CANADA
DEPARTMENT OF AGRICULTURE
EXPERIMENTAL FARMS SERVICE

DOMINION EXPERIMENTAL STATION

SCOTT

SASKATCHEWAN

G. D. MATTHEWS, B.S.A., SUPERINTENDENT

PROGRESS REPORT
1948-1953

SHELTERBELTS ARE ALMOST ESSENTIAL FOR GARDENS IN THE OPEN PLAINS

Published by authority of the Right Hon. JAMES G. GARDINER, Minister of Agriculture, Ottawa, Canada.

51792—1

TECHNICAL PERSONNEL

G. D. MATTHEWS, B.S.A., Superintendent
E. VAN NICE, B.S.A., Animal Husbandry
A. G. KUSCH, B.S.A., M.Sc., Cerealist
H. A. FRIESEN, B.S.A., M.Sc., Field Husbandry
D. E. FORSBERG, B.S.A., M.Sc., Forage Crops
H. UKRAINETZ, B.S.A., Soil Fertility
D. H. DABBS, B.Sc., M.Sc., Horticulture
C. H. KEYS, B.S.A., Illustration Stations
W. B. TOWILL, B.S.A., Illustration Stations

51792—2

CONTENTS

51792—2½

INTRODUCTION

This report of the Experimental Station, Scott, Sask., covers the results of experimental work for the years 1948 to 1953. The last published report covered the years 1937 to 1947. The Station is located approximately one hundred miles west of Saskatoon on the main line of the C.N.R. and serves an area comprising, roughly, the northwest quarter of the province.

Four additions have been made to the research staff in the past five years. These are: a soil specialist, an agronomist in forage crops, a horticulturist and a supervisor for a substation located on the grey wooded soils of northwestern Saskatchewan.

Problems associated with drought, short frost-free seasons and severe winters are the main climatic hazards peculiar to the territory served by this Station.

A new drought-resistant wheat has been developed, tested and increased for distribution. Early tillage of summerfallow in the spring and seeding ten days later has been found to increase yields of grain, particularly oats, in dry seasons. This practice appears to have wide application, because on the substation at Rosetown, an average increase of some four bushels in the yield of wheat has been obtained in the past three years when compared with cultivating and drilling the same day. The use of phosphate fertilizers in conjunction with this practice has increased its effectiveness. Such findings are of great economic importance in grain production which is the main source of farmer's income in the territory served.

On the Illustration Stations in the north, the results from fertilizers have been more consistent than on the open plains, with sulphur increasing yields at Loon Lake in the north. The inclusion of a legume in the rotation has increased the effectiveness of fertilizers in this area.

Of wide interest to gardeners is the work in progress in horticulture dealing with advancing maturity of heat-loving vegetables and studies in winter hardiness in tree fruits. A hardy carnation, which has wintered outside successfully, was introduced in 1952.

In 1952, poultry work was discontinued and most of the funds formerly used in this work were diverted to experimentation in field crops.

METEOROLOGICAL RECORDS

Weather is all important in crop production and detailed records of precipitation and temperatures are extremely useful in the interpretation of experimental results in agriculture. Consequently, a summary of important features of weather records at this station is presented in Tables 1 to 3.

TABLE 1.—Meteorological Records—1912-1953 (42 years)

Month	Average temperature in ° F			Average precipitation in inches			Average hr. bright sunshine	Average miles of wind[1]	Average evaporation in inches[2]
	Highest	Lowest	Mean	Rain	Snow	Total			
January	34·6	−39·9	−0·8	0·01	6·55	0·66	83·4	7567	
February	36·6	−35·5	3·6	0·02	5·56	0·58	113·7	7633	
March	45·7	−23·5	16·1	0·02	5·90	0·61	151·9	9112	
April	71·9	4·6	37·2	0·52	3·34	0·86	208·9	9566	
May	84·0	21·7	50·0	1·47	0·22	1·50	259·8	9861	4·03
June	87·3	30·3	57·3	2·23	.....	2·23	258·8	8455	3·54
July	93·0	37·4	61·7	2·29	.....	2·29	315·6	8275	4·44
August	90·9	33·0	59·4	1·73	.....	1·73	271·4	7767	3·82
September	83·3	20·7	50·5	1·19	0·44	1·25	181·2	8169	2·45
October	72·7	7·0	38·7	0·51	2·05	0·73	150·0	8657	
November	52·0	−12·2	20·3	0·07	5·61	0·63	91·1	7724	
December	39·3	−17·6	6·4	0·02	6·36	0·65	70·0	7766	
Annual	.....	.....	33·4	10·08	33·03	13·72	215·58	100,552	18·28

[1] Average wind velocity for 29 years.
[2] Average evaporation for 31 years.

In prairie agriculture, rainfall, particularly the amount and distribution during the growing months, is the greatest single factor in crop production. Unfortunately, the range of precipitation during May, June, July, and August has varied widely over the years as shown in Table 2. The annual precipitation

Figure 1: Supplementing low rainfall by sprinkler irrigation on potatoes using water from spring runoff stored in nearby dam.

is not necessarily a good index of production because, for example, the year 1951 had two inches more than in 1952 but the crop yields were much higher for the latter year. Average annual precipitation for the past six years, as shown in Table 2, is practically the same as the average for the past 42 years.

For quick reference, a few of the average agricultural weather records may be stated as follows:

Annual precipitation	13·72	inches
Winter snowfall	33·03	inches
Summer evaporation	18·28	inches
Annual sunshine	2,155·80	hours
Annual wind	100,552·00	miles
Frost-free period	88	days
Killing-frost-free period	118	days

TABLE 2.—Monthly and Annual Precipitation

Average Monthly and Annual Precipitation and Monthly Extremes in Inches 1912-1953

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total Annual
1912	0·37	0·62	0·23	0·00	2·46	2·19	6·16	2·93	2·01	0·15	0·20	0·27	17·59
1913	0·68	0·42	0·23	0·15	0·95	1·28	2·98	2·62	1·24	0·46	0·25	0·08	11·64
1914	0·65	0·03	0·20	1·36	1·15	2·37	1·80	1·41	3·51	3·17	0·60	1·80	18·05
1915	0·10	0·15	0·05	0·90	1·40	3·54	2·11	0·48	0·98	0·25	0·40	0·10	10·46
1916	1·25	0·50	1·05	0·52	2·52	4·23	4·03	3·87	1·77	0·50	0·05	0·50	20·79
1917	0·60	0·15	0·03	1·10	0·41	0·88	1·03	1·78	0·46	0·13	0·25	0·55	7·37
1918	0·77	0·49	0·57	0·58	0·20	0·29	1·87	0·93	0·19	0·32	0·10	0·28	6·59
1919	0·73	0·30	0·90	0·79	0·88	0·91	0·75	2·56	1·56	1·22	0·15	0·43	11·18
1920	1·30	0·28	1·25	0·62	0·65	2·47	3·74	2·37	1·49	0·54	0·36	0·45	15·52
1921	0·53	0·80	0·95	2·54	1·39	1·66	1·65	0·56	2·51	0·00	0·68	0·23	13·50
1922	0·40	0·43	0·40	0·79	2·03	0·87	0·26	3·04	0·56	1·01	0·08	0·55	10·42
1923	0·35	0·52	0·22	0·29	0·95	5·67	4·25	1·45	0·65	0·32	0·06	0·30	15·03
1924	0·12	1·10	1·10	1·03	1·10	0·58	0·70	2·87	1·60	0·31	1·11	0·95	12·57
1925	0·94	1·08	0·81	1·41	1·51	3·48	2·68	1·31	2·05	0·72	0·30	0·56	16·85
1926	0·48	1·23	0·05	0·91	2·97	1·39	0·75	2·52	0·74	0·61	0·83	1·09	13·57
1927	0·11	0·08	0·51	1·42	2·54	2·14	3·10	1·18	2·46	0·74	0·59	0·02	14·89
1928	0·01	0·07	1·36	1·54	0·82	2·73	3·00	0·61	0·16	0·36	0·00	0·28	10·94
1929	0·54	0·49	0·44	0·94	0·63	2·64	0·67	0·45	1·32	0·22	0·80	0·83	9·97
1930	0·68	0·59	0·40	0·38	0·38	2·79	2·45	1·08	1·38	1·14	0·40	0·39	12·06
1931	0·20	0·30	0·83	0·27	0·12	2·41	3·13	0·83	2·21	0·52	0·83	0·95	12·60
1932	1·62	0·30	1·23	1·66	1·82	2·99	2·78	1·30	0·77	0·24	0·60	0·65	15·96
1933	0·65	0·78	1·22	0·91	1·34	1·78	0·86	1·67	1·80	1·11	0·70	1·75	14·57
1934	0·93	0·45	0·53	0·73	1·70	5·03	1·52	1·47	1·11	0·06	0·58	1·15	15·26
1935	1·15	0·25	0·78	1·25	0·82	2·30	1·98	1·26	0·66	1·28	2·20	1·20	15·13
1936	1·05	0·73	0·15	0·44	0·78	1·79	0·96	0·85	0·44	1·08	0·43	1·80	10·50
1937	0·85	1·10	0·70	1·20	2·28	0·77	2·91	0·65	0·71	1·44	1·35	1·68	15·64
1938	1·50	1·63	0·50	0·73	2·38	1·44	1·71	1·61	2·59	1·32	2·00	0·25	17·66
1939	0·90	1·75	0·45	0·32	1·56	4·44	1·20	0·84	0·60	0·49	0·32	1·13	14·00
1940	0·28	0·89	1·10	0·75	1·75	2·53	2·09	0·09	0·50	1·76	1·53	0·50	13·77
1941	1·40	0·05	1·38	0·53	4·00	1·10	0·78	2·33	1·21	0·37	0·56	0·17	13·88
1942	0·02	0·28	0·36	1·83	1·07	3·57	3·70	1·50	1·57	0·61	0·83	0·39	16·08
1943	0·41	0·86	0·28	0·12	2·92	1·45	2·81	2·28	0·77	1·66	0·75	0·08	15·06
1944	0·25	0·70	0·80	0·04	3·39	2·84	4·02	4·99	1·09	0·07	0·33	0·15	18·67
1945	0·75	0·64	0·22	1·12	0·61	1·11	1·37	1·68	1·93	0·28	0·59	0·51	10·81
1946	1·05	0·74	0·18	0·84	1·27	1·81	0·90	4·25	0·58	1·66	1·29	0·06	15·17
1947	0·49	0·14	0·24	0·35	0·45	1·85	1·70	2·89	2·60	0·33	1·02	1·40	13·06
1948	1·27	1·12	0·41	1·94	0·24	1·02	3·00	0·77	0·09	0·05	0·48	0·67	11·06
1949	0·10	0·33	0·48	0·49	2·87	1·72	2·31	1·59	1·02	0·38	0·65	0·51	12·45
1950	0·41	0·13	0·09	0·66	0·38	3·68	3·25	1·26	1·29	2·37	0·86	0·81	15·19
1951	0·64	0·56	0·85	1·39	2·27	0·73	4·19	2·23	1·00	0·92	0·71	0·47	15·96
1952	0·80	0·22	0·91	0·20	2·21	4·19	2·77	0·84	0·91	0·19	0·52	0·18	13·94
1953	0·76	0·36	1·56	1·23	1·92	0·99	2·32	1·50	0·34	0·15	0·13	0·83	12·09
42-yr. average	0·66	0·58	0·61	0·86	1·50	2·23	2·29	1·73	1·25	0·73	0·63	0·65	13·72
Extremes 1912-1953 Low	0·01	0·03	0·03	0·00	0·12	0·29	0·67	0·09	0·09	0·00	0·00	0·02	6·59
Extremes 1912-1953 Low year	1928	1914	1917	1912	1931	1918	1929	1940	1948	1921	1928	1927	1918
Extremes 1912-1953 High	1·62	1·75	1·38	2·54	3·39	5·67	6·16	4·99	3·51	3·17	2·20	1·80	20·79
Extremes 1912-1953 High year	1932	1939	1941	1921	1944	1923	1912	1944	1914	1914	1935	1914 1936	1916

TABLE 3.—Occurrence of Frost and Frost-Free Period
(Frost: 32°F or lower; Killing Frost: 28°F or lower)

Year	Last frost in spring		First frost in fall		Frost-free period (above 32° F.)	Last killing frost in spring		First killing frost in fall		Killing frost-free period (above 28° F.)
	Date	Temp. (° F.)	Date	Temp. (° F.)		Date	Temp. (° F.)	Date	Temp. (° F.)	
1912	June 6	29·7	Sept. 15	24·2	101	May 21	27·6	Sept. 17	28·0	119
1913	June 14	28·7	Sept. 2	31·3	80	May 21	26·2	Sept. 10	23·7	114
1914	May 28	30·2	Aug. 25	30·2	89	May 13	27·2	Sept. 3	28·0	113
1915	June 16	30·2	Aug. 23	31·0	68	May 17	26·6	Sept. 9	27·4	115
1916	May 29	29·2	Aug. 11	30·2	74	May 16	27·8	Sept. 14	20·4	121
1917	June 20	28·2	Sept. 6	31·2	78	June 12	25·6	Aug. 8	27·7	57
1918	June 5	30·2	July 24	27·2	49	June 3	27·2	July 24	27·2	51
1919	June 9	28·8	Sept. 2	28·7	85	June 2	20·2	Sept. 27	27·0	117
1920	June 13	30·2	Aug. 20	29·4	68	May 21	24·2	Sept. 19	27·7	121
1921	June 4	26·7	Sept. 9	30·2	97	June 4	26·7	Sept. 29	26·7	117
1922	June 7	31·4	Sept. 9	26·7	94	May 30	26·7	Sept. 9	26·5	102
1923	May 18	21·4	Sept. 11	30·0	116	May 18	21·4	Sept. 12	22·1	117
1924	June 24	31·5	Sept. 13	27·5	81	May 23	20·4	Sept. 13	27·5	112
1925	June 4	31·2	Sept. 13	29·5	101	May 15	25·4	Sept. 27	26·0	135
1926	June 14	32·0	Aug. 8	29·0	55	May 19	28·0	Sept. 17	26·0	121
1927	May 21	32·0	Aug. 8	31·0	79	May 19	27·0	Sept. 20	23·1	124
1928	May 11	27·0	Aug. 23	30·8	104	May 11	27·0	Aug. 27	27·0	108
1929	June 4	31·5	Sept. 14	31·6	92	May 15	27·6	Sept. 5	26·0	113
1930	June 4	30·0	Aug. 31	28·0	88	May 23	21·2	Aug. 31	28·0	100
1931	May 27	29·3	Sept. 17	30·8	113	May 20	26·3	Oct. 4	24·4	137
1932	May 27	28·6	Sept. 19	31·3	115	April 27	28·0	Oct. 4	21·7	160
1933	June 2	31·5	Aug. 1	29·0	60	May 10	28·0	Sept. 27	23·6	140
1934	June 3	30·4	Aug. 23	30·3	81	May 2	27·5	Sept. 22	17·9	143
1935	June 7	27·6	Aug. 16	27·7	70	June 7	27·6	Sept. 30	25·6	115
1936	June 3	27·6	Sept. 9	31·1	98	June 3	27·6	Sept. 14	21·9	103
1937	June 8	32·0	Aug. 29	31·0	82	May 8	18·9	Sept. 6	28·0	121
1938	May 29	31·0	Aug. 23	31·3	86	May 16	25·5	Oct. 15	25·0	152
1939	May 12	30·0	Sept. 7	30·0	118	April 20	25·0	Sept. 24	17·4	157
1940	May 14	27·7	Sept. 9	30·3	118	May 14	27·7	Sept. 24	26·0	133
1941	May 22	28·5	Sept. 8	29·2	109	May 7	26·3	Sept. 9	26·7	125
1942	May 30	28·5	Sept. 2	26·5	95	May 17	25·8	Sept. 2	26·5	108
1943	May 26	30·5	Sept. 8	30·2	105	May 25	24·5	Sept. 19	23·0	117
1944	June 17	31·4	Sept. 15	31·5	90	May 8	26·0	Sept. 30	25·0	146
1945	June 16	30·0	Sept. 12	31·5	88	May 27	23·5	Sept. 20	27·0	116
1946	June 17	31·0	July 23	31·0	36	May 20	28·0	Sept. 19	23·0	122
1947	June 10	27·5	Sept. 9	31·0	91	June 10	27·5	Sept. 24	25·0	106
1948	May 10	29·0	Sept. 6	28·5	119	May 26	27·0	Sept. 24	20·0	121
1949	June 17	30·0	Aug. 30	30·5	74	May 23	18·0	Sept. 27	28·0	127
1950	June 8	31·5	Aug. 17	31·5	70	May 24	28·0	Sept. 11	22·0	110

1951	June 30	31·5	Sept. 15	29·0	77	June 5	26·2	Sept. 28	14·0	115
1952	June 25	31·0	Aug. 8	31·0	44	May 15	27·8	Sept. 5	22·0	113
1953	June 19	29·5	Sept. 21	26·0	94	May 21	26·5	Sept. 21	26·0	123
42-year average	June 5		Sept. 1		88	May 20		Sept. 15		118
Shortest crop season	June 5 1918	30·2	July 24	27·2	49	June 3	27·2	July 24	27·2	51
Longest crop season	May 10 1948	29·0	Sept. 6	28·5	119	April 27 1932	28·0	Oct. 4	21·7	160

Earliest and latest frosts (32° F. or lower) 1912-1953.

Latest spring frost.....June 25, 1952—31·0°
Earliest date of last spring frost.....May 10, 1948—29·0°
Earliest fall frost.....July 23, 1946—31·0°
Latest date of first fall frost.....Sept. 21, 1953—26·0°

Earliest and latest killing frost (28° F. or lower) 1912-53.

Latest spring killing frost.....June 12, 1917—25·0°
Earliest date of last spring killing frost.....April 20, 1939—25·0°
Earliest fall killing frost.....July 24, 1918—27·2°
Latest date of first fall killing frost.....Oct. 15, 1938—25·0°

FIELD HUSBANDRY

H. A. FRIESEN

Tillage Experiments

The program of experimental work with various tillage practices is extensive. Of particular interest have been studies of various methods of preparing summerfallow, the pre-seeding treatment of land in fallow; the effect of different seeding methods, and soil packers; and methods of rejuvenating root-bound brome grass.

Methods of Summerfallowing

The semi-arid conditions in the area served by the Experimental Station, Scott, require frequent use of the summerfallow as a means of conserving moisture for a succeeding crop. Moisture conservation can best be effected by timely tillage to control weed growth. This observation has been fully borne out by the results of a test carried on over the past 37 years in which the first working of fallow was begun on each of three dates, May 15, June 15, and July 15. In this test the crop on the fallow, where the first working was given on May 15 yielded an average of 2·3 bushels per acre more than when the fallow was first worked on June 15 and 5·5 bushels per acre more than when the first working was not started until July 15. The depth of tillage or type of tillage machine used tended to have little or no effect on the yield, provided the tillage operation did a thorough job of cutting off the weeds. Shallow tillage can be performed with wide implements, which have much lower draft requirements than deep tillage machines such as the mold board plow. Hence, shallow tillage is less costly in both time and money. Furthermore, shallow tillage is essential if the crop residue is to be utilized as a trash cover to protect the soil against erosion.

In 1947 an experiment was begun in which eight different methods of preparing summerfallow were studied. Each method or treatment was replicated four times on plots 1·3 acres in size. Wheat, oats, and barley were sown on each of the plots. A fallow—grain rotation was used. The eight treatments and the average yield of each crop on these treatments over the past six years are given in Table 4.

During the course of this test a number of interesting observations have come to light. Spraying the crop grown on fallow with 2,4-D, treatment 7, has resulted in the highest average yields of wheat, oats, and barley. The use of cyanamid at 75 pounds per acre has resulted in a slight stimulation in the yield of each of the three grain crops. Of particular interest are the grain yields on Indian fallow. Indian fallow is a term used to denote fallow that did not receive tillage of any description throughout the fallow year. In the spring, the weeds were burned off, prior to plowing, packing, and seeding, treatment 8. In treatment 5 the weeds were merely plowed down and the land packed and seeded. In treatment 8, where the weeds were burned before plowing and seeding, the average yields of oats and barley were about equal to those on the control plots, treatment 1, which were summerfallowed in the usual manner. Furthermore, the plots on burned Indian fallow were remarkably free of weeds. In treatment 5, the yields were depressed, due to the poor stands that resulted from the open nature of the soil after plowing in the heavy stand of dead weeds. As a result the crops tended to be rather heavily infested with weeds. Each of the plots, except those in treatment 1, ordinary fallow, were wire-weeded about one week after seeding to control the annual weeds. The value of this tillage is clearly demonstrated by the lower average yields of wheat, oats, and barley given for treatment 1 in Table 4.

Treatments 4 and 6 were included to assess the value of 2,4-D as a substitute for at least part of the tillage required for weed control in the summerfallow program. The results of this type of fallow have not been too satisfactory, because of heavy growth of volunteer grain and weed species resistant to 2,4-D. These so-called "chemical" fallows were costly to conduct because almost as much tillage was required to control the volunteer grain as was required to control all growth on the cultivated fallow, treatment 3, plus the cost of the herbicide. During the first two years, only one tillage operation for fallow was given and the plots were sprayed twice in the same season with 2,4-D. Growth of resistant weeds and volunteer grain was sufficiently heavy to seriously depress the yield of the succeeding grain crops in those seasons.

Soil moisture analyses were made to a depth of three feet on each type of fallow treatment in the late fall and early spring of each year that the test has been conducted. This work has shown that the moisture reserves on the Indian fallows were much lower than on the cultivated fallows in the fall, due to the uncontrolled weed growth. Analyses made in the spring indicated that the snow accumulated by the weeds during the winter had replenished the soil moisture on the Indian fallows to a depth of two feet. However, at a depth of three feet the cultivated fallows contained considerably more moisture. This greater reserve of moisture would largely explain the higher yields on the cultivated fallows in dry years and consequently the higher average yields shown in Table 4.

Burning the weeds on the Indian fallow leaves an even coating of black carbon on the soil, which should theoretically result in a more rapid warming of the soil and this in turn should stimulate plant growth and yield. Attempts were made in 1948 and 1949 to apply carbon black to simulate the effect of burning on cultivated fallow. The attempts were not successful because a satisfactory technique for applying the carbon could not be devised.

TABLE 4.—The Effect of Different Methods of Preparing Summerfallow on the Yield of Grain

Treatment[1]	Average yield in bushels per acre 1948-1953		
	Wheat[2]	Oats	Barley
1. Check, one-way disk late May, plow late June, cultivate as required for weed control	11·3	36·3	22·3
2. Fallow as in (1). Cyanamid dusted on at 75 lb./acre after seeding the crop	13·5	41·5	25·6
3. Fallow as in (1). Apply carbon black after seeding	12·2	40·0	23·2
4. Heavy duty cultivator in May. Control weeds and volunteer grain with 2,4-D or tillage as required	11·1	40·1	23·8
5. Indian fallow—no tillage. Plow, pack, and seed in crop year	11·3	35·8	20·7
6. One-way disk in May. Control weeds and volunteer grain with 2,4-D or tillage as required	10·1	35·9	20·7
7. Fallow same as in (1). Spray crop with 2,4-D at recommended time and rate	16·6	44·4	29·1
8. Indian fallow—no tillage. In crop year burn weeds, plow, pack and seed	12·5	35·7	22·5

[1] All plots except treatment 1 were wire-weeded one week after seeding.
[2] Due to unfavorable weather, wheat yields were not obtainable in 1951, 5-year average.

Pre-Seeding and Seeding Treatment of Fallow

In west central Saskatchewan, low rainfall and high winds commonly occur during the months of April and May. Bare fallow, if left unworked during this period, tends to crack and dry out very quickly with the result that much of the moisture conserved in the previous season is lost. Furthermore, such land tends to drift readily. Shallow tillage, as soon as possible in the spring, at a slow speed, will break the surface crust and materially reduce evaporation. The lumps created by this operation on loam soils will usually be large enough and dry sufficiently hard to resist wind erosion. The tillage must be done early, just as soon as the soil is dry enough to permit the operation of tillage implements. Seeding need not follow directly after the tillage but may be deferred for a number of days.

Nine pre-seeding and seeding treatments as well as the effect of each on the yield of wheat, oats, and barley are given in Table 5. As shown in this table the use of manure and phosphate fertilizer has resulted in the highest average yields of wheat, oats, and barley. Packing after seeding and rod-weeding one week after seeding each increased the yield of wheat and oats by at least two bushels per acre and the yield of barley by one bushel per acre. Seeding with the one-way disk without packing depressed the yield of wheat but not the yields of oats and barley. One-way seeding and packing resulted in higher average yields of oats and barley and slightly higher yields of wheat. In treatments 8 and 9 the fallow was cultivated early in the spring and seeding on treatment 9 was done directly following the cultivating, while on treatment 8 the seeding was deferred for ten days. It was of particular interest to note that the average yield of wheat was 1·2 bushels higher, oats 8·7 bushels and barley 3·1 bushels per acre higher on the deferred seeding than on the early seeded plot. Because this test was conducted on large field strips where soil differences could not be corrected, a further trial was laid down in 1947 to assess the merits of one-way disk versus drill seeding and early versus deferred seeding. The treatments used are given in Table 6. From the average yields presented in Table 6, early cultivating and seeding ten days later with the drill has been the outstanding treatment. The remaining treatments have resulted in closely similar average yields with the exception of early cultivating and seeding, treatment 8. Seeding with the double disk drill has shown some advan-

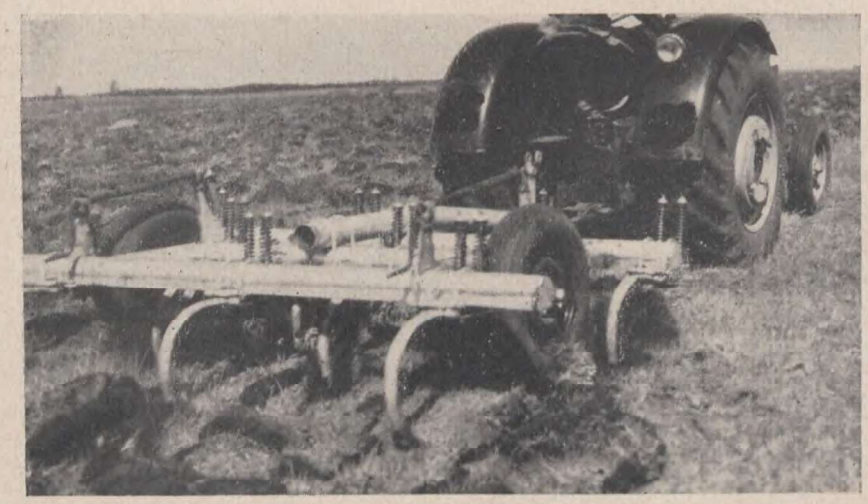

Figure 2: Heavy-duty cultivators are used to break sod instead of the plow which is fast disappearing from the prairie scene.

tage over the one-way disk seeder with packers attached in treatments where the seeding was delayed. However, in those treatments where the seeding was done early the one-way disk seeder tended to show a slight advantage.

Early tillage and seeding ten days later is of particular interest for two reasons. Firstly, the early tillage roughens the surface soil and thereby often materially aids in the control or prevention of wind erosion. Secondly, the breaking of the surface tends to prevent soil from cracking and thus reduces evaporation and the loss of the soil moisture reserves. The retention of this moisture reserve is of prime importance in those years when rainfall during the growing season is abnormally low. Thus, in the years 1948 and 1951, when the moisture reserves in the early spring were good but subsequent rainfall was light and occurred late in the season, early tillage and seeding ten days later significantly increased the yield of grain on fallow.

TABLE 5.—The Effect of Spring Treatments on Uniform Fallow on the Yield of Grain

Spring treatment	Average yield in bushels per acre, 1941-1953		
	Wheat[1]	Oats	Barley
1. Manure 10 tons per acre	16·5	41·5	28·6
2. Ammonium phosphate 11-48-0 at 20 lb./acre	16·2	40·5	25·8
3. Pack after seeding with drill	13·1	34·9	18·9
4. Check—cultivate and drill	10·9	33·3	17·9
5. Rod-weed—7 days after seeding with drill	13·2	36·6	19·2
6. One-way disk seeder	9·6	34·1	20·5
7. One-way disk seeder and packer	11·4	40·4	22·4
8. Cultivate early spring–drill seed 10 days later	12·0	41·1	23·3
9. Check—early spring cultivate and drill	10·8	32·4	20·2

[1] Wheat not threshed in 1951, hence 12-year average only.

TABLE 6.—The Effect of Pre-seeding Tillage on Summerfallow on the Yield of Grain

Treatment	Yield in bushels per acre 1947-1953		
	Wheat[1]	Oats	Barley
1. Allow weeds to start—seed with one-way disk and pack	12·1	30·0	18·6
2. Early spring seed with one-way disk and pack	10·7	25·5	17·1
3. Early spring cultivate—seed with one-way disk 10 days later	12·0	28·9	17·6
4. Allow weeds to start—cultivate and drill seed	10·2	29·4	16·4
5. Early spring cultivate—drill seed 10 days later	13·3	34·8	21·6
6. Allow weeds to start—cultivate, seed with one-way disk 10 days later	9·9	29·5	16·8
7. Allow weeds to start—cultivate, drill seed 10 days later	10·4	29·3	19·3
8. Early spring cultivate and drill seed	10·7	27·6	16·5

[1] Due to unfavorable weather, the wheat could not be threshed in 1951 hence only the five-year average yields are available.

Stubble Treatments

Various methods of preparing and seeding stubble land to grain crops have been under test over the past 37 years. Spring plowing and seeding with the drill has resulted in the highest average yields of either wheat or oats. Fall tillage, either deep or shallow, which resulted in a breaking down of the stubble, tended to materially reduce the yield. Shallow spring tillage with the disk harrow or duckfoot cultivator before seeding with the drill resulted in lower yields than spring plowing and seeding. In more recent years, seeding with the one-way disk seeder and packing resulted in yields as high as those following spring plowing. This treatment is now most commonly used because it is much cheaper and less time-consuming than plowing and seeding. Spring burning and seeding with no previous tillage has given yields almost equal to plowing but is highly conducive to soil drifting and is not recommended. Drill seeding directly into the stubble without previous tillage has resulted in extremely low yields.

Straw Mulch for Wheat

The effect of spreading straw at the rate of one and one-half tons per acre directly after seeding wheat on fallow and on spring-plowed stubble has been tested over the past 25 years. The straw did not increase the yield of wheat on fallow, but the residual effect increased the yield of the crop on stubble by nearly three bushels per acre. When the mulch was applied to the wheat crop on spring-plowed stubble it increased the yield of that crop by nearly three bushels per acre but had little or no residual effect on the succeeding crop on fallow. The straw mulch tended to delay the maturity of the crop by some three days in the year that it was applied.

In 1952 soil analyses were made on samples taken from plots in which the stubble had been burned each spring for the past 37 years, where straw mulch had been applied over the past 25 years and from virgin sod. The results of these analyses, given in Table 7, are of particular interest in that the organic-matter content in the top six inches of soil was virtually unaffected by the burning or the mulching.

TABLE 7.—The Effect of Various Cultural Treatments on the Soil

Cultural treatment	Depth of sampling	% nitrogen	% organic matter
1. Straw burned	0–6	0·198	4·14
2. Cut with binder, no straw returned	0–6	0·207	3·69
3. Cut with binder—straw mulch of 1·5 tons/acre applied	0–6	0·202	3·86
4. Virgin sod	0–6	0·356	7·60

Weed Control Experiments

Weed control has become an increasingly important problem under conditions of extensive grain production. In the past a great deal of experimental work has been done on the control of weeds by tillage and cropping methods. With the advent of 2,4-D and other herbicides in the last decade, the trend of weed control work has been largely devoted to studies dealing with the most effective use of these products.

Light Tillage After Seeding Wheat for Weed Control

This project was designed to study the effectiveness of light tillage at various dates after seeding wheat for the control of annual weeds. Operations were made with a rod weeder, finger weeder, wire weeder and diamond-tooth harrow at four, five, six, and seven days after seeding. The rod and wire weeders tended to result in very slightly better weed kills and higher yields, than the finger weeder and harrow. However, each implement gave effective weed control in those seasons when weather conditions caused the weeds to emerge prior to the emergence of the crop.

Weed Control with Chemicals

The effect of 2,4-D on wheat, barley, and oats applied at twenty different stages of growth.—In this project plots of wheat, barley, and oats were sprayed with the butyl ester and a "mixed" amine of 2,4-D at rates ¼ and ½ pound of acid equivalent per acre. The sprayings were made at 20 different stages of growth beginning at emergence and continuing at intervals of three days thereafter. Since it was desired to measure only the effect of 2,4-D on the crop, the plots were kept weed free by hoeing. The results of these trials have shown that the most susceptible stages of growth in both wheat and barley occurred at two rather widely separated periods. The first period was represented by the early seedling stages, when the plants advanced from emergence until the four-leaf stage was reached. The second period occurred much later or during the pre-heading stage, approximately three to nine days prior to heading. Little or no damage occurred when these crops were sprayed during the interval between the two periods just described. Oats were found to be more sensitive to 2,4-D than either wheat or barley, particularly during the period when the plants advanced from the early shot-blade stage, or were some eight to ten inches tall, until the early boot stage. The oat crop was noted to be more tolerant to the amine rather than to the ester formulation of 2,4-D. The most satisfactory time to treat oats with 2,4-D was found to be when the plants were in the three- to six-leaf stage of growth provided the amine formulation was used and at a rate of not more than eight ounces of 2,4-D acid per acre. Oats should not be treated with 2,4-D during the time that the crop advances from the six-leaf stage until the shot-blade or flag leaf stage has been reached. During the shot-blade to early boot stage the crop could be safely treated with the ester formulation, but the amine formulation of 2,4-D was preferable particularly under conditions conducive to rapid growth.

The Control of Annual Weeds with Herbicides

In the past five years an extensive program to determine the most effective usage of 2,4-D and various other herbicides has been under way.

Of major importance was the finding that many of the most prevalent annual weeds such as stinkweed, lamb's quarters, mustards, and Russian thistle could be readily killed or controlled with 2,4-D at a low cost per acre. The herbicide was much more effective under conditions that favored rapid growth. For most efficient and effective control the treatment should be made during the early or seedling stages of growth of these weeds. It was also found that weed species varied widely in their reaction to 2,4-D, and thus the ester was effective on a wider variety of weeds than the amine formulation. Some weeds, such as wild buckwheat, have shown a marked resistance to 2,4-D and M.C.P., this species being severely stunted but not killed by dosages of as much as ½ pound of acid per acre. While the "low volatile" esters have resulted in an even more severe stunting of the buckwheat, they have not usually given a satisfactory kill or control. The merit of any product or practice is usually based by the farmer on the increased yields and returns per acre from his crops. Thus,

in a replicated test in which the fallow on two sets of plots was prepared in exactly the same way, the wheat on those plots which were sprayed with an ester of 2,4-D at ¼ pound of acid per acre, when the grain was in the five-leaf stage of growth, yielded an average of 2·9 bushels per acre more than the unsprayed plots, over the past four years. (See Table 4 under Fallow Treatments). Yield increases of a similar magnitude were noted with barley and to a lesser extent with oats. These increased crop returns under a short grain rotation and good farming practices have resulted in the very wide acceptance of the use of 2,4-D by the farmers of west central Saskatchewan.

In the experimental program the herbicides were largely applied as liquid sprays because they could be more readily controlled on small plots in this way. Comparative tests of 2,4-D sprays versus 2,4-D dusts showed that it was necessary to apply the dust at a rate 1½ ounces of 2,4-D acid per acre higher than the spray to obtain equally good weed control. The cost of the dust was somewhat higher than the cost of the spray. However, in areas where water was scarce and had to be hauled for several miles the extra cost of the dust was frequently more than offset by the cost of hauling water.

Trials with treating flax at various stages of growth with 2,4-D have shown that this crop should be treated as soon as the weed growth is sufficiently heavy to warrant it, provided the flax has already formed three to four leaves. Severe damage was noted from treatments made during the bud and early flowering stages. Flax was less tolerant to 2,4-D treatment than wheat, barley, or oats. This crop was considerably more tolerant to the amine than to the ester formulation.

Very young stands of crested wheat grass and brome grass can be safely treated with 2,4-D at dosages ranging up to one pound of acid per acre. The removal of the weed competition seemed to result in quicker and better stands of these grasses than either mowing the weeds or no treatment of any kind for weed control.

Young stands of alfalfa and sweet clover were very sensitive to 2,4-D even at low dosages. Alfalfa usually recovered to some extent within six weeks after treatment but the young plants of sweet clover usually failed to recover. The use of 2,4-D is not recommended for weed control in sweet clover; with alfalfa only if the weed infestation is extremely serious.

Control of Perennial Weeds

During the past five years, methods for the control of such perennial weeds as Canada thistle, perennial sow thistle, and couch grass by the use of herbicides have been under test.

Canada thistle and perennial sow thistle patches were effectively removed by allowing these weeds to reach the bud stage before treating with 2,4-D at one pound of acid per acre. The patches were then left undisturbed for some six weeks after which they were intensively cultivated until freeze-up. The 2,4-D treatment resulted in about 90 per cent of the roots being killed while the tillage destroyed the survivors.

Effective control of the top growth of these perennial weeds in growing grain crops was obtained by the use of 2,4-D applied when these weeds were four inches tall which is approximately at the time spraying is normally done for the control of annual weeds. Root kills from this treatment were very slight with heavy regrowth beginning to appear by harvest time.

Couch grass control has been attempted with such chemicals as TCA, IPC, MH, and CMU. TCA has given complete or nearly complete kills of couch grass patches if applied at not less than 80 pounds per acre using upwards of 80 gallons per acre of water as a carrier. Treatment was most effective when applied in midsummer or early fall. Tillage given after treatment permitted

the rate of application to be reduced by one-third with equally effective control. Residual effect on cereals and grasses, especially, was noted in the season following treatment. The cost of this chemical limits its use to the control of relatively small patches.

CMU at 40 pounds per acre has completely prevented the growth of couch or other herbage for at least three seasons. The very high cost of this herbicide and its prolonged effect on the soil (the actual length of the period of soil sterility has not yet been determined) limit its use to the control of small patches.

IPC and MH applied in water as a carrier have not been too effective. IPC in an oil carrier has shown some promise.

Control of Persistent Perennial Weeds (Toadflax)

Toadflax has spread at such an alarming rate in parts of west central Saskatchewan that a project in co-operation with the Illustration Stations Division was set up at Marsden, Sask., in 1948. Of the various cultural methods tested, a system of alternate grain and fallow has shown the greatest promise. By this method the toadflax has been reduced to some 5 per cent of its original stand or to the point where it did not interfere with wheat production. The tillage operations were timed so that the toadflax was not permitted to make green growth for more than 5 to 8 days, at any time after the initial spring working. On soils where erosion was a problem, precautions such as dividing the infested area into narrow strips of alternate grain and fallow, the seeding of fall rye in the rotation or seeding down to crested wheat grass after a season of intensive tillage were found to be necessary.

2,4-D has not been found to be satisfactory either when used at light rates to control the top growth or when used at heavy rates on toadflax patches on land not in crop.

Herbicides such as sodium chlorate, CMU, TCA, MH, polybor chlorate and borascu have been tested for the control of small patches of this weed. Sodium chlorate and polybor chlorate at 10 pounds per square rod have given satisfactory control. CMU at 60 pounds per acre has appeared to be the most promising but has not as yet been fully assessed. Each of these chemicals at the rates indicated tend to sterilize the soil for two or more years. This feature coupled with the very high cost definitely limits their use to rather small patches.

The control of toadflax on land classed as submarginal for grain production presents a rather serious problem, but as yet has not come under the scope of the present project.

The Rejuvenation of Old Brome Grass Stands

Brome grass seed production is an enterprise of considerable importance in the area closely surrounding the Experimental Station, Scott. This crop tends to become rootbound with the result that the yields of both seed and hay decline sharply some four years after a new stand has been established. Breaking the sod and reseeding is both costly and time consuming. Hence, various tillage and fertilizer practices, as outlined in Table 8, were investigated as possible methods of rejuvenating old stands and restoring them to high productivity. The entire study was laid down in duplicate so that snow conservation by means of ridging could be carried out on one of the duplicates. Each of the treatments was laid down in the very early spring of 1948 and was not repeated in the subsequent years.

From the data presented in Table 8 it is apparent that tillage was a more effective means of rejuvenating the grass than was the application of fertilizer or manure. Plowing four inches deep was a more rigorous treatment than shallow one-way disking and resulted in a much higher average seed yield over the four-year period of the test. In the season that the plowing was done the brome did not recover sufficiently to produce a crop. This loss of revenue was largely overcome by working down the sod and cropping the land to oats.

As shown in Table 8 snowplowing materially increased the average yield of brome seed in this test. Brome grass has heavy moisture requirements during the months of April and May. These months are normally a period of low rainfall in west central Saskatchewan. Hence, the effect of the additional moisture made available, during this usually dry period, by snowplowing the previous winter, has been decidedly reflected in the seed yields.

TABLE 8.—The Effect of Various Tillage, Fertilizer and Snow Conservation Treatments on the Seed Yield of Old Brome Grass Stands

Treatment	Average yield in lb./acre 1948-1952		
	Snow-plowed	Not snow-plowed	Difference
1. Check—no treatment	92	76	16
2. Amm. phosphate 16–20–0 at 100 lb./acre	96	83	13
3. Amm. sulphate 21–0–0 at 100 lb./acre	93	85	8
4. Amm. sulphate 21–0–0 at 50 lb./acre and one-way disked at shallow depth	137	112	25
5. Manure—12 tons/acre	106	86	20
6. Manure—12 tons/acre—shallow one-way disked	153	113	40
7. Mold board plowed—4 inches deep	184	140	44
8. Shallow one-way disked	131	98	33

Crop Rotations

Crop rotation studies were initiated at Scott, Sask., in 1912. Since that time various grain and fallow and grain, grass, and fallow rotations have been studied. As shown by the yield of crops and the return values per acre given in Table 9, there has been essentially no difference in favor of the straight grain over the mixed grain and grass rotations. Farmers in the area nevertheless follow a short grain rotation almost exclusively.

Rotation C, a three-year rotation of fallow, wheat, wheat as shown in Table 9, has been somewhat more profitable than rotation B, a two-year rotation of fallow and wheat and is far more widely used in western Saskatchewan north of township 33. Although the average wheat yields on stubble are only slightly lower than the average yields on fallow, the stubble crop is more dependent on the precipitation during the growing season and yields tend to fluctuate more widely from year to year. For this reason a fallow, wheat rotation has been adopted on many farms as a form of crop insurance. Furthermore, phosphate fertilizers can be used to better advantage with wheat on fallow than with wheat on stubble and the two-year rotation lends itself very well to the use of trash covers and strip-farming practices in the drier areas for soil drifting control.

TABLE 9.—Average Yields and Return Values per Acre for Various Crops in Rotations

Rotation	Av. yield per acre in bu. or tons 1933-48	Av. profit or loss per acre 1933-48	Av. yield per acre in bu. or tons 1948-53[1]	Av. profit per acre for period 1948-53
		$ cts.		$ cts.
"B" Fallow, wheat				
1. Wheat on plowed fallow	11·8	3 35	16·3	17 18
2. Wheat on cultivated (plowless) fallow	11·5	3 17	16·1	16 75
"C" Fallow, wheat, wheat				
1. Wheat on fallow receiving 30 lb./acre A.P. 11-48-0	14·8	4 59	22·5	24 49
2. Wheat on fallow not fertilized	10·97	2 68	14·5	13 72
3. Wheat on stubble	9·68	1 06	13·0	11 11
"D" fallow, wheat, oats seeded down to sweet clover				
1. Wheat on fallow	12·52	3 17		
2. Oats on wheat stubble	20·1	2 59	Rotations D and J were discontinued and shifted to a new location during 1949 and 1950, hence data are not available for this period.	
3. Sweet-clover hay	0·64	−1 08		
"J" Fallow, wheat, wheat, oats seeded down to a grass legume mixture, hay, hay.				
1. Wheat on fallow	10·65	1 78		
2. Wheat on wheat stubble	9·08	0 78		
3. Oats on wheat stubble	22·90	2 53		
4. Hay	0·71	−1 19		
5. Hay	2·36	−1 76		

[1] Five-year average only because the 1951 crop could not be threshed due to very wet fall weather and early freeze-up.

Rotations containing grass or legumes present a number of serious problems and as a result have not come into wide usage. One of the major problems is the frequent failure of the hay crop, which precludes the keeping of livestock necessary to the successful operation of a mixed-farm rotation. The mixed rotations require year-round work with high labor costs whereas grain production has become highly mechanized with labor requirements only about one-third of those required by livestock production for equal returns. Furthermore, seasonal precipitation is normally much higher in June and July than it is in April and May, which again favors grain rather than hay production. If grasses are to be included in the rotation, they should be left down for a period of at least four years.

Except for some localized areas where erosion has been very severe, there is little evidence to indicate that crop yields are declining under straight grain rotations.

SOILS AND FERTILIZERS

H. UKRAINETZ

Experimental investigations with the aim of improving soil tilth and productivity have been continued during the past five years, and some new projects have been added during this period.

Rates of Phosphate Fertilizer for Wheat

A most important consideration in the use of fertilizer is the rate of application per acre. The effect of rate of phosphate fertilizer on the yield of wheat has been studied in a test in which rates ranging from 15 to 40 pounds per acre have been used. In Table 10 are shown the average yields and yield increases obtained during the past five- and eleven-year periods. The corresponding average net profits per acre for each rate are also given.

The 40-pound rate of ammonium phosphate 11-48-0 gave the highest yield increase and also the highest net profit per acre. The highest yield increases from fertilizer and the greatest responses to the heavier rates were obtained when moisture conditions were favorable. In the very dry years response to fertilizer was smaller and at such times the 20-pound rate of fertilizer was applied with more profit than the 40-pound rate. However, when moisture was in better supply the 40-pound rate of fertilizer gave the highest net returns per acre, in this experiment. In areas where moisture conditions are more favorable the heavier rates of ammonium phosphate 11-48-0 up to 60 pounds per acre are recommended for summerfallow grain crops.

TABLE 10.—Rates of applying phosphate fertilizer for wheat on summerfallow

Rate of ammonium phosphate 11–48–0 per acre	5-yr. av. yield	5-yr. av. increase	11-yr. av. yield	11-yr. av. increase	[1] Profit per acre	
					5-yr. av.	11-yr. av.
lb.	bu./ac.	bu./ac.	bu./ac.	bu./ac.	$ cts.	$ cts.
11–48–0 15	18·0	4·7	17·7	4·6	6 72	6 56
11–48–0 20	17·8	4·5	18·2	5·1	6 14	7 10
11–48–0 25	18·3	5·0	18·1	5·0	6 68	6 68
11–48–0 30	17·3	4·0	17·6	4·5	4 81	5 61
11–48–0 35	18·0	4·7	18·0	4·9	5 67	5 99
11–48–0 40	19·7	6·4	19·8	6·7	8 12	8 60
Check— no fertilizer	13·3	.....	13·1			

[1] Price of wheat taken as $1.60 per bushel in 1952. Price of fertilizer in 1952 was $106 per ton.

Rates of Seeding Wheat with Phosphate Fertilizer

A study was made of the relative effect of phosphate fertilizer on the yields of wheat sown at several rates. The wheat was sown at three, four, five, and six pecks per acre with and without 20 pounds per acre of ammonium phosphate 11-48-0. While the highest increase per acre resulting from fertilizer was from the lowest seeding rate, the highest total yields were obtained from the five- and six-peck rates. Five pecks per acre is the recommended seeding rate for wheat on summerfallow with fertilizer in this area.

Dates of Seeding Wheat with Phosphate Fertilizer

In this test, wheat was sown with and without 20 pounds per acre of ammonium phosphate 11-48-0 on six dates at intervals of one week, commencing as early as possible in the spring. The first seeding was usually made during the third week of April. The largest average increase in yield was obtained from seeding wheat with fertilizer on the earliest date. However, the highest average total yield was obtaind from seeding on the second date, usually during the last week of April or the first week of May. Although several good yields and yield increases resulted from seeding with fertilizer on the last two dates, the average yields were lowest and the wheat was frozen before it could be harvested in four out of the eleven years.

The Response of Different Varieties of Wheat to Phosphate Fertilizer

Marquis, Apex, and Thatcher wheat were tested to compare their response to 20 pounds per acre of ammonium phosphate 11-48-0 applied with the seed. On the basis of the average results for the period in which this test was conducted, the highest yield and the largest increase from fertilizer was obtained with Thatcher. However, the yield increases differ only slightly for the three varieties. The total yields and yield increases were highest for Thatcher and lowest for Marquis.

The Response of Wheat to Phosphate Fertilizers of Different Formulas

In this project six phosphate fertilizers: namely ammonium phosphates 11-48-0, 16-20-0, 2-19-0, and 4-15-0, triple superphosphate 0-43-0 and superphosphate 0-18-0 were tested and compared. Comparisons were on the basis of equal rates, equal phosphate application and equal costs per acre of fertilizer for wheat on summerfallow. The standard of comparison was 20 pounds per acre of ammonium phosphate 11-48-0.

On the basis of equal rate per acre, ammonium phosphate 11-48-0 excelled all the other fertilizers, giving the largest average increase in yield of wheat. On an equal phosphate application basis the highest yield increases were obtained from the two superphosphates, but these were only slightly higher than the yield increase produced by 11-48-0. The smallest responses were obtained from the ammonium phosphates 16-20-0 and 4-15-0. These results serve to emphasize the need of phosphate supplementation for summerfallow crops on the Dark Brown Soils. Cost is perhaps the most important factor governing the use of fertilizers by farmers. Compared on the basis of equal cost of fertilizers per acre, ammonium phosphate 11-48-0 gave the highest yield increases. Ammonium phosphate 11-48-0 is recommended for grain crops on summerfallow. Experiments are now being conducted to study the effect on grain crops of several ratios and rates of nitrogen, phosphate, and potash in fertilizers.

The Effect of Combined Cultural, Fertilizer, and Spraying Treatments for Cereal Grains

Experimental results from past years have shown that the use of certain cultural treatments, fertilizers, and chemical weed killers have significantly increased the yield of grain. In 1951, a project was begun to test the merits of these treatments when used singly, as well as when used in various combinations. The following treatments were included in this test:

1. Check—regular seeding
2. Fertilizer (ammonium phosphate 11-48-0 at 30 pounds per acre)
3. Spray (2,4-D)
4. Delayed seeding (shallow tillage of summerfallow early in spring, seeding ten days later)
5. Post-seeding tillage (shallow rod-weeding one week after seeding)
6. Fertilizer, spray
7. Delayed seeding, fertilizer
8. Fertilizer, post-seeding tillage
9. Delayed seeding, spray
10. Spray, post-seeding tillage
11. Delayed seeding, post-seeding tillage
12. Delayed seeding, fertilizer, spray
13. Fertilizer, spray, post-seeding tillage
14. Delayed seeding, fertilizer, spray, post-seeding tillage.

At present there are insufficient results from this experiment to make any definite conclusions about the treatments. However, some very interesting observations have been made during the three years, 1951, 1952, and 1953, in which the experiment was conducted.

In 1951, a dry season, the highest yields in this test were obtained from the practice of delayed seeding (early shallow cultivation and seeding ten days later). This practice has been found to increase yields of grain crops in the drier seasons and it is discussed in more detail under the heading "Pre-Seeding and Seeding Treatments of Fallow", with resulting yields of crops shown in Tables 5 and 6.

An outstanding treatment with oats in 1951 was the use of 30 pounds per acre of ammonium phosphate 11-48-0, from which substantial yield increases were obtained. Where both delayed seeding and fertilizer were combined into one treatment, the yield increase with oats was doubled, as compared with

the delayed-seeding treatment alone. Substantial increases were obtained with wheat and barley. In the other treatment combinations, the inclusion of either delayed seeding or fertilizer, or both, resulted in yields considerably higher than the check yield. Again in 1953 a fairly dry season, substantial yield increases were obtained when delayed seeding was used with other cropping practices. The results indicated that where susceptible weed growth was abundant in the crop, the proper use of 2,4-D gave profitable yield increases. In 1952, when moisture conditions were highly favorable throughout the growing season, the practice of early shallow tillage of summerfallow and delayed seeding did not significantly increase the yields of any of the crops in this test. Shallow rod-weeding one week after seeding has been a fairly effective method of controlling wild buckwheat.

The Response of Cereal Grains to Liquid Fertilizers

During the past five years a considerable amount of publicity has been given to liquid fertilizers. Experiments were conducted at this Station to study the effectiveness of these liquid fertilizers when used both as seed treatments and foliage sprays on wheat and oats. Results typical of those obtained with the seed treatments are given in Table 11.

TABLE 11.—Response of wheat to Liquid Fertilizer Seed Treatment as compared with usual soil applications of 11-48-0, Dominion Experimental Station, Scott, Sask. 1951

Treatment	Yield	Increase
	Bu./acre	Bu./acre
Check—untreated	27·3	
5–10–5 (1 gal. per 8 bu. seed)	28·3	1·0
3–18–9 (1 gal. per 8 bu seed)	28·4	1·1
Water (1 gal. per 8 bu. seed)	25·6	−1·7
11–48–0 (20 lb. per acre)	33·6	6·3
3–18–9 (1 gal. per 8 bu. seed) 11–48–0 (20 lb. per acre)	32·6	5·3
5–10–5 (1 gal. per 8 bu. seed) 11–48–0 (20 lb. per acre)	32·8	5·5
11–48–0 (30 lb. per acre)	34·1	6·8
3–18–9 (1 gal. per 8 bu. seed) 11–48–0 (30 lb. per acre)	33·5	6·2

A similarly poor response to the liquid fertilizers 5-10-5 and 3-18-9 and the superiority of ammonium phosphate 11-48-0 were observed with oats and barley tests. The small amounts of nutrients supplied in the seed dressings apparently do not significantly influence the yields. On the basis of these results the liquid fertilizers are not recommended for use as seed treatments for cereal grains.

Although several significant increases in the yield of oats were obtained as a result of the use of liquid fertilizer as a foliage spray, the practice was uneconomical because of the high cost of material and the added cost of application.

The Effects of Micro-Nutrient Foliage Dusts on the Yields of Cereal Grains

Various fortified 2,4-D and other micro-nutrient dusts have been tested to determine their effect on growth and yields of cereal grains. On the basis of results obtained to date, foliage applications of the fortified dusts cannot be recommended to farmers in this area.

Chemical Soil Conditioners

Since early in 1952, when synthetic chemical soil conditioners first became available, tests have been conducted on a limited scale to study their effect on the soil and on plant growth. Treatment of the soil with the conditioner generally resulted in increased soil aggregation and prevention of surface crusting. On several soil types, where poor physical structure was often a limiting factor for plant growth, some crops responded to soil treatment. More uniform emergence and more rapid growth of alfalfa was obtained on a treated grey wooded soil. In several experiments the yields and rate of growth of carrots, onions, and radishes were substantially increased as a result of treating a clay loam soil with a commercial soil conditioner at Scott. The yields of several other vegetables and grain crops were not significantly influenced. At the present time the high cost of these chemicals makes their use for general agricultural purposes uneconomical in the area served by this station.

CEREALS

A. G. KUSCH

The period 1948 to 1953 has witnessed a considerable expansion in cereal work at Scott in both the testing and breeding phases, with approximately ten acres taken up with nursery work involving some 30,000 plots.

Yield tests of varieties and hybrids occupy the largest acreage and account for the greatest proportion of the work, but the expansion of the breeding program entails more time and effort each year. The development of a four-row power plot seeder has aided greatly in the research program. (Fig. 4). The primary objective of testing is to obtain reliable information on the suitability of varieties of cereal crops for the area served; while the purpose of the breeding program is to produce varieties suitable for growing under the semi-arid conditions prevalent in the area. The need for regional adaptation of varieties is now generally recognized. As a consequence, emphasis in the breeding program is being placed on the production of varieties primarily adapted to the area served by the Scott Station.

Spring Wheat

The chief characteristic of any variety of wheat which is to be grown in northwestern Saskatchewan must be its ability to produce under prolonged periods of dry weather and hot winds. The varieties recommended at present possess this characteristic to some extent but there is room for improvement. A new variety of wheat, called Lake, which does have the ability to yield well under dry conditions was developed at Scott. Lake was licensed in the spring of 1954, and 1,200 bushels were distributed in small lots to the farmers in the area.

TABLE 12.—Spring Wheat Station Data 1948-53. Scott, Sask.

Variety	Yield bu./ac.	Days to mature	Height inches	Bushel weight
Lake	24·4	107·5	29·0	64·7
Thatcher	22·0	105·7	27·2	64·7
Apex 2177	21·7	107·7	27·8	64·7
Rescue	21·1	107·4	27·3	64·2
Chinook	20·4	105·5	27·1	64·7
Redman	19·6	105·7	27·3	64·4
Saunders	19·1	104·6	26·5	64·5
Lee	16·3	107·4	25·8	64·1

NOTE: All of the above are susceptible to race 15B of stem rust.

Lake is a high yielding, good quality wheat possessing considerable drought tolerance and good resistance to spring frosts. It was developed at the Experimental Station, Scott, Sask., and was licensed, named, and distributed in the spring of 1954. It is resistant to bunt but susceptible to leaf rust and loose smut. It is slightly later in maturity than Thatcher but is taller growing and possesses a larger, brighter kernel. It threshes easily but does not shatter readily.

Thatcher has a wide adaptability and is recommended throughout the whole area. It has short, strong straw, reasonably early maturity, and considerable tolerance to spring frosts. It is resistant to loose smut but susceptible to leaf rust and bunt. The kernels are small, somewhat dull in color, and bleach readily. It has a tendency to show bronzy kernels if swathed too early.

Apex 2177, an improved selection, has taller, weaker straw than Thatcher but equal resistance to shattering. The kernels are larger and have less tendency to bleach. It has moderate resistance to bunt and loose smut and is susceptible to leaf rust. It appears to have a place in a limited area in west central Saskatchewan.

Rescue is the first sawfly-resistant wheat. It was distributed in 1946. The baking quality is not equal to Marquis and for that reason it is not eligible for grades higher than No. 3 Northern. Compared with Thatcher, it has weaker straw of equal length, is slightly later in maturity and tends to shatter somewhat more readily. It is quite susceptible to spring frost damage. It has large, bright kernels that do not bleach readily, and it is susceptible to bunt, loose smut, and leaf rust. It is recommended for growing only where sawfly resistance is needed.

Chinook is the second sawfly-resistant wheat and was licensed in 1952. It is equal in quality to Marquis and is as early maturing as Thatcher. Otherwise it is very similar to Rescue, especially in susceptibility to spring frost. From yield data so far available it appears to be lower yielding than Rescue.

Figure 3: Position of hands indicates short-strawed Nugget durum and long-strawed Stewart durum.

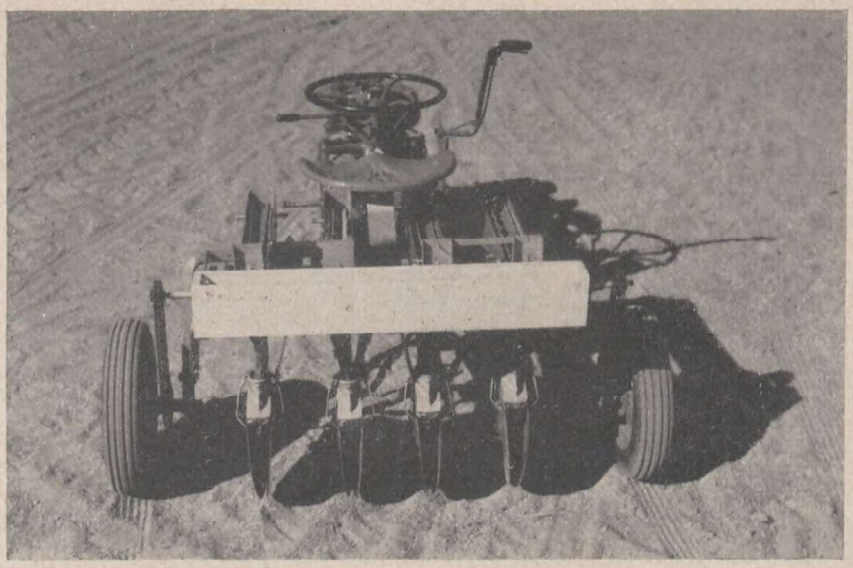

Figure 4: Rear view of four-row power seeder (developed at Scott) used to speed sowing of many thousands of tests in rod rows.

Redman is similar to Thatcher except that it is lower in yield. It does not appear to have quite the drought tolerance necessary for open prairie conditions, but does well where drought is not a problem. It is resistant to bunt, moderately susceptible to loose smut and somewhat susceptible to spring frost damage but better in this respect than Rescue and Chinook.

Saunders is a good quality, early wheat which, it was hoped, would be suitable for growing in northern areas with short frost-free seasons. However, it has not yielded up to expectations in northwestern Saskatchewan and does not seem to possess enough drought tolerance for growing in the plains area. It is similar to Thatcher in disease reactions but is slightly shorter in the straw.

Lee is the only variety at present that is resistant to leaf rust. However, it is susceptible to both bunt and loose smut. It is bearded, is later maturing than Thatcher, has shorter, weaker straw, and is somewhat susceptible to spring frost damage. It has tended to yield poorly and therefore is not recommended.

Durum Wheat

The main varieties of durum wheat have been included in a test with Thatcher, the main common wheat grown in the area. They have not yielded so well as Thatcher and on the whole have matured about a week to ten days later.

TABLE 13.—Durum Wheat Data 1948-53. Scott, Sask.

Variety	Yield in bu./acre	Days to mature	Height inches	Bushel weight
Thatcher	22·1	107·6	27·7	64·2
Stewart	18·1	115·0	34·7	63·2
Pelissier	17·8	117·2	34·0	63·8
Carleton	16·2	116·5	36·0	63·6

Stewart is resistant to stem and leaf rust (susceptible to race 15B) and possesses good macaroni quality. It is earlier maturing than Pelissier and Carleton but too late in most years. On the basis of results, it is the preferred variety where durum is adapted.

Pelissier is a black bearded durum whose macaroni quality makes it ineligible for Grades 1 and 2 CW. It is grown in drier areas because of its supposed drought tolerance, but has not yielded so well as Stewart at Scott. It is late maturing, averaging about ten days later than Thatcher.

Carleton is similar to Stewart except that it possesses stronger straw. It has been the lowest yielding of the durums tested.

Nugget is an early maturing, short-strawed variety of durum which has been tested at Scott for the past two years. (See Fig. 7). It possesses good macaroni quality. In the two years that it has been tested, it has yielded as well as Stewart. It may have a place because of its early maturity.

Oats

Oats are an important crop in the northern half of the area served by this Station, because in that area, the returns per acre from oats are greater than from wheat, hence they are often grown as a cash crop as well as to supply feed for livestock.

Numerous varieties and hybrids of diverse types have been tested and are still being tested to determine their adaptability. However, only five varieties are being recommended as suitable at the present time.

TABLE 14.—Station Data on Oats 1948-53. Scott, Sask.

Variety	Yield in bu./acre	Days to mature	Height inches	Bushel weight
Exeter	51·8	99·6	31·6	39·9
Ajax	51·0	95·0	31·3	38·8
Fortune	50·7	98·4	30·9	39·0
Victory	50·4	100·7	32·0	39·8
Larain	34·2	92·1	31·4	40·8
Valor	33·0	92·0	30·2	39·2

Exeter is a late maturing, large seeded, heavy hulled variety that has yielded well at Scott. It is tall growing but has slightly weak straw. It is resistant to most, but not all, races of stem rust and is susceptible to leaf rust and smuts.

Ajax is a high yielding, early maturing oat. It is shorter growing than Exeter, but has stronger straw. Its disease reactions are similar to Exeter except that it has slightly more resistance to the smuts. Its main fault is its slim unattractive kernel, but this is compensated for by a lower percentage hull.

Fortune is resistant to smut. In other respects it is similar to Exeter except that it has a slightly smaller kernel of lighter hull.

Victory is a late, plump seeded, heavy hulled variety that is susceptible to the rusts and smuts. It has slightly weak straw of good length. It yields well in the northern areas where rust is not a factor.

Eagle is similar to Exeter in maturity but has stronger straw. It is susceptible to the smuts and to both stem and leaf rust. For the past three years, when it has been tested at Scott, it has given slightly higher yields than Exeter.

Larain and Valor have large, attractive kernels and are early maturing. They are both low in yield. They have resistance to lodging, but will shatter readily when ripe. Valor is more resistant to the smuts than Larain. Their main use would be as a cleaning crop for wild oats because of their early maturity.

Barley

Barley acreage in this area is increasing and farmers are beginning to be variety conscious. The advent of smooth-awned barleys that are capable of being handled with the combine-harvester has helped to increase the popularity of barley production in northwestern Saskatchewan. This is an area of feed barleys, although malting barleys can be grown successfully in the northern portion of the area. The chief need at present is for varieties that are resistant to the smuts, especially loose smut, which has increased alarmingly during the past five years. At present there are no varieties available that are entirely resistant to loose smut, but breeding programs are under way to produce such new varieties. This Station is also endeavoring to incorporate spring frost resistance in its barley hybrids.

TABLE 15.—Barley Station Data 1948-53

Variety	Yield in bu./acre	Days to mature	Height inches	Bushel weight	1000 kernel weight
Velvon 11	35·2	98·4	28·7	50·5	40·5
Vantage	33·9	100·1	27·9	51·7	38·0
Harlan	33·0	97·0	25·7	50·0	43·0
Titan	27·7	94·9	26·2	51·8	34·1
Montcalm	27·4	102·0	29·9	51·1	37·7

NOTE.—All the above are six rowed, smooth awned barleys.

Velvon 11 is a medium late, medium strong-strawed feed barley. It is susceptible to both leaf and stem rust. It is resistant to many races of both loose and covered smut but susceptible to those prevalent at the present time. It is suitable for straight combining but the awns are often difficult to remove from the kernel in threshing.

Vantage is a medium late, strong-strawed feed barley. It is resistant to stem rust but susceptible to leaf rust and both loose and covered smut. It is suitable for combining and has the same characteristic of adhering awns as Velvon 11.

Husky is a new medium late, strong-strawed feed barley that has yielded well in the four years it has been tested. It is resistant to stem rust, moderately susceptible to leaf rust, susceptible to loose smut, but moderately resistant to covered smut.

Harlan is a medium early, medium short, strong-strawed feed barley. It is susceptible to both leaf and stem rust and loose smut but moderately resistant to covered smut. It is suitable for combining and also has the adhering awn fault.

Montcalm is a blue seeded, medium weak-strawed variety of high malting quality. It is susceptible to stem and leaf rust and loose smut but moderately resistant to covered smut. It shatters and loses heads readily when ripe and is therefore not suitable for straight combining. It is eligible for Grade 1C.W. six row. It yields poorly on the open plains but does well in the more northerly areas, where moisture conditions are better.

Titan is an early maturing, short, strong-strawed feed barley. It is susceptible to leaf and stem rust and moderately resistant to covered smut. It is susceptible to the races of loose smut prevalent at the present time. It has not yielded well at Scott.

Hannchen is a rough awned, late maturing, weak strawed variety. It is susceptible to rusts and smuts. In some areas it produces fairly good yields of a high quality milling barley, which is in good demand at the present. At Scott, it has not yielded so well as the standard six rowed, smooth awned varieties.

Warrior is a hooded (awnless) feed barley that may be useful where early maturity is required. It has not yielded so well as the standard smooth awned six rowed varieties.

Flax

Flax is not now grown to any great extent in the area served by the Station. Even on the heavier clays to the south, flax acreage has declined to the point where the crop is now a minor one. Flax acreage has increased somewhat in the northern areas with the introduction of earlier maturing varieties. In these areas, where distances to market are usually great, flax has the advantage of less transportation cost per unit dollar return. However, in spite of this, the northern acreage of flax is still small.

In the six years under review, the flax crop was frozen too badly to harvest in the two years, 1950 and 1951. Therefore four years results only are available. Yields were poor in two of these years, 1948 and 1949, very good in 1952, and just average in 1953.

TABLE 16.—Yield and Maturity Data on Flax Varieties, Scott, Sask.

	Royal	Dakota	Rocket	Victory	Redwing	Redwood	Marine
Yield in Bushels per Acre							
1948	6·2	7·3	6·2	4·5	4·4		
1949	7·3	5·8	5·6	5·9	5·4		
1952	22·3	24·4	26·9	24·7	16·5	23·7	18·1
1953	12·5	11·2	11·6	13·5	8·6	12·0	8·7
1948-53	12·1	12·2	12·6	12·2	8·7		
Days to Mature							
1948	110·8	110·3	109·5	109·6	105·3		
1949	91·2	90·2	90·2	89·8	86·5		
1952	125·6	122·8	123·8	125·0	117·2	126·4	123·4
1953	112·8	111·0	113·7	112·0	109·7	114·0	110·7
1948-53	110·1	108·6	109·3	109·3	104·7		

Royal is a late maturing variety which in the last few years has been attacked heavily by new races of flax rust. For this reason, it is not recommended.

Dakota is a medium late maturing variety that has yielded well. It has the ability to ripen uniformly so that it can be readily straight combined. However, this variety has also been attacked by new races of rust and so is being taken off the recommended list.

Rocket is a late maturing variety. It has large brown seeds and has yielded well. It is resistant to the prevailing races of flax rust.

Victory is a late maturing variety resistant to the prevailing races of rust. It has white blossoms and large golden colored seeds. It has yielded as well as Rocket.

Redwing is an early maturing, rust susceptible variety. It has small brown seeds. It is lower yielding than the late maturing varieties at Scott but is grown in northern areas because of its earliness.

Redwood is a new variety of flax, highly resistant to wilt and rust. It is late maturing and, in tests so far, appears to be a good yielder. As yet, this Station has tested it for only two years.

Marine is an early maturing flax, resistant to rust, which was intended to replace Redwing in northern areas. As yet, it has been tested for only two years, so it is too soon to say much about its performance.

Seed Production

Seed production in cereals has been limited mainly to the propagation of Foundation stocks of new varieties for which the Station is responsible. At present Foundation stocks of Velvon 11 barley and Lake wheat are being produced. Small amounts of surplus Foundation stocks are increased in limited quantities, sufficient to let farmers in the area have a few bushels. This enables them to get started with pure seed of new varieties. This Station does not produce registered seed in bulk as this is left to members of the Canadian Seed Growers Association.

FORAGE CROPS

D. E. Forsberg

Forage work in the early years was mostly confined to comparative testing of varieties and strains of adapted grasses and legumes for their value as hay and pasture in the area served. No breeding program has been initiated but a nursery has been maintained to determine the value of various introductions as forage for the area. Commencing in 1951, an enlarged program was started including an introduction nursery, pasture studies, fertilizer tests for hay and seed production and tests to determine the suitability of various forage crops for upland and alkali areas.

Perennial Grasses

Three grasses, tested in recent years, appear sufficiently adapted to the district served to warrant farm use. These grasses are intermediate wheat grass, tall wheat grass, and Russian wild rye. They likely will not achieve the importance of brome grass or crested wheat grass but will be useful for special purposes or on particular soils.

Intermediate wheat grass is a fairly long-lived grass although a slight amount of winter-killing has been noted. It is more or less creeping rooted depending on moisture conditions, and forms a tough sod. It can be seeded

without trouble through the ordinary grain drill. The hay tends to be coarse, consequently haying should be done in early June before flowering commences. This grass appears suited to conditions that favor brome grass, and is less competitive than crested wheat grass under dry conditions.

Tall wheat grass is a bunch grass with tall, solid stems and is not noted for leafy growth. Tests indicate that tall wheat grass has alkali or salinity tolerance well above brome grass or crested wheat grass and slightly above slender wheat grass. The grass should not be tried, however, when conditions are too alkaline or saline for growth of native grasses or weeds that grow under these conditions. Tall wheat grass is a special-purpose grass and should not be used where better quality forage crops such as brome grass or crested wheat grass do well. Its use should be restricted to wet saline soils. It is recommended that it be seeded on small acreages until its forage value and adaptation are determined for a particular area.

Russian wild rye has a bunch habit of growth and produces a large number of basal leaves and relatively few stems. Russian wild rye is not recommended for hay as yields are generally lower than those of brome grass or crested wheat grass. It seems particularly suitable for pasture because of heavy basal leaf production and ability to produce more than most grasses during the dry summer months.

Alfalfa

On the open upland prairie, alfalfa has failed to produce a satisfactory yield, but in the northern areas it produces very well. It is grown extensively there, not only as a hay and pasture crop, but also as a seed producing crop.

TABLE 17.—Hay Yields of Alfalfa Varieties in Tons Per Acre, at the Experimental Station, Scott, Sask.

Variety	1949	1951	1953	Av. 3 years
Ladak	0·39	0·40	0·46	0·42
Viking	0·31	0·37	0·37	0·35
Ranger	0·29	0·32	0·39	0·33
Ferax	0·27	0·25	0·40	0·30
Canauto	0·26	0·28	.....	0·27[1]
Rhizoma	0·25	0·31	0·47	0·34
Grimm	0·24	0·39	0·42	0·35
Buffalo	0·17	0·18	.....	0·18[1]

[1] 2-year average.

Grimm has been the standard variety for many years but recently the variety Ladak has been replacing it. The reason for this is that it has been higher in hay yield than Grimm and equal to it in seed yield. Also Grimm is susceptible to alfalfa wilt, which is becoming quite serious in reducing alfalfa stands. The variety Ladak is not entirely resistant to this disease but has some resistance. The variety Ranger is highly resistant to wilt. However, Ranger cannot be recommended in the Prairie Provinces because it is not sufficiently winter hardy, and use of it would result in lowered forage yield and in severe losses in stand in seasons when winter-killing is severe.

The variety Rhizoma was selected for the creeping-rooted or spreading habit. However, under dry conditions, this characteristic does not develop.

Canauto, Ferax, and Buffalo are not sufficiently winter hardy for this district.

Based on tests in the past years it is recommended that Ladak alfalfa be used for both hay and seed production.

Mixtures of Grasses and Alfalfa

Wherever possible it is advisable to grow a grass legume mixture for hay and pasture purposes. Because of its perennial habit, alfalfa is the legume most generally used although sweet clover may be used under certain conditions. Bloating of animals is one of the big hazards in pasturing alfalfa. This is considerably reduced when alfalfa occupies a small portion of the mixture. Two pounds of alfalfa per acre in a mixture is sufficient to give fair stands of alfafa and prevent bloating. With the addition of alfalfa, the yield of hay is increased, and the quality is improved. Five pounds of brome grass, three pounds of crested wheat grass, and two pounds of alfalfa have been found most satisfactory for field conditions on the station.

Annual Hay Crops

A number of cereal grain crops as well as millet and peas have been tested for their suitability as a hay crop.

TABLE 18.—Hay Yields of Annual Crops in Tons per Acre

Crop	1952	1953	12-year av. 1935-1946
Velvon barley	1·70	0·84	
Titan barley	1·59	0·78	
Siberian Millet	.....	.....	0·85
Warrior barley	1·82	0·88	0·97
Oats	.....	.....	0·96
Ajax oats	1·97	0·80	
Exeter oats	1·89	0·80	
Valor oats	1·50	0·76	
Oats and peas	.....	.....	0·96
Thatcher wheat	1·34	0·69	0·82
Stewart Durum wheat	1·44	0·72	
Prolific spring rye	2·13	0·76	
McKay peas	.....	.....	0·85

The results of a number of years of testing show that oats are the most dependable crop to grow for annual hay. Ajax oats, although earlier than Exeter, was the top yielder in 1952 with the exception of spring rye. Although spring rye has in some years outyielded oats, it is not so desirable as a hay crop because of its high fiber content and unpalatability. Long-vined varieties of peas such as McKay and Arthur, did not produce consistently good yields by themselves but increased the quality of the hay when seeded with oats. The seasons in this area have been too short and dry for the successful growing of Millet. Smooth-awned varieties of barley have proved superior to the rough-awned varieties for hay. Common spring wheat and Durum wheat have not been so satisfactory for annual hay as oats.

TABLE 19.—1952-53 Brome Grass Seed yields in Pounds per Acre after the Application of Commercial Fertilizers

Treatment	Soil Type						
	Asquith very fine sandy loam	Oxbow loam	Weyburn loam	Weyburn loam	Scott loam	Asquith very fine sandy loam	Weyburn loam
60 lb. ammonium nitrate applied in Sept.	408	222	358	123	381	194	137
120 lb. ammonium nitrate applied in Sept.	475	261	385	173	397	225	127
240 lb. ammonium nitrate applied in Sept.	618	403	601	235	455	301	184
200 lb. ammonium sulphate applied in Sept.	387	251	422	192	430	179	169
262 lb. ammonium phosphate applied in Sept.	445	361	477	148	492	290	162
120 lb. ammonium nitrate applied in Oct.						177	140
200 lb. ammonium sulphate applied in Oct.						169	171
262 lb. ammonium phosphate applied in Oct.						178	215
120 lb. ammonium nitrate applied in April	283	222	326	105	325	131	132
200 lb. ammonium sulphate applied in April	307	204	208	113	336	98	80
262 lb. ammonium phosphate applied in April	254	146	312	142	259	123	112
Check no fertilizer	163	146	175	103	369	51	77

Seed Yield Response to Fertilizer

Brome grass seed yields on various soil types and at different locations showed varying responses to applications of fertilizer.

From the data in Table 19 it is evident that fall applications of fertilizer give the best response in seed yields. The use of 120 pounds per acre of ammonium nitrate appears to be the most economical rate to use. The use of fertilizers on old brome grass stands is important in keeping these stands productive for a longer period of time. Normally a stand of brome grass will become sodbound within five years and rejuvenation is necessary. The use of fertilizers will help to overcome this condition provided moisture conditions are adequate.

ANIMAL HUSBANDRY

E. Van Nice

Horses

During the six-year period covered by this report the horses at the Scott station have been gradually reduced from sixteen purebred Percherons at December 31, 1947, to four mares at the end of 1953.

These mares are used for work horses only and there is seldom more than one two-horse team used at a time. There are no projects under way with horses at this station.

Beef Cattle

For the purpose of providing cattle for experimental work a purebred Shorthorn herd has been maintained. During the six years covered by this report the numbers of cattle on hand have varied from 50 to 75 head.

It is not intended that breeding stock be produced for sale, but surplus animals have been sold as available.

Preliminary Feeding Trial.—During the winter of 1949-50 a preliminary feeding trial was conducted in which three steers and one heifer were each fed in separate box stalls by use of individual self-feeders. The test continued for 171 days. (Dec. 15-June 4). The average daily gain was 1·92 pounds with a meal requirement of 727 pounds per hundred pounds gain.

The meal mixture in the self-feeders was made up as follows:

	To 700 lb.	*700 lb. to finish*
Oat chop	55 lb.	25 lb.
Barley chop	35 lb.	70 lb.
Oilcake meal	10 lb.	5 lb.

Salt mineral mixture was kept before the animals in separate boxes.

The high meal requirement may have been partly due to age of animals and over finish. The age at the start varied from 259 days to 478 days with the average of the four head at 364 days.

Another factor may have been the low grade roughage consisting of crested wheat grass which was too far advanced when harvested. It was kept before the animals but the average quantity consumed per day was only 2·7 lb. each, or about one fifth as much hay as meal by weight for the full period.

For individual feeding the use of self-feeders makes necessary a separate box stall for each animal which is rather wasteful of space, but otherwise the self-feeder has several advantages over hand feeding.

The preliminary tests in cattle feeding were continued during the winters of 1950-51 and 1951-52 using weanling, steer calves at six months of age at the start of the test. Each calf was hand fed twice daily from the age of six months until a weight of 900 pounds was reached. Tables 20, 21, and 22 show some details of results.

One bull calf was included in 1951-52 for a comparison.

TABLE 20.—Calf Feeding Test, 1950-51

Tattoo of animal	1E	3E	8E	11E	14E	17E	19E	21E
Birth weights	71	72	76	86	78	73	72	81
Age in days at 900 pounds	457	447	416	375	515	401	451	366
Av. daily gains, weaning to 900 lb.	1·7	1·7	1·8	2·0	1·9	2·2	2·1	2·5
Days feeding 500 to 900 lb.	234	234	206	190	283	174	189	165
Meal per 100 lb. gain (weaning to 900)	552	559	530	466	515	485	531	433
Dressing percentage based on starved wt. cold carcass wt.	60	61	60	60	60	61	61	62

TABLE 21.—1951-52

Tattoo of animal	4F	9F	10F	15F	17F	25F	Bull
Birth weights	92	83	69	71	69	68	77
Age in days at 900 pounds	406	406	476	461	443	452	340
Av. daily gains weaning to 900 lb.	1·9	2·0	1·8	1·7	1·7	2·0	2·3
Days feeding 500 to 900 lb.	214	214	250	246	241	216	167
Meal per 100 lb. gain (weaning to 900)	563	530	565	564	546	407	396
Dressing percentage based on starved wt. cold carcass wt.	55	56	60	60	58	58	

TABLE 22.—Average Data

—	1950-51 8 steers	1951-52 6 steers
Average birth weight	76	75
Age in days at 900 lb	429	440
Average daily gains, weaning to 900 lb	2·0	1·0
Days feeding 500 to 900 lb	209	230
Meal per 100 lb. gain (weaning to 900)	509	539
Dressing percentage	61	58

As shown by the low meal requirement per hundred pounds gain, there were four steers out of fourteen that required less than 500 pounds of meal per hundred pounds gain. These, in order of lowest requirement, were 25F in Table 21 and 21E, 11E and 17E in Table 20.

There seems to be no relationship between birth weight and economy of gains in these groups.

The average data in Table 22 show mostly differences in favour of the 1950-51 group. The bull made a more economical gain than any of the steers, which is usual when bulls and steers are compared.

From the 1953 calf crop five bulls and six steers were fed from six months of age to a weight of 900 lb.

The average daily gain was 2·36 pounds for bulls and 1·92 for steers while the meal requirement was 399 pounds for bulls and 549 for steers per 100 lb. gain. The average number of days feeding was 188 for bulls and 246 for steers.

The health program for cattle at this Station has for many years included systematic vaccination against blackleg before the calves reach six months of age, the annual testing of the entire herd for tuberculosis and brucellosis (Bang's disease), and beginning with the 1951 calf crop, calfhood vaccination of females has also been a routine policy conducted in co-operation with the Health of Animals Division. The herd has been accredited for T.B. since 1928, and has been certified free of Bang's disease since annual tests were initiated in 1938.

Swine

During the six-year period covered by this report the breeding herd has included approximately twenty brood sows with necessary boars.

The major part of the breeding plan had to do with Advanced Registry work in co-operation with the Advanced Registry Board at Ottawa.

Strains of Yorkshires which have given a high score in the slaughter tests were compared with low scoring strains as to inheritance of carcass quality. The tests included the progeny of both high and low boars, each tested with high and low families of females. It was demonstrated that consistent selection for the best in high testing strains gave excellent slaughter scores.

In one case, five sows from high testing litters and six sows from low testing litters were all bred to a boar from a high testing strain. The average slaughter score was 81 in both groups but when the same sows were bred to a boar from a low testing group the average score was 63, the same for each group of sows. Hence, it seemed that the boars were more prepotent than the sows. The pigs sired by the low boar lost points in the slaughter test chiefly in length, back-fat, and loin area.

Tests have previously shown boars to dominate the sows in prepotency.

In 1952 fifteen litters were tested on Advanced Registry, nine from a high sire and high dams and six from a low sire and low dams. The average slaughter score for the nine high litters was 75 and for the six low litters 68, a difference of only seven points. As for feed economy the average live weight gain during the A.R. feeding test showed the feed requirement per hundred pounds gain to be 355 lb. for the high scoring litters and 400 lb. for the low scoring litters.

This higher feed requirement for the low testing litters is in keeping with many other similar tests, and is contrary to the frequent claim of some feeders that the shorter, low scoring pigs make quicker and more economical gains.

Mildewd Oats for Swine Feeding.—During the winter of 1951-52 many farmers were compelled to leave large quantities of oats in the field in piles on the ground because of a lack of storage space. When brought to market in the next spring and summer, many samples were graded "rejected for mildew".

To test the value of these mildewd oats for feed, three lots of ten pigs each were used. The usual oat-barley chop mixture was used with adequate protein supplements to all lots. The mildewd oats were used in two lots and good oats in the third lot.

The feed requirement per hundred pounds gain was 52 pounds greater in the mildewd oat lots, which worked out to a greater cost per hundred pounds gain by $1.33 where the mildewd oats were used. Both samples weighed 36 lb. per bushel and were calculated at the same market value for this test.

The test indicated that commercial feeder pigs fed from 50 to 200 pounds would cost $2.00 per head more when mildewd oats were used and calculated at the same market value.

A sample of the mildewd oats was submitted to the Botany and Plant Pathology Division at Ottawa for investigation and ten different surface molds were found. No signs of digestive troubles were observed and the palatability seemed to be satisfactory when the oats were mixed with barley and hog concentrate.

A New Breed of Swine.—As a supplement to a Lacombe Station project in testing a new breed of swine, temporarily called "Black and White", 30 Yorkshire sows were bred at Scott to farrow in May 1953. Half of these sows were bred to the Black and White boars and half to pure Yorkshires. The object of this supplement was to test the combining ability of the new breed with Yorkshires.

Each litter was tested on Advanced Registration for economy of gains and carcass quality to furnish a definite comparison of the crossbred pigs and pure Yorkshires.

Nineteen litters were available for A.R. test consisting of eight pure Yorkshire and eleven Black and White. Table 23 shows some details of results obtained.

This single test shows the crossbreds to be excellent in combining ability and indicates the need of further tests for confirmation.

TABLE 23.—Yorkshires vs. Crossbreds

Number of pigs	Age in days at 200 lb.	Carcass grades			Feed/ 100 lb. gain	Carcass score	Loin area sq. in.
		%A	%B	%C			
32 Yorks	181·4	75	25	0	357·5	80	3·98
44 Crossbreds	157·4	79·5	18·1	2·4	345·6	82·1	4·10

Poultry

Poultry work at this station was discontinued at the end of 1952.

During the five-year period ended December 31, 1952, the breeding flock of Barred Rocks and New Hampshires varied from 300 to 400 birds.

Pedigree breeding for egg production was carried with Barred Rocks only. The highest individual egg production record in the flock remained at 313 eggs for several years, but in 1948 it was raised to 319 eggs averaging 57·2 grams (2·02 oz.) per egg. In comparing the relative merits of the Station strain of Barred Rocks with New Hampshires, the former was consistently higher in egg production, but upon investigation it was revealed that the strain of New Hampshires used was not a superior strain of the breed for egg production as was the strain of Barred Rock used. As for body size, the New Hampshire chicks averaged approximately one tenth of a pound per bird heavier at November 1 which is not a significant difference.

The New Hampshire had the advantage of fast feathering which seemed to count more for appearance and comfort than for actual profits to the owner. The summary of all differences found between the two breeds and the crosses, made both ways, failed to justify any recommendation of one above the other.

A special strain of Barred Rocks developed at the Experimental Station at Harrow, Ont., was outstanding for egg production over a ten-year period. It was decided that the strain should be tested under prairie conditions and the stations at Scott and Indian Head were selected for the purpose. After all data were summarized at Ottawa from three Stations, a very definite and significant difference was found between Stations, indicating the importance of the effect of environment upon the production obtainable from an adequate sample of the same strain of birds. This additional information emphasizes that production levels obtained at the poultry plants of various breeders cannot be considered to be due only to the breeders' different strains, but are very likely to be largely due to the environment of the breeders' poultry plants.

In 1952, a temporary project was conducted in methods of raising pullets on range. Lot one received full feed for the entire period, lot two received three quarters as much as lot one and lot three was not fed mash or grain on Wednesday or Sunday of each week.

In addition to the feed they had access to brome and alfalfa range in every case. The lots one and two getting full feed and three quarters feed gave practically the same results. The gain in body weight averaged 2·9 pounds in lot one and two, but in lot three the average gain was 2·6 pounds. The average age when first egg was laid was 199 days for full feed, 196 days for three quarters feed and 210 days for lot three which was not fed mash or grain on Wednesday and Sunday. This single test would indicate that the most economical plan would be approximately three quarters of full feed during the full growing period in preference to either of the other plans tested.

Turkeys

Turkeys were grown under total confinement on a slatted floor during the period 1948 to 1952.

The average farm turkey running at large is subject to death from storms, cars on the road, and predatory animals such as coyotes, dogs, and skunks. The total confinement plan wipes out nearly every hazard including diseases and internal parasites carried in the soil. The average quantity of feed for the five-

year period was 100·8 lb. per bird per season from hatching to market weight. The cost of feed varies from year to year, but in 1952 commercial feeds were purchased at an average price of 5·3 cents per pound including the starter.

In 1952, an equal number of poults was raised under total confinement and another lot in a small yard where green feed was grown. The same quantity of feed and whole grain was used. The gains and feed eaten were practically the same for both lots as the pasture did not increase the economy of gains in this case.

HORTICULTURE

D. H. Dabbs

A great variety of vegetables, flowers, and fruit can be regularly produced in a well-sheltered prairie garden. However, to be assured of any measure of success the prairie gardener must grow proved varieties and be willing to give the plants the care and attention they deserve.

Methods of Starting Onions

Yields of onions obtained from seed planted directly into the garden are often disappointing in this area. It is also recognized that onions grown from "Dutch Sets" often do not keep well in storage. In 1947, a project was begun at this Station with the object of comparing different methods of starting onions and to compare their performance under conditions of natural rainfall and irrigation.

The three varieties, Ailsa Craig, Yellow Globe Danvers, and Sweet Spanish were used in this study. The performance of seed planted outdoors in early spring was compared with that of seedlings started in late winter in the greenhouse and with seedlings started at this same time in the open garden on Vancouver Island and shipped for transplanting.

TABLE 24.—Average yields of onions (pounds per thirty-foot row) for 1948-53 at Scott, Sask.

Treatment		Ailsa Craig	Sweet Spanish	Yellow Globe Danvers	Average
Transplants					
Scott Greenhouse	Dry	26·9	29·9	13·5	23·4
(February planting)	Irrigated	29·6	33·8	13·8	25·7
Transplants					
Vancouver Island	Dry	19·3	17·6	10·0	15·6
(February planting)	Irrigated	29·7	21·9	11·2	20·9
Transplants					
Scott Greenhouse	Dry	30·8	38·9	21·3	30·3
(March planting)	Irrigated	33·7	43·1	19·1	32·0
Transplants					
Vancouver Island	Dry	30·4	35·7	18·8	28·3
(March planting)	Irrigated	33·1	42·3	20·4	32·0
Seedlings					
Sown outside	Dry	20·2	25·1	14·5	19·9
early in May	Irrigated	19·8	25·4	13·2	19·5

This experiment has shown that much higher yields of onions can generally be obtained by starting the plants early in the season and transplanting into the garden the latter part of May. Seedlings started in March have generally outyielded those that were started in February. A striking feature of this experiment has been the excellent results and high yields obtained from the field-grown transplants produced on Vancouver Island, B.C. The mild winter and early spring in southern Vancouver Island make it possible to sow seed in the open in plenty of time to grow young transplants and ship them for spring planting in prairie gardens. In general, onions have not shown a very great response to irrigation.

It is recommended that the home gardener in this area either start his own seedlings in the house in early March, or procure them from some other source in order to assure himself a much higher yield of sizeable onions than can be obtained by seeding directly outdoors.

Potatoes

The average Canadian eats more potatoes than he does any other vegetable. This crop is generally so easily grown that it is taken for granted. However, there is an urgent need in this area for a potato variety that will combine high yielding ability under relatively dry conditions, with scab resistance, shallow eyes, and high quality. Present standard varieties which yield well under local conditions are lacking in one or more of the other salient features mentioned.

During the period 1948-53 some three hundred potato varieties and seedlings were tested at Scott, Sask., in the National Potato Variety and Seedling Tests. By far the greatest number of these have been discarded because in one or more important features they lacked superiority to established varieties. Some promising seedlings and new varieties are now being tested, but none can be introduced until further rigorous testing has been carried out. At present, the two recommended varieties for this district are Irish Cobbler and Warba.

Vegetable Varieties

The passing years see many new vegetable varieties come and go. Some of these new varieties possess special merit for this district, while others do not. An important part of the vegetable work at this Station consists of a comparison of the performance of these new varieties with accepted standard sorts. From time to time the list of recommended varieties has been altered, until the present list differs very markedly from one of 20 or 25 years ago. A recommended list of vegetable varieties is contained in Table 25, based on tests conducted at Scott.

TABLE 25. Recommended List of Vegetables for the West Central Area of Saskatchewan

Perennials	
Asparagus	Martha Washington, Mary Washington
Rhubarb	MacDonald, Ruby, Sunrise
Annuals	
Beans	Snap-Bush type: Wax-podded: Round Pod Kidney Wax, Pencil Pod Black Wax Green-podded: Stringless Green Pod, Tender Green, Top Crop Pole type: Blue Lake (black seeded) Broad: Broad Windsor
Beets	Detroit Dark Red
Broccoli	Italian Green Sprouting
Cabbage	Early: Copenhagen Market, Golden Acre Late: Danish Ballhead, Penn State
Carrots	Chantenay, Imperator, Scarlet Nantes

Cauliflower	Early Dwarf Erfurt, Early Snowball
Celery	Cornell 19, Golden Plume, Utah
Citron	Red Seeded
Corn	Sweet-Early: Dorinny, Golden Gem, Early Golden Sweet Mid-season to late: Marcross, Spancross, Sugar Prince
Cucumber	Table: Improved Long Green, Straight Eight Pickling: Chicago Pickling, Mincu
Lettuce	Leaf: Early Curled Simpson, Grand Rapids Head: Great Lakes, New York No. 12, Imperial No. 44
Muskmelon	Far North, Hale's Best
Onion	For bulbs: Ailsa Chraig, Sweet Spanish, Yellow Globe Danvers For pickling: White Barletta, White Portugal
Parsnips	Guernsey, Hollow Crown, Short Thick
Peas	Early: American Wonder, Little Marvel, Thomas Laxton Medium: Lincoln, Selkirk Late: Stratagem, Telephone
Peppers	Harris Earliest, King of the North
Potato	Irish Cobbler, Warba
Pumpkin	Early Cheyenne, Sugar
Radish	Cherry Belle, French Breakfast, Saxa, White Icicle
Spinach	Long Standing Bloomsdale, King of Denmark, New Zealand
Squash	Buttercup, Green Hubbard, Golden Hubbard
Swiss Chard	Lucullus
Tomato	Staking: Abel, Earliana Non-staking: Early Chatham, Improved Farthest North, Redskin
Turnip	Summer: Early Snowball, Purple Top Milan Swede: Laurentian
Vegetable Marrow	Long White Bush
Watermelon	Early Canada, Sweet Sensation, Sweet Siberian

Advancing Maturity of Heat-Loving Vegetables

Preliminary results have indicated that much can be done to hasten the maturity of such heat-loving plants as peppers and cucumbers by using individual plant protectors in the spring and early summer. Hotkaps, or the larger Hotents, should be placed over the plant at transplanting time, or in the case of cucumbers the protector should be placed over the hill at the time the seeds

Figure 5: *Left* normal production of peppers from five plants, *Right*: Yield from same number of plants grown under Super Hotents. (1952).

are planted. When the plant has completely filled the protector a crossed slit should be cut in the top to allow the plant to emerge slowly. Earlier maturity and higher yields can be obtained in most seasons from such protected plants.

Irrigation and the Farm Garden

During the years 1948-53 further information was obtained on the effects of irrigation water from a dugout upon various vegetable crops. Full directions for irrigating a vegetable garden from a dugout by the furrow method were published in the 1937-47 Progress Report of this Station.

A motor-driven force pump is necessary to move the water from the dugout to the garden. If the garden area is level the rows can be very effectively irrigated by means of the furrow method. However, if the area is not level this method will not be satisfactory. Since the water will be under pressure from the pump, either sprinklers, perforated aluminum pipe or porous canvas hose may be used effectively to irrigate garden produce that is not growing on level land. Table 26 gives results of the response of some vegetable crops to irrigation water applied by the furrow method at the appropriate time, or times, during the growing season.

TABLE 26.—A comparison of yields of vegetables irrigated and not irrigated. Yields except corn in pounds per 30-foot row

Vegetable	Av. yield for entire period			No. of years tested
	Check	Irrigated	% Increase	
Beans	10·8	17·3	60·2	14
Beets	34·3	43·2	25·9	14
Cabbage	45·6	74·1	62·5	13
Carrots	39·2	51·9	32·4	14
Cauliflower	25·6	30·1	17·6	9
Celery	45·1	81·7	81·2	12
Corn (ears)	58·8	89·7	52·6	14
Cucumbers	20·5	39·6	93·2	14
Onions	18·4	21·3	15·8	15
Parsnips	21·6	39·1	81·0	15
Peas	12·4	19·8	59·7	13
Potatoes	54·4	78·6	44·5	14
Tomatoes—ripe	17·6	25·3	43·6	12
—green	26·3	38·0	44·5	1
Turnips (Swede)	89·6	135·8	51·6	13

These figures show varying degrees of response to irrigation. Onions, and possibly cauliflower, have not responded sufficiently to make irrigation economically feasible. In contrast, the average yield of cucumbers has been nearly doubled by irrigation. However, these results have been obtained in a well-sheltered garden area which has been manured each fall. Even greater yield increases due to irrigation could logically be expected from the average prairie garden which generally lacks adequate shelter.

The increase in yield does not present the entire picture, particularly in very dry years. The quality of such crops as celery, beans, and cauliflower, that have been grown with an ample supply of moisture constantly available, is immeasurably superior to those that have been forced to subsist on a shortage of life-giving water.

Whenever feasible, a farm dugout designed to catch and hold spring runoff water should be constructed. The increased crops of more nutritious vegetables which this water makes possible will repay the cost of construction many times over in the years that lie ahead.

Water from the dugout can also be used to advantage on flowers, fruits, ornamental shrubs and trees. It is disheartening to have a beautiful border of flowers or a promising crop of raspberries or strawberries wither in the heat of the July sun. In most years strawberries and raspberries show a marked response to irrigation. In fact, a first-rate crop can seldom be obtained from these two fruits in this district unless they do receive supplemental water. Also, there are few summers in which water cannot be used to advantage on the flower border. If the soil is dry in late fall, evergreens, in particular, will stand a better chance of surviving the winter in peak form if the soil about their roots is thoroughly soaked immediately prior to freeze-up.

The Home Fruit Garden

A variety experiment with bush fruits has been conducted at this station for many years. Data for the past five years indicate that generally there is no substitute for hardiness. One possible exception to this is Madawaska raspberry. This variety, if not completely winter-killed, may throw out vigorous laterals from the lower buds and produce a satisfactory home crop of large, dark-red, high quality berries. However, it has been found advisable to tip-cover all raspberry varieties in late fall. The canes are thus entirely below the snow-line in most winters. Strawberries should always be mulched in late fall.

The relative hardiness of the variety has been directly reflected in the average yield of currants and gooseberries for the past five years. Hardiness of the variety is probably more important when considering tree fruits than it is with the small fruits. There is not much point in having a fruit tree that will bear fruit only once every five or six years. Table 27 contains a suggested list of tree fruits and small fruits for the area served by this Station.

TABLE 27. Suggested List of Fruit Varieties for West-Central Saskatchewan

Apples	Heyer No. 12, Rescue
Crabapples	Adam, Columbia, Dolgo, Osman, Robin
Plums	Assiniboine, Bounty, Norther
Sandcherry × plum hybrids	Heaver, Opata
Currants	White: White Grape Red: Prince Albert, Red Perfection, Red Stephens, Red Lake Black: Kerry, Magnus, Climax
Gooseberries	Pembina Pride (Thoreson), Pixwell, Abundance
Raspberries	Chief, Starlight, Trent, Rideau, Madawaska
Strawberries	June bearing: Dunlop, Dakota Everbearing: Gem, Pixie

Flowers

For many years the performance of tulips, narcissus, and hyacinths was studied at this station. It was found that tulips were the only bulbs satisfactory for outside planting. The most satisfactory time of planting was in the latter half of September. Early October planting usually resulted in less vigorous foliage, shorter stems and smaller flowers. Planting should be done in well-prepared soil and the bulbs placed at depths of four to six inches, depending on their size.

A fine display of late-winter bloom can be obtained in the home if a few bulbs of tulips, narcissus, and hyacinths are forced. Bulbs should be planted in the autumn in pots, in a good friable soil that will not bake. Water thoroughly at planting time and then transfer to a cool moist cellar. Allow the pots to remain there for at least six weeks, until a vigorous root system has developed. Bring gradually to full light and heat for forcing. Do not allow the soil in the pots to become dry at any time.

The flower border at the Experimental Station, Scott, is a never-ending source of attraction to visitors from early summer until killing frosts arrive in the fall. It has been repeatedly demonstrated that growing beautiful annuals and perennials in this district is not difficult, provided adequate shelter is available. The Station flower border is protected from the north and west by a seven-foot hedge of white spruce. An excellent snow cover is thus trapped and maintained during the winter. This provides protection for the herbaceous perennials and also serves to thoroughly soak the soil in the spring. The young developing plants are also protected from the cold northwest winds of spring and early summer, and later in the growing season the tall growing plants are protected from much of the wind damage which inevitably occurs in an exposed area.

2,4-D Damage to Gardens

A great deal of unnecessary damage to prairie gardens is caused each year by careless use of 2,4-D. Probably most people are aware of the fact that tomatoes, in particular, are very susceptible to damage from this herbicide. Even a very slight drift of 2,4-D fumes from a nearby grain field will cause great distortion of the newly developing leaves. While the plants generally recover, they will have received a severe setback which is very serious in this part of the country where the growing season is so very short. Other garden plants very susceptible to 2,4-D damage are beans, peppers, vine crops when plants are small, elm trees, and Manitoba maples.

Much of this damage could be avoided if fields were sprayed or dusted when the wind was blowing away from the garden. The use of low volatile forms of the herbicide is another means of lessening the possible damage.

ILLUSTRATION STATIONS

C. H. KEYS and W. B. TOWILL

During the period covered by this report, 1948-1953 inclusive, several changes took place with respect to Illustration Stations supervised from the Experimental Station, Scott, Sask. In 1949, the Illustration Station at North Makwa was closed due to the retirement of the operator and was replaced by a Substation on Gray Wooded soil near Loon Lake. Illustration Stations were instituted at Marsden in 1949, Dorintosh in 1950, and Turtleford in 1951. In 1953 a total of four District Experiment Substations, five Illustration Stations and one Substation on Gray Wooded soil were functioning and an inspection for an Illustration Station was made in the Pierceland district.

Climatic Conditions

Records of precipitation have been maintained by the Illustration and Substation operators. For this report continuous six-year records were available for six stations while shorter periods were available for three other stations.

The figures in Table 28 include the annual precipitation for the past six years, where available, as well as the average precipitation for this period and the eighteen-year average precipitation. Table 29 contains the precipitation records for the months of April, May, June, and July for the past six years as well as the average precipitation for these months for the same period and the eighteen-year average.

TABLE 28.—Precipitation Records on Illustration Stations and Substations

Station	Annual Precipitation in Inches						Av. Precipitation	
	1948	1949	1950	1951	1952	1953	1948–53	1936–53
Conquest	11·18	12·70	15·25	18·10	11·61	15·13	14·00	15·13[2]
Kindersley	7·26	12·74	13·27	14·67	7·09	11·90	11·16	10·82
Loverna	9·23	10·30	13·72	16·30	11·42	12·48	12·24	12·55
Rosetown	13·32	11·48	14·55	17·16	11·38	12·23	13·35	13·00
Glaslyn	10·20	13·41	13·41	13·98	14·60	16·24	13·64	13·47[2]
Glenbush	8·81	13·89	11·31	12·00	15·94	11·98	12·33	11·72
Loon Lake	.....	15·37	14·10	16·39	16·38	17·87	16·02[1]	
Turtleford	.....	.....	.....	10·10	14·73	15·79	13·54[1]	
Dorintosh	.....	.....	.....	.....	18·45	14·32	16·38[1]	

[1] Averages for the years shown in the table.
[2] Eight-year averages—1946–1953.

TABLE 29.—Precipitation Records on Illustration Stations and Substations for Months of April, May, June and July

Station	Seasonal precipitation in inches						Average seasonal precipitation	
	1948	1949	1950	1951	1952	1953	1948–53	1936–53
Conquest	4·34	6·66	6·50	8·16	6·60	8·10	6·73	6·38[2]
Kindersley	3·32	8·24	7·90	5·97	4·63	7·89	6·34	6·01
Loverna	4·32	7·20	6·30	6·94	7·02	7·63	6·62	6·12
Rosetown	5·42	5·60	7·98	6·93	7·18	6·67	6·63	6·72
Glaslyn	5·62	5·98	7·40	7·44	9·68	7·93	7·34	7·07[2]
Glenbush	4·18	8·01	5·94	6·65	10·79	6·38	6·99	6·24
Loon Lake	.....	6·97	6·12	9·05	9·73	9·11	8·20[1]	
Turtleford	.....	.....	.....	5·60	9·25	4·93	6·59[1]	
Dorintosh	.....	.....	.....	.....	9·14	6·41	7·78[1]	

[1] Averages for the years shown in the table.
[2] Eight-year averages—1946–1953.

Fertility Studies

Fertilizer trials have been conducted on the various soil types represented by the stations to determine the crop response to applications of chemical fertilizers. On the heavy textured soils of the Brown and Dark Brown soils zones, as represented at Loverna, Kindersley, and Rosetown, applications of ammonium phosphate and phosphate have not given increases in yield that, when subjected to statistical analysis, proved to be significant. On the lighter textured soils of the Dark Brown soil zone, represented at Conquest, yield responses to applications of ammonium phosphate fertilizers have been significant.

On Degraded Black and Gray Wooded soils, plant nutrient deficiency studies have indicated that phosphate carrying fertilizers have resulted in substantial yield increases and advanced maturity. At Loon Lake, the addition of nitrogen and sulphur have also given increases in the yield of grain. Yield results obtained at Loon Lake, Dorintosh, and Glaslyn (all located on Gray Wooded soils) are given in Table 30.

TABLE 30.—Effect of Fertilizers on the Yield of Wheat on Fallow on the Gray Wooded Soils

Treatment	Rate per acre	Station		
		Loon Lake 1949-53, 5 yr.	Dorintosh 1950-53	Glaslyn 1949-53
	lb.	bu.	4 yr.	5 yr.
Check (no fertilizer)	.....	23·5	27·2	28·3
Ammonium nitrate	50	23·4	28·1	29·6
Sulphur	20	28·5	29·4	27·3
Ammonium sulphate	80	31·1	28·1	27·2
Triple super phosphate	45	25·2	32·1	32·2
A.P. 11-48-0 + A. nitrate	45+35	29·3	32·5	32·7
A.P. 16-20-0 + Sulphur	100+ 6	30·2	31·6	33·0
A.P. 16-20-0 + Pot. sulp.	100+40	29·2	30·4	32·6

In those areas of northwestern Saskatchewan favoring the production of legumes or legume grass mixtures, the results from sulphur carrying fertilizers have been pronounced. On highly podzolized Gray Wooded soils, as represented by the Loon Lake station, applications of gypsum at 50 pounds per acre have resulted in increases of up to two tons of legume hay per acre.

Soils low in natural fertility may be improved through the use of a legume crop and manure in the rotation. Comparison of returns of wheat after hay and fallow, and wheat after oats and fallow, are shown in Table 31 with the fertility treatments that were applied to the grain in both rotations.

TABLE 31.—The Effect of Fertilizers on the Yield of Wheat on Fallow in a Grain Rotation and in One Containing a Legume on Gray Soil at Glaslyn

Average yield per acre

Treatment	Rate per acre	Wheat on fallow following	
		Oats 1949-53 5 years	Legume hay 1949-53 5 years
		bu.	bu.
Manure	15 tons	29·8	38·6
Check (no fertilizer)	.....	25·8	30·7
Ammonium nitrate	50 lb.	24·4	29·2
Sulphur	20 lb.	27·5	31·2
Check (no fertilizer)	.....	24·9	27·4
Ammonium sulphate	80 lb.	22·8	28·3
Triple superphosphate	45 lb.	28·1	35·1
Check (no fertilizer)	.....	24·0	29·6
A.P. 11-48-0+Amm. nitrate	45 + 30 lb.	30·2	35·3
A.P. 16-20-0 + Sulphur	100 + 6 lb.	27·9	28·2
Check (no fertilizer)	.....	23·3	27·7
A.P. 16-20-0 + Pot. sulphate	100 + 40 lb.	32·2	32·9

Rotations

Two or more rotations have been under study at each station. On the heavy textured soils of the Brown and Dark Brown soil zones, alternate fallow and wheat has formed the main farm rotation; with fallow, coarse grain, and fallow, wheat, wheat on a restricted scale. Recently a mixed-farming rotation has been introduced in these areas. The effect of continued cropping is being studied in light soil or droughty areas. In the Black, Degraded Black and Gray Wooded soil areas various mixed-farming rotations have been studied. These rotations range from three to six years in length and include a legume or grass-legume mixture. Table 32 gives the available yield figures for the short grain rotations well adapted to the prairie regions.

TABLE 32.—Grain Rotations

Average yield per acre.

Type of rotation and kind of crop	Station			
	Conquest	Loverna	Kindersley	Rosetown
	bu.	bu.	bu.	bu.
A Continuous cropping wheat	21·5 (8)	16·5 (5)		
B Alternate fallow and wheat—wheat	26·4 (8)	15·3 (26)	17·8 (30)	21·5 (16)
C Alternate fallow and coarse grain—oats	.....	.....	32·8 (9)	34·3 (9)
D Three-year rotation fallow wheat, wheat.				
Wheat on fallow	38·5 (3)	15·4 (8)	18·2 (8)	21·8 (8)
Wheat on stubble	22·0 (3)	10·8 (8)	10·1 (8)	15·6 (8)

( ) Figures in brackets indicate the number of years included in the average.

Figures in Table 33 will indicate how a legume included in the rotation has increased the yield of grain. The five-year (1949-1953) average yield at Glaslyn for wheat after fallow and oats was 26·7 bushels per acre while wheat following legume hay and fallow averaged 31·2 bushels per acre for the same period which was a 4·5 bushel increase in favor of the fallow, wheat and hay rotation.

Weed Control

Weed control studies have been confined to the troublesome kinds in the local areas. At the Illustration Station located near Marsden, Sask., control of toadflax has been the main project. Since this project is a joint one with

Figure 6: Application of CMU to heavy stands of toadflax in 1951 has resulted in complete control for three years at least.

the Field Husbandry Division the details of the work done at Marsden may be found in that section of the report. Control of green foxtail in flax with TCA (trichloroacetic acid) at the Conquest Substation has shown some promise. Satisfactory top growth control of sow thistle and Canada thistle with relatively low rates (six to eight ounces of acid) of 2,4-D and MCP have been obtained in the crop (oats) at Glaslyn.

Cost of Producing Farm Crops

As the predominant cash crop has been wheat, cost of production calculations have been confined to this crop.

Since the costs of the field operations vary from year to year, Table 33 below has been drawn up to show the five-year average cost of operations for all stations. The highest and lowest cost of each operation has also been noted.

TABLE 33.—Average Cost per Acre of Field Operations for Nine Illustration Stations and Substations, 1948-1953

Operation	Average cost	Highest cost	Lowest cost
	$ cts.	$ cts.	$ cts.
Harrow	0 26	0 68	0 11
Plow	1 27	3 47	0 64
Disk	0 59	1 09	0 21
One-way	0 76	1 08	0 40
Cultivate	0 55	1 26	0 31
Seed (one-way)	0 72	0 93	0 62
Seed (drill)	0 48	0 66	0 34
Rod weed	0 42	1 07	0 21
Binder	1 31	2 25	0 64
Swath	0 42	0 75	0 25
Combine	1 41	3 13	0 70
Mow	0 68	1 70	0 30
Rake	0 41	0 79	0 13
Thresh	2 55	3 29	1 04
Spray	0 69	1 00	0 50

In addition to the cost of field operations, items such as seed, hail insurance, use of land and taxes, use of buildings, general farm expense, labor, hauling expenses and managerial charge all go to make up the cost of producing a crop. Table 34 gives the cost of fallowing in 1952 and average cost, while Table 35 gives the cost of producing wheat on fallow.

TABLE 34.—Fallowing Costs on Illustration Stations and Substations per Acre in 1952

	Conquest	Kindersley	Loverna	Rosetown	Glaslyn	Glenbush	Dorintosh	Loon Lake	Turtleford	Average
	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.
Use of land and taxes	0 85	2 38	0 33	1 90	0 65	0 77	1 25	1 04	0 92	1 12
Use of machinery	0 55	0 64	1 32	0 72	2 58	1 50	2 36	1 91	1 11	1 41
Oil, gas and grease	0 61	0 58	0 21	0 43	1 25	0 83	1 04	0 80	0 59	0 69
Man labor	0 41	0 51	0 42	0 34	1 89	1 47	1 65	1 60	0 70	1 00
General farm expense	0 17	0 34	0 21	0 27	0 43	0 56	0 56	0 29	0 78	0 40
Managerial charges	0 64	1 56	0 20	1 15	0 26	0 52	0 69	0 50	0 49	0 67
Total cost	3 12	6 01	2 73	4 81	7 08	5 65	7 55	6 14	4 59	5 30
Number of years	7	9	9	9	7	7	2	4	2	
Average cost	4 35	4 87	3 31	4 92	5 57	4 70	10 50	7 18	4 67	

TABLE 35.—Cost per Acre of Producing Wheat on Fallow on Illustration Stations and Substations, 1952

—	Conquest	Kindersley	Loverna	Rosetown	Glaslyn	Glenbush	Dorintosh	Loon Lake	Turtleford
	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.
Use of land, buildings and taxes	1 00	2 53	0 52	2 06	0 85	0 88	2 02	1 22	1 05
Cost of fallow and interest	2 08	6 16	1 89	5 09	2 72	2 95	2 94	4 61	3 34
Cost of seed and interest	2 30	2 30	2 55	2 30	2 30	2 30	2 30	2 30	2 30
Hail insurance									
Machinery Use									
Preparation and seeding	1 04	1 09	1 42	1 42	2 92	1 66	3 18	1 87	1 50
Combine harvesting	1 75	1 42	1 54	2 47	4 12	.....	.....	.....	1 95
Binding and threshing	.....	.....	.....	.....	.....	4 98	6 39	5 18	.....
General equipment	0 52	0 08	0 46	0 13	0 54	0 14	0 11	0 14	0 12
Hauling	0 32	0 30	0 25	0 38	0 30	0 37	0 33	1 75	0 32
Miscellaneous Costs									
Labor, man and horse									
Interest or net cost	0 11	0 09	0 11	0 13	0 27	0 21	0 30	0 27	0 13
General farm expense	0 17	0 34	0 21	0 27	0 43	0 56	0 56	0 29	0 78
Managerial charge	0 64	1 56	0 20	1 15	0 26	0 52	0 69	0 50	0 49
Total cost per acre	9 93	15 87	9 15	15 40	14 71	14 51	24 82	18 13	11 98

Study of Farm Business

The success of a farm business has depended largely upon such factors as soil management, crop rotations, secondary enterprises and the personal factor. To determine the relative productivity of the various farm enterprises in terms of money income, operators have been required to give rather detailed reports on revenue and expenditure and an annual inventory outlining their assets and liabilities.

Since the bulk of farm revenue has been derived from field crops (Table 36), the productivity of the land has been of prime importance. The stations in the great plains area, namely: Kindersley, Loverna, Conquest, and Rosetown, have an average area of 1,140 acres of land, 880 acres of which are under cultivation. On the northern stations, on the other hand, the total land occupied per station is 627 acres while the cultivated land comprises 317 acres.

Wheat has been the main crop on the southern substations and last year occupied 50 per cent of the cultivated acreage. There was approximately 5 per cent in oats, the same in barley, less than 3 per cent in forage crops and the balance, some 37 per cent, in summerfallow. On the northern stations, wheat occupied 26 per cent of the total cultivated acreage, oats 23 per cent, barley 18 and forage crops 17 per cent. The balance of 16 per cent was in summerfallow.

The records show that 47 per cent of the farm capital was invested in land and buildings during the year 1952. Livestock comprised 16 per cent of the capitalization while machinery and equipment occupies 37 per cent of the total capital.

This picture is somewhat different from five years ago in that there has been a large increase in machinery and livestock investment, while the investment in land and buildings has risen only slightly.

Table 37 gives the capital investment, investment per acre and gross receipts per acre for each station in 1952.

TABLE 36.—Percentage contributions of various farm enterprises to gross revenue, 1952

Cattle and dairy products	19·3%
Field crops	59·7%
Hogs	6·9%
Poultry	1·4%
Machinery and buildings	3·0%
Miscellaneous	5·7%
Farm produce consumed in household	4·0%

Field Days on Illustration Stations and Substations

During the past five years a total of thirty-eight field days have been held on Illustration Stations and Substations with an average attendance of fifty-eight people per meeting.

TABLE 37.—Capital Investment, Investment per acre of crop land and Gross Revenue per acre of crop land for all Illustration Stations and Substations, 1952

Station	Land and buildings		Livestock		Machinery and equipment		Total Capital	Investment per acre of crop land	Gross receipts per acre of crop land
	Amount	Percentage of total	Amount	Percentage of total	Amount	Percentage of total			
	$ cts.		$ cts.		$ cts.		$ cts.		
Conquest	32,043 73	56·4	6,720 00	11·8	18,090 37	31·8	56,854 10	45·63	21·02
Kindersley	17,343 17	67·8	350 00	1·4	7,890 61	30·8	25,583 78	61·50	15·76
Loverna	9,780 68	27·9	3,487 00	9·9	21,761 61	62·2	35,029 29	28·52	16·94
Rosetown	28,298 70	62·3	2,587 50	5·7	14,565 30	32·0	45,451 50	72·38	23·23
Glaslyn	5,698 00	37·8	4,258 75	28·3	5,110 00	33·9	15,066 75	83·70	20·13
Glenbush	16,024 20	50·1	8,085 00	26·8	7,260 12	23·1	31,369 32	71·69	10·86
Dorintosh	10,860 30	57·7	2,398 40	12·8	5,537 41	29·5	18,796 11	143·48	45·77
Loon Lake	2,435 13	25·8	2,078 00	22·0	4,933 33	52·2	9,446 46	45·64	20·79
Turtleford	17,520 82	36·9	11,805 00	24·8	18,172 54	38·3	47,498 36	69·44	28·54
Total	140,004 73	422·7	41,769 65	143·5	103,321 29	333·8	285,095 67	631·98	203·04
Average	15,556 08	46·97	4,641 07	15·94	11,480 14	37·09	31,677 30	70·22	22·56

APPENDIX

Abbreviated List of Active Projects

Field Husbandry

Meteorological Records
Rotation Experiments
Tractor Operating Costs
Soil Fertility Experiments
Tillage and Cropping Practises
Soil Drifting Studies
Weed Control Experiments
Irrigation (consumptive use of water)

Cereals

Variety Tests (wheat, oats, barley, and flax)
Plant Breeding (improved varieties for dry areas)
Seed Production (foundation seed of certain varieties)

Forage Crops

Grass and Legumes for Hay and Pasture
Fertilizers for Brome Grass (hay and seed)
Alkali Tolerance of Grasses, Legumes, and Herbs
Forage Adaptation Nursery

Animal Husbandry

Beef Cattle (studies in feeding of calves)
Swine Breeding (certain crosses compared with the Yorkshire)

Horticulture

Variety Experiments (vegetables, fruit, flowers, trees, and shrubs)
Onions (starting methods and maggot control)
Irrigation studies (vegetables and fruit)
Tomato Breeding (improved set of fruit with earlier maturity)
Hastening Maturity of Heat-Loving Vegetables

Illustration Stations

Meteorological Records
Rotation Experiments
Soil Fertility Studies
Tillage Practises
Crop Variety Testing (cereal, flax, forage, potatoes)
Farm Management (production costs and farm business studies)
Field Days

6M—19892—6:55