CANADA
DEPARTMENT OF AGRICULTURE
EXPERIMENTAL FARMS SERVICE

DOMINION EXPERIMENTAL FARM

SWIFT CURRENT

SASK.

G. N. DENIKE, B.S.A., SUPERINTENDENT

PROGRESS REPORT
1948-1954

TURKEYS ON RANGE, EXPERIMENTAL FARM,
SWIFT CURRENT, SASK.

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INTRODUCTION

The Dominion Experimental Farm, Swift Current, Sask., has conducted research and experimental work for 33 years, to discover the solutions to, and methods of overcoming, the problems of agricultural production in the "short grass" or Light Brown soil zone of the prairie region. Over the years investigations have included drought, weeds, soil erosion, and all the other problems associated with low rainfall and low yields, as well as the problems connected with better than normal yields, the diversification of land use, and the tremendous evolution of mechanization.

The change-over from the original policy where each Experimental Farm attempted to cover every phase of production in its area to the present policy of placing major emphasis upon a few regional phases, and minor emphasis on the remainder, has taken place in recent years. The major divisions of work at Swift Current, with coverage of the whole prairie region, are Agricultural Engineering, Pasture Investigations, Turkey Nutrition, and Range Sheep Improvement. Those divisions having special significance to major work in the Light Brown soil zone are Field Husbandry, Substations, Forage Crops, Cereal Crops, and Horticulture. This report gives an outline of the more important findings in all of these fields as a result of 33 years of active work.

Irrigation has become a major interest in most of the Light Brown soil zone during the past 20 years and special investigations have been undertaken by all divisions. Their findings are mentioned herein.

This Progress Report is designed to give the reader a brief survey of the diversified research work being undertaken at this Experimental Farm, and to bring up to date the progress made in experimental work since the publication of the last report in 1948. Special bulletins are available for distribution on most research undertakings and these are designed to give the detailed results as projects reach a point where conclusions may be indicated.

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FIELD HUSBANDRY

Meteorological Observations

Meteorological data have been recorded at the Experimental Farm since its inception in 1922. The monthly precipitation records for this Farm are presented in Table 1, a summary of meteorological data in Table 2, and a summary of the rainfall records at the Substations in southwestern Saskatchewan in Table 3.

An analysis of the records shows that there is considerable variation in precipitation from month to month and year to year. The highest annual rainfall recorded at this Farm is 20·01 inches in 1927 and the lowest 9·17 inches in 1937, with an average over a 33-year period of 13·90 inches. Precipitation records at the Substations, Table 3, show that there is considerable variation in the average annual rainfall from one district to another. Fox Valley with an average rainfall of 10·11 inches is the lowest and Carmichael with 15·98 inches is the highest.

Table 1.—Precipitation Records

DOMINION EXPERIMENTAL FARM, SWIFT CURRENT, 1922–1954 (33 YEARS)

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1922	0·81	0·32	0·16	0·68	3·43	4·48	1·22	2·28	0·25	0·28	0·53	0·45	14·89
1923	0·80	1·05	1·20	0·64	2·00	7·01	3·87	1·41	0·02	0·39	1·16	0·45	20·00
1924	1·05	0·55	0·53	0·16	2·73	2·51	2·06	2·32	0·68	3·16	0·55	0·57	16·87
1925	0·15	0·14	0·83	2·18	0·91	1·30	1·54	1·68	1·99	0·65	0·06	0·14	11·57
1926	1·25	0·25	0·26	0·12	2·64	1·83	2·23	3·20	0·97	0·49	0·35	0·17	13·76
1927	0·13	1·05	1·39	1·19	5·50	1·20	2·83	2·82	1·61	1·21	0·72	0·36	20·01
1928	0·27	0·11	0·37	0·44	0·52	4·76	2·17	0·32	0·15	0·55	0·00	0·44	10·10
1929	1·72	0·22	0·29	0·64	1·81	2·59	1·30	0·44	1·33	0·29	0·62	1·19	12·44
1930	0·25	0·07	0·13	1·44	0·39	3·77	0·71	1·33	2·41	0·55	0·21	0·31	11·57
1931	0·00	0·05	0·48	0·35	0·68	1·69	1·11	1·79	2·01	0·12	0·76	0·90	9·94
1932	0·95	0·35	0·44	1·13	0·76	2·31	4·79	3·44	0·21	0·50	0·30	0·13	15·31
1933	0·13	0·18	0·10	0·89	2·00	2·20	0·59	3·92	1·63	0·46	0·31	0·83	13·24
1934	0·19	0·03	0·12	0·07	0·40	4·67	1·18	0·43	1·55	0·20	0·08	0·25	9·17
1935	1·48	0·33	0·81	1·14	1·01	3·43	2·94	1·46	0·04	0·64	0·56	0·78	14·62
1936	1·00	0·45	1·13	0·34	0·96	2·09	0·56	2·01	0·35	0·59	0·15	0·27	9·90
1937	0·74	0·25	0·07	0·27	0·88	0·63	1·11	0·97	0·70	0·62	0·45	0·55	7·24
1938	0·99	1·68	1·60	0·50	1·72	1·88	0·84	1·73	2·51	0·66	0·54	0·55	15·20
1939	0·77	0·37	0·90	0·62	3·30	5·93	1·89	0·25	0·28	0·81	0·06	0·45	15·63
1940	0·39	0·77	0·34	1·36	0·82	2·75	1·54	0·18	1·51	0·67	0·57	0·35	11·25
1941	0·51	0·20	0·61	0·40	0·89	1·98	2·20	2·39	0·88	0·05	0·92	0·60	11·63
1942	0·25	0·63	0·43	2·23	0·73	6·59	1·85	2·64	1·73	1·06	0·48	0·51	19·13
1943	1·01	0·38	0·49	0·14	1·76	1·54	1·02	1·11	1·03	2·07	0·39	0·12	11·06
1944	0·10	0·72	0·64	0·18	4·44	2·04	4·42	1·38	0·63	0·77	1·07	0·05	16·44
1945	0·66	0·80	0·22	1·48	0·52	1·23	0·31	2·52	2·52	0·60	0·60	0·68	12·14
1946	0·55	0·65	0·21	0·71	0·41	2·20	2·28	3·06	1·33	0·73	1·60	0·63	14·36
1947	0·20	0·41	0·43	0·98	0·99	2·72	0·41	1·80	1·66	0·36	1·19	0·54	11·69
1948	0·48	1·10	0·62	2·12	0·74	1·52	2·85	0·82	0·09	0·04	0·64	1·23	12·25
1949	0·55	0·20	0·45	0·22	1·14	1·76	1·91	0·92	0·69	1·47	0·33	0·94	10·58
1950	1·74	0·31	0·71	1·09	0·98	2·92	3·62	1·92	0·78	0·83	0·70	0·74	16·34
1951	0·99	2·03	1·41	1·26	0·70	3·43	1·04	3·16	2·73	1·08	0·52	0·71	19·06
1952	1·69	0·40	1·04	0·03	2·10	4·08	2·40	1·98	1·22	0·19	0·85	0·07	16·05
1953	0·93	0·95	1·50	1·96	2·35	3·77	0·52	0·51	2·06	0·28	0·15	0·65	15·63
1954	0·79	0·27	0·83	0·93	3·37	3·51	3·55	2·77	2·74	0·41	0·43	0·11	19·71
Av.	0·71	0·52	0·63	0·85	1·62	2·92	1·91	1·79	1·22	0·69	0·54	0·51	13·90

Table 2.—Summary of Meteorological Records

DOMINION EXPERIMENTAL FARM, SWIFT CURRENT, SASK. 1922–1954 (33 YEARS)

Month	Precipitation in inches	Evaporation in inches	Temperature Degrees F.		
			High	Low	Mean
January	0·71	—	58	−47	7·6
February	0·52	—	60	−55	13·0
March	0·63	—	69	−33	23·4
April	0·85	—	92	−21	39·9
May	1·62	5·37	97	8	51·6
June	2·92	5·64	103	27	58·6
July	1·91	7·28	103	35	66·0
August	1·79	6·25	100	26	62·8
September	1·22	4·06	97	9	52·8
October	0·69	—	90	−15	41·9
November	0·54	—	71	−26	25·9
December	0·51	—	70	−40	14·2
Annual	13·90	28·60	—	—	38·1

Table 3.—Precipitation Records

SUBSTATIONS, SOUTHWESTERN SASKATCHEWAN

Station	Number of years	Number of Years Seasonal Rainfall					*Average seasonal rainfall	Average annual rainfall
		Under 3 inches	3 to 5 inches	5 to 7 inches	7 to 9 inches	Over 9 inches		
Bracken	19	3	5	5	2	4	6·19	13·18
Carmichael	19	0	3	6	6	4	7·05	15·98
Fox Valley	27	7	13	5	2	0	4·39	10·11(19)
Gravelbourg	19	1	2	7	6	3	6·68	13·88
Kincaid	19	1	4	4	6	4	6·86	14·20
Limerick	19	0	5	1	9	4	6·90	14·68
Mortlach	15	0	2	5	6	2	6·97	14·53(15)
Riverhurst	29	2	11	9	5	2	5·22	10·22(14)
Shackleton	16	3	1	6	4	2	5·89	13·38(15)
Shaunavon	33	2	8	13	7	3	6·07	12·85(19)
Swift Current	33	2	10	8	6	7	6·44	13·90
Tugaske	34	2	7	12	5	8	7·00	15·14(19)
Valjean	19	1	3	11	2	2	5·97	13·35

* Seasonal Rainfall—Total rainfall during May, June, and July.

( ) Figures in brackets indicate number of years records.

Evaporation from an open water surface at Swift Current for the five months, May to September inclusive, averages 28·60 inches or approximately three times the precipitation for the same period.

July is the hottest month with the greatest number of hours of sunshine, followed by August and then June. Highest average mileage of wind is recorded for May, closely followed by April and then March. This indicates these three months are most critical for soil drifting.

Table 4 shows the latest spring frosts and earliest fall frosts, 32°F. or lower, for the past 32 years. The shortest frost-free period was in 1950 with only 72 days, while the longest was in 1938 with 152 days without frost; the average frost-free period being 107 days. The latest killing frost in spring, 28°F. or lower, occurred on June 3, 1935, while the earliest killing frost in the fall occurred on August 18, 1950. The average period between killing frosts was 129 days.

Records have been kept since 1938 of date of freeze-up. These show that the earliest freeze-up occurred on October 18, 1945, while the latest was on December 19, 1939.

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Table 4.—Frost Records

DOMINION EXPERIMENTAL FARM, SWIFT CURRENT, SASK.

1923–1954 (32 YEARS)

Frost 32°F. or lower, Killing frost 28°F. or lower

Year	Last frost in spring		First frost in fall		Number of frost-free days	Last killing frost in spring		First killing frost in fall		Number of days above 28°F.	Date of freeze-up
	Date	Temp.	Date	Temp.		Date	Temp.	Date	Temp.		
		°F.		°F.			°F.		°F.		
1923	May 17	22	Sept. 9	31	115	May 17	22	Sept. 11	28	117	—
1924	June 4	31	Sept. 12	29	100	May 22	23	Sept. 24	24	125	—
1925	May 15	25	Sept. 20	31	128	May 15	25	Sept. 29	28	137	—
1926	May 31	31	Sept. 11	28	103	May 1	24	Sept. 11	28	133	—
1927	May 17	31	Aug. 7	29	82	May 8	26	Sept. 19	22	134	—
1928	June 8	32	Aug. 22	26	75	May 9	28	Aug. 22	26	105	—
1929	June 3	32	Sept. 3	31	92	May 18	26	Sept. 6	25	111	—
1930	May 26	31	Aug. 31	28	97	May 22	25	Aug. 31	28	101	—
1931	May 21	31	Sept. 16	32	118	May 18	28	Oct. 7	23	142	—
1932	May 27	27	Sept. 15	30	111	May 27	27	Oct. 3	22	129	—
1933	June 10	31	Sept. 24	28	106	May 9	28	Sept. 24	28	138	—
1934	May 22	32	Aug. 22	32	92	April 25	23	Aug. 23	28	120	—
1935	June 3	28	Aug. 25	30	83	June 3	28	Sept. 25	28	114	—
1936	June 3	29	Sept. 13	28	102	June 1	27	Sept. 13	28	104	—
1937	June 5	31	Aug. 28	31	84	May 19	28	Sept. 30	28	134	—
1938	May 14	31	Oct. 13	27	152	May 7	27	Oct. 13	27	159	Nov. 5
1939	May 11	26	Sept. 6	32	118	May 11	26	Sept. 27	27	139	Dec. 19
1940	May 13	29	Oct. 5	26	145	April 15	21	Oct. 5	26	173	Nov. 5
1941	May 9	31	Sept. 20	29	134	April 18	19	Sept. 24	27	160	Nov. 19
1942	June 12	30	Sept. 22	26	102	May 15	18	Sept. 24	26	130	Oct. 22
1943	June 3	32	Sept. 8	31	97	May 15	27	Sept. 18	25	126	Oct. 31
1944	May 3	29	Sept. 18	32	138	May 2	27	Sept. 29	26	150	Nov. 1
1945	May 28	31	Sept. 17	32	112	May 28	28	Sept. 19	25	114	Oct. 18
1946	May 19	31	Aug. 31	31	104	May 13	23	Sept. 25	28	135	Oct. 25
1947	May 28	27	Sept. 23	29	118	May 28	27	Oct. 6	28	131	Nov. 3
1948	May 26	32	Sept. 7	32	104	May 9	27	Sept. 29	18	143	Nov. 7
1949	May 22	17	Aug. 30	31	100	May 22	17	Sept. 12	18	113	Dec. 3
1950	June 7	32	Aug. 18	28	72	May 6	28	Aug. 18	28	104	Nov. 17
1951	May 31	25	Sept. 14	32	106	May 31	25	Sept. 22	26	114	Oct. 23
1952	May 30	31.	Sept. 4	31	96	May 27	26	Oct. 3	18	128	Nov. 15
1953	May 16	32	Sept. 20	30	127	May 12	25	Sept. 29	28	140	Nov. 17
1954	June 2	32	Sept. 18	28	108	May 4	27	Sept. 18	28	137	Nov. 27
Average					107					129	

Crop Rotations

Various crop rotations have been tested at this Farm since its inception. An extensive program of rotational and cultural studies is also carried out on the Substations to provide information on the different soil types and farming conditions throughout the area served by the Experimental Farm. The information obtained would indicate that the fallow-crop rotation system provides greater assurance against crop failure than any other method tested.

Although summerfallowing half the land each year is common in this area, any practice that keeps half the land out of production and at the same time tends to expose it to erosion is open to question. Experiments have been conducted at this Farm during the past nine years to determine whether it is possible to modify the straight fallow-crop system to advantage. Practices tested include seeding stubble when the land was moist to a depth of 18 inches at seeding time, when the soil was moist to a depth of 27 inches, and when moist to a depth of 36 inches. A 2-year rotation of crop and fallow and continuous cropping are included for comparison. The number of crops produced and the average yield of wheat, oats, and barley per cultivated acre with the various rotations are presented in Table 5.

Table 5.—Yields of Wheat, Oats, and Barley in Various Cropping Systems

YIELDS IN BUSHELS PER CULTIVATED ACRE EXPERIMENTAL FARM, SWIFT CURRENT

Cropping system	Number of crops	Yield per cultivated acre		
		Wheat	Oats	Barley
Continuous cropping	9	14·5	31·6	24·5
Seed when soil is moist 18 inches or more	8	15·3	30·6	23·9
Seed when soil is moist 27 inches or more	5	12·5	21·0	16·9
Seed when soil is moist 36 inches or more	5	12·4	26·6	17·1
Fallow-crop rotation	9	9·8*	22·5*	15·5*

* Yields based on half the average yield of nine crops

Analysis of the records shows that the average yields for continuous cropping compare favorably with those from any of the other systems. However, this method is subject occasionally to crop failure. Records of crop production at this Farm, as well as at the Substations in southwestern Saskatchewan, during the past 15 years show that crop failures have occurred only when there was little or no moisture in the soil at seeding time. On the other hand, when there was a good reserve of moisture in stubble, yields have compared favorably with crops on fallow. Thus, total production per cultivated acre can be increased by seeding stubble land whenever there is a good supply of reserve moisture at seeding time.

Crop Forecasting Experiments

It is a well known fact that moisture is generally the major limiting factor in crop production in the drought area. Any attempt at crop forecasting, therefore, should be based largely on two factors, the amount of moisture conserved in the soil, and the amount of moisture that is likely to fall during the growing season.

The amount of moisture in the soil can be determined fairly accurately and all that is required is the relationship between this factor and the ultimate crop yields. Rainfall, on the other hand, fluctuates widely from season to season. However, some indication of the probable rainfall for any given district can be obtained from past records such as are presented in Table 3.

During the past 17 years, records of depth of moist soil, rainfall during the growing season (May, June, and July), and crop yields have been obtained from Substations in the drought area in an attempt to establish a basis for crop forecasting. (Determining the amount of moisture in the soil by measuring the depth of moist soil has been found sufficiently accurate for all practical purposes.) So far, 323 records of individual conditions have been obtained. A summary of the data is presented in Tables 6 and 7.

Table 6.—Effect of Depth of Moist Soil at Seeding Time and Seasonal Rainfall on the Average Yields of Wheat

BROWN SOIL ZONE, SOUTHWESTERN SASKATCHEWAN AND SOUTHEASTERN ALBERTA (1938–1953 INCLUSIVE)

Depth of moist soil	*Seasonal rainfall					Average yield per acre
	Under 3 inches	3 to 5 inches	5 to 7 inches	7 to 9 inches	Over 9 inches	
Inches	Bu.	Bu.	Bu.	Bu.	Bu.	Bu.
0 to 20	2·6	6·0	8·5	14·4	20·6	9·7
21 to 27	6·0	8·1	10·9	19·8	31·4	13·0
28 to 33	9·6	11·0	13·9	26·9	36·0	16·6
34 to 39	12·2	14·8	16·7	25·7	34·5	18·6
40 to 45	14·0	14·2	14·7	29·8	31·5	20·5
46+	12·9	18·8	21·8	29·1	31·3	23·9
Average.....	8·0	11·2	13·9	24·1	28·2	16·5

* Seasonal Rainfall—Total rainfall during May, June, and July.

Table 7.—Effect of Seasonal Conditions on Yields of Wheat as Indicated by the Percentage of Reports Showing Yields Within Various Yield Ranges

BROWN SOIL ZONE, SOUTHWESTERN SASKATCHEWAN AND SOUTHEASTERN ALBERTA (1938–1952 INCLUSIVE)

Depth of moist soil	Total records	Percentage of records within yields indicated						
		0 to 5·0	5·1 to 10·0	10·1 to 15·0	15·1 to 20·0	20·1 to 25·0	25·1 to 30·0	30·1+
In.								
0 to 20	91	32	34	17	4	11	1	1
21 to 27	53	15	34	28	7·5	2	7·5	6
28 to 33	36	3	28	17	28	8	8	8
34 to 39	41	0	17	29	21·5	10	10	12·5
40 to 45	21	0	19	14	24	10	19	14
46+	81	0	5	20	17	12	16	30

To obtain some indication of the influence of seasonal rainfall on crop yields, the records were divided into various categories; those obtained in years when seasonal rainfall (total for May, June, and July) was less than 3 inches, 3 to 5 inches, 5 to 7 inches, 7 to 9 inches, and over 9 inches.

Table 6 shows that when the depth of moist soil at seeding time was 20 inches or less and the seasonal rainfall under 3 inches, the average yield was 2·6 bushels per acre, whereas when the depth of moist soil was over 46 inches under similar rainfall, the average yield was 12·9 bushels per acre. Corresponding yields for years when the seasonal rainfall was over 9 inches are 20·6 and 31·3 bushels per acre respectively. Thus, depth of moist soil has a fairly direct effect on average yields of wheat.

While the depth of moist soil has a definite influence on average yields, wide fluctuation in individual yields has resulted from differences in seasonal climatic conditions, soil type, and other factors. (See Table 7).

Table 7 shows that when the depth of moist soil was 20 inches or less at seeding time, 32 per cent of the crops yielded 5 bushels or less, 34 per cent between 5 and 10 bushels, 17 per cent between 10 and 15 bushels, and 1 per cent over 30 bushels. When the depth of moist soil was 46 inches or more, 5 per cent of the crops yielded between 5 and 10 bushels, 30 per cent yielded over 30 bushels, and the remainder ranged between the two.

While wide fluctuations in crop yields have occurred, the results show that the chances of obtaining a paying crop are more or less proportional to the depth of moist soil at seeding time. Since the depth of moist soil can be determined previous to seeding and rainfall records of the past give some indication of the probable seasonal rainfall, the figures presented suggest the size of crop that can be expected under any given set of conditions.

Stubble Cropping

As shown above, relatively high returns may be obtained by seeding stubble land when there is a good reserve of moisture in the land at seeding time. A detailed study of methods of preparing and seeding stubble land has been undertaken during the past nine years. Table 8 shows the methods tested and the average yields obtained.

Table 8.—Stubble Treatments

7-Year Average Yield in Bushels Per Acre—1946-54

Experimental Farm, Swift Current

Treatment	Average yield	
	1946-1952	1953-1954
Plow, pack, and seed with drill	17·4	19·9
Seed with one-way disk and pack	14·5	18·9
One-way, seed with drill	14·1	—
Burn, cultivate, seed with drill	14·8	—
Chisel 7 to 8 inches fall	—	20·5
Blade cultivate in fall	—	20·6

Although plowing is a slow, expensive operation, it gave average yields approximately 3 bushels per acre higher than any of the treatments tested during the period from 1946 to 1952 inclusive. In this connection, it should be pointed out that the soil at the Farm is a clay loam which can be readily plowed with a moldboard plow. Plowing was done about 3 inches deep and the land was packed and seeded before it had a chance to dry out. In general, stands of grain have been more uniform with fewer weeds than with the other treatments. Investigations during the past two years indicate there is also less root-rot infection when the land is plowed previous to seeding.

The use of the one-way to prepare a seedbed into which the seed is drilled has produced the lowest average yield. Considerable difficulty has been encountered, especially in years when there was a heavy stubble, in obtaining a uniform depth of seeding due to the heavy trash on the surface. While burning the stubble eliminates the trash problem, the loss of organic matter and the possible damage from soil drifting are so great that this practice cannot be considered sound from any point of view.

Investigations were started in 1953 to determine the merits of fall tillage of stubble land with the blade and chisel-type cultivators in opening the soil to prevent spring run-off and thus increase the amount of moisture in the soil. Results to date have varied considerably and further study is needed before it will be possible to make any specific recommendations.

Summerfallow Treatments

The main object in summerfallowing in this area is to conserve moisture. Experimental work was undertaken to determine the effect of date of starting fallow operations on the amount of moisture conserved and the subsequent yield of crop. Previous to starting this experiment, the land had been well farmed with the result that weed growth was not a serious menace to crop production.

The dates of starting fallow operations and the 7-year average yield of wheat are presented in Table 9. In all cases operations were started as close as possible to the date indicated. Subsequent operations were done with whatever machine was considered to give best weed control, and at the same time leave the land in such a condition as to prevent soil drifting.

Table 9.—Effect of Date of Starting Fallow Operations on Yields of Wheat

EXPERIMENTAL FARM, SWIFT CURRENT

Treatment	7-year average yield per acre
Blade stubble early fall, cultivate as required during fallow year	21·3
One-way stubble early fall, cultivate as required during fallow year	21·0
Start cultivation early spring, cultivate as required	21·4
Start cultivation May 15, cultivate as required	21·6
Start cultivation June 1, cultivate as required	20·7
*One-way June 15, cultivate as required	18·8
*Plow June 15, cultivate as required	19·2
Start cultivation June 30, cultivate as required	18·3

* No tillage previous to June 15.

Blading the stubble in the fall previous to summerfallowing produced the highest yields in four years out of seven. Because of excessive reserve moisture in 1952 and 1953, the advantage of this treatment was not so great and this reduced the average yield relative to the other treatments.

One-waying in the fall previous to summerfallowing showed no advantage over starting fallow operations in the spring. Furthermore, it was more difficult to maintain a trash cover when the stubble had been knocked down in the fall than when it was left standing through the first winter.

In general, there was a gradual decline in yield as the date of starting fallow operations was delayed. These differences in yields reflect the lessened amount of moisture conserved in the fallow. Part of the difference, however, must be attributed to the difference in weed growth in the crop. There was a noticeable increase in the weed population, especially stinkweed, in the plots where the first operation had been delayed until after June 1. This increase in weeds, no doubt, will tend not only to widen the differences in yields between the various dates of starting fallow operations, but also to increase the number of operations required to keep the weeds under control.

Somewhat similar experiments using an early fallow, starting tillage operations in early May, as compared with fallow started in late June, were conducted at a number of Substations during the past four years. Since the Substations selected cover a fairly wide range of soil and climatic conditions, the results obtained are indicative of the difference in yields that can be expected from these two methods of handling the fallow.

The average yields of 19 experiments show that the early fallow yielded 4·8 bushels per acre more than the late fallow. Early fallow required an average of 3·4 operations per year as compared with 2·3 operations for the late fallow and cost an extra 63 cents per acre. The higher cost of early fallow was small compared with the increased yield of 4·8 bushels per acre.

Methods of Seeding

During the past five years experiments have been conducted at this Farm to determine the relative yields of wheat sown with various types of seeding machines. The machines used include the standard double disk drill, double disk press drill, one-way seeder, disker seeder, and several other machines not in common use. The machines were all calibrated and set to sow $1\frac{1}{4}$ bushels of wheat per acre. Seeding was done on a uniform field of well-prepared fallow.

Tillage, seeding, and packing were done in one operation with the one-way and packer and the disker and packer. In the case of the seed drills, the land was worked with the duckfoot cultivator previous to seeding in the first two years of this experiment and with the disker in the third year. In this connection there is some evidence that seed drills produce more uniform stands and higher relative yields when the disker rather than the duckfoot cultivator is used for preparing the land. An attempt was made to seed the grain at a uniform depth for all machines. Examination of the emerging plants after seeding indicated that the depth of seeding with the disker was much more irregular than with any of the other machines. Stands of crop were also more variable. Following are average yields for the three years: one-way disk—23·0, press drill—25·3, double disk drill—23·8, and disker—19·9 bushels per acre.

Effect of Date of Seeding on Yields of Wheat, Oats, and Barley

An experiment to determine the effect of date of seeding on the yield of wheat on fallow was begun in 1933. The following year, oats and barley were added. This experiment was further enlarged in 1939 to include seeding of all three crops on stubble.

Originally, the crops were seeded as early as possible with subsequent seedings at 10-day intervals. As indicated in Table 10, there were wide variations in the dates it was possible to start seeding. This created the difficulty of making definite recommendations regarding specific dates of seeding. Consequently, the experiment was revised in 1946 so that all seedings except the first would fall on specific dates: as early as possible, and May 1, 10, 18, and 26 in the case of wheat, and the first four dates mentioned in the case of oats and barley.

Table 10.—Dates of Starting Seeding at Swift Current 1933-1954

EXPERIMENTAL FARM, SWIFT CURRENT

1933..... April 29	1939..... April 20	1945..... April 20	1951..... May 7
1934..... April 21	1940..... May 1	1946..... April 5	1952..... April 22
1935..... May 2	1941..... April 9	1947..... April 30	1953..... April 29
1936..... April 30	1942..... April 16	1948..... May 4	1954..... May 11
1937..... April 19	1943..... April 21	1949..... April 12	
1938..... April 21	1944..... April 19	1950..... May 1	

During the period 1933-1954, inclusive, early-seeded crops were damaged by frost in the years 1942, 1946, 1947, and 1949. Damage was exceptionally heavy on oats in 1946 and on barley in 1942 and 1946. Wheat was not injured as severely as the other crops. Although frosts caused some damage in 1947 and 1949, this did not materially reduce the yields of earlier-seeded crops as compared with those seeded at a later date.

The varieties used during the earlier years of this experiment were Marquis wheat, Trebi barley, and Ajax oats. Results at that time indicated that highest yields were obtained by seeding oats and barley as early as possible and wheat about May 10. With the introduction of such earlier maturing varieties as Thatcher and Rescue wheat, Titan barley, and Ajax oats, the results show a

slightly different trend. As indicated in Table 11, barley produces the highest average yield if sown not later than May 1, oats from May 1 to 10, and wheat between May 1 and 20. Later seedings tend to reduce yields considerably.

Table 11.—Effect of Date of Seeding on Yields of Wheat, Oats, and Barley

EXPERIMENTAL FARM, SWIFT CURRENT

Date of seeding	Yield in bushels per acre			Yield in pounds per acre		
	Wheat	Oats	Barley	Wheat	Oats	Barley
Crop on fallow, 20-year average—						
Early as possible	18·6	45·7	33·7	1,116	1,544	1,618
May 1	18·7	46·2	33·2	1,122	1,571	1,594
May 10	18·7	46·1	33·1	1,122	1,567	1,589
May 18 to 20	18·3	39·6	28·0	1,098	1,346	1,344
Crop on stubble, 14-year average—						
May 1	13·8	33·9	25·6	828	1,153	1,229
May 18 to 20	14·5	31·7	23·6	870	1,078	1,133

Relative Yields of Wheat, Oats, and Barley

In order to obtain relative yields of wheat, oats, and barley, the yields have been calculated in pounds of grain per acre. The relative yields at Swift Current for both fallow and stubble crops are presented in Table 11. It will be noted that barley (by weight) is the highest yielding crop for all dates of seeding except the latest, when it is about equal to oats. Both barley and oats out-yielded wheat by a considerable margin. This difference is much more marked for the seedings made up to and including May 10.

Table 12.—Relative Yields of Wheat, Oats, and Barley on Fallow

EXPERIMENT SUBSTATIONS, SOUTHWESTERN SASKATCHEWAN

Station	Number of years tested	Average yield Pounds per acre			Yield Percentage of Wheat	
		Wheat	Oats	Barley	Oats	Barley
Bracken	15	954	966	1,037	101	109
Carmichael	15	1,140	1,261	1,282	111	112
Eastend	3	2,196	2,098	2,654	95	121
Fox Valley	23	792	751	926	95	117
Gilroy	3	1,092	1,166	1,440	107	132
Gravelbourg	15	1,428	1,768	1,838	124	129
Kincaid	14	1,326	1,561	1,761	118	133
Limerick	14	1,134	1,435	1,651	126	146
Maple Creek	3	1,014	1,200	1,570	118	155
Pambrun	5	744	765	917	103	123
Riverhurst	10	756	857	1,066	113	141
Shackleton	14	1,206	1,241	1,526	103	126
Shaunavon	10	1,074	1,013	1,430	94	133
Tugaske	19	1,230	1,459	1,685	119	137
Valjean	9	876	1,050	1,402	120	160

Wheat, oats, and barley were grown in a 2-year rotation of fallow-crop at the Substations in southwestern Saskatchewan for a period of years. Compared on a basis of pounds per acre, barley produced the highest yield at all stations. The results also showed considerable variation in the relative yields of these crops for different stations. For example, yields of barley range from 109 to 160 per cent of that obtained from wheat, and oat yields range from 95 to 126 per cent of wheat. Since the yields of oats and barley relative to wheat and to

each other vary considerably from station to station, it is difficult to make any specific recommendations. However, the results give an indication of the relative yields that may be expected in the various localities.

Commercial Fertilizers

Commercial fertilizers have been tested at this Farm for the past sixteen years and for a shorter period at the Substations in southwestern Saskatchewan. Results have varied from year to year, from district to district, and with the different types of fertilizers used. In general, more response from fertilizer was obtained on clay soils than on the lighter soils. Fertilizers containing phosphates gave more response than those containing only nitrogen. There also is some indication that more response has been obtained in the Cypress Hills bench area, where rainfall is somewhat heavier, than in the surrounding districts.

Since the tests began ammonium phosphate 11-48-0 applied at from 40 to 50 pounds per acre has increased yields in nine years and decreased yields in six years. Increases have ranged from 0·2 to 5·5 bushels per acre, while decreases have ranged from 0·5 to 3·9 bushels per acre. On the average, ammonium phosphate increased yields by 0·5 bushels per acre. With ammonium sulphate 21-0-0 at 40 to 50 pounds per acre, the largest increase obtained was 2·1 bushels and the largest decrease 2·9 bushels per acre, with the 15-year average showing a slight decrease in yield.

Somewhat similar variations in yields have been obtained with fertilizers at the Substations. Although the response was good under certain conditions, average yields over a period of years have not shown a sufficient increase to warrant recommending commercial fertilizers for general use in southwestern Saskatchewan.

Cultural Practices for Fall-Seeded Crops

During recent years experiments have been conducted to try to determine the relative effect of cultural practices on winter survival of fall rye and winter wheat. While fall rye is considerably more hardy than winter wheat in this area, cultural practices definitely influence the degree of winterkilling, and both crops tend to respond in a similar manner to various cultural practices.

Factors that influence winter survival include snow cover, date, method, and depth of seeding, and the amount of reserve moisture and general condition of the soil. Best results have been obtained by seeding as shallow as possible into a firm, moist seedbed with a good reserve of moisture. When the surface soil was dry at seeding time, the use of deep furrow drills which move the dry surface soil to the side and permit seeding shallow into firm, moist soil below has been found beneficial. Deep seeding or seeding into loose soil has invariably resulted in a high degree of winterkilling.

The most satisfactory date of seeding winter wheat is from late August to early September. Fall rye shows considerably more tolerance in this regard and can apparently be seeded any time before freeze-up. However, the highest average yields have been obtained from seedings made about September 1. In years when grasshoppers are numerous in the fall, seeding of both of these crops should be delayed as long as other conditions permit, otherwise these pests may cause serious damage to the crop.

CEREALS

Introduction

The area served by the Experimental Farm at Swift Current has approximately six million acres of cereals in crop each year. By far the greatest proportion of this is seeded to wheat (4,600,000), while the remainder is seeded to barley

(500,000), oats (400,000), rye (300,000), and flax (200,000). All these crops receive consideration in the cereal improvement program carried on at this Farm, with the major emphasis on wheat production.

During the fall of 1948, six of the ten staff members in the Division were transferred to the Experimental Farm at Lethbridge. This reduction in staff resulted in a less intensive cereal breeding program. However, the testing of varieties and hybrids has increased considerably during the past seven years, and a fall rye improvement program was initiated in 1951. In addition to the regular cereal breeding and testing, 2,112 samples of farmers' grain have been grown and examined for purity of variety under what is known as the "Crop Testing Plan" sponsored by the Searle and Midland-Pacific Grain Companies. Farmers are advised as to the suitability of the variety they are growing and assisted in locating satisfactory seed when necessary. The percentage of samples grown at Swift Current and classified as unsatisfactory for purity has varied from 27·2 per cent in 1948 to 11·4 per cent in 1954.

In addition to varieties imported from foreign countries, all promising hybrid material produced in Western Canada is tested. The best of this material is then grown at twenty locations representing various soil and climatic conditions in southwestern Saskatchewan. The information obtained from these tests, and similar tests grown in other parts of Saskatchewan, is reviewed each year and a pamphlet entitled "Varieties of Grain Crops for Saskatchewan" prepared by the Saskatchewan Advisory Council on Grain Crops. Free copies of this pamphlet are available from any of the agricultural institutions in the province, and should be consulted for the latest information on cereal varieties.

Hard Red Spring Wheat

Three varieties of wheat, Thatcher, Rescue, and Chinook, have dominated the wheat acreage in southwestern Saskatchewan during the period 1948-1954 inclusive.

Following the release of Rescue in 1946, this variety was predominant in the area by 1948 and was largely responsible for the reduction of the sawfly population to the point where this pest was no longer a limiting factor in wheat production. With sawflies no longer a current problem, the acreage devoted to Thatcher again increased because Rescue is less satisfactory than Thatcher in resistance to root rot, spring frost, lodging, and shattering. Sawfly infestations are again building up to serious proportions following the increased acreage of sawfly-susceptible wheats and the practice of seeding wheat on wheat stubble when moisture conditions are favorable. Consequently, Rescue and a new, sawfly-resistant wheat, Chinook, are replacing the hollow-stemmed varieties in this area.

Rescue is classified as not equal to Marquis in quality, but was licensed because of the seriousness of the sawfly problem. An intensive breeding program to produce a sawfly-resistant wheat with quality characteristics similar to those of Marquis resulted in the licensing of Chinook in the spring of 1952. Chinook is a selection from the cross Thatcher × S-615 developed at Swift Current, and combines good quality with satisfactory sawfly resistance. A summary of 117 comparisons between Thatcher, Rescue, and Chinook is presented in Table 13.

Chinook has been slightly higher yielding than Thatcher and much superior in bushel weight during comparatively dry seasons. In favorable years, however, Chinook has not yielded so well as Thatcher, but has continued to produce a superior seed sample. Chinook is taller than Thatcher and just as early maturing. Like Rescue, however, Chinook is weak in the straw, has a tendency to shatter, and is susceptible to spring frost damage.

Apex 2177, Redman, Saunders, Lake, and Lee wheats have been tested extensively during the past seven years. These varieties are all susceptible to

Table 13.—Summary of Yields and Weights per Measured Bushel of Thatcher, Rescue, and Chinook Wheat Grown in Southwestern Saskatchewan

Type of season	Number of tests	Yield—Bushel per acre			Weight per measured bushel—Pounds		
		Thatcher	Rescue	Chinook	Thatcher	Rescue	Chinook
Dry.....	57	13·9	14·1	15·5	56·8	58·3	60·6
Wet.....	60	26·4	25·6	25·2	58·3	59·9	60·1

sawfly damage and have not yielded so well as Thatcher under our conditions. Redman, Saunders, and Lee mature about the same time as Thatcher, while Apex 2177 and Lake are later maturing. The seed of these varieties does not bleach so easily as does Thatcher, but Thatcher has more resistance to root rot and spring frost damage. Lee is a bearded wheat and is the only variety at present that has satisfactory resistance to leaf rust. Fortunately, leaf rust is rarely a serious problem in this part of Saskatchewan.

Selkirk wheat is resistant to race 15B of stem rust and is also moderately resistant to leaf rust. This variety was licensed in 1953 and is the only commercial variety with resistance to the race of stem rust that is so prevalent at present. In 1954 when rust was a problem in many areas, Selkirk naturally was

FIG. 1 Wheat Variety Test, Swift Current, 1949. From left to right: Apex 2177, Thatcher, C.T. 609. Note difference in straw strength.

high yielding. When rust was not a problem, Selkirk did not yield so well as Thatcher, Rescue, or Chinook in this area. Compared with Thatcher, Selkirk is about the same in height, straw strength, and maturity, but shatters more easily. Selkirk is resistant to both loose and covered smut and does not bleach so easily as Thatcher. Selkirk is susceptible to sawflies.

Marquis, Red Bobs, Regent, Renown, Reliance, and Canus are older varieties no longer used except in isolated instances. Of these varieties, Marquis probably

occupies the largest acreage, mainly west of Swift Current on the lighter land. Late maturity is not a problem in such areas as a rule and Marquis produces a good sample of grain. It has been our experience that Thatcher outyields Marquis even in those areas.

Hard Red Winter Wheat

During this 7-year period, work with winter wheat has been confined to the testing of varieties and hybrids at Swift Current and at several locations south of the Cypress Hills.

In 1948, 25 varieties and hybrids were sown at Swift Current, Vidora, and Loomis. The tests at Vidora and Loomis winterkilled severely. Yogo proved to be the most hardy of this group, with an average of 15 per cent damage, while the rest of the material suffered from 40 to 100 per cent damage. At Swift Current winterkilling was not serious and the test averaged 21 bushels per acre, about the same as spring wheat. None of the varieties or hybrids significantly outyielded Yogo, which is still considered the most satisfactory variety under our conditions.

While winter wheat is still a fair risk in certain restricted areas southwest of Swift Current, cultural methods will have to be improved and hardier varieties produced before this crop will occupy an important acreage in southwestern Saskatchewan.

Durum Wheat

Pelissier and Stewart are the only two varieties of durum wheat recommended for use in southwestern Saskatchewan. Pelissier has yielded higher than Stewart particularly in dry years. However, because of its inferior quality, Pelissier is not eligible for grades above 3 C.W. Stewart is equal to Mindum, which is the standard for quality, and has consistently outyielded both Mindum and Carleton. Nugget is the only variety of durum wheat to be licensed for sale in Canada during recent years. This variety was developed in North Dakota and has exceptionally high quality characteristics. However, under our conditions, it has not proved to be so high yielding as either Stewart or Pelissier. Nugget has short, weak straw, matures about a week earlier than Pelissier, and is low yielding.

Because of its resistance to stem rust and sawflies, Golden Ball has been seeded on a considerable acreage during recent years. Golden Ball is a late maturing variety with poor macaroni quality and is not licensed for sale in Canada.

To determine the relative yielding ability of durum and hard red spring wheats under drought conditions, Pelissier, Stewart, and Thatcher were grown together at a number of locations in 1948, 1949, and 1950. The average yield of Pelissier in these tests was 14·7 bushels per acre compared with 13·5 bushels per acre for Stewart and 14·0 bushels per acre for Thatcher. It is quite possible that the small difference in favor of Pelissier on a rod-row basis would be accentuated on a field scale where the greater height of the durums would tend to make machine harvesting more efficient, particularly in a dry year.

Oats

The three oat varieties most commonly grown in southwestern Saskatchewan are Ajax, Fortune, and Victory. These varieties represent three different ranges in maturity. It is possible that all three varieties have a place in this area depending on the use of the crop and the district in which they are grown.

Ajax is the earliest maturing and has been the highest yielding oat, particularly on medium light land and in a dry season. It has moderate resistance to rusts and smuts, and the seed is small but low in percentage hull. Fortune represents the medium maturity class and is most satisfactory on the heavier land and in more moist seasons. It is resistant to smuts, and the seed is medium in

size and reasonably low in percentage hull. Victory is a late maturing variety susceptible to both rusts and smuts. Where these three characters are not serious disadvantages, it gives a fair yield of good quality grain. Victory is possibly of most use where oats are to be cut for green feed, since it makes a leafier growth than either Ajax or Fortune. Exeter and Eagle are late maturing varieties that usually outyield Victory and are equally satisfactory for green feed. These varieties along with Victory are usually too late maturing to produce high grain yields in this area.

Rodney and a new selection of Garry oats were licensed for sale in Canada in 1953. Both of these varieties have more disease resistance than older varieties in common use and have yielded well in this area during the past few years. Rodney is late maturing with large kernels that tend to peel easily. Garry matures about the same time as Fortune and has yielded as well as Ajax in this area.

Occasionally a very early oat is required for some special purpose such as late seeding of sloughs. Clinton, Larain, and Valor are varieties that mature at least a week before even Ajax. Clinton has proved to be the most satisfactory variety in this characteristic. Clinton outyields Larain and Valor, it is shorter than Larain but is resistant to smut. Being very resistant to lodging, Clinton will stand longer after maturity than either Larain or Valor.

Where hulless oats are required, the variety Brighton has proved to be superior to Laurel, James, or Torch.

FIG. 2 Irrigated Oat Variety Test, Swift Current, 1952. Note difference in resistance to lodging between Ajax (left) and Clinton (right).

Barley

Since about 1938, the barley acreage in southwestern Saskatchewan has steadily increased. This has paralleled the introduction of early maturing, high yielding, smooth-awned varieties suitable for combining. During the period 1948 to 1954, three such varieties, Titan, Vantage, and Compana, have been recommended. Because of the variable soil and climatic conditions in this part of the province, each of these varieties serves a useful purpose.

Titan and Vantage are six-rowed feed barleys, while Compana is a two-rowed feed barley that is used also as a pearling barley. Titan is earlier maturing than Vantage and is most useful on medium soil types and in dry years, while Vantage shows to best advantage on the heavier land and in seasons with above-average rainfall. Compana seems to be particularly adapted to part of the area south and west of Swift Current and has yielded well under adverse conditions. There are no commercial varieties of barley that have resistance to loose smut.

Husky is a new variety developed by the University of Saskatchewan. Compared with Vantage, Husky is slightly taller, a few days later maturing, smaller seeded, and has a greater tendency to shatter. It is similar to Vantage in disease resistance. On the average of tests grown in this area since 1950, Husky has yielded as well as Vantage. However, before any recommendation is made concerning Husky, information on its performance in a dry year should be obtained.

Vantmore and Wolfe are two varieties of barley that were licensed in 1954. Vantmore has been similar to Vantage at Swift Current, but superior to Vantage in Manitoba. Wolfe is an early maturing variety that has not shown too much promise in this area to date, but appears to be adapted to central Alberta.

Plush, Newal, Trebi, and Velvon 11 have not compared favorably with Vantage under the conditions experienced during the past seven years and are not recommended. Warrior is the best of the hooded barleys. It is earlier maturing than Titan, but considerably lower in yield. Malting barley varieties, such as Montcalm and O.A.C. 21, grown in this area are not suitable for the malting trade because of their high protein content; they are also lower yielding than the recommended feed barleys.

FIG. 3 General view of Barley Variety Test, Swift Current, 1951. Note differences in lodging.

Flax

Since 1940 Royal has been the most commonly grown variety of flax in this area. However, in 1950, 1951, and 1952, rust seriously damaged fields of Royal flax with the result that Royal is no longer recommended for use in southwestern Saskatchewan. Flax rust differs from stem rust of wheat in that it can overwinter in this country and once established is difficult to control. Fortunately, there are several varieties of flax that are resistant to rust infection and have yielded as well as Royal.

Rocket, Redwood, and Victory flax are equally high yielding varieties here and all three varieties are recommended. Each matures about the same time as Royal and is resistant to wilt and rust.

Raja and Marine are two new, early maturing varieties that are rust resistant. These were intended as replacements for Redwing in areas where rust is a serious problem. They have not yielded so well as Rocket at Swift Current.

In response to inquiries concerning the average yield of straw from linseed flax grown in this area, samples from ten widely separated locations were weighed in 1951. As expected, there was no consistent relationship between grain yields and straw yields. The average yield of straw from these tests was $\frac{1}{2}$ ton per acre. However, since the samples were hand harvested with little or no loss of straw, this figure is probably too optimistic. It is estimated that an average yield of $\frac{1}{3}$ ton of straw per acre on a commercial scale would be a reasonable expectation in this part of the province.

Rye

Rye is a useful crop in this area, particularly fall rye which is much hardier than winter wheat. Its ability to produce a crop under adverse conditions and its value in controlling erosion by wind and water are two reasons for the extensive acreage of fall rye in southwestern Saskatchewan each year. In the area west of Swift Current, the acreage seeded to fall rye is second only to the wheat acreage.

Many varieties of fall rye have been tested, but only two varieties are hardy enough to survive the winter with a reasonable degree of success. The most commonly grown variety is Dakold 23. This has small, wrinkled seed which is mostly greenish in color. Antelope is a recently licensed selection from the variety Crown. It was developed by the University of Saskatchewan and is similar to Dakold 23 except that the seed is slightly larger.

There has been considerable interest recently in Tetra Petkus, a tetraploid fall rye variety developed in Germany and licensed for sale in Canada in 1954. This variety has very large, uniform kernels and strong straw. The limited available data on yield and hardiness indicate that Tetra Petkus is susceptible to winterkilling and produces only average yields under our conditions.

Because rye is a cross-fertilized crop, the varieties do not have the same degree of uniformity found in self-fertilized crops such as wheat. The generally low yields of rye are due in part to the fairly high degree of sterility and the losses due to shattering as the seed matures. A breeding program to improve fall rye was started at the Experimental Farm in the fall of 1951.

Prolific is the most suitable variety of spring rye for Saskatchewan. The seed is large, fairly smooth, and generally green in color.

FORAGE CROPS

Forage crops are used extensively in southwestern Saskatchewan for pasture and hay. The cultivated grasses and legumes have proved to be much more productive than native grasses and, as a result, there has been a gradual increase in acreage of these crops.

Grasses

Crested wheat grass *(Agropyron cristatum)* is the outstanding grass for dry land, brome grass *(Bromus inermis)* for irrigated land, and reed canary grass *(Phalaris arundinacea)* for sloughs and flooded meadows. However, tests have shown that a number of new grasses may be used to advantage for hay or pasture on most farms where livestock are kept.

Russian wild rye grass *(Elymus junceus)* is similar to crested wheat grass in persistence and longevity. Once established it is not easily killed out and crowds out annual and perennial weeds. Pure stands of this grass have not yielded heavily when cut as hay because its leaves are at the base and it seldom heads out when seeded in a solid stand. It contains about twice as much protein as most other grasses in late summer and in the fall, and even after overwintering its protein content is around 7 per cent. These qualities make Russian wild rye grass especially useful as a late season pasture grass in the dry prairie region. It is suggested that crested wheat grass and Russian wild rye grass be grazed in rotation, crested wheat grass early in the season and Russian wild rye grass in summer and fall. Russian wild rye grass is very palatable to the grazing animals; sheep and cattle prefer it to crested wheat grass during most of the season.

Intermediate wheat grass *(Agropyron intermedium)* generally does well where brome grass does well. It is an excellent hay and pasture grass on dry land as well as on irrigated land, especially when grown in combination with alfalfa. In tests conducted during the last seven years, it has outyielded all other grasses during the first three crop years but after that it tends to become sodbound and frequently winterkills on dry land. Intermediate wheat grass produces vigorous seedlings and is easier to establish than any other grass tested. The seed can be readily sown through the grain drill. Preliminary results suggest that it would be a sound practice to seed intermediate wheat grass in mixture with the long-lived grasses, such as crested wheat grass and Russian wild rye grass. The intermediate wheat grass would help to ensure a complete stand and provide for a greater yield during the first few crop years.

Tall wheat grass *(Agropyron elongatum)* and slender wheat grass *(Agropyron trachycaulum)* have proved to be the best grasses for low-lying lands which tend to be alkaline. They also withstand considerable spring flooding and can be seeded on low-lying meadows of heavy clay. Tall wheat grass is more tolerant of alkali than slender wheat grass, but appears to be more difficult to establish. A mixture of the two grasses could be used where seed is not to be harvested. Tall wheat grass is a coarse grass, but when cut in the pre-flowering stage it makes fair quality hay and in the early leaf stages it is readily grazed by livestock.

Reed canary grass is the outstanding grass for seeding in sloughs and other lands flooded for considerable lengths of time. It can stand many months of flooding if the water is not too deep. Reed canary grass has also yielded well for hay under irrigation. On spring-flooded areas it should be seeded on well-prepared land either in the summer when the land is dry or just before freeze-up in the fall.

Such grasses as timothy *(Phleum pratense)*, orchard grass *(Dactylis glomerata)*, and various fescues *(Festuca* spp.*)* winterkill frequently and are not recommended. Other new grasses are being tested and several are quite promising and may be added to the recommended list in future years.

Legumes

Alfalfa *(Medicago)* is the outstanding legume on both dry and irrigated land in the area. It has consistently outyielded the clovers *(Trifolium)*, trefoils *(Lotus)*, and vetches *(Astragalus)*. Ladak is a hardy alfalfa, more productive than other varieties, and should be used throughout the area on dry and irrigated land. The variety Grimm may be used if seed of Ladak is not available. Rambler, a new variety developed at Swift Current and licensed for seed increase in 1955, will probably replace both Ladak and Grimm in the Prairies on dry land as soon as sufficient seed becomes available, because of its superior winter hardiness and drought resistance. The varieties Ranger, Buffalo, and Rhizoma, are less hardy than Ladak and are not recommended.

Alsike clover *(Trifolium hybridum)* yields well and is quite persistent. It stands longer periods of wet conditions than alfalfa and should be used in preference to alfalfa on wet meadows. White Dutch clover is useful in irrigated pasture mixtures.

Sweet clover *(Melilotus)* is the only biennial legume that can be grown successfully in southwestern Saskatchewan. Common yellow and Erector are the two recommended varieties. White-flowered varieties such as Arctic are more difficult to establish in this area, probably because of greater root-rot damage to the seedlings. The sweet clover weevil, which attacks the leaves, has done a great deal of damage to this crop in recent years. These insects can be partly controlled by spraying the seedling crop with ½ pound of dieldrin or heptachlor or 1½ pounds of D.D.T. per acre when the plants emerge in the spring. To avoid damage, sweet clover should not be seeded on land adjacent to a sweet clover stand or that has recently grown a crop of sweet clover.

Grass-Legume Mixtures

Grass-alfalfa mixtures have produced greater yields than any other type of mixture on irrigated land as well as on dry land. Only one hay cutting should be made on dry land to avoid damaging the alfalfa stand and only two cuttings on irrigated land, the last not later than August 20.

In Table 14, results from a dry land test seeded in 1942 are presented. It may be noted that the grass-alfalfa mixtures were yielding as much in the tenth crop year as in the first, while the grasses alone yielded only about one-quarter as much. After the fourth crop year, grass alone usually produces very low yields because of the sodbound condition brought about by a deficiency in available nitrogen. Heavy applications of fertilizer will amend the situation, but it is cheaper to prevent it by using alfalfa in mixture with the grass.

Table 14.—Hay Yields in Pounds per Acre from a Dryland Test Seeded in 1942

Year	Crested wheat grass	Brome grass	Crested wheat grass and alfalfa	Brome and alfalfa
1943	1,580	1,860	3,160	2,720
1944	1,320	1,200	2,920	2,680
1945	840	800	1,540	1,240
1946	280	560	640	900
1947	840	920	1,900	2,100
1948	440	560	1,340	1,440
1949	0	0	0	0
1950	600	660	1,240	1,240
1951	400	320	1,040	880
1952	500	840	2,800	2,800
1953	1,180	1,080	2,460	2,840
1954	1,560	1,540	3,120	3,020
12-Year Average	795	860	1,850	1,820

On irrigated land, grass-alfalfa mixtures yield much more than grasses alone from the beginning. The results from an experiment seeded in 1950 are shown in Table 15. They show that the mixtures yielded about three times more forage than the grasses alone. Tall wheat grass and alfalfa gave the highest yields in this test, followed by intermediate wheat grass and alfalfa, slender wheat grass and alfalfa, and crested wheat grass and alfalfa.

Annuals

Certain of the common cereal crops provide the best source of annual fodder for hay or pasture in this area. Very recent tests on dry and irrigated land, which included most of the fodder annuals, continue to show that none are better than oats, spring rye, and barley.

Table 15.—The Yield of a Number of Grasses Seeded with and Without Alfalfa on Irrigated Land

Grass	Hay—Tons per acre					
	Without alfalfa			With alfalfa		
	1951	1952	2-year average	1951	1952	2-year average
Brome—Common	0·87	0·76	0·82	3·86	2·67	3·26
Brome—Manchar	0·89	0·88	0·88	3·76	2·85	3·30
Slender wheat grass—Common	1·31	1·00	1·16	4·08	3·34	3·71
Intermediate wheat grass	1·25	1·00	1·12	4·22	3·22	3·72
Tall wheat grass	1·05	1·08	1·06	4·82	3·70	4·26
Crested wheat grass	1·00	0·92	0·96	4·40	3·23	3·82
Reed canary grass	0·42	0·68	0·55	3·78	2·69	3·24
Timothy	0·84	0·87	0·86	4·53	2·87	3·70
Fescue—Ottawa 39	0·64	0·72	0·68	4·35	3·01	3·68

The common cereals usually yield better than other annuals, such as corn, sorghum, or the millets. They are also more resistant to frost and drought, better weed competitors, and more suited to the seeding and hay harvesting methods of this area.

In a test to determine the best cutting stage for oats, spring rye, barley, and wheat on dry land, it was found that greater hay yields were obtained when the crops were cut in the early dough stage, while greater protein yields were obtained if cutting occurred at the flowering stage (Tables 16 and 17). In the light of this information, it is recommended that cereal grain crops when used for hay can be cut any time between the flowering and the dough stages. Results also indicate that spring rye or oats produce more fodder than barley and considerably more than wheat.

Table 16.—Average Hay Yields of Four Cereals Cut at Four Stages (1947-1950)

Stage of cutting	Hay yield—Tons per acre				Average
	Spring rye	Oats	Barley	Wheat	
Flowering	1·25	1·10	1·18	1·00	1·13
Milk	1·25	1·18	1·13	1·02	1·15
Early dough	1·35	1·36	1·24	1·10	1·26
Late dough	1·51	1·44	1·28	1·26	1·37
Average	1·34	1·27	1·21	1·09	

Table 17.—Protein Yield in Pounds per Acre of Four Cereals Cut at Four Stages (1947-1950)

Stage of cutting	Spring rye	Oats	Barley	Wheat	Average
Flowering	346	326	334	272	320
Milk	305	314	317	293	307
Early dough	333	327	301	247	302
Late dough	312	319	278	266	294
Average	324	321	308	270	

Effect of Grass on Subsequent Wheat Yield and Soil Driftability

In 1939 strips of crested wheat grass, brome grass, and mixtures of these with alfalfa were seeded on light loam land that had been drifting badly through the dry "thirties". A 2-year rotation of wheat-summerfallow was followed on

alternate strips. In 1946 a part of each strip in grass was broken and a 2-year rotation practised on it. In subsequent years, additional parts were broken each year and a 2-year rotation of wheat-fallow practised from then on. Thus the wheat was grown on land that had been in grass from six to twelve years.

Wheat yield data were obtained on the different strips each year and the soil was examined for driftability by sifting samples and classifying the soil into various-sized particles. Wheat yields were generally lower after grass during the first two crop years with the third wheat crop year equalling the yield of the check. As soon as the grass roots had decayed, which occurred after the second year, the soil was just as driftable as the land that had been farmed in a 2-year wheat-fallow rotation. The age of the grass stand mattered little. It was concluded that land cannot be improved for growing grain by growing grasses that are harvested for hay.

Rejuvenation of Old Grass Stands

The question often comes up whether or not it would pay to thin out an old sodbound grass field and make it more productive. Experiments were conducted in this connection on crested wheat grass at several locations with various implements. It was found that the one-way disk set at medium depth and worked in two directions was effective in thinning out the stand and yet leaving sufficient plants to maintain a stand. However, the land remained rather rough even after being worked over with a disk harrow and drag harrow. Yields taken subsequently showed a considerable increase over the non-worked plots the improvement lasting for about two years. It was concluded from the experiments that if a stand of grass becomes sodbound, it is best to plow it and re-seed with a grass-alfalfa mixture. Thinning out the stand is costly, the field remains in a rough condition, and the yield is increased for only about two years.

Method and Time of Seeding

On dry land the best time to seed forage crops is either late in the fall (just before freeze-up) or early in the spring. When seeding in the fall the ground should be covered with trash such as stubble or dead weeds. Summerfallow should not be seeded in the fall because of the danger from soil drifting and soil crusting.

In the spring, the best stands resulted when seeding was done on well-prepared firm land. The soil should be well packed prior to seeding. Irrigated land is best seeded in the spring and, if the surface soil is dry, the land should be irrigated after seeding to bring the crop up as quickly as possible. However, care must be taken not to wash the soil. Small heads of water need to be used and careful attention paid to proper drainage.

Detailed experiments on the use of companion or nurse crops have shown that cereal crops can be used when seeding is done in the spring. The companion crop, wheat or oats, should be seeded first in rows spaced one foot apart at right angles to the forage crop rows. The companion crop may be seeded at one-half normal rate. This will be accomplished when the indicator is set at normal rate since only half the runs will be seeding. The forage crop should be seeded immediately after the grain crop. Better stands occurred where the grain crop was cut as high as possible thus leaving a taller stand of the grass and legume seedlings.

On dry land all seeding of the forage crop should be done in rows about one foot apart (through every other run of the drill); closer spacings produce lower yields. However, on irrigated land the crop should be seeded solid in order to prevent the growth from being too coarse. The rate of seeding will vary with the crop, but a good rule to follow is to seed at a rate so that from 25 to 35 seeds drop per foot of row.

Forage crops start growth early in the spring and three to five irrigations are generally required to provide for maximum production. The first irrigation can usually be made about the end of May, the second one after the first hay crop, and the third one after the second hay crop. Sometimes it may be necessary to irrigate more often. Care should be taken not to let the crop suffer from lack of moisture even for a few days because yields will be greatly reduced. Since most falls are dry, it is usually necessary to irrigate in the fall. The fall irrigation will ensure strong growth and prevent winterkilling.

Seed Production

Seed production of grasses and legumes is a specialized business, the success of which depends upon the consideration given to seeding, harvesting, and storing.

It is not generally possible to produce alfalfa seed in southwestern Saskatchewan because of a scarcity of wild bees. The honeybees are generally not a useful substitute for the wild bees because under average conditions they trip very few flowers. Alfalfa seed may be produced successfully on small fields adjacent to ravines and coulees in which considerable brush grows where wild bees nest.

Seed production of the grasses can be a success on dry land as well as on irrigated land. Most grasses produce the highest yield of seed when seeded in rows 3 feet apart. Fertilizers applied at about 150 pounds per acre of ammonium phosphate 16-20-0 or 100 pounds of ammonium nitrate 33·5-0-0 give excellent seed yield increases, especially under irrigation.

If seeded in rows, weeds can be controlled either by cultivation or by spraying with 2, 4-D at a rate generally used for wheat. New grass stands should not be sprayed before they are in the 3-leaf stage.

Introduction Nurseries

New grasses and legumes are periodically space planted in introduction nurseries in order to observe them for possible use in the area. Of hundreds of grasses and legumes grown, the following show promise.

Stipa viridula—Green stipa grass, selected in North Dakota, may become a useful hay and pasture grass. It is very productive but has a dormant seed characteristic which is undesirable.

Agropyron riparium—Streambank wheat grass is very hardy and a strong sod former. It appears to be very promising for seeding in water erosion channels, in ditches, spillways, and on dykes.

Agropyron dasystachyum—Thick spike wheat grass is a native sod-forming grass. Certain strains of it are showing considerable promise for use under cultivation.

Elymus turgaicus and *Elymus Augustus*—These are extremely hardy and productive but very coarse. They may have a place on the sandy soils.

Astragalus cicer—Milk vetch is a hardy legume, productive, but not so readily eaten by livestock as alfalfa.

Siberian red clover—This clover persisted through several years and may be useful under irrigation.

Grasses and legumes introduced from Argentina, Australia, and New Zealand all winterkilled the first year.

Plant Breeding

Alfalfa.—The objective in the alfalfa breeding program is to develop a hardy, drought-tolerant, creeping-rooted alfalfa for dryland hay and pasture use. Selections from Ladak, Siberian *(M. falcata)*, and the new variety Rhizoma were used as parent material.

Excellent progress has been made through years of selection and on February 1 a strain tested under the number Syn. Sc 34922F was licensed and named Rambler. Seed is now being increased as rapidly as possible.

The distinguishing characteristics of Rambler are its creeping-rooted habit, excellent drought resistance, and good winter hardiness. The flower color of Rambler is variable, ranging from blue through greenish yellow to yellow with yellow predominating. It recovers more slowly after cutting or grazing than common alfalfa varieties but is especially useful for seeding pasture and hay fields in mixture with grasses. At most points in the Prairie Provinces, it will yield as much or more than either Ladak or Grimm on dry land, and it will persist in the stand much longer than either variety. It is the persistence and spreading characteristic of Rambler that will make it especially useful in areas where common varieties frequently kill out because of drought, cold, or both. Rambler is somewhat resistant to wilt. See Fig. 4 illustrating the type of plants found in Rambler.

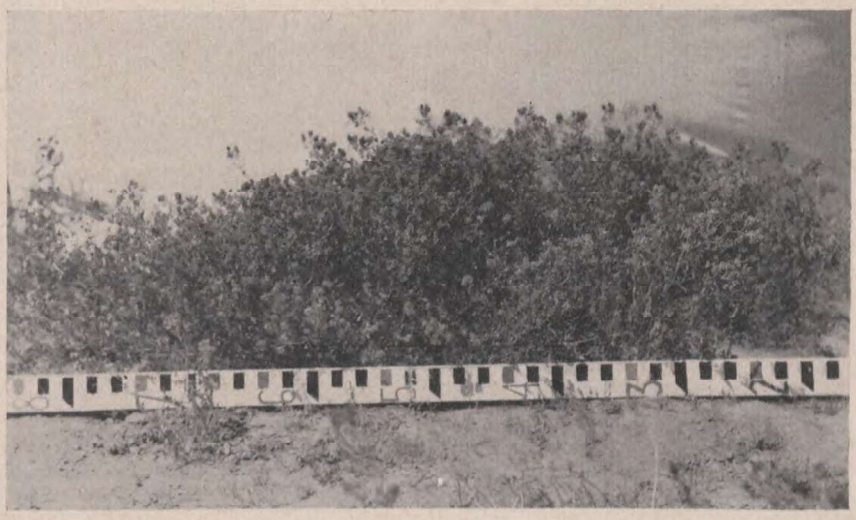

FIG. 4 A creeping-rooted alfalfa plant. This plant has spread about 9 feet in three years.

Intermediate Wheat Grass.—The breeding objective with this grass is to develop strains that are more winter hardy and will produce higher yields of forage and seed. Considerable work has been done on methods of breeding this grass and there are indications that it will be possible to develop strains better adapted to this area (Fig. 5).

Russian Wild Rye Grass.—This grass is now in commercial use but it has one defect, poor seed production, which has limited its wide use. An attempt is being made to select and breed higher seed yielding strains.

Tall Wheat Grass.—This grass is very coarse and selections have been made for finer stemmed types.

PASTURE

Yield of Native Grasslands

The highest yielding native pasture in southwestern Saskatchewan is in the Cypress Hills where rough fescue is the most abundant grass. Lowest yielding pastures are those where blue grama grass and sedges are the dominant species. An indication of the yields that can be expected is presented in Table 18.

When pasture yields less than 250 pounds per acre, at least 5 acres are required to provide feed for one cow for one month. Pastures that yield between 400 and 500 pounds per acre will produce feed on 2 to 3 acres for one cow-month.

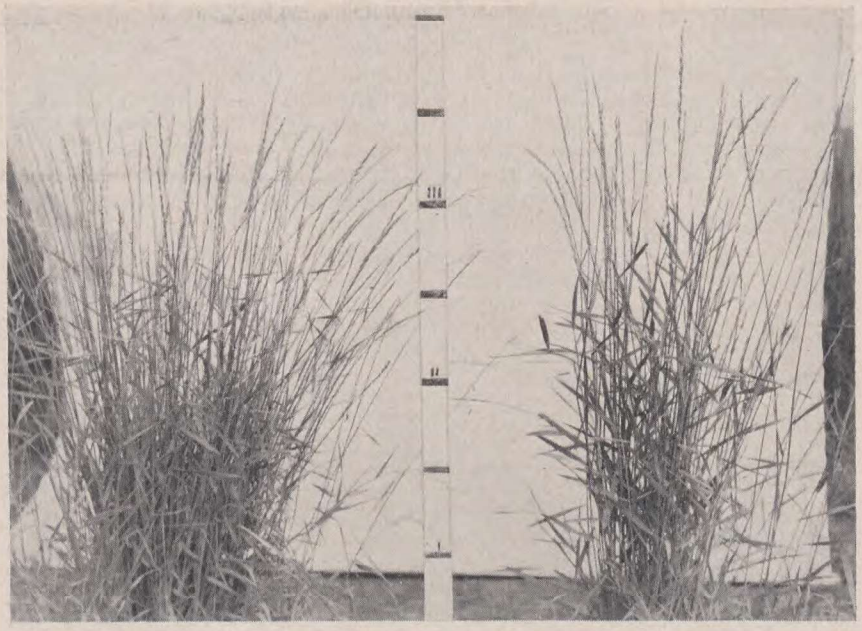

FIG. 5 Plants of intermediate wheat grass in the breeding nursery. The plant at the left is leafy and more desirable for forage than the coarse-stemmed one at the right.

Table 18.—Yields of Native Grassland in Pounds of Dry Matter per Acre

Type of cover	Average yield 1946 to 1954 inclusive
Short-grass prairie (Cadillac)	315
Mixed-grass prairie (Swift Current)	535
Fescue prairie (Cypress Hills)	730

Native grasses appear to grow rapidly during the spring. The leaves lengthen rapidly and will have nearly completed their elongation by late May or early June. At this time, however, the leaves are narrow and light, and will weigh less than one-third of their final weight. During June rapid weight increases occur as the leaf fills out. Spring growth is usually completed by mid-July when the seeds are maturing. Following ripening there is usually a marked reduction in yield caused by dropping of seed and curing of leaves. This loss is often recovered by fall growth. The seasonal yield patterns of mixed-grass prairie and crested wheat grass pastures are shown in Table 19.

The nature of growth is one reason why either spring protection or light spring grazing is recommended for range grasses in the short-grass and mixed-grass prairies. Although the fields appear ready for grazing because the leaves are long, there is very little body to the grass until early June. Heavy use after that date does not appear to cause an overgrazed condition so readily as does heavy use during May. Further, heavy spring grazing causes a reduction in the feed available for midsummer and autumn use; a 35 per cent reduction is not uncommon. The value of spring protection is evident from the information presented in Table 19, which shows average yields of mixed-grass prairie pastures, spring grazed and protected, as well as that of crested wheat grass pasture by months from 1948 to 1952 inclusive.

Table 19.—Average Monthly and Seasonal Yields of Mixed-Grass Prairie and Crested Wheat Grass Pastures at Swift Current—1948 to 1952 Inclusive

Month	Yield in pounds per acre		
	Mixed-grass prairie		Crested wheat grass spring-grazed
	Grazed May to October	Protected until June 15	
April—May	106	140	324
June	101	195	117
July	76	94	74
August	15	35	12
September—October	10	15	66
Total	308	479	593

Fescue prairie which grows on the Cypress Hills bench has a growth pattern somewhat similar to that of mixed-grass prairie. Growth starts early in May and continues slowly until early June. Following a rapid growth during June, the rate declines slowly until mid-July when the growth season ends. The crude protein cycle differs from that of mixed-grass prairie in that the percentage protein content increases during June to 14 per cent from the 10 to 11 per cent content in mid-May; on mixed-grass prairie the protein drops during this period.

Management of Native Grasslands

Spring protection, or deferment of grazing, prevents overgrazing and increases carrying capacity of native rangelands. However, in order to follow this practice, it is necessary to have an alternate source of feed. Experimental results indicate that stockmen should provide 1 to 3 acres of crested wheat grass per animal for early spring grazing; the larger amount in the short-grass prairie area and the lesser in better growth regions. Two acres of crested wheat grass per animal are recommended for the Swift Current area. This practice will increase carrying capacity of mixed-grass prairie by 60 to 90 per cent.

The value of crested wheat grass for spring pasture cannot be overemphasized. No other grass tested to date fills the need for spring pasture as does this species. At least one reason for its excellent performance is associated with its growth characters. Whereas the leaves of native species elongate but do not fill during the early spring, the leaves of crested wheat grass fill out as they grow. As shown in Table 19, crested wheat grass production is at least one month ahead of that of mixed-grass prairie.

The nutritive value of the crested wheat grass-native grass rotation is equal to that of continuously grazed range. Protein contents decline in all grasses as maturity approaches, and under any system of management will be reduced to critical levels by mid-August on both short-grass and mixed-grass pastures. The rotation produces a greater bulk of feed and more pounds of protein per acre, sound reasons for its practice.

Fertilization of native range by commercial fertilizers has not increased yields of mixed-grass prairie. This result agrees with reports from the Manyberries Range Station where fertilizer tests were undertaken on short-grass range. However, heavy applications of manure have increased yields, while applications of both commercial fertilizers and manure have increased the protein content of pastures during autumn.

Regrassing of Native Pastures

Pasture regrassing is often slow and is hindered by native weeds, including the little clubmoss. Experiments in progress demonstrate that during average or poorer than average moisture years, the clubmoss effectively prevents seeds of

spear grass, bluejoint, and blue grama grass from establishing, but with ample moisture supplies the clubmoss does not retard establishment of these common native species.

Regrassing of native range with cultivated grasses requires some preparation of the land. Results to date show that plowing followed by disking provides the most satisfactory seedbed of the several implements tested. Although plowing treatments are the most expensive, good stands grow on them quickly because native grasses, weeds, and clubmoss are destroyed and the rough surface provides protection against wind.

Regrassing of abandoned land for pasture may require some cultivation prior to seeding. Results indicate that good stands of crested wheat grass can be expected when seeded on land covered with Russian thistle and tumbling mustard. However, where pasture sage, roses, goldenrod, and other perennial weeds are abundant, cultivation should precede sowing. Again, the best stands are obtained when the land is plowed and disked, although nearly equal stands are secured when the land is double one-wayed; a single one-waying is not sufficient to kill the weeds, and thus obtain a satisfactory stand. In all conditions seed should be sown with a drill, not broadcast.

Livestock Losses on Native Grassland

No new poisonous plants have invaded southwestern Saskatchewan.

Livestock Losses from Water

Cattle and sheep losses were traced to the high nitrate contents of water in a well. This well was old and was located in the barnyard. It acted as a sump for much of the water draining from a manure pile. On the basis of this result, it is recommended that water be tested for nitrate content if it is being obtained from a well adjacent to farm buildings and on sandy land.

Control of Pasture Weeds with Herbicides

Various formulations of 2, 4-D and 2, 4, 5-T have been applied at light and heavy rates in efforts to destroy stands of snowberry, roses, sage brush, pasture sage, water hemlock, wolf willow, cactus, and poplar. Of these only wolf willow has been eradicated. None of the others has indicated that it is permanently susceptible to any herbicide tested, although the aerial growth of snowberry, sage brush, and water hemlock may be killed back; in all cases luxuriant stands of these species reappeared the following year.

These results do not agree entirely with those reported from other districts. However, all stands treated in the Swift Current tests were complete stands with no grass growing as an understory. Thus there were no plants to occupy the land when the weeds were set back by the herbicide. Reports from other stations have dealt with weeds that were invading grasslands, and when the weeds were reduced in vigor by the herbicide there were grasses at hand to occupy the land.

Yields of Irrigated Pastures

A test of six grasses seeded with alfalfa and white clover was pastured from 1951 to 1954. The six grasses were grazed in a rotation that provided a rest of three to four weeks between grazings. The average yields of dry matter and protein produced, as well as other data, are given in Table 20.

The high yields of intermediate wheat grass and brome grass indicate their usefulness for irrigated pasture in southwestern Saskatchewan. Apparent consumption records indicate that both are quite palatable, although field observations show that intermediate wheat grass is more readily eaten. Alfalfa is standing up well in all pastures and the clover is increasing as is the cover of each of the grasses. Bloat has occurred on crested wheat grass, brome grass, and

Table 20.—Yields in Pounds of Dry Matter and Carrying Capacity of Six Grass-Legume Mixtures Under Irrigation

Grass: Seeded With 2 Pounds Each of Alfalfa and White Clover	Average of 1951–1954 results			
	Yield in pounds per acre		Carrying capacity sheep per acre	Daily consumption in pounds per sheep
	Pasture	Protein		
Intermediate wheat grass	8,475	1,510	11	4·7
Russian wild rye grass	7,880	1,720	11	4·6
Brome grass	7,605	1,385	10	4·8
Timothy	7,155	1,175	8·5	5·6
Reed canary grass	6,415	1,010	8	4·0
Crested wheat grass	6,160	1,220	8	3·8

Russian wild rye grass when the alfalfa topped the grass, but the timothy, reed canary grass, and intermediate wheat grass pastures have been bloat-free to date. Despite the high yield of the Russian wild rye grass—legume mixture, the pasture has not been too satisfactory; weeds invaded the stand in its third year of grazing, the clover increased very rapidly, the livestock gains were poor in two of the four years. Results to date suggest that an intermediate wheat grass—timothy—alfalfa mixture seeded at 8, 3, and 2 pounds respectively per acre will provide nutritious and palatable pasture during a long season and maintain a healthy stand for a period of years.

Yield and Management of Cereal Crops for Pasture

Ajax and Exeter oats, Thatcher wheat, and Titan barley have been tested for summer pasture since 1952. Fields 0·6 acres in size were grazed by five yearling ewes. The results obtained are summarized in Table 21.

Table 21.—Results of Grazing Annual Crops (1952-1954) at the Rate of Five Yearling Ewes per 0·6 Acres

Crop	Days of grazing	Gain per ewe in pounds daily	Mutton per acre in pounds	Dry matter consumption per ewe per day
				Lb.
Ajax oats	121	0·163	165	3·6
Exeter oats	120	0·164	165	3·6
Thatcher wheat	104	0·168	150	3·85
Titan barley	120	0·162	162	3·7

There is no apparent difference in daily gain, nor in total gain between crops. However, both the oats and barley have had longer grazing seasons than the wheat. Apparently all crops had equal palatability as no significant differences were established in estimated daily consumption.

It was observed that oats would make regrowth after heavy grazing. Neither the barley nor wheat exhibited this character to the same degree.

These results indicate the value of cereal crops for midsummer and autumn pasture. Although few differences have been established between crops to date, the ability of Ajax oats to regrow following grazing and drought recommends it above other cereal crops for pasture purposes on dryland in the Swift Current district. Land preparation and seeding practices were the same as for grain production; grazing commenced at six to seven weeks following seeding.

ANIMAL HUSBANDRY

Range Sheep Improvement

The main interest of the Animal Husbandry Section continues to be the development of good, market-type sheep that are better adapted to range conditions. This program includes (1) improvement of the Rambouillet breed, and (2) testing new breeds.

The improvement of the Rambouillet is based on a breeding program that involves a high degree of selection plus planned matings designed to (1) remove excessive face cover, (2) remove body and neck wrinkles, (3) increase staple length, and (4) improve mutton conformation.

The breeding flock now is almost "wrinkle-free". Mutton conformation is greatly improved and fleece length has been increased. Face cover continues to be the major problem. An attempt to establish clean-faced lines has been held up by the lack of suitable rams. In 1954, three clean-faced rams were obtained from the United States and are to be used in this work.

FIG. 6 Note the smoothness and depth of this Rambouillet ram which is out of a line outstanding in mutton conformation and carcass quality.

New breeds being tested include the Romeldale, which was developed in California. It is open-faced and has reasonably good mutton conformation. It lacks the hardiness and longevity of the Rambouillet. It also has longer, coarser wool which usually does not command so high a price as the finer wools.

The Romeldales, along with the Romnelet and Canadian Corriedale, are being compared with the Rambouillet under identical conditions to evaluate the relative value of these breeds. Any of the three new breeds that do not show some superiority over the Rambouillet will be discarded. Work to date indicates that the Romnelet is superior in several characteristics.

Cobalt has been found generally to have a beneficial effect in the rations of fattening lambs. To a lesser degree, it also is beneficial when fed to the ewe flock. The addition of 0·8 ounce of cobalt sulphate to 50 pounds of salt plus 50 pounds of bonemeal has proved to be ample.

Suitable rations for pregnant ewes have also been studied. Alfalfa hay fed by itself throughout pregnancy is superior to grass hays supplemented by either grain or a protein supplement. Since total digestible nutrients (T.D.N.) and protein content in the latter were equal to that in the alfalfa, some other factor or factors must be responsible for the beneficial effect on the percentage of lambs born and on the strength and vigor of the new-born lambs.

AGRICULTURAL ENGINEERING

Power

Tractor Performance: By the use of special equipment the effect of overhaul on tractor performance is being measured. Valve condition has been found to have a marked effect on the efficiency and the total output. The total output of a 2-3 plow tractor was increased by five horse-power after the valves had been reconditioned. These studies are being continued to determine the effects of poor rings on output and the frequency of overhauls necessary to maintain efficiency.

Air-Cooled Engines: Results of preliminary tests on small air-cooled engines indicate that a combination of heavy duty oil and nonleaded gasoline gives the least build-up of carbon deposits.

Power Requirements of Field Machinery: Draft and power data on several new machines are shown in Table 22.

Table 22.—Draft Data

Implement	Field operation	Speed M.P.H.	Depth Inches	Draft, Lb./Ft. Width	
				Loam	Clay
One-way disk harrow	Summerfallow	3·5	3	135	160
	Seeding with packer	3·5	3	160	180
	Stubble	3·5	3	160	180
Blade cultivator	Summerfallow*	4·5	3–4	165	175
	Stubble	4·5	3–4	200	210
Heavy duty cultivator	Summerfallow*	4·5	3–4	135	
1. Sweeps and chisels	Stubble	4·5	3–4	300	
2. Chisels	Summerfallow*	3·5	6–8	250	
3. Shovels	Summerfallow*	4·5	3–4	130	160
Deep furrow drill	Seeding	4·5	3	60	
Sub-soiler	Summerfallow*	2·0	18–20		4,000
8-inch shovel	Sod	2·0	18–20		5,000
Forage crop harvester	Brome grass (1 to 2 tons/acre)	2·0		6–10 h.p.	6–10 h.p.

* Refers to second operation.

Operating Costs and Utility of Agricultural Machinery: Based upon records that have been kept at the Experimental Farm, Swift Current, Publication 881, "Cost Charges for Agricultural Machinery", is now available for distribution.

Seeding

Methods of Seeding: Table 23 shows the results of five years' experiments on methods of seeding on Wood Mountain loam at Swift Current.

Table 23.—Wheat Yields in Relation to Methods of Seeding on Wood Mountain Loam—Averages for Five Years

Machine used for seeding	Wheat yields—Bushels per acre					
	1950	1951	1952	1953	1954	5-year average
Press drill	20·7	17·9	36·5	24·8	26·6	25·3
Double disk drill	19·3	16·8	36·5	21·4	24·8	23·8
One-way disk and packer	21·5	20·0	33·9	18·8	20·7	23·0
One-way disk harrow and packer	20·1	20·5	25·8	15·1	17·8	19·9

Tillage

Tractor-Mounted Units: Studies of mounted units indicate that: (1) Mounted equipment is more economical to operate on light loads than similarly pulled equipment, (2) tire slippage at higher loads with mounted equipment is greater than with the pulled type (3), pulled equipment operated more economically at higher loads, and (4) mounted equipment does not operate satisfactorily on hillsides unless the work is done on the contour.

In order to reduce excessive slippage from heavy loads with mounted equipment, the rear wheels of the tractor should be properly weighted and cutting edges correctly adjusted and sharpened.

Anti-Friction Bearings: Implements fitted with ball or roller bearings require much less power to operate. Such anti-friction bearings when fitted to a one-way disk resulted in a reduction of draft by 20 per cent over boxing-type bearings.

Graphical Analysis of the One-Way Disk: Drawings have been made to represent the cut of the one-way disk as affected by disk diameter, spacing, angle and depth of operation. As shown in Fig. 7, it is possible to make a quick analysis of a particular machine as to completeness of cut for the various settings available.

Heavy-Duty Cultivators: This equipment has been widely accepted in many areas. The machine is much stronger structurally than the standard cultivator and numerous attachments, such as chisels, sweeps, wide sweep shovels, duckfoot shovels, rodweeder, and seeding box, are available. The trash clearance is superior to the conventional three-row cultivator. Because of the extra weight, this machine maintains a more constant depth of operation under variable soil types. As a rule only the standards with releases or shear pins are suitable for stony land.

Land Packers: Packer studies indicate in general that packing is essential after blade and disk-type seeders, or where ground is left in a loosened condition.

Depth of Tillage: Results of studies to date on Wood Mountain loam in comparing the effect of deep tillage with standard depth of tillage on summerfallow show that the yields obtained were approximately the same from each practice. However, the power requirements and the cost per acre for deep tillage are much greater than for shallow tillage. Further work is being done in other areas on different soil types.

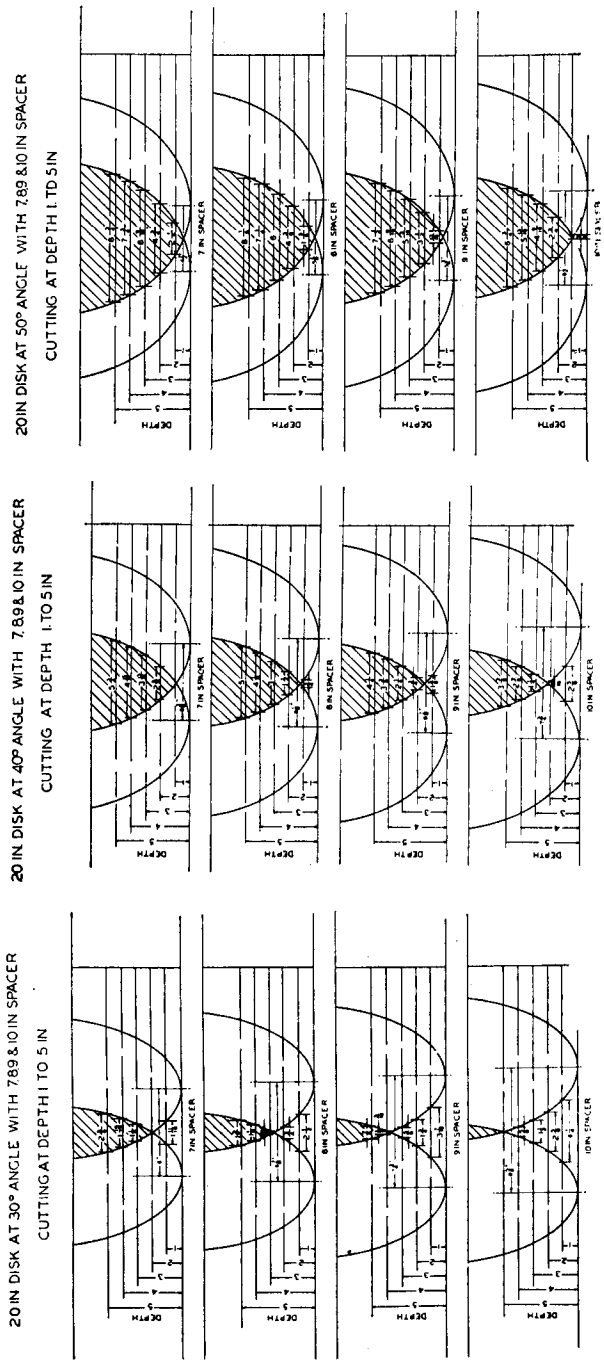

FIG. 7 Graphical analysis of one-way disk.

Hay

Stacking Baled Hay and Straw: Baled material can be kept over a period of years if the stacks are well built and consist only of well-cured hay or straw. In stacking baled material, the following points should be considered: (1) Stacks should be located on well-drained areas, preferably high ground, (2) the stacks should be well separated to minimize the fire hazard, (3) stack width recommended is 18 feet; the length will vary with the amount of material and the height depends on available labor and equipment.

The stacks may have flat tops or sloping sides and ends, but in either case they should be topped with loose hay to protect them adequately from the weather.

Forage Crop Harvester: Hay harvesting can be completely mechanized with the forage crop harvester. Equipment includes a mower and side delivery rake for cutting and windrowing, rubber-tired wagons equipped with end unloaders, a blower, and a tractor. The cost of this equipment is approximately $3,000 without the tractor. If the vacuum blower system of unloading is used, the equipment cost would be $4,000. An operator should have at least 250 tons of hay or straw to harvest in order to justify the purchase of this equipment. With smaller tonnages of fodder, it would be necessary to do some custom work to keep the fixed charges within reason.

Harvesting

Grass Seed Harvesting: An attempt is being made to determine the best method of harvesting seed from grasses grown on the prairies, using equipment now on the farms. The following comments can be made: (1) Swaths should be windrowed to about one foot in width, (2) seed was easily removed from the head with cylinder speed and concave setting the same as used for wheat, (3) wind was blocked off as completely as possible, and the remaining air supply directed to the front of the sieve; adjustable sieve was opened one-half and the lower one left the same as for wheat. Reducing and properly directing the air decreased the amount of seed loss with only a slight increase in the amount of litter contained in the threshed seed.

The Swather: Investigations are in progress to find the earliest stage at which wheat can be swathed. Results to date indicate that wheat can be safely swathed ten days before it is ready for straight combining. This method advances the harvesting date and consequently decreases the losses from insects, wind, and frost, as well as minimizing the green weed problem.

The self-propelled swather offers the following advantages: (1) Areas of mature grain can be swathed in fields without damaging less mature standing grain, (2) the variable forward speed of travel can be controlled to provide the proper operating conditions for the grain being cut, (3) fuel costs per acre are less than those for a conventional swathing outfit, (4) it is very manoeuverable, which permits the combine harvesting of small or irregular fields.

Self-Propelled Combine: Studies conducted on the power requirements of the self-propelled combine show that on level land there is a 50 per cent reserve of power on good footing and a 25 per cent on soft footing. On hilly land with soft footing, this reserve would not be adequate.

Straw Bunchers and Cutters: Introduction of the combine method of harvesting has made it necessary for the livestock owner to find a means of collecting straw for feed and bedding. Several types of straw harvesters have been built by farmers and commercial firms to meet these needs. Some of them are described in a publication entitled "Methods of Collecting and Handling Combined Straw".

For heavy crop areas, where it has become a problem to till the land because of the heavy straw cover, a straw cutter attachment at the rear of the combine is being used to replace the straw spreader; it appears to facilitate tillage operations.

Water Erosion

Control Measures: Soil erosion control has been under study for several years. Measures designed to control water erosion usually aid also in the control of erosion by wind as well as assisting in moisture conservation. Soil erosion can be reduced by using good tillage practices that leave a trash cover on the soil surface.

Reclamation and stabilization of an eroded field by contour cultivation and planting has been effective on a field with a slope approaching 5 per cent. Experiments with dykes on a reclaimed gully have stopped erosion. Due to the conservation of moisture, the yield from the area has been increased substantially. Diversion dykes are usually more costly, but are effective in controlling erosion.

Grassed waterways properly formed and well sodded are an economical means of halting erosion by water. A smooth saucer shape permits crossing with agricultural implements. Perhaps the reason for their wide acceptance lies in the fact they can be constructed with implements found on most farms—the plow or the one-way. Fig. 8 shows a one-way hitched on a chain in the preliminary operations of constructing a grassed waterway. To build grassed waterways with farm implements, it is necessary to begin control measures before erosion has progressed too far. In advanced stages of gully formation, grassed waterways can be constructed only with heavy earth-moving equipment.

FIG. 8 Constructing a grassed waterway with a one-way disk.

Hydrology Stations

Stations for measuring the runoff from snow and rain on small watersheds have been established at Davin and Swift Current, Sask. Such factors as rainfall intensities, daily precipitation, temperature, wind velocities, and evaporation are being measured. The information obtained from these stations is being used for the proper allocation of water rights for small dams and dugouts on small watersheds.

Seepage and Drainage Studies

Canal Lining: Seepage of water from irrigation canals and ditches has caused the water table of adjacent land to rise, which in turn brings up the saline or alkali salts. In severe cases the soil will not support plant life. Experiments at Swift Current indicate that a combination of drainage and canal lining is required to correct these conditions. For drainage, a system of both open and tile drains is under test. Over a period of one year the water table was lowered 2 feet. Several types of lining have been installed. Table 24 shows the types used and summarizes the results for two years. A number of years under local conditions will be needed to evaluate canal linings accurately.

Table 24.—Canal Lining Material in Relation to Seepage Loss

Lining material	Seepage loss*	Cost of lining per square yard	Comments
		$	
Compacted earth	·16	0·18	Seepage losses will vary as the linings deteriorate. Cost of maintenance will be higher on some linings than on others.
Asphalt membrane	·08	1·03	
Shotcrete	·06	0·82	
Not lined	2 to 3		

* Cubic feet of water per square foot of canal section per day.

Irrigation

Sprinkler Irrigation: Because of the widespread interest in this method of applying water special emphasis has been placed on a study of sprinkler irrigation during the past four years. Comparing sprinkler and surface methods, two general recommendations are:

1. Irrigation by gravity is recommended whenever possible because of the low first cost. It also gives better water distribution than sprinklers in windy weather. Irrigating the home garden is the exception to this rule. A small sprinkler unit does not present the operational complexities of a large system and the satisfaction of a good garden is well worth the cost. More detailed information is contained in Publication 851, "Irrigating The Prairie Home Garden".
2. The main advantage of the sprinkler irrigation method is its ability to apply water on land difficult or impossible to irrigate by the surface methods.

Results from a study of uniformity of water application by sprinklers are as follows:

1. Sprinklers that operate at 35 to 40 pounds per square inch are recommended for field irrigation. Giant sprinklers, low angle sprinklers, and perforated pipe are not recommended for the Prairies.
2. The smaller sprinklers that operate at 20 to 25 pounds per square inch are recommended for garden irrigation.
3. A 40-by-60-foot spacing of the field sprinklers is satisfactory for wind speeds up to 10 miles per hour.
4. At higher wind speeds, better uniformity is obtained by spacing the sprinklers 20-by-60 feet.
5. A 20-by-40-foot spacing is recommended for the garden sprinklers.

Siphon Tubes: The siphon tube used for furrow irrigation gives good control of stream flow and requires little preparatory labor. From a cost standpoint, the aluminum siphon tube is preferable to the plastic or rubber tube. Fig. 9 illustrates three types of tubes in operation.

Treatment of Canvas for Irrigation Dams:

1. The cost of preservatives (either copper napthanate or penta chlorophenol) for a canvas dam 4-by-9 feet is about 60 cents.
2. Treated canvas absorbs less water and thus is lighter to handle.
3. Treating the canvas does not permit careless handling of dams. The canvasses should be handled similarly to untreated ones, namely, removed from the ditch after use, then cleaned and dried.

FIG. 9 Three siphon tubes in action. From left to right: aluminum, plastic, and reinforced rubber.

Irrigation Efficiency: In this study the border ditch and border dyke methods have been compared with the following results:

1. A border ditch width of 100 feet is not too wide on heavy clay soils.
2. A border dyke length of 1,500 feet is satisfactory on heavy clay soils.

Safe Domestic Water From Dugouts: In order to maintain a safe and palatable water supply from a dugout, the following rules should be observed:

1. Keep a tightly cribbed well and filter. The filter must be cleaned periodically.
2. Keep livestock and poultry away with a tight fence.
3. No trees should be grown within 100 feet of the dugout.
4. The greenish growth or algae should not be allowed to collect on the water. It can be controlled by adding a quantity of copper sulphate. The quantity depends upon the size of the dugout and the depth of water. (For further information, a pamphlet entitled "Treatment of Dugout Water for Domestic Use" may be obtained from the Experimental Farm, Swift Current, Sask.)
5. The quality of water for human consumption should be tested periodically by sending a sample to the Department of Health.

Farm Structures

Concrete on the Farm: Special emphasis has been given to the water-cement ratio and the advantages to be gained from the proper proportioning of the fine and coarse aggregates. Some attention is also being given to light-weight, thermal-insulating concrete for livestock buildings.

Mechanization: Mechanization for handling cereals and hay has been rapid but slower in the livestock field. More attention is being given to mechanization of the various phases of the livestock and poultry enterprises. Plans of buildings and labor-saving ideas are being gathered on various livestock enterprises as an initial step in the study of this phase of work.

Special Work

Rust and Corrosion Studies: Research has demonstrated that rust proofing of the working surfaces of agricultural machinery saves equipment depreciation and labor used in getting rusty surfaces back to proper operating efficiency. The compounds used for rust proofing were obtained from commercial companies. When machinery is put into service the compounds can be washed off with solvent or kerosene, but in many instances this is not necessary.

Mechanical Hedge Trimmers: Trimmers of the sickle bar and chain saw type have been tested for the past five years. The sickle bar type is more suitable for first year growth, while the chain saw is more satisfactory in second year material. Mechanical trimming of hedges required 50 per cent less labor than the hand method.

General Comments on Other Work in Progress

Seed Cleaning and Treating Plants: Seed cleaning machinery, its arrangement and use in municipal and farm plants, has been thoroughly studied. Recommendations can now be made for individual seed cleaning equipment and use.

Farm Electrification: Studies are being conducted in farm electrification in the Swalwell, Olds, and Vegreville areas in Alberta. Surveys on power consumption and use are being continued. Appliance use is being studied and the power operational costs of home appliances have been tabulated. This work is continuing and should provide useful information for the electrification of rural homes and farms.

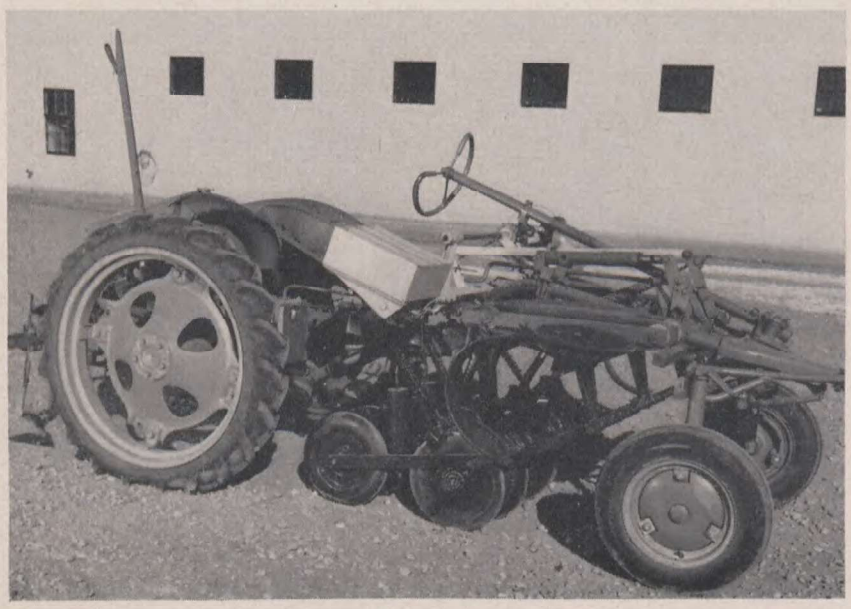

FIG. 10 Powered four-row rod row seeder.

Field Flax Pick-Up Brake: In areas where the flax crop is extensively produced the combined straw is usually baled and sold to companies who later "brake" it, that is, remove woody matter from the fibers and use the tow for upholstery and fine paper. A machine was designed and developed to brake and bale the finished tow in the one operation in the field thus reducing the cost of handling, especially the freight charges from the farmer to the processor, on

account of the reduced bulk. The machine is now built and it will be field-tested this fall at Portage la Prairie, Man., to see if it will meet specifications and expectations.

Power Rod Row Seeder: A four-row power rod row seeder has recently been built which is attached to a Model "G" Allis-Chalmers. The unit is equipped with a hydraulic lift, and four V-packers independently attached follow the double disk furrow openers (See Fig. 10).

Soil Pulverization Studies: Studies in soil pulverization are being conducted to determine the effect of various tillage implements on the soil structure with varying speeds and moisture contents. This work is proceeding satisfactorily, but no definite statement can be made at this time. Fig. 11 shows the rotary sieve used to measure aggregate sizes.

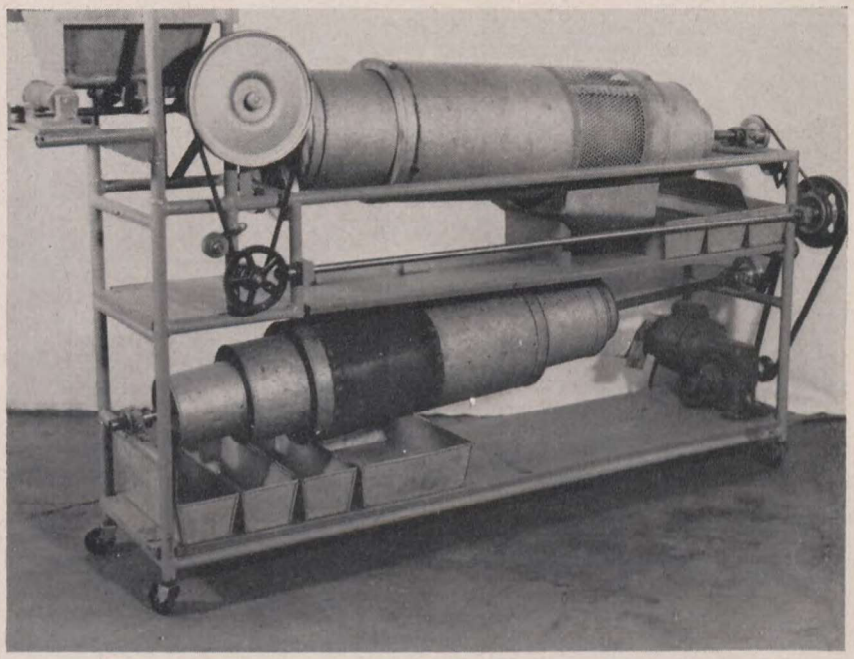

FIG. 11 Rotary sieve used in soil pulverization studies.

POULTRY

Since 1947 poultry work on this Farm has been confined to the problems of turkey raising. In consequence the research facilities for studying nutrition and management of prairie turkey flocks were greatly enlarged and expanded. During the last seven years some 76 separately controlled experiments have been undertaken. These have dealt with such problems as sources of protein for turkey poult starters; toxicity to growing turkeys of certain insecticides used for the control of field crop insects; effects of certain granular forms of turkey poult starters on growth and nutritional ailments; methods and rations for the early fattening and finishing of market turkeys; and the value of rape-seed oilcake meal in starting and finishing rations for poultry. Fifteen separate feeding experiments have been conducted to determine the effect of adding very small quantities

of certain antibiotics to the diet of young turkey poults. Many studies have also been undertaken for the purpose of determining the minimum vitamin requirements for the proper growth of the turkey poult.

The Use of Rape-Seed Oilcake Meal in Starting and Finishing Rations for Turkeys

The world shortage of vegetable oils during the latter years of World War II resulted in the widespread growing of Argentine Black rape as an oil-seed crop in Western Canada. At the same time, the shortage of protein feed supplements created an interest in the by-product from the extraction of rape-seed oil. A project was set up to investigate the feeding value of this by-product.

During 1947 feeding experiments indicated that in common with many other Brassica seeds this product contained a goiterogenic principle which resulted in a gross enlargement of the thyroid gland of both chicks and poults. It was also determined that 10 grams of a commercial iodinated casein preparation (Protamone) per 100 pounds of feed was capable of counteracting this goiterogenic principle. Further tests indicated that rape-seed oilcake meal at high levels used as a protein supplement in turkey poult starters caused a depression in growth rate. The results of these tests showed that no more than 5 per cent of rape-seed oilcake meal should be used in turkey poult starter diets.

Studies undertaken during 1949-1950 showed that during the growing period, from 8 to 24 weeks of age, 12 per cent of rape-seed oilcake meal could be used as a protein supplement.

Sources of Protein for Poult Starters

Studies to determine the proper levels and sources of protein for poult starter diets have shown that, for maximum growth, protein levels should be as follows:

day-old to 2 weeks of age	28 per cent
2 to 4 weeks of age	26 per cent
4 to 8 weeks of age	24 per cent

It is realized that the commercial manufacturing of poult starters with various levels of protein is not practical. The recommendations in regard to protein levels for poult starters have, therefore, been set at a minimum of 26 per cent throughout the starting period of 8 weeks.

In a study of sources of protein for poult starter diets, a series of experiments conducted through 1950-1951 have shown that for the purpose of providing proper protein requirements and at the same time providing adequate control of the calcium and phosphorus levels, the use of soybean oilmeal as one protein source was indicated. The use of high levels of commercial meat and bone scrap generally results in an improper balance of calcium and phosphorus in the diet. An improper balance of these minerals results in a high incidence of weak hocks.

Interrelationship of Various Vitamins in Turkey Poult Nutrition

Studies with various nutritional deficiency ailments of turkey poults have been undertaken. During 1947-1948 the problem of dermatitis was investigated. The addition of various vitamins of the "B" group to the diet in an effort to overcome this disorder indicated that the addition of supplementary biotin would alleviate but not entirely eliminate the symptoms.

It is of interest to note that while rather high levels of commercial meat and bone scrap were being used in the diets of both the breeder hens and the poults, the incidence of dermatitis in the poults was much more marked. Reorganization of the diets of both breeder hens and poults during 1949 to make much greater use of soybean oilmeal resulted in the almost complete elimination of the problem of dermatitis. No explanation is presently available to account for this.

A perosis-like type of hock weakness occurs more or less regularly with battery reared poults. An investigation of the cause of this ailment has not resulted in any clear-cut findings. Recommendations by some American workers appear to have little effect when applied under Western Canadian conditions. Experiments in which members of the B vitamin group were supplied in larger amounts did not result in any improvement. This problem is being further investigated.

Vitamin B^{12}: The isolation of Vitamin B^{12} as one of the most important ingredients in the so-called "animal protein factor" lead to an investigation of the possibilities of the use of crystaline Vitamin B^{12} as a substitute for at least a part of the expensive animal protein feed supplements. The results of a number of experiments would indicate that turkey poults hatched from breeders which had an ample level of Vitamin B^{12} in the diet do not require a supplementary source of this vitamin. This is contrary to the findings of those who have worked with chicks, but the above results have been borne out by workers in other institutions.

The Effect of Growth Stimulants on Turkeys

During 1950 it was shown by workers in many institutions that certain of the antibiotics, such as penicillin, aureomycin, terramycin, and bacitracin, when added to the diet of turkey poults and chickens were capable of producing an increased growth rate. A series of experiments has been undertaken to determine the effect of these antibiotics when added to a typical Western Canadian type diet. Indications are that the addition of these growth stimulants to commercial starters serves a useful purpose in stimulating growth, reducing mortality, and producing more uniform growth of poults. It is important to note that since amounts added are so small, it is not possible to add them to the diets on the farm. It must be done under controlled conditions in a feed-mixing plant.

The addition of antibiotics to the diet of growing turkeys beyond eight weeks of age has not been found to produce any marked stimulation in growth rate. A further series of experiments was undertaken in an effort to determine the reason why antibiotics are capable of producing a growth stimulus. The results of these experiments have been published as technical papers.

The Stability of Penicillin During the Pelleting Process

It is well known that most antibiotics are not particularly stable under conditions of high temperature and high humidity. An experiment was set up in 1951 to determine the effect of high temperature and high humidity during the pelleting process on the growth-promoting properties of penicillin. It was shown that there was a marked stimulus in growth rate of turkey poults when fed a crumbled form of diet regardless of whether the penicillin was added before or following the pelleting process. The pelleting process had little or no effect on the growth-promoting properties of penicillin.

Feeding Pelleted Concentrate to Growing Turkeys

The most common method of feeding growing turkeys on the prairies of Western Canada is by the use of a growing mash and whole grain fed free-choice in open hoppers. The mash is made up by adding a commercial protein-mineral-vitamin supplement to home-grown ground grains. With a view to eliminating the cost of grinding grain and the labor of mixing a mash, a series of experiments was undertaken. The following feeding methods were compared:

1. A growing mash made up of a concentrate and ground grain.
2. The free-choice feeding of powdered concentrate.
3. Free-choice feeding of pelleted concentrate.
4. Restricted feeding of pelleted concentrate.

In all cases whole grain was also fed free-choice in open hoppers.

Results indicate that when pelleted concentrate was fed free-choice with whole grain, a larger amount of the concentrate was consumed than appeared to be necessary. Restricted feeding of pelleted concentrate at the level normally consumed when fed in the form of mash appears to be the most satisfactory method of feeding pelleted concentrate. Results to date show that a pelleted concentrate containing 35 per cent protein should be fed at the rate of one pound per bird per week from the eighth to the sixteenth week, thereafter the amount should be reduced to $\frac{3}{4}$ pound per week until the twenty-fourth week, and thereafter reduced to $\frac{1}{2}$ pound per week.

Ultimate body weights were almost identical regardless of the method or amount of concentrate consumed, provided the birds received at least 16 pounds of concentrate from 8 to 28 weeks of age. However, birds that consumed up to 26 and 27 pounds of concentrate during this period graded somewhat better.

Trace Minerals in Turkey Nutrition

Certain highly advertised commercial products which consist largely of natural diatomaceous earth products containing numerous trace minerals have been recommended as supplements to the diet of growing and breeder turkeys. An investigation into the possibility of supplementing turkey starter diets with these products has shown that at least one of them when added to the diet, at up to 3 per cent, had no effect on growth, feathering, mortality, or nutrition disorders.

Vitamin Requirements for Turkey Poults

A series of experiments conducted during the past three years has indicated that where other ingredients in the diet are of high quality, satisfactory growth can be obtained from poult starter diets that do not contain either dried milk powder or brewer's yeast. Further tests have also indicated that normal growth can be produced from poult starter diets from which the rather expensive item, oat groats, has been eliminated. In this case the cereal grain portion of the ration consisted of ground wheat and ground barley only.

HORTICULTURE

Horticulture on the prairies of Saskatchewan, except in those areas adjoining large centers of population, cannot be considered as a major source of farm income. The value of horticulture in the rural areas is largely from the standpoint of more comfortable living on exposed farmsteads and the production of a domestic supply of fruits and vegetables for the farm family. There are in addition, of course, the aesthetic values that can be derived from the building up of ornamental plantings about the farmstead. These latter factors can contribute greatly towards the development of a more permanent and stable agriculture.

Somewhat better moisture conditions during the past five years have resulted in the stimulation of interest in the planting of farm shelterbelts and the beautifying of farm home surroundings.

Shelterbelt Planting

Experience over a long period of years continues to demonstrate that the planting of properly located and planned farm shelterbelts will remove many of the hazards of growing fruits, vegetables, and ornamentals. Shelterbelt trees are provided free of charge to bona fide farmers from the Forest Nursery Stations at Indian Head and Sutherland. It is important to note that applications for trees should be made a year in advance. This provides time for proper planning as well as preparation of the land.

Recommended varieties of trees are as follows:

Permanent—Green ash, American elm, white spruce, Colorado spruce, caragana.

Temporary—Poplar, willow, cottonwood, box elder.

NOTE:—Willow and cottonwood are not recommended for general upland prairie planting. They should be used only in areas with exceptionally high water table or where abundant runoff water is available.

Vegetable Gardening

The vegetable work of the Horticulture Section of this Farm consists largely of annual tests for adaptability to prairie conditions of newer introductions of vegetable varieties. Only one breeding project has been undertaken. This consists of attempting to develop an early fruiting, medium sized tomato with determinate habit of growth. Some progress has already been made and one variety, F-25, has been selected as showing considerable promise.

Most vegetables are, of course, seeded out of doors, but a number, including early cabbage, cauliflower, tomato, head lettuce, egg plant, and pepper, must be started indoors earlier in the season. Since facilities are not generally available for the proper growing of these plants, those who require this type of plant should ask a local market gardener or grower, who has proper facilities, to grow the required plants for them. It is important to note here, however, that the recommended varieties should be grown. The indiscriminate purchase of tomatoes, cabbage, cauliflower, etc., from growers or general stores, without any knowledge of the variety name or its suitability to the area, should be avoided.

A few kinds are discussed below. General lists of recommended varieties are available from the Dominion Experimental Farm, Swift Current, Saskatchewan.

Asparagus.....This vegetable should be grown in every farm garden. It is the first available green in the spring. Asparagus should be planted where it will receive runoff water. It can be started from seed, but two-year-old plants are better. The variety Mary Washington is recommended.

Beets.....Make successive sowings. Harvest when approaching 2 inches in diameter and process the surplus for winter use. Large roots lack quality. Detroit Dark Red (Short Top) is recommended.

Sweet Corn.....Hybrid varieties are replacing many of the standard varieties. They produce higher yields and larger cobs. Quality is not quite up to the best standard varieties. Only a very few hybrids are early enough for our conditions. Do not save seed from hybrid varieties. Standard varieties recommended are: Early Golden Sweet, Dorinny. Hybrid varieties: Spancross, Marcross, Sugar Prince.

Lettuce.....Grand Rapids is the leading variety of leaf lettuce. For best results with head lettuce, the seed should be sown indoors in early April and the plants set out in early May. Space plants 10 inches apart. The varieties New York No. 12 and Early Great Lakes are recommended for this purpose.

Onions.....Seeding onions outdoors has not always proved successful. Where seeding outdoors is practised, seed should be sown as early as possible and the seedlings thinned very early in the season. Transplanted onions, grown as for head lettuce, are much more successful. Plant 6 inches apart. Treat early for maggot control. Varieties:

For the open ground..... Yellow Globe Danvers

Sets..... White and Yellow Dutch Sets

Transplants..... Giant Yellow Prizetaker, Sweet Spanish

Peas.....Peas are best not sown in cold, wet soil. Thomas Laxton and Little Marvel are early varieties. Lincoln (Homesteader) is recommended for the main crop. Successive sowings should be made.

Rhubarb..... This should be planted where it will receive runoff water if possible. A portion of the bed should be renewed annually. Only small one-eyed divisions should be planted on fallowed land. Deep and thorough cultivation, with a liberal application of well-rotted manure, should be the rule before planting. Macdonald is the leading variety, but Sutton has proved to be very early and vigorous under south-western conditions. It is not quite equal to Macdonald for quality.

Spinach..... This vegetable tends to bolt to seed rapidly in hot weather. An excellent supply of this valuable green can be grown early in the season if a glass-covered frame is set up in a sheltered location facing south. A rich soil should be used, but the surface of the soil in the frame should not be above ground level. The variety Bloomsdale is recommended.

Tomatoes..... The determinate or "self-pruning" varieties are recommended for general use. They can be staked, but no pruning is necessary. Varieties:

Pruning	Harkness, Best of All
Non-pruning	Early Chatham, Bounty, Meteor, and Monarch and Mustang hybrids

Potatoes..... Plant on fallowed land not later than May 15. The need for constant attention to the quality of seed potatoes cannot be overemphasized. Annual seed plot grown from Certified or Foundation seed is recommended. Varieties:

White	Irish Cobbler, Canus
Pink or Red	Warba, Early Ohio, Pontiac
Irrigation only	Netted Gem, Columbia Russet

Irrigation of the Farm Garden

The problems connected with the irrigation of the farm home garden are covered in considerable detail in Publication No. 851, a copy of which may be secured from your nearest Dominion Experimental Farm. The management of irrigated vegetable gardens differs somewhat from those grown under dryland conditions. The following points are of importance:

1. The frequent summerfallowing of vegetable gardens is not necessary except for weed control purposes.
2. Spacings between rows can be greatly reduced.
3. Root vegetables such as carrots and beets need not be thinned so rigidly. They tend to become too large and coarse where this is done.
4. Fall cultivation and irrigation of the garden area is strongly recommended.

Ornamental Gardening

The continued testing of trees, shrubs, and flowers has demonstrated that there are kinds and varieties of all three of these that are hardy enough for general recommendations under prairie conditions. It is important to note that there are many varieties of most kinds of ornamental material. Only a few of these are hardy enough for general recommendations under prairie conditions. Many of the varieties listed in commercial nursery catalogues are reliably hardy under good moisture conditions, but will not stand up under the drought conditions that often prevail on the prairies.

Varieties of Trees and Shrubs

Trees..... Green Ash, American Elm, White Spruce, and Colorado Spruce

Shrubs..... Siberian Crab, Aldenham Flowering Crab, Russian Olive, Common Caragana, European Bird Cherry, Amur Maple, Common Honeysuckle, Native Hawthorn, Common Lilac, Villosa Lilac, Cotoneaster —red berried and black berried, Persian Yellow Rose, Betty Bland Rose, Missouri Currant, Spiraea media, Siberian Almond, Dwarf Burning Bush.

These shrubs are listed in descending order of their height at maturity.

Perennial Flowers: Perennials are of particular value in farmstead planting because of their permanency. It is true that during seasons of extreme drought, late summer bloom is often meager, but spring and early summer bloom can usually be counted upon. The exposures that face east or north are preferred to those facing south or west. South and west exposures are subjected to alternate freezing and thawing during the months of February and March. This results in much winterkilling of the less hardy kinds. A covering of boughs on top of a good snow blanket will often prevent winter injury caused by too early thawing.

Annual Flowers: Annual flowers will produce an abundance of bloom during the summer months and are excellent for bedding purposes. They are divided into two main groups, those that can be seeded out of doors, known as hardy annuals, and those that must be started indoors and planted out later. These are known as half-hardy annuals. Under practical farm conditions, it is often necessary to sow hardy annuals in straight rows in the garden. This does not produce the same landscape effect as seeding them in beds, but at least an abundance of bloom can be provided under these conditions. Half-hardy annuals must be started indoors. Here again the lack of proper facilities for starting plants indoors often results in crowded, spindly plants. This can be overcome by purchasing ready-to-set-out plants from commercial growers.

Kinds and Varieties

Perennials	Iris pumila*, Iris arenaria*, Iris germanica (common iris), Siberian Flax, Sweet Rocket, Ixiolirion montanum, Columbine (Long Spurred Hybrids), Oriental Poppy, Cerastium* (Snow in Summer), Creeping Veronica*, Grass Pinks*, Maiden Pink*, Sedum* (in variety), Maltese Cross, Lily (in variety), Creeping Gypsophila*, Baby's Breath, Saponaria ocymoides*, Ox-eye Daisy, Pentstemon glaber, Gaillardia, Peach-Leaved Bellflower, Carpathian Bellflower*, Aethopappus pulcherrimus, Bachelor's Button, Chinese Delphinium, Tall Delphinium Alyssum saxatile, Linum flavum* (Yellow Flax), Iceland Poppy, Peonies. Those marked * are dwarf.
Annuals—	
Hardy Annuals	Linaria, California Poppy, Mignonette, Tagates, Nasturtium, Godetia, Bartonia, African Daisy, Calendula, Cornflower, Clarkia, Sweet Peas, Larkspur.
Half-hardy Annuals	Petunia, Alyssum, Lobelia, Verbena, Pansy, Snapdragon, Stocks, Dianthus (Pinks), Aster, Gaillardia (double and single), Salpiglosis, Ageratum.

Fruit Growing

Fruits for domestic purposes have been grown with moderate success in southwestern Saskatchewan. In common with all other horticultural crops, a suitable site, adequate protection, and proper care are essential for success. A site with a northerly slope is strongly recommended to avoid sunscald injury.

All fruit trees and bushes are most successfully planted in early spring. Trees of apple, crabapple, and plum should be cut back to within a foot or 18 inches of the ground when planting is done. This encourages low branching, which is desirable. Subsequent pruning should consist of the removal of dead wood and only enough new growth to keep the tree in a symmetrical open form.

Currants and gooseberries are best cut back almost to ground level at planting time. Annual pruning thereafter consists of the removal of old wood as well as the weaker new growth. Cuts are made as near ground level as possible. All pruning is best done when the tree or bush is dormant.

Irrigation of prairie orchards makes a remarkable difference in the growth, yield, and winter survival of many varieties of fruits. An important point in connection with the irrigation of fruit trees, or for that matter any type of tree or shrub under prairie conditions, is to withhold irrigation water after August 15. Water supplied after this date will usually result in growth continuing too late into the fall. Late fall irrigation just prior to freeze-up is an ideal time to use up all surplus water.

Recommended Varieties

Apples	Heyer No. 12
Crabapples	Osman, Dolgo, Trial, Rosilda, Rescue
Plum-Cherry Hybrids	Opata, Dura, Manor, Tom Thumb
Tree Plums	Tecumseh, Pembina
Black Currants	Kerry, Magnus
Red Currants	Fays Prolific, Perfection
Gooseberries	Pixwell
Raspberries	Viking, Chief, Trent, Madawaska
Strawberries	June-Bearing—Senator Dunlap
	Everbearing—Gem, Pixie, Sparta

Garden Insect Control

The introduction of new insecticides during recent years has changed materially garden insect control measures.

Specific insect problems should be referred to your nearest Dominion Experimental Farm or the Dominion Entomology Laboratory, University of Saskatchewan, Saskatoon, Sask.

Lawns

Much greater use can be made of grass around the farmstead than is now the case. The entire farmstead area, with the exception of driveways and paths, can and should be seeded to grass. This includes such places as the service area beneath the clothes line as well as the barnyard. This can be accomplished by drilling crested wheat grass or other suitable species into the existing cover. Better class lawns for which water is available can be seeded to Kentucky blue grass or a mixture of Kentucky blue grass and creeping red fescue. Information on the establishment of farm lawns is given in a bulletin on "Seeding and Care of Lawns in Saskatchewan" prepared jointly by the Experimental Farms Service and the Saskatchewan Department of Agriculture. This bulletin is available from this Farm.

DISTRICT EXPERIMENT SUBSTATIONS

Experiment Substations provide an opportunity to study farm problems under a variety of soil and climatic conditions. By establishing these stations in representative areas, farmers problems can be studied in their local environment and thereby provide a direct link between the research worker and the individual farmers. All phases of farming are studied and the projects undertaken are closely co-ordinated with the work being done at the Experimental Farm. This makes it possible to obtain information on any particular problem under a variety of conditions in a relatively short period of time.

Substations and Illustration Stations are privately owned but the farmer has signed an agreement to undertake to co-operate with the Experimental Farms Service in undertaking various experiments and keeping accurate records of all phases of his operations. The locations of these stations and the names of the operators who have co-operated with the Experimental Farm for all or part of the period from 1948 to 1954 inclusive are as follows:

Dryland Substations	*Operator*
Bracken	J. Honey
Carmichael	A. C. Butler
Eastend	G. Higgins
Fox Valley	D. Mutschler
Gilroy	F. Cocks
Gravelbourg	Pinsonneault Bros.
Kincaid	W. C. Phillips
Kyle	A. Noble
Limerick	Smith Bros.
Maple Creek	S. N. Colquhoun
Pambrun*	M. Colburn
Riverhurst*	N. C. Rudd
Shackleton	C. D. Underwood
Shaunavon	H. Hockett
Tugaske	L. Wilson
Valjean	F. Lindquist
Irrigation Illustration Stations	
Consul	J. Reesor
Eastend	W. Lewis
Maple Creek	R. Sandau
Val Marie	J. Spiess

* Stations discontinued 1951.

Experiments undertaken on these farms are of two types: (1) Large-scale experiments which are conducted on a practical scale by the farmer himself, and (2) more detailed experiments which are conducted on small plots or on long, narrow strips so that direct comparisons of the results can be made. In the latter case, special equipment is transported to the individual stations and much of the work is done by the Experimental Farm staff. Fig. 12 shows a series of fertilizer plots with a swath cut out of the center of each plot to obtain yield data. The results of the experimental work done on the Substations have been included in the various sectional reports.

In addition to the experimental work mentioned above, a detailed study is made of the farm organization and management. The following is a summary of this phase of the work.

Sales of Seed Grain by Substations

The Substations make a large contribution in the distribution of new and recommended varieties of grain. The operators are provided with small quantities of the latest recommended varieties of seed as they become available. This seed is increased for distribution in the area.

During the 1948-1954 period the following varieties were distributed: Thatcher, Rescue, and Chinook wheat; Ajax and Fortune oats; Titan, Compana, and Vantage barley; and Dakold and Antelope fall rye. A total of 110,114 bushels of grain were sold. A summary of sales is presented in Table 25.

Cost of Operating Farm Machinery

Records have been kept on the cost of operating farm machinery. The total cost includes depreciation, repairs, interest, gas, oil, grease, and labor.

The average costs per acre are presented in Table 26. There is a large variation between the highest and lowest cost. These differences are due to such factors as size of equipment, rate of travel, depth of working, and condition of the land.

Table 25.—Sales of Seed by Substations, Southwestern Saskatchewan

1948–1954 INCLUSIVE

Station	Wheat	Oats	Barley	Rye
	Bu.	Bu.	Bu.	Bu.
Bracken	7,471	515	1,219	—
Carmichael	1,688	1,316	1,307	—
Eastend	5,759	—	375	—
Fox Valley	4,565	115	689	185
Gilroy	709	—	—	—
Gravelbourg	20,446	570	3,577	—
Kincaid	12,841	—	735	—
Limerick	8,274	1,577	3,774	—
Maple Creek	42	—	—	70
Pambrun	410	434	357	—
Shackleton	7,293	—	1,009	—
Shaunavon	6,506	215	2,914	—
Tugaske	6,533	274	4,954	—
Valjean	353	390	563	90
Total	82,890	5,406	21,473	345

Table 26.—Cost per Acre of Farm Operations

SUBSTATIONS—1948–1954

Implement	Number of reports	Average	Highest cost	Lowest cost
		$	$	$
Single disk	15	0·31	0·17	0·44
Cultivator	42	0·50	0·81	0·20
Rodweeder	35	0·40	0·65	0·23
Blade	50	0·66	1·13	0·42
One-way disk	35	0·65	1·06	0·40
One-way seeder	34	0·79	1·37	0·48
Disker	28	0·57	0·76	0·38
Disker seeder	28	0·67	0·91	0·46
D.D. drill	31	0·48	0·75	0·28
Deep tillage	7	0·73	1·03	0·45
Swather	43	0·45	0·55	0·24
S.P. combine	49	1·59	2·42	0·83
A.M. combine	12	1·74	2·58	0·82
P.T.O. combine	9	1·64	3·07	0·85

The average costs for cultural operations, swathing, and combining during the 1948-1954 period were 18, 29, and 59 per cent higher respectively than the average costs during 1943 to 1947.

Cost of Producing Wheat on Fallow

Substations provide an excellent opportunity to make a detailed study of all phases of farm management under practical farm conditions. Included in the records kept by the operators is detailed information that can be used directly to calculate the actual costs of producing wheat.

In compiling the cost of producing wheat, the following factors have been included: use of land and buildings; taxes; repairs; depreciation and interest on farm machinery; gas, oil, and grease; seed; hail insurance; labor; general farm expenses; cost of hauling grain; interest on net cost; and a charge for farm management.

The 7-year average costs of producing wheat on fallow at ten Substations in southwestern Saskatchewan are presented in Table 27.

Table 27.—Seven-Year Average Cost of Producing Wheat on Fallow

SUBSTATIONS, SOUTHWESTERN SASKATCHEWAN 1948-1954

Station	Cost of fallow per acre	Total cost of production	7-year average yield bushels per acre
	$	$	
Bracken	3·30	9·54	14·6*
Carmichael	4·29	13·27	18·9
Fox Valley	3·57	10·28	17·3*
Gravelbourg	5·16	14·94	24·4**
Kincaid	4·75	13·33	20·9
Limerick	5·19	14·11	19·8**
Shackleton	5·08	14·13	21·1*
Shaunavon	4·14	13·47	19·5
Tugaske	4·74	13·20	19·1**
Valjean	3·09	10·04	17·9**

*Severe hail damage one or two years.

**Severe rust damage in 1954.

It will be noted the cost of fallow ranges from $3.09 to $5.16 per acre and the total cost of producing wheat ranges from $9.54 to $14.94 per acre. Some of the factors causing these variations are value of land and buildings, size of farm, method of working the land, equipment used, and general farm management. Since each of these factors may vary widely from farm to farm, it is only natural that there would be wide variations in the cost per acre from one farm to another.

A comparison of cost of fallow and the total cost of production indicates the former is approximately one-third of the total cost. Since the methods used for seeding and harvesting stubble crops are usually the same as those used on fallow, the above figures would indicate the cost of producing stubble crops is approximately two-thirds of the cost of that on fallow.

The average costs of the items entering into wheat production are presented in Table 28. The highest item of cost for fallowing and cropping was for use of machinery. A comparison of the average data on costs for 1943-1947 shows that cost of fallowing has increased 22 per cent and cost of production has increased 19 per cent.

Table 28.—Average Cost of Producing Wheat

SUBSTATIONS—1948-1954 INCLUSIVE

Item	Cost of Fallow			Total Cost Crop and Fallow		
	Average 83 station years	Highest station average	Lowest station average	Average 80 station years	Highest station average	Lowest station average
	$	$	$	$	$	$
Use of land and buildings	0·73	1·20	0·50	1·55	2·61	1·06
Taxes	0·53	0·65	0·39	1·15	1·27	0·77
Seed	—	—	—	2·05	2·05	2·14
Use of machinery	1·17	1·38	1·00	3·05	3·59	2·51
Gas, oil, and grease	0·43	0·22	0·41	0·89	0·57	0·67
Man labor	0·46	0·33	0·42	0·99	0·79	0·69
Hauling	—	—	—	0·42	0·74	0·28
Spray	—	—	—	0·09	0·12	—
Interest on net cost	—	—.	—	0·34	0·40	0·26
General expense	0·16	0·18	0·08	0·41	0·40	0·17
Management	0·73	1·20	0·50	1·46	2·40	0·99
Total cost	4·21	5·16	3·30	12·40	14·94	9·54
Total cost 1943-1947	3·46	4·73	2·68	10·40	12·91	7·81
Percentage increase	22	9	23	19	16	22

Land Utilization

During the period covered by this report, there has been a gradual increase in wheat acreage and a decrease in coarse grains and summerfallow on Substations. Favorable soil moisture conditions in the spring during the 1951-1954 period resulted in a fairly large acreage of stubble being seeded. This acreage reached a peak in 1954.

The data on land utilization for Substations in 1954 are presented in Table 29. The first twelve stations listed can all be classed as grain farms as practically all income is from grain production. The average of these stations shows that the cultivated land was 88·6 per cent of the total acreage. Forage and pasture land accounted for 10·4 per cent. Some 45·7 per cent of the cultivated acreage was in wheat, 10·2 per cent in other grains, and 44·1 per cent in fallow. The other two stations in the table are on sandy soil where the main source of income is from cattle. On these two stations, 23·9 per cent of the total acreage was cultivated and 75·4 per cent was in forage crops and pasture. Of the cultivated land 22·1 per cent was in wheat, 64·0 per cent in other grain, and 13·9 per cent was in fallow.

Table 29.—Land Utilization—Substations, 1954

Station	Total area	Total** cultivated land	Forage and pasture	Cultivated land**		
				Wheat	Other grains*	Fallow
	Acres	Acres	Acres	Acres	Acres	Acres
Bracken	1,504	1,419	70	545	255	619
Carmichael	1,760	1,029	697	480	104	445
Eastend	2,400	2,220	170	884	479	857
Fox Valley	800	499	296	219	60	220
Gilroy	480	460	15	221	21	218
Gravelbourg	3,040	2,995	30	1,607	14	1,374
Kincaid	640	590	30	335	39	216
Kyle	800	775	10	476	10	289
Limerick	1,280	1,160	110	524	60	576
Shackleton	800	734	46	312	50	372
Shaunavon	960	895	55	299	176	420
Tugaske	624	585	34	207	99	279
12-station average	1,257	1,113	130	509	114	490
Percentage		88·6	10·4	45·7	10·2	44·1
Sandy Soil						
Maple Creek	2,720	568	2,142	104	408	56
Valjean	374	173	191	60	66	47
2-station average	1,547	371	1,167	82	237	52
Percentage		23·9	75·4	22·1	64·0	13·9

* Other grains include barley, oats, and rye.

** Cultivated land does not include land for hay production.

Study of Farm Business

The determining factor in successful farming is the net return obtained from the various enterprises. Complete records are kept at each of the Substations so an appraisal can be made of the economic value of the various undertakings. Weekly reports of revenue and expenditures are submitted. Complete inventories are recorded at the end of each year. The average farm inventory for 1947 and 1954 is presented in Table 30. During the 1948-1954 period, there was a general increase in total value of farm inventory. The percentage increase for the various categories varied from 23 to 230 per cent. The total inventory increased 90 per cent.

Table 30.—Average Farm Inventory

Item	1947*	1954*	Percentage increase
	$	$	
Land and buildings	17,757	21,895	23
Livestock	2,040	2,771	36
Feeds and supplies	6,354	20,977	230
Machinery and equipment	6,791	16,933	149
Total	32,942	62,576	

* The same 10 Substations.

The percentages of the total revenue and expenses accounted for by the various enterprises for the 1948-1954 period are presented in Table 31. This shows that 76·7 per cent of the total revenue was obtained from field crops, while income derived from the cattle enterprise was only 7·9 per cent of the total. The largest item of expense was for purchases and repairs of machinery. Gas, oil, and grease was the second highest expenditure. Labor expenses are low as most of the work is done by the operator. The cash expenses were 54·6 per cent of the cash revenue.

Table 31.—Percentage of Total Cash Revenue and Expenses from Various Items

TWELVE SUBSTATIONS, SOUTHWESTERN SASKATCHEWAN

SEVEN-YEAR AVERAGE—1948-1954

Item	Percentage of total cash revenue	Percentage of total cash expenses
Cattle and dairy products	7·9	3·1
Field crops	76·7	6·6
Hogs	1·5	0·4
Poultry	1·7	1·2
Old machinery and buildings	9·4	59·5
Taxes	—	7·1
Labor	—	7·4
Gas, oil, and grease	—	12·5
Miscellaneous	2·8	2·2

Development of Experimental Areas on Irrigation Projects

With the development of various tracts of land for irrigation in southwestern Saskatchewan, it was inevitable that the methods of handling these areas would have to be completely altered. The first attempt at handling this land was based on information obtained from other irrigated areas. It became apparent, however, that each of these areas had local conditions that made it impractical to adopt cultural and irrigation practices followed in older established irrigation districts. This meant that methods more suitable for each individual area would have to be devised. With this objective in mind, Irrigation Illustration Stations were established on the irrigation projects at Consul, Eastend, and Val Marie in 1950 and one on the Maple Creek project in 1952. In addition, government owned experimental areas were established on the lake bottom of the Rush Lake project and at Outlook on the proposed South Saskatchewan River project.

Experiments that have been started on these areas include crop rotations for soil improvement, cultural practices, methods of irrigating, suitability of various forage crops, fertilizer investigations, and the problem of weed control. Since experimental work has been conducted for only a short period of time, no definite conclusions can be drawn at this time.

ABBREVIATED LIST OF ACTIVE PROJECTS

Field Husbandry

Rotation Experiments, Two- and Three-Year Rotations and Continuous Cropping.

Commercial Fertilizer Investigations on Wheat and Barley.

Cultural Treatments on Methods of Summerfallow; Stubble Treatments; Dates of Seeding Wheat, Oats, and Barley; Methods of Seeding Wheat, Oats, and Barley.

The Production of Fall Rye and Winter Wheat.

Seed Treatment for Control of Seed-Borne Diseases and Wireworms.

Weed Control Work Including Cultural and Chemical Control Measures.

Cereal Crops

Variety Tests of Spring Wheats, Winter Wheats, Oats, Barley, Flax, and Fall Rye.

Verification of Purity and Varietal Composition of Samples of Farmers' Grain.

Breeding Varieties of Hard Red Spring Wheat and Fall Rye.

Forage Crops

Alfalfa Breeding—For Greater Drought Resistance and Pasture Use.

Grass Breeding—Intermediate Wheat Grass, Tall Wheat Grass, Russian Wild Rye Grass.

Perennial and Biennial Grasses and Legumes for Hay and Pasture.

Annual Crops for Hay and Pasture.

Variety Tests for Alfalfa, Crested Wheat Grass, and Brome Grass.

Variety Tests for Corn and Sunflowers.

Row Spacing Tests of Grasses.

Regrassing Investigations.

Methods of Seeding Forage Crops.

Seed Production Investigations of Grasses, Legumes, and Miscellaneous Crops.

Pasture

Growth and Development of the Principal Species of Range Plants.

Succession of Native Range Plants.

Revegetation of Rangelands.

The Carrying Capacity of Rangelands.

Rotation Versus Continuous Grazing on Cultivated Grasses and Legumes.

Animal Husbandry

Improving Existing Breeds of Sheep for Western Range Conditions (Rambouillet and Romeldale).

Breed Comparisons of Sheep Under Feedlot Conditions (Rambouillet, Romnelet, Canadian Corriedale, and Romeldale).

Agricultural Engineering

Power Studies of Tractors, Field Machinery, Fuels and Oils, and Costs.

Tillage Machinery Investigations as Related to Depth, Soil Structure.

Research on Planting and Packing Equipment Used for Cereal Grains.

Harvesting Equipment Investigations as Related to Mechanics of Swathing and Combine Losses.

Seed Cleaning and Treating.

Hydrology Studies at Davin and Swift Current.

Irrigation Research Re Canvas and Lumber Treatment, Water Efficiency, Water Application by Sprinklers.

Soil Conservation Re Impounding Dykes, Strip Contours, and Grassed Waterways.

Drainage Research as Related to Salinity and Seepage Losses in Canals, etc.

Farm Facilities for Storing Grain.

Poultry

Nutritional Experiments With Turkeys (Vitamins, Proteins, Antibiotics, Hormones, Fattening and Finishing Diets, Growing Concentrates, Pelleted Diets, Minerals, Confinement Rearing Diets, etc.).

Horticulture

Vegetable Variety Experiments (Perennial Vegetables, Root Vegetables, Leguminous Vegetables, Leafy Vegetables, Solanaceous Vegetables, Vegetable Vine Crops).

Tree and Shrub Variety Experiments.

Tree and Small Fruit Variety Experiments (Apples, Crabapples, Currants, Gooseberries, Raspberries, etc.).

Annual and Perennial Flower Variety Experiments.

District Experiment Substations

Agricultural Meteorology.

Co-operative Projects on Cultural Practices, Farm Crops, Weed Control, Fertilizers, and Livestock.

Farm Organization and Management Studies.

Testing the Practical Application of Projects Listed Under the Various Activities of the Experimental Farm.

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