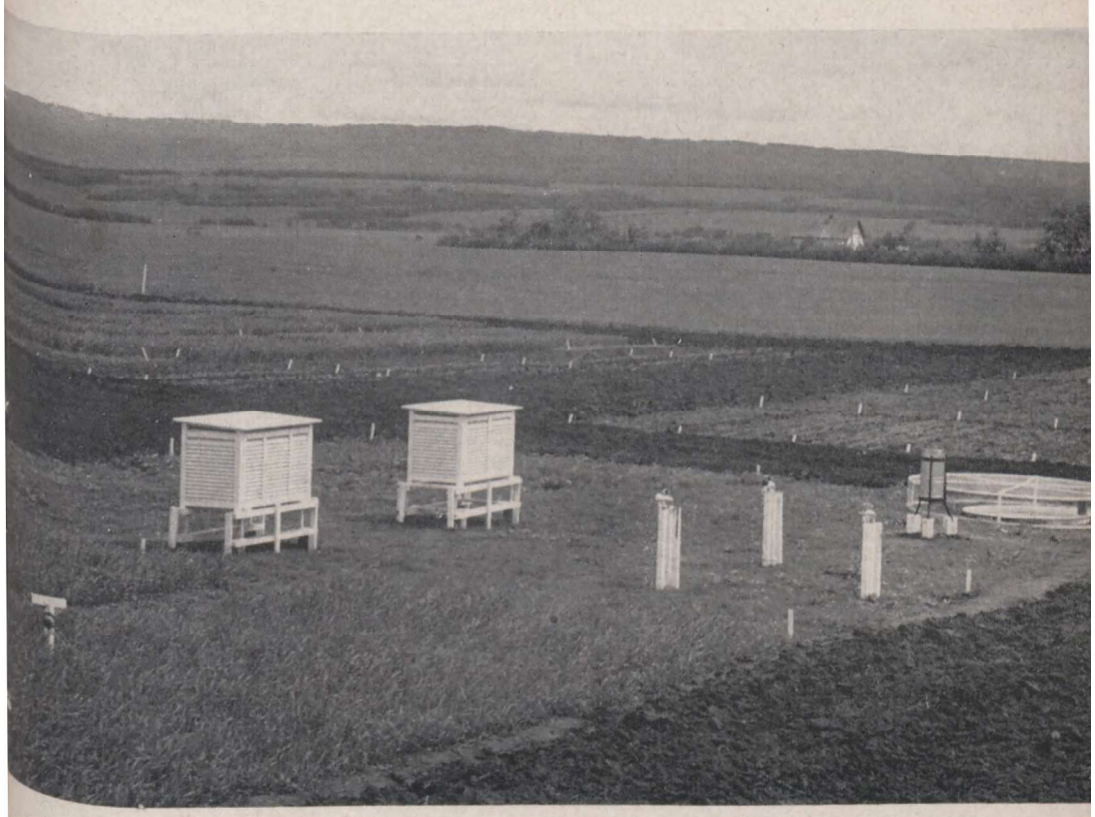
CANADA
DEPARTMENT OF AGRICULTURE
EXPERIMENTAL FARMS SERVICE

DOMINION EXPERIMENTAL STATION

BEAVERLODGE
ALBERTA

E. C. STACEY, B.A., M.Sc., SUPERINTENDENT

PROGRESS REPORT
1948 - 1952



An agro-climatological site is being established on the Station to study climatic factors affecting crop development.

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* Resigned September, 1952.

INTRODUCTION

The region served by the Beaverlodge Station comprises the area commonly known as the Peace River Block of Alberta and British Columbia. It extends from Whitecourt on the Athabasca River, and the east end of Lesser Slave Lake, west to Hudson Hope, and north to Keg River on the Mackenzie highway, and Muncho Lake on the Alaska highway. The potential arable land is estimated at 16,500,000 acres, of which 13,000,000 may be classed as grey wooded soil. At present there are 2,500,000 acres under cultivation. Since the end of World War II settlement and development have been extensive and are continuing without abatement.

The Station has expanded considerably in the period covered by this report. Physically, this includes the acquisition of 160 acres of land to be devoted to pasture trials, the installation of fire-fighting equipment and the construction of a fully modern office building, a heated garage, six staff houses, a water reservoir and water and sewer services. In addition, three staff houses have been renovated. Staff additions include specialists to take charge of livestock, forage, and pasture investigations. A second Supervisor of Illustration Stations was also added.

Soil studies have demonstrated the importance of proper soil structure, and fertility studies now under way indicate clearly the need for applications of fertilizer containing both nitrogen and phosphorus, to cereals, and especially nitrogen to crops on land broken out of sod. Weed control studies have advanced, but infestations of wild oats, couch grass and toadflax cannot be controlled adequately on the basis of present knowledge. The new chemical BHC can now be utilized to reduce wireworm populations. Much progress has been made in defining horticultural problems. Cereal breeding is designed to produce superior, early-maturing varieties of barley and wheat. Forage crop seed has become a very important cash crop throughout the district and studies have been initiated to solve the many associated problems. Test seedings have done much to popularize the use of forage crops for soil improvement. Livestock research has centered on losses in baby pigs and nutritional disorders of swine. Studies are being conducted also to test the pasture potential of degraded and grey wooded soils, both in good physical condition and when depleted.

Since the publication of the Progress Report for 1937-47 by this Station, agriculture has experienced many changes. Most notable of these has been the utilization of expensive farm machinery to offset the acute shortage of labor and to permit proper and timely operation. This has led to greater efficiency in some instances, but in others serious problems, such as greater weed spread through the use of combines, and speedy, shallow tillage by heavy equipment which leaves the soil in improper condition have resulted.

Review of the Seasons

In 1948 seeding was not general until May 18. Adequate rains did not fall until early July, too late for satisfactory yields, while a killing frost occurred August 26. Harvesting was not completed until mid-October. The frost was severe on forage crop seed, especially sweet clover. Cereals suffered likewise, wheat grading number 3 or 4.

The 1949 season started well and a good crop was in prospect. By mid-summer the outlook was only fair, while late rains caused considerable second growth, resulting in uneven ripening and delayed harvesting. Frost held off until September 11 but even at that date did considerable damage to late grain crops. Much of the legume seed crop was lost because of unfavorable harvest conditions.

TABLE 1.—PRECIPITATION RECORDS

Monthly and Annual Precipitation Records in Inches
1948-52, Inclusive, with 37-year Average and Monthly Extremes for the Same Period

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total annual snow-fall	Total annual rain-fall	Total annual preci-pitation
1916	0·70	0·30	1·45	0·09	0·21	0·45	3·98	0·47	0·52	0·56	0·10	1·50	40·00	6·33	10·33
1917	2·50	1·00	0·95	0·37	6·62	1·02	0·41	0·88	0·21	1·82	0·39	2·60	89·50	9·82	18·77
1918	1·12	1·20	1·36	0·60	0·22	2·29	3·59	1·71	0·42	0·97	0·55	1·10	55·00	9·63	15·13
1919	0·65	0·70	1·95	0·82	1·04	2·48	2·22	2·14	1·78	2·18	2·34	1·78	92·00	10·88	20·08
1920	3·85	0·20	2·12	1·82	1·15	3·17	2·52	2·66	1·80	1·65	0·43	0·75	78·50	14·27	22·12
1921	1·40	0·97	1·20	0·03	1·65	2·04	1·89	2·51	2·69	0·67	0·91	0·60	44·60	12·10	16·56
1922	1·75	1·75	1·20	0·10	2·11	0·38	0·44	0·54	1·44	0·61	0·78	0·80	72·00	4·70	11·90
1923	0·70	.....	1·60	0·23	0·23	1·26	3·65	0·92	0·37	0·18	0·12	0·50	28·50	6·91	9·76
1924	1·20	0·44	1·40	0·15	0·45	0·60	1·91	4·60	1·43	1·99	1·43	1·57	71·20	10·05	17·17
1925	1·27	1·79	1·70	0·13	0·93	1·23	1·38	3·50	2·45	1·61	2·05	2·51	114·30	9·12	20·55
1926	0·50	0·45	0·28	0·66	1·06	4·45	2·06	0·69	1·84	0·68	1·49	1·17	64·30	8·90	15·33
1927	1·65	1·40	1·00	0·79	2·38	2·78	2·98	1·03	2·27	0·85	1·55	2·00	92·60	11·42	20·68
1928	0·42	0·20	1·12	3·05	0·95	2·26	2·16	1·48	0·84	0·83	0·10	1·40	62·10	8·60	14·81
1929	2·60	0·60	0·50	1·17	2·05	2·17	3·54	1·20	4·89	0·70	1·34	0·85	90·25	12·58	21·61
1930	0·65	0·40	0·49	0·56	2·71	3·20	1·20	0·95	2·39	1·72	1·32	0·36	39·00	12·05	15·95
1931	0·25	.....	1·50	0·10	1·34	2·54	1·11	1·66	1·18	0·67	1·40	0·73	35·80	8·90	12·48
1932	0·80	1·86	1·45	2·08	0·93	0·48	1·93	1·38	0·82	0·87	2·42	0·35	83·75	6·99	15·37
1933	1·53	1·78	1·15	1·06	1·76	1·72	1·90	0·30	1·73	2·41	3·43	3·35	111·40	10·98	22·12
1934	0·98	0·30	1·55	0·34	1·25	2·16	2·36	2·99	3·29	1·38	1·71	1·55	63·50	13·51	19·86
1935	3·20	0·85	1·65	0·69	2·21	3·08	4·90	2·33	0·94	1·22	2·32	0·68	92·70	14·80	24·07
1936	1·36	0·98	0·60	1·36	1·14	4·11	1·81	1·87	3·60	1·67	1·11	1·12	84·10	12·32	20·73
1937	1·88	0·25	1·06	0·84	0·73	1·60	2·25	3·85	1·24	1·20	1·45	1·04	65·40	10·85	17·39
1938	0·75	1·18	0·70	0·43	0·34	1·41	0·49	2·41	2·24	0·70	1·48	1·48	57·10	7·90	13·61
1939	1·09	2·63	1·29	0·98	1·66	1·61	3·70	1·94	2·02	3·22	1·19	1·34	91·45	13·52	22·67
1940	1·79	0·71	2·09	1·97	1·03	1·29	2·83	0·37	0·54	0·58	1·52	0·49	70·50	8·16	15·21
1941	1·10	1·49	0·42	0·68	2·15	2·75	4·56	3·24	4·05	1·16	0·68	1·09	57·70	17·60	23·37
1942	0·05	0·59	0·68	1·15	2·34	2·92	1·00	2·20	1·32	0·34	2·67	1·06	57·40	10·58	16·32
1943	0·41	0·74	1·65	0·08	3·44	3·31	2·26	2·71	0·64	0·49	.....	0·13	29·50	12·91	15·86
1944	0·33	1·75	0·71	0·88	1·09	2·34	1·42	0·98	2·85	0·46	1·98	0·78	48·90	10·68	15·57
1945	2·65	0·81	0·48	0·88	1·53	1·94	0·62	0·44	2·27	1·87	1·51	0·57	84·80	7·09	15·57
1946	1·62	0·90	0·18	0·11	1·37	1·54	1·31	0·89	1·57	0·35	0·99	1·97	58·10	6·99	12·80
1947	2·55	2·40	0·67	1·18	1·49	1·27	5·57	2·21	1·33	0·91	0·83	1·65	87·71	13·29	22·06
1948	0·64	2·54	1·54	2·28	0·84	8·83	3·88	3·99	1·62	0·45	0·46	0·88	78·70	12·08	19·95
1949	1·56	1·39	0·86	0·82	1·74	2·15	1·84	2·14	0·93	0·94	0·91	2·12	65·10	10·89	17·40
1950	0·44	1·19	0·19	0·96	2·20	0·55	2·42	2·21	0·91	0·65	2·20	0·91	63·85	8·44	14·83
1951	1·26	2·33	1·44	1·09	2·07	1·10	8·23	1·86	1·22	2·27	0·53	0·87	72·70	17·00	24·27
1952	2·03	0·93	0·84	0·36	0·41	2·01	2·18	2·36	1·03	0·52	0·15	0·40	47·10	8·51	13·22
5-year average	1·19	1·68	0·97	1·10	1·45	1·33	3·71	2·51	1·14	0·97	0·85	1·04	65·49	11·39	17·94
37-year average	1·33	1·05	1·11	0·83	1·54	1·96	2·50	1·88	1·69	1·12	1·24	1·19	68·68	10·58	17·44
Extremes for the 37-year period 1916-1952 — Low	0·05	0·00	0·18	0·03	0·21	0·38	0·41	0·30	0·21	0·18	tr.	0·13	28·50	4·70	9·76
Year	1942	1923 1931	1946	1921	1916	1922	1917	1933	1917	1923	1943	1943	1923	1922	1923
High	3·85	2·63	2·12	3·05	6·62	4·45	8·23	4·60	4·89	3·22	3·43	3·35	114·30	17·60	24·27
Year	1920	1939	1920	1928	1917	1926	1951	1924	1929	1939	1933	1933	1925	1941	1951

NOTE: Snow is converted to rain (10 inches of snow equals 1 inch of rain).

Meteorological records taken in co-operation with the Meteorological Division of the Department of Transport.

The weather in 1950 was unseasonal much of the time. The first seeding on the Station was late, May 15. Crops started well but were retarded by scanty moisture in June. July and August rains revived the crops but delayed maturity.

A severe hail storm ruined much of the seed crop of creeping red fescue. Finally, several inches of wet snow blanketed the crop on August 15, followed by five degrees of frost on August 16.

The 1951 season opened late, with wheat seeding becoming general by May 25 and seeding of coarse grains extending into June. Growth was slow until July, when 8·23 inches of moisture were recorded at the Station and lesser amounts elsewhere. This stimulated all crops. A frost on August 14, severe at Beaverlodge, checked growth. In the Grande Prairie district yields and grades were low; elsewhere they were more favorable and the crop was secured without undue effort.

The 1952 April and May were dry, June and July normal, and August wetter than usual. Frosts hit on August 15 so that once again yields and grades were affected, though not generally so much as in 1951.

Early fall frosts may be expected in this latitude and their severity varies with location. However, the succession of such frosts within the period of this report is unusual and has caused much concern, particularly in areas not previously known to be frosty. This has been met to some degree by a greater diversification of cropping, particularly seed production of forage crops, and an intensification of livestock enterprises.

TABLE 2.—METEOROLOGICAL RECORDS 1948-52 INCLUSIVE

Month	Temperature in °F.			Precipitation in inches			Bright sun in hours	Wind hourly velocity in m.p.h.	Evaporation in inches
	Highest	Lowest	Mean	Rain	Snow	Total precipitation			
January	44·8	−47·1	1·48	0·02	11·7	1·19	75	7·0	—
February	48·0	−33·7	7·91	0·00	16·8	1·68	108	6·7	—
March	51·5	−35·3	18·44	0·03	9·4	0·97	150	7·0	—
April	71·0	− 8·0	34·93	0·48	6·2	1·10	201	9·3	0·34
May	83·2	23·9	50·17	1·40	0·5	1·45	267	9·7	3·14
June	89·1	32·1	56·93	1·33	0·0	1·33	290	9·0	3·85
July	90·1	34·9	59·58	3·71	0·0	3·71	280	7·3	3·40
August	88·2	27·1	55·58	2·41	1·0	2·51	236	6·8	2·75
September	86·0	15·9	51·25	1·06	0·8	1·14	209	7·5	2·26
October	78·5	− 8·4	38·68	0·72	2·5	0·97	131	7·7	0·89
November	71·3	−26·6	24·94	0·13	7·2	0·85	85	7·0	—
December	53·6	−35·9	8·80	0·08	9·6	1·04	68	6·2	—
Annual			34·06	11·37	65·7	17·94	2,100	7·6	16·63
Long-term			*35·67	*10·59	*68·6	*17·48	†2,101	‡8·1	§18·24

* 1916-52 (37 years)
† 1923-52 (30 years)
‡ 1936-52 (17 years)
§ 1922-52 (31 years)

TABLE 3.—OCCURRENCE OF FROST AND FROST-FREE PERIODS

Frost: 32°F. or Lower; Killing Frost: 28°F. or Lower

Year	Last frost in spring		First frost in fall		Number of frost-free days	Last killing frost in spring		First killing frost in fall		Number of crop days (above 28°F.)
	Date	Temp.	Date	Temp.		Date	Temp.	Date	Temp.	
		°F.		°F.			°F.		°F.	
1916	June 1	25·0	Aug. 10	27·0	69	June 1	25·0	Aug. 10	27·0	69
1917	May 31	32·0	July 29	32·0	58	May 29	28·0	Sept. 4	27·0	97
1918	June 5	30·0	July 23	29·0	47	May 25	27·0	Sept. 30	25·0	127
1919	June 5	32·0	Aug. 5	31·0	60	June 1	24·0	Sept. 27	23·0	117
1920	June 11	31·0	Aug. 29	32·0	78	May 25	28·0	Sept. 15	28·0	112
1921	June 3	31·0	Sept. 2	32·0	90	May 4	27·0	Sept. 9	26·0	127
1922	June 18	32·0	Sept. 2	30·5	75	June 6	26·0	Oct. 2	28·0	117
1923	May 28	31·0	Aug. 1	32·0	64	May 15	28·0	Sept. 22	24·0	129
1924	May 26	30·0	Aug. 30	32·0	95	May 8	28·0	Sept. 20	24·0	134
1925	May 27	32·0	Sept. 12	32·0	107	May 24	28·0	Sept. 16	25·0	114
1926	June 10	32·0	Sept. 8	30·0	89	May 6	28·0	Sept. 14	27·0	130
1927	May 26	32·0	Sept. 6	32·0	102	May 1	26·0	Sept. 24	25·0	145
1928	June 6	30·0	Sept. 7	28·0	92	May 10	23·0	Sept. 7	28·0	119
1929	June 17	30·0	Sept. 5	30·0	79	May 9	24·0	Sept. 26	26·0	139
1930	May 23	32·0	Aug. 30	32·0	98	May 21	21·0	Sept. 22	24·0	123
1931	May 25	32·0	Sept. 14	31·0	111	May 8	26·0	Sept. 17	26·0	131
1932	June 18	30·0	Sept. 12	30·0	85	May 18	28·0	Sept. 20	28·0	124
1933	June 11	32·0	Sept. 4	29·0	84	April 29	28·0	Sept. 6	27·0	129
1934	May 22	32·0	Sept. 12	31·2	112	April 18	25·3	Sept. 14	26·5	148
1935	June 8	28·0	Aug. 16	30·9	68	Juns 8	28·0	Sept. 23	27·3	106
1936	May 12	31·1	Sept. 10	31·2	120	April 28	27·2	Sept. 13	27·8	137
1937	May 20	31·4	Sept. 21	31·3	123	April 26	25·6	Sept. 23	26·8	149
1938	June 6	31·6	Oct. 6	30·8	121	April 30	27·2	Oct. 16	26·9	168
1939	May 10	28·8	Sept. 13	28·1	125	April 30	27·1	Oct. 2	27·2	154
1940	May 28	31·1	Oct. 5	25·6	129	April 16	25·8	Oct. 5	25·6	171
1941	May 26	29·2	Aug. 30	31·2	95	April 17	23·8	Sept. 20	27·6	155
1942	May 15	28·1	Sept. 16	31·9	123	April 26	26·3	Oct. 12	23·2	168
1943	May 16	27·3	Sept. 7	31·1	113	May 16	27·3	Sept. 15	25·4	121
1944	May 12	28·9	Sept. 29	27·3	139	May 11	26·3	Sept. 29	27·3	140
1945	May 9	28·8	Sept. 21	31·1	134	May 8	25·8	Sept. 24	18·2	138
1946	May 14	30·9	Sept. 6	31·2	114	May 9	26·8	Sept. 7	27·1	120
1947	May 18	30·9	Aug. 19	30·8	92	May 5	25·9	Sept. 17	27·2	134
1948	May 3	29·9	Aug. 26	28·2	114	April 28	27·8	Sept. 29	27·2	153
1949	May 26	31·9	Sept. 10	31·6	106	May 23	27·4	Sept. 11	20·7	110
1950	May 24	31·3	Aug. 15	31·9	82	April 26	27·1	Aug. 16	27·1	111
1951	May 30	27·0	Sept. 14	32·0	106	May 30	27·0	Sept. 23	25·0	115
1952	May 7	28·9	Aug. 15	31·8	99	May 6	23·9	Oct. 3	24·0	149
37-year average	May 27	—	Sept. 2	—	97	May 11	—	Sept. 19	—	130
Shortest crop season: 1918	June 5	30·0	July 23	29·0	47	June 1	25·0	Aug. 10	27·0	69
Longest crop season: 1944	May 12	28·9	Sept. 29	27·3	139	April 16	25·8	Oct. 5	25·6	171

Earliest and latest frost dates (32°F. or lower) 1916-52

Latest spring frost: June 18, 1922—32°, 1932—30°
Earliest last spring frost: May 3, 1948—29·9°
Earliest fall frost: July 23, 1918—29°
Latest first fall frost: Oct. 6, 1938—30·8°

Earliest and lateet killing frost dates (28°F. and lower) 1916-52

Latest spring killing frost: June 8, 1935—28°
Earliest last killing frost of spring: April 16, 1940—25·8°
Earliest fall killing frost: Aug. 10, 1916—27°
Latest first killing frost of fall: Oct. 16, 1938—26·9°

ANIMAL HUSBANDRY

Swine Nutrition

Baby Pig Losses as Related to Nutrition of the Sow:—Research has indicated that nutrition is one of the most important factors affecting death losses among young pigs. If sows are not fed properly during the pregnancy period, many pigs may be born dead or so weak that they never make normal growth. Mortality of spring-farrowed pigs is almost twice that of pigs farrowed in the fall. Sows placed on good alfalfa pasture and fed only small allowances of concentrates almost invariably farrow thrifty litters whereas sows confined in vegetation-free yards frequently have reproductive trouble or unthrifty litters. These observations suggest that the levels of alfalfa used in dry lot rations are not sufficiently high for optimum performance of the sow. Therefore, an experiment was undertaken using alfalfa in varying proportions with oats, wheat, and tankage. The object was to learn whether or not different levels of alfalfa in the ration of pregnant sows would have any pronounced effect on the number of live pigs farrowed or on their survival to weaning time.

Purebred Yorkshire gilts were used in the experiment. They were placed in vegetation-free paddocks for a period of about 16 weeks and were penned individually at feeding time to permit records of feed consumption. The pertinent data for the two successive farrowings are presented in Table 4.

TABLE 4.—EFFECT OF VARIOUS LEVELS OF ALFALFA ON STRENGTH, LIVABILITY, AND WEANING WEIGHT OF SWINE, 1952

Alfalfa in pregnancy ration	Litter	Average number of pigs per litter	Average birth weight per pig	Strong pigs at birth	Weaned	Average number of pigs weaned per sow	Average litter weight at 56 days
%			lb.	%	%		lb.
0	First	9·2	2·6	84	86	8·0	209
	Second	11·8	2·5	79	81	10·0	233
10	First	8·8	2·8	97	94	8·5	232
	Second	10·8	2·8	93	91	9·8	235
20	First	11·5	2·5	83	85	9·8	228
	Second	9·0	2·8	91	88	8·0	232

This experiment indicates that breeding efficiency, strength, birthweight, and percentage survival can be increased slightly by including a moderate amount of high quality, field-cured alfalfa hay in the ration of pregnant sows.

The investigation is being continued to determine whether pre-weaning losses can be reduced further and weaning weights increased through feeding a high-energy, high-protein ration to the suckling pigs instead of the lactation ration fed in this trial.

Improving the quality of oat rations for weanling pigs:—Many pigs fail to make satisfactory gains during the first month after weaning. Young pigs, when confined, often have digestive troubles and make poor growth. In some instances there is a general deterioration in their condition to the point of emaciation, extreme weakness, and even death. This is particularly evident when the ration contains ground oats. Most of the external symptoms indicate that the pigs suffer from digestive disturbances induced by an inadequate post-weaning ration.

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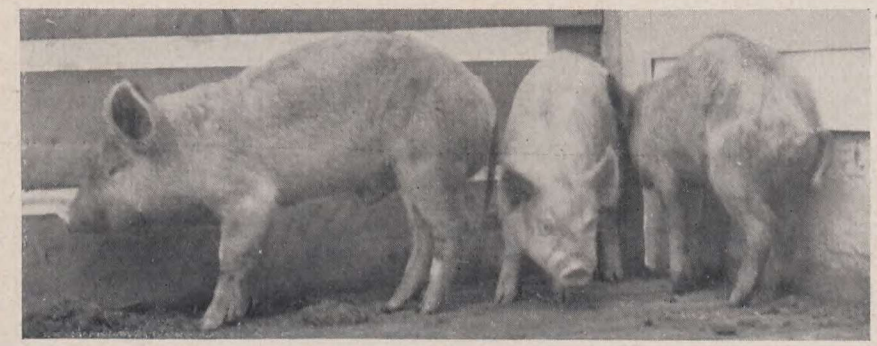

FIG. 1.—Unthrifty pigs resulting from digestive disturbances.

To investigate this complex problem a feeding trial was set up to study the effect of certain combinations of B-complex vitamins and antibiotics in the ration of weanling pigs. The following basal ration was fed to each of five lots:

	lb.		lb.
Oats finely ground	520	Alfalfa meal	10
Oat groats	345	Limestone	5
Tankage	50	Iodized salt	5
Soybean oil meal	40	Vitamin A and D oil	5
Linseed oil meal	20		

Supplements to the basal ration were:

Lot 1 — Basal ration only.
Lot 2 — Basal plus 4·0 mg. niacin per lb. of ration.
Lot 3 — As Lot 2, plus 1·0 mg. riboflavin per lb. of ration.
Lot 4 — As Lot 3, plus 2·0 mg. calcium pantothenate per lb. of ration.
Lot 5 — As Lot 4, plus 5·0 mg. penicillin per lb. of ration.

Essential data relative to this experiment are presented in Table 5.

TABLE 5.—INFLUENCE OF B VITAMINS AND ANTIBIOTIC SUPPLEMENTS ON GAIN AND FEED REQUIREMENTS OF SWINE, 1952

Lot number	Initial weight	Final weight	Daily gain	Daily ration	Feed per 100 lb. gain
	lb.	lb.	lb.	lb.	lb.
1	30·2	84·0	0·77	2·34	303
2	29·8	81·6	0·74	2·34	316
3	30·0	91·0	0·87	2·63	302
4	29·8	86·0	0·80	2·58	321
5	29·8	100·6	1·01	2·88	284

Data basis individual gains. Five pigs per lot.

No symptoms of nutritional inadequacy were observed in any of the lots. Apparently the basal ration contained sufficient amounts of niacin, riboflavin, and pantothenic acid as symptoms indicative of intestinal disturbances were not observed in any of the lots. There was no evidence that the vitamin supplements added anything in which the pigs were deficient. The antibiotic, penicillin, when added to a combination of these three vitamins, resulted in 32 per cent increase in daily gain the result probably of stimulation to greater food consumption and to more efficient utilization of feed.

FIG. 2.—Same pigs as in Fig. 1 but with digestive disturbances corrected.

Swine Management

Save the pigs by crating the sow:—It has been estimated that 25 per cent of all pigs born die from crushing and chilling during the first ten days unless given protection. Efforts have been made to keep these losses to a minimum by using guard rails and brooders. Farrowing crates have been used with varying success but are relatively unknown in Western Canada.

In 1952 the use of the farrowing crate was adopted to standardize farrowing losses in an important nutrition experiment. The results to date suggest that it offers the surest and easiest method of caring for farrowing sows and their litters. Not only are there fewer losses from crushing but the time required in supervising farrowing is materially reduced. The practice is to place the sow in the crate from two days before farrowing until eight days after farrowing. The basic plan, as distributed by the Alberta Department of Agriculture, is used but the openings to the side portions are adjusted to the size of the sow so that she cannot become wedged under the safety compartment.

The records of 16 sows and gilts which farrowed in 1951 in pens equipped with guard rails and electric brooders and 22 sows and gilts which farrowed in crates in 1952 are presented in Table 6. This comparison indicates the relative merits of the two methods of handling.

TABLE 6.—COMPARISON OF PEN AND CRATE FARROWINGS

—	Pen	Crate
Litters.....no.	16	22
Pigs farrowed alive.....no.	172	205
Pigs crushed.....no.	21	4
Per cent crushed..... %	12·2	2·0

Sheep Nutrition

Moldy oats in the ration of fattening lambs:—The problem of the feeding value of oats damaged by various fungi, i.e., molds and mildews, was widespread in the spring of 1952. In the Peace River region alone approximately

one million bushels of oats had become damaged as a result of overwintering in the swath or stook. For the most part, this grain was badly discolored and some kernels showed rot. An experiment was conducted, therefore, to determine the feeding value of these oats compared with number 1 Feed oats.

Fattening lambs were penned in groups of nine and individually stall-fed. All lambs were given access to a mineral mixture of equal parts bonemeal and cobaltized salt. The moldy oats fed weighed 32 pounds per bushel and were graded as Rejected. The number 1 Feed oats weighed 34 pounds per bushel.

TABLE 7.—FEEDING VALUE OF MOLDY OATS, 1952

—	Number 1 Feed oats, brome-alfalfa hay	Rejected oats, brome-alfalfa hay
Initial weight.....lb.	64·2	64·3
Final weight..... "	95·0	93·4
Daily gain..... "	0·37	0·35
Daily oats fed..... "	1·69	1·74
Daily hay fed..... "	1·10	1·06
Oats required for 100 lb. gain..... "	462	502
Hay required for 100 lb. gain..... "	302	307

Daily gains were very good in both lots and the lambs fattened at essentially the same rate. It is significant that it required 9 per cent more Rejected oats to produce the same amount of gain as number 1 Feed oats. This increase is in line with the difference in bushel weight of the two feeds.

CEREALS

Emphasis is placed on the breeding of early maturing varieties, with barley receiving the greatest attention. An active wheat breeding program is conducted in co-operation with the Experimental Station, Lacombe. A moderate selection program is maintained with oats. No breeding work is undertaken with flax or with winter cereals.

Varieties and selections that respond favorably on the Station are studied more extensively on from 10 to 14 farms located throughout the district, in co-operation with the Illustration Stations Division. All locations are classified as being either on degraded-black-to-black or grey wooded soil and the varieties are studied on the basis of their response to soil type. These adaptability trials, which indicate a variety's potential worth to a part or all of the region, constitute the basis for this report.

Hard Red Spring Wheat

While Saunders is meeting with considerable success, there is still much scope for improvement of many of the characteristics prerequisite to satisfactory performance. In the breeding program, development of still earlier maturity is being given first consideration. It is realized, of course, that the ultimate also demands satisfactory quality, high yield, strong straw, and resistance to shattering, combined with easy threshing and resistance to disease, especially bunt.

Adapted varieties:—Saunders is the variety best adapted to all major soil and climatic conditions within the area. It is slightly superior to Thatcher in yield on the various black soils and slightly inferior on the grey wooded soils. On all soils it is considerably earlier maturing than Thatcher, superior in kernel characteristics and at least equal to it in other respects. It threshes more easily than Thatcher but holds its kernels sufficiently well to make a satisfactory combine variety under normal conditions. It is at least moderately resistant to all important diseases, including bunt and root rot.

While Thatcher appears generally inferior, there are a few areas in which it apparently excels Saunders in performance and where its later maturity is not a disadvantage.

TABLE 8.—COMPARATIVE PERFORMANCE OF ADAPTED VARIETIES OF HARD RED SPRING WHEAT

(Summary 1947-49, 1951-52)

Variety	Days to ripen	Height in inches	Resistance to lodging (Scale 1-9)	Yield in bushels per acre	Bushel weight in lb.	1000 K weight in gm.
	Degraded-Black-to-Black Soil Locations					
Number of tests	24	30	30	30	30	30
Saunders	119·3	31·3	1·4	34·9	62·1	32·6
Thatcher	121·6	33·4	1·5	33·5	61·3	29·3
	Grey Wooded Soil Locations					
Number of tests	13	19	19	19	19	19
Saunders	115·4	26·9	1·2	20·5	62·0	31·7
Thatcher	118·1	29·4	1·3	20·8	61·7	29·5

Other varieties:—Garnet and Red Bobs were at one time widely grown but are no longer considered suitable varieties. Neither excel Saunders in yield but Garnet is slightly earlier maturing. Both are below the required quality standards and for this reason cannot receive top grades.

TABLE 9.—COMPARATIVE PERFORMANCE OF GARNET, RED BOBS AND SAUNDERS WHEAT

(Summary 1945-49)

Variety	Days to ripen	Height in inches	Resistance to lodging (Scale 1-9)	Yield in bushels per acre	Bushel weight in lb.	1000 K weight in gm.
Number of tests	46	49	50	48	50	50
Garnet	107·0	30·5	1·2	20·9	61·1	26·3
Red Bobs	110·7	30·7	1·1	21·5	60·7	30·2
Saunders	107·6	28·3	1·1	21·9	60·8	29·4

A number of varieties that are suited to conditions elsewhere in Western Canada are not well adapted to the Peace River area. These include Chinook, Lee, Redman, and Rescue.

Oats

A moderate breeding program designed for development of superior early maturing oat varieties is maintained. The goal is a variety combining the earliness of Ajax or Beaver with the yield and kernel type of Victory. The straw should be of only moderate length and good strength. While disease may never constitute a production problem, new varieties should be at least moderately resistant to all common forms.

Adapted varieties:—Despite relatively late maturity, Victory is the most suitable variety of oats for much of the area. High yield and a large, attractive kernel contribute greatly to its popularity.

During the period of this report Beaver has replaced Ajax as a suitable variety for those so located that they cannot mature Victory during most years. Beaver is similar to Ajax in earliness of maturity but appreciably lower yielding on the degraded-black-to-black soils. This lack of yield is offset to some extent by its advantage over Ajax in kernel size and by its greater resistance to lodging under conditions of excessive moisture.

TABLE 10.—COMPARATIVE PERFORMANCE OF ADAPTED VARIETIES OF OATS

(Summary 1947-49, 1951-52)

Variety	Days to ripen	Height in inches	Resistance to lodging (Scale 1-9)	Yield in bushels per acre	Bushel weight in lb.	1000 K weight in gm.
	Degraded-Black-to-Black Soil Locations					
Number of tests	24	30	30	30	30	30
Ajax	109·6	36·2	2·3	73·6	41·0	30·9
Beaver	110·0	36·0	1·9	69·4	39·9	34·9
Victory	114·1	39·2	2·3	83·1	43·1	34·0
	Grey Wooded Soil Locations					
Number of tests	17	24	25	25	25	25
Ajax	110·9	29·0	1·8	43·2	39·3	30·8
Beaver	111·1	29·6	1·5	42·7	38·4	33·5
Victory	113·8	31·4	1·9	54·3	40·9	33·2

Other varieties:—Table 11 presents the data on four newer varieties tested extensively during 1951 and 1952. It will be noted that all are more or less intermediate between Beaver and Victory in period of maturity and that all but Fortune approximate Victory in yield. These varieties display some degree of promise but further testing is required before their adaptability can be determined definitely.

TABLE 11.—COMPARATIVE PERFORMANCE OF SOME NEW VARIETIES OF OATS

(Summary 1951-52)

Variety	Days to ripen	Height in inches	Resistance to lodging (Scale 1-9)	Yield in bushels per acre	Bushel weight in lb.	1000 K weight in gm.
Number of tests	19	27	27	27	27	27
Beaver	110·3	35·6	1·7	73·6	40·2	35·3
Victory	115·0	38·8	2·1	89·6	42·8	34·2
Abegweit	112·2	34·4	2·0	86·6	41·0	34·4
Eagle	114·5	36·2	2·0	89·6	41·2	31·6
Exeter	112·4	36·0	2·2	92·0	41·5	32·4
Fortune	112·4	37·2	2·0	80·7	40·3	30·4

As new varieties are developed and come into general use, the older types are often discarded as being unsuitable. Banner, Early Miller, Larain, and Legacy have now been relegated to this position in the Peace River region.

Barley

In the interest of more balanced cereal production, barley should be more widely grown than at present. The main reason that it is not more widely grown is the lack of highly suitable varieties. An effort is being made to develop varieties incorporating the earliness of Olli, high yield, greater stability of performance, satisfactory length of straw, high resistance to lodging, and smooth awns. For the present, malting quality is not being stressed.

Adapted varieties:—It is not the intention to infer that present varieties are completely unsuitable. The most popular variety, Olli, is satisfactory in that it is early maturing and acceptable as either a feed or malting type. However, it produces only moderate yield, has rather poor straw characteristics, and is rough awned. Montcalm has suitable malting qualities and is slightly higher yielding than Olli. Nevertheless, because of its late maturity it should be grown only in the most favored locations and only when malting quality is desired.

Newal and Vantage are of feed quality only. Newal is two to four days later maturing than Olli, 2 to 3 bushels per acre higher yielding, and smooth awned. Its extreme susceptibility to loose smut often causes considerable loss of yield. Vantage is five to six days later maturing than Olli, approximately 7 bushels per acre higher yielding, strong strawed, and smooth awned.

TABLE 12.—COMPARATIVE PERFORMANCE OF ADAPTED VARIETIES OF BARLEY
(Summary 1947-49, 1951-52)

Variety	Days to ripen	Height in inches	Resistance to lodging (Scale 1-9)	Yield in bushels per acre	Bushel weight in lb.	1000 K weight in gm.
	Degraded-Black-to-Black Soil Locations					
Number of tests	24	31	32	32	32	32
Montcalm	112·1	36·9	2·3	49·0	50·0	36·5
Newal	109·2	34·1	2·5	50·6	50·9	38·4
Olli	104·7	29·7	2·7	47·6	50·8	34·0
Vantage	110·9	32·6	1·6	54·7	50·0	37·6
	Grey Wooded Soil Locations					
Number of tests	21	25	27	27	27	27
Montcalm	115·2	32·1	1·9	35·4	48·8	36·8
Newal	112·8	28·9	2·5	34·7	49·9	38·7
Olli	109·4	25·2	2·0	32·7	50·8	35·1
Vantage	114·1	28·0	1·3	39·1	49·2	37·8

Other varieties:—The variety Gateway, developed by the University of Alberta, appears promising. During two years at all locations, it has averaged only a day later maturing than Olli, nearly5 bushels per acre higher yielding, and is smooth awned. The variety is being tested further.

The hooded variety Warrior is similar to Olli in period of maturity and slightly higher in yield but produces a "trashy" sample. Titan is no longer grown because of the difficulty experienced in removing the awns in threshing.

Linseed Flax

The program with flax has been restricted to testing on the Station. Expansion of testing to include the off-Station locations is expected but no breeding work is planned.

Adapted varieties:—Redwing is the only variety that is sufficiently early maturing to be suitable for this area.

TABLE 13.—COMPARATIVE PERFORMANCE OF VARIETIES OF LINSEED FLAX TESTED ON THE STATION

Variety	Days* to ripen	Height in inches	Resistance to lodging (Scale 1-9)	Yield in bushels per acre	Bushel** weight in lb.	1000 K** weight in gm.
	Summary 1947-49, 1951-52					
Redwing	134·7	20·8	1·0	16·5	54·0	5·1
Rocket	139·4	19·7	1·2	14·5	50·7	6·1
Royal	142·4	20·8	1·3	11·7	51·4	5·5
Victory	142·2	19·9	1·1	14·1	51·7	7·2
	Summary 1947-49, 1951					
Redwing	137·7	21·4	1·0	16·0	53·5	5·2
Dakota	140·0	20·4	1·0	14·6	52·1	5·4
	Summary 1949, 1951-52					
Redwing	129·9	21·1	1·0	19·1	55·5	5·1
Marine	132·1	19·3	1·0	15·8	54·3	5·1
Redwood	138·9	21·2	1·0	14·9	52·5	5·5

* Excluding 1951. **Excluding 1947 and 1948.

It has been the highest yielding variety under test. The seed is small but is satisfactory in the quantity and quality of oil produced.

Other varieties:—The varieties listed in Table 13 are being produced or show promise in one or more areas in Western Canada. The majority are potentially higher yielding than Redwing but because of late maturity their yields are usually reduced by frost. Accordingly, none of the varieties except Redwing are considered suitable for production in this region.

Winter Grains

Winter wheat:—Kharkov M.C. 22 is the only variety considered suitable for production. Although considered hardy, severe killing may be expected during two years out of five. When it overwinters in a healthy condition the variety produces good yield, matures early and has satisfactory straw characteristics.

Fall rye:—Dakold is the hardiest variety suitable for this region. Severe winterkilling may be expected during approximately one year out of ten. It is a good yielder and matures early but like most varieties is rather weak in the straw and prone to shattering.

FIELD HUSBANDRY

Soil Fertility

Fertilizers

The use of commercial fertilizers has resulted in substantial yield increases of farm crops despite the incidence of dry weather in some seasons. Applications of phosphorus have been beneficial for grain crops, and there is some evidence that added nitrogen is also beneficial. Nitrogen alone has not increased yields of grain grown on fallow or on stubble at Beaverlodge although elsewhere, particularly on heavy stubble, nitrogen has increased yields substantially. Hay and pasture crops have shown a marked response to nitrogen fertilizers, as have grass crops grown for seed. Grain crops grown on partially decomposed grass sod respond to medium applications of nitrogen fertilizer.

Light Fertilizer Application for Cereals Recommended:—Phosphorus shows marked influence on root development and tillering. Weed growth is depressed and insect ravage decreased by ensuring the seedlings an early and vigorous start. Ammonium phosphate 11-48-0 at 25 to 50 pounds per acre has proved to be the most economical and effective fertilizer for wheat, oats and barley on fallow or on light stubble. However, where these crops are seeded into heavy combine straw and stubble, it may be necessary to increase the amount of nitrogen applied. In such cases 16-20-0 at 50 to 60 pounds per acre is recommended.

FIG. 3.—Fertilized wheat. Denser growth and advanced stage resulting from use of 11-48-0, right, compared with ammonium nitrate, left.

TABLE 14.—YIELDS OF FERTILIZED WHEAT AFTER SUMMERFALLOW IN FALLOW-WHEAT-WHEAT ROTATION, RATES EXPERIMENT, 1949-52

Treatment	Rate per acre in pounds	Increase over check bushels/acre
11-48-0	25	6·0
	50	9·2
16-20-0	30	3·0
	60	5·6
	120	9·3
0-18-0	33	3·1
	66	4·3
	132	8·5
33.5-0-0	29	−2·5
	58	−2·1
9-27-9	90	8·9

Yield of unfertilized check 20·0 bushels per acre.

Fertilizer for Cereals on Land Broken out of Grass Sod:—Recent experiments indicate that applications of nitrogen fertilizer to wheat and flax contribute to the decomposition of grass sod and increase yields substantially when these crops are grown on creeping red fescue and brome grass sod. Where grain crops are seeded on grass sod broken in late autumn or spring, the rate of application should be 100 pounds of ammonium nitrate per acre. For grassland broken in midseason the previous year a 50-pound application should suffice.

TABLE 15.—YIELDS OF GRAIN FOLLOWING BREAKING OF GRASS SOD, 1952

Treatment	Rate per acre in pounds	Yield of wheat on spring-broken creeping red fescue sod, bushels/acre	Yield of flax on autumn-broken brome sod, bushels/acre
Check	—	4·4	9·2
Ammonium nitrate 33·5-0-0	100	16·0	16·2

Medium Applications of Nitrogen Fertilizer Promote Grass Seed Yields:—The longevity of grass stands for seed production has been increased by the application of ammonium nitrate fertilizer. Stands of brome and creeping red fescue, particularly the latter, tend to become sod-bound following the removal of two seed crops. At this stage autumn applications of 100 pounds per acre of ammonium nitrate have in some instances doubled the yield of seed. Early spring applications have also resulted in substantial yield increases but fall applications are preferred.

TABLE 16.—SEED YIELDS OF FERTILIZED GRASSES, 1952

Treatment	Rate per acre in pounds	Creeping red fescue		Brome
		Spring fertilized, yield pounds/acre	Autumn fertilized, yield pounds/acre	Spring fertilized, yield pounds/acre
Check	—	215	197	57
16-20-0	250	456	484	113
Ammonium nitrate 33·5-0-0	66	338	333	104
Ammonium nitrate 33·5-0-0	132	404	432	170
Ammonium sulphate 21-0-0	195	457	392	99

Deep-Rooted Legumes Do Not Respond to Commercial Fertilizer:—Limited trials indicate that established legumes do not respond to applications of commercial fertilizer. Soil surveys suggest that available phosphorus is present in the upper subsoil in adequate amounts for good plant growth and that once established, the deep-rooted legumes are able to feed upon this supply. Since legumes are capable of fixing nitrogen, this plant food is not required. However, it has been observed that legumes establish themselves better when a phosphatic fertilizer such as 11-48-0 is applied in the year of seeding.

Barnyard Manure Has Long-term Effect:—The value of farm manure cannot be over-emphasized. In a 3-year rotation of fallow-wheat-wheat with manure applied at the rate of 10 tons per acre in the fallow year and ammonium phosphate 11-48-0 drilled in at 35 pounds per acre with each wheat crop, the commercial fertilizer affected only the crop to which it was applied, while the single application of manure had a marked beneficial effect on subsequent crops. Similar results have been obtained with continuous cropping to wheat and in wheat-wheat-sweet clover rotations.

Crop Rotations

Crop Rotations Are Simple to Plan:—Crop rotations are easy to establish. They serve to promote better cropping practices and ease of management, and make farming itself more stable. The cropping system need not be rigid and can be adjusted to meet economic trends. In the Peace River region it is especially important to maintain the required balance of sod and grain crops for a particular soil. Whether the grain be wheat, oats, or barley; or whether the sod crop be brome and alfalfa, creeping red fescue, or sweet clover may not be important.

Some Crop Rotations:—The following rotation is suggested for all soil types, whether black, degraded black or grey wooded, and is intended for established farms producing grain and livestock: fallow, grain (seeded to alfalfa, sweet clover, brome or creeping red fescue), hay or pasture, hay or pasture, hay or pasture (break in midsummer), grain, grain, grain (optional).

The following is recommended as an introductory rotation to condition grey wooded soils for a permanent rotation: fallow, grain (seeded), sweet clover, grain.

Where livestock numbers are limited, the following is suggested: fallow, grain (seeded to sweet clover and brome), hay or seed, seed, hay, grain, grain, grain (optional). In this cropping system, a grass such as creeping red fescue might be substituted for brome.

For low, moist clay areas the following rotation is suggested, especially where there is emphasis on seed production: fallow, grain (seeded), alsike (two to four years), grain, grain, grain.

Where seed production of grasses is the main enterprise they may best be grown in a planned rotation as follows: fallow, grain (seeded), hay or seed, seed, seed and pasture, pasture and break, grain, grain. Creeping red fescue or brome grass may be used to advantage in such a cropping system.

Crop Sequence Studies:—In outlining a rotation, it is well to keep in mind the effect that one crop may have upon another. It is now well understood that

grasses such as creeping red fescue and brome tend to have a deleterious effect upon the following crop if the sod is only partially decomposed. This, however, can be overcome by growing legumes in combination with the grasses or, where the grasses must of necessity be grown singly, by the use of nitrogenous fertilizers in the year following breaking. Crop sequence studies under way since 1949 suggest that wheat is influenced to a greater degree by previous cropping than are oats, flax, or peas. All grain crops do well following legumes, with alfalfa and sweet clover recognized as excellent soil improvers. The ability of these deep-rooted legumes to take up the available phosphorus in the lower soil horizons and upon their decomposition to deposit it in organic form in the surface soil is no doubt partially responsible for the beneficial effects exercised by these plants.

Soil Conservation

Peace River Soils Susceptible to Erosion:—Many soils of the area are underlain by a heavy and impermeable subsoil. When heavy, flash rains occur the moisture is not absorbed readily and the surplus runs off carrying precious topsoil. Such occurrences are common in many areas, even on what appears to be

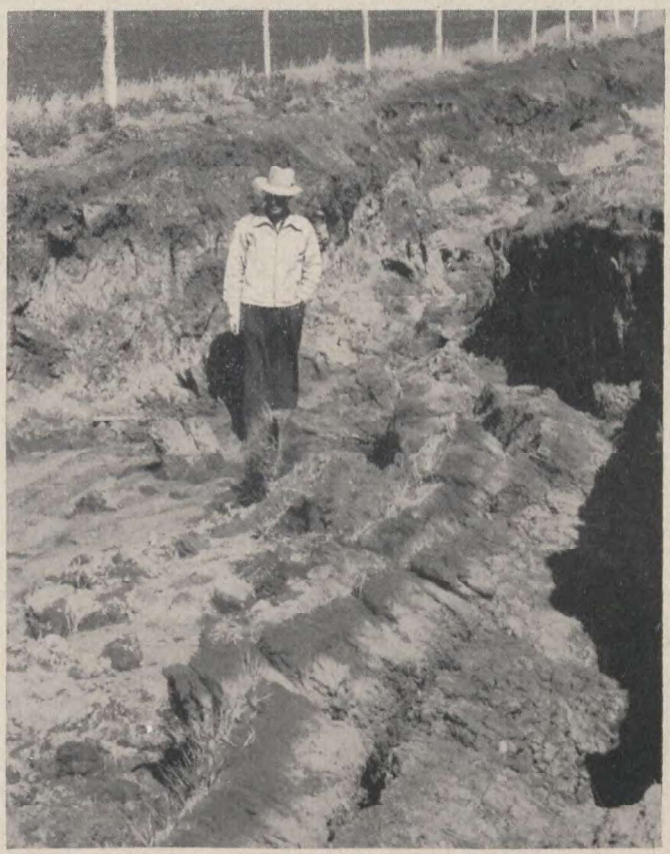

FIG. 4.—Severe gullying resulting from heavy flow of water in an inadequate V-ditch.

level land. Moreover, the high salt content in the lower horizons of some soils enhances dispersion, with the result that serious erosion has resulted where a heavy water flow has been directed into inadequate road ditches.

FIG. 5—Severe sheet erosion on a gently sloping field. Note filling of road ditch with topsoil.

Grasses and Legumes Required for Soil Conservation:—A soil conservation program should include the use of forage crops. The legumes, particularly the deep-rooted sweet clover or alfalfa, assist in opening up tough and impermeable subsoil. This increases the permeability and moisture-holding capacity and lessens the danger of water erosion. Grasses add fibre to the soil and thus tend to bind the soil particles together to make a more granular soil. This, in turn, serves to decrease erosion by both wind and water. In addition, grasses and legumes contribute immeasurably to soil fertility and productivity by way of added organic matter and bacterial activity.

Sweet Clover Substituted for Summerfallow:—Wheat after fallow has outyielded wheat after sweet clover only slightly and the second-crop wheat yields have been comparable. The sweet clover yielded 0·64 ton of cured hay per acre and had better stands been obtained it is thought that the results would have been in favor of the clover rotation. It must be recognized, however, that heavy crops of sweet clover may serve to deplete soil moisture reserves.

Summerfallow is recommended only where necessary for moisture conservation and weed control previous to seeding down. Continuous use of summerfallow is wasteful and is detrimental to soil structure.

Creeping Red Fescue Produces Abundant Fibre:—The use of creeping red fescue as a pasture and seed crop has done much to promote grassland farming in the Peace. Because of the dense turf, it is an ideal grass in erosion-control programs. Its carpet-like growth slows runoff and largely prevents the cutting action of swiftly moving water, particularly where ditches are well graded and sloped to accommodate excessive runoff. Because of its extensive root system, creeping red fescue tends to bind loose soil particles and thus improve soil structure.

FIG. 6.—Partially worked creeping red fescue sod. Note dense mass of fibre.

Practical Measure for Erosion Control:—In 1950 a strip method of cropping was devised for 80 acres of steep rolling land on the Station. The field strips are parallel, at an angle to the slope and with grass strips left at convenient widths to reduce water velocity. Complete contour principles could not be followed because of the extreme variations in slope. Each field is subjected to a sequence of fallow-wheat-barley repeated four times, after which the strip remains in grass for a period of four years. The rotation of crops is worked systematically across the field. This is a modified system of contour farming.

By following the approximate contour of the land and by including 90-foot grass strips at intervals down the slope it has been possible to reduce water erosion substantially. Yields have been maintained at a satisfactory level and there is every indication that this method of cropping will serve to make a higher percentage of the steeper valley land of the region suitable for cropping to grain.

Pasture Investigation

Cultivated pastures are especially valuable in this region because of the low nutrient value and the uncertain carrying capacity of native pastures. At times vast areas of burned-over forest land could be seeded to suitable pasture species and thereby bring wasteland into economic production.

Rotational Grazing Ensures Best Use of Pastures:—An aged stand of brome and alfalfa was utilized in an experiment with sheep over a 2-year period employing heavy rotational, heavy continuous, and moderate continuous grazing. The results indicate the advantage of heavy rotational grazing. Much more efficient use could be made of present farm pastures if they were divided into two or more sections and rotational grazing practised.

TABLE 17.—CARRYING CAPACITY IN SHEEP UNITS AND POUNDS FORAGE PER SHEEP UNIT, 1951-52

Pasture	Pounds dry matter per acre	Average No. sheep units* per acre	Pounds forage per sheep unit
Heavy rotational	2,809	8·6	334
Heavy continuous	2,778	5·0	564
Moderate continuous	2,880	3·8	734

* Two lambs equal one sheep unit.

Burned-Over Lands Can be Utilized for Productive Pastures:—During the autumn of 1950 extensive forested areas adjacent to settlement were ravaged by fire. The damage to the soil, tree cover, and native pasture was extensive. It seemed possible to rehabilitate these areas for pastures purposes, hence seedings of various forage species were made at widely separated points and on different soil types. It was found that:

1. Creeping red fescue and brome appear well adapted for this use. Timothy and Kentucky blue grass also hold promise. The time of seeding does not appear to influence stands of these grasses.
2. Sweet clover, alfalfa and alsike established reasonably well when spring seeded but they failed when seeded in the late fall. This may have been the result of poor inoculation.
3. Altaswede red clover made a poor showing regardless of time of seeding.

A mixture of creeping red fescue, brome, alfalfa, and sweet clover probably would be satisfactory for use in seeding burned-over lands. Alsike might be added for low-lying areas. Burned-over areas should be seeded not later than the spring following the burn, before native weeds and shrubs have time to take over and before wind and water have an opportunity to erode these burned and oxidized soils. Early spring seedings are recommended. Where practical, burned-over areas should be cleared of debris and seeded. However, in many cases small areas may be effectively seeded with hand seeders without removing the debris. Where large community pastures are possible, airplane seedings would appear to be desirable.

FIG. 7.—Burned-over area adjacent to the Alaska Highway in British Columbia.

Weed and Insect Control

Weed Control

Many serious weeds common on the Prairies have not invaded the Peace River region as yet; some have appeared but are under control; while others such as wild oats, couch grass, and toadflax are on the definite increase because of characteristics which make control difficult.

Wild Oats:—Dockage caused by wild oats runs as high as 40 per cent, without allowance for the shattered seeds. In one off-Station test where pollution was heavy the yield of clean wheat was 3·9 bushels, the recovered yield of wild oats 3·8 bushels, and the shattered wild oats 33·4 bushels per acre. Thus, the losses tend to be hidden and infestation goes on unabated.

To date efforts to control wild oats by selective chemicals have failed. Recently, an experiment was launched at Beaverlodge to assess the value of tillage and cropping methods for the control of this weed. Results so far obtained would indicate the value of delayed seeding of spring grain, shallow tillage in early spring or late fall and the use of fertilizer. The use of winter grains, sod crops, and the growing of such smother crops as sweet clover have also been found to suppress wild oats.

Couch grass:—Investigation has shown that the control method for couch grass is largely determined by the size of the infestation. Very small patches are most conveniently removed by 4 pounds of sodium chlorate per square rod applied dry or wet. Larger patches are best treated with TCA applied at 100 pounds per acre to undisturbed sod. Late summer or early autumn applications are best. In the Peace River region tillage has not always enhanced the effectiveness of this chemical. The residual effect of TCA may last well into the season following treatment but soil tilth is not impaired. A new chemical, CMU, has been found best applied in early spring or late summer to undisturbed sod at about 40 pounds per acre. This herbicide should only be used on non-cropped land or for spot application because of its long-lasting residual effect as a soil sterilant.

TABLE 18.—EFFECT ON COUCH GRASS OF TCA ALONE AND IN COMBINATION WITH CULTIVATION

Treatment	Rate pounds TCA acetate equivalent per acre	Percentage kill one year after treatment	
		Spring application	Autumn application
TCA on undisturbed sod	nil	0	0
	25	15	55
	50	60	97
	75	63	99
	100	89	100
One-wayed once 5 inches deep, TCA applied	nil	5	5
	25	57	85
	50	80	97
	75	90	98
	100	98	99
One-wayed twice 5 inches deep, TCA applied	nil	0	10
	25	63	91
	50	75	97
	75	93	99
	100	97	100
One-wayed once 5 inches deep, TCA applied, one-wayed again	nil	0	10
	25	60	80
	50	90	96
	75	89	90
	100	95	100

It is not economical to use any of the available chemicals on a field scale for couch grass control. Cultivation is required and recent tests by the Station indicate the value of a sharp one-way to shred the rootstocks to induce starvation by growth. It is imperative that the first operation be made in the fall as close

to freeze-up as possible. By this means the rootstocks are exposed to the desiccating effects of winter and are in a greatly weakened condition to withstand the cultivations of the following year.

Toadflax:—There is no practical means of control for field-scale infestations of toadflax. Stands have been reduced 90 per cent by one year's tillage but this is only temporary relief. Heavily infested fields can be brought under control by two cycles of alternate intensive tillage and cropping. Unfortunately, toadflax produces seed prolifically and this seed retains its viability for a number of years so that eventual eradication by this means is doubtful.

Trials conducted in the Peace River region have shown that small patches of toadflax are most readily controlled by the use of sodium chlorate at 5 pounds per square rod applied when the weed is in the late bud or early flowering stage, or in the autumn. This chemical is not advocated for extensive patches as its use is accompanied by ruinous breakdown of the structure of the soil together with sterilization. Vigorous patches of toadflax in this region have been reduced 90 per cent by the use of 2 to 3 pounds per acre of 2,4-D acid applied annually over a 4-year period following breaking of the infested area and seeding it down to grass.

Dandelion:—The Peace River region is one of the few areas in Western Canada where the dandelion as a field pest is difficult to control. Experiments have shown that it must be cut off below the bulbous portion of the root and the whole brought to the surface to dry out. A blade cultivator set 4 to 5 inches deep followed by a cable- or rod-weeder was found to be an effective method of accomplishing this.

Other Troublesome Weeds:—Tests in the Peace River region have shown that many creeping-rooted, persistent perennial weeds such as hoary cress, perennial sow thistle, blue lettuce and Canada thistle can be controlled by seeding infested fields down to grass and applying the ester of 2,4-D at 2 pounds per acre when the weeds are in the bud stage. Repeat treatments over several years have been found necessary for the more resistant types such as hoary cress and Canada thistle. Because regional strains of the latter weed differ widely in reaction to 2,4-D, it may be found that while certain infestations succumb easily to the herbicide others may prove virtually immune.

2,4-D and Field Crops:—Experiments at Beaverlodge have been instrumental in showing that wheat and barley pass through stages of varying sensitivity to 2,4-D. From the seedling stage through to the five-leafed stage is a susceptible period, but from then to the early boot stage the plants are relatively tolerant. Obviously, 2,4-D should be applied during this latter time. Later, until full heading, these cereals pass through another susceptible period. Even during stages of comparative tolerance, dosage should be only sufficient to control the weeds at hand.

The developmental periods are not so well defined in oats, as this crop appears to be rather susceptible to 2,4-D at all stages. Treatment can most safely be done from the early shot-blade up to the early boot stage.

Flax is still more susceptible and there does not seem to be any growth period when it is reasonably tolerant to 2,4-D. Experiments have shown that it should be treated as soon as weed growth warrants, provided the flax has formed three to four leaves. It should not be treated after the flax comes into the bud stage.

The importance of keeping 2,4-D dosage proportionate to the task at hand is shown by the following table. The data present one year's results and were obtained from crops in which no weeds grew. It is understandable that had

heavy weed competition been removed by the 2,4-D the derogatory effects of the chemical would have been masked at least until heavy rates were applied. This is the usual occurrence in farmers' fields.

TABLE 19.—EFFECT OF DIFFERENT RATES OF THE ESTER OF 2,4-D APPLIED AT THE OPTIMUM PERIOD ON WHEAT, OATS AND FLAX

Ounces 2, 4-D acid per acre	Yield clean grain bushels/acre			Kernel weight grams/1000 kernels		
	Wheat	Oats	Flax	Wheat	Oats	Flax
Nil	19·3	77·3	20·3	30·3	28·0	4·8
2	18·5	77·3	16·9	30·3	26·8	4·4
4	16·5	58·9	14·7	30·1	21·0	4·4
6	13·6	—	—	29·7	—	—
8	10·5	56·9	12·7	29·4	20·4	4·0
12	9·5	41·3	13·5	29·7	18·0	3·8
16	8·1	36·7	—	28·0	16·0	—

2,4-D and Legumes:—In the Peace River region volunteer sweet clover has proved a troublesome pest in grass stands for seed production. Trials have shown 2,4-D to give a ready solution to the problem. An ester of this herbicide applied at about 6 ounces acid per acre to the sweet clover when approximately 6 inches high is recommended.

TABLE 20.—SUPPRESSION OF VOLUNTEER SWEET CLOVER BY THE ESTER OF 2,4-D

Growth stage sweet clover when treated	Rate, ounces 2, 4-D acid per acre	Percentage kill
Rosette	4	53
	8	95
	12	95
	16	100
6 inches high	4	83
	8	100
	12	100
	16	100
12 inches high	4	60
	8	70
	12	83
	16	85

Alfalfa, alsike and red clover are more tolerant to 2,4-D than sweet clover and this fact suggests the use of the chemical to remove highly susceptible weeds from newly-seeded stands of these more resistant legumes. The chemical, MCP, the European counterpart of 2,4-D, is less harsh in action and is recommended for this use. Tests have shown it to be practical to use the sodium salt of this herbicide at rates of 3 to 5 ounces acid per acre where broad-leafed susceptible weeds are over-growing and choking out a promising stand of seedling legume.

Field Crop Insect Control

Wireworm Control:—In a co-operative experiment with the Science Service benzene hexachloride (BHC) was found to be an effective control for wireworms. The chemical is applied as a seed dressing and protects the seedlings from wire-

worm attack. It also kills many wireworms. It is chiefly recommended for use with spring wheat following grasses or summerfallow. Tests have shown that one ounce gamma BHC per acre gives the most economical control. One treatment should be effective for five or more years, except in severely infested fields.

The chemical BHC should be used sparingly and should supplement cultural controls which can be worked into regular farming operations. Summerfallow kept free of grain and grass from mid-June until the end of July will reduce populations. Tests have shown also that wireworm damage can be lessened by providing a firm, moist seedbed, by the use of good seed, and by seeding not over 3 inches deep followed by heavy packing.

TABLE 21.—WIREWORM KILL BY BHC SEED TREATMENT TO SPRING WHEAT ON FALLOW

—	Year of treatment		Year following treatment	
	Untreated	One ounce gamma BHC per acre	Untreated	One ounce gamma BHC per acre
Number of plants per square yard	15·5	124·5	10·0	48·6
Wireworms per square foot to plow depth	4·4	1·3	3·0	1·9
Per cent reduction wireworms by treatment	—	70	—	37
Bushels clean grain per acre	2·8	12·8	3·4	18·0

FIG. 8.—Spring wheat on fallow. Left treated with one ounce gamma BHC per acre for wireworm control; right untreated.

Agro-Climatology

Plant breeders and agronomists are anxious to learn as much as possible about the unusual responses of crops to northern weather. Phenomenal growth and crop yields are common in the Peace River District and in Northern Alberta.

The reasons for such, however, are not readily explicable. The climatic and soil conditions, if anything, are less favourable here than at many more southerly areas. Temperatures are relatively cool, the growing season short, rainfall is light and in many localities the soil fertility is low. Studies of the response of crops to various weather factors will assist plant breeders with the development of varieties better suited to northern conditions and will help agronomists in selecting better cultural practices which will net greater returns for the farmer.

Numerous climatological factors influence growth. Day length undoubtedly plays an important role in the rapid crop growth which takes place in this northland, but other factors such as temperature, rainfall, strength of sunshine, and rate of crop transpiration are also important. In order to learn precisely how weather affects crop growth agro-climatological studies were started at the Station in 1950. These studies involve the close observation of growth and development of some 20 different crops. Crop heights are measured. Dates of emergence, jointing, budding, flowering and maturity are noted. Quality and quantity of the final harvested crop are also recorded.

The proper measurement of weather conditions is one of the most important considerations in studying the response of crops to their meteorological environment. The layout of the instruments shown on the cover photograph is arranged to achieve this purpose. The two larger boxes house thermometers and equipment which automatically record, on a continuous basis, variations in temperature and relative humidity of the air near the level of the growing crops. The boxes have louvred sides with open tops and bottoms which permit free circulation of air. These boxes are placed much lower to the ground than the official standard Stevenson screen (not shown) which is 4½ feet above ground and in which official maximum and minimum temperatures are measured.

The large, low, circular object to the right is an evaporation tank. The tank is four feet in circumference and two feet deep. Measurements of the water level are made daily with a micrometer gauge. In this way the amount of free water evaporation each day is determined. Evaporation is closely related to the amount of water which plants transpire, a factor which cannot be easily and readily measured. The chicken wire covered frame over the tank is to prevent birds and animals from using it as a watering trough and bath. Permanent sites are enclosed with wire fences and the evaporation tank covers, which have a tendency to reduce evaporation, are not necessary.

The posts in the foreground support three different types of atmometers, which are used for measuring the drying ability of the air, a factor also closely related to plant transpiration. The three different types are being tested for their relative efficiency.

The large cylindrical tank supported on three legs is an automatic rain gauge. This instrument records the intensity and duration of rainfalls which are important in growth studies as well as in soil erosion studies being conducted in co-operation with the Soils Division of the University of Alberta.

The T-post on the extreme left is a support for electrical wires leading to electronic instruments for determining soil temperatures and moisture tension at different depths under the crop. Soil moisture tension is a measure of the availability of moisture to the roots of the growing plant.

Apparatus not shown in the photograph includes equipment for measuring wind speed and direction and instruments for measuring the duration of bright sunshine and the intensity of natural light. Also not shown is the standard Stevenson screen in which the daily maximum and minimum temperatures are recorded.

FORAGE CROPS

Many Peace River farmers are alert to the destructive forces of erosion and realize that the systematic use of forage crops provides a satisfactory means of control. In some localities the Station's recommendation that one-third of the land be seeded down is practised. Throughout the region about 9 per cent of the cultivated acreage is in forage crops but the advantages of grassland farming are becoming so well understood that the acreage is rapidly increasing.

Alfalfa

Alfalfa is the most popular legume because of its ability to penetrate the tough subsoil to moisture and to recover leached nutrients and because of its ability to produce a seed crop regardless of soil conditions.

Seed Production Problems:—Seed-setting in alfalfa depends upon cross pollination by insects, notably leaf cutter and bumble bees. Surveys support the theory that fields should be long and narrow and adjacent to unbroken land where these bees nest. The effectiveness of the insects can be increased by maintaining thin stands. This is accomplished by seeding not more than 2 pounds of seed per acre in a firm, well prepared seedbed and by thinning during subsequent years. Thinning is best accomplished during early spring by use of a cultivator or by the one-way set 3 inches deep.

The greatest single threat to alfalfa seed crops is offered by the lygus bug. Both adults and nymphs inflict damage by feeding on the bud stalks, causing them to drop, while the adult lygus feeds upon the immature seed. Control has been obtained with DDT at 12 ounces technical per acre before the alfalfa comes into bloom or Toxaphene at 1½ pounds technical per acre while the alfalfa is in flower. Both insecticides can be applied as a spray or as a dust.

FIG. 9.—Dusting alfalfa to control the lygus bug.

Defoliants:—The persistent green growth in legume crops at time of seed harvest is the cause of heavy harvest losses. Windrowing is successful provided neither rain nor wind molest the swath. Straight combining necessitates artificial drying or delayed harvesting. Defoliation would seem to circumvent these hazards but field-scale trials to date have been either unsuccessful or too costly. Nevertheless, it is a promising field of study and will be pursued further.

Cultivated Pastures

Creeping red fescue derives its local popularity from some excellent seed crops sold to good advantage. A secondary consideration is the enormous mass of finely divided roots produced and the effect of these in improving soil structure. A third and possibly the most significant consideration is its ability to provide abundant pasture. It blends well with alfalfa for summer pasture and unlike other species flourishes throughout the autumn months. The herbage remains fresh under the snow throughout the winter, when it is relished by livestock.

Thus creeping red fescue should be a constituent of all pasture mixtures. A mixture of creeping red fescue, brome and alfalfa at 6, 3 and 3 pounds per acre, respectively, gives a nutritious, high-yielding pasture where soils are adequately drained and a pronounced hardpan is not present. Creeping red fescue seeded alone at 10 pounds per acre, or at 6 pounds per acre in a mixture with alfalfa at 4 pounds, provides pasture swards suited to better-structured soils. For poorly-structured soils where hardpan is a problem, a pasture mixture of brome, alfalfa, and sweet clover is recommended. An alsike-timothy mixture is adapted to low-lying land subject to spring flooding.

Grasses for Seed

Crowding Reduces Yields:—As grass stands age there is a heavy drain on food and moisture reserves and this is accentuated by the demands of organisms active in breaking down organic matter sloughed off from the growing plants. When the situation becomes acute the stand is regarded as having become sodbound and seed production is greatly decreased.

To determine the productive period, an experiment was conducted using spaced rows when seeding brome, creeping red fescue, crested wheat grass, and Kentucky blue grass. The results are indicated in Table 22.

TABLE 22.—SEED PRODUCTION IN POUNDS CLEAN SEED PER ACRE FROM VARIOUS GRASSES AT DIFFERENT SPACINGS

Grass	Spacing of rows (inches)	1950	1951	1952
Creeping red fescue	6	77	220	27
	12	105	450	10
	18	72	467	15
	24	73	397	25
Brome	6	409	166	21
	12	434	299	21
	18	331	344	43
	24	322	414	45
Crested wheat grass	6	329	195	43
	12	377	346	44
	18	366	484	61
	24	380	529	87
Kentucky blue grass	6	108	125	64
	12	121	193	72
	18	119	153	93
	24	117	129	86

Combined Seedings:—The use of cereal companion crops is frequently advisable as a means of weed control and as a source of revenue while the forage crop is becoming established. In some years, however, the companion crop is highly competitive and a slowly establishing grass such as creeping red fescue may be held back so that it will not produce a crop in the year after seeding. It has been demonstrated that sweet clover may be used as a hay crop to bridge this gap and that stray plants of the clover in the fescue stands can be controlled during the third year by means of 2, 4-D.

New Species

Russian wild rye is showing promise in some parts of Western Canada but its position with respect to the Peace River region is not defined as yet. It would appear to be inferior to brome for hay or pasture and to creeping red fescue for pasture. No difficulty has been encountered in securing satisfactory seed crops, approximately 300 pounds per acre without handling loss, but shattering has been excessive even when the seed is in the dough stage. There is evidence to suggest that Russian wild rye requires ample fertility and moisture for best results, hence its use will likely be limited.

FIG. 10.—Russian wild rye for seed.

Intermediate wheat grass and tall wheat grass are also under study. Unfortunately, they make tall, coarse growth that hardens readily, hence are not attractive for hay purposes. Intermediate wheat grass bears such a close resemblance to couch grass as to make it unpopular.

The Empire variety of birdsfoot trefoil has made impressive showings in small plots and this has led to some commercial seedings. Plot seedings were partially hardy but field-scale seedings killed outright during two successive years. Test plots yielded 250 pounds of seed per acre without handling loss but satisfactory handling techniques would have to be developed before commercial seed production could be considered, because of uneven maturity and ready shattering.

HORTICULTURE

Weather conditions during the period of this report have been more rigorous than normal, thus recommendations are now more specific. A wide range of material can be grown successfully. Complete lists may be obtained from the Station on request.

Ornamentals

Ornamental trees and shrubs form the basis of the landscaping about the home and grounds and produce the desired effect of beauty and permanence. The following lists indicate species and varieties showing outstanding performance or particular promise.

Trees:—Deciduous—American elm (grafted), burr oak, green ash, poplars (Griffin No. 1 and Griffin No. 4), Ohio buckeye, Siberian larch. Evergreen—Colorado spruce, Koster spruce, Scots pine, white spruce.

Tall Shrubs:—Amur choke cherry, Amur lilac, crabapples Amur Red and Brooks No. 22, European bird cherry, Greenes mountain ash, hawthorn, American cranberrybush, Hungarian lilac, lilacs (adapted grafted varieties), late lilac, nannyberry viburnum, pin cherry, saskatoon, silver buffaloberry, Tatarian honeysuckle.

Medium Shrubs:—Altai rose, dogwood, flowering currant (Potter's strain), Oriental spirea, Peking cotoneaster, Pikov spirea, Poiret barberry, rose varieties Betty Bland, Harison's Yellow, Hansa, Mrs. John MacNab, Tetonkaha and Therese Bugnet, Tidy caragana, sweetberry honeysuckle.

Dwarf Shrubs:—Dahurian bush cinquefoil, Friedrichsen bush cinquefoil, pygmy caragana, rose daphne, Russian almond.

Evergreen Shrubs:—Common juniper, creeping juniper, Eastern arborvitae (cedar), Mugho pine, Savin juniper, tamarix juniper, Ware Eastern arborvitae.

Windbreaks:—The following are considered best adapted for windbreak use in the Peace River region: caragana, northwest poplar, American elm, green ash, Siberian larch, white spruce, Colorado spruce, Scots pine.

Ornamental Crabapples:—Two hardy varieties of ornamental crabapples were introduced in 1952. Their hardiness is indicated by the fact that they were two of very few varieties of apples to survive without damage some of the severest seasons on record. Their description is as follows: *Arctic Dawn*—Flowers mauve-pink; petals have ruffled edges. Bloom is followed by clusters of saskatoon-like berries. Tree vigorous, spreading. Foliage purple tinted, semi-glossy. *Snow Cap*—Glistening white blossoms produced annually in great profusion. Bloom followed by clusters of small, bright red fruits. Tree vigorous, upright to conical in form. Narrow, semi-glossy leaves.

FIG. 11.—The original tree of the Arctic Dawn rosybloom crabapple. Planted in 1942.

Gladiolus Culture:—Varieties classified as later than early-midseason are generally too late. On the other hand, a wide choice of varieties is available in the early and early-midseason types. It has been found that pre-sprouting gladiolus corms ten days prior to transplanting outside will advance the date of first bloom by approximately two weeks and thus extend the range of suitable varieties. The corms are pressed into sand, vermiculite or soil, placed in a warm, shady room and kept moist. Care in planting must be exercised to prevent breakage of tender rootlets.

The following varieties are recommended: Abu Hassan, Allard Pierson, Early Rose, Fay, Huntress, Interceptor, J. S. Bach, June Day, Lemon Ice, Mauvie Rose, Polar Ice, Radiance, Snow Princess, True Love, W. R. Reader.

Lily Culture:—The cold, impervious nature of the subsoil does not favor lilies but a special cultural method has been evolved and has given outstanding results. It consists of digging a trench 18 inches deep and 18 inches wide; the bottom of the trench is filled with equal parts of topsoil, sand and peat up to 2 inches below the required level for planting of specific varieties. A 2-inch layer of sand is then applied and the bulbs planted. The remainder of the trench is then filled with a soil mixture similar to that in the bottom of the trench.

Varieties of lilies belonging to the Stenographer and Airplane groups originated at the Central Experimental Farm, Ottawa, have given outstanding performance.

Annual Flowers:—In recent years hybridists have originated many outstanding varieties of annuals superior to older types in form and color. Some of these, as well as some older varieties that have performed exceptionally well, follow.

Botanical name	Common name	Variety	Height	Color
			in.	
**Calendula officinalis*	Pot marigold	Pacific Beauty	15–24	Orange, lemon, cream
†*Callistephus chinensis*	China aster	Ballet Queen	10–12	Salmon rose
		Princess	24–30	Various
		Kirkwell	10–12	Various
**Centaurea cyanus*	Cornflower	Jubilee Gem	12	Blue
†*Cosmos bipinnatus*	Common cosmos	Radiance	36	Rose
**Dimorphotheca aurantiaca*	Cape marigold		12	Orange to white
**Lathyrus odoratus*	Sweet pea	Cuthbertson	48–60	Various
†*Lobelia erinus*	Edging lobelia;	Crystal Palace	4–6	Dark blue
	Basket edging lobelia	Sapphire	8–12	Dark blue, white eye
**Lobularia maritima*	Sweet alyssum	Carpet of snow	4–12	White
		Violet Queen	4–12	Violet
†*Mathiola incana*	Annual stock	Ten Week	12–15	Various
		Beauty of Nice	18–24	Various
		Giant Imperial	24–30	Various
†*Petunia hybrida*	Common petunia	Blue Bedder	20	Dark blue
		Celestial Rose	20	Rose
		Firechief	18	Red
		Snowstorm	18	White
		Colossal Shades of Rose (double)	18	Rose
†*Schizanthus pinnatus*	Wingleaf butterfly-flower	Dr. Badger's hybrids	20	Various
†*Tagetes erecta*	Aztec marigold	Glitters	24	Canary yellow
		Pot o'Gold	15–18	Deep orange
†*Viola tricolor hortensis*	Garden pansy	Coronation Gold	8	Yellow
		Pay Dirt	8	Yellow
		Royal Exhibition Mixture	8	Various
		Ullswater	8	Blue

* Started indoors although outdoor seeding is successful. † Started indoors.

Fruits

Apples:—Heyer No. 12 is the best variety tested to date. It is a fall apple and produces fruit two to three years after planting. The crabapple varieties Amur Red, Osman, Columbia and Anaros have withstood extremely severe weather conditions and can be expected to produce good yields of fruit annually. Rosthern No. 17 apple-crabapple hybrid is promising, while varieties such as Rescue, Trail, and Rosilda have proved to be too tender.

Plums and Cherries:—Native plums are generally too late in maturity although the varieties Norther, Dandy, Bounty, and Olson may succeed in favored locations. Mandarin, a Korean plum, is hardy, early maturing and annually productive. Manor is the best cherry plum and may be pollinated by the sandcherries.

The Manchu cherry (Northern Limit strain) shows variation in hardiness and hardy bushes may be selected. The Mongolian cherry shows promise although it is subject to suckering. Native pin cherries and choke cherries transplant readily and select plants should not be overlooked as a source of useful fruit.

Bush Fruits:—Madawaska and Trent raspberries are highly recommended for their high quality, yield and disease resistance. Muskoka and Tweed show promise. The following currant varieties have performed well: Red—Prince Albert; Black—Magnus, Climax, Eclipse; White—White Imperial, White Grape. Pixwell, Abundance, and Pembina Pride gooseberries are hardy and abundant yielders.

FIG. 12.—Tip-covering raspberry canes for winter protection is a standard practice.

Strawberries:—Senator Dunlap has proved to be the best summer-bearing variety. Gem and Sparta × Wild, a new variety, are the best everbearers tested to date.

New Saskatoons:—Selection among many different types of saskatoons has produced two high-quality strains, Pembina and Smoky, named after rivers in the regions in which they originated. Since vegetative propagation appears difficult the new strains are propagated as seedlings of the original selections without appreciable loss of quality. Plants are spaced 6 to 8 feet apart within the row for fruit production and the soil kept cultivated. They are valued also for ornamental planting, as loose hedges and as single specimens. The following describes the new strains:

Pembina—Fruit is large, flavor full, sweet and tangy. Bush is upright and slightly spreading, vigorous and productive and produces comparatively few suckers.

Smoky—Fruit is large and flavor unusually sweet. Bush is medium-high and spreading, permitting easy picking. Root sprouts are freely produced.

Vegetables

The following list includes vegetable varieties which have performed well in test plots:

Asparagus	Giant Washington, Mary Washington
Rhubarb	Macdonald, Valentine, Irish Giant.
Beans	Bountiful (green), Round Pod Kidney Wax (yellow), Stringless Green Pod (green).

Beets	Crosby's Egyptian (early), Detroit Dark Red (main crop).
Broccoli	Italian Green Sprouting.
Cabbage	Golden Acre (early), Copenhagen Market (midseason), Pennstate Ballhead (late), Chieftain (savoy).
Carrots	Chantenay, Danvers.
Cauliflower	Snowball (early), Snowdrift (midseason), Veitch's Autumn Giant (late).
Celery	Cornell No. 19 (early, partial green), Salt Lake (late, green).
Chard	Lucullus.
Corn	Altagold, Seneca 60, Banting, Pickaninny, Early Alberta.
Lettuce	Grand Rapids (leaf), Great Lakes strains (head).
Onions	Yellow Globe Danvers, Red Wethersfield (late, storage), Barletta (pickling).
Parsnip	Short Thick, Hollow Crown.
Peas	Little Marvel (early), Lincoln, Selkirk (midseason), Stratagem (late).
Potato	Warba, Carter's Early Favorite (early), Irish Cobbler, Canus (main crop).
Radish	Cavalier, Cherry Belle, Comet (red), Icicle (white).
Spinach	Bloomsdale (early), New Zealand (late).
Tomato	Farthest North, Earlinorth, Early Chatham.
Vine Crops	Not generally adapted. Pumpkin—Early Cheyenne; Cucumber—Early Russian, Mandarin, Mincu; Squash—Giant Summer Crookneck, Hubbard; Marrow—Long White Bush.

ILLUSTRATION STATIONS

In 1950 a second Supervisor was appointed and two districts, Beaverlodge East and Beaverlodge West, established. Included in the Beaverlodge West district are the Illustration Stations in the British Columbia section of the Peace River Block and those at Brainard, Goodfare, Hines Creek, and Wapiti in Alberta. The remainder are in Beaverlodge East district.

Illustration Stations

Location	Operator	Established	Soil Type
Baldonnel, B. C.	H. G. Hadland	1942	Degraded black
Black Duck, Alberta	W. H. Smith	1944–50	Grey wooded
Brainard, Alberta	R. A. Hill	1952	Degraded black
Debolt, Alberta	W. Perkins	1939–52	Grey wooded
Fairview, Alberta	K. R. Macdonald	1930	Degraded black
Goodfare, Alberta	C. Third	1942	Grey wooded
High Prairie, Alberta	L. R. Cowell	1951	Black
Hines Creek, Alberta	J. Syrnyk	1951	Grey wooded
Progress, B.C.	H. Bentley	1942–52	Grey wooded
Rolla, B.C.	W. C. Henderson	1951	Degraded black
Wapiti, Alberta	M. E. Lofstrom	1942	Grey wooded
District Experiment Substation			
McLennan, Alberta	N. Lamoureux	1946	Grey wooded

Crop Rotations

Crop rotation studies are basic to Illustration Stations work and practically all units are operated on a rotation recommended for the area and the type of farming followed. One-acre rotation plots have been laid down at each Station, in which the fallow-wheat and the fallow-wheat-wheat rotations are compared with recommended rotations which include forage crops. Cost of production and yield data are compiled for each rotation so that a direct measure of the productivity as well as the economic returns can be compared. In addition, the soil on each plot was analysed when the rotation commenced. Further analyses will determine the effect on the supply of soil nutrients of continuous grain cropping as opposed to the use of a balanced rotation.

Recommendations:—For grey wooded soils a conditioning rotation of four or five years duration that includes a legume is recommended. Sweet clover is generally preferred because of its rapid biennial growth. When this rotation has completed two or three cycles, a mixture of grass and legume is substituted and the rotation lengthened to suit the farming program. On dark soils a rotation of from six to eight years that contains a grass-legume mixture is recommended. The 8-year rotation of fallow-grain-grain-hay-hay-hay and break-grain-grain is established at three Illustration Stations. It is considered well suited to a mixed farming enterprise that includes livestock as well as forage seed production.

Fertilizer Testing

A fertility testing project was carried at four Stations during the period 1944-51. This involved two rotations, i.e., fallow-wheat-oats and fallow-wheat-legumes. Plots were arranged across the field strips and various fertilizer applications made to each wheat crop in the year after fallow. Rotted barnyard manure was applied on summerfallow. The chemical fertilizers were broadcast in order to apply exact amounts, which undoubtedly reduced their effect. Had the fertilizer been applied with the conventional attachment the response might be expected to increase yields of wheat by at least double those recorded in Table 23.

Responses to phosphate and ammonium phosphate were substantial and consistent. Applications of sulphur and nitrogen alone had little beneficial effect. Barnyard manure was very effective, particularly on grey soils, probably because it improved the texture of these soils which are characteristically low in organic matter. Furthermore, in the year after application, manure showed a strong residual effect whereas the chemical fertilizer did not.

Phosphate Applications Effective for Cereals:—As a continuation of the fertility work carried on a field basis during 1947-51, rod-row fertilizer tests were commenced in 1951 to test formulations that had effectively increased the yield of wheat on fallow. Included were wheat, oats, and barley seeded on second-crop land as well as on summerfallow. Specific recommendations based on soil type and previous cropping should be forthcoming. The various cereal crops on summerfallow have reacted similarly to fertilizer treatment and the responses have been associated with phosphate and ammonium phosphate formulations. Further experiments must be conducted to determine the value of a high nitrogen-carrying phosphate fertilizer in counteracting the depressing effect of stubble decomposition on succeeding crops.

TABLE 23.—PLANT FOOD DEFICIENCY TRIALS, 1944-51

Treatment	Plant food supplied in pounds per acre				Wheat after fallow and oats	Wheat after fallow and legume hay	Oats after wheat	Legume hay after wheat
	N	P_2O_5	K_2O	S				
					bu.	bu.	bu.	ton
Check	—	—	—	—	22·7	24·3	43·5	1·47
					Yield Increases			
Manure at 15 tons	—	—	—	—	18·1	15·8	19·4	0·17
Ammonium nitrate at 50 lb	16	—	—	—	1·0	0·9	0·2	0·16
Sulphur at 20 lb	—	—	—	20	−0·5	0·4	0·7	0·10
Ammonium sulphate at 80 lb	16	—	—	20	0·7	1·1	0·2	0·06
Triple superphosphate at 45 lb	—	20	—	—	2·1	2·8	2·8	0·03
11–48–0 at 45 lb. plus ammonium nitrate at 36 lb	16	20	—	—	4·7	1·5	5·1	0·19
16–20–0 at 100 lb. plus sulphur at 6 lb	16	20	—	20	3·0	2·4	3·2	0·16
16–20–0 at 100 lb. plus potassium sulphate at 40 lb	16	20	20	20	3·3	2·7	1·8	0·11

Basis 21 crops of wheat, 18 of oats, and 13 of legume hay.

FIG. 13.—Contrast in crop growth between the manured plot, left, and the check plot, right. Progress Illustration Station, 1951.

Chemical Weed Control

Blue Lettuce Controlled by 2, 4-D:—Blue lettuce, *Lactuca pulchella*, is a hardy perennial that is difficult and costly to eradicate by tillage. In 1949 a heavy infestation on the Baldonnel Illustration Station was treated at the bud, flower, and mature stages with 4, 8, 12 and 16 ounces of 2, 4-D butyl ester. Re-treatments were made in 1950 and 1951. Applications of 8 ounces and higher at the bud stage were found to be highly effective and produced kills of over 90 per cent. Re-treatments resulted in a further reduction of weed population indicating that continued re-treatment will eliminate the weed. Treatment when the blue lettuce is in flower, or later, is relatively ineffective.

Cereals

Cereal variety tests including wheat, oats, and barley are conducted on each Illustration Station in co-operation with the Cereal Division to cover the wide range of growth conditions throughout the region.

Operators at Baldonnel, High Prairie, and Rolla are growers of pure seed stocks. The Baldonnel operator is a qualified elite seed grower of Beaver oats and Saunders wheat. During the period 1948-52 the operators sold 7,962 bushels of grain to 161 customers.

Forage Crops

Meadow Mixtures:—Meadow mixtures are grown in a forage area within one-acre rotation fields at each Station. In addition to providing comparative yield data, they permit a study of the residual effect of various seedings on succeeding crops. The main constituents of satisfactory meadow mixtures are alfalfa, brome, creeping red fescue, and sweet clover. A mixture of brome and alfalfa is widely adaptable and produces high yields of good quality forage. Sweet clover and creeping red fescue may be used as supplements in this mixture.

Pasture Studies:—Simulated pasture trials are carried at Baldonnel and McLennan as a co-operative project with the Forage Crops Division. At the Brainard Illustration Station a comprehensive pasture grazing trial has been initiated with sheep providing the grazing complex.

Livestock

Operators are encouraged to keep good quality livestock to balance their farming enterprises and as a source of high-quality breeding stock in the district. Most swine kept are of Yorkshire breeding from original stock obtained at Beaverlodge. Over 90 purebred gilts and boars have been distributed from Illustration Stations to district farmers during the past five years.

Purebred bulls are used in all Station herds. The operator at Progress maintains a herd of registered Herefords, from which breeding stock is obtained.

Cost of Crop Production

Cost of crop production is greatly influenced by soil type, capital investment, machine and labor cost. Records of farm costs provided by the operators are used to study the effect of each of these factors. All direct costs are charged to the enterprise concerned and any expenses that cannot be directly classified are allocated to all enterprises on the basis of relative capital investment.

Cost of Machinery Operation:—Cost per acre of machinery operation can vary widely. Data gathered on Illustration Stations show that both the size of machine and actual operating costs have an important influence on the total charge. The saving made in using large machinery, which increases the labor output per man, can often be offset by an increased charge for machinery investment. Soil type, moisture conditions, depth of tillage and the mechanical condition of the machine exert an important influence on the final cost. All these factors have been considered in compiling the costs presented in Table 24.

TABLE 24.—COST OF FARM OPERATIONS PER ACRE, 1943-52

Item	1948-52				1943-52	
	No. of records	Average cost	Highest cost	Lowest cost	No. of records	Average cost
		$	$	$		$
Plow (stubble)	32	1.63	2.51	0.95	56	1.53
Plow (sod breaking)	3	2.82	3.02	2.61	—	—
Plow (brush breaking)	—	—	—	—	5	5.66
Harrow	22	0.27	0.44	0.13	45	0.28
Double disk	24	0.68	1.07	0.24	49	0.70
One-way disk	16	1.04	1.93	0.60	24	1.06
Tiller combine	7	1.11	1.50	0.70	11	1.08
Cultivator	18	0.68	1.38	0.42	29	0.66
Spring-tooth harrow	7	0.60	1.01	0.32	13	0.57
Drill	31	0.62	1.29	0.31	57	0.60
Binder	23	1.19	2.07	0.61	46	1.04
Swather	10	0.67	1.21	0.43	11	0.67
Combine	13	2.26	3.94	1.55	21	2.31
Mower	14	0.82	1.29	0.41	27	0.82
Rake	13	0.42	0.55	0.19	26	0.41

Cost of Summerfallow:—Although confronted with a heavier-textured soil the operators on grey wooded soils are able to summerfallow land for slightly more than one-half the cost incurred by operators on black soils. Lower costs on grey soils are a result of low cultivation costs and less capital investment on these farms. Charges for management and land use are based on land value and are considerably lower for grey wooded soils. These soils require only one-half the number of tillage operations to maintain weed control and this saving is reflected in lower charges for fuel, use of machinery and labor. Lower summerfallow costs do not necessarily mean that cost of crop production is less as yield plays an important part in final cost per unit.

TABLE 25.—COST PER ACRE TO SUMMERFALLOW LAND

Soil type	Number of crop years	Use of land and taxes	Use of machinery	Gas, oil and grease	Horse labor	Man labor	General farm expense	Management	Total cost per acre
		$	$	$		$	$	$	$
Black	11	1.58	1.75	0.96	—	1.40	0.61	1.02	7.32
Grey	17	0.81	1.05	0.67	—	0.70	0.51	0.62	4.63

Cost of Producing Cereal Crops:—Cost of producing cereal crops on the two main soil types of the Peace River area are presented in Table 25. Heavy frost damage in 1950 and 1951 reduced yields severely on both soil types and tended to minimize the spread in production costs. Yields of grain on some of the grey wooded soils that have been improved by regular cropping to legumes equal those obtained in many of the black areas where less attention has been paid to maintaining the fertility of the soil.

Community Service:—Field meetings are held on the Stations during the growing season when the experimental results are reviewed and farmers present have an opportunity to view the work under way. Over the past five years 33 of these meetings have been held with a total attendance of 2,701 adults.

ACTIVE PROJECTS

Animal Husbandry

Baby Pig Losses as Related to the Nutrition of the Sow; Improving the Quality of Oat Rations for Weanling Pigs; Feeding Value of Oats Damaged by Molds and Mildews for Lambs and Swine.

Cereals

General, Supplementary and Co-operative Tests— Spring Wheat, Oats, Barley, Flax, Winter Wheat, Winter Rye; Alcan Test—Spring Wheat, Oats, Barley; Breeding Spring Wheat, Oats, Barley; Verification of Farmers' Samples of Spring Wheat; Production and Maintenance of Foundation Stock—Spring Wheat, Oats, Barley; Response of Varieties of Spring Wheat to Length of Day, and Other Environmental Conditions; Effect of the Application of Fertilizer to Spring Wheat on Experimental Error and Varietal Reaction.

Field Husbandry

Meteorological Records; Growth Rhythm of Crop Plants as Affected by Conditions at Different Latitudes; Crop Rotations; Sequence of Crops; Pasture Research on Depleted Soils; Fertilized Pasture Studies; Effect of Grazing Practices and Intensities on Pasture; Establishment of Cultivated Grasses and Legumes on Burned-Over Lands; Effect of Date of Seeding on the Response of Cereals to Fertilizer; Rates of Applying Commercial Fertilizer for Wheat, Oats, Barley; Chemical Fertilizer Formulae for Wheat; Straw Disposal Studies; Study of Modified Contour Farming on Steep Slopes; Control of Wild Oats by Cropping and Tillage Practices; Toadflax Control; Couch Grass Control; Selective Control of Wild Oats by Herbicides; Effect of 2, 4-D on Grain Crops at Different Growth Stages; Tractor Operating Costs; Snow Utilization Experiment; Wireworm Control by Insecticides.

Forage Crops

Introduction and Testing of New Species; Alfalfa Varieties for Hay Production, Hardiness and General Suitability; Comparative Tests—Red Clover; Perennial and Biennial Grasses and Legumes for Pasture; New Grasses for Hay and Pasture; Turf Research; Production of Foundation Stock Seed; Rejuvenation of Grass Stands for Seed Production; Grass Seed Production as Affected by Spacing; Factors Affecting Seed-Set in Alfalfa; Herbarium.

Horticulture

Strawberry, Variety Experiment; Windbreaks and Shelterbelts, Variety and Culture Experiment; Perennial Climbers; Ornamental Trees and Shrubs; Vegetable Variety Trails—Corn, Leafy, Leguminous, Perennial, Root, Solanaceous, Vine; Flower Variety Trials—Annuals, Herbaceous Perennials, Bulbous Plants, Flowering Bulbs; Fruit Variety Trials—Bush, Tree; Tomato Breeding; Breeding Improved Apples and Crabapples for Northern Areas; National Potato and Seedling Tests.

Illustration Stations

Plant Food Deficiency in Grey Wooded Soils; Chemical Fertilizer Studies; Effect of Chemical Fertilizers on Cereals; Residual Effect of Grasses and Legumes on Grain Crops; Control of Weeds by Cultural Methods; Effect of Herbicides on

Perennial Weeds—Blue Lettuce, Field Horsetail; Water Development Studies; Water Erosion Control; Study of Regional Climatic Conditions Related to Crop Production; Testing Cereal Varieties; Production of Registered and Certified Seed Grain; Perennial and Biennial Grasses and Legumes for Hay and Pasture; Methods of Producing Grass Seed; Potato Variety Test; Development of the Farm Garden and Orchard; Farm Home Beautification; Farm Shelterbelts; Animal Pathological Records; Sales of Livestock for Breeding Purposes; Yield and Cost of Producing Farm Crops; Study of Farm Productivity and Progress; Study of Farm Business; Crop Rotations.

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