DOMINION OF CANADA

DEPARTMENT OF AGRICULTURE

DOMINION EXPERIMENTAL FARMS

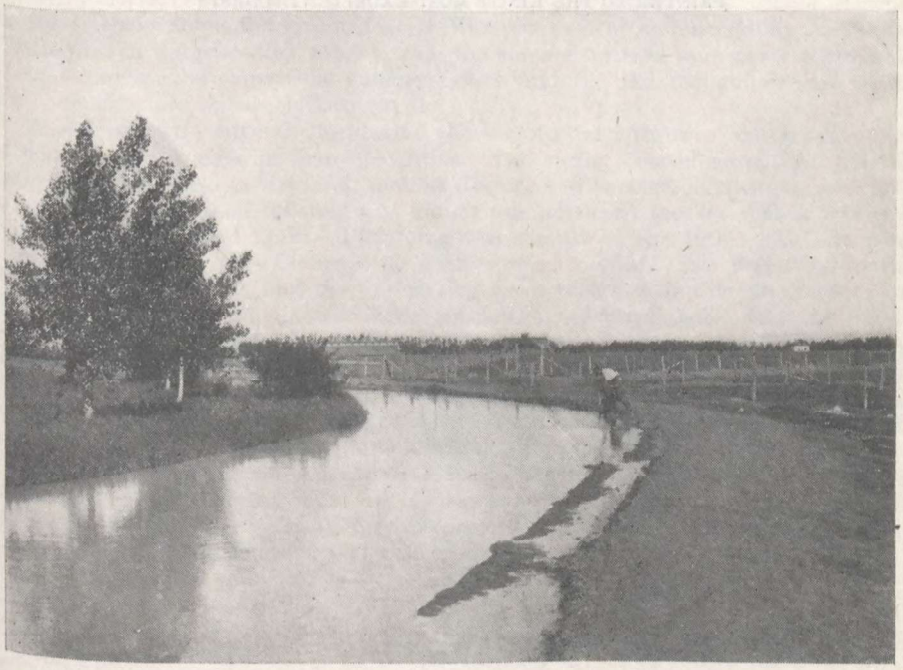
EXPERIMENTAL STATION

LETHBRIDGE, ALTA.

INTERIM REPORT OF THE SUPERINTENDENT

W. H. FAIRFIELD, M.S.

FOR THE YEAR 1921



View of main irrigation canal passing through the Experimental Station, Lethbridge.

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OTTAWA
F. A. ACLAND
PRINTER TO THE KING'S MOST EXCELLENT MAJESTY
1922

EXPERIMENTAL STATION, LETHBRIDGE, ALBERTA

REPORT OF THE SUPERINTENDENT, W. H. FAIRFIELD, M. S.

THE SEASON

The season of 1921 commenced quite favourably. While the previous fall was dry and the winter open, leaving little reserve moisture in the soil, the timely storms of March and April gave the crops a good start. The crop prospects looked favourable until the middle of June, but from then on grain as well as all other crops deteriorated rapidly. The results at threshing time proved very disappointing, and over the greater part of southern Alberta another crop failure has to be recorded for the season just passed. In the part of the province referred to there were approximately 12,000,000 bushels less wheat produced than in 1920. July showers being lighter in some districts than in others, though aiding somewhat at filling time, made the yield irregular in different localities, but in no case was it good. The most favoured locality was, perhaps, in the extreme southwest corner of the province, near the mountains.

One rather interesting feature in connection with grain yields that was commonly observed, was the fact that spring ploughed stubble land produced so very much better results than fall ploughed stubble land; in fact, instances were not unusual when spring ploughing yielded as well as summer-fallow. This seasonal condition is accounted for by the fact that in the case of summer-fallow there was so little rain in the preceding summer that the summer-fallows were never thoroughly wet, and during the winter the summer-fallow and the fall ploughing were blown bare of snow while the stubble caught it.

There was little soil drifting during the season, but cutworms and grasshoppers did considerable damage in many localities. The spring opened normally. On the Station the first work on the land, such as discing and surface cultivation, was done on April 2. A cold spell followed this and it was not until the 8th that it was possible to get on the land again. Ploughing was started on the 12th. The last frost in the spring was on May 31, when 30 degrees was recorded. The first frost in the fall was on September 9, and the first killing frost recorded at this Station was on October 26. The ground did not freeze up until very much later, allowing ample time to lift potatoes and similar crops. A particular advantage that resulted from the late fall in the irrigated areas was the chance it gave farmers to do fall irrigating, and it is gratifying to be able to say that the farmers availed themselves of the opportunity to a very much greater extent than ever before. This applies particularly to the Raymond, Lethbridge, and Coaldale districts.

The precipitation from August 1, 1920, to August 1, 1921, which constitutes what might be termed the "crop year," was much below normal, being but 10.96 inches. Only four other years in the past twenty had as low a rainfall as this year, as shown in the tables appearing later on in the report.

METEOROLOGICAL DATA FOR CALENDAR YEAR 1921

Month	Temperature F.			Precipitation	Bright Sunshine	Wind			
	Highest	Lowest	Mean			Hourly mean	Greatest mileage in 1 hour		
	°	°	°	inches	hours	miles	miles	direction	date
January	50·0	− 6·0	22·55	0·56	90·9	14·5	72	SW	14
February	60·0	−11·0	24·3	0·47	120·1	18·3	63	SW	6
March	61·0	−26·0	24·03	1·42	141·1	14·4	48	Varied	31
April	68·0	17·0	40·89	1·19	193·3	15·3	50	Varied	1
May	81·5	24·0	49·2	0·96	248·6	11·1	47	NW	11
June	87·0	39·0	61·6	1·04	308·9	12·6	40	W	11
July	96·0	43·0	64·2	3·23	344·5	11·3	36	W	20
August	89·0	38·0	62·05	0·46	318·3	10·9	48	W	21
September	81·0	27·0	49·55	1·29	187·7	14·6	53	W	26
October	79·0	16·0	48·9	0·23	204·0	15·4	47	W	28
November	65·0	−32·0	22·6	1·73	72·0	12·5	49	W	27
December	57·0	−21·0	21·1	0·19	92·5	16·0	58	W	11
Total for year				12·77	2,321·9				

Latest spring frost occurred on May 31, 1921 ..... 30·0°
First fall frost occurred on September 9, 1921 ..... 32·°
First killing frost occurred on October 26, 1921 ..... 16·0°
Total precipitation for the 4 growing months of April, May, June and July, 1921 ..... 6·42 inches
20 years average for the 4 growing months of April, May, June and July .... 8·00 inches
20 years average annual preciptation ..... 15·40 inches

SOME OBSERVATIONS CONCERNING THE CLIMATE OF SOUTHERN ALBERTA

That there are differences in the climatic conditions in various localities in southern Alberta both in regard to the rainfall and the frequency of summer frosts, is a recognized fact. The question is often asked by farmers as to how nearly representative Lethbridge is of the greater portion of this part of the province which the Experimental Station here located is intended to serve. The extensive development in irrigation that is now in progress only adds to the interest in this question. Unfortunately there are so few points where weather observations have been taken continuously for a sufficient number of years past that it is impossible to make as many comparisons as one would desire. However, from those that are available, the weather at Lethbridge appears to be quite reasonably representative as is indicated by some of the statistics that are here given, which have been obtained from the records of the Dominion Meteorological Service.

The length of time between the last frost in the spring and the first frost in the fall is perhaps of greater importance to the farmer on irrigated land than it is to the dry land farmer because of the greater diversity of crops grown under irrigation. The following gives some interesting facts concerning this point:—

FROST-FREE DAYS

	Average for 20 years days	Average for past 10 years only days
Lethbridge	104	110
Macleod	107	115
Medicine Hat	123	119
Brooks	...	98

At Sundial, Alberta, the data are only available from 1911 to 1916 inclusive. For these six years the average frost-free days are 111, as compared with 110 days at Lethbridge for the corresponding years.

With reference to precipitation, it is unfortunate that continuous records extending back even for ten years are available for such a few points in Southern Alberta. This is particularly true of all of that area lying east of Lethbridge. Realizing the importance of obtaining and having on record the annual precipitation from as many different points throughout southeastern Alberta as possible, rain gauges have been supplied to a certain number of farmers who are kindly reporting monthly to the Station here. A permanent record of the reports of these voluntary observers is being compiled for future reference.

The following summary of data taken from the records of the Dominion Meteorological Service covering points where considerable farming is being done is here presented because it will doubtless be of interest to many.

TOTAL ANNUAL PRECIPITATION

	Average for 20 years inches	Average for past 8 years inches
Lethbridge	15.40	14.63
Macleod	14.65	16.65
Medicine Hat	11.27	12.24
Claresholm	....	15.62
Vauxhall	....	12.35

The drought year of 1921 following the three preceding dry years has about exhausted the courage, not to mention the finances, of the farmers in southern Alberta. Much interest is consequently evinced in the record of rainfall during the past years, for the question as to whether or not a continuation of seasons as dry as the past four or five is probable, is one that is naturally agitating the minds of many.

As indicated in a preceding paragraph the precipitation at Lethbridge appears to be reasonably representative of quite a large adjacent area. A study month by month, therefore, of the Lethbridge records going back 20 years is of interest. Records are available from the Experimental Station since 1908, but prior to this date back to 1902 the record of precipitation is obtained from Mr. C. B. Bowman of the city of Lethbridge.

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TABLE showing precipitation at Lethbridge, giving the total for each season from August 1 to July 31. The reason for presenting it in this manner is that moisture received after July 31st has little effect on growing grain, but from this date on, during the fall, there is reason to believe that at least some of the moisture received in the form of rain and snow is carried over in the soil and subsoil for the use of the crop the following spring. Consequently, the total precipitation is given for what is termed the "crop year" rather than reporting for the total of the "calendar" year as is usually done.

Year	Aug.	Sept.	Oct.	Nov.	Dec.	Year	Jan.	Feb.	Mar.	April	May	June	July	Total for	
	inches	inches	inches	inches	inches		inches	inches	inches	inches	inches	inches	inches		inches
						1902	0·67	1·03	0·48	0·15	11·27	5·68	5·95	(Jan. to Aug.) 1902,	25·23
1902	0·69	0·84	0·02	0·43	0·84	1903	0·62	0·79	·89	0·33	2·95	1·12	1·86	Crop year 1903	11·38
1903	3·21	1·60	0·18	0·58	0·70	1904	0·50	0·90	1·03	0·41	2·86	1·80	0·96	" 1904	14·73
1904	1·19	0·52	0·85	0·03	0·35	1905	1·45	0·05	0·74	0·56	1·13	2·68	1·44	" 1905	10·99
1905	1·99	0·80	1·13	1·36	0·25	1906	0·22	0·20	0·54	1·30	8·60	2·31	0·83	" 1906	19·53
1906	4·70	0·16	1·93	0·81	0·88	1907	1·52	0·30	0·34	1·08	1·14	3·64	1·43	" 1907	17·93
1907	2·30	3·24	0·05	0·14	0·32	1908	0·27	0·75	1·10	0·67	2·78	7·64	0·41	" 1908	19·67
1908	0·89	0·73	1·16	0·02	0·35	1909	0·49	0·28	0·37	1·51	4·27	0·62	1·98	" 1909	12·67
1909	0·21	0·49	0·40	0·53	0·54	1910	0·24	0·83	0·17	0·28	0·79	0·53	0·09	" 1910	5·10
1910	1·07	2·01	0·59	0·41	0·94	1911	0·70	0·52	0·32	0·82	1·90	4·71	2·27	" 1911	16·26
1911	3·63	4·16	0·57	0·95	0·77	1912	0·69	0·40	0·44	0·20	0·66	1·73	2·78	" 1912	16·98
1912	1·41	2·61	1·07	0·99	0·23	1913	0·80	0·30	0·42	0·52	1·70	4·70	1·29	" 1913	16·04
1913	1·93	1·65	0·50	0·36	nil	1914	1·55	0·96	1·12	0·54	0·29	2·48	0·93	" 1914	12·31
1914	3·59	1·07	2·17	0·63	1·19	1915	0·50	0·94	0·22	0·04	3·03	4·84	3·44	" 1915	21·66
1915	0·96	1·32	0·96	0·75	0·27	1916	1·09	0·86	0·90	0·46	3·77	3·54	3·33	" 1916	18·21
1916	2·97	4·66	1·99	0·49	0·51	1917	0·73	0·27	0·10	1·57	0·95	1·42	1·37	" 1917	17·05
1917	2·00	1·67	0·72	nil	1·13	1918	0·46	0·76	0·66	0·13	0·58	0·75	0·85	" 1918	9·71
1918	1·23	1·07	0·24	0·43	0·46	1919	0·06	0·95	0·75	0·47	1·75	0·56	1·06	" 1919	9·03
1919	1·05	2·04	1·78	1·26	0·55	1920	0·84	1·21	0·89	4·37	1·66	0·40	2·59	" 1920	18·64
1920	0·20	0·05	0·99	0·06	0·79	1921	0·56	0·47	1·42	1·19	0·96	1·04	3·23	" 1921	10·96
1921	0·46	1·29	0·23	1·73	0·19										
Average	1·78	1·60	0·88	0·60	0·56		0·70	0·64	0·64	0·83	2·65	2·61	1·91		15·40

Ten inches of snow is computed as one inch of precipitation.

ANIMAL HUSBANDRY

HORSES

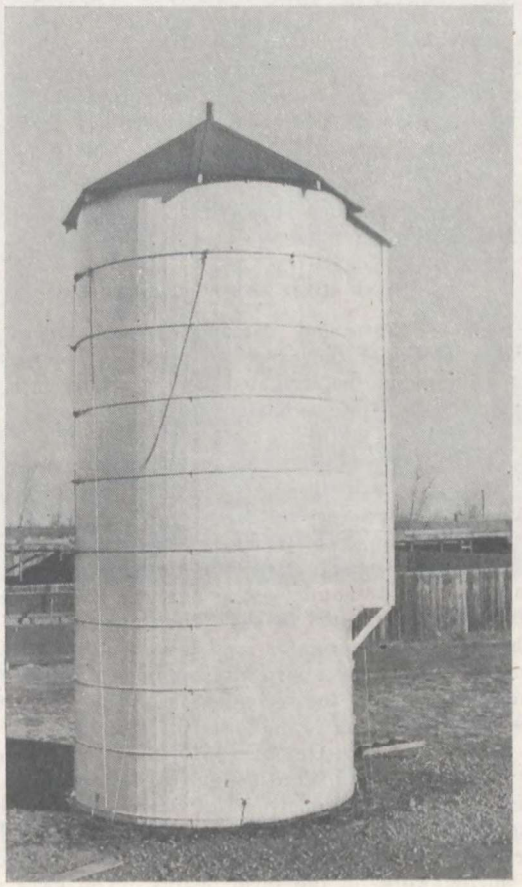
Project 2.—There are 19 work horses, 1 team of drivers and 5 young horses kept at this Station. With the exception of one team of pure-bred Clyde mares, they are all grades. As in the past, they were all wintered outside in a corral with an open straw shed for shelter, except the drivers and two draught teams which were stabled. This method of wintering has proved to be entirely satisfactory. All of the horses improved in condition during the winter and were in excellent condition to begin the spring's work. The saving of labour required in feeding and caring for horses wintered in this way as compared with stabling is considerable.

In the late fall of 1921 the young horses and one team of work horses were put out to pasture. The other horses are being wintered in the same manner as during the previous winter. None of the mares had colts.

CATTLE

FEEDING STEERS

Project 1.—A feeding test with 40 head of steers comparing as a roughage alfalfa hay with a mixture of chopped straw and alfalfa, was concluded May 12, 1921. The detailed results of this experiment were included in last year's interim report, so will not be repeated here.



A wood stave silo just completed. 12 ft. × 26 ft.

To get some information as to the value of feeding silage along with alfalfa as a roughage to steers, and also to compare corn and sunflower ensilage, a feeding test was started December 16 with 39 head of steers. The steers were divided into 3 lots with 13 in each. Each lot throughout the test was to receive the same quantity of grain made up of a mixture of equal parts of ground oats and barley, but the roughage supplied was to be varied as follows:—

Lot 1—Alfalfa hay.
Lot 2—Alfalfa hay and corn silage.
Lot 3—Alfalfa hay and sunflower silage.

The steers are being fed in the open in corrals where they have access to water at all times. For shelter other than the 7 foot board fence surrounding the corral they are provided with a straw shed open to the south. The results of the test are being looked forward to with considerable interest, not only for the comparison between the two kinds of silage, but also for the results from the lots receiving silage as compared with the lot receiving alfalfa hay alone.

SHEEP

FEEDING LAMBS

Project 3.—An experiment similar to that with steers, planned along identical lines, was started with lambs on January 5, with 120 range lambs divided as equally as possible as to weight and general quality into three lots of 40 each. For grain, the lambs were to receive whole oats. The roughage to be supplied to the different lots was to be the same as for the steers.

Lot 1—Alfalfa hay.
Lot 2—Alfalfa hay and corn silage.
Lot 3—Alfalfa hay and sunflower silage.

PASTURING SHEEP IN FOREST RESERVE

October, 1921, completed the second year of the experiment in pasturing sheep on the forest reserve. The object of the experiment was to determine, if possible, the feasibility of alfalfa growers on the irrigated land carrying fairly good sized flocks of sheep on their farms and for summer pasture using the nearby forest reserve in the Rocky Mountains.

As was pointed out in last year's interim report, such farmers can produce large quantities of cheap winter feed principally in the form of alfalfa, but are handicapped for summer pasture, for there is no prairie pasture worth mentioning that is available to them. Consequently, if it is possible to make use of the summer feed that is now going to waste in the forest reserve just west of the irrigated land in the Lethbridge district, it will be not only an economic saving but will be a great aid in developing the live stock industry on the irrigated farms. The importance of increasing the live stock holdings on the high priced irrigated land is so well recognized by the thoughtful farmers in the district that no special comment in this connection is necessary.

The financial returns for this, the second year of the test, although much more satisfactory than the first year owing to the lower price of feed, are still disappointing.

Description of Experiment.—In October, 1919, nine hundred grade Merino ewes were provided for the test. A shed large enough to accommodate about 1,000 ewes while lambing was constructed, the dimensions of which was 140 feet by 64 feet. The ewes both seasons have been bred to begin lambing about the middle of March. The object of this rather early lambing is to have much of this done and out of the way before the press of spring work on the farm begins. The ewes were sheared early

enough in May to allow time for branding and dipping before the first of June, which is as early as it is possible to start pasturing in the forest reserve, and then only in the lower parts. In the upper reaches there is not enough growth in many seasons to provide feed before the 15th of June. The practice is to transport the sheep to and from the reserve by rail, as trailing is out of the question. The result of the experiment seems to hinge largely on whether this cost for transportation by rail to and from the summer pasture can be borne by the sheep. The charge for pasturing made by the Forestry Branch is very reasonable, being 2 cents per head per month, no charge being made for the "followers"—that is, the suckling lambs. The freight rate during the two seasons that the experiment has been carried on was unusually high, except for the return trip in October, 1921, the live stock rate having been reduced two months earlier. In this connection it might be well to point out that the

Dipping sheep. The swimming vat is thirty feet long.

Canadian Pacific Railway Company a few years ago had a special rate in effect for sheep being shipped to the forest reserve which was 25 per cent less than the usual live stock rate. No doubt if the volume of business increased to any material extent the company would reinstate this special rate.

In caring for the sheep while on pasture in the mountains it has been our custom to put a man and a boy in charge, and to supply them with two pack ponies.

Our experience during the past two summers has demonstrated that it is possible on the choice pasture to bring the March and April lambs along fast enough to have half or two thirds of them fit for market in August. This is a distinct advantage.

for by so doing they can be offered for sale from one to three or four weeks before any fat lambs come to market from the prairie ranges, which means that they can demand a somewhat better price. Any lambs not fit for market in August can come back to the farms and be fattened and go on the market after the run of the lambs from the prairie ranges is over.

As to the date of moving the sheep out of the reserve, they have been shipped both seasons by the first of October. To avoid, as much as possible, danger from September snowstorms the practice has been that of arranging to have a portion of the allotted range nearest the railway left ungrazed early in the summer, to run the sheep on during September.

An observation might not be out of place here as to the possibility of lessening the cost of wintering by providing stubble fields for winter pasture rather than having to feed hay, except, of course, in storms and during the lambing period.

Details of test October, 1920, to October, 1921.—When the sheep returned from the mountains in October, 1920, the ewes were separated from the lambs and 150 were culled out as being too old to be worth breeding. These were put in a feeding lot, fattened and sold.

Oxford Down bucks were used, except in the case of fifty high-grade Merino ewes which were bred to a pure-bred Lincoln. The progeny of this cross will in turn be bred to the Corriedale buck that is now on the Station. The bucks were turned with the ewes October 18 and taken out November 29. The lambs at this date were thrown in with the ewes and they were all run as one band for the winter. Stubble fields in the neighbourhood were rented and the sheep were pastured until the middle of February. They were then brought in and fed on alfalfa hay until the 1st of March. On this date the feeding of sunflower silage was begun and continued until the sheep were moved to summer pasture. A small quantity of grain was also fed for a short period.

The amount of feed given varied somewhat. When lambing the daily ration consisted of 1½ pounds of alfalfa, ½ pound of oats, and about 1½ pounds of sunflower silage. After lambing, the grain was cut off and the sunflower silage increased to about 2½ pounds per day.

On May 26 the sheep were sheared. The wool clip for the past two years averaged 8½ pounds per head. Immediately after shearing the sheep were dipped (a second dipping is given in the fall before winter sets in). The sheep were loaded on cars at Lethbridge on the evening of June 2 and reached Coleman about five o'clock on the morning of June 3. There were loaded between 80 and 85 head of mature sheep in each deck, or 130 head in all, counting lambs. In neither season have we had any losses while the sheep were in transit. By taking advantage of the cool night run, neither the ewes nor the lambs seem to feel any ill effects from the train trip.

Statement for the year.—There were 642 ewes bred. During the winter 17 died from various causes, so that there were 625 to go to pasture. There were 657 lambs shipped, making a lamb crop of 105 per cent. During the summer in the mountains there were 13 ewes and 6 lambs lost. On August 20, 251 of the best wether lambs and 122 yearling wethers were sold. The lambs averaged 71 pounds apiece, weighed off cars at Calgary. The sheep were shipped back to the Station on October 5. The expenses for the year were as follow:—

Winter pasture on stubble fields	$ 774 00
Alfalfa, 115,000 pounds at $10 per ton	575 00
Silage, 105,000 pounds at $5 per ton	262 50
Oats, 30,800 pounds at $25 per ton	385 00
Salt, 3,000 pounds at $40 per ton	60 00
Summer pasture on forest reserve	91 29
Total freight to and from forest reserve	682 15
Shearing	146 25
Labour, total for 12 months	1,476 00
	$4,452 19

FINANCIAL STATEMENT

Inventory, October, 1920—	
Number of ewes bred, 642, valued at $6.25	$ 4,012 50
Number of cull ewes, 150, valued at $1.25	187 50
Number of ewe lambs on hand, 404, valued at $5.25	2,121 00
Number of wether lambs on hand, 122, valued at $5	610 00
Number of bucks on hand, 20, valued at $25	500 00
Expenses, October, 1920, to October, 1921	4,452 19
	$11,883 19
Sales—	
146 old ewes	$ 807 69
251 lambs and 122 yearlings, net receipts	1,813 45
Net wool returns	1,013 93
Inventory, October, 1921—	
Number of ewes to be bred, 900, valued at $6	$ 5,400 00
Number of cull ewes to be bred, 53, valued at $1	53 00
Number of ewe lambs on hand, 330, valued at $5.25	1,732 50
Number of wether lambs on hand, 70, valued at $4.75	332 50
Number of bucks on hand, 19, valued at $20	380 00
	$11,533 07
Loss	350 12
	$11,883 19

Not unlike the grain farmer, the stockman has had to contend with the slump in the market prices. With 6½ cents for lambs at the time of marketing, as compared with 11½ cents the previous season, combined with a fall in the price of wool at the same ratio, the small net loss on the year's operations is to a great extent accounted for.

FIELD HUSBANDRY

TWO FARMS

Half the land on the Station can be irrigated; the balance is devoted to dry or non-irrigated farming. Two experimental farms are therefore really being operated at Lethbridge. Their object is, not to compare the relative merits of the two systems but to study their individual problems. To aid in doing this and to prevent confusion, the part of this report dealing with field husbandry, horticulture, cereals and forage crops is divided; the results from the dry farm are first dealt with and then the results from the irrigated farm.

CROP ROTATIONS (DRY LAND)

Project 11a.—The need of a satisfactory rotation for dry land farming in southern Alberta becomes more apparent each year. The present system generally followed of growing grain exclusively, has depleted the organic matter of the soil and destroyed its fibre to such an extent that drifting has become a serious menace and the water-holding capacity of the soil has undoubtedly been greatly reduced. In an attempt to meet this condition, an experiment in crop rotations has been conducted at this Station for the past eleven years. These rotations include straight grain crops, grain with annual hay and pasture crops, and grain with alfalfa and hoed crops, barnyard manure being applied on some of the rotations.

It has been found extremely difficult to arrange a satisfactory rotation to meet the conditions encountered on the dry farm, and so far no entirely satisfactory one has been found. This year two new rotations were started, one containing grain, western rye grass and alfalfa and the other grain and sweet clover. Both of these rotations contain a crop that returns fibre and humus to the soil.

Records have been kept each year of all items of expense and returns since the rotations were started. Prior to 1920 a fixed set of values was used in determining the expenses and returns. In computing the results for the past two seasons values were based on current prices.

COST VALUES FOR THE SEASON 1921

Rent, dry land, per acre	$ 2 00
Rent, irrigated land, per acre	10 00
Manure, cost charged equally to all years of the rotation, per ton	1 00
Seed wheat (winter), per bushel	2 50
Seed wheat (spring), per bushel	1 75
Seed oats, per bushel	44
Seed barley, per bushel	80
Seed peas, per bushel	3 00
Seed rye, per bushel	1 50
Seed corn, per pound	10
Seed alfalfa, per pound	75
Seed potatoes, per ton	30 00
Twine, per pound	20
Machinery, per acre	1 00
Manual labour, per hour	33
Horse labour per horse, per hour	15
Threshing wheat and barley, per bushel	15
Threshing oats, per bushel	10

RETURN VALUES FOR THE SEASON 1921

Wheat, per bushel	1 00
Oats, per bushel	34
Barley, per bushel	50
Peas, per bushel	2 00
Potatoes, per ton	20 00
Alfalfa hay, per ton	10 00
Corn ensilage, per ton	5 00
Wheat straw, per ton	2 00
Oat straw, per ton	4 00
Barley straw, per ton	4 00
Pea straw, per ton	2 00
Pasture, one horse or cow, per month	2 00
Pasture, one sheep, per month	50

Cultivation of Rotations (Dry land).—The summer-fallow fields of all the rotations were surface cultivated in the spring, some with a disc, but most of them with a spring tooth cultivator.

They were ploughed to a depth of from 6 to 7 inches in May or early in June, harrowed down after ploughing, and kept clean from weeds throughout the summer by cultivating with the duckfoot cultivator and rod weeder. From three to five cultivations were found necessary to keep the weeds in check. Fields growing hoed crops were cultivated and hoed sufficiently during the summer to keep down weeds. In the spring previous to seeding on summer-fallow the fields have been cultivated with a spring tooth cultivator. Where late sown crops such as corn were grown two cultivations were usually given before seeding.

All fields not summer-fallowed or in hoed crops the previous season were ploughed to a depth of about 6 inches early in April and harrowed down immediately. Fields in hoed crops the previous season usually receive the same spring treatment as land that had been summer-fallowed.

Seeding of Rotations (Dry land).—Winter wheat was seeded at the rate of 75 pounds per acre, September 15th to 20th; winter rye 50 pounds per acre September 25th; spring wheat 75 pounds per acre April 11th to May 3rd; oats 85 pounds per acre April 19th to 26th; corn 15 to 20 pounds per acre May 24th; and mixed oats and peas, 105 pounds peas and 15 pounds oats, April 18th.

ROTATION "A", WHEAT CONTINUOUSLY

The growing of wheat continuously without an intervening summer-fallow has been practised by many farmers for a number of years, but during the past four dry years the results of this method of farming have been a financial failure.

ROTATION "B", TWO YEARS' DURATION

First year.—Wheat.
Second year.—Summer-fallow.

The alternating of wheat and summer-fallow is a practice that is followed by many farmers in the dry belt, as it seems the most logical way of conserving moisture for the production of a good crop and incidentally of combatting weeds. It also has the advantage of making more of the plant foods in the soil immediately available, thus making possible the production of a crop with minimum water costs.

The principal objection to this rotation is that it changes the texture of the soil so quickly, for perhaps in no way is the fibre of the soil destroyed as rapidly as by the clean summer-fallow, and then when the fibre content becomes low the natural mulching of the soil during the summer and winter when lying fallow makes it very susceptible to drifting in the spring.

Notwithstanding the disadvantages that result from the use of summer-fallow, it seems impossible to devise any practical method of cultivation for the dry belt that will ensure reasonable chances of getting a profitable crop without at least having part of the farm summer-fallowed each year. In a dry season the only hope of obtaining a crop on dry land is by having in reserve moisture from the year before which has been saved and stored in the subsoil. The summer-fallow makes this possible, for by preventing the growth of all vegetation no moisture is lost except through evaporation, and this is very much less than is popularly supposed. A substitute for summer-fallow in the form of some intertilled crop is naturally advocated, but the objection to this is that in the drier areas the moisture required to produce the intertilled crop in very dry seasons lessens the amount of stored moisture in the subsoil to such an extent that the grain crop following is reduced, as compared with the crop following a straight fallow. It is only fair to state, however, that in such

a season the crop in both cases will be light. In localities where the rainfall is less scanty there is everything in favour of and absolutely no objection to the summer-fallow substitute.

It is obvious that this method of alternate summer-fallow and wheat cannot be followed indefinitely, because, as previously observed, the fibre in the soil is lessened to such an extent that drifting is almost certain to become a serious menace, and this is particularly true where large areas of from one to several hundred acres in extent are summer-fallowed in a block.

It has yet to be determined whether it will be possible to devise some means whereby the summer-fallow can be continued and still hold soil drifting under control.

ROTATION "C," THREE YEARS' DURATION

First year.—Summer-fallow.
Second year.—Wheat.
Third year.—Wheat or coarse grain.

This rotation conforms to the practice of a greater number of farmers better, perhaps, than does any other rotation carried on at this Station. It has the advantage of rotation "B" in that only one-third instead of one-half of the farm is lying idle. The fibre is not destroyed as rapidly as with the more frequent summer-fallow, and the crop planted on land which was cropped the previous year is not so likely to be damaged by soil-drifting as is that planted on summer-fallow. This rotation has the disadvantage that the crop following wheat may be a failure in a dry season, as was the case this year, and the loss of soil fibre, while perhaps not so rapid as on the two years' rotation, is still going on, making the danger of soil drifting on the summer-fallowed portion an important factor.

ROTATION "M," SIX YEARS' DURATION

First year.—Summer-fallow.
Second year.—Wheat.
Third year.—Coarse grains. Manured in fall.
Fourth year.—Summer-fallow.
Fifth year.—Peas and oats for hay.
Sixth year.—Barley or oats.

Rotation "M" is similar to rotation "C" in that each field is summer-fallowed every third year. A crop of peas and oats is, however, substituted for the wheat crop every sixth year, and barnyard manure is applied once in six years. This rotation introduces a hay crop to meet the demands of the dry farmer for feed for his stock, and it also provides a legume which helps to keep up the nitrogen content of the soil. The same objections may be raised to this rotation that were noted with rotation "C," viz., the danger of crop failure on the fields planted two years in succession and the loss of fibre and consequent soil-drifting on the summer-fallow. The high price that has prevailed for seed peas has mitigated against the profitable use of this crop for hay.

ROTATION "S," NINE YEARS' DURATION

First year.—Summer-fallow.
Second year.—Hoed crop.
Third year.—Wheat.
Fourth year.—Summer-fallow.
Fifth year.—Wheat.
Sixth year.—Coarse grains.
Seventh year.—Summer-fallow.
Eighth year.—Peas and oats for hay. Seeded to fall rye.
Ninth year.—Rye pasture.

In this rotation, as in the two previous ones, each field is summer-fallowed every third year. It differs from rotation "M" in that a hoed crop and fall rye for pasture are substituted for grain crops. Manure is added to each field and a legume is grown on each field once in nine years instead of once in six years. The hoed crop is of assistance in keeping weeds in check, although the returns of this crop in dry years have often been disappointing.

ROTATION "T," TEN YEARS' DURATION

First year.—Summer-fallow.
Second year.—Wheat.
Third year.—Oats or barley.
Fourth year.—Seeded to alfalfa in rows.
Fifth year.—Alfalfa hay or seed.
Sixth year.—Alfalfa hay or seed.
Seventh year.—Alfalfa hay, seed or pasture.
Eighth year.—Summer-fallow.
Ninth year.—Hoed crop.
Tenth year.—Wheat. manured on stubble.

This rotation has been carried on in an attempt to find a crop that would replace the fibre of the soil and at the same time give profitable returns to the farmer. For this purpose each field is seeded to alfalfa every tenth year and kept in alfalfa for five years; thus one-half of the area devoted to the experiment is in this crop.

The alfalfa is seeded in rows 35 inches apart, making the stand thinner than if sown broadcast or in close drills, and thus giving each plant more moisture and nourishment and permitting intercultivation to destroy weeds and so aid in conserving moisture. This method is also more favourable for the growing of alfalfa for seed. The yield of seed is, however, uncertain. This year the seed crop was a failure, due to a combination of circumstances. The blooms "set" seed poorly, partly because of the extremely dry weather, but principally on account of other reasons which have not yet been definitely determined. Heavy winds shattered the few seed pods from the stems as fast as they ripened, so that it was impossible to save even the light crop that was produced. Regardless of the disadvantages encountered, the net financial returns from this rotation have been better than the returns of most of the other dry land rotations.

ROTATION "J," SIX YEARS' DURATION

First year.—Summer-fallow Manured before ploughing.
Second year.—Wheat.
Third year.—Wheat.
Fourth year.—Oats seeded down to Western rye grass and alfalfa.
Fifth year.—Hay.
Sixth year.—Hay or pasture.

ROTATION "Z," FIVE YEARS' DURATION

First year.—Summer-fallow. Manured before ploughing.
Second year.—Wheat.
Third year.—Oats.
Fourth year.—Seeded to sweet clover (without a nurse crop).
Fifth year.—Hay or pasture.

Both rotations "J" and "Z" are arranged to provide hay and pasturage, and to keep up the nitrogen and fibre of the soil. This is the first year for these rotations at this Station, so no comments can be offered.

LIGHT CROP 1 VS. SUMMER FALLOW

An experiment has been conducted at this Station since 1914 to determine the feasibility of substituting a thinly seeded hoed crop for summer-fallow on dry land wheat farms. The plan of the experiment has been to grow one acre of Marquis wheat each year on land that had grown potatoes the year previous, on land that had grown corn the year previous, and on land that had been summer-fallowed the year previous, thus using a total of six acres in the experiment. Both the potatoes and corn were planted in check rows three feet apart each way. By seeding in this way there were relatively few plants to absorb the moisture from the soil, and the crop could be cultivated both ways, thus making it possible to keep the field clean and conserve the moisture of the soil with a minimum amount of labour. The yields of wheat for the past seven years were:—

LIGHT HOED CROP VERSUS SUMMER-FALLOW, 1915 AND 1921

—	1915	1916	1917	1918	1919	1920	1921	Average for 7 years
	bush.lb.	bush.lb.	bush.lb.	bush.lb.	bush.lb.	bush.lb.	bush.lb.	bush.lb.
Wheat following fallow	59–10	44–0	21–15	18–5	2–5	20–40	6–0	24–28
Wheat following potatoes	53–0	37–25	20–50	7–25	nil	18–30	10–30	21–6
Wheat following corn	51–40	43–40	22–10	10–00	nil	17–50	5–0	21–28

The results of the experiment show the average yields of wheat for seven years on summer-fallow to be about 4 bushels per acre more than the yields on potato and corn land. To offset the 4-bushel loss in yield of wheat we have the following production of corn and potatoes for the eight years of the experiment. The variety of corn used is Squaw. This is very low-growing, but is the earliest sort known. Gold Coin was the variety of potatoes used.

YIELD PER ACRE OF CORN AND POTATOES USED AS SUBSTITUTES FOR SUMMER-FALLOW GROWN ON SPRING PLOUGHED STUBBLE

Year	1914	1915	1916	1917	1918	1919	1920	1921	Average for 8 years
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
Shelled corn	1,156	580	288	1,337	nil	nil	1,683	nil	631
Potatoes	6,130	12,145	11,815	4,960	735	nil	nil	nil	4,473

The yields obtained from both corn and potatoes, as indicated in the table, are low, but the cost of production is also low, for in addition to the seed and labour of putting it in, the work of cultivation during the summer is little greater than in maintaining a good fallow. The objection that the average farmer would raise to the growing of potatoes over large acreages would be the difficulty in getting labour to lift the crop in the fall. With corn this objection cannot be made, for in the conception of this experiment the idea was that providing a reasonable yield of grain could be obtained it would be practicable to "hog" it off in the fall and winter. With our light winter snowfall this is quite practicable, for not only will hogs harvest the crop with alacrity, but cattle, sheep and horses show a great liking for a patch of this kind.

The average yield of corn for the eight years, notwithstanding the fact that there was a total failure in three of them, amounted to 631 pounds of shelled corn per acre or 11¼ bushels. The value of having a field of this kind to turn in a bunch of growing pigs, or, in fact, any kind of live stock, is quite obvious.

In most seasons the corn fully matured, and even in the years where this was not the case there was no difficulty in selecting enough mature ears for seed the following year. The Squaw corn is extremely low-growing and the short but numerous ears all grow close to the ground.

It is planned to continue this experiment with corn, but sunflowers are to be substituted for the potatoes.

DRY LAND ROTATIONS

Rotation "A" (wheat *continuously*)

Rotation year	Crops 1920	Crops 1921	Area	Items of expense in raising crop. Per acre: Rent and manure	Seed, twine, and use of machinery	Manual labour: Hours	Manual labour: Cost	Horse labour (including teamster): Hours: 2-horse team	Hours: 3-horse team	Hours: 4-horse team	Value of horse labour	Cost of threshing	Total cost of 1 acre	Cost of 1 bushel	Cost of 1 ton	Height of stubble	Particulars of crop. Per acre: Weight: Grain	Weight: Straw	Weight: Hay	Weight: Hoed crop ensilage	Value of crop per acre	Profit or loss per acre
			ac.	$ c.	$ c.	No.	$ c.	No.	No.	No.	$ c.	$ c.	$ c.	$ c.	$ c.	ins.	lbs.	lbs.	lbs.	lbs.	$ c.	$ c.
9	Wheat	Wheat	1·57	2 00	3 19	.....	.....	2·23	.....	4·99	5·97	.....	11·16	.....	.....	.....	nil	nil	.....	.....	.....	−11 16

Rotation "B" (two years duration)

2	Wheat	Summer-fallow	1·57	2 00	1 00	.....	.....	.....	0·70	7·75	7 55	.....	10 55	.....	.....	.....	.....	.....	.....	.....	.....	−10 55
1	Summer-fallow	Wheat	1·57	2 00	3 45	1·83	0 60	.....	0·96	1·48	2 14	1 58	9 77	0 75	.....	5	634	1,108	.....	.....	11 68	1 91
	Aggregate	.....	3·14	4 00	4 45	1·83	0 60	.....	1·66	9·23	9 69	1 58	20 32	.....	.....	.....	.....	.....	.....	.....	11 68	.....
	Average per acre	.....	.....	2 00	2 22	0·92	0 30	.....	0·83	4·62	4 85	0 79	10 16	.....	.....	.....	.....	.....	.....	.....	5 84	4 32

Rotation "C" (three years duration)

2	Summer-fallow	Wheat	1·57	2 00	3 45	1·17	0 39	.....	1·17	1·48	2 29	1 27	9 40	1 12	.....	5	506	1,082	.....	.....	9 51	0 11
3	Wheat	Oats	1·57	2 00	1 85	.....	.....	1·60	.....	4·99	5 65	.....	9 50	.....	.....	.....	nil	nil	.....	.....	.....	− 9 50
1	Oats	Summer-fallow	1·57	2 00	1 00	.....	.....	.....	0·70	7·59	7 60	.....	10 60	.....	.....	.....	.....	.....	.....	.....	.....	−10 60
	Aggregate	.....	4·71	6 00	6 30	1·17	0 39	1·60	1·87	14·06	15 54	1 27	29 50	.....	.....	.....	.....	.....	.....	.....	9 51	.....
	Average per acre	.....	.....	2 00	2 10	0·36	0 13	0·53	0·62	4·69	5 18	0 42	9 83	.....	.....	.....	.....	.....	.....	.....	3 17	− 6 66

Rotation "M" (six years duration)

4	Summer-fallow	Peas and oats	1·25	4 00	6 40	0·80	0 26	1·66	.....	1·66	2 59	.....	13 25	.....	10 49	.....	.....	.....	2,526	.....	12·63	− 0 62
5	Peas and oats	Oats	1·25	4 00	1 85	.....	.....	1·60	.....	6·26	6 83	.....	12 68	.....	.....	.....	.....	.....	90	.....	0 45	−12 23
6	Oats	Summer-fallow	1·25	4 00	1 00	.....	.....	.....	.....	6·00	5 58	.....	10 58	.....	.....	.....	.....	.....	.....	.....	.....	−10 58
1	Summer-fallow	Winter wheat	1·25	4 00	4 16	0·80	0 26	.....	1·20	1·33	2 17	1 34	11 93	1 33	.....	5	536	1,136	.....	.....	10 07	− 1 86
2	Winter wheat	Oats	1·25	4 00	2 09	0·80	0 26	.....	1·06	5·40	6 78	0 36	13 49	5 44	.....	5	88	170	.....	.....	1 22	−12 27
3	Oats	Summer-fallow	1·25	4 00	1 00	.....	.....	.....	.....	6·40	5 95	.....	10 95	.....	.....	.....	.....	.....	.....	.....	.....	−10 95
	Aggregate	.....	7·50	24 00	16 50	2·40	0 78	3·26	2·26	28·05	29 90	1 70	72 88	.....	.....	.....	.....	.....	.....	.....	24 37	.....
	Average per acre	.....	.....	4 00	2 75	0·40	0 13	0·54	0·38	4·68	4 98	0 28	12 14	.....	.....	.....	.....	.....	.....	.....	4 06	− 8 08

Rotation "S" (nine years duration)

8	*Peas and oats*	*Winter rye*	*1·25*	*3 33*	*3 25*					*9·84*	*9 15*		*15 73*				pastu	red 1 days.	horse	*16·8*	*1 06*	*−14 67*
9	*Winter rye*	Summer-fallow	*1·25*	*3 33*	1 00					11·40	10 60		14 93									−14 93
1	Summer-fallow	Corn	1·25	3 33	2 80			1·86		3 80	4 71		10 84							nil		−10 84
2	Corn	Wheat	1·25	3 33	3 24	0·80	0 26		1·06	1·86	2 56	0 84	10 23	1 73		5	354	366			6 27	3 96
3	Wheat	Summer-fallow	1·25	3 33	1 00					8·94	8 31		12 64									−12 64
4	Summer-fallow	Winter wheat	1·25	3 33	4 16	0 80	0 26			2·54	2 36	0 74	10 85	2 20		5	196	48			4 98	− 5 87
5	Winter wheat	Oats	1·25	3 33	1 85			1·60		6·40	6 96		12 14						76		0 15	11 99
6	Oats	Summer-fallow	1·25	3 33	1 00					9·40	8 74		13 07									−13 07
7	Summer-fallow	Peas and oats	1·25	3 33	6 40	0·80	0 26	1·66		1·20	2 16		12 15		12 76				1,904		9 52	− 2 63
	Aggregate		11·25	29 97	24 70	2·40	0 78	5·12	1·06	55·38	55 55	1 58	112 58								21 98	
	Average per acre			3 33	2 74	0·27	0 09	0·57	0·12	6·15	6 17	0 18	12 51								2 44	−10 07

Rotation "T" (ten years duration)

3	Oats	Alfalfa seeding	1·57	3 20	3 25					4·99	4 65		11 10						nil			−11 10
4	Alfalfa seeding	Alfalfa seed	1·57	3 20	3 25			6·37			4 01		10 46				nil					−10 46
5	Alfalfa seed	Alfalfa seed	1·57	3 20	3 25			8·92			5 62		12 07				nil					−12 07
6	Alfalfa seed	Alfalfa seed	1·57	3 20	3 25			8·92			15 62		12 07				nil					−12 07
7	Alfalfa seed	Summer-fallow	1·57	3 20	1 00					17·25	16 04		20 24									−20 24
8	Summer-fallow	Corn	1·57	3 20	4 51	28·19	9 30	4·47	1·27	1·53	5 23		22 24		16 62					2,675	6 69	−15 55
9	Corn	Wheat	1·57	3 20	3 19			1·80		1·40	2 43		8 82				nil					− 8 82
10	Wheat	Summer-fallow	1·57	3 20	1 00					9·87	9 18		13 38									−13 38
1	Summer-fallow	Winter wheat	1·57	3 20	3 23	0·75	0 25		1·91	1·06	2 47	1 35	10 71	1 17		5	548	344			9·47	1 24
2	Winter wheat	Oats	1·57	3 20	1 85			1·69		4·99	5 71		10 76				nil	nil				−10 76
	Aggregate		15·70	32 00	27 78	28·94	9 55	32·17	3·18	41·09	60 96	1 35	131 85								16 49	
	Average per acre			3 20	2 78	2·89	0 96	3·22	0·32	4·11	6 10	0 14	13 18								1 61	−11 56

CULTURAL EXPERIMENTS

Project 9.—In the spring of 1921 a revised set of cultural experiments was started. Uniform land was chosen for the work, part of which was virgin prairie and the remainder had only been cropped one year in wheat since breaking.

The land was divided into three ranges with 20-foot roads between the ranges, the plots being one-tenth of an acre in size and separated by 4½-foot paths.

Following in tabular form is given the outline of the new cultural investigational work now under way. It is hoped that the results of these experiments may prove of value in aiding to solve some of our dry land problems.

For these experiments 207 plots are required, as a three-year rotation is used in every case. With the exception of the summer-fallow substitute experiment, and where otherwise specified, the rotation is: first year summer-fallow, second year wheat, third year wheat. No manure is applied to any of the plots except those indicated in the application of manure experiment.

SUMMER-FALLOW SUBSTITUTES

—	1st year	2nd year	3rd year
Plot 1	Summer-fallow.	Potatoes	Wheat
Plot 2	"	Corn	"
Plot 3	"	Sunflowers	"
Plot 4	Potatoes	Wheat	"
Plot 5	Corn	"	"
Plot 6	Sunflowers	"	"

SUMMER-FALLOW TREATMENT

(A) DEPTH OF PLOUGHING FOR SUMMER-FALLOW—

Plot 1—Plough 3 inches.
Plot 2—Plough 4 inches.
Plot 3—Plough 5 inches.
Plot 4—Plough 6 inches.
Plot 5—Plough 7 inches.
Plot 6—Plough 8 inches.
Plot 7—Plough 9 inches.
Plot 8—(Check) plough 4 inches.
Plot 9—(Check) plough 6 inches.

(B) DATE OF PLOUGHING FOR SUMMER-FALLOW—

Plot 10—Plough 6 inches middle May.
Plot 11—Plough 6 inches middle June.
Plot 12—Plough 6 inches middle July.

(C) FALL CULTIVATION BEFORE PLOUGHING FOR SUMMER-FALLOW—

Plot 13—Disc stubble after harvest, plough 6 inches in May or June.
Plot 14—Plough stubble 6 inches after harvest.

(D) SPRING CULTIVATION BEFORE PLOUGHING FOR SUMMER-FALLOW—

Plot 15—Disc stubble early spring, plough 6 inches in May or June.

(E) FALL PLOUGHING FOR SUMMER-FALLOW—

Plot 16—Stubble ploughed 6 inches in fall.

(F) Packing vs. Non-packing when Ploughing for Summer-fallow (Check)—
Plot 17—Plough 6 inches May or June, pack with disc.
Plot 18—Plough 6 inches May or June, surface pack.
Plot 19—Plough 6 inches May or June, subsurface pack.
Plot 20—Plough 6 inches May or June, combination pack.

STUBBLE TREATMENT

(A) Fall Ploughing vs. Spring Ploughing—
Plot 1—Fall plough 3-4 inches.
Plot 2—Spring plough 3-4 inches.
Plot 3—Fall plough 6 inches.
Plot 4—Fall plough 6 inches, leave unharrowed.
Plot 5—Early spring plough 6 inches, leave unharrowed, seed 10 days later.
Plot 6—Spring plough 6 inches.
Plot 7—Fall plough 8 inches.
Plot 8—Spring plough 8 inches.

(B) Fall Cultivation After Harvest—
Plot 9—Stubble disced at harvest, fall plough 6 inches.
Plot 10—Stubble disced at harvest, spring plough 6 inches.

(C) Discing in Place of Ploughing—
Plot 11—Disc stubble in fall, harrow in spring before seeding.
Plot 12—Disc stubble in spring before seeding.

(D) Burning of Stubble—
Plot 13—Burn stubble in spring, plough 6 inches, harrow, seed.
Plot 14—Burn stubble in spring, disc, seed.
Plot 15—(Check) fall plough 6 inches.
Plot 16—(Check) spring plough 6 inches.

APPLICATION OF MANURE

(a) To Affect (Spring) Grain

On Summer-fallow—
Plot 1—Summer-fallow *no manure.*
Plot 2—Apply before ploughing for summer-fallow.
Plot 3—Apply on summer-fallow in September, disc in before seeding.
Plot 4—Apply on summer-fallow in winter, disc in before seeding.

On Stubble—
Plot 5—Fall plough *no manure.*
Plot 6—Apply before fall ploughing.
Plot 7—Apply after fall ploughing, disc in before seeding.
Plot 8—Fall plough, apply with spreader after seeding.
Plot 9—Spring plough *no manure.*
Plot 10—Apply before spring ploughing.
Plot 11—Spring plough, apply with spreader after seeding.
Plot 12—Apply in winter, spring plough.

(b) To Affect Hoed Crop

On Summer-fallow—
Plot 13—Summer-fallow *no manure,* following spring plant potatoes.
Plot 14—Apply before ploughing summer-fallow, following spring plant potatoes.
Plot 15—Summer-fallow *no manure,* following spring plant corn.
Plot 16—Apply before ploughing summer-fallow, following spring plant corn.
Plot 17—Summer-fallow *no manure,* following spring plant sunflowers.
Plot 18—Apply before ploughing summer-fallow, following spring plant sunflowers.

SOIL PACKERS

(A) PACKING VS. NON-PACKING WHEN PLOUGHING FOR SUMMER-FALLOW—

Plot 1—Plough summer-fallow and harrow, following spring harrow, seed.
Plot 2—Plough summer-fallow and pack, following spring harrow, seed.
Plot 3—Plough summer-fallow and harrow, pack following spring, seed.
Plot 4—Plough summer-fallow and pack, following spring harrow, seed.

(B) PACKING BEFORE SEEDING, ALSO DOUBLE PACKING—

Plot 5—Plough summer-fallow harrow, following spring harrow, pack, seed.

(C) Plot 6—Plough summer-fallow harrow, pack following spring, harrow, seed, pack.

(D) PACKING AFTER SEEDING—

Plot 7—Plough summer-fallow harrow, following spring harrow, seed, pack.
Plot 8—Plough summer-fallow harrow, following spring harrow, seed, pack, harrow.

(E) PACKING BEFORE AND AFTER SEEDING—

Plot 9—Plough summer-fallow harrow, following spring harrow, pack, seed, pack.

(F) PACKING GRAIN WHEN 3 INCHES HIGH—

Plot 10—Plough summer-fallow, following spring harrow, seed, pack when 3 inches high.
Plot 11—Plough summer-fallow, following spring harrow, seed, harrow when 3 inches high.
Plot 12—Plough summer-fallow, following spring harrow, seed, harrow and pack when 3 inches high.

(G) ORDINARY DISC DRILL VS. PRESS DISC DRILL—

Plot 13—Plough summer-fallow, following spring seed with ordinary single disc drill.
Plot 14—Plough summer-fallow, following spring seed with ordinary single disc drill, pack.
Plot 15—Plough summer-fallow, following spring seed with press disc drill.

PACKING ON FALL PLOUGHED STUBBLE

(A) PACKING VS. NON-PACKING IN FALL—

Plot 1—Fall plough, harrow, following spring harrow, seed.
Plot 2—Fall plough, harrow, pack, following spring harrow, seed.

(B) PACKING IN SPRING BEFORE SEEDING—

Plot 3—Fall plough, harrow, following spring harrow, pack, seed.

(C) PACKING IN SPRING AFTER SEEDING—

Plot 4—Fall plough, harrow, following spring harrow, seed, pack.

(D) PACKING IN FALL AND IN SPRING AFTER SEEDING—

Plot 5—Fall plough, harrow, pack, following spring harrow, seed, pack.

PACKING ON SPRING PLOUGHED STUBBLE

(A) PACKING BEFORE SEEDING—

Plot 6—Plough, pack, seed—no harrow.
Plot 7—Plough, harrow, seed.
Plot 8—Plough, harrow, pack, seed.
Plot 9—Plough, harrow, pack, seed, harrow.

CROP ROTATIONS (IRRIGATED LAND)

Project 11.—The rotation experiment on the irrigated farm consists of three rotations, each of which have been quite satisfactory.

The same cost and return values were used in compiling the expense and income data as were used on the dry farm, except that rent was charged at $10 instead of $2 per acre.

SEEDING.—Spring wheat was sown April 16 to 23 at the rate of 90 pounds, oats April 26 at the rate of 102 pounds, barley April 23 to May 3 at the rate of 85 to 90 pounds, peas April 26 at the rate of 180 pounds, alfalfa May 3 at the rate of 12 to 15 pounds, corn May 24 at the rate of 17 pounds, and potatoes May 13 at the rate of 1,350 pounds per acre.

CULTIVATION.—All the fields planted except those in hoed crops the previous year were ploughed early in April and harrowed down immediately. Fields in hoed crops the previous year were not ploughed the following spring, but were springtooth cultivated before seeding. Where alfalfa was broken up the field was ploughed to a depth of 3 inches in the fall (crowned) and then ploughed to a depth of 6 inches in the spring.

ROTATION "U," TEN YEARS' DURATION

First year.—Alfalfa.
Second year—Alfalfa.
Third year—Alfalfa.
Fourth year.—Alfalfa.
Fifth year.—Alfalfa.
Sixth year.—Alfalfa. Manured previous fall.
Seventh year.—Hoed crop.
Eighth year.—Wheat.
Ninth year.—Oats.
Tenth year.—Barley. Seeded down to alfalfa.

On the new irrigation projects in Alberta grain is certain to be grown almost exclusively during the early years of development, as it brings in quick cash returns. With the high price of irrigated lands, however, a more diversified system of farming will have to be followed eventually. Rotation "U" is an example of a good variation of crops. In this rotation six-tenths of the land is in hay, one-tenth in hoed crop, one-tenth in wheat and two-tenths in coarse grain. This arrangement not only gives crop variation, but it fits in well with diversified farming, as a large amount of feed is produced, making the keeping of live stock a necessity; while the wheat and hoed crop, if potatoes are grown, may be used as a cash crop.

All alfalfa plots with the exception of lot No. 1 were irrigated the previous fall, and all were irrigated after each cutting of hay was removed. Three cuttings of alfalfa were obtained from plots 6, 7, 8, 9 and 10, with an average total yield per acre of 4 tons 1,207 pounds. Plot number 1 was cut twice, and produced a total of 1 ton 755 pounds.

The average yield of alfalfa for 10 years on the rotation was 4 tons 624 pounds per acre. The average yield for the same period on the plot seeded down the previous year was slightly less than the yields on the older fields, being 3 tons 1,062 pounds per acre. The average yields for the plots three, four and five years old were approximately equal, and this average for 10 years was 4 tons 750 pounds per acre. The plot on which manure was applied in the fall gave an average of 1,057 pounds greater yield than the alfalfa not so treated, indicating that the application of manure to the alfalfa field is good practice. As it has been the practice to apply this manure early in the fall it is very probable that the winter protection given by the manure mulch has had as much to do with the increased yield of hay the following season as has the plant food supplied by the manure

ROTATION "V," ALFALFA CONTINUOUSLY

This field was seeded to alfalfa in 1909 and will be left indefinitely. One of the objects of the experiment is to get some idea of the probable life of an alfalfa field under favourable conditions. So far, no deterioration is noticeable. The average yield of alfalfa hay for 11 years was 3 tons 1,772 pounds per acre. This field was irrigated in the fall of 1920 and after each crop of hay was removed during the current year. This is the usual practice followed since the experiment was started.

ROTATION "X," FIFTEEN YEARS' DURATION

First year.—Alfalfa seeding.
Second year.—Alfalfa.
Third year.—Alfalfa.
Fourth year.—Alfalfa.
Fifth year.—Alfalfa.
Sixth year.—Alfalfa.
Seventh year.—Alfalfa.
Eighth year.—Alfalfa.
Ninth year.—Alfalfa.
Tenth year.—Alfalfa.
Eleventh year.—Barley.
Twelfth year.—Corn.
Thirteenth year.—Wheat.
Fourteenth year.—Oats.
Fifteenth year.—Peas.

Rotation "X," which was begun in 1914, is a rotation within a rotation. Two-thirds of the land is in alfalfa and one-third in field crops. Instead of breaking up one field of alfalfa each year and seeding down a field each year, as is the case on rotation "U," the breaking is done but once in five years; then the five fields that have been used for ordinary cereal and field crops are seeded down at once and five fresh fields are broken up and used for these crops. The cereal and field crops are conducted as a five-year rotation.

This rotation is especially adapted for a stock farm, as two-thirds of the land is producing hay and the remainder is producing feed grains or ensilage.

ROTATIONS ON IRRIGATED LAND

Rotation "U" (ten years duration)

Rotation year	Crops		Area	Items of expense in raising crop. Per acre														Height of stubble	Particulars of crop. Per acre					
				Rent and manure	Seed, twine, and use of machinery	Manual labour		Horse labour (including teamster)					Cost of threshing	Total cost of 1 acre	Cost of 1 bushel	Cost of 1 ton								
								Hours																
						Hours	Cost	Single horse	2-horse team	3-horse team	4-horse team	Value of horse labour							Grain	Straw	Hay	Hoed crop	Value of crop per acre	Profit or loss per acre
	1920	1921	! ac.	$ c.	$ c.	No.	$ c.	No.	No.	No.	No.	$ c.	$ c.	$ c.	$ c.	$ c.	ins.	lbs.	lbs.	lbs.	lbs.	$ c.	$ c.
10	Barley and alfalfa seeding	Alfalfa	1·00	11 20	3 89	6·17	2 04	.....	3·83	.....	0·83	3 18	.....	20 31	.....	14 71	.....	.....	.....	2,755	.....	13 77	− 6 54
9	Oats	Barley and alfalfa seeding	1·00	11 20	5 99	3·33	1 10	.....	.....	1·50	8·66	9 22	5 30	32 81	0 90	.....	6	1,700	1,500	.....	.....	20 67	−12 14
8	Wheat	Oats	1·00	11 20	2 62	6·00	1 98	.....	.....	1·66	8·00	8 72	8 33	32 85	0 40	.....	6	28,30	2.580	.....	.....	33 46	0 61
7	Potatoes	Wheat	1·00	11 20	4 53	6·00	1 98	.....	.....	1·83	5·00	6 08	6 50	30 29	0 79	.....	6	2,600	2,810	.....	.....	46 14	15 85
6	Alfalfa	Potatoes	1·00	11 20	21 25	147·50	48 67	4·00	6·42	.....	28·00	32 00	.....	113 12	0 30	.....	.....	.....	.....	.....	22,595	218 53	105 41
5	Alfalfa	Alfalfa	1·00	11 20	3 89	9·66	3 19	.....	5·83	.....	.....	3 88	.....	21 95	.....	4 77	.....	.....	.....	9,190	.....	45 95	24 00
4	Alfalfa	Alfalfa	1·00	11 20	3 89	9·83	3 24	.....	5·58	.....	.....	3 52	.....	21 85	.....	5 34	.....	.....	.....	8,185	.....	40 93	19 08
3	Alfalfa	Alfalfa	1·00	11 20	3 89	9·83	3 24	.....	5·66	.....	.....	3 57	.....	21 90	.....	4 71	.....	.....	.....	9,245	.....	46 23	24 33
2	Alfalfa	Alfalfa	1·00	11 20	3 89	9·83	3 24	.....	5·66	.....	.....	3 57	.....	21 90	.....	4 57	.....	.....	.....	9,580	.....	47 90	26 00
1	Alfalfa	Alfalfa	1·00	11 20	3 89	9·83	3 24	.....	5·66	.....	.....	3 57	.....	21 90	.....	4 45	.....	.....	.....	9·835	.....	49·18	27·28
	Aggregate		10·00	112 00	57 73	217·98	71 92	4·00	38·64	4·99	50·49	77 11	20 13	338 88	.....	.....	.....	.....	.....	.....	.....	562 76	.....
	Average per acre		.....	11 20	5 77	21·80	7 19	0·40	3·86	0·50	5·05	7 71	2 02	33 89	.....	.....	.....	.....	.....	.....	.....	56 28	22 39
	Rotation "V" (alfalfa continuously)																						
10	Alfalfa	Alfalfa	1·06	10 00	1 00	9·27	3 06	.....	5·34	.....	.....	3 36	.....	17 42	.....	4 21	.....	.....	.....	8,280	.....	41 40	23 98
	Rotation "X" (fifteen years duration)																						
6	Alfalfa	Alfalfa	1·00	10 80	1 00	3·30	1 09	.....	2·94	.....	.....	1 85	.....	14 74	.....	11 84	.....	.....	.....	2,490	.....	12 45	− 2 29
7	Alfalfa	Alfalfa	1·00	10 80	1 00	3·30	1 09	.....	2·94	.....	.....	1 85	.....	14 74	.....	11 84	.....	.....	.....	2,490	.....	12 45	− 2 29
8	Alfalfa	Alfalfa	1·00	10 80	1 00	3·30	1 09	.....	2·94	.....	.....	1 85	.....	14 74	.....	11 84	.....	.....	.....	2,490	.....	12 45	− 2 29
9	Alfalfa	Alfalfa	1·00	10 80	1 00	3·33	1 09	.....	2·94	.....	.....	1 85	.....	14 74	.....	11 84	.....	.....	.....	2,490	.....	12 45	− 2 29
10	Alfalfa	Alfalfa	1·00	10 80	1 00	3·30	1 09	.....	2·94	.....	.....	1 85	.....	14 74	.....	11 84	.....	.....	.....	2,490	.....	12 45	− 2 29
2	Corn	Wheat	1·00	10 80	5 03	4·00	1 32	.....	.....	1·83	3·00	4 22	4 20	25 57	0 61	.....	6	2,520	5,050	.....	.....	45 05	19 48
3	Wheat	Oats	1·00	10 80	2 62	4·00	1 32	.....	1·66	.....	9·50	9 88	6 53	31 15	0 41	.....	6	2,220	2,220	.....	.....	26 64	− 4 51
4	Oats	Peas	1·00	10 80	10 00	4·00	1 32	.....	2·00	.....	9·66	10 24	2 33	34 69	2 24	.....	6	930	1,585	.....	.....	32 58	− 2 11
5	Peas	Barley	1·00	10 80	2 39	4·00	1 32	.....	1·66	.....	11·50	11 74	4 54	30 79	1 02	.....	6	1,455	905	.....	.....	16 97	−13 82
1	Barley	Corn	1·00	10 80	2 70	4·00	1 32	2·30	3·17	4·00	10·66	16 14	.....	30 96	.....	6 52	.....	.....	.....	.....	9,500	23 75	− 7 21
11	Alfalfa	Alfalfa	1·00	10 80	1 00	2·80	0 92	.....	4·20	.....	.....	2 65	.....	15 37	.....	6 61	.....	.....	.....	4,650	.....	23 25	7 88
12	Alfalfa	Alfalfa	1·00	10 80	1 00	2·80	0 92	.....	4·20	.....	.....	2 65	.....	15 37	.....	6 61	.....	.....	.....	4,650	.....	23 25	7 88
13	Alfalfa	Alfalfa	1·00	10 80	1 00	2·80	0 92	.....	4·20	.....	.....	2 65	.....	15 37	.....	6 61	.....	.....	.....	4,650	.....	23 25	7 88
14	Alfalfa	Alfalfa	1·00	10 80	1 00	2·80	0 92	.....	4·20	.....	.....	2 65	.....	15 37	.....	6 61	.....	.....	.....	4,650	.....	23 25	7 88
15	Alfalfa	Alfalfa	1·00	10 80	1 00	2·80	0 92	.....	4·20	.....	.....	2·65	.....	15 37	.....	6 61	.....	.....	.....	4,650	.....	23 25	7 88
	Aggregate		15·00	162 00	32 74	50·50	16 66	2·30	44·19	5·83	44·32	74 72	17 60	303 71	.....	.....	.....	.....	.....	.....	.....	323 49	.....
	Average		.....	10 80	2 18	3·37	1 11	0·15	2·95	0·39	2·95	4 98	1 18	20 25	.....	.....	.....	.....	.....	.....	.....	21 56	132

WHEAT FOLLOWING CORN VS. WHEAT FOLLOWING SUNFLOWERS (IRRIGATED)

Since the farmers of the district have become interested in the growing of sunflowers for ensilage many inquiries have been received as to the relative effect of this crop on the productiveness of the soil as compared with the effect of a crop of corn. For the purpose of obtaining some data on this question, two fields of 1·75 acres each, one of which produced 15 tons of sunflowers per acre and the other 6·7 tons of corn per acre the previous year, were seeded to Marquis wheat. The corn and sunflower stubble were cultivated with a springtooth cultivator on April 16th and the wheat seeded on April 18th at the rate of 90 pounds of seed per acre. The fields were irrigated the previous fall and once during the growing season.

The wheat following sunflowers yielded 42 bushels and 23 pounds per acre and the wheat following corn yielded 36 bushels and 17 pounds per acre. The sunflower land produced 6 bushels and 6 pounds more per acre than did the corn land.

Winter wheat did not do quite as well on sunflower stubble as did spring wheat. The yield on 2·11 acres of Kharkov was 37 bushels and 50 pounds, which was 4 bushels and 33 pounds less than the yield of the spring wheat on the adjoining field. The irrigations of the fall wheat and spring wheat were the same.

PERMANENT PASTURES (IRRIGATED)

Four fields of four acres each and one field of two and one-half acres were seeded down in 1915 to various grasses and legumes to be used as permanent pastures. The object of the experiment is to determine the best mixtures for permanent pastures on the irrigated farms of the district.

The seed mixture used, and the average number of sheep per acre for each pasture has carried for five years, are as follows:

PERMANENT PASTURES-TEST OF GRASS MIXTURES

Field 1		Field 2		Field 3		Field 4		Field 5	
Seed	lbs.	Seed	lbs.	Seed	lbs.	Seed	lbs.	Seed	lbs.
Kentucky Blue..	30	Meadow fescue..	8	Meadow fescue..	30	Western rye grass.....	6	Brome.....	8
White Dutch Clover.....	4	Orchard grass...	4	White Dutch Clover.....	4	Kentucky blue grass.....	6	Alsike.....	5
Timothy.....	2	Timothy.....	2	Timothy.....	2	Meadow fescue..	6	Red clover.....	5
		Alsike Clover..	2			Alfalfa.....	4		
		White Dutch Clover.....	2						
		Alfalfa.....	4						

FIVE YEAR AVERAGE CARRYING CAPACITY PER ACRE FOR FOUR MONTHS

Field 1	Field 2	Field 3	Field 4	Field 5
2·54 sheep	6·63 sheep	2·28 sheep 370 lbs. hay	8·97 sheep	6·37 sheep

In the above statement one cow or one horse is considered to be equal to four sheep, and in computing the carrying capacity of the various fields they have been so treated; for sheep, cattle and horses have all been pastured on these fields at

different times, although sheep have predominated. On the basis of four sheep being equal to one cow or horse, the carrying capacity of the different pasture fields for the four summer months can be expressed as follows:—

Field 1 has carried 0·6 cows per acre.
Field 2 has carried 1·7 cows per acre.
Field 3 has carried 0·6 cows per acre.
Field 4 has carried 2·2 cows per acre.
Field 5 has carried 1·6 cows per acre.

In regard to the carrying capacity of any permanent pasture, there is one point that cannot be emphasized too greatly, and that is the frequency of irrigation. There is no crop that we raise that requires irrigating so often, if the maximum results are to be obtained, as does a pasture. The cross-fencing should be so arranged that the stock may be kept on one part of the pasture while the other part is being irrigated.

Western Rye Grass, Kentucky Blue Grass, Meadow Fescue and Alfalfa have proved to be the most satisfactory mixture for the irrigated farms of any tried. All of the grasses in this mixture give good returns and stand pasturing well. Alfalfa has been exceptionally satisfactory in the mixtures in all cases increasing the carrying capacity of the pasture. One of the chief objections raised to alfalfa as a pasture for sheep and cows is the danger of bloat. The experience here has shown, however, that with a mixture of grasses such as we have had in our pastures there is little danger of bloat from the alfalfa present, for we have yet to have our first case of bloat on alfalfa where it is grown in a mixture of grasses which form a thick turf, while we have had many cases of bloat and some deaths from pasturing on straight alfalfa. Brome grass has given good results when kept pastured down. The chief objection to this grass on irrigated land is the difficulty to eradicate it from fields and ditch banks and to prevent it from becoming a troublesome weed. It also has a tendency to crowd other grasses out when sown in a mixture.

HORTICULTURE

DRY LAND

So far the greater part of the work in horticulture has been carried on under irrigation, including all variety tests and cultural experiments. The dry land garden serves the purpose of demonstrating the possibilities of a dry land farmer's garden.

VEGETABLE GARDEN

On account of the excessive drought the yields on the dry land were light in 1921 but the quality of the vegetables grown was good. The dry land garden is divided into two parts to permit of planting the garden on summer-fallowed land each year. The seeds were sown on April 19, only one row of each vegetable being grown.

Project 53.—TURNIPS.—The variety used was Early White Flat Dutch Strapped. The yield obtained from a 110-foot row was 48 pounds. These were of good table size.

Project 54.—ONIONS.—Two varieties were sown. White Globe yielded 38 pounds from a 112-foot row, and Red Globe yielded 51 pounds from a 114-foot row. Both varieties ripened well and were of fair size.

Project 55.—BEETS.—Crosby Egyptian was the variety sown, and the yield obtained from a 116-foot row was 172 pounds. They were a good table size.

Project 56.—CARROTS.—Danvers Half Long yielded 65 pounds from a row 118 feet in length. They were of medium size and good quality.

Project 57.—PEAS.—Two varieties were grown. Thomas Laxton yielded 22 pounds of green peas from a 120-foot row, and Little Marvel yielded 17 pounds of green peas from a 122-foot row.

Project 58.—BEANS.—The variety used was Early White Kidney, which yielded 39 pounds of green beans from a 124-foot row.

Both the lettuce and radish were unsatisfactory as they ran to seed owing to the extremely hot weather.

Project 59.—CORN.—White Alberta, the variety selected at this Station, did well. A great number of cobs, however, were shelled by the unusually large number of crows prevalent this season.

Project 60.—POTATOES.—Ten varieties were tested. These were planted May 10 and dug October 6. They were cultivated four times during the growing season.

From the following table it will be noticed that Irish Cobbler leads in the nine-year average. This potato is one of the varieties which has been under test for 14 years, and is outstanding in point of earliness. For main crop the variety recommended is Gold Coin. Both these varieties are white skinned potatoes and are popular in this district.

POTATOES-TEST OF VARIETIES (DRY LAND)

Variety	Yield of marketable potatoes	Yield of unmarketable potatoes	Total Yield	Average for 9 years
	bush. lbs.	bush. lb.	bush. lb.	bush. lb.
Irish Cobbler	126-40	21-40	148-20	218-24
Gold Coin	100	18-20	118-20	217-6
Morgan Seedling	123-20	21-40	145	215-44
Factor	155	23-20	178-20	212-40
Reeves Rose	73-20	31-40	105	202-16
Dalmeny Beauty	68-20	15	83-20	193-16
Wee MacGregor	125	21-40	146-40	193-15
Table Talk	58-20	28-20	86-40	187-44
Empire State	96-40	30	126-40	Not tested for
Sutton Abundance	106-40	35	141-40	9 years

SMALL FRUITS

Project 33.—Three rows of currants were planted in the spring of 1915, one row of Black currants, one row of Red currants and one row of White currants, each row containing three varieties and twelve bushes of each variety. This is the first year they have borne fruit, and the following yields were obtained:

BLACK CURRANTS.—Merveille de la Gironde, 9 quarts; Saunders, 7 quarts; Eagle, 10 quarts.

RED CURRANTS.—New Red Dutch, 14 quarts; Red Grape, 18 quarts; Cumberland, 16 quarts.

WHITE CURRANTS.—Large White, 4 quarts; White Grape, 7 quarts; White Pearl, 6 quarts.

IRRIGATED LAND

VEGETABLES

This year all vegetables did exceptionally well. A large number of tomatoes ripened before frost, particularly the early varieties. Flea beetles were numerous and attacked radish, turnip and kohl-rabi, but did little damage to other plants. This is the first year they have done any noticeable damage.

As soon as the soil was in workable condition the seeds were sown. This was April 16.

It has been found by fall ploughing the irrigated garden that the land is in better condition and can be worked much earlier in the spring.

Project 61.—ASPARAGUS.—The asparagus plantation yielded heavily by producing an abundance of strong shoots.

Project 62.—BEETS.—Nine varieties were sown, some of which grew too large and coarse for table use. The best varieties for table use were Black Red Ball, Crosby Egyptian, Early Wonder and Detroit Dark Red. The yields from a 30-foot row were respectively 78 pounds, 91 pounds, 97 pounds, and 117 pounds.

Project 63.—BEANS.—Twelve varieties were grown, 30-foot row of each being planted, and, as ready for use, the green beans were picked. The yields from the best varieties were Stringless Green Pod 48 pounds, Hodson Long Pod 36 pounds, Masterpiece 25 pounds, and Davis White Wax 15 pounds.

Project 64.—CABBAGE.—Nineteen varieties were grown, a number of which were too large for table use. The best early varieties were Early Jersey Wakefield and Early Paris Market, with yields of 115 and 81 pounds respectively from twenty plants.

The best midseason varieties were Copenhagen Market, Enkhuizen Glory and Wong Bok, with yields of 185, 172 and 149 pounds respectively from 15 plants. The best winter variety was Extra Amager Danish Ballhead, with a yield of 104 pounds from 15 plants. The best red cabbage for pickling purposes was Delicatesse, with a yield of 64 pounds from 15 plants.

Project 65.—CAULIFLOWER.—Two varieties were grown. Both did well and produced large fine heads. The yields from 20 plants were Extra Early Dwarf Erfurt, 64 pounds, and Early Snowball with 56 pounds.

Project 66.—CELERY.—Eight varieties were grown. The best varieties with yields from 30 plants in order of their earliness are White Plume 48 pounds, Golden Self Blanching 73 pounds, Sandford Superb 62 pounds, Giant Pascal 89 pounds and Winter Queen 84 pounds.

Project 67.—CUCUMBERS.—Six varieties were grown, using six hills of each variety; three hills of each were started under glass and three hills were sown in the open. The plants started under glass were earlier and produced larger yields; however, they can be grown, as a rule, quite satisfactorily from seed sown in the open. The seed was sown in the garden, i.e., in the open on the 3rd of June, and the earliest variety was ready for use the beginning of August. In order of earliness they were: Early Russian, Improved Long Green, Prolific, Giant Pera, Davis Perfect, and West India Gherkin, the last named for pickling.

Project 68.—CARROTS.—Seven varieties were grown, and all did well. The best, with yields from a 30-foot row, were: Oxheart 81 pounds, Half Long Scarlet Nantes 85 pounds, Chantenay 106 pounds, Improved Danvers Half Long 118 pounds and Hutchinson 130 pounds.

Project 69.—CORN.—Twenty-three varieties of corn were grown, all producing roasting ears before frost. The best varieties in order of earliness, with yield of edible ears from 20 hills, are as follow:—Pickanniny A 110 ears, Indian Sweet 157 ears, Early Mayflower 79 ears, Nuetta 118 ears, Early June 162 ears, Sweet Squaw 92 ears, and Extra Early Cory with 72 ears.

Project 70.—LETTUCE.—Eleven varieties were grown, consisting of Leaf, Cabbage and Cos Lettuce. Some varieties ran quickly to seed. The best varieties, with yields from 15-foot rows were: Hanson 18 pounds, Grand Rapids 17 pounds, All Heart 15 pounds and Salamander 15 pounds.

Project 71.—MUSK MELON.—Only two of the earliest varieties were grown, Emerald Gem and Extra Early Hackensack, three hills from plants started under glass and three hills from seed sown in the open. The seed in the open was sown on the 3rd of June. More fruit reached maturity before frost on the plants started under glass and planted out. Melon growing has not proved satisfactory owing to the cool nights and short season.

Project 72.—ONIONS.—Thirteen varieties were grown. Some of the best varieties, with yields from 30-foot rows, were: Extra Early Red Flat 12 pounds, Danvers Yellow Globe 15 pounds, Yellow Globe 18 pounds, Large Red Wethersfield 18 pounds, Ailsa Craig 18 pounds, Red Globe 22 pounds, and White Bartletta (for pickling) 9 pounds.

Project 73.—PEAS.—Twenty-one varieties were sown. Some of the best varieties in order of their earliness, with yields of green peas from a 30-foot row, were: Eight Weeks 10 pounds, Gregory Surprise 9 pounds, Little Marvel 9½ pounds, Gradus 6½ pounds, Sherwood 14½ pounds, McLeans Advancer 14½ pounds, Homesteader 13½ pounds, and Stratagem 11 pounds.

Project 74.—PEPPERS.—Three varieties were grown, twenty plants of each being set out. None ripened peppers outside, but the full grown peppers ripened when spread out in the cellar. The varieties in order of earliness, with yields, are as follow:—Harris Earliest 15 pounds, Large Red Cayenne 8 pounds, and Chili 5 pounds.

Project 75.—PUMPKIN.—Three varieties of pumpkins were grown. Three hills from plants started under glass and three hills planted in the open. The seed was sown outside on the 3rd of June. More plants ripened before frost from plants started under glass, although for the past few seasons early varieties of pumpkins have ripened from seed sown in the open. The varieties used were Connecticut Field, King of the Mammoths, and Small Sugar.

Project 76.—PARSNIP.—One variety, Hollow Crown, was sown yielding 77 pounds of large sized parsnips from a 30-foot row.

Project 77.—PARSLEY.—Two varieties were sown viz:—Triple Curled and Champion Moss Curled. Both varieties made strong, heavy growth and were well curled.

Project 78.—POTATOES.—The number of varieties was duplicated in the irrigated garden as planted on the dry land. They were planted on May 10th, irrigated August 12th and 23rd, and were all dug on October 7th. The yield of potatoes depends to a large extent on the method of irrigating. The first irrigation should not, as a rule, be given until the plants come in bloom, unless the soil is very dry. A thorough soaking at the first application is not desirable, and it has been found that the lighter this irrigation is, the better. A good plan to follow is to allow the water to run down every other row. The second irrigation should follow before the soil shows sign of becoming dry; this is before the soil loses its binding quality. The water should be run between each row at this irrigation. A third irrigation is usually required. This is determined by examining the soil and, if found necessary, the third irrigation should be the heaviest, owing to the fact that tubers are larger and require more water for their full development. In any event, when properly applied three irrigations are usually sufficient.

POTATOES—TEST OF VARIETIES (IRRIGATED)

Variety	Yield of marketable potatoes	Yield of unmarketable potatoes	Total Yield	Average for 9 years
	bush. lbs.	bush. lb.	bush. lb.	bush. lb.
Irish Cobbler	808–20	63–20	871–40	530–0
Reeves Rose	556–40	66–40	623–20	522–24
Dalmeny Beauty	705–00	83–20	788–20	510–26
Empire State	648–20	56–40	750–00	504–21
Factor	733–20	43–20	776–40	504–47
Gold Coin	760–00	70–00	830–00	504–18
Table Talk	688–20	65–00	753–20	501–58
Wee MacGregor	688–20	45–00	733–20	498–27
Morgan seedling	800–00	41–40	841–40	494–46
Sutton Abundance	870–00	40–00	910–00	Not tested for 9 years

Project 79.—RADISH.—Three varieties were sown. Owing to the flea beetle a poor stand was obtained. The beetles were so numerous that poisoning did not keep them in check.

Project 80.—RHUBARB.—Until the last two or three years rhubarb has been more or less difficult to grow, owing to the presence of a bacterial disease which seems to be common throughout southern Alberta. After experimenting with various methods to overcome the trouble it was found that plants did not appear to suffer from this trouble until they were past three years old. It would therefore appear to be necessary to raise plants from seed every third year. A strong growing variety such as Victoria is recommended. Where a large quantity is to be grown it would be advisable to sow seed every year in order to replace a few rows at a time and either discard the old plants or use them for winter forcing in a frost-proof cellar.

Project 81.—SALSIFY.—The variety Long White yielded 39 pounds from a 30-foot row.

Project 82.—SQUASH.—Five varieties were sown. Three hills from plants were started in the hotbed and three hills sown in the open. The seed was sown in the open on the 3rd of June. More squash ripened from plants started under glass, although a large number usually ripen each year from seed sown in the open. The varieties grown were Green Hubbard, Golden Hubbard, Delicious, Long White Bush Marrow, and English Vegetable Marrow.

Project 83.—TOMATOES.—Fourteen varieties were grown from plants started under glass and planted in the open on the 14th of June, using five plants of each variety. Following is given the yields of ripe tomatoes from the best varieties in order of earliness: Earlibell, 7 pounds 7 ounces; Burbank Early, 4 pounds 9 ounces; Danish Export, 8 pounds 5 ounces; Chalks Early Jewel, 6 pounds 3 ounces; First of All, 7 pounds 9 ounces; and Alacrity, 5 pounds 5 ounces.

Project 84.—TURNIPS.—Three varieties were sown in rows 3 feet long. The yields in order of earliness were Early Snowball, 36 pounds; Extra Early Purple Top Milan, 48 pounds; and Golden Ball, 83 pounds.

SMALL FRUITS

The yields from the small fruits were considerably lighter this year, due to the severe weather just after the bushes began to bloom.

Project 88a.—BLACK CURRANTS.—Seventeen varieties are under test, there being three bushes of each variety. Some of the best yields this year were: Eagle, 10 pints; Magnus, 8 pints; Merveille de la Gironde, 7 pints; and Topsy, 7 pints.

WHITE CURRANTS.—Nine varieties are under test, three bushes of each variety. Some of the best yields this year were: Wentworth Leviathan, 30 pints; Climax, 26 pints; Large Brandenburg 24 pints; and Large White, 22 pints.

RED CURRANTS.—Nineteen varieties are under test, there being three bushes of each variety. Some of the best yields this year were: Moores Seedling, 32 pints; Raby Castle, 20 pints; New Red Dutch, 18 pints; Prince Albert, 18 pints; and Victoria, 15 pints.

Project 35.—RASPBERRIES.—About half the fruit buds were dead when uncovered in the spring, they having probably been injured by the severe frosts before the canes were covered in the fall. This lessened the yields considerably; in fact the fruit crop was almost a failure

Project 36.—STRAWBERRIES.—A new plantation consisting of 20 varieties was set out on the 26th of May, and an exceptionally good stand was obtained. The old plantation was ploughed under, all young plants being required for the new plantation.

TREE FRUITS

Project 32.—APPLES.—Both the standard and crab apple trees came through the winter in good condition. In the crossbred orchard a number of varieties bore fruit. The outstanding ones are Robin, Jewel, Silvia, Norman, and Tony. These varieties have borne fruit for a number of years and are unsurpassed for jelly purposes.

Project 34.—PLUMS.—Thirty-two special Manitoba selected seedling plum trees were planted in 1912. This year all the trees bloomed and fourteen trees bore fruit, three of which look very promising, the fruit being of good size, colour and flavour. Propagation from these three specimens is being begun.

FLOWERS

Project 85.—ANNUALS.—The annuals made a fine showing, the sweet peas particularly, being covered with bloom until late in the season. Seventy-four kinds and varieties of annuals were under test, in addition to a large number of varieties of sweet peas. Some of the annuals which did best were: Stocks, Asters, Antirrhinums, Petunias, Phlox, Verbena, Nicotiana, Calendula, Chrysanthemums, Marigolds and Helichrysum (everlastings).

Project 86.—PERENNIALS.—Owing to the perennial border having been dug up and replanted, the bloom was rather poor. The Iris border was not disturbed and made a splendid showing, the different varieties giving a continuous bloom for a relatively long season.

Project 87.—ROSES.—The roses were also dug up in the spring and planted in a more suitable position. Most of the varieties made fair growth, and a few varieties bloomed.

Project 88.—GLADIOLUS.—The corms were planted between the rose bushes and made a bright showing, producing tall spikes of first-class bloom. The corms are dug up in the fall with stem attached and hung up in a dry cellar, where they keep in good condition.

Project 81.—BULBS.—This year the bulbs made a splendid showing, although the stems were shorter than in previous seasons. The early varieties of tulips commenced to bloom on the 7th day of May, followed by the Darwin tulips, which finished blooming on the 14th of June.

The daffodils bloomed better this year than usual. The early varieties started to bloom on the 9th of May and the late varieties finished blooming on the 30th of May. It has been found advisable to plant the bulbs in a sheltered position, to protect the bloom from the prevailing winds.

SHRUBS

The flowering shrubs bloomed freely again this year and added greatly to the attraction of the grounds. The outstanding kinds were Lilacs, Honeysuckle, *L. tatarica grandiflora, Viburnum Opulus sterile, Caragana arborescens, Caragana pygmæa, Ribes aureum, Spiræa arguta,* and *Rosa spinosissima.*

LAWNS.—The lawns present a very pleasing effect each year. The practice of fall irrigating carries them over until June or July, when they are again irrigated. Usually one good irrigation in the summer time is sufficient. Cutting is done weekly, but is discontinued early enough in the fall to permit a good growth to be left for protection during the winter. Every few years an application of well-rotted manure is applied, which not only improves the condition of the lawn, but lessens the irrigation required.

CEREALS

DRY LAND

WHEAT

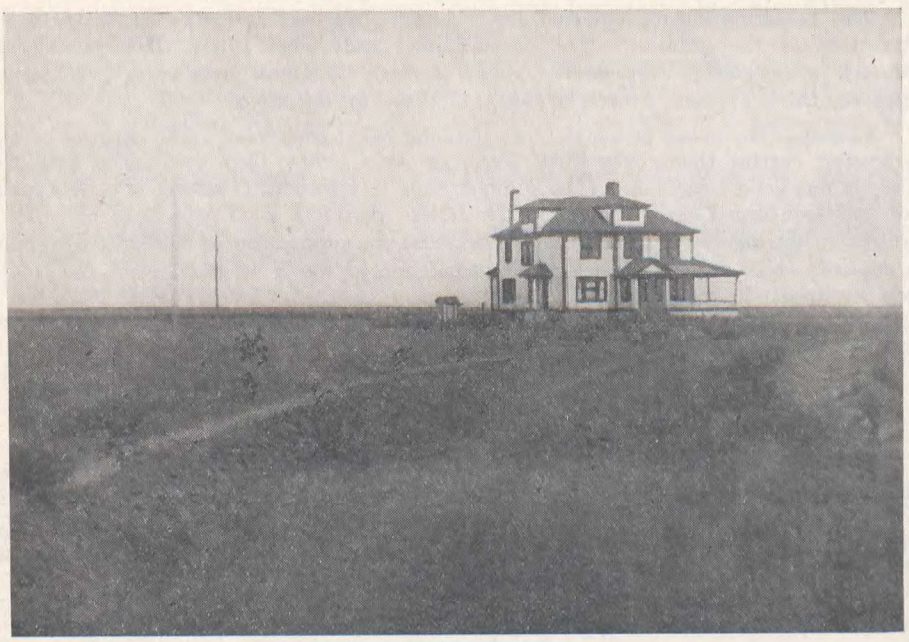
Project 89.—Eight varieties of spring wheat were sown on well prepared summer-fallowed land on May 11. The rate of seeding was 75 pounds per acre. The yields of all the varieties were low, due to the severe drought of the early summer. Red Bobs has been grown for but four years, and Ruby for three years, so the average yields of these wheats are not given in the following table.

SPRING WHEAT—TEST OF VARIETIES (DRY LAND)

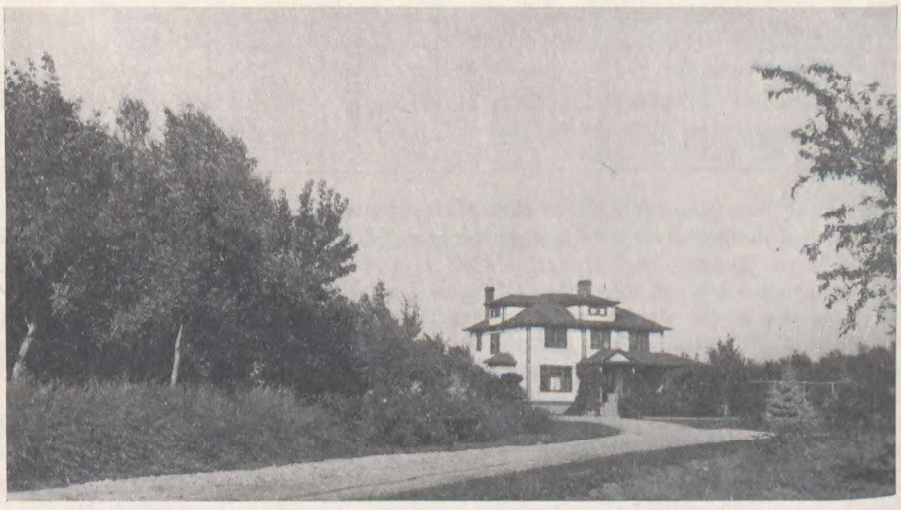
Name of Variety	Date of ripening	Number of days maturing	Average length of straw and head	Average length of head	Actual yield of grain per acre	Average yield per acre for 8 years
			inches	inches	bush. lbs.	bush. lbs.
Kubanka	Aug. 16	97	29	2·5	6–15	29–11
Huron, Ottawa 3	" 9	90	23	3·5	11–00	27–04
Marquis, Ottawa 15	" 5	86	22	3·0	12–15	24–54
Early Red Fife, Ottawa 16	" 9	90	24	3·0	9–00	24–50
Red Fife, Ottawa 17	" 16	97	24	3·0	9–00	24–18
Pioneer, Ottawa 195	July 29	79	19	2·0	4–15	19–15
Red Bobs	Aug. 5	86	21	3·0	9–00	
Ruby, Ottawa 623	July 29	79	18	2·2	4–15	

An analysis of the table shows that Marquis gave the highest yield this year, but Kubanka has the best average for a period of eight years. A feature of the comparative yields of Marquis and Kubanka that should be noted, however, is that while Kubanka produced much more than Marquis in the wet years, Marquis yielded more than Kubanka in the dry years. The average for Marquis for the four dry years, 1918, 1919, 1920 and 1921 was 8 bushels and 43 pounds, and Kubanka for the same years 6 bushels and 3 pounds. Huron is second to Kubanka in average yield, but it is a wheat of rather low baking quality and has the disadvantage of being bearded.

Taking everything into consideration, the Fife and Marquis varieties have maintained their reputation for reliability of yield. In baking quality they are almost in a class by themselves.



The Superintendent's house in 1908.



The Superintendents's house as it is now.

OATS

Project 90.—Seven varieties of oats were tested on the dry land. The oats were seeded May 11 on well prepared summer-fallow. All yields were low, and some varieties failed, due to the drought of the early summer. Only four of the varieties have been grown for a number of years.

OATS—TEST OF VARIETIES (DRY LAND)

Name of Variety	Date of ripening	Number of days maturing	Average length of straw and head	Average length of head	Actual yield of grain per acre	Average yield per acre for 7 years
			inches	inches	bush. lbs.	bush. lbs.
Gold Rain	Aug. 4	85	26	6	3-18	53-19
Danish Island	" 4	85	25	6	3-33	52-6
Banner, Ottawa 49	" 4	85	26	6	3-33	49-14
Leader	" 4	85	25	6	1-35	
Daubeney, Ottawa 47	July 29	79	23	4	nil	36-33
Victory	Aug. 4	85	25	5	nil	
Liberty, Ottawa 480	July 27	77	24	5	nil	

Banner is the most widely used oat in southern Alberta, and its popularity is justified by the results obtained here. While Gold Rain and Danish Island have given slightly higher yields, the straw of both is weaker than the straw of Banner, and for this reason the danger of lodging in wet seasons is much greater for these two varieties than for Banner. This more than offsets the slightly greater yields.

BARLEY

Project 91.—Twelve varieties of barley were seeded on May 11 on summer-fallowed land but owing to the drought of the early summer there was no crop. Of the twelve varieties nine have been grown for a sufficient length of time to give the following average yields for a number of years.

BARLEY—TEST OF VARIETIES (DRY LAND)

Name of Variety	Average yield per acre for 6 years
	bush. lbs.
Bark's Excelsior	29-11
Gold	26-39
O. A. C. 21	24-26
Manchurian, Ottawa 50	24-23
Invincible	24-21
Swedish Chevalier	24-8
Early Chevalier, Ottawa 51	22-47
Odessa	22-26

Bark's Excelsior gave the highest average yield over a period of six years. This is a six-rowed feed barley of good quality, and, in addition to being a good yielder, is uniform in type and has fair strength of straw, making it very satisfactory.

In addition to the varieties reported in the table, a hulless variety, Guymalaye, has been tested. The average yield of this barley for six years was 20 bushels and 17 pounds.

PEAS

Project 92.—Seven varieties were seeded on May 10 on summer-fallowed land, but none of the varieties survived the drought of the early summer.

PEAS—TEST OF VARIETIES (DRY LAND)

Name of Variety	Average yield per acre for 8 years
	bush. lbs.
Prussian Blue	23–15
Mackay, Ottawa 25	22–26
English Grey	22–11
Chancellor	21–43
Solo	20–4
Arthur, Ottawa 18	13–30
Golden Vine	17–35

FLAX

Project 93.—Three varieties of flax were seeded May 11 on summer-fallow. The crop was a total failure.

FLAX—TEST OF VARIETIES—(DRY LAND)

Name of Variety	Average yield per acre for 6 years
	bush. lbs.
Novelty, Ottawa 53	5–17
Longstem, Ottawa 52	5–5
Common	4–23

SPRING RYE

Project 94.—A plot of spring rye seeded on summer-fallow on May 11 matured in 86 days and produced 6 bushels and 9 pounds per acre.

WINTER RYE

Project 94a.—About the same yields were obtained from winter rye as from spring rye. The yield on a field of 2·53 acres of common winter rye was 6 bushels and 47 pounds.

THE WOLFRYN ELECTRO-CHEMICAL PROCESS OF SEED ELECTRIFICATION

Project 95.—In the spring of 1921 considerable publicity was given to the electrification of seed wheat as a means of increasing the yield.

On the 14th of May four plots were given over to this test, comparing electrification with seed treated with a brine solution, seed untreated, and seed soaked in water.

In all cases the Marquis seed wheat was from the same source, was sown on the same day, and on summer-fallow land of uniform character. The following results were obtained:—

Treatment	Yield per per acre
	bush. lbs.
Water	9-36
Electrification	7-55
Untreated	7-44
Brine	7-20

From one year's study it is apparent that there is little to be gained from the electrification of wheat before seeding.

IRRIGATED LAND

VARIETY TESTS

All variety tests on the irrigated farm were conducted on land which was in hoed crop the previous year. Irrigation was applied on June 25.

WHEAT

Project 96.—Eight varieties of wheat were seeded May 10 at the rate of 90 pounds of seed per acre. Only four varieties have been grown for a long enough period to justify giving averages for a number of years.

SPRING WHEAT-TEST OF VARIETIES (IRRIGATED)

Name of Variety	Date of ripening	Number of days maturing	Average length of straw	Average length of head	Yield of grain per acre	Average yield per acre for 8 years
				inches	bush. lbs.	bush. lbs.
Huron, Ottawa 3	Aug. 23	105	41	3·5	38-00	61-22
Marquis, Ottawa 15	" 17	99	40	3·5	40-00	60-13
Red Fife, Ottawa 17	" 23	105	42	3·5	36-30	50-54
Pioneer, Ottawa 195	" 13	95	41	3·0	37-15	44-37
Red Bobs	" 16	98	36	3·0	39-15	
Kubanka	" 27	109	47	2·0	31-30	
Early Red Fife, Ottawa 16	" 23	105	38	3·5	28-45	
Ruby, Ottawa 623	" 13	95	32	2·0	24-00	

Marquis was the heaviest producer this year while Huron yielded an average of 1 bushel and 9 pounds per acre per year more for a period of eight years. Marquis is most satisfactory for the irrigated farm of any wheat tested, as it is of high milling quality and has a strong straw which stands up well when other varieties have a tendency to lodge.

OATS

Project 97.—The oats for variety tests were seeded May 10 at the rate of 102 pounds per acre. Seven varieties were grown, four of which have been tested for a sufficient number of years to report a seven-year average.

OATS—TEST OF VARIETIES (Irrigated)

Name of variety	Date of ripening	Number of days maturing	Average length of straw and head	Average length of head	Actual yield of grain per acre	Average yield per acre 7 years
			inches	inches	bush. lbs.	bush. lbs.
Danish Island	Aug. 16	98	40	7·0	83 — 28	128 — 3
Banner, Ottawa 49	" 16	98	36	6·0	66 — 6	115 — 15
Gold Rain	" 13	95	37	5·5	58 — 23	110 — 32
Daubeney, Ottawa 47	" 8	90	30	5·0	59 — 4	94 — 22
Victory	" 16	98	41	6·0	73 — 8	
Leader	" 16	98	42	7·0	92 — 22	
Liberty (hulless), Ottawa 480	" 8	90	30	5·0	44 — 4	

Danish Island gave the highest average for a period of 7 years, but is subject to lodging. Banner stands up much better and for this reason it is more satisfactory for the irrigated land.

BARLEY

Project 98.—Twelve varieties of barley were seeded May 11 at the rate of 85 pounds of seed per acre. Nine of the varieties have been grown for a sufficient length of time to report the average yields for a period of years.

BARLEY—TEST OF VARIETIES (Irrigated)

Name of variety	Date of ripening	Number of days maturing	Average length of straw and head	Average length of head	Actual yield of grain per acre	Average yield per acre for 6 years
			inches	inches	bush. lbs.	bush. lbs.
Bark's Excelsior	Aug. 23	104	33	2·0	95 — 00	101 — 28
Invincible	" 23	104	37	3·5	70 — 00	80 — 27
Swedish Chevalier	" 23	104	37	4·0	65 — 30	80 — 6
Gold	" 23	104	33	2·5	66 — 27	79 — 3
Guymalaye (hulless)	" 8	89	27	2·0	45 — 30	68 — 16
Odessa	" 16	97	35	2·5	74 — 33	65 — 18
O.A.C. 21	" 16	97	38	2·5	74 — 33	62 — 29
Early Chevalier, Ottawa 51	" 8	89	39	2·5	44 — 28	61 — 9
Manchurian, Ottawa 50	" 17	98	42	3·5	58 — 06	60 — 3
Trebi	" 8	89	31	2·5	76 — 27	
Cape	" 8	89	27	1·7	62 — 24	
Mariout	" 8	89	24	1·5	62 — 24	

Bark's Excelsior gave an average yield for six years of 21 bushels and 1 pound more than any other variety grown for that period, and appears to be promising.

FLAX

Project 99.—Three varieties of flax were seeded on May 11. The results are as follows:—

FLAX—TEST OF VARIETIES (Irrigated)

Name of variety	Date of ripening	Number of days maturing	Average length of straw	Actual yield seed per acre	Average yield per acre 6 years
			inches	bush. lbs.	bush. lbs.
Novelty, Ottawa 53	Aug. 23	104	21	23 — 32	24 — 34
Common	" 23	104	23	22 — 28	23 — 26
Longstem, Ottawa 52	" 8	89	34	11 — 14	23 — 29

In addition to the varieties reported above, a small area was seeded to flax for fibre. This was hand-pulled and forwarded to the Fibre Division at Ottawa for further studies.

PEAS

Project 100.—Seven varieties of peas have been under test on the irrigated farm for eight years. The peas were seeded on May 10 at the rate of 180 pounds per acre.

PEAS—TEST OF VARIETIES (Irrigated)

Name of variety	Date of ripening	Number of days maturing	Average length of straw	Average length of pod	Actual yield of grain per acre	Average yield per acre for 8 years
			inches	inches	bush. lbs.	bush. lbs.
Golden Vine	Aug. 17	99	43	2·5	26 — 00	38 — 28
Arthur, Ottawa 18	" 17	99	43	2·5	29 — 00	37 — 39
Mackay, Ottawa 25	" 17	99	48	2·5	17 — 00	37 — 30
Chancellor	" 17	99	44	2·2	44 — 00	36 — 41
Prussian Blue	" 17	99	48	2·5	20 — 00	36 — 32
English Grey	" 17	99	46	2·2	31 — 00	36 — 4
Solo	" 15	97	39	2·7	13 — 00	32 — 24

Solo, a variety earlier than the others, has proved to be the poorest yielder. There is little difference in the results obtained from the other varieties.

The most serious objection to the raising of this crop is the difficulty in harvesting, for on account of the high winds the crop is apt to blow badly after cutting before being threshed or stacked.

FORAGE CROPS

IRRIGATED LAND

The yields of all forage crops on the irrigated land were very satisfactory. The growing of the crops for silage has been taken up by a number of farmers on irrigated land.

ENSILAGE CROPS

VARIETY TESTS WITH CORN FOR ENSILAGE

Project 101.—Thirteen varieties of corn were seeded in rows 3 feet apart on May 18, on spring ploughed stubble land. The land was irrigated June 24 and July 12. Beyond thinning with a hoe, the only cultivation given during the season was once before irrigation and then again after each irrigation. The crop was cut for ensilage on September 3.

CORN—TEST OF VARIETIES (Irrigated)

Variety	Per cent stand	Average height	Stage of maturity	Yield per acre
		inches		tons lbs.
Longfellow	100	96	Kernels early milk	30 — 1800
North Dakota	60	84	Tasseled	26 — 1500
Whitecap Yellow Dent	90	102	Kernels early milk	26 — 1100
Compton's Early	85	102	Silked	26 — 100
Wisconsin No. 7	85	102	Kernels early milk	25 — 1400
Leaming	60	96	Kernels early milk	24 — 1300
Northwestern Dent	80	96	Kernels early milk	24 — 800
Bailey	90	96	Tasseled	24 — 200
Twitchell's Pride	80	72	Kernels glazed	21 — 1000
Quebec Yellow	100	72	Kernels late milk	21 — 500
Paris Yellow Flint	100	72	Kernels late milk	19 — 1200
Canada Yellow	80	72	Kernels glazed	17 — 200
Alberta Yellow Flint	75	42	Ripe	6 — 900

SUNFLOWERS

Project 102.—The suitability of Indian corn for ensilage purposes has been demonstrated at this Station since 1911, but in order to test out the productiveness of sunflowers for this purpose considerable investigational work is being carried on.

While in the past corn has been siloed far more than all other crops put together, in very recent years sunflowers grown for silage have been given wide publicity. This has been the result mainly of their higher yielding qualities in districts where the climate is too cool for corn to thrive.

Five varieties or strains of sunflowers were under test. These were seeded the same time as the corn varieties, and on similar land. The treatment given, both as regards cultivation and irrigation, was identical with corn. They were cut for ensilage on September 3.

SUNFLOWERS—TEST OF VARIETIES (Irrigated)

Variety	Per cent stand	Average height	Stage of maturity	Yield per acre
		inches		tons lbs.
Common, Giant Russian	100	114	10% in bloom	37 — 1500
Saunders' Early	100	120	75% in bloom	36 — 1200
Improved Russian	100	78	Full bloom	28 — 00
Hutton's	100	72	Ripe for seed	23 — 1500
Finsen's	100	60	Ripe for seed	15 — 1400

One field of 5.86 acres of sunflowers produced 8 tons 1,258 pounds, and another field of 4.72 acres produced 7 tons 1,879 pounds of ensilage per acre. Both of these fields were planted on alfalfa sod, but the alfalfa was not killed and it gained such a start over the sunflowers that the yield of the latter was reduced very materially thereby.

To obtain information as to the best date to plant, the best distance apart to place the rows and to have the plants spaced in the rows, tests have been carried out again this year.

The following table shows that there is a decided falling off in yield when seeding is done after the middle of May.

SUNFLOWERS—DATES OF SEEDING (Irrigated)

Date	Yield per acre
	tons lbs.
May 3	32 — 00
" 14	34 — 1000
June 7	18 — 1000
" 16	7 — 400
" 27	2 — 1820

The average yield per acre for the past two years when the rows were 21 inches apart was 22 tons 1,876 pounds, when 35 inches apart 23 tons 1,429 pounds, and when 42 inches apart 23 tons 941 pounds. A deduction from these figures would lead us to believe that the rows should be either 3 or 3½ feet apart for maximum yields. Another argument for having the rows at this distance apart is that it makes two-horse cultivation possible, and so reduces the cost of production.

The following table gives the comparative yields for unthinned and thinned to 6, 9, 12, and 18 inches apart in the row.

SUNFLOWERS—DISTANCES THINNED (Irrigated)

Rows 35 inches apart	Yield per acre	Average yield per acre for two years
	tons lbs.	tons lbs.
Unthinned	26 — 400	
Thinned 6 inches	29 — 1900	28 — 830
Thinned 9 inches	35 — 900	30 — 986
Thinned 12 inches	30 — 1300	27 — 1178
Thinned 18 inches	29 — 300	23 — 1714

Judging from the two-year average, it would appear that thinning from 6 to 9 inches, or about the width of the hoe, would give the best yield, although probably little or no thinning will be required provided a reasonably even spaced stand is obtained.

SHRINKAGE IN WEIGHT AFTER CUTTING (IRRIGATED)

In order to determine the loss of moisture between the time the sunflowers are cut and the time they are usually put in the silo, a representative lot was weighed immediately after cutting and again after twenty-four hours, with the following result:—

Weight of sheaves at time of cutting	180 pounds.
Weight of sheaves after drying 24 hours	130 "
Loss of moisture in 24 hours	50 "
Per cent of loss	27·7

FIELD ROOTS

TURNIPS

Project 103.—Eight varieties of swede turnips were grown on the dry land. They were sown May 18 on spring ploughed stubble land which was manured the previous fall. The land was irrigated July 20 and the crop harvested October 20.

TURNIPS—TEST OF VARIETIES (Irrigated)

Variety	Per cent stand	Yield per acre
		tons lbs.
McKenzie Bangholm	90	32 — 1000
Shepherds' Denmark	85	32 — 00
Bangholm Denmark	85	31 — 100
McKenzie Imperial	80	31 — 00
Ditmars Swede	95	23 — 00
Sutton's Champion	90	23 — 00
Monarch (Nappan)	90	21 — 500
McKenzie Northwest	95	21 — 00

MANGELS

Project 104.—Six varieties were tested. They were sown May 18 on land which had been manured the previous fall. All varieties of root crops were irrigated the same day and harvested the same time.

MANGELS—TEST OF VARIETIES (IRRIGATED)

Variety	% Stand	Yield per acre
		tons lbs.
Ottawa Yellow Inter	75	20 — 00
Giant Long Red	60	19 — 00
McKenzie Eclipse	45	10 — 1000
Yellow Inter	50	10 — 00
Manitoba Giant Yellow	40	9 — 1500
Golden Tankard	20	6 — 500

CARROTS

Project 105.—Six varieties were tested. They were sown May 18 on similar land and given the same treatment as other varieties of roots tested. Owing to the slow germination a very poor stand was obtained.

CARROTS—TEST OF VARIETIES (IRRIGATED)

Variety	% Stand	Yield per acre
		tons lbs.
McKenzie Giant White Vosges	60	13 — 1700
McKenzie Giant Long Red Surrey	35	10 — 800
White Belgian	40	9 — 1500
Danish Champion	25	5 — 00
McKenzie Cooper's Yellow Inter	10	3 — 1200
Danish Yellow Champion	10	2 — 1500

SUGAR BEETS

Project 106.—The same varieties were tested as on the dry land. These were sown May 18 on spring ploughed stubble land. They received the same treatment after this date as the other varieties of roots.

SUGAR BEETS—TEST OF VARIETIES (IRRIGATED)

Variety	% Stand	Yield per acre
		tons lbs.
Waterloo	80	14 — 1000
Chatham	60	9 — 1000
B. C. Grown	25	5 — 500

GRASSES AND LEGUMES

ALFALFA

The area seeded to alfalfa in southern Alberta is increasing from year to year. The fact that it does not winter-kill and is particularly adapted to irrigation, coupled with the fact that it will last for many years, reduces the cost of production to a minimum.

To get the best results the land should be irrigated after each crop is taken off. As the yield depends on the care exercised in irrigating, no parts of the field should be missed and no parts over-irrigated to such an extent as to cause injury to the crop. Alfalfa will not stand water remaining on the surface of the land for any extended length of time. Such conditions cause the crop to turn yellow, and if the crowns remain under water much longer the plants soon die. Therefore all land seeded to alfalfa should have natural surface drainage to allow surplus water to flow off as soon as the irrigation is finished.

Fields of Alfalfa

Project 34.—On the irrigated part of the farm the alfalfa yields were good. One field of 7·05 acres produced 6 tons 157 pounds per acre, and another field of 4·78 acres produced 4 tons 518 pounds per acre.

CLOVER

Project 27.—Five varieties or strains of clover were tested, giving the following yields.

Variety	Yield tons-lbs
1 acre of Sweet Clover (2 cuttings)	5–1630
0·5 acre of Sweet Clover (2 cuttings)	5–720
0·5 acre Bark's Red Clover	3–1620
0·5 acre Common Red Clover	2–1780
0·5 acre Alsike Clover	2–150

MIXED HAY

Project 25.—The highest yield obtained from any field of hay on the farm this year was 7 tons 1,591 pounds per acre, cut from a field of two acres of mixed grasses, clovers and alfalfa.

TIMOTHY

Project 107.—Timothy is always in demand at a price well above that offered for alfalfa but the area devoted to this crop on the irrigated farms in the district is much less than that devoted to alfalfa. The reason for this is that the yields of timothy are invariably much lower than the yields of alfalfa and its water requirements are greater. On some farms, however, where the surface drainage is not satisfactory for alfalfa, timothy can often be grown with success, as it is a crop which will tolerate much more water. It does well on land that is kept moist, and is rarely if ever injured by over irrigation.

While timothy cannot be considered as equal to alfalfa as a hay crop for this district, there are many farms where parts of the alfalfa fields have been drowned out that could profitably be sown to timothy.

A field of 0.5 acres of timothy situated on a part of this farm where it received an excessive amount of water yielded 5 tons 500 pounds per acre.

DRY LAND

The experimental work with forage crops consisted of testing out varieties of corn, sunflowers, field roots and hay crops. On account of the very dry weather during the early summer the yields of the corn, sunflowers and root varieties were extremely light and the hay crop practically a total failure.

ENSILAGE CROPS

CORN

Project 108.—Thirteen varieties of corn were tested. These were sown May 18 in rows 3 feet apart, on land which had been summer-fallowed the previous season. They were cut for ensilage on August 25.

The results obtained from corn each season emphasize the fact that it deserves more attention on dry land farms in southern Alberta than it is receiving.

From a silage standpoint the farmers with a few milk cows will find a few acres of corn a great aid in keeping up the milk supply during August and the early part of September, when the pastures are dry or burnt up. By having it growing near the pasture or corral and cutting some each day the milk flow is maintained when the pasture becomes parched in the late summer.

The yields given in the following table are for green fodder weighed as cut.

CORN—TEST OF VARIETIES (DRY LAND)

Variety	% Stand	Average height	Stage of maturity	Yield per acre
		inches		tons lbs.
Wisconsin No. 7	80	54	Tasseled	7 — 1900
Bailey	60	54	"	7 — 1900
Compton's Early	90	48	"	7 — 1300
White Cap Yellow Dent	75	66	"	6 — 1800
North Western Dent	80	60	"	6 — 1500
North Dakota	40	48	"	6 — 1200
Longfellow	75	60	"	6 — 600
Quebec Yellow	100	42	Glazed	6 — 100
Leaming	40	60	Tasseled	5 — 900
Twichell's Pride	60	42	Glazed	5 — 900
Paris Yellow Flint	80	42	Tasseled	4 — 1500
Canada Yellow	90	42	"	3 — 1900
Alberta Yellow Flint	50	24	Ripe	— 1800

SUNFLOWERS

Project 109.—Five varieties of sunflowers were seeded on similar land to the corn varieties. It will be noted from the following table that a very poor stand was obtained, with correspondingly low yields.

SUNFLOWERS—TEST OF VARIETIES (DRY LAND)

Variety	% Stand	Average height	Stage of maturity	Yield per acre
		inches		tons lbs.
Common	40	54	10% in bloom	4 — 1300
Saunders Early	40	60	Ripe	4 — 300
Improved Russian	10	36	Ripe	2 — 800
Finsen's	50	24	50% in bloom.	1 — 1200
Hutton's	5	30	50% in bloom.	— 180

FIELD ROOTS

TURNIPS

Project 110.—Owing to the labour involved in growing field roots very little interest is taken in them by the farmers in this part of the province. Eight varieties were sown on summer-fallow land on May 18. They were sown in rows 3 feet apart and thinned to from 8 to 10 inches in the row. They were pulled October 19.

TURNIPS—TEST OF VARIETIES (DRY LAND)

Variety	% Stand	Yield per acre
		tons lbs.
Ditmars' Swede	95	9 — 1400
McKenzie Northwest	100	8 — 1200
Shepherds' Denmark	80	8 — 200
McKenzie Imperial	90	7 — 600
McKenzie Bangholm	100	6 — 1800
Bangholm (Denmark)	100	6 — 1300
Monarch (Nappan)	100	6 — 1200
Suttons' Champion	90	5 — 1300

MANGELS

Project 111.—Six varieties of mangels were tested. These were sown on summer-fallow on May 18. Due to the poor germination and the effect of the sweeping winds after the plants were thinned, a very poor stand was obtained. They were pulled October 19.

MANGELS—TEST OF VARIETIES (DRY LAND)

Variety	% Stand	Yield per acre
		tons lbs.
Ottawa Yellow Intermediate	80	9 — 900
McKenzie Eclipse	40	5 — 300
McKenzie Grant Long Red	15	3 — 1300
McKenzie Yellow Intermediate	13	3 — 1000
McKenzie Manitoba Giant Yellow	20	2 — 1700
McKenzie Golden Tankard	15	2 — 1100

CARROTS

Project 112.—Six varieties of carrots were seeded on similar land to the other varieties of root crops, but the crop was a total failure.

SUGAR BEETS

Project 113.—Three varieties of sugar beets were tested. They were sown on summer-fallow on May 18. As with the other roots, conditions were unfavourable for obtaining a satisfactory stand. They were dug October 19.

SUGAR BEETS—TEST OF VARIETIES (DRY LAND)

Variety	% Stand	Yield per acre
		tons lbs.
Waterloo	70	5 — 1100
Chatham	20	2 — 1000
B. C. Grown	5	1 — 1900

GRASSES AND LEGUMES

HAY

The season was so dry that practically none of the fields or plots produced anything except the alfalfa grown in rows.

The results of this season's experiments only emphasize the conclusions given in previous reports that alfalfa must be planted in rows to allow inter-tillage if results are to be expected in a dry season. When the rows are less than 3 feet apart the plants do not make much growth, and cultivation with ordinary corn machinery is impracticable.

All of the alfalfa in rows was left for seed production. In most cases the pods failed to fill, and what did were badly broken off by the wind.

The work undertaken with permanent forage crops in the past two years has been very disappointing, as it has been practically impossible to obtain a satisfactory stand owing to the extreme drought.

POULTRY

The weather during the winter of 1920-21 was relatively mild, and although changeable at times, was on the whole favourable for winter egg production, and local farmers and poultrymen have shown considerable interest in the egg production of the Station flock during the past year. Only one breed, the Barred Plymouth Rocks, are kept. One of the main objects in connection with the work with poultry is an endeavour to develop the egg-laying capacity of the flock.

The demand for hatching eggs and cockerels has increased each year to such an extent that it can now only be partially met.

The number of birds kept during the winter of 1920-21 was 160 pullets, 91 hens, and 43 cockerels. All hens and pullets were trapnested throughout the year. The following gives the record of 160 pullets for the four winter months:—

WINTER EGG RECORD OF 160 PULLETS

Pen Number	Number of birds in pen	Number of Eggs Laid				Average per pullet for 4 months
		November	December	January	February	
1	50	78	572	755	461	37·2
2	50	.....	620	719	352	33·3
3	50	684	971	488	612	55·1
Contest pen	10	143	193	156	157	64·9
Total	160	905	2,356	2,118	1,582	43·6
Average per pullet	.....	5·66	14·72	13·24	9·89	

Pen number 3 and the contest pen were early hatched, while pens numbers 1 and 2 were late hatched. This accounts for the higher production of pen number 3 and the contest pen. The record of the best fifty pullets is not so high as the previous year, because the pullets were hatched in early March and started laying in September and October, and later went into a winter moult; also four of the birds died early in the period and were not replaced.

Of the ten pullets entered in the Alberta Egg Laying Contest, six qualified for the Record of Performance (150 eggs) and one for the Advanced Record of Performance (225 eggs).

The 100 late hatched pullets were trapnested until June, and those not showing themselves constant layers were culled out, fattened and sold.

FEEDING

Project 114.—WINTER FEEDING.—The scratch feed fed to pullets for winter laying consisted of equal parts corn and wheat fed in from 6 to 8 inches of straw. The feed is given liberally before the birds go to roost at night. What remains in the litter is sufficient to encourage a good scratch the following morning. At noon a moist mash is fed, composed of equal parts of bran, shorts and corn meal. Green cut bone to the amount of 3 ounces per bird per week is added to the moist mash. No more of the mash is fed than can be consumed in five minutes. Crushed oats, oyster shell, grit, and charcoal fed in hoppers are kept before them all the time. Mangels, cabbage, turnips, and alfalfa leaves have all been fed as green feed. The latter seems to be liked best by the fowls, and has proved to be the most satisfactory in keeping the birds in good condition. Alfalfa is especially valuable as a green feed for the amateur poultryman, as there is not the danger of scouring the fowls with an overfeed of alfalfa that there is with other green feeds.

Project 114a.—SUMMER FEEDING.—For summer feeding the scratch feed is changed to one part corn and five parts wheat. The green bone is reduced to 1½ ounces per bird per week and the wet mash is fed but three or four times per week. When a green crop is growing in the run, no other green feed is supplied. The other feeds are provided the same as in the winter.

INCUBATION

Project 115.—A 2,400 capacity Buckeye incubator was installed in the spring of 1919. This incubator is ventilated with electric fans. Very poor hatching results were obtained with it, due to the electric current supplied the Station being irregular in voltage. Storage batteries were installed in an endeavour to overcome this difficulty, but the results were still disappointing, as the highest hatch obtained was only 18 per cent.

A 200-egg capacity Buckeye was also used with the following results:—

Eggs set	Eggs unfertile	Chicks hatched
609	114	248

PEDIGREE BREEDING WORK

As previously stated, emphasis is being placed at this Station upon developing a laying strain of poultry. The value of this work, if successfully done, can hardly be over-estimated. It is hoped that high production, size, conformation and other desired qualities may be fixed by careful selection for several generations of the progeny of birds of merit who prove themselves able to transmit these features to their descendants.

Pedigree breeding is too expensive and complicated to be successfully carried on by the average commercial poultryman or the farmer, so if much is to be accomplished along this line it must be done by public institutions. In commencing the

work, care is taken in selecting the hens and males used for breeding. The dams are chosen from trapnested stock that have made excellent laying records, as well as meeting the poultryman's requirements for size and type. The sires must be from dams of known merit and are considered satisfactory for pedigree mating only when several of their full sisters have been shown to be consistent layers.

After the breeders have been selected, ten hens are placed in the breeding pen with one male. The hens are trapnested, and as each one is removed from the nest the egg laid is marked in such a way that it can be identified as having been laid by that hen.

Just before hatching, all eggs are placed in bags made of mosquito netting, so that the chicks may be identified. When removing the chicks from the bags they are immediately leg banded. The pullets are trapnested until the next breeding season when selections are made for the breeding.

The cockerels that develop the best are retained until their sisters have been tested out, and only those whose full sisters have made satisfactory laying records are used as breeders.

This year four pens, each containing ten hens and one cockerel, were used for pedigree work. All hens used made records of 180 eggs or more in their pullet year. The male birds were from dams having records of 200 eggs or more. Both hens and cockerels were carefully selected for vigour and trueness to type. From the result of these matings we have 107 pullets now being trapnested and 60 cockerels which are retained waiting for the winter egg laying records of their full sisters. When these records are obtained they will be considered in selecting the males as breeders for the coming season.

THE PROVINCIAL EGG LAYING CONTEST

The second Alberta Egg Laying contest, in which there were ten more pens entered than in the first contest, was concluded on October 30, 1921. These contests are being carried on in an endeavour to aid in developing better laying strains of poultry in Alberta. Each contestant entered a pen consisting of 10 pullets of a standard breed.

Table showing the total production of each hen and each pen in the Contest ending October 30, 1921.

B.R.—Barred Rocks; S.C.R.I.R.—Single Comb Rhode Island Reds; R.C.R.I.R.—Rose Comb Rhode Island Reds; W.W.—White Wyandottes; R.C.Anc.—Rose Comb Anconas; S.C.A.—Single Comb Anaconas; S.C.W.L.—Single Comb White Leghorns; B.O.—Buff Orpingtons; S.L.W.H.—Silver Laced Wyandotte Hens; F.—Floor eggs.

X—Production of more than one bird.
D—Dead but not substituted.

Pen	Owner and address	Breed	1	2	3	4	5	6	7	8	9	10	F	Total
1	W. Northcott, Beddington, Alta.	B.R.	156	142	85	134	153	D78	135	117	167	130	21	1,318
2	W. A. Fraser, Medicine Hat, Alta.	B.R.	97	180	129	72	86	97	128	218	136	138	18	1,299
3	Coleman & Son, Lethbridge, Alta.	B.R.	163	166	229	142	120	136	101	197	142	155	9	1,560
4	C.P.R. Demonstration Farm, Strathmore	B.R.	45	180	199	125	246	178	102	69	162	148	15	1,469
5	Mrs. W. Dow, Veteran, Alta.	B.R.	139	148	135	181	68	175	D75	132	23	127	27	1,330
6	F. Edwards, Edmonton, Alta.	B.R.	193	172	132	146	181	127	158	166	178	203	12	1,668
7	Westbrook Bros., Lethbridge, Alta.	B.R.	D125	102	168	81	185	181	133	207	142	168	10	1,503
8	H. V. Grainger, Calgary, Alta.	S.C.R.I.R.	182	X75	124	D	79	91	224	9	98	119	18	1,019
9	G. Jones, Lethbridge, Alta.	R.C.R.I.R.	115	123	65	148	168	136	90	162	174	118	6	1,305
10	Patrick Lee, Royalist, Alta.	W.W.	81	104	119	108	145	131	103	100	96	86	13	1,086
11	C.P.R. Demonstration Farm, Strathmore	S.C.R.I.R.	111	132	120	72	X92	161	175	198	105	184	17	1,367
12	Sunalta P. Yards, Calgary, Alta.	R.C.A.	170	115	110	125	155	46	142	27	D3	144	7	1,044
13	H. C. Graham, Lethbridge, Alta.	S.C.A.	155	125	140	110	113	176	126	146	176	130	10	1,407
14	Alex. Masson, Lethbridge, Alta.	S.C.A.	134	144	111	130	168	140	169	103	96	177	14	1,396
15	J. Heintz, Lethbridge, Alta.	S.C.A.	D65	145	109	149	125	174	136	121	89	94	9	1,216
16	F. Enderton, Lethbridge, Alta.	S.C.A.	80	156	207	212	118	124	153	152	111	177	10	1,500
17	E. H. Young & Son, DeWinton, Alta.	S.C.W.L.	122	121	118	142	98	77	42	103	105	137	8	1,076
18	J. and N. Gurr, Lethbridge, Alta.	S.C.W.L.	69	107	152	D66	86	68	115	92	99	D71	4	929
19	V. Erickson, Dunmore, Alta.	S.L.W.H.	89	144	89	26	93	143	106	38	146	99	7	980
20	D. P. Carlyle, Lethbridge, Alta.	B.O.	x163	165	86	117	73	104	164	125	91	126	10	1,264
21	Exp. Station, Lethbridge, Alta.	B.R.	220	188	166	199	167	238	191	204	162	187	5	1,961

The third contest is now under way, having been begun on November 1, 1921.

BEES

The season's results with bees furnish further proof that the possibilities of profitable honey production are very promising in localities in this district where alfalfa is grown under irrigation. The problem of wintering appears to be the only serious obstacle to be overcome. Experience during the past dozen years seems to demonstrate that any colony that is in a strong condition in the spring will gather a most satisfactory supply of honey during the summer, provided the bees have access to nearby alfalfa fields. The results this season confirm previous observations concerning the fact that the bees gather little or no honey previous to the time alfalfa is in bloom.

WINTERING

Project 116.—During the winter of 1920-21 two colonies were wintered in a dug-out cellar and nine colonies outside in wintering cases.

The two colonies wintered in the dug-out cellar were put on swinging shelves to protect them from any possible attacks from mice. To prevent moisture gathering on the inside of the hives the covers were replaced with cloth tops and covered with about five inches of chaff.

The colonies wintered outside in wintering cases were packed on all sides, as well as the bottom and tops, with from five to six inches of planer shavings. One colony was packed singly and two lots of two colonies in a double case, and the remaining four colonies were packed in a large case, two colonies facing the north and two the south. It appeared to make little difference whether they were packed singly or in lots of two or four. The colonies facing the north did not make as many flights during the winter as those facing south. The winter's results again demonstrated that the colonies wintered outside in wintering cases come through better than those wintered in the dug-out cellar.

The first examination was made on April 11. It was found that of the nine outside colonies, seven had brood and eggs. Queens were present in the other two, but these died later, owing, probably, to the honey being candied. Another hive was lost from the bees fighting. Had the hives been placed farther apart, and smaller entrances used, this loss could doubtless have been prevented. The two colonies wintered in the cellar were found dead with stores soured and candied.

The six best colonies at this first examination average five frames each, well covered with bees.

Of the eleven colonies therefore that went into the winter only six were alive to begin the summer's work.

As to the causes of winter-killing, observations at this Station have been rather conclusive in indicating that the candying of the stores has a great deal to do with the winter difficulties. The honey candies in the comb, as alfalfa honey often does, and the bees appear to die of thirst during the long periods when it is impossible for them to have flights and seek moisture from outside sources. To overcome this trouble, or at least supply the bees with some stores that will not candy, liberal feeding in the fall of sugar syrup is resorted to. The syrup is made up with two parts of granulated sugar to one part of water.

GENERAL NOTES

On the first of June one of the hives was placed on a scale and a record of its weight was made each day until the first frost occurred in the fall. Some interesting data were thus obtained as to whether the bees were gaining or losing and when the greatest amount of honey was being gathered. The greatest gain made by this colony in any one day was 22 pounds.

The production of honey during the summer was very satisfactory. The six hives (spring count) averaged 149 pounds 10 ounces of honey for the season. The highest record from one hive was 369 pounds of extracted honey.

Two 2-pound packages of bees were purchased in Alabama and were received on May 20. These arrived in good condition, again demonstrating the fact that bees can be shipped long distances by mail quite safely.

One was given drawn out comb and the other given foundation and both fed 7 pounds of sugar syrup. A month later these were examined and it was found that the one given the drawn out comb had six frames of brood and eggs, while the other had only three frames of brood and eggs.

At the close of the season the one started on the drawn out comb had produced 128 pounds of extracted honey, while the other started on the foundation produced only 108 pounds.

For re-queening purposes two frames were taken from the highest producing colony of the previous year and put in a hive by itself. There was no difficulty experienced in getting this hive to produce queen cells, and from these all colonies were requeened during the month of August. These queens laid in time to produce a large number of young bees for wintering, which is always most desirable.

EXHIBITION WORK

Two exhibitions were staged during the year, one at the Lethbridge Summer Fair and the other at the Annual Flower Show held at Calgary.

The Lethbridge Fair was well attended by farmers, and their interest in the display of silos and silage crops was very encouraging.

The Calgary exhibit was entirely along horticultural lines, demonstrating the possibilities of growing vegetables and fruits in this part of the province.