COMPARISON OF RATES AND FORMULATIONS OF COMMERCIAL FERTILIZER APPLICATION OF SUMMERFALLOW IN WESTERN NORTH DAKOTA

This is a companion trial designed to make dual use of the plot layout involved in the Maintenance of Summerfallow Trial. Fertilizer is applied at planting time by drill attachment according to the plot layout shown in the following table. Yield data for 1970 are recorded in Tables 42, 43 and 44.

EVEN NUMBERED YEARS Table 41.

167	100# 11-48-0	15	Rep. 4	138		137	100# 18-46-0	10	Rep. 2	108
	check	14					50# 23-23-0	9		
5 wk.	50# 18-46-0	13				6 wk.	100# 23-23-0	8		
	100# 18-46-0	12					check	7		
	50# 11-48-0	11					50# 18-46-0	6		
166	100# 0-46-0	15		139		136	100# 18-46-0	10		109
	check	14					50# 0-46-0	9		
4 wk.	50# 18-46-0	13				4 wk.	100# 0-46-0	8		
	100# 18-46-0	12					check	7		
	50# 0-46-0	11					50# 18-46-0	6		
165	100# 23-23-0	15		140		135	100# 18-46-0	10		110
	check	14					75# 10-30-10	9		
6 wk.	50# 18-46-0	13				7 wk.	150# 10-30-10	8		
	100# 18-46-0	12					check	7		
	50# 23-23-0	11					50# 18-46-0	6		
164	150# 10-30-10	15		141		134	100# 18-46-0	10		111
	check	14					50# 11-48-0	9		
7 wk.	50# 18-46-0	13				5 wk.	100# 11-48-0	8		
	100# 18-46-0	12					check	7		
	75# 10-30-10	11					50# 18-46-0	6		
163	50# 0-46-0	15		142		133	100# 0-46-0	5		112
	100# 0-46-0	14					50# 0-46-0	4		
4 wk.	check	13				4 wk.	check	3		
	100# 18-46-0	12					100# 18-46-0	2		
	50# 18-46-0	11					50# 18-46-0	1		
162	50# 23-23-0	15		143		132	150# 10-30-10	5		113
	100# 23-23-0	14					75# 10-30-10	4		
6 wk.	check	13				7 wk.	check	3		
	100# 18-46-0	12					100# 18-46-0	2		
	50# 18-46-0	11	Rep. 3				50# 18-46-0	1	Rep. 1	
161	50# 11-48-0	15		144		131	100# 11-48-0	5		114
	100# 11-48-0	14					50# 11-48-0	4		
5 wk.	check	13				5 wk.	check	3		
	100# 18-46-0	12					100# 18-46-0	2		
	50# 18-46-0	11					50# 18-46-0	1		
160	75# 10-30-10	15		145		130	100# 23-23-0	5		115
	150# 10-30-10	14					50# 23-23-0	4		
7 wk.	check	13				6 wk.	Check	3		
	100# 18-46-0	12					100# 18-46-0	2		
	50# 18-46-0	11					50# 18-46-0	1		

Table 42. Grain Yields Recorded in the Trial Comparing Rates and Fertilizer Formulation on the Summerfallow Management Trial – 1970.

Treatment		Yields in bushels per acre 1	2	3	4	Avg.
Check		24.2	22.6	13.2	17.8	19.5
50 lbs.	0-46-0	25.5	24.9	15.1	19.4	21.2
100 lbs.	0-46-0	27.3	22.2	14.1	18.9	20.6
50 lbs.	18-46-0	26.5	28.4	13.0	15.7	20.9
100 lbs.	18-46-0	26.8	20.2	15.0	17.1	19.8
The above yields are from the 4-week cultivation interval.						
Check		21.6	19.8	18.3	16.7	19.1
50 lbs.	11-48-0	22.7	19.5	14.5	17.5	18.6
100 lbs.	11-48-0	19.0	18.2	15.8	14.3	16.8
50 lbs.	18-46-0	23.3	20.5	16.5	18.0	19.6
100 lbs.	18-46-0	24.4	18.8	18.5	16.0	19.4
The above yields are from the 5-week cultivation interval.						

Table 43. Grain Yields Recorded in the Trial Comparing Rates and Fertilizer Formulation on the Summerfallow Management Trial – 1970.

Treatment		Yields in bushels per acre 1	2	3	4	Avg.
Check		18.7	23.5	13.6	17.9	18.4
50 lbs.	23-23-0	21.6	22.0	13.9	14.3	18.0
100 lbs.	23-23-0	21.8	22.0	13.8	18.2	19.0
50 lbs.	18-46-0	20.0	24.5	15.2	15.8	18.9
100 lbs.	18-46-0	21.6	23.8	13.0	15.0	18.4
The above yields are from the 6-week cultivation interval.						
Check		16.9	19.4	16.8	14.1	16.8
75 lbs.	10-30-10	18.0	21.3	15.2	14.5	17.2
150 lbs.	10-30-10	24.9	21.3	15.7	14.1	19.0
50 lbs.	18-46-0	18.5	23.2	16.5	11.9	17.5
100 lbs.	18-46-0	21.6	21.8	16.7	15.2	18.8
The above yields are from the 7-week cultivation interval.						

Table 44. Record of Grain Yields From Check Plots Compared to the 18-46-0 Formulation in the Fertilizer Use on Summerfallow Management Trial – 1970.

Treatment		Grain yields in bushels per acre								Avg.	1968 Avg.	1969 Avg.	3-Yr. Avg.
Check		24.2	22.6	13.2	17.8	21.6	19.8	18.3	16.7				
Check		18.7	23.5	13.6	17.9	16.9	19.4	16.8	14.1	18.4	38.6	41.1	32.7
50 lbs.	18-46-0	26.5	28.4	13.0	15.7	23.3	20.5	16.5	18.0				
50 lbs.	18-46-0	20.0	24.5	15.2	15.8	18.5	23.2	16.5	11.9	19.2	42.1	43.3	34.9
100 lbs.	18-46-0	26.8	20.2	15.0	17.1	24.4	18.8	18.5	16.0				
100 lbs.	18-46-0	21.6	23.8	13.0	15.0	21.6	21.8	16.7	15.2	19.1	39.6	45.4	34.7

Table 45. Fertilizer Rate and Formulation Trial – Dickinson, 1968-1970.

Fertilizer Treatment	Pounds applied	Yield in bushels per acre 1968	1969	1970	3-Yr. Avg.
18-46-0	100#	39.6	45.4	19.1	34.7
18-46-0	50#	42.1	43.3	19.2	34.9
11-48-0	100#	39.8	46.0	16.8	34.2
11-48-0	50#	45.6	43.8	18.6	36.0
0-46-0	100#	39.3	44.8	20.6	34.9
0-46-0	50#	39.9	44.3	21.2	35.1
23-23-0	100#	40.3	43.5	19.0	34.3
23-23-0	50#	39.1	43.3	18.0	33.5
10-30-10	150#	40.2	40.3	19.0	33.2
10-30-10	75#	38.4	38.0	17.3	31.2
Check	0	38.6	41.1	18.4	32.7

Table 46. Fertilizer Tate and Formulation Trial – Beach, 1970.

Fertilizer Treatment	Pounds applied	Yield in bushels per acre Rep 1	Rep 2	Rep 3	Rep 4	Avg.
18-46-0	200#	30.5	38.3	32.5	34.9	34.1
18-46-0	100#	35.4	35.1	36.6	36.9	36.0
18-46-0	50#	33.7	38.3	38.3	36.6	36.7
11-48-0	100#	36.9	35.7	40.0	36.6	37.3
11-48-0	50#	37.1	35.1	38.0	35.7	36.5
0-46-0	100#	35.1	40.0	38.9	37.1	37.8
0-46-0	50#	36.0	37.4	36.6	35.4	36.4
23-23-0	200#	31.9	37.4	36.8	31.6	34.4
23-23-0	100#	33.7	35.7	34.6	34.9	34.7
10-30-10	200#	33.4	36.3	36.9	35.1	35.4
10-30-10	100#	32.5	40.7	38.1	32.0	35.8
Check		32.2	36.9	37.8	33.1	35.0

Analysis of Variance

Source	DF	SS	MS	F
Replications	3.	90.19	30.06	9.24
Treatments	11.	58.81	5.35	1.64
Error	33.	107.36	3.25	
Total	47.	256.36		

Standard error of a treatment mean = 0.9019
Standard error of a difference among treatment means = 1.2754
The C.V. = 5.03 P.C. The L.S.D. at 5% is 2.59 bushels per acre.

Table 47. Fertilizer Rate and Formulation Trial – Glen Ullin, 1970.

Fertilizer Treatment	Pounds applied	Yield in bushels per acre				
		Rep 1	Rep 2	Rep 3	Rep 4	Avg.
18-46-0	200#	30.9	29.7	25.9	24.5	27.8
18-46-0	100#	31.4	26.8	29.8	22.7	27.7
18-46-0	50#	27.6	27.2	28.2	21.6	26.2
11-48-0	100#	29.3	31.5	30.1	20.6	27.9
11-48-0	50#	26.4	28.6	24.6	22.9	25.6
0-46-0	100#	28.6	29.2	27.9	20.4	26.5
0-46-0	50#	28.5	29.0	25.0	19.6	25.5
23-23-0	200#	27.8	29.0	24.5	21.1	25.6
23-23-0	100#	25.9	27.9	22.7	19.6	24.0
10-30-10	200#	27.3	26.7	24.3	20.0	24.6
10-30-10	100#	25.4	26.7	19.1	18.8	22.5
Check		28.5	24.4	28.6	23.9	26.4

Analysis of Variance

Source	DF	SS	MS	F
Replication	3.	368.64	122.88	36.64
Treatments	11.	112.98	10.27	3.06
Error	33.	110.67	3.35	
Total	47.	592.29		

Standard error of a treatment mean = 0.9156
Standard error of a difference among treatment means = 1.2949
The C.V. = 7.08 P.C. The L.S.D. at 5% is 2.63 bushels per acre.

Table 48. Fertilizer Rate and Formulation Trial – Off Station Sites 1969-1970.

Fertilizer Treatment	Pounds applied	Beach		2 Yr. Avg.	Glen Ullin		2-Yr. Avg.
		1969	1970		1969	1970	
18-46-0	200#	41.6	34.1	37.9	49.2	27.8	38.5
18-46-0	100#	38.2	36.0	37.1	43.8	27.7	35.8
18-46-0	50#	36.5	36.7	36.6	40.4	26.2	33.3
11-48-0	100#	37.3	37.3	37.3	42.5	27.9	35.2
11-48-0	50#	36.7	36.5	36.6	38.3	25.6	32.0
0-46-0	100#	39.5	37.8	38.7	37.5	26.5	32.0
0-46-0	50#	36.5	36.4	36.5	37.5	25.5	31.5
23-23-0	200#	40.8	34.4	37.6	38.9	25.6	32.3
23-23-0	100#	35.8	34.7	35.3	32.9	24.0	28.5
10-30-10	200#	38.2	35.4	36.8	39.2	24.6	31.9
10-30-10	100#	35.1	35.8	35.6	34.6	22.5	28.6
Check	0	28.5	35.0	31.8	24.2	26.4	25.3
L.S.D. @ 5%		6.08	2.59		4.57	2.63	

Table 49. Summary of Wheat Yields on Continuous Cropping, Cornland and Fallow, Fertilized and Unfertilized for the Period 1959-1970.

Year	Spring plowed continuous cropping	Spring plowed continuous cropping fertilized	Summerfallow	Summerfallow fertilized	Disked cornland	cornland fertilized
	Yields in bushel per acre					
1959	6.7	8.1	11.1	12.9	7.3	8.6
1960	10.8	12.5	15.3	22.0*	10.6	13.6*
1961	4.8	3.9	6.2	8.1	-	-
1962	-	-	-	-	-	-
1963	17.8	19.4	28.1	33.8*	18.7	25.7*
1964	8.6	10.7*	13.0	16.1*	10.6	11.8
1965	17.3	22.3*	31.4	34.0*	24.6	31.4*
1966	-	-	-	-	-	-
1967	15.4	14.0	25.8	23.6	17.2	21.4*
1968	11.6	10.0	22.8	33.6*	20.7	24.5*
1969	18.1	22.8*	33.7	45.1*	16.2	23.6*
1970	9.4	10.6	21.0	21.9	14.5	15.9
10 Year Avg.	12.1	13.4	20.8	25.1*	14.0	17.7*

Crop destroyed by hail in 1962 and 1966.
* Years when fertilizer application increased yields to or in excess of the breakeven point.

SUMMERFALLOW MANAGEMENT STUDY

The objective of this trial is to determine the optimum number of cultivations required on summerfallow in western North Dakota as related to yield and cost of operation.

Previous work on summerfallow at this station has determined the best average date for first tillage of fallow as May 15.

Results of similar trials at two other western North Dakota stations support the observations made at Dickinson. In trials at the North Central Agricultural Experiment Station at Minot, Geiszler found that wheat on fallow which received the first tillage of the fallow year on July 1 produced only about 91 per cent as much grain as when the first tillage was on June 1. At the Northern Great Plains Field Station at Mandan, wheat yields were reduced about 6 bushels per acre on the average when the first tillage of the fallow year was delayed until July 1 as compared to June 1 according to Sarvis and Thysell.

In 1968 a trial was begun at Dickinson which compares grain production from summerfallow where the cultivations have been at 4 week, 5 week, 6 week and 7 week intervals, starting with the first tillage operation as close to May 15 as possible. When the first tillage can be applied on or about May 15, the average number of cultivations required for the 4 week treatment is 6, the 5 week treatment requires 5 and the 6 and7 week intervals require 4 tillage operations during the season.

Fifty cents per acre can be considered a very conservative cost for one cultivating operation on summerfallow. To get the cost down this low an operator would have to be covering approximately 2000 acres. On this basis the 4 week cultivation interval costs a dollar per acre more and the 5 week cultivation fifty cents per acre per season more than does the 6 and 7 week cultivation method.

Table 50. Yields from the Summerfallow Management Study -1970.

	Yield in bushels per acre				
Treatment	**1**	**2**	**3**	**4**	**Avg.**
4 week cultivation	24.2	22.6	13.2	17.8	19.5
5 week cultivation	21.6	19.8	18.3	16.7	19.1
6 week cultivation	18.7	23.5	13.6	17.9	18.4
7 week cultivation	16.9	19.4	16.8	14.1	16.8

Table 51. Yields from the Summerfallow Management Study – 1968-1970.

	Average yield in bushels per acre			
Cultivation interval	**1968**	**1969**	**1970**	**3-Year Avg.**
4 weeks	38.8	43.0	19.5	33.8
5 weeks	37.4	43.0	19.1	33.2
6 weeks	38.6	40.3	18.4	32.4
7 weeks	39.5	38.0	16.8	31.4