pounds per bush

TABLE 28—FIELD BEANS—VARIETY TEST

Variety	Number of years grown	Average yield per acre	
		bush.	lb.
White Navy	4	14	43
White Marrowfat	4	14	26
White Wonder	4	13	44
Norwegian, Ottawa 710	4	13	43
White Pea	4	12	55
Yellow Eye	4	12	51
Pierce's Imp. Tree	4	12	40
New Prize Winner	4	12	19
Large White, Ottawa 713	4	10	6
V. I. S. 3	4	9	25
Robust Navy Pea	4	9	24
Beauty, Ottawa 712	4	9	15
Small Navy	2	16	40
Navy, Ottawa 711	2	15	53
V. I. S. 5	2	15	20

The varieties, White Marrowfat and White Navy were consistent in best yields each year. V.I.S. 5 was very outstanding in vigorous and upright habit of growth. Other varieties showing vigour of plant were White Navy, New Prize Winner and Pierce's Improved Tree. The latter variety was the most uniform in growth of all varieties under test.

A type of bean largely in use by the trade to-day in British Columbia is a small uniform white bean called Kotenashi. This variety is grown by Japanese in Siberia and exported in large quantities to Canada. In the variety test of beans this year, Kotenashi was included in a test of sixteen varieties and recorded the lowest yield—10 bushels and 5 pounds per acre. It weighed the heaviest per measured bushel after cleaning—70 pounds, and required the longest time to mature—115 days. It should be noted, however, that Kotenashi has only been included for one season in our bean variety tests.

Being a legume and a hoed crop, beans help to enrich and clean the soil. Under irrigation an even distribution of moisture and a warm soil is essential at planting time to secure the quick, uniform germination and early development that is so necessary in the successful culture of this crop.

FORAGE PLANTS

With the exception of a cold spell with snow the middle of December, the winter of 1922-23 was mild and open. Forage crops wintered well. The spring was early but cold with very unusual precipitation which continued throughout the summer. The autumn was very mild and dry. Irrigation was timely and plentiful. The season was exceptionally favourable for all forage crops.

TABLE 29—MISCELLANEOUS CROP YIELD, 1923

Crop	Preceding crop	Acreage	Type of soil	Date of seeding	Date of cutting	Maturity	Irrigation — Rate of application in in acre-inches	Yield per acre	Per cent dry matter	Dry matter per acre
								tons lb.	p.c.	tons lb.
Sunflower.....	Corn.....	0·34	Gravelly loam side hill	April 26	Aug. 9	75% in head	5·00	9 220	.. ..	.. ..
Longfellow.....	Sunflower	0·65	Silt loam.	" 25	Sept. 11	Glazed to ripe	5·00	20 327	23·75	4 1,578
North Western Dent	Alfalfa....	3·85	Gravelly loam	June 9	" 18	Ripe.....	22·49	8 1,758	24·21	2 229
North Western Dent	Grasses...	0·11	Gravelly loam	May 23	" 10	Ripe.....	8·00	8 159	40·93	3 614
Peas, oats, vetch...	Sunflower	1·28	Silt loam.	" 17	July 27	Cut green for hay	6·50	5 141	41·30	2 188

INDIAN CORN

Sixteen varieties of Indian corn were tested in duplicate one sixty-seventh acre plots on uniform gravelly loam soil which had grown hay the previous two years. The land was fall ploughed in 1922 and given an application of 10 tons of manure. In 1923 the land was disked and spring ploughed and prepared for seeding. All varieties were sown April 28 in rows 3 feet apart and the plants were thinned to 8 inches apart in the rows. All plots were weighed immediately after cutting and samples weighing approximately 50 pounds were passed through an ensilage cutter, and representative duplicate samples each weighing one pound, taken for the determination of the absolute dry matter. These samples were air-dried, partially in a shed and the drying process continued in a heated room until no further shrinkage was observed. The samples were then placed in an electric oven at a temperature of 100° C. and dried to absolute dry weight.

The rate of irrigation applied in acre inches for all varieties was as follows: May, 1.5; July, 3.5; August, 2.5; September, 1.5; total for season 9.0 acre-inches.

TABLE 30—INDIAN CORN—TEST OF VARIETIES

Variety	Source	Date cut	Maturity when cut	Average yield per acre—1923 green	Per cent dry matter	Dry matter per acre—1923
				tons lb.		tons lb.
Disco Pride Yellow Dent—1015.	Dakota Improved Seed Co., Mitchell, S. Dakota.	Sept. 8	Ripe.....	21 240	41·87	8 1,686
North Western Dent, A. B.	" " "	" 18	"	20 40	26·25	5 510
Longfellow—1099.....	" " "	" 18	"	16 1,660	29·06	4 1,782
Compton's Early.....	J. O. Duke.....	" 18	"	21 570	22·81	4 1,700
90 Day White Dent—1318	Dakota Improved Seed Co., Mitchell, S. Dakota.	" 18	"	19 1,930	23·43	4 1,356
Leaming.....	John Parks.....	" 18	"	18 630	25·31	4 1,271
North Dakota.....	Steele Briggs Seed Co., Toronto, Ont.	" 18	"	16 1,660	27·50	4 1,256
Golden Glow.....	J. O. Duke.....	" 18	"	17 1,640	25·93	4 1,241
North Western Dent 15-772.	A. E. McKenzie Seed Co.	" 18	"	18 102	25·31	4 1,137
Wisconsin No. 7.....	John Parks.....	" 18	Glazed...	17 320	25·62	4 793
*Twitchells.....	Fredericton.....	" 18	"	17 1,574	22·50	4 4
Leaming.....	J. O. Duke.....	" 18	Ripe.....	15 492	25·62	3 1,812
Quebec No. 28.....	Macdonald College, Que..	" 8	"	11 1,760	31·87	3 1,572
Wisconsin No. 7.....	J. O. Duke.....	" 18	"	13 1,060	26·56	3 1,187
Longfellow.....	"	" 18	"	12 1,740	27·18	3 996
White Cap Yellow Dent..	Steele Briggs Seed Co., Toronto.	" 18	Glazed...	12 1,080	26·25	3 683
Average.....	.....	.....	.....	16 1,906	27·07	4 1,187

*Single plot.

The different varieties of corn under test were harvested as nearly as possible at the same stage of maturity. The fact that nearly all varieties reached maturity is worthy of consideration as it would seem to suggest the possibility of economically producing corn for either ensilage or seed purposes of the more promising late-maturing and heavy-yielding varieties. A comparison of results shows considerable variation in yields of corn sold under the same name but obtained from different sources. It is also apparent on examining the table of yields, that the varieties that gave the highest yields of green matter did not always produce the highest amounts of dry matter per acre. While no definite conclusions can be drawn from any one year's tests, yet the results indicate that the source of seed is a very important factor for growers to consider when purchasing seed corn. As an ensilage corn, Longfellow is well suited for the southern sections, and North Western Dent and Compton's Early for the northern sections of this district.

TABLE 31—CORN VARIETIES—AVERAGES FOR THREE YEARS

Variety	Average yield per acre—green—1921-1923
	tons lb.
Compton's Early.....	20 1,750
North Western Dent.....	16 1,984
Longfellow.....	16 1,873
Leaming.....	16 1,580
North Dakota.....	16 603
Wisconsin No. 7.....	16 379
Average.....	17 693

TABLE 32—CORN VARIETIES—AVERAGES FOR TWO YEARS

Variety	Source	Average yield per acre—green—1922-1923	
		tons	lb.
Compton's Early	J. O. Duke	15	125
Leaming	John Parks	14	155
Wisconsin No. 7	J. O. Duke	11	1,390
Longfellow	"	10	1,870
Average		12	1,885

SUNFLOWERS

Four varieties or strains of sunflowers were tested in duplicate one-sixty-seventh-acre plots on gravelly loam soil which had grown hay the previous two years. They were planted April 28, in rows three feet apart, and the plants when up, were thinned to 8 inches apart in the row. On August 8, all varieties were harvested and representative samples in duplicate taken for the determination of the absolute dry matter.

The rate of application of irrigation in acre-inches for all varieties was as follows: May 1.5; July 3.5; August 2.5; September 1.5; total for the season 9 acre-inches.

TABLE 33—SUNFLOWERS—TEST OF VARIETIES

Variety	Source	Average height of plants	Average per cent in bloom	Average yield per acre—green—1923	Per cent dry matter	Dry matter per acre
		inch.		tons lb.		tons lb.
Mammoth Russian	K. McDonald & Sons	144	60	52 1,853	16·85	8 1,836
Mixed Mennonite	Rosthern	84	100	20 95	21·10	4 460
Manchurian	A. E. McKenzie Seed Co., Brandon.	84	100	20 1,801	18·40	3 1,691
Early Ottawa 76	Exp. Farm, Ottawa	89	100	20 1,125	18·10	3 1,444
Average		100	90	28 1,218	18·61	5 358

Three varieties or strains were tested in duplicate one-one-hundredth acre plots on uniform rich loam soil. They were planted April 28, in rows 3 feet apart and were harvested on August 8, when the plants were in full bloom and 25 per cent ripe. The average height of each variety was 7 feet. The rate of application of irrigation in acre-inches was as follows: June 1.5; August 2.0; total for season 3.5 acre-inches.

The yields of the varieties tested are given in the following table.

TABLE 34—SUNFLOWERS—TEST OF VARIETIES

Variety	Source of seed	Average yield per acre—green—1923	
		tons	lb.
Manteca	C.P.R.	58	1,700
Black	"	45	1,300
Mixed	"	20	1,800
Average		41	1,600

Insufficient land in the regular area for forage plants necessitated testing the varieties or strains of sunflowers on different benches having considerable variation of soil and moisture. This gave very variable results and made it necessary to make two tables of yields of the strains under test.

The high-yielding capacity of the sunflower plant has resulted in many growers over-rating its value, in comparison with corn, as an ensilage crop. The results of the yields of the green and dry fodder per acre in corn and sunflowers show that although sunflowers yielded more green fodder than corn, yet the latter produced more dry matter. As the dry matter constitutes the feeding value of crops, a study of the yields of the green and dry fodder is important when placing a value on them.

Three varieties or strains of sunflowers have been grown for two years. The average yields are given in table 35.

TABLE 35—SUNFLOWERS—TEST OF VARIETIES

Two-year Average

Variety	Source	Average yield per acre—green— 1922-1923	
		tons	lb.
Mammoth Russian	K. McDonald & Son	35	1,126
Early Ottawa 76	Exp. Farm, Ottawa	15	442
Mennonite Mixed	Rosthern District	13	647
Average		21	738

CORN, SUNFLOWERS, SORGHUM, SUDAN GRASS

COMPARATIVE TEST FOR ENSILAGE AT DIFFERENT DATES OF PLANTING

Comparative tests were again conducted this year with corn, sunflowers, sorghum and sudan grass for ensilage, at different dates of seeding in rows three feet apart.

A comparison of the yields of the different dates of seeding would seem to indicate that there is no advantage in seeding these crops before the soil is warm, about May 15. A fact worthy of consideration is that sorghum produced approximately 5 tons more fodder than corn. Sorghum was easily harvested and made excellent ensilage. It shows promise of being a good ensilage crop under irrigation in the Dry Belt. Sudan grass also was easy to harvest, made ensilage but the yield was too low to commend its extensive use as an ensilage crop.

The average yields per acre for two years—1922-23 are given in the following table:—

TABLE 36—CORN, SUNFLOWERS, SORGHUM, SUDAN GRASS

Average Yield per Acre for Two Years 1922-1923

Variety	Average yield per acre—green weight 1922-1923	
	tons	lb.
Mammoth Russian Sunflowers	21	1,252
Sorghum	14	668
North Western Dent Corn	9	761
Sudan Grass	6	1,214

Two areas each 0.11 of an acre of gravelly loam which had been in grass the previous year were sown to sorghum and sudan grass. Each was sown May 23, harvested September 10, and received 8 acre-inches of irrigation water. The yields per acre were as follows:—

Sorghum 12 tons 1,159 pounds green material: 4 tons 489 lbs. dry matter.

Sudan grass 6 tons 1,141 pounds green material: 2 tons 1,749 lbs. dry matter.

ANNUAL HAY CROPS

MILLETS

Six varieties of millets were tested in duplicate one-forty-eighth acre plots on uniform silt loam soil which had grown potatoes in 1922. The land received an application of ten tons of manure per acre and was fall ploughed in 1922. All varieties were sown broadcast May 16, at the rate of 25 pounds of seed per acre. Each variety was harvested as soon as it was well headed with the exception of Japanese. This variety just previous to heading, dried out considerably and appeared to be unable to withstand the hot sun. A little aftermath, but not sufficient to harvest, was developed by all varieties The rate of irrigation applied in care-inches was as follows: June, 2.0; August, 3.0; total for the season, 5 acre-inches. The yields of field air-dried hay per acre are given in the following table.

Definite conclusions from one year's results should not be drawn, but the yields would seem to indicate that millets have a value as a supplementary hay crop.

TABLE 37—MILLETS—TEST OF VARIETIES

Variety	Average yield per acre—1923—air dried	
	tons	lb.
Hog	3	1,632
Siberian	3	1,416
Golden	3	240
Japanese	3	144
Common	2	1,568
Hungarian	2	512
Average	3	252

SPRING RYE, BARLEY AND OATS FOR ANNUAL HAY

One variety each of rye, barley and oats were tested to determine their suitability for hay. All varieties were grown under the same conditions as the millets and were cut when in the soft dough with the following results:

TABLE 38—SPRING RYE, BARLEY AND OATS FOR ANNUAL HAY

Variety	Average yield per acre 1923 air dried	
	tons	lb.
Spring Rye	2	16
Gold Barley	1	1,840
Daubeney	1	1,024
Average	1	1,627

More varieties and at different stages of maturity when cut will need to be tested before any definite conclusions can be drawn.

TABLE 39—GRASSES AND CLOVERS FOR ANNUAL HAY

Variety	Average yield per acre 1923 air dried	
	tons	lb.
Sudan grass	3	720
Hubam clover	1	1,600
White sweet clover	1	1,360
Average	2	560

GRASSES AND CLOVERS FOR ANNUAL HAY CROPS

Varieties of grasses and clovers for annual hay were grown under the same conditions as the millets and were cut when the Hubam and white sweet clover showed approximately ten per cent bloom and the sudan in full bloom. All varieties produced considerable aftermath but not enough to harvest.

MANGELS—TEST OF VARIETIES

Twenty-four varieties of mangels were tested this year and particular attention given to trueness of type and dry matter content of root. The lack in the past of continuity in the supply of samples of varieties or types of mangel seeds to be tested makes it impossible at this time to strike averages and from the results obtained draw conclusions that would enable dependable recommendations to be given. The work, however, indicates the importance of seeding with the best quality seed obtainable and of the most economical type for the particular soil and climatic conditions of the district.

The following table gives the average yield of five varieties for four years 1920 to 1923.

TABLE 40—MANGEL VARIETIES

Variety	Average yield per acre for four years, 1920-23	
	tons	lb.
Half Sugar White	36	700
Mammoth Long Red	35	45
Yellow Intermediate	32	583
Golden Tankard	27	1,815
Yellow Globe	22	1,951
Average	30	1,818

FIELD CARROTS—TEST OF VARIETIES

Nineteen varieties of field carrots were tested under the same field conditions and with the same object in view as with mangels.

The following table gives the average yields per acre of three varieties of field carrots for three years 1921-1923.

TABLE 41—FIELD CARROT VARIETIES

Variety	Average yield per acre for three years, 1921–23	
	tons	lb.
White Intermediate S. D.	23	671
Danish Champion	16	1,239
White Belgian	13	612
Average	17	1,507

Selected roots of White Intermediate carrot and White Intermediate mangel were grown for seed. The yields per acre of seed after cleaning were as follows: White Intermediate carrot 229 pounds; White Intermediate mangel 840 pounds. Roots were also grown of these varieties and selections made for seed raising in 1924.

ALFALFAS, CLOVERS, GRASSES

ALFALFA—TEST OF VARIETIES

Eleven varieties of alfalfa were seeded in 1923 at the rate of 12 pounds of seed per acre in duplicate one hundredth-acre plots on light gravelly loam soil. In midsummer the plots were clipped and on September 7 harvested with the following results.

The rate of application of irrigation was 12 acre-inches for the season.

TABLE 42—ALFALFA—TEST OF VARIETIES

Variety and Source	Average yield per acre, air dried, 1923	
	tons	lb.
Grimm, Experimental Station, Cap Rouge	1	1,800
Variegated, Steele Briggs	1	1,600
Cossack, D. I. S. C.	1	1,400
Grimm, Brooks, Alberta	1	1,350
Cossack, Hassen stock	1	1,200
R. M. McCannus, Ida, Ont.	1	1,150
Shoobut, S. Argentine	1	1,050
*Siberian Cossack, Nelson, B.C.	1	1,050
Turkestan, Steele Briggs	1	950
Medicago falcata	0	675
Siberian Yellow-flowered, Boyd, Alberta	0	650
Average	1	807

* Single plot.

Five varieties of alfalfa were seeded in one-hundredth-acre plots in 1922 on light gravelly loam at the rate of 12 pounds of seed per acre. The following table gives the varieties tested and the yields per acre.

TABLE 43—ALFALFA—TEST OF VARIETIES

Variety	Source	First cutting, June 25		Second cutting, Aug. 6		Third cutting, Sept. 19		Total yield per acre, air dried, 1923	
		tons	lb.	tons	lb.	tons	lb.	tons	lb.
Turkestan	Steele Briggs	4	1,000	2	1,800	2	1,500	10	300
Grimm	Lyman	4	0	2	1,000	2	1,000	9	0
Grimm	Expt. Station, Cap Rouge	4	0	1	1,500	2	500	8	0
New Zero	Enderby	3	1,000	2	900	2	1,000	8	900
Siberian	Nelson	2	1,000	1	800	0	0	3	1,800
Average		3	1,400	2	400	2	0	7	1,800

NOTE.—Turkestan; Grimm, Lyman; and Grimm, Cap Rouge were in duplicate plots.

Three varieties of alfalfa were seeded in 1922 in single one-fourteenth acre plots on sandy soil at the rate of 12 pounds of seed per acre. The following table gives the yield per acre.

TABLE 44—ALFALFA—TEST OF VARIETIES

Variety	Source	First cutting, June 20		Second cutting, Aug. 13		Third cutting, Sept. 19		Total yield per acre, 1923	
		tons	lb.	tons	lb.	tons	lb.	tons	lb.
Grimm	Exp. Sta., Summerland	3	20	2	648	1	1,150	6	1,818
Grimm	Lyman	2	1,880	2	550	1	1,500	6	1,930
Turkestan	Steele Briggs	1	1,080	1	1,976	1	100	4	1,156
Average		2	993	2	391	1	917	6	301

TABLE 45—CLOVER—TEST OF VARIETIES

Variety	Date of seeding	Date cut, 1923	First cutting		Second cutting		Total yield per acre, air dried, 1923	
			tons	lb.	tons	lb.	tons	lb.
Ottawa Perennial	1922	June 25, Aug. 29	3	0	3	500	6	500
Altaswede*	1922	June 20. Aug. 13	1	1,640	2	900	4	540

* Owing to insufficient growth in 1922, Altaswede was not harvested.

WESTERN RYE

Nine varieties of western rye grass were seeded on April 6, 1922, in duplicate plots of one fifty-fifth of an acre. These were harvested on July 4, 1923, to obtain comparative hay yields which are given in the following table:—

TABLE 46—WESTERN RYE VARIETIES

Source of Seed	Average yield per acre, 1923	
	tons	lb.
No. 4, Central Experimental Farm, Ottawa	3	1,786
No. 5, Central Experimental Farm, Ottawa	3	1,351
Dom. Exp. Station, Morden	3	1,351
No. 11, Central Experimental Farm, Ottawa	3	262
No. 6, Central Experimental Farm, Ottawa	2	1,989
Wm. Rennie Seed Co., Vancouver	2	1,881
Steele Briggs Seed Co., Winnipeg	2	1,853
Dom. Exp. Station, Summerland	2	1,445
No. 10, Central Experimental Farm, Ottawa	2	900
Average	3	313

HAY MIXTURES WITH ALFALFA AS THE BASE

Five hay mixtures were seeded in 1922 on drifting sandy soil in one-fourteenth-acre plots. Insufficient irrigation retarded growth to such an extent that it was doubtful as to whether the plots were worth keeping. In the spring of 1923, however, they showed promise of a good crop. The rate of application in acre-inches of irrigation was as follows: May, 12 inches; June, 2; July, 6; August, 6; total for the season, 26 acre-inches. The following table gives the mixtures sown and the yields of field-cured hay.

TABLE 47—HAY MIXTURES WITH ALFALFA AS THE BASE

Seeding	Rate per acre	First cutting, June 20		Second cutting, Aug. 13		Third cutting, Sept. 19		Total yield per acre, air dried, 192?	
	lb.	tons	lb.	tons	lb.	tons	lb.	tons	lb.
Alfalfa Timothy	6 8	1	1,646	2	648	1	1,680	5	1,974
Alfalfa Western rye	6 8	1	1,780	2	732	1	240	5	752
Alfalfa Meadow fescue	6 15	2	200	1	1,220	1	450	4	1,870
Alfalfa Orchard grass	6 15	1	1,780	1	1,500	0	1,750	4	1,030
Alfalfa Tall oat grass	6 15	1	1,920	1	1,080	0	1,400	4	400

These hay mixtures were started to determine what grasses can be economically grown in a hay mixture with alfalfa as the base. Such grasses should be green, succulent and of fine texture and ready to cut with alfalfa. Such a mixture helps alfalfa to stand up better, cut and harvest more easily, dry and cure faster, which is very important, especially during unfavourable harvesting weather. It also improves very materially the feeding value of hay, especially when fed to horses. This experiment is being continued and enlarged, the results of which will be available in 1924 and 1925.

Some field notes taken on the plots when the alfalfa was ready to cut were as follows:—

ALFALFA AND WESTERN RYE.—Grass green, fine texture, about same height as alfalfa, not quite ready to cut. Second cut of Western Rye was as tall as the alfalfa and in the blossom stage. Excellent mixture.

ALFALFA AND MEADOW FESCUE.—Height of grass about same as alfalfa, ready to cut. Second cut of Meadow Fescue very poor stand. This Mixture although not as good as Western Rye is very fair.

ALFALFA AND TALL OAT.—Tall oat ready to cut. Second cut of Tall Oat very poor stand. Not as suitable as Meadow Fescue.

ALFALFA AND ORCHARD GRASS.—Orchard grass matures too early for alfalfa, grass somewhat coarse, does not give promise of being a suitable mixture in the first cut. Second cut of Orchard Grass was short, green and of excellent quality.

ALFALFA AND TIMOTHY.—Alfalfa much too early for timothy. Timothy in the second cut of little value.

As previously mentioned, the grasses should be ready to cut with alfalfa. This time is usually when alfalfa is showing 5 to 10 per cent flower or when the young alfalfa shoots growing from the crown of the plants are approximately one inch long. It is more important to be guided as to when alfalfa is ready to cut by the length of these young tender shoots than by the amount of flower. Cut before the young shoots are high enough to be clipped by the mower. This prevents unnecessary loss of valuable plant growth and delay in the time to grow the next crop. This is very important, especially when two or more crops are desired and the time limited by an unfavourable season.

POULTRY

STOCK

The poultry work on this Station is carried on with one breed—the White Wyandotte. At the end of December, 1923, the flock consisted of the following: 115 two-, three-, and four-year-old females; 335 laying pullets; 12 yearling males; 70 cockerels for spring use and sale, making a total of 532 birds.

INCUBATION

COOLING.—This season, no eggs were cooled during incubation longer than the time taken to turn them by hand twice daily, in a cellar with temperature varying from 48° to 57° F. Each tray was removed separately and the eggs turned and put back immediately, which would make a period of about four minutes at each turning. Results have come up to the average of other years (when eggs were cooled after turning), and mortality in shell has been a little less.

Year	Per cent fertile	Per cent fertile hatched	Per cent total eggs hatched
1923	78·1	71·9	56·1
1922	74·9	74·8	56·1
1921	80·8	78·8	63·7
1920	77·9	62·2	48·5

TURNING WHILE HOLDING.—To find the best method of keeping eggs for incubation—whether to turn them over daily on their sides, or to let them rest on their small ends—a test was carried out during the spring of 1923, eggs being kept as long as fourteen days prior to setting. Results, given below, point towards turning being unnecessary. It might be added that using thirty-dozen egg crates, or one-dozen cartons should it be necessary to keep pens separate, is the most convenient way of holding. The room temperature varied from 48° to 57°.

Method	Eggs set	Fertile	Fertile hatched	Total hatched
		p.c.	p.c.	p.c.
Resting on sides and turned over daily	545	85·1	70·5	60·0
Standing upright on small ends	645	84·9	75·0	63·7

COST OF INCUBATION.—All oil consumed by the various makes of incubators was measured, and the cost of same worked out. Coal oil cost 29 cents per gallon. Twenty-three days allowed for test; being one day for trial running and warming up, twenty-one days for hatching, and one day for hardening chicks.

Make of Incubator	Egg capacity	Oil used	Cost	Cost per 100 eggs
		pints	$ cts.	cts.
Prairie State	120	26¼	0 95	79·1
Buckeye	350	41½	1 50	42·8
"	600	46¾	1 69	28·1
Jubilee	440	40¼	1 46	33·1

BROODING

A record of all coal consumed by " Buckeye " brooder-stoves was kept during the season of 1923. Fuel had to be shipped in from Vancouver, costing $23.20 per ton, plus $10 per ton freight, a total of $33.20. This price is for the best anthracite obtainable.

Date of Hatch	Fuel used	Cost of running
	lbs.	$ cts.
March 23	1,300	21 58
April 3	1,000	16 60
" 27	830	13 78

COST OF REARING

A total of 1,225 chicks were transferred from the incubators to the brooders in 1923, the mortality in these from March 21 to December 1 being 184 chicks, or 15 per cent. Broilers were put on the local market at the beginning of June, and not much difficulty was experienced in disposing of all surplus stock as soon as ready for sale. Prices varied from 21 cents per pound for live birds to 35 cents for dressed. A little more than 12 tons of feed was used during the period mentioned above. Itemized lists of feeds consumed and poultry sold for table use follows:—

Feed Used

300 lb.	Chick Grain	at $ 5 00	per 100 lb.	$	15 00
160 "	Buttermilk Mash	10 00 "	100 "		16 00
217 "	Rolled Oats	5 50 "	100 "		11 93
300 "	Developer	4 00 "	100 "		12 00
414 "	Mash	2 62 "	100 "		10 85
9,911 "	Mash	1 96 "	100 "		194 26
5,695 "	Wheat	1 95 "	100 "		111 05
4,985 "	Cracked Corn	2 35 "	100 "		117 15
2,113 "	Oats	1 57 "	100 "		33 17
24,295 "	Total			$	521 41

Poultry Sold

63½ lb.	at $ 0 35	$	22 31
67½ "	0 30		20 25
725 "	0 27		195 75
25½ "	0 25		6 31
199½ "	0 24		47 88
37½ "	0 22		8 20
448 "	0 21		94 08
1,566½ "	Total	$	394 78

YARD-RANGE VERSUS CONFINEMENT

This experiment was conducted with two pens of sixty birds each, picked as evenly as possible at the beginning of the test. The results show greatly in favour of range of some kind, even although green feed has to be cut and brought to the pens daily, as was necessary in this case.

REPORT OF BIRDS ON YARD—RANGE

Month	Eggs laid	Average per bird	Average price	Total value	Feed consumed	Feed per bird	Total cost of feed	Cost of feed per bird	Profit per pen	Profit per bird
			cts.	$ cts.	lb.	lb.	$ cts.	cts.	$ cts.	cts.
Nov., 1922	420	7·0	50	17·50	476	7·9	9·41	15·7	8·09	13·5
Dec	927	15·4	49	37·85	569	9·5	11·31	18·8	26·54	44·2
Jan., 1923	1,075	17·9	35	31·35	596	9·9	11·33	18·8	20·02	33·4
Feb	867	14·4	32	23·12	566	9·4	9·83	16·4	13·29	22·1
March	1,192	19·9	26	25·82	604	10·1	11·71	19·5	14·11	23·5
April	1,140	19·0	21	19·95	443	7·4	9·42	15·7	10·53	17·5
Totals and averages	5,621	93·7	35·5	155·59	3,254	54·2	63·01	$ 1.05	92 58	$ 1.54

REPORT OF BIRDS CONFINED

Month	Eggs laid	Average per bird	Average price	Total value	Feed consumed	Feed per bird	Total cost of feed	Cost of feed per bird	Profit per pen	Profit per bird
			cts.	$ cts.	lb.	lb.	$ cts.	cts.	$ cts.	cts.
Nov., 1922	165	2·7	50	6 87	483	8·0	9 54	15·9	2 67 (loss)	4·5 (loss)
Dec	701	11·7	49	28 62	532	8·9	10 58	17·6	18 04	30·1
Jan., 1923	1,186	19·8	35	34 59	621	10·3	11 80	19·7	22 79	38·0
Feb	961	16·0	32	25 62	563	9·4	9 91	16·5	15 71	26·2
March	1,178	19·6	26	25 54	593	9·9	11 29	18·8	14 25	23·7
April	1,078	18·3	21	18 86	442	7·3	9 40	15·7	9 46	15·8
Totals and averages	5,269	87·8	35·5	140 10	3,234	53·9	62 52	$1 04	77 58	$ 1 29

BREEDING FOR EGG SALE

Two pens were mated in 1922 to determine the respective value of the male and female in breeding to increase the size of egg. Unfortunately, poor fertility was experienced among a number of the birds, and on top of this, the percentage of males produced was far in excess of the females. It would appear from the results, tabulated below, that the male is a slightly greater factor where the size of egg in the progeny is concerned. Having this in mind, the 1923 pens were mated along these lines in many cases, i.e. a male from a large-egg dam running with hens laying eggs below standard which were desirable to retain for some other characteristic. Hatching results were good, and egg-size had been increased in a great majority of cases up to the end of December, 1923.

Pen No. 1

Cockerel No. F. 345, from dam laying eggs 26·8 oz. per doz.

Hen Band No.	Egg weight of same	Progeny number	Egg weight
	oz. per doz.		oz. per doz.
E. 52	23·0	G. 80	25·8
		117	Over 24·0
E. 55	22·5	132	24·0
E. 70	23·0	87	26·7
E. 114	23·5	135	23·5
		224	24·1
		237	21·0
E. 216	22·0	136	24·3
		241	23·2
E. 259	23·5	217	25·4

Pen No. 2

Cockerel No. F. 72, from dam laying eggs 22·5 oz. per doz.

Hen Band No.	Egg weight of same	Progeny number	Egg weight
	oz. per doz.		oz. per doz.
E. 20	24·5	G. 90	23·5
E. 32	25·0	84	23·0
		150	25·5
		205	23·0
E. 53	25·5	24	25·9
		196	23·5
		120	over 24·0
E. 63	26·0	170	24·0
		190	24·2
		242	20·0
		111	over 24·0
E. 249	27·5	247	21·0
		250	27·3

FIBRE-PRODUCTION

HEMP SEED, FOR FIBRE PRODUCTION

For several years experiments have been conducted in growing hemp to determine whether hemp seed can be economically grown in this district, in order to supply Canadian-grown seed for fibre production purposes and thus avoid the necessity of importing hemp seed from foreign countries. Experiments to date have given small results. It would seem that, like the Prairie Provinces and Eastern Canada, the season in the southern Okanagan is too short for economical seed production. To compare autumn versus spring seeding for early maturity, hemp was seeded on November 27, 1922, and on April 4, 1923, on the same bench, on deep sandy soil in hills four feet apart each way. The plants blossomed on July 15, and a few plants ripened a fair amount of seed by the end of August. Maturity on the whole, however, was very uneven and slow in both the autumn and spring planting. This experiment is being continued.

BEES

In the fall of 1922 eight colonies of bees were packed away for the winter, four in a four-colony wintering case and four in Kootenay hives. All came through in excellent condition. The winter was not very severe. There was an average snowfall and by the middle of February the ground was clear. March was moderately dry and warm, but during April, May, and June the precipitation was exceptionally heavy for this district. However, all colonies got away to a good start, and it was thought the honey flow would equal the year 1922, which was a record year. But these high expectations were not to be realized, as after the first honey flow nectar only came in in moderate quantities throughout the remainder of the season. The total weight of extracted honey produced by the eight colonies was 723 pounds, an average of 90·37 pounds per colony. (In 1922 the average per colony was 165 pounds.) The greatest yield from one colony was 168 pounds. The total value of the honey produced, at 20 cents per pound, was $144.60, which after deducting the value of sugar fed left a net profit of $132.10 or $16.51 per colony. No increase was made during the season.

Eight colonies were packed away in the fall of 1923, four in the four-colony winter case and four in Kootenay cases. Each colony had approximately 65 pounds of stores after feeding. Soon after packing away for the winter, we experienced a very heavy wind storm followed by a heavy rain in the early morning. The top blew off one Kootenay case and off the four-colony wintering case, with the result that two colonies were severely chilled and never recovered. The remaining six colonies came through strong and healthy.

EXPERIMENTAL PROJECTS UNDER WAY AT THE EXPERIMENTAL STATION, SUMMERLAND, B.C.

Project No.	Title.

ANIMAL HUSBANDRY

BEEF CATTLE

A. 171. Roots vs. ensilage for steer feeding.
A. 180. Feeding steers loose vs. tied.
A. 252. Feeding roots to steers.
A. 271. Light vs. heavy feeding of concentrates to steers.
A. 345. Feeding alfalfa hay and straw in varying amounts to steers.
A. 346. Feeding steers vs. cows for beef.
A. 347. Heavy roots and meal vs. light roots and meal for steer feeding.
A. 348. The economy of feeding alfalfa hay to steers.
A. 349. Shelter vs. no shelter for steers.
A. 350. Corn ensilage vs. sunflower ensilage for steers.

DAIRY

A. 351. Control of bacterial count in milk.

SWINE

A. 166. Cost of maintaining herd boar.
A. 352. Fish meal vs. soy bean meal vs. oil meal for hogs.

SHEEP

A. 310. Grading up flock with pure bred rams.

FIELD HUSBANDRY

ROTATION EXPERIMENTS

F. 46. Seven-year rotation—corn; wheat or oats; alfalfa for 5 years

FARM MANAGEMENT EXPERIMENTS

F. 90. Cost of operating tractor.
F. 91. Cost of producing farm crops.

HORTICULTURE

POMOLOGY

H. 29. Apple storage experiment.
H. 32. Apple pruning experiment.
H. 33. Apple, variety experiment.
H 35. Cherry, variety experiment.
H. 40. Grape, variety experiment.
H. 44. Pear, variety experiment.
H. 48. Plum, variety experiment.
H. 331. Orchard, methods of soil management.
H. 332. Peach, variety experiment.
H. 334. Apricot, variety experiment.
H. 403. Clean cultivation in an orchard.
H. 404. Alfalfa sod mulch in an orchard.
H. 405. Soiling crops and hairy vetch in an orchard.
H. 406. Red clover and alfalfa sod mulch in an orchard.
H. 407. Vegetable intercrops and vetch in an orchard.
H. 408. Farm rotation and vetch in an orchard.
H. 409. Cultural methods for stone fruit orchards.
H. 410. Thinning stone fruits.
H. 411. Irrigation of orchards.
H. 412. Fertilization of apple trees.
H. 413. Apple, thinning experiment.
H. 414. Different dates of picking apples for storage.
H. 416. Jonathan breakdown.

PROJECT No. TITLE.

VEGETABLE GARDENING

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H. 61. Bean, variety experiment.
H. 63. Bean, weekly sowings for yield.
H. 68. Beet, variety experiment.
H. 75. Cabbage, protection from root maggot.
H. 77. Cabbage, variety experiment.
H. 83. Carrot, variety experiment.
H. 86. Cauliflower, protection from root maggot.
H. 88. Cauliflower, variety experiment.
H 104. Cucumber, breeding.
H. 118. Muskmelon, breeding.
H. 134. Onion, seed versus sets.
H. 136. Onion, thinning experiment.
H. 137. Onion, transplanting vs. sown in the open.
H. 150. Pea of different seasons vs. one variety planted at different dates.
H. 204. Tomato, breeding.
H. 207. Tomato, methods of training.
H. 415. Irrigation of vegetables.
H. 356. Rhubarb, development from seed.

CEREAL

Ce. 1. Common spring wheat—test of varieties or strains.
Ce. 5. Oats—Test of varieties or strains.
Ce. 6. Barley—Test of varieties or strains.
Ce. 8. Beans—Test of varieties or strains.

FORAGE CROPS

Ag. 1. Indian corn, variety tests for ensilage purposes.
Ag. 16. Mangels, variety tests for yield and purity.
Ag. 17. Mangels, breeding of pure strains.
Ag. 20. Mangels, early vs. late seeding for fodder.
Ag. 36. Carrots, variety tests for yield and purity.
Ag. 37. Carrots, breeding of desirable types.
Ag. 66. Sugar beets, variety tests for yield and purity.
Ag. 76. Sunflowers, variety tests for yield and purity.
Ag. 95. Breeding improved strains of Agropyron spicatum.
Ag. 117. Breeding improved strains of soy beans.
Ag. 126. Alfalfa, variety tests for hardiness, yield, suitability.
Ag. 134. Alfalfa, irrigation for hay and seed production.
Ag. 146. Red clover, variety tests for yield and general suitability.
Ag. 201. Timothy, variety tests for yield and purity.
Ag. 221. Western rye, methods of seeding for hay production.
Ag. 231. White Dutch clover, variety tests for yield and suitability.
Ag. 241. Anual hay crops, variety tests for yield and suitability.
Ag. 241B. Legume varieties, variety tests for yield and suitability.
Ag. 241C. Other grasses, variety tests for yield and suitability.
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Ag. 251. Millets, variety tests.
Ag. 255. Miscellaneous grasses, variety tests.
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Ag. 258B. Hay and pasture mixtures experiment, alfalfa as a base.

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C. 44. "Dried manure" experiment.
C. 10. Sugar beet investigation.
C. 11. Agricultural meteorology.
C. 77. Jonathan apple investigation.

Project No.	Title.

POULTRY

P. 8. Loss of weight in eggs during incubation.
P. 15. Incubation costs.
Exp. (*a*) Fuel costs.
P. 22. Brooding costs.
Exp. (*b*) Fuel costs.
P. 56. Pedigree breeding for egg production (W.W.).
P. 58. Best hatching date for egg production.
P. 80. Dry vs. wet mash.
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P. 111. Breeding for fertility, hatchability and livability.
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P. 112. Transmission of sterility.
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Ap. 3. Control of swarming by periodic destruction of queen cells.
Ap. 8. Wintering in 4-colony cases.
Ap. 10. Wintering in single-colony cases.
Ap. 20. Returns from apiaries.
Ap. 21. Comparison of different sizes of hives.
Ap. 28. Study of honey flows.

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