Soil Series 84

A Report on Field Research in Soils

(A compilation of recent experimental results by personnel of the Department of Soil Science, Extension Specialists and Agronomists at St. Paul and the Branch Stations at Crookston, Grand Rapids, Lamberton, Morris, Rosemount, and Waseca).

Department of Soil Science

University of Minnesota

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Some of the results herein reported are from experiments carried on during 1968 only, and should not be regarded as the results obtained over a number of years. The investigations are those of a more prectical nature, and do not include some of the more theoretical problems presently under study in greenhouse and in the laboratory. Because these are largely results of one year they should not be considered as conclusive and are not for further publication.

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Some Climatological Notes, Fall 1968

by Donald G. Baker (Feb. 1969)

A. Summary of the 1968 Soil Water Survey

The Fall, 1968, soil water results are shown in table 1. Unlike several previous years, and 1967 in particular, the soils almost everywhere contain an abundance of water. With an average available water content of around 9 inches the soils are thus capable of sustaining crops from planting in mid-May to the end of June without additional precipitation.

The relatively high soil moisture reserves do pose two possible handicaps over more normal seasons. One is that due to such high soil water reserves the soil cannot absorb as much spring runoff and precipitation as usual. And this leads to a greater possibility of spring flooding. A second handicap is that with more water in the soil than usual the soils will be slower to warm unless there is a higher than usual evaporation rate this spring.

There were a number of sites where the soils were simply too wet to obtain samples. This, of course, was a direct result of the most unusual precipitation distribution, particularly at the end of the growing season. Figure 1 contrasts the 1968 season with the average for 1961-67 at Lamberton. The difference begins in the early spring with the very low water reserves. And then with hardly a pause the reserves continue to increase even through the growing season, which is just the opposite of the normal course of events. No measurements were made after September 13, 1968, but the soil water undoubtedly continued to increase as shown by the dashed line.

Table 1. Fall, 1968, soil water survey results (from sampling to a depth of 5 feet).

County	Nearby Town	Operator	Soil Type	Crop	Total Available Water, Inches	% of Possible Water	Inches Difference Fall '68-Fall '67	Water Used In Season, Inches	
Big Stone	Ortonville	H.Dimberg	Barnes c.l.	Small grain	2.6	22.8	+ 1.8	16.9 (4/12-11/6)	OG
Big Stone	Beardsley	Wright	Barnes si.l.	Alfalfa	0.5	4.9	+ 0.1	19.1 (4/12-11/6)	OG
Chippewa	Milan (Big Bend)	H.Olson	Rothsay si.l.	Small grain	7.3	50.7	+ 2.6	22.8 (4/12-11/6)	OG
Chippewa	Montevideo	Sederstrom	Barnes	Corn	6.0	45.8	+ 5.4	19.2 (4/12-11/6)	OG
Dodge	Dodge Center	Sutherland	Kasson si.l.	Corn	8.0	76.1	+ 4.8	21.2 (4/30-12/4)	SCS
Jackson	Lakefield	Pietz	Primghar si. c.l.	Corn	Too wet to sample	-	-	-	GH
Kandiyohi	Pennock	Giese	Clarion si.l.	Soil bank	7.8	57.8	+ 7.6	28.0* (4/11-11/6)	OG
Kandiyohi	Kandiyohi	Arvidson	Nicollet	Corn	Too wet to sample	-	-	-	OG
Lac Qui Parle	Bellingham	Glasser	Aastad si.c.l.	Small grain	9.7	59.1	+ 2.8	24.1* (4/12-11/6)	OG
Lac Qui Parle	Lac Qui Parle	Heimdahl	Rothsay si.l.	Corn	5.3	39.0	+ 4.3	22.6* (4/12-11/6)	OG

Table 1. (Continued)

Lac Qui Parle	Marietta	Aebli	Rothsay si.l.	Corn	9.3	72.1	+ 5.0	20.4 (4/12-11/6)	OG
Lac Qui Parle	Dawson	Nelson	Aastad si.c.l.	Corn	9.8	90.7	+ 3.6	20.6 (4/12-11/6)	OG
Lincoln	Arco	Madsen	Barnes c.l.	Corn	6.3	49.2	+ 5.2	33.4* (4/13-11/4)	GH
Lincoln	Porter	Boulton	Barnes si.c.	Flax	8.9	69.0	+ 5.2	19.4 (4/13-11/4)	GH
Lyon	Marshall	Boerboom	Vallers	Corn	Too wet to sample	-	-	-	GH
Murray	Slayton	Larson	Barnes si. c.l.	-	Too wet to sample	-	-	-	GH
Mille Lacs	Milaca	Nichols	Mora si.l.	Hay	11.8	118.0	+ 8.3	28.4* (4/25-11/8)	SCS
Nobles	Fulda	Horn	Primghar	Corn	Too wet to sample	-	-	-	GH
Polk	Crookston	U of M	Hegne si.c.l.	Corn (#1)	9.8	57.3	+ 8.1	19.6 (5/17-10/31)	OS
Polk	Crookston	U of M	Hegne si.c.l.	Wheat (#4)	6.9	40.3	+ 6.3	19.0 (5/20-10/31)	OS
Polk	Crookston	U of M	Hegne si.c.l.	Sugarbeets (#5)	7.9	46.2	+ 0.2	20.0 (6/5-10/31)	OS
Pipestone	Pipestone	Bucher	Kranzburg si.l.	Corn	9.9	73.3	+ 8.6	25.7* (4/15-11/12)	GH

Table 1. (Continued)

Ramsey	St. Paul	U of M	Waukegan si.l.	Sod	12.1	147.5	+12.1	23.7* (5/2-11/8)	DGB
Ramsey	St. Paul	U of M	Waukegan si.l.	Soy	12.8	156.0	+12.8	25.4* (5/2-11/8)	DGB
Ramsey	St. Paul	U of M	Waukegan si.l.	Bare of vegetation	10.8	131.7	+10.8	25.5* (5/2-11/8)	DGB
Redwood	Belview	Anderson	Nicollet c.l.	Corn	Too wet to sample	-	-	-	GH
Redwood	Lamberton	U of M	Webster c.l.	Corn	3.5	35.3	+ 0.4	19.8 (3/26-9/13)	WN
					Too wet to sample after Sept. 13				
Redwood	Wabasso	Kuehn	Nicollet	Corn	7.0	53.8	+ 6.3	25.6* (4/15-11/4)	GH
Redwood	Morgan	Prokosch	Nicollet c.l.	-	Too wet to sample	-	-	-	GH
Rock	Hardwick	Hengeveld	Kranzburg si.l.	Corn	13.0	92.9	+ 6.0	21.1 (4/15-11/12)	GH
Sibley	Winthrop	Woods	Nicollet c.l.	Corn	Too wet to sample	-	-	- (5/2-11/13)	SCS
Stevens	Morris	U of M	Aastad	Corn	3.4	27.0	+ 2.1	18.3 (4/11-11/6)	OG
Swift	Danvers	Stubbs	Barnes c.l.	Small grain	4.8	33.6	+ 3.7	21.2 (4/11-11/6)	OG
Swift	Murdock	Tucker	Vallers si.c.	Soybeans	15.4	106.2	+ 6.0	(4/11-11/6)	OG

Table 1. (Continued)

Todd	Long Prairie	C.Hartung	Blowers l. f.s.	Oats	8.3	96.5	-	13.8 (5/21-9/30)	AF
Wabasha	Kellogg	Zickrick	Fayette si.l.	Corn	13.5	93.1	+ 5.6	34.1* (4/13-11/4)	SCS
Watonwan	Butterfield	Hanson	Nicollet c.l.	-	Too wet to sample	-	-	-	SCS
Watonwan	Lewisville	Tilney	Kingston si.l.	Corn	11.1	91.7	+ 6.4	(4/16-11/26)	SCS
Watonwan	Lewisville	Tilney	Medelia si.l.	Sugarbeets	6.6	48.9	+ 0.5	(4/16-11/26)	SCS
Yellow Medicine	Granite Falls	Velde	Aastad si.c.l.	Corn	8.8	58.3	+ 4.7	22.3 (4/16-11/8)	GH

*Excessive seasonal precipitation, some of which was lost directly as runoff, gives a false figure as to the quantity of water consumed by the crop.

Dr. Olaf Soine of the Northwest Experiment Station at Crookston has obtained similar data under various crops that he sampled during the 1968 season. Data from his corn plot are shown in figure 2. Unlike much of the state the northwest did not receive the heavy autumn rains (see figure 3) but did receive a good snowfall and above average spring precipitation. The result was an earlier increase in soil water reserves. Like Lamberton the Crookston soil water reservoir continued to increase during the growing season--a rare event indeed.

Figure 3 shows the September and October precipitation totals which explain the late summer and autumn soil reservoir increases. A high of 18 inches was recorded at Tracy with secondary highs in east-central and south-central Minnesota.

Table 2 lists the average fall soil water content at the various sampling sites.

Fig. 1

Comparison of the 1968 soil water season at Lamberton corn plots with the 1961-67 average

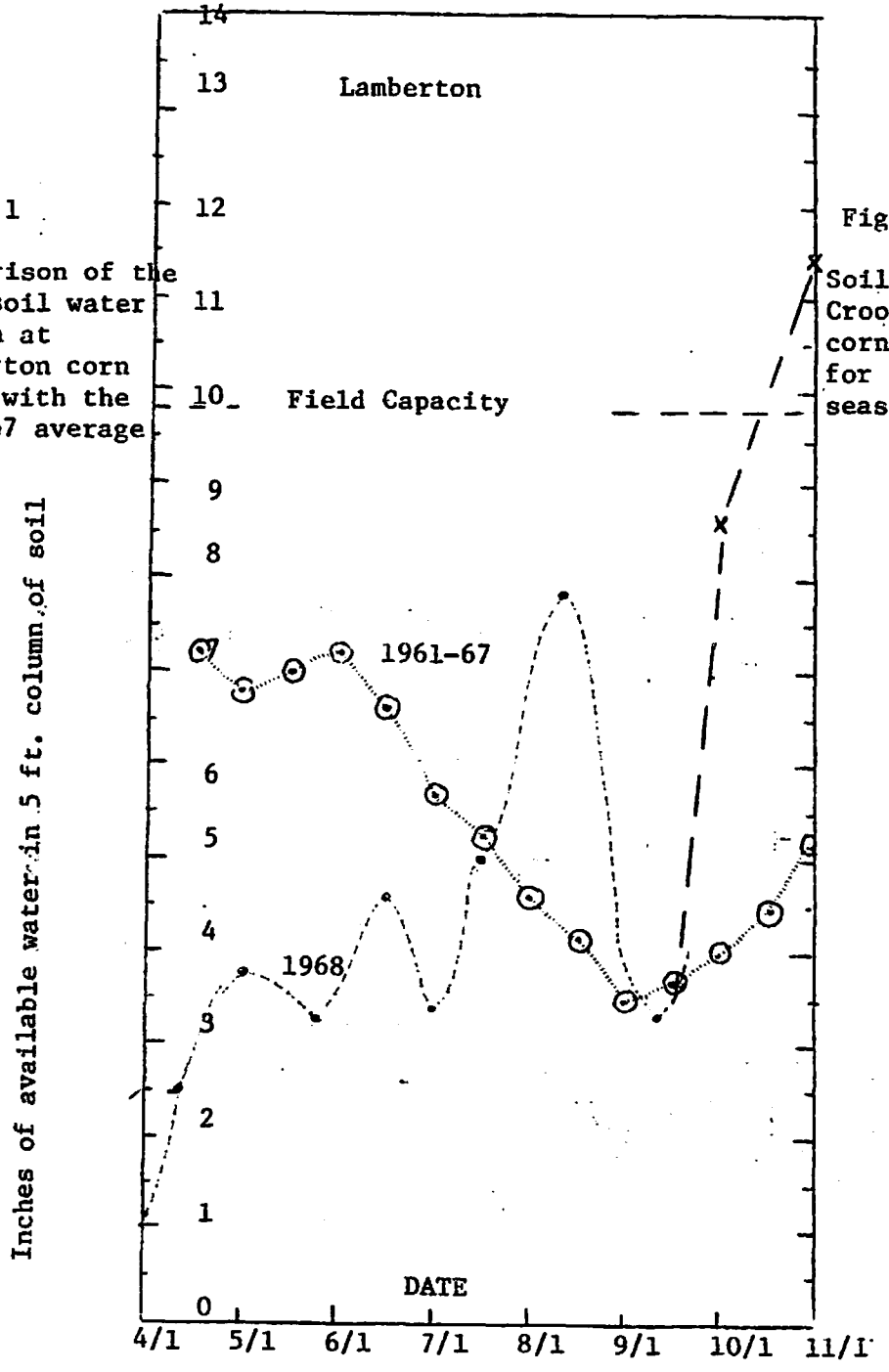
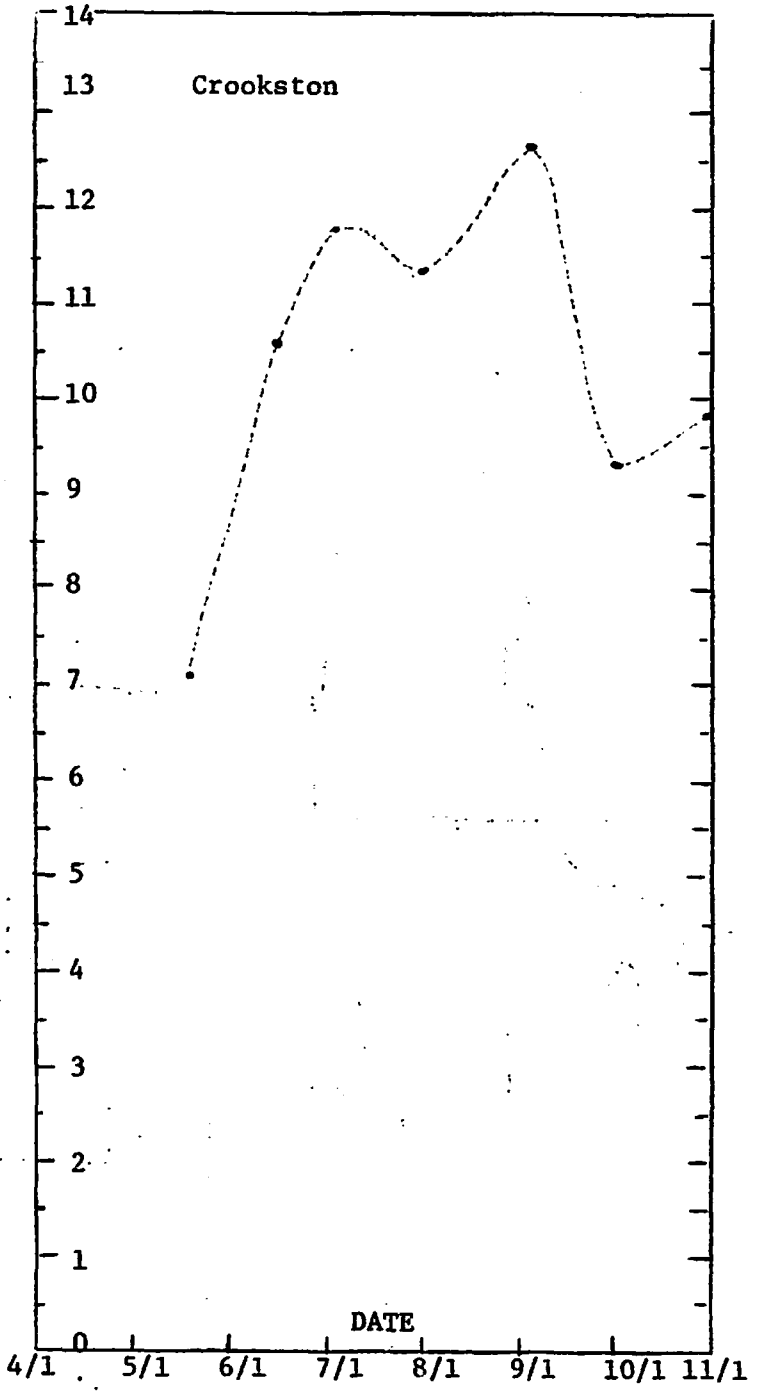


Fig. 2

Soil water at Crookston under corn in site 1 for the 1968 season.



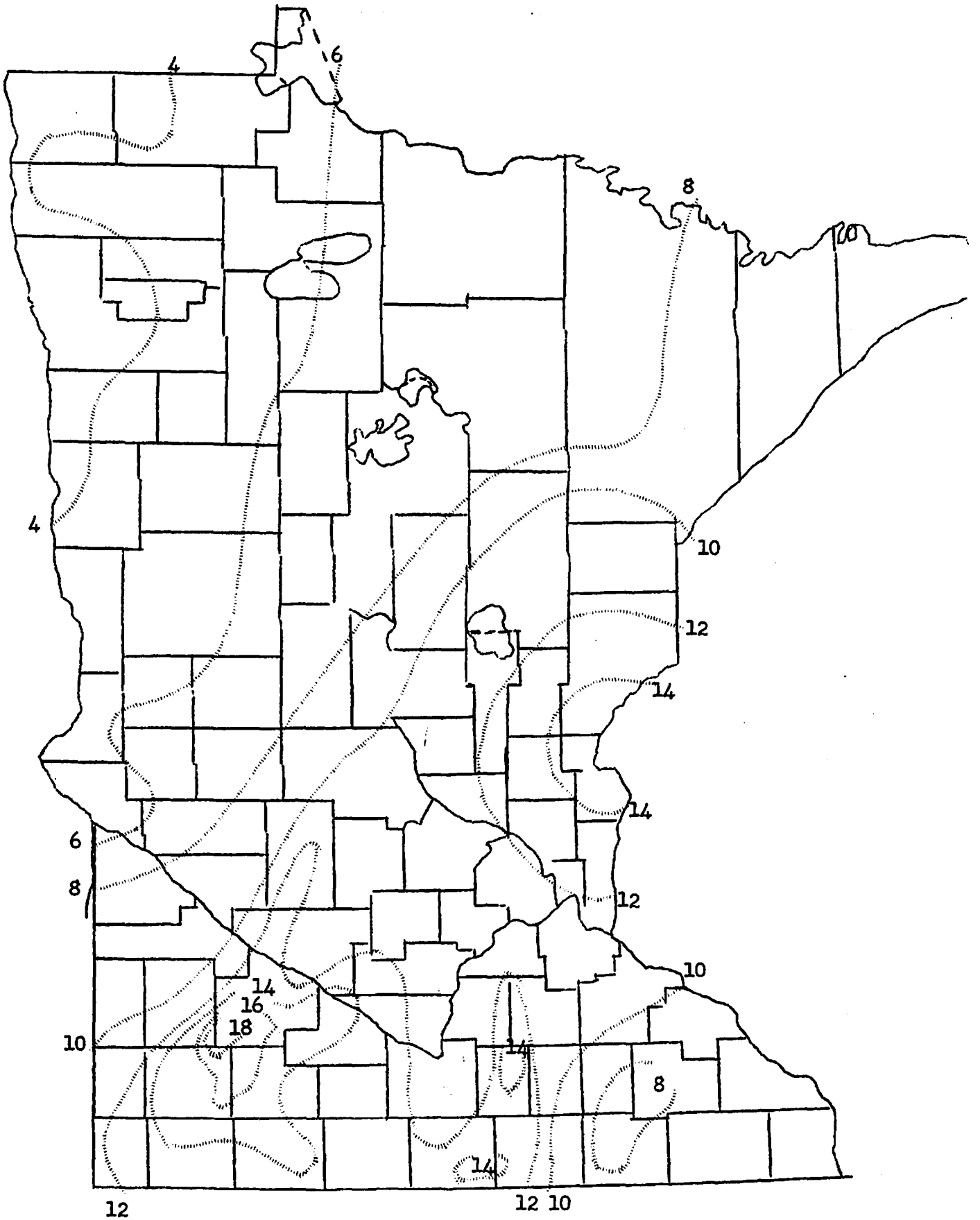


Fig. 3. Total September and October Precipitation for 1968.

Prepared by Weather Bureau Office of Climatology.

Table 2. Average fall soil water reserves in inches of available water in a 5 foot column of soil

County	Nearby Town	Ave. Water Content (in.)	Years of Data
Big Stone	Ortonville	1.7	3 (1966-68)
"	Beardsley	0.3	3 (1966-68)
Chippewa	Milan (Big Bend)	6.5	6 (1962-68) '65 msg
"	Montevideo	3.7	4 (1965-68)
Dodge	Dodge Center	4.8	9 (1960-68)
Jackson	Lakefield	3.7	1 (1967)
Kandiyohi	Pennock	2.3	5 (1963-68) '65 msg
"	Kandiyohi	1.4	4 (1963-68) '65 msg
Lac Qui Parle	Bellingham	9.1	6 (1962-68) '65 msg
"	Lac Qui Parle	3.1	4 (1965-68)
"	Marietta	6.2	6 (1962-68) '65 msg
"	Dawson	6.8	5 (1963-68) '65 msg
Lincoln	Asco	3.3	6 (1963-68)
"	Porter	5.1	6 (1963-68)
Lyon	Marshall	5.7	4 (1963-67) '66,'68 msg
Murray	Slayton	1.1	1 (1967) '68 msg
Mille Lacs	Milaca	6.7	8 (1961-68)
Nobles	Fulda	3.1	1 (1967)
Polk	Crookston	5.6 (Plot 1)	8 (1961-68)
"	"	3.7 (Plot 4)	3 (1964-68) '66 msg
"	"	7.9 (Plot 5)	4 (1964-68) '66 msg
"	"	5.8 (Plot 6)	3 (1964-66) '67,'68 msg
"	"	2.9 (Plot 7)	2 (1966-67) '68 msg
Pipestone	Pipestone	5.6	2 (1967-68)

Table 2. (Continued)

County	Nearby Town	Ave. Water Content (In.)	Years of Data
Ramsey	St. Paul	6.9 (Sod Plot)	4 (1965-68)
"	"	6.4 (Soy Plot)	6 (1962-68) '64, '67 msg
"	"	8.3 (Base Plot)	3 (1965-68) '67 msg
Redwood	Belview	5.5	6 (1962-68) '68 msg
"	Lamberton	5.2	7 (1961-68) '68 msg
"	Morgan	7.6	3 (1965-68) '68 msg
"	Wabasso	5.2	5 (1963-68)
Rock	Hardwick	10.0	2 (1967-68)
Sibley	Winthrop	8.5	7 (1961-68) '68 msg
Stevens	Morris	2.3	2 (1967-68)
Swift	Danvers	4.6	5 (1963-68)
"	Murdock	10.1	5 (1963-68)
Todd	Long Prairie	8.3	1 (1968)
Watonwan	Butterfield	7.4	7 (1961-68) '68 msg
"	Lewisville (Mad)	7.6	3 (1966-68)
"	Lewisville (King)	8.1	3 (1966-68)
Wabasha	Kellogg	9.5	8 (1961-68)
Yellow Medicine	Granite Falls	9.3	6 (1963-68)

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Weather Summary - 1968
Southwest Experiment Station, Lamberton

Wallace W. Nelson, Supt.

Month	Period	Precipitation Inches	Air Temperature Ave.Max.	Air Temperature Ave.Min.	Soil Temperature Ave.2"	Soil Temperature Ave.12"
January	1-31	0.45	27	7	27	29
February	1-29	0.08	27	5	25	26
March	1-31	0.88	57	26	37	34
April	1-10	2.21	58	33	42	39
	11-20	1.32	69	43	51	45
	21-30	0.92	65	38	50	46
	Total	4.45				
May	1-10	0.47	69	41	54	51
	11-20	0.55	68	40	56	51
	21-31	0.68	68	56	57	52
	Total	1.70				
June	1-10	1.87	91	63	71	61
	11-20	0.25	82	53	70	64
	21-30	1.84	80	54	68	63
	Total	3.96				
July	1-10	0.71	82	56	73	65
	11-20	3.32	89	67	80	71
	21-31	5.60	81	59	80	69
	Total	9.63				
August	1-10	1.45	85	62	74	69
	11-20	0.28	82	55	71	67
	21-31	0.30	81	59	74	68
	Total	2.03				
September	1-10	1.61	73	49	64	63
	11-20	1.63	75	54	63	62
	21-30	4.42	72	47	60	59
	Total	7.66				
October	1-31	7.88	63	40	50	52
November	1-30	0.72	42	27	37	41
December	1-31	1.46	24	9	30	34
(Growing Season) April 1-September 20		29.43	76	51	64	59
(Annual) January 1-December 31		40.90	58	35	49	48

Method of Corn Planting Study

Lancaster, Wisconsin - University of Wisconsin Experiment Farm

Arthur Peterson, James Swan and William Paulson, Supt.

The following field experiment was conducted near Lancaster, Wisconsin during the 1968 growing season.

Soil: Fayette silt loam, 6 to 8% south slope, previously in corn

Fertilizer: 250 to 300 lbs/acre of 6-24-24

100 lbs of N as anhydrous ammonia

Population planted 22,000 plants/acre; depth of planting 1½ to 2 inches on wheeltrack planting and 2 to 2½ inches on coulter planting.

Corn: Wisc. 601, 110 days

Experimental design for final yield - 4 x 4 latin square (plot size was 18 x 50 feet with alleys of 15 to 50 feet). Soil temperature and early growth cannot be analyzed in the latin square design.

Treatments:
1 Plow-disk-harrow
2 Plow
3 Chisel
4 None

Tillage and planting on May 8. All treatments were chisel plowed in early April 1968.

Yield determinations were made on the wheeltrack treatment only.

Each plot consisted of six 36-inch rows 50 feet long. Each plot was divided into three 2-row subplots with the following types of planting: coulter, wheeltrack, and combined wheeltrack and coulter.

Soil temperature measurements

Soil temperature was measured on the following treatments:

1 Plow-disk-harrow (coulter)

2 Plow (coulter)

2 Plow (wheeltrack)

4 None (coulter)

No temperature measurements were made on the chisel treatment. One set of thermocouples was placed in a chemically killed sod plot.

Soil temperatures were measured by thermocouples on 2 reps (only one rep was part of the 4 x 4 latin square). Thermocouples were placed at the 3-inch depth in the row. Four couples were used in parallel in each treatment.

Final stand and yield

Treatments	Population at harvest plants/acre	Yield bu/acre at 15.5% moisture
Plow-disk-harrow	21,200 a	130 a
Plow	17,500 b	128 a
Chisel	19,500 a	126 ab
None	19,400 a	121 b

Significant at 5% level by Duncans New Multiple Range test.
Above yield and stand measurements were taken from the wheeltrack treatments.

1968 Weather Record at Lancaster

	Air Temperature				Precipitation	
Month	Avg.	Max.	Min.	Departure from Normal	Inches	Departure from normal Inches
May	55.0°F	79°F	32°F	-4.1°F	2.42	-1.43
June	68.2	89	49	-0.3	7.47	+2.54
July	70.4	89	48	-3.0	5.51	+1.78
August	70.1	91	50	-1.6	3.94	+0.11
September	60.8	83	38	-2.5	4.12	+0.44

Early growth was measured on June 17 on two reps not included in the 4 x 4 latin square. Later infiltration measurements were taken on these reps and final yields could not be taken.

Treatment	Early Growth
Plow-disk-harrow	42 gms
Plow	32
Chisel	33
None	31
(Sod)	(12)

Conclusions:

1) Differences in early growth on the 2 reps measured were not significantly different at the 10 percent level for either the 4 tillage treatments or the 3 types of planting. (The sod treatment was not included in the analysis.)

2) Compared to the plow-disk-harrow (coulter) treatment, small reductions in soil temperature were measured for coulter planting on the plow and none treatments. Small increases in soil temperature were measured for the plow (wheeltrack) treatment. On the sod (coulter) treatment decreases in soil temperature of up to 5°F were measured. Early growth was greatly reduced on the sod treatment.

3) Final yields were significantly lower at the 5 percent level on the "none" tillage treatment. Similar results were reported from Ohio. Research in Ohio in which conventional and "no tillage" systems were compared, indicated yields decreased on "no tillage" trials on crusting soils with 5 percent cover. There was no difference in yields at 50 percent cover and yields increased with "no tillage" at 90 and 100 percent cover. N. Rask, G. B. Triplett, D. M. VanDoren, Jr. (Ohio Report, January-February 1967, page 14, 15). Plant populations varied on the tillage treatments and were significantly lower on the wheeltrack-plow treatment.

4) Average air temperature in May was 4°F below the normal. Rainfall was above normal in June and July.

Soil temperatures at three-inch depth under designated tillage treatments

(average of 2 reps - only one rep was in the 4 x 4 latin square)

Dates	Plow-Disk-Harrow (coulter) (conventional)			Difference in Soil Temperature for NONE(coulter)-conv.			Difference in Soil Temperature for Plow(wheeltrack)-conv.			Difference in Soil Temperature for Plow(coulter)-conv.			Difference in Soil Temperature for Sod(coulter)-conv.		
	AM °F	PM °F	AVG °F	AM °F	PM °F	AVG °F	AM °F	PM °F	AVG °F	AM °F	PM °F	AVG °F	AM °F	PM °F	AVG °F
May 9-11	48.7	60.8	54.8	+0.4	-0.3	+0.1	-0.4	+1.8	+0.7	+0.1	+0.1	+0.1	-	-	-
12-18	53.9	62.0	58.0	-0.3	-0.1	-0.2	-0.1	+1.3	+0.6	-0.3	-0.1	-0.2	-0.4	-2.8	-1.6
19-25	53.1	61.5	57.0	-0.3	-0.7	-0.5	-0.3	+0.9	+0.3	-0.5	-0.2	-0.4	+0.3	-2.7	-1.2
May 26 June 1	55.3	62.0	58.7	-0.1	-0.4	-0.3	+0.1	+0.4	+0.3	-0.1	-0.3	-0.2	+0.3	-1.4	-0.6
June 2-8	66.3	79.4	72.7	-0.8	-1.4	-1.1	+0.5	+1.3	+0.9	-0.3	-0.6	-0.5	-3.0	-7.5	-5.2
9-15	66.7	73.4	70.1	-0.3	-0.8	-0.6	+0.1	0	+0.1	-0.1	-0.6	-0.4	+0.2	-0.9	-0.4

Note - Read to nearest 0.5°F so differences less than 0.5°F are within the error of measurement. Average readings are for days with both AM and PM readings.

AM readings taken 0900 DST ± 2 hours
PM readings taken 2000 DST ± 2 hours

Land Forming Experiment
Northwest Experiment Station, Crookston - 1968

Olaf C. Soine, Soil Scientist

This experiment was laid out in the fall of 1965 to study the effect of 5 different methods of land forming on crop yields in a rotation of corn, wheat, barley, and alfalfa. A fertilizer trial was included in the experiment.

The wheat yields in 1968 were good, but lower than those of 1967. The lowest yields were on the .02 and .01 percent and level treatments plots, partly because the soil was most disturbed here during the initial land forming. The 40+40+20 fertilizer gave the largest yield increases on all treatments in 1968 and also for the 3-year averages.

The barley yields were average and the 40+40+20 fertilizer increased the yields from 10 to 16 bu. on all treatments over the check plot. The 0+40+20 fertilizer gave 4-6 bu. increases over the 0+40+0 application in 1968. In the 3-year averages, the 40+40+20 fertilizer showed 20 and 17 bu. increases over the check on the .02 and .01 percent slope treatments, respectively.

The 1968 corn yields were very high and there were very little differences between the fertilizer applications.

There were no alfalfa yields in 1966 and the drought of 1967 had a severe effect on the new seedings. On the "Land Smoothing" plots the alfalfa stands were too poor to harvest. The yields were variable on all treatments in 1958 and no definite trends were evident from the various fertilizer applications.

Effect of 5 different methods of "Land Forming" on the yield of corn, wheat, barley and alfalfa.

Land Forming	Fertilizer	Corn*		Wheat		Barley		Alfalfa**	
		bu/acre						lbs/acre	
Treatments	lbs/acre	1968	Av 1966-68	1968	Av 1966-68	1968	Av 1966-68	1968	Av 1967-68
	0+0+0	102	83	41	38	57	51	4670	3807
CHECK	0+40+0	100	83	41	37	63	55	4927	3855
	0+40+20	105	79	40	36	58	48	4402	3593
	40+40+20	111	87	49	39	67	57	4015	3378
	0+0+0	107	84	36	35	52	41	4417	3911
.02%	0+40+0	100	81	33	35	56	45	5116	4386
SLOPE	0+40+20	105	77	30	34	62	49	5353	4410
	40+40+20	100	86	43	40	68	61	4474	4088
	0+0+0	100	75	32	32	61	43	4242	3610
.01%	0+40+0	93	74	30	31	61	42	5255	4012
SLOPE	0+40+20	93	78	35	34	62	47	5903	4363
	40+40+20	96	81	48	40	72	60	4599	4126
	0+0+0	100	82	33	35	56	53	2689	3284
LEVEL	0+40+0	100	86	35	35	56	56	2784	3040
	0+40+20	90	80	36	34	62	50	2025	2764
	40+40+20	102	88	46	39	68	61	2899	2974
	0+0+0	100	87	41	38	57	56	2623	
LAND	0+40+0	104	87	47	39	57	52	2071	
SMOOTHING	0+40+20	93	85	41	39	61	61	2033	
	40+40+20	97	83	45	39	74	62	2044	

*15.5% Moisture, 22-inch rows

**15.5% Moisture, 2 cuttings

Field Experiments with Asphalt Soil Barriers (22" deep) on Sandy Soils in Sherburne County in 1968

George R. Blake

Precipitation Record
Elk River Experiment Station
1968

June date	Ppt. Inches	July date	Ppt. Inches	August date	Ppt. Inches	September date	Ppt. Inches
14	1/	1	.21	5	.05	3	.49
17	2/	13	.63	7	.16	4	.21
18	1/	15	1.87	8	2.92	9	.37
20	1/	17	.07	16	.26	16	.12
21	0.73	18	.13	19	.06	17	1.52
24	TR	22	Tr	26	.15	18	.67
26	0.40	26	Tr			19	.11
27	TR	29	.07			20	.02
		31	.81				

1/ Amount unknown. Raingauge installed June 21.

2/ Rain over weekend preceding 17th unknown amount.

TR indicates trace, less than 0.01 inch.

Asphalt Barriers
1968 Potato Yields
Elk River Experiment Field

Item	Irrigated Barrier	Irrigated No Barrier	Not Irrigated Barrier	Not Irrigated No Barrier	Significance
Yield #1 cwt/A	218.7	203.6	124.5	85.8	I*
Knobs cwt/A	8.0	6.6	34.1	43.8	I*
Sp. Gravity	1.0070	1.0773	1.0742	1.0727	NS

Asphalt Barriers
1968 Snap Beans Yield, lbs/A
Elk River Experimental Field

Size	Not Irrigated No Barrier	Not Irrigated Barrier	Irrigated No Barrier	Irrigated Barrier	Statistical Significance
1	116.7	196.0	264.3	204.9	NS
2	249.9	201.7	392.6	339.4	NS
3	300.0	313.5	508.1	563.2	NS
4	847.0	970.5	1240.6	1247.0	NS
5	1958.4	2071.4	2890.1	2510.0	NS
5	2008.6	3268.7	2841.0	2407.2	NS
1 + 2	366.5	397.7	656.9	544.3	NS
3,4 + 5	3105.3	3355.5	4638.8	4320.1	NS
1,2 + 6	2375.1	3666.4	3497.9	2951.5	Irr. x B*
Total	5480.4	7021.9	8137.0	7271.6	NS

Asphalt Barrier Experiment
1968 Sweet Corn Data 1/
Elk River Satellite Farm

	Asphalt Barrier Application Rate (gal/A)			
	0	800	1100	1600
Corn height, inches	47.6a	52.0b	52.2b	52.9b
Weight of ears, lbs	7,620a	8,805ab	9,066bc	10,112c
Number of ears, lbs	21,390	21,353	21,698	24,012
Immature ears, lbs	1,010	908	968	1,127
No. immature ears	6,843	5,999	6,244	6,743
Gross wt - immature	6,610a	7,897b	8,098b	8,985b
Gross No. - immature	14,547	15,355	15,455	17,270
Mean wt/ear,lbs	0.46	0.48	0.52	0.52
Ears with smut, lbs	156a	584b	873b	857b
No. ears w/smut	245a	871b	1180b	1298b
Ditto 99% lebel	245a	871ab	1180b	1298b
Missing kernels, rows 2/	7.1	7.1	7.2	7.3
Filled ear ends 2/	5.4	5.7	5.9	6.0
Overall visual quality 2/	5.7	6.4	6.4	6.6

1/ Values are on acre basis except as noted. Values with like letters are statistically equal; with unlike letters different by DMR test at 95% probability level unless noted. Values without letters not different at 95% probability level.

2/ Mean of arbitrary 1 to 10 scale rating on random subsample from each plot where 10 was best, 1 poorest.

1968 Sweet Corn Yields with Asphalt Barriers
Elk River Experimental Field

	Irrigated		Not Irrigated		Statistical
	Barrier	No Barrier	Barrier	No Barrier	Significance[2]
Weight lbs./A.	14,932	13,768	13,225	11,269	Barrier*
No. ears/A	24,682	23,386	22,841	20,896	NS
Quality rating[1]	7.14	7.52	7.10	6.77	NS
Weight/ear	0.61	0.59	0.60	0.54	Barrier*, Irrigation*
No. ears smut/ total ears	0.028	0.020	0.018	0.024	NS
Filled ends of ears[1]	5.88	6.09	6.21	5.76	NS
Missing rows & kernels	8.55	7.87	8.19	7.83	Barrier*

[1]Overall quality, filled ear tips, and missing rows or kernels: weighted rating based on examination of about 36 randomly selected ears per plot separated to good, medium and poor.
Values are derived from good = 10, medium = 6, and poor = 2.

[2]Single asterisk is 95% level; NS means difference not significant. None of the barrier x irrigation interactions was significant.

Date of Irrigation
Asphalt Barrier
Elk River Experimental Field
Data Book 41
1968

Water was added at the rate of about 0.4 to 0.5 inches per hour. This varied slightly depending on other irrigation systems using the source. Amounts added are nominal being approximated by placing cans at random on plot being irrigated.

Date	Setting	Amount in inches
July 2	West half	1
July 3	East half	1
July 11	Both halves	1
July 25	Both	1
July 30	Both	.75
August 5	Both	1
August 15	Both	.9
August 21	Both	.9

Water Content
30 inch free darining profile
Hubbard Loamy Coarse Sand
Elk River, Minnesota
1968

Depth in inches	Map Location M5	K4	M3	L2	Mean
		Water Content by Weight			
0-3	14.73	15.06	12.34	13.16	13.82
3-6	12.16	10.87	8.65	11.71	10.85
6-9	6.88	7.55	6.04	14.34	8.70
9-12	5.71	6.11	5.95	11.67	7.36
12-15	8.63	6.31	6.49	17.71	9.79
15-18	8.78	7.02	13.14	16.44	11.35
18-21	14.26	11.00	11.27	15.56	13.02
21-24	13.52	10.39	15.24	15.48	12.93
24-27	13.46	10.29	14.37	13.52	12.91
27-30		9.64		13.42	11.53
		Water Content by Volume			
0-3	18.71	21.84	18.63	17.63	19.20
3-6	15.44	15.76	13.06	15.69	14.99
6-9	9.29	11.33	9.12	19.26	12.25
9-12	8.28	9.78	9.40	16.92	11.20
12-15	13.81	11.23	10.64	27.10	15.70
15-18	14.05	11.93	21.68	25.15	18.20
18-21	23.53	18.15	18.60	24.90	21.30
21-24	22.31	17.14	25.15	25.54	22.54
24-27	22.21	16.98	23.71	22.31	21.30
27-30		15.91		22.14	19.03

Water Content
30 inch free draining profile
Zimmerman fine sand 1/
Elk River Satellite Station, Minnesota
1968

Depth in inches	Location A	Location B	Mean
	Water Content by Weight		
0-4	11.85	11.69	11.77
4-8	13.47	13.44	13.46
8-12	12.81	15.91	14.36
12-16	14.54	17.58	16.06
16-20	19.52	20.21	19.87
20-24	20.78	21.16	20.97
24-28	21.95	20.50	21.23
28-30	20.89	23.15	22.02
	Water Content by Volume		
0-4	18.37	18.12	18.25
4-8	20.88	20.83	20.86
8-12	19.86	24.66	22.26
12-16	22.54	27.25	24.90
16-20	30.26	31.33	30.80
20-24	32.21	32.79	32.50
24-28	34.02	31.78	32.90
28-30	32.38	35.88	34.13

1/ Composited soil 8-30 inches was used since texture and density do not vary in this soil.

Soil Pesticide Residue Studies

Russell S. Adams, Jr.

Simulated atrazine residue plots were continued at Lamberton, Morris, and Waseca in 1968. Again "residue" rates of atrazine were incorporated in the spring prior to seeding of oats and soybeans. Yields for 1968 and averages for the three year study are shown in Table 1. Field plots in 1968 were subject to severe extremes of weather. Oat plots at Lamberton and Waseca experienced hail, winds and late freezes. These weather factors apparently were additive to the atrazine injury as the 1/4 lb rate of atrazine at both locations was sufficient to reduce oats stands by more than 50%. At Morris between 1/4 and 1/2 lb was necessary for 50% stand reduction. Recovery was good at Lamberton and oat yields were not appreciably affected by 1/2 lb of atrazine at Lamberton or at Morris. Between 1/2 and 1 lb/A was required at all locations to reduce yields by 50%. Considering a 20% yield loss as severe, approximately 55% reduction in stand can be tolerated when normal recovery is taken into account. In the three year study approximately 0.6 lb/A of atrazine was required to produce 55% reduction in stand.

The season was such that severe atrazine injury occurred in soybeans at the 1/2 and 1 lb/A rates at Morris. Little affect on stand was observed at the other locations. Weeds in the row were a problem at both Lamberton and Morris. Soybeans have little capacity to compete with weeds. Only a few in the row can reduce yields. In 1968, grasses seriously infested the rows in plots where only simulated atrazine "residues" treatments were applied. A small amount of atrazine resulted in some weed control which offset the atrazine injury where no other herbicide treatment was used. Wherever weed free checks were successfully established yields in those checks have generally been as high or higher than the highest yielding chemical treatments.

Table 1. Stand and Yield of Oats and Soybeans When Atrazine Was Incorporated

Atrazine treatment lb/A	Lamberton Stand, % Control 1968	Lamberton Stand, % Control 3 year Avg.	Lamberton Yield, bu/A 1968	Lamberton Yield, bu/A 3 year Avg.	Morris Stand, % Control 1968	Morris Stand, % Control 3 year Avg.	Morris Yield, bu/A 1968	Morris Yield, bu/A 3 year Avg.	Waseca Stand, % Control 1968	Waseca Stand, % Control 3 year Avg.	Waseca Yield, bu/A 1968	Waseca Yield, bu/A 3 year Avg.
Lodi Oats, average 5 replications												
0	100	100	32.8	44.5	100	100	75.8	77.5	100	100	56.4	68.2
1/4	44	73	37.6	46.0	75	78	79.9	86.8	46	66	42.6	59.5
1/2	40	56	29.3	43.7	32	48	59.6	71.8	46	47	35.5	46.7
1	30	22	16.8	23.2	17	26	28.9	52.0	17	28	17.0	34.3
1 1/2	11	18	7.5	16.1	6	17	4.2	31.7	7	15	14.8	23.5
Chippewa 64 Soybeans, average 4 replications												
0	100	100	10.2	16.1	100	100	6.2	15.2	100	100	35.6	33.8
1/4	83	85	11.0	16.0	101	101	8.4	18.5	108	105	35.3	35.1
1/2	85	88	11.1	15.9	48	84	6.4	17.2	105	100	37.5	30.7
1	80	86	11.3	14.9	43	71	2.7	14.2	90	81	33.4	28.6

Field data for 1968 and cumulative three year averages are given for the herbicide interaction plots in Table 2. In these plots atrazine was incorporated in a split plot design across plots containing no chemical, linuron (2 1/2 lb/A), CDAA (5 lb/A), amiben (3 lb/A), and trifluralin (1 lb/A). As in previous years atrazine-linuron and atrazine-amiben plots appeared to suffer the greatest physical injury. This has not been reflected in the three-year average yields because of the additional weed control obtained in all the herbicide-atrazine treatments. However, with atrazine-linuron plots 1 1/2 lb/A or less atrazine was required to reduce yields (compared to the linuron control) by 50%. All other herbicide-atrazine combinations required 1 1/2 lb/A or more atrazine to reduce yields by 50%. Consistently atrazine-trifluralin treatments gave the least reduction in yield from atrazine. Caution should be exercised in interpreting these data broadly. The soil characteristics in the plots at these three stations were similar in texture (all clay loams), organic matter content and pH. Consequently, results observed there might not be duplicated in coarse textured soils or soils low in organic matter. Furthermore, one cannot be certain that applying atrazine in "residual" amounts near the time of application of the other herbicides would give the same results as residual atrazine. Atrazine was applied in the spring in order to have a reasonably reproducible amount of atrazine from year to year. Carryover of atrazine from the previous year will vary widely, depending upon weather conditions during the growing season after application of the herbicide, and cannot be relied upon to be present in sufficient amounts to give injury.

Table 2. Yield of Chippewa 64 soybeans as affected by herbicide treatments and residue amounts of atrazine. Four replications.

"Residual" atrazine lb/A	No chemical 1968	No chemical 3 yr. Avg.	Limuron 1968	Limuron 3 yr. Avg.	CDDA 1968	CDDA 3 yr. Avg.	Amiben 1968	Amiben 3 yr. Avg.	Trifluralin 1968	Trifluralin 3 yr. Avg.
	bu/A									
					Lamberton					
0	10.2	16.4	20.0	19.4	20.8	20.7	18.0	20.2	19.6	20.4
1/4	11.0	16.0	20.5	20.3	19.5	19.9	17.4	19.0	19.6	19.7
1/2	11.1	15.9	15.3	17.4	17.4	20.3	13.1	17.7	16.8	19.5
1	11.3	14.9	12.5	13.8	13.3	16.5	9.1	16.3	15.0	18.6
					Morris					
0 (weed-free check)	17.4									
0	6.2	15.2	14.9	23.0	9.9	19.7	17.7	23.4	17.7	23.8
1/4	8.4	18.5	17.1	24.4	12.0	22.2	16.6	24.3	19.2	26.1
1/2	6.4	17.2	4.8	19.7	6.9	18.5	11.8	20.5	16.6	23.8
1	2.7	14.2	3.8	14.3	3.8	17.8	3.9	18.2	11.6	22.5
					Waseca					
0 (weed-free check)	37.8									
0	35.6	33.8	35.1	34.2	35.2	34.9	33.8	34.9	34.1	33.5
1/4	35.3	33.8	37.0	35.1	35.3	34.3	35.2	33.7	33.4	33.2
1/2	37.5	30.7	36.5	30.8	35.9	33.5	35.0	33.1	33.5	32.3
1	33.4	27.4	30.9	28.3	33.1	30.2	31.5	29.1	35.4	29.4

Lime Plots, Lamberton, 1968

J. Grava, W. W. Nelson and G. W. Randell

A field experiment was established in the fall of 1965 to study the effects of liming on crop yields, chemical composition of plant tissue and chemical properties of soils. The crops grown were: (a) Vernal alfalfa, and (b) corn (1966 and 1968) and Chippewa soybeans (1967) in a sequence. Yield, plant and soil analytical data were reported in the "Bluebooks" of Feb. 1967, pp. 69-70, and March 1968, pp. 38-41.

Since the initial lime treatments had not raised the soil pH to the desired levels additional amounts were applied in spring of 1968 and worked in soil by disking (corn-soybeans series), or disking and plowing (alfalfa series). Alfalfa was seeded in 1968, stand established but no yields were obtained.

Corn was grown in 30-inch rows; population: 21,000 plants/A; herbicide: Ramrod; all plots received 115+135+22 lb./A of plant nutrients, expressed as N, P_2O_5 and K_2O.

Corn yield and moisture content were not affected by lime treatments (Table 1). The first increment of lime increased the magnesium and copper contents, and decreased the manganese content of sixth corn leaf at silking (Table 2).

Table 1. Yield and Moisture Content of Corn, Lamberton Lime Plots, 1968.

Rate of Lime To./Acre	Corn Yield Bu./Acre	Moisture %
0	148	37.6
3*	144	38.4
6*	156	37.6
Significance	N.S.	N.S.
CV	6	3

* 3 or 6 tons/A. applied in fall of 1965 and again in spring of 1968.

Table 2. Chemical Composition of Sixth Corn Leaf at Silking, Lamberton Lime Plots, 1968.

Lime Treatment To./acre	P	K	Ca	Mg	Zn	Cu	Mo	Mn	B	Fe	Sr
	Percent in Dry Matter				Parts per million in Dry Matter						
0	.28	1.96	.67	.53a	17	6a	.95	36b	7	131	21
3	.27	1.91	.67	.61b	23	8b	.99	32a	7	155	23
6	.28	1.81	.69	.62b	19	7ab	1.1	32a	7	144	24
Significance	N.S.	N.S.	N.S.	**	N.S.	*	N.S.	*	N.S.	N.S.	N.S.
CV	6	6	6	6	26	15	14	6	10	33	8

FERTILIZER AND LIME TRIALS AT PIERZ, MORRISON CO., MINNESOTA 1968

C. J. Overdahl, G. W. Randall

This experiment was initiated in the fall of 1962. Lime applications of 5 tons per acre were made at that time for the potassium experiment, bringing the average pH to 6.72. Seeding time treatments of K in the spring of 1963 consisted of 0, 60, 120, 180 and 240 pounds per acre of K_2O. Soil tests, tissue analysis and yields in 1967 showed no evidence of the 1963 K treatments remained in the soil.

Annual topdressing treatments of 0, 120 and 240 pounds per acre of K_2O were started in the fall of 1964. All seeding time treatments were split three ways. This amounted to 20 plots of each topdressing rate. These plot numbers were reduced to 10 each, (except for check plots) in 1968 when the topdressing treatments were omitted on half of them.

Comparison is made in Table 1 of the yield differences, as well as tissue analyses, between four years of annual topdressing with plots where the fourth annual topdressing was omitted. There was a significant drop in alfalfa yield, even with the 240 pound treatment. There was also a significant drop of %K in the tissue.

The topdressings were made the previous fall after the third cutting had been removed. Table 1 shows a serious drop in %K by cuttings which might indicate insufficient K levels or that topdressing should be done in early summer, perhaps after the first cutting.

Of further interest in the 1968 results were the yield-soil test relationships for pH, phosphorus and potassium. Phosphorus soil tests from the 48 plots that had adequate lime were compared to the 1968 alfalfa yield. These relationships are shown by curves in Figure 1. The one year's data indicate no further yield increase beyond a P soil test of approximately 50 lbs. per acre of extractable phosphorus (Bray's P_1).

Similar comparisons were made with the 1968 pH versus 1968 alfalfa yields and the 1967 soil K tests with the 1967 alfalfa yields. These are shown in Figures 2 and 3, respectively. Again, with one year's data, the optimum pH appears to be about 6.7 and the optimum soil K level appears to be approximately 300 pounds of exchangeable K.

Table 1. Effect of omitting last of 4 annual fall K topdressings on yield and %K of alfalfa the following year. (Morrison Co., Pierz, Minn., Brainerd Sandy Loam soil.)

	Cutting	Annual treatments of K_2O, lbs/A				
		0	120		240	
Yields T/A	1	.67	2.02	1.70*	2.23	2.05*
	2	.62	2.01	1.68*	2.03	2.05*
	3	.12	.85	.60*	1.20	.99*
	Total	1.41a	4.88c	3.98*b	5.46d	5.09*c
% K, tissue 1968	1	.93	1.96b	1.48*a	3.12c	2.21*b
	2	--	1.44b	.90*a	2.24c	1.74*b
	3	--	.89a	.68*a	1.90c	1.21*b

* Topdressing omitted for 1968 crop after 3 previous applications.

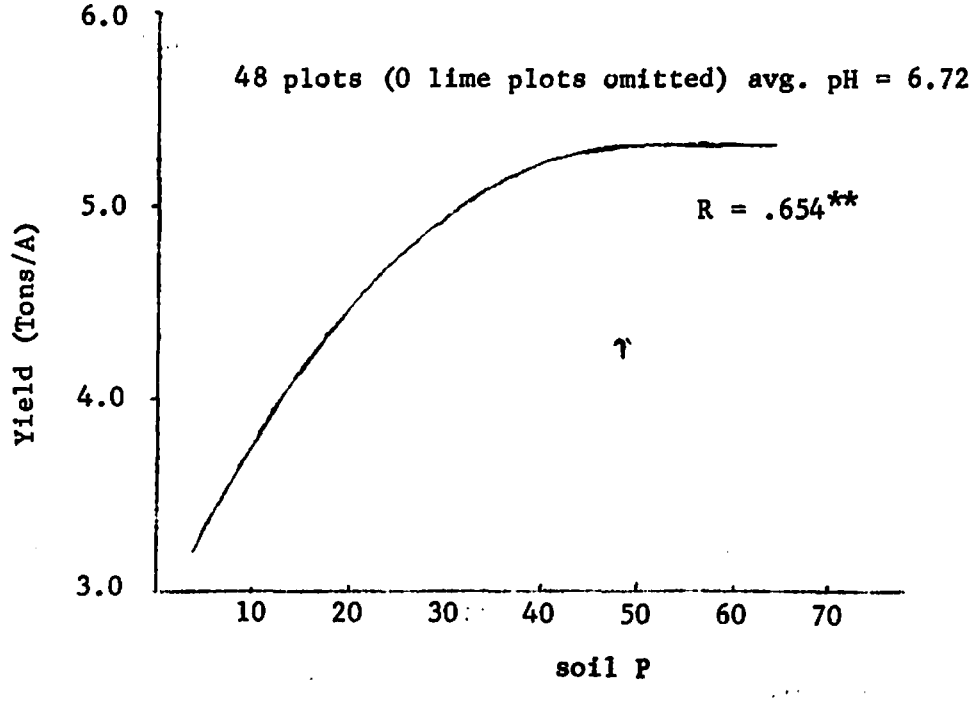

Figure 1. Relationship of soil test P and alfalfa yield, 1968.

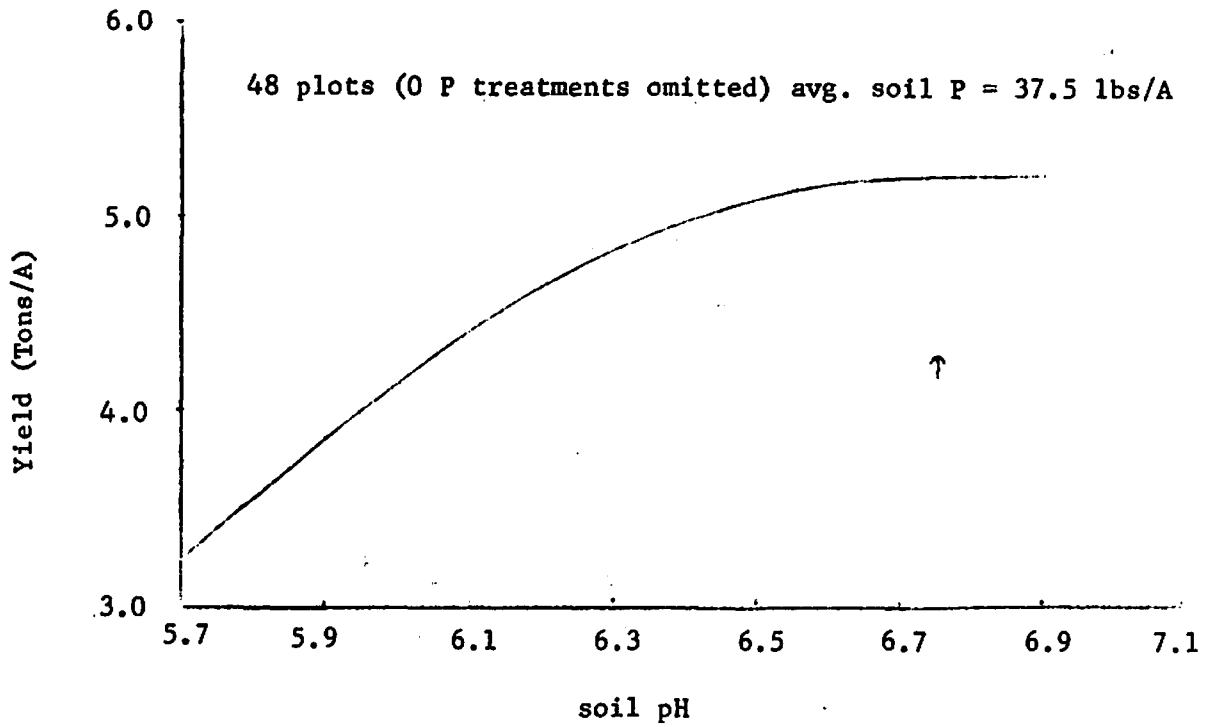

Figure 2. Relationship of soil pH and alfalfa yield, 1968.

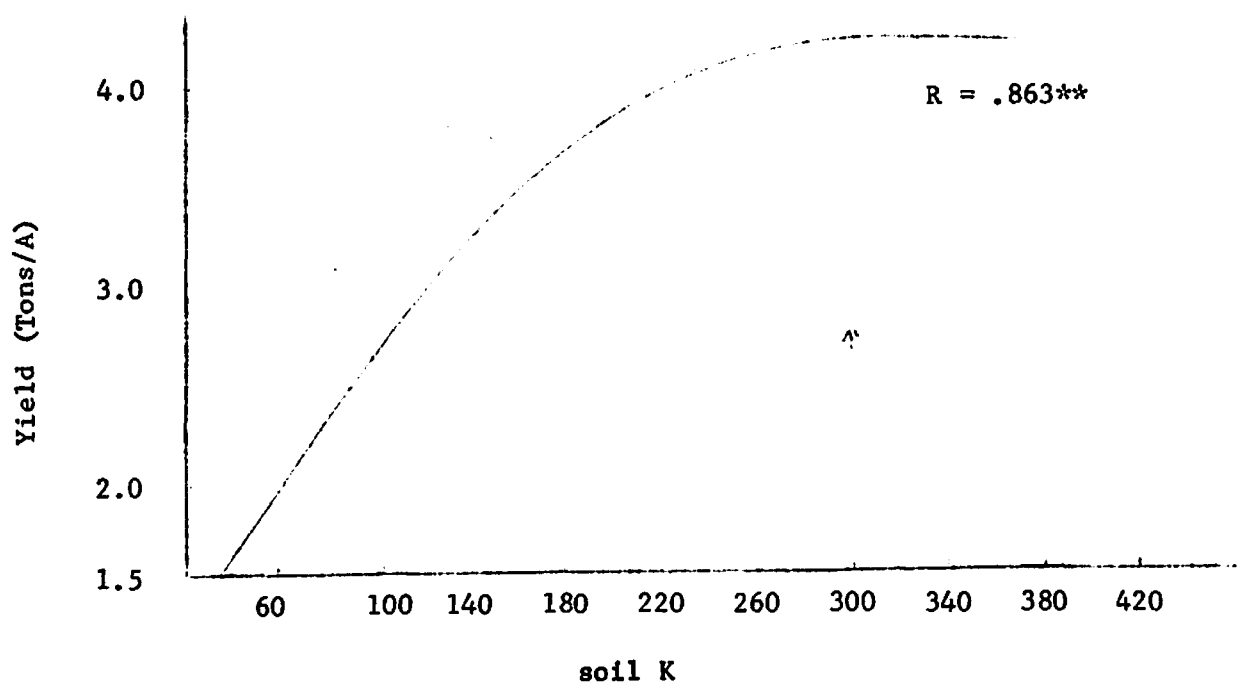

Figure 3. Relationship between soil K and alfalfa yield, 1967.

ROSEMOUNT SOILS FARM

Rosemount Agricultural Experiment Station
1968

Paul M. Burson

GENERAL CONDITIONS AND RESULTS

The year 1968 was another unusual year as far as moisture conditions were concerned. The moisture range was from one extreme to the other. The first 2 weeks of May were dry, followed by a high intensity rain on May 15 of 1.13 inches and May 27 of 1.17 inches, making a total of 2.30 inches for the 2 days out of a total of 3.85 inches for the month. The months of September and October were very wet in most of southern Minnesota as well as at Rosemount. A total of over 5.00 inches for each month with a total of 10.95 inches for the 2 months. This condition caused poor ripening and drying conditions for the corn and soybeans. Some plots were too wet to harvest. Moisture content in the grain ran high because of the poor drying weather. After plots were harvested, it was impossible to harvest parts of some of the remaining fields because the soils were too wet to operate the heavy harvesting equipment. From March 15 through October 31, there was a total of 31.16 inches of rain. June had the highest rainfall for a single month of 7.45 inches.

All corn and soybeans were planted in 30 inch rows with a final average stand of 22,000 plants per acre for the corn. The planting rate for corn was 26,000 kernels per acre. The final stand was about 15 percent less than the planting rate. On the fertilized corn the stand was much better than on the checks. The difference in stand of corn for many years has been 2,000 more plants per acre on the fertilized as compared to the check areas.

Weed sprays have been used every year for the last several years. At the present time practically no cultivation is being done on corn and

soybeans. As the weed spray program continues from year to year on corn, soybeans and the year alfalfa is seeded, grassy weeds are becoming a rather minor problem. On some fields mustard and Canadian thistles are still causing some trouble.

40 INCH VS. 30 INCH VS. 20 INCH ROW SPACINGS FOR CORN

In 1968 all the corn and soybeans on the Soils Farm were planted in 30 inch rows with a John Deere 4-row Flexi Intergal Toolbar planter. This planter can be adjusted for any row width down to 20 inches. Comparisons were made on both corn and soybeans at 40, 30 and 20 inch row spacing.

The results for corn are given in Table 1. The rate of planting was 26,000 kernels per acre with a final stand of 22,000 plants per acre regardless of the row width which would provide for different spacing between plants in the row. The general trends for 1968 was an increase in yield from the 40 inch row to the 20 inch row regardless of the fertilizer treatment. In all row widths there was an increase in yield of corn from the use of band fertilizer and band plus sidedressed nitrogen placement.

With soybeans where row spacing was compared, two rates of planting of 45 and 60 lbs. per acre were also compared. Differences in row spacing, as reported in Table 2, compared with different spacing of plants in the row along with the placement of fertilizer in a band and starter (Pop-Up). In the case of starter (Pop-Up), both liquid and dry materials were used. There was practically no difference in yield between the 60 lb. and the 45 lb. rates of planting. Injury to germination was noted on the dry starter (Pop-Up) but none on the liquid which was the same as reported in 1967. May was comparable to the moisture conditions in 1967 which were also very dry. During the growing season the band placement showed the best growth but the yields in the fall did not indicate this seasonal

TABLE 1. ROW WIDTH FOR CORN - 40-30-20 INCH SPACING.

Rosemount Soils Farm
1968

Field 18

Fertilizer Treatments	Yield in Bu. per acre		
	40 inches	30 inches	20 inches
Check	99.0	105.0	111.0
Band (1)	102.0	111.0	121.0
Band + N (2)	119.0	130.0	153.0

(1) 300 lbs. per acre of 4-12-24

(2) 160 lbs. of actual N broadcast and disked in before planting.

Atrazine for weed control - no cultivation

Planted May 28, 1968

Limed 3 tons per acre November, 1964

Continuous corn since 1952

Soil Type - Clyde silty clay loam

TABLE 2. ROW SPACING AND PLANTING RATE FOR FERTILIZED SOYBEANS.

Rosemount Soils Farm
1968

Field 37

Fertilizer Treatments	Yield in Bu. per Acre					
	40 inch rows		30 inch rows		20 inch rows	
	No Broadcast	(1) Broadcast	No Broadcast	(1) Broadcast	No Broadcast	(1) Broadcast
	Planting Rate 60 lbs. per Acre					
Check	20.0	21.6	23.3	26.6	23.3	25.0
Band	21.6	21.6	23.3	26.6	25.0	26.6
Starter (Pop-Up)-Dry(3)	25.0	20.0	28.3	28.3	28.3	30.0
Starter (Pop-Up)-Liquid(4)	25.0	23.0	25.0	30.0	30.0	30.0
	Planting Rate 45 lbs. per Acre					
Check	23.3	20.0	25.0	20.0	25.0	25.0
Band	28.3	23.3	21.6	23.3	30.0	26.6
Starter (Pop-Up)-Dry(2)	21.6	20.0	23.3	25.0	30.0	26.6
Starter (Pop-Up)-Liquid(3)	23.3	23.3	21.6	23.3	33.3	31.6

Planted June 4

Continuous soybeans for 5 years

(1) Residual broadcast and plowed down 800 lbs. of 4-12-14 in 1966.

(2) Band of 4-12-24 at 300 lbs. per acre.

(3) 10-30-12 dry fertilizer with seed at 10 lbs. total N + K per acre.

(4) 7-21-7 liquid fertilizer with seed at 10 lbs. total N + K per acre.

Variety - Chippewa 64

Weed control - Lorox and Ramrod after planting

Limed 3 tons per acre 1953

Soil type - Port Byron & Judson silt loam.

growth difference. The residual broadcast fertilizer did not seem to show any carry-over from the 1966 application. The 20 inch row spacing as compared to the wider row spacings were generally a little better in yield. The 40 inch spacing was lower in yield than the 20 and 30 inch spacing in both rates of planting.

EARLY BERSUS LATE PLANTING FOR CORN

Questions are raised by farmers about planting corn early. What is early in Minnesota may be a question. Some say May 1 and others say May 10th to May 15th. Trials were run in 1968 considering May 1 as early planting and May 10 as late planting. In 1968, May 1 was too early because the corn was damaged and set back by frost, while no injury to the May 10th planting. Each planting date received the same fertilizer treatments and the same methods of placement as given in Table 3. This field had never received a basic broadcast plow-down fertilizer treatment. For that reason, the combination of starter (Pop-Up) plus band gave the better yields. In general, for this particular field from year to year, May 1 planting can be considered too early because the chance of a frost injury is always possible. In talking to farmers in the cornbelt area of southern Minnesota, they generally agree May 1st is too early. They feel, as the results indicate in Table 3, that probably May 10 might be the date to consider as early planting from year to year and possibly May 20th as late planting. Under Minnesota spring weather conditions, planting by calendar is usually not satisfactory. In the over-all yields for the trials the later planting was the most favorable.

TABLE 3. EARLY PLANTING VERSUS LATE PLANTING OF CORN

Rosemount Soils Farm
1968

Field 17E

Fertilizer Treatments	Percent Moisture	Yield in Bu. per Acre Early(1)	Yield in Bu. per Acre Late(2)	Percent Moisture
Check	26.1	95.0	109.0	25.7
Band(3)	25.3	104.0	128.0	25.9
Band + N(4)	24.6	132.0	135.0	25.5
Starter (Pop-Up)(5)	25.7	131.0	132.0	27.7
Starter (Pop-Up) + N	25.0	142.0	139.0	26.6

(1) Early planting May 1

(2) Lake planting May 10

(3) 300 lbs. per acre 4-12-24

(4) 160 lbs. of actual N per acre sidedressed with planter after corn emergence

(5) 10-30-12 with total of 15 lbs. N & K

Atrazine for weed control - no cultivation

Continuous corn since 1952

Soil type - Clyde silty clay loam

Planting rate 26,000

Final stand 22,000 plants

CONTINUOUS CORN CROPPING SYSTEM

There are 4 fields on the Rosemount Soils Farm that have been in continuous corn from 8 to 16 years. These fields in 1968 did not produce quite as well as the field that have been in a regular rotation system. This has been true for both corn and soybeans. Not all the fields were harvested in 1968 because of lack of help and funds.

Tables 1, 3, 4 and 8 are fields that have been in continuous corn for 16 years with only commercial fertilizer treatments (no manure), while Table 7 gives the results on field 48 that has been in corn for 16 years but has received manure at the rate of 10 to 20 tons per acre per year with only banded placed fertilizer. The soil types on fields reported in Tables 1, 3 and 7 are Clyde silty clay loam.

CORN AND SOYBEANS IN A CROP ROTATION SYSTEM

Trials were continued in 1968 where a basic broadcast plow-down placement of fertilizer has been made every three years, beginning in 1959, regardless of the crop that appeared in that particular year of the rotation system. The grade of fertilizer used was based on soil test. The rotations used are as follows:

1. Corn - Alfalfa seeded - Alfalfa hay (2 years).
2. Corn - Soybeans - Alfalfa seeded - Alfalfa hay (1 year).
3. Corn - Soybeans - Alfalfa seeded (green manure) - Corn - Alfalfa seeded - Alfalfa hay (1 year).

Table 5 gives the yields of corn on Field 22 following 1 year in alfalfa hay. Fertilizer was broadcast plowed-down every 3 years with band and starter (Pop-Up) placement at corn planting time. Yields were generally somewhat higher in 1968 over 1967, but were not as high as has usually been in previous years. Table 5 gives the yields of corn in rotation with broadcast plow-down, band and starter (Pop-Up) placement.

TABLE 4. BROADCAST-BAND-STARTER (POP-UP) FERTILIZER PLACEMENT FOR CONTINUOUS CORN

Rosemount Soils Farm
1968

Field 10

Yields in Bu. per Acre

Plot No.	Fertilizer Treatments	Check	Years and Broadcast Fertilizer Rates (1) 1959 1962 1965 1968		1960 1963 1966 1969		1961 1964 1967 1970	
			300	600	300	600	300	600
1.	Check	54.0	73.0	74.0	74.0	73.0	72.0	70.0
2.	Check + N(2)	83.0	94.0	91.0	88.0	89.0	75.0	76.0
3.	Starter (Pop-Up) Fertilizer Shoe(3)	93.0	118.0	114.0	104.0	112.0	103.0	99.0
4.	Starter (Pop-Up) Fertilizer Shoe + N(2)	116.0	114.0	116.0	107.0	117.0	107.0	101.0
5.	Starter (Pop-Up) with seed(4)	117.0	108.0	110.0	108.0	112.0	102.0	108.0
6.	Starter (Pop-Up) with seed + N(2)	119.0	112.0	110.0	111.0	119.0	110.0	113.0
7.	Band + Starter (Pop-Up)	118.0	114.0	112.0	109.0	115.0	108.0	110.0
8.	Band-Starter (pop-Up) + N(2)	123.0	115.0	114.0	113.0	129.0	122.0	127.0
9.	Band (5)	113.0	110.0	112.0	109.0	116.0	113.0	114.0
10.	Band + N(2)	116.0	114.0	114.0	111.0	124.0	121.0	115.0

Planted May 11, 1968

(1) Broadcast plow-down of 0-20-20 through 1966, 0-12-36 at 500 and 1000 lbs per acre in 1967 and 4-12-24 at 500 and 1000 lbs per acre in 1968. Based on soil test.

(2) Actual N at 160 lbs per acre sidedressed at first cultivation on all plots.

(3) Starter (Pop-Up) placed with fertilizer shoe ahead of planter shoe and at the same depth as the seed. 10-30-12 at 15 lbs total N+K per acre.

(4) Starter (Pop-Up) placed directly with the seed. 10-30-12 at 15 lbs total N+K per acre.

(5) Band of 4-12-24 at 300 lbs per acre.

Limed 3 tons per acre July 1951.

Continuous corn since 1952.

Soil type - Port Byron Silt Loam.

TABLE 5. BROADCAST-BAND-STARTER (POP-UP) FERTILIZER PLACEMENT ON 1ST YEAR CORN IN CROP ROTATION (1)

Rosemount Soils Farm
1968

Field 22

Yields in Bu. per Acre

Plot No.	Fertilizer Treatments	Check	Years and Broadcast Fertilizer Rates(2) 1959 1962 1965 1968		1960 1963 1966 1969		1961 1964 1967 1970	
			300	600	300	600	300	600
1.	Check	92.0	104.0	106.0	73.0	90.0	92.0	114.0
2.	Chech + N(3)	100.0	104.0	106.0	108.0	93.0	108.0	117.0
3.	Starter (Pop-Up) Fertilizer shoe(4)	123.0	127.0	127.0	118.0	113.0	135.0	128.0
4.	Starter (Pop-Up) Fertilizer shoe + N(3)	128.0	124.0	127.0	122.0	123.0	139.0	137.0
5.	Starter (Pop-Up) with seed(5)	124.0	130.0	135.0	122.0	123.0	127.0	126.0
6.	Starter (Pop-Up) with seed +N(3)	142.0	139.0	137.0	130.0	132.0	142.0	137.0
7.	Band(6)	139.0	128.0	129.0	118.0	119.0	141.0	143.0
9.	Band + N(3)	139.0	127.0	127.0	114.0	115.0	146.0	142.0

Planted May 11, 1968

(1) Corn-soybeans-alfalfa seeded-alfalfa hay-corn etc.

(2) Broadcast plow-down of 0-20-20 through 1966, 0-12-36 at 500 and 1000 lbs. per acre in 1967 and 4-12-24 at 500 and 1000 lbs. per acre in 1968. Based on soil test.

(3) Actual N at 100 lbs. per acre sidedressed at 1st cultivation.

(4) Starter (Pop-Up) placed with fertilizer shoe ahead of planter shoe and at the same depth as the seed. 10-30-12 at 15 lbs. total N + K per acre.

(5) Starter (Pop-Up) placed directly with the seed. 10-30-12 at 15 lbs. total N + K per acre.

(6) Band of 4-12-24 at 300 lbs. per acre

Limed 3 tons per acre July 1952.

Soil Type - Port Byron Silt Loam.

Table 6 gives the yields of soybeans in rotation with broadcast plow-down, band and starter (Pop-Up) placement.

LIME ON CONTINUOUS CORN

The results from use of lime on continuous corn are reported in Tables 7 and 8. Field 48, as reported in Table 7, has been in corn since 1952. This field was limed at 3.0 tons per acre in the fall of 1961 as determined by the soil test. This field has also received from 10 to 20 tons of manure per acre per year. Field 44, as reported in Table 8, has been in corn for the same period and was limed at 3.0 tons per acre in the fall of 1964. No manure has ever been applied, but instead trials are being run on methods of N placement which includes plow-down, sidedressing, disked in after plowing and all the N applied in a band at planting time. Tables 7 and 8 are on following pages.

FERTILIZED ALFALFA YIELDS

Trials were continued on alfalfa production in the various crop rotation systems of landuse on cropland. Broadcast fall plow-down was made every three years regardless of the crop that appeared in that particular year of the rotation. The year that the field was in alfalfa the fertilizer was broadcast on the alfalfa. The grades and rates per acre of the fertilizer are given in the footnotes of Table 9.

In this table, the yields are given for 2 cuttings of alfalfa for each of the 4 fields and the average yields per acre for all fields. These results show the difference in yields of the 1968 application as compared to when the fertilizer was applied in 1967 and as far back as 1966. Also, there is the comparison of the residual band-placed fertilizer applied on the corn with and without broadcast. In all cases the residual band-placed fertilizer has given some increase in yield. This indicates that the

TABLE 6. BROADCAST-STARTER (POP-UP)-BAND FERTILIZER PLACEMENT FOR SOYBEANS GROWN IN A CROP ROTATION (1)

Rosemount Soils Farm
1968

Field 32

Yields in Bu. per Acre

Fertilizer Treatments	Check	Years and Broadcast Fertilizer Rates(2) 1959 1962 1965 1968		1960 1963 1966 1969		1961 1964 1967 1970	
		300	600	300	600	300	600
Check	25.0	30.0	26.0	---	31.6	---	---
Band(3)	28.3	31.6	31.6	---	31.6	---	---
Starter (Pop-Up)(4)	26.6	30.0	31.6	---	28.3	---	---
Starter (Pop-Up)(5)	26.6	28.0	30.0	---	30.0	---	---

Variety - Chippewa 64

(1) Corn-soybeans-alfalfa (GM)-C-alfalfa seeded-hay.

(2) Broadcast plow-down of 0-20-20 through 1966, 0-12-36 at 500 and 1000 lbs per acre in 1967 and 4-12-24 at 500 and 1000 lbs per acre in 1968. Based on soil test.

(3) Band of 4-12-24 at 300 lbs per acre.

(4) Starter (Pop-Up) placed with seed. 10-30-12 at 10 lbs total N + K per acre.

(5) Starter (Pop-Up) placed with fertilizer shoe ahead of planter shoe and at the same depth as seed. 10-30-12 at 10 lbs total N + K per acre.

Weed control - Lorox and Ramrod after planting.

Planted June 4, 1968.

Limed 3 tons per acre November 1964.

Samples were not taken on 3 sets of plots because we lost student help followed by bad weather.

Soil Type - Port Byron Silt Loam.

TABLE 7. LIME VS NO LIME FOR CONTINUOUS CORN

Rosemount Soils Farm

1968

Field 48

Fertilizer Treatments	Yield in Bu. per Acre		
	No lime	Lime	Increase for lime
Manure	114.0	138.0	24.0
Band + Manure	120.0	139.0	19.0
Band	--	118.0	--
Starter (Pop-Up) + Manure	--	140.0	--
Starter (Pop-Up) + Band + Manure	--	141.0	--

Limed 3 tons per acre in 1961

Manure at 10 tons per acre per year

Band - 6-24-12 at 175 lbs per acre

Atrazine for weed control. Part of field was cultivated in 1968 because of a few wet areas

Pop-Up - 10-30-12 at 15 lbs per acre of total N and K

Planting rate 26,000 per acre

Final stand 22,000 per acre

Planting date - May 3, 1968

Continuous corn since 1952

Soil Type - Clyde silty clay loam

TABLE 8. LIME VS NO LIME FOR CONTINUOUS CORN

Rosemount Soils Farm
1968

Field 44

Fertilizer Treatments	Yield in Bu. per Acre			
	No lime	Percent Moisture	Lime	Percent Moisture
Check	66.0	29.5	71.0	29.1
Band(1)	86.0	26.1	85.0	25.9
Band + N	107.0	26.0	119.0	25.6
500 Bc. Plowed(2) + N(3)	112.0	26.4	108.0	26.1
Band + N Plowed(4)	107.0	28.2	116.0	27.9
Band + N Disked(5)	102.0	27.7	114.0	27.6
Band blend(6)	--	--	114.0	28.1

Planted May 27

Planting rate 26,000

Final stand 22,000

Weed control - atrazine broadcast before planting with no cultivation in 1968

Spring plowed

Continuous corn since 1952

(1) Band 4-12-24 at 300 lbs per acre

(2) 4-12-24 Broadcast and plowed under

(3) N sidedressed at 160 lbs of actual N per acre

(4) N broadcast and plowed under at 160 lbs of actual N per acre

(5) N broadcast and disked in at 160 lbs of actual N per acre

(6) N mixed with band fertilizer and all placed in a band

Limed 3 tons per acre in 1964

Soil Types - Judson Silty Clay Loam and Clyde Silty Clay Loam.

TABLE 9. FERTILIZED ALFALFA HAY YIELDS

Rosemount Soils Farm
1968

Yields in Tons per Acre

Cuttings of Hay	Check	Years and Broadcast Fertilizer Rates: 1959(1) 1962 1965 1968		1960(1) 1963 1966 1969		1961(1) 1964 1967 1970	
		300	600	300	600	300	600
Field 20							
No Banded Residual Fertilizer							
1st Cutting	1.96	2.39	2.07	2.20	1.69	2.09	2.01
2nd Cutting	1.96	2.77	2.36	2.12	1.99	1.99	1.80
Total	3.95	5.16	4.43	4.32	3.68	4.08	3.81
Banded Residual Fertilizer							
1st Cutting	2.12	2.44	1.85	2.23	2.17	1.85	2.09
2nd Cutting	2.09	2.71	2.65	2.07	2.41	1.96	2.17
Total	4.21	5.15	4.50	4.30	4.58	3.81	4.26
Field 25							
No Banded Residual Fertilizer							
1st Cutting	1.91	2.44	2.17	2.85	2.60	1.64	2.12
2nd Cutting	1.27	2.15	1.85	2.01	1.96	2.33	1.75
Total	3.08	4.59	4.03	4.86	4.56	3.97	3.87
Banded Residual Fertilizer							
1st Cutting	2.09	2.83	2.93	2.79	2.33	1.91	2.20
2nd Cutting	2.15	2.12	2.17	2.07	1.80	1.93	1.59
Total	4.24	4.95	5.10	4.86	4.13	3.84	3.79
Field 27							
No Banded Residual Fertilizer							
1st Cutting	1.45	1.53	1.96	1.80	2.09	2.33	2.15
2nd Cutting	1.61	1.91	2.04	1.88	1.91	1.85	1.88
Total	3.05	3.44	4.00	3.68	4.00	4.18	4.03

Table 9. Continued.

	Banded Residual Fertilizer						
1st Cutting	1.61	1.53	2.07	2.01	2.23	2.49	2.55
2nd Cutting	1.69	2.07	2.44	2.12	2.31	2.12	2.01
Total	3.30	3.60	4.51	4.13	4.54	4.61	4.56
	Field 35						
	No Banded Residual Fertilizer						
1st Cutting	1.56	2.33	1.93	1.93	1.61	--	--
2nd Cutting	1.88	1.88	2.39	2.28	1.85	--	--
Total	3.44	4.21	4.32	4.21	3.46	--	--
	Banded Residual Fertilizer						
1st Cutting	1.80	2.44	2.44	2.09	1.99	--	--
2nd Cutting	1.93	2.52	2.31	2.28	2.12	--	--
Total	3.73	4.96	4.75	4.37	4.11	--	--
	Averages for 4 Fields						
	No Banded Residual Fertilizer						
1st Cutting	1.72	2.17	2.03	2.20	1.89	2.02	2.09
2nd Cutting	1.68	2.18	2.16	2.07	1.92	2.05	1.81
Total	3.40	4.35	4.19	4.27	3.81	4.07	3.90
	Banded Residual Fertilizer						
1st Cutting	1.90	2.31	2.32	2.28	2.18	2.08	2.61
2nd Cutting	1.96	2.35	2.39	2.14	2.16	2.00	1.92
Total	3.86	4.96	4.69	4.42	4.34	4.08	4.53

(1) Broadcast fall plow-down based on soil tests.
0-20-20 from 1959 through 1966 at 300 and 600 lbs. per acre.
0-12-36 for 1967 at 500 and 1000 lbs. per acre.
4-12-24 for 1968 at 500 and 1000 lbs. per acre.
All fertilizer was applied every 3 years.

Residual fertilizer is the carry-over from 4-12-24 banded on corn at 300 lbs. per acre and sidedressed with 100 lbs. of actual N per acre.

Variety - Vernal

Seeding rate - 16 lbs. per acre.

over-all fertility level is being increased from year to year from the residual band-placed fertilizer for both corn or soybeans. Over the years since 1959, the 300 lbs. per acre of broadcast plow-down placed fertilizer has been as good as the 600 lb. rate per acre. The 500 and 1,000 lbs. per acre did not add enough of an increase in yields to merit the added cost.

ALFALFA VERSUS BIRDSFOOT TREFOIL IN PASTURE MIXTURES

Considerable support has been given Birdsfoot Trefoil as the basic legume to use in a pasture mixture as compared to other perennial legumes such as alfalfa. Questions have been raised about Trefoil as to its yield, its carrying capacity, its uniform seasonal production as a pasture legume and its palatability as compared to other legumes. On pastures G Birdsfoot Trefoil was compared to alfalfa. Seedings in 2 replications were made in the summer of 1967 after the pastures had been sprayed to control the grass so a direct comparison could be made between the 2 legumes. Each pair of replications had the same fertilizer treatments, as shown in Table 10, so the alfalfa and the trefoil could be compared with the same fertility levels. The results show the alfalfa to be far superior to the trefoil in yield per acre on the basis of 2 cuttings. The cuttings were made at the time recommended for hay. There is a very striking difference in yield of alfalfa over the trefoil for the second cutting. This would indicate the yield and the carrying capacity as a pasture legume would not keep up the summer production as would be the case in favor of the alfalfa. The results of this test are shown in Table 10.

TABLE 10. ALFALFA VS BIRDSFOOT TREFOIL IN PASTURE MIXTURES

Rosemount Soils Farm
1968

Pastures G

Yield in Tons per Acre(1)

Cuttings of Hay	Check		Manure		Nitrogen		Renovation	
	Alfalfa	Trefoil	Alfalfa	Trefoil	Alfalfa	Trefoil	Alfalfa	Trefoil
First	2.33	2.60	3.68	3.95	3.65	3.04	3.79	3.20
Second	2.71	1.64	3.73	1.91	3.52	1.96	3.97	1.91
Total	5.15	4.24	7.41	5.86	7.17	5.00	7.76	5.11

Alfalfa and Trefoil seeded in July 1967

No manure after fall of 1964 for 1965 pastures

Manured pastures received annual fall applications of 8 tons per acre beginning in fall of 1957.

No nitrogen fertilizer after spring of 1965.
Nitrogen applied annually in spring at 80 lbs. of actuan N per acre.

All pastures limed at 3.0 tons per acre September 1956.

Average of All Residual Manure and All Fertilizer Treatments on Alfalfa(1)

Cuttings of Hay	Yield tons per acre
First	3.36
Second	3.48
Total	6.84

Average of All Residual Manure and All Fertilizer Treatments on Birdsfoot Trefoil(1)

Cuttings of Hay	Yield tons per acre
First	3.19
Second	1.85
Total	5.04

(1) All pastures received a basic treatment (except check) of 300 lbs. per acre of 0-20-20 as based on soil test followed by annual spring application of 200 lbs. per acre through 1965.

All pastures (including check) received 200 lbs. per acre of 0-20-20 at seeding time in 1967.

FALL VERSUS SPRING PASTURE RENOVATION

Questions have been raised by farmers as to when is the best time to renovate pasture sods for the purpose of establishing a legume with the old grass sod. If the renovation is started in late August or early September, all the desirable pasture grasses are killed and the cost of renovation in time and power is greater because the soil is dryer and more difficult to prepare a seedbed as compared to the spring renovation. When renovation is done in early spring before the frost is entirely out of the soil, the job can be completed before soil conditions are ready for the preparation of the regular field cropland. In the early spring the soil is not so compact as a result of the freezing and thawing and the grass sod will not be destroyed or killed out as in the case of the fall renovation. There also has to be additional cultivation in the spring for the final seedbed preparation on the fall renovation. It is not necessary to kill out all the pasture grasses and then buy new grass seed for reseeding. As in the case of spring renovation, a good seedbed can be prepared for the new legume seeding. Early spring renovation merely sets back the pasture grasses so the new legume seeding and the old pasture sod will start growth at the same time. At both times of renovation the seedbed must be a thoroughly prepared seedbed. Fertilizer can be applied in the spring for both situations. Plots were set up in the fall of 1967 to compare fall renovation with plots that were renovated in the spring of 1968. Table 11 shows the comparison of the estimated percentages of alfalfa, grass and weeds at both times of renovation with the estimates made on June 10th and September 23rd.

TABLE 11. FALL VS SPRING PASTURE RENOVATION

Rosemount Soils Farm
1968

PERCENT OF TOTAL PASTURE COMPOSITION(1)

Fertilizer Treatments(2)	Fall Renovation(3)						Spring Renovation(4)					
	June(7)			Sept. (7)			June (7)			Sept. (7)		
	Alf.	Grass	Weeds	Alf.	Grass	Weeds	Alf.	Grass	Weeds	Alf.	Grass	Weeds
Check (5)	65	5	30	40	10	50	47	48	5	25	75	Trace
0+80+0	69	2	30	50	10	40	55	40	5	40	60	Trace
0+80+80	65	5	30	75	5	20	47	48	5	40	60	Trace
20+80+80	65	5	30	60	20	20	47	48	5	30	70	Trace
Check (5)	65	5	30	50	20	30	4	48	5	30	70	Trace
0+80+0	65	5	30	75	5	20	47	48	5	40	60	Trace
0+80+80	65	5	30	70	10	20	47	48	5	40	60	Trace
20+80+80	65	5	30	60	20	20	47	48	5	40	60	Trace
Check (6)	20	75	5	5	90	5	25	75	0	5	90	5

(1) Pasture composition includes alfalfa, bromegrass, timothy and weeds.

(2) Alfalfa was seeded at 16 lbs. per acre on all renovated plots. All fertilizer applied in early spring before final seedbed preparation.

(3) Renovated in the fall, starting in late Aug. 1967 with no fertilizer applied until spring 1968.

(4) Renovated in the spring on March 24 and 25 and seeded March 26, 1968.

(5) Same as (3) and (4). Renovated but no fertilizer.

(6) No renovation and no fertilizer.

(7) Pasture composition estimates were made June 10 and Sept. 23, 1968.

Taller grass on 20+80+80 ---- 15" ---- June 10 reading.
Weed growth greater on fall renovation, because of less grass.
Weed growth less on spring renovation on all plots.
Weed growth same at September reading.
Bare spots on spring renovation. Trace to 5 percent.
Bare spots on fall renovation - 20 to 30 percent.

CONTINUOUS CORN - HIGH FERTILITY EXPERIMENT

Rosemount Soils Farm
Established 1953
Fields 42 and 43

W. P. Martin, P. M. Burson and G. W. Randall

This experiment was established in 1953. Yields have been harvested annually for 16 years. During this time, soil and plant samples have been taken and analyzed. Yield results from past years may be found in the mimeographed "Bluebook" for 1963, 1964, 1965, 1966, 1967 and 1968. Fertilizer rates, ratios and stand populations have been changed in recent years. Since the amount of K per acre has been increased the yields have been increasing.

The corn was first planted in 30 inch rows in 1967. Atrazine was used in 1968 with no cultivation and resulted in good weed control. Final stands were 26,000 plants for the high population rate and 20,000 plants for the low population rate. The check yields are still very high. This area has a deposition from surrounding land of 4 feet or more.

TABLE 12. HIGH FERTILITY CORN YIELDS FOR 1968

Plot No.	Fertilizer Treatment (2)	Av. Yields in Bu. per Acre (1) High (3)	Low (4)
1	Check	128.0	123.0
2	12 + 36 + 108	133.0	118.0
3	112 + 36 + 108	143.0	125.0
4	212 + 36 + 108	148.0	132.0
5	28 + 84 + 252	138.0	113.0
6	128 + 84 + 252	142.0	124.0
7	228 + 84 + 252	146.0	122.0
8	44 + 132 + 296	136.0	119.0
9	144 + 132 + 396	143.0	126.0
10	244 + 132 + 396	146.0	119.0
Av. yields for high and low populations		140.3	122.1

(1) Average for 4 replications.

(2) Pounds of N + P_2O_5 + K_2O per acre for 1968.

(3) High population 26,000 plants per acre.

(4) Low population 20,000 plants per acre.