LIME PLOTS, LAMBERTON, 1969

J. Grava, W. W. Nelson, D. S. Fairchild and B. D. McCaslin

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 in series 4, and (b) in series 5, corn (1966 and 1968) and Chippewa soybeans (1967) and Hark soybeans (1969) in a sequence. Data on crop yields, soil and plant analyses were reported in the "Bluebooks" of February 1967, pp. 69-70; March 1968, pp. 38-41; March 1969, pp. 30-31.

Since the initial lime treatments (3 and 6 tons per acre of dolomitic limestone applied in fall of 1965) had not raised the pH to the desired levels, additional amounts were applied in spring of 1968 and worked in soil by disking (corn-soybean series), or disking, plowing and disking (alfalfa series). Alfalfa was seeded in 1968, stand established but no yields were obtained.

Soybeans, in 1969, were grown in 30-inch rows; herbicide: Treflan; fertilizer: none. Alfalfa received in 1969: 0 + 60 + 30 lb/A of plant nutrients, expressed as P_2O_5 and K_2O. Soybean yield was not affected by lime treatments (Table 1).

Table 1. Yield of soybeans, Lamberton lime plots, 1969.

Rate of lime tons/acre	Yield bu/acre
0	45
3*	45
6*	45

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

Five tons per acre of alfalfa were harvested in three cuttings (Table 2). Liming had no effect on the hay yields.

Table 2. Yield of alfalfa, Lamberton lime plots, 1969.

Rate of lime	1st cutting	2nd cutting	3rd cutting	Total
		Hay, tons/acre		
0	2.5	1.4	0.9	4.8
4*	2.7	1.3	1.0	5.0
10**	2.6	1.4	1.0	5.1

*3 tons/A applied in fall of 1965 and 4 tons/A applied in spring of 1968.

**6 tons/A applied in fall of 1965 and 10 tons/A applied in spring of 1968.

The effect of dolomitic limestone applications on soil pH is shown in Tables 3 and 4. Phosphorus and potassium soil test values for the two crop areas are given in Tables 5 and 6.

Table 3. Effect of liming on soil pH, alfalfa area (series 4), Lamberton, 1969.

Depth inches	Lime treatment tons/acre		
	0	4	10
		soil pH	
0-3	5.7 a*	6.1 b	6.8 c
3-6	5.7 a	6.1 b	6.6 c
6-9	5.8 a	6.3 b	6.5 b
9-12	6.1	6.1	6.3
12-18	6.4	6.3	6.4

* Means in horizontal rows followed by different letters are significantly different at 5% level.

Table 4. Effect of liming on soil pH, corn-soybean area (series 5), Lamberton, 1969.

Depth inches	Lime treatment tons/acre		
	0	3	6
		Soil pH	
0-3	6.1 a	6.6 a	6.9 b
3-6	6.1 a	6.7 b	6.8 b
6-9	6.1 a	6.6 b	6.7 b
9-12	6.2	6.7	6.7
12-18	6.6 a	7.0 b	6.9 b

Table 5. Phosphorus and potassium soil tests, alfalfa area, Lamberton lime plots, 1969.

Depth inches	Lime rate tons/acre 0	4	10	Lime rates tons/acre 0	4	10
	Extr. P, pp2m			Exch. K, pp2m		
0-3	82	75	78	304	284	266
3-6	62	76	86	206	210	214
6-9	53	68	60	210	208	202
9-12	8	10	12	190	186	178
12-18	4	3	4	176	172	160

Table 6. Phosphorus and potassium soil tests, corn-soybean area, Lamberton lime plots, 1969.

Depth inches	Lime rate tons/acre 0	3	6	Lime rates tons/acre 0	3	6
	Extr. P, pp2m			Exch. K, pp2m		
0-3	49	43	55	290	270	270
3-6	54	50	40	320	270	250
6-9	42	43	27	230	230	210
9-12	9	8	5	215	200	180
12-18	4	3	3	190	190	170

THE EFFECT OF HEAVY SULFATE SALT APPLICATIONS TO AN OSTRANDER LOAM AT ROSEMOUNT AND TO A CALCAREOUS WEBSTER CLAY LOAM AT LAMBERTON ON SOIL EXTRACT CONDUCTIVITY, PLANT POPULATIONS AND YIELDS OF HARK AND OF CHIPPEWA 64 SOYBEANS IN 1969.

J.M. MacGregor, P.M. Burson, W.W. Nelson and Dean Fairchild

The 1968 results were reported in Soil Series 84 (pp 168-171) and the experiment was described at that time. The 1968 electrical conductivities of the soil extracts were somewhat less than desired and resulted in no visual chlorosis of the soybean plants, but the heavier salt applications decreased soybean germination. It was decided to broadcast a second salt treatment sometime before planting in 1969, similar to that made in 1968. No additional fertilizer, other than the salts, was applied in 1969. Hark and Chippewa 64 soybean varieties were again planted as in the previous year of the study. Soil samples from the 0"-6" and 6"-12" depths were collected from each plot near Rosemount on July 11, 1969 and from the Lamberton field on August 5th, and electrical conductivities of the saturated extracts were determined.

Plant population counts and observations for plant chlorosis were made periodically during the summer. At Rosemount, there was no evidence of chlorosis from any of the treatments on either soybean variety, but the heaviest soluble salt treatments seriously reduced plant population. Chlorosis, especially of the Hark variety, was evident over much of the experimental area during the entire growth period, but there was no consistent effect of the salt treatments and appeared to be caused by natural differences in the soil itself. Populations were highly variable on the Lamberton field and, therefore, no harvest yields were obtained. The 1969 results obtained are shown in Tables 1 and 2.

Table 1. Soil Treatment, Extract Electrical Conductivity, Plant Population and 1969 Yields of Hark and Chippewa 64 Soybeans on an Ostrander Silt Loam Near Rosemount.

	Treatment & desired conductivity	Sat'd extract conductivity (actual) mmhos/cm 0"-6"	6"-12"	Soybean population 1000's/A Hark	Chippewa 64	Yield (bu/A) Hark	Chippewa 64
1)	Check	1.26	0.85	129.8 d	130.3 cd	24.4 b	27.6 b
2)	2 mmho $MgSO_4$	2.12	0.99	121.0 bcd	138.0 d	25.5 b	26.9 b
3)	2 mmho salt mix	2.60	1.15	126.5 cd	130.5 cd	31.8 b	26.3 b
4)	4 mmho $MgSO_4$	3.46	1.72	108.5 b	99.3 b	27.5 b	23.5 b
5)	4 mmho salt mix	3.15	1.69	124.3 bcd	133.0 cd	31.5 b	25.7 b
6)	6 mmho $MgSO_4$	5.43	2.95	10.5 a	16.0 a	12.5 a	7.4 a
7)	6 mmho salt mix	3.56	2.50	111.8 bc	115.8 bc	31.3 b	27.7 b
		Sampled 7/11/69		Counted 7/3/69		Harvested 10/28/69	

Table 2. Soil Treatment, Extract Electrical Conductivity, and Plant Population in 1969 of Hark and Chippewa 64 Soybeans on a Calcareous Webster Clay Loam Near Lamberton. (Sampled 8/5/69)

	Treatment & desired conductivity	Sat'd extract conductivity (actual) mmhos/cm 0"-6"	6"-12"	Soybean population 1000's/A Hark	Chippewa 64
1)	Check	3.1	3.0	68.5	55.0
2)	2 mmho $MgSO_4$	3.4	4.2	70.8	59.2
3)	2 mmho salt mix	3.6	3.1	67.1	48.5
4)	4 mmho $MgSO_4$	3.6	3.5	75.6	57.3
5)	4 mmho salt mix	3.4	3.3	67.5	42.3
6)	6 mmho $MgSO_4$	4.1	3.4	73.6	44.8
7)	6 mmho salt mix	3.6	3.5	70.2	48.1

On the heaviest salt treatment where an electrical conductivity of the saturated soil extract of 6 mmhos was desired, the highly soluble magnesium sulfate was spread at the rate of 24,248 pounds per acre or a two year total of over 48 tons at Rosemount, and 16,408 pounds at Lamberton (or a two year total of some 32.8 tons). This salt was soluble and dissolved on the soil surface within a few minutes and would certainly increase the osmotic pressure of the soil solution.

On the other hand, the salt mix consisting largely of gypsum ($CaSO_4$ $2H_2O$ - which is only slightly soluble) and lesser amounts of magnesium, potassium, and sodium sulfates, although applied in larger amounts - 35,066 pounds per acre at Rosemount and 17,584 pounds at Lamberton in each of the two years - was relatively slightly soluble and evidently had a lower activity and effectiveness to increase electrical conductivity of the soil solution.

At Rosemount, the 4 mmho $MgSO_4$ treatment significantly lowered germination and plant populations of both varieties, although soybean yields were not significantly depressed. The 4 mmho salt mix was considerably less effective for increasing conductivity and yields were somewhat (but not significantly) better than the 4 mmho $MgSO_4$ treatment. However, the 6 mmho $MgSO_4$ treatment almost eliminated soybean stand, with resulting serious yield reduction. Although the 6 mmho salt mix significantly lowered soybean population, soybean yields apparently were not affected. There was no evidence of plant chlorosis in either variety during the entire growing season, although the more moderate salt treatments appeared to increase the height of the Hark variety some six inches.

The untreated calcareous and evidently salty Webster clay loam near Lamberton had an initial high electrical conductivity and the relatively

heavy salt treatments apparently increased this only slightly. Plant chlorosis was evident over much of the experimental area (especially in the Hark variety) but was largely independent of the applied salt treatments. The plant populations were low and highly variable with no evident correlation with salt treatment and, as in 1968, yields were not secured because of this variability.

Conclusions

This experiment was designed to study the effect of soluble salt concentrations in the soil on the incidence of the so-called "iron chlorosis" of soybeans. It is well known that soluble salt concentrations are only one of the soil factors contributing to the chlorotic conditions since excessive soil moisture, low soil temperature, and high soil pH are also involved.

It is apparent that soybean chlorosis does not develop, even where low tolerance varieties such as Hark are grown, unless more of the causative soil factors can be controlled along with increasing soluble salt content. Since varying levels of soil moisture and the depression of soil temperatures are presently not practical in field experiments, this phase of the chlorosis investigation will be discontinued in 1970.

WINTER VERSUS SPRING FERTILIZATION ON 1969 CORN YIELD

J. M. MAC GREGOR, W. W. NELSON AND P. M. BURSON

This experiment was first conducted during the late winter, spring and summer of 1968 with two fields at Rosemount (a fall plowed Ostrander silt loam having a 5% slope, and a spring plowed Judson silt loam having a 1% slope). The third field was located on an essentially level untiled Webster clay loam at Lamberton. Four replications of randomized paired plots 50 feet long and 20 feet wide received broadcast mid-January or early April applications of N, P_2O_5, and K_2O at Rosemount, but only N and P_2O_5 applied at Lamberton.

The winters of 1967-68 and 1968-69 had moderate amounts of snowfall and large fertilizer spreading trucks could have operated fairly well during the winter months. However, as reported in Soil Series 84 (pp 105-7), fertilizer applications were not effective on the two Rosemount fields. Significant fertilizer effect at Lamberton showed both winter or spring treatments to be equally effective for increasing 1968 corn yield.

The fall of 1968 and spring of 1969 were extremely wet and the experimental field at Lamberton remained too wet to plow until late May of 1969. Fertilizer was broadcast on the three fields as in the previous year, but the corn at Lamberton remained immature and only silage weights were obtained. The results are shown in the following tables.

TABLE 1

THE 1969 YIELD OF EAR CORN AT ROSEMOUNT ON OSTRANDER SILT LOAM

FOLLOWING FERTILIZATION IN MID-JANUARY OR IN MAY

Treatment (Lbs/A)	Time of Fertilizer Broadcast	Bushels of ear corn/A @ 15.5% moisture				
		I	II	III	IV	Average
None	-	67.5	84.6	101.8	118.4	93.1
40+0+0	January	81.9	91.4	67.8	61.5	75.7
40+0+0	May	79.4	80.0	81.3	108.7	87.4
0+40+0	January	66.5	81.4	97.3	103.9	87.3
0+40+0	May	65.9	84.8	91.3	84.9	81.7
0+40+40	January	64.9	87.4	121.6	117.2	97.8
0+40+40	May	67.0	62.5	126.2	70.6	81.6
40+40+40	January	84.8	66.3	96.4	125.6	93.3
40+40+40	May	76.1	92.9	89.8	132.2	97.8

Fertilizer treatments not significant

TABLE 2

THE 1969 YIELD OF EAR CORN ON JUDSON SILT LOAM AT ROSEMOUNT.

FOLLOWING FERTILIZATION IN MID-JANUARY OR MAY

Treatment (Lbs/A)	Time of Fertilization	Bushels of ear corn /A @ 15.5% moisture				
		I	II	III	IV	Average
None		65.7	89.5	72.1	73.3	75.2
40+0+0	January	67.4	92.2	96.7	84.6	85.2
40+0+0	May	77.2	96.1	105.6	97.9	94.2
0+40+0	January	81.9	82.0	86.2	98.0	87.0
0+40+0	May	73.5	86.6	101.3	91.8	88.3
0+40+40	January	84.3	92.3	74.9	77.0	82.1
0+40+40	May	113.7	87.4	80.1	109.8	97.8
40+40+40	January	79.1	91.5	92.2	74.7	84.4
40+40+40	May	103.4	85.4	97.9	74.5	90.3

Fertilizer treatments not significant

TABLE 3

THE 1969 YIELD OF SILAGE CORN FROM WEBSTER CLAY LOAM NEAR LAMBERTON

FOLLOWING FERTILIZATION IN JANUARY OR IN MAY

Treatment (Lbs/A)	Time of Fertilization	Yield of silage corn (Tons/A) I	II	III	IV	Average
None	-	8.09	8.24	8.67	6.55	7.89 ab
40+0+0	January	10.88	8.79	10.59	7.57	9.46 bc
40+0+0	May	10.85	12.67	13.40	7.74	11.17 c
0+40+0	January	10.03	7.28	8.29	7.71	8.33 ab
0+40+0	May	8.50	7.60	6.84	5.97	7.23 a
40+40+0	January	9.98	11.14	8.70	8.32	9.54 bc
40+40+0	May	9.89	11.02	7.48	8.35	9.19 b

As in 1968 the fertilized corn on the two soil types at Rosemount (Tables 1 & 2) produced an extremely variable yield and there was no significant effect of the fertilizers on either field, and hence time of application effect was not measurable.

The late spring plowed Webster clay loam at Lamberton (Table 3) also failed to produce a clear cut fertilizer effect making the effect of fertilization time relatively inconclusive.

Although these studies on winter versus spring fertilization for corn production have not resulted in clear and definite answers to possible yield differences, these experiments will not be continued in 1970, largely because of the deep snow cover in January 1970. One of the main difficulties in such a study is to locate experimental areas which are uniformly low in fertility.

CONTINUOUS CORN SILAGE

West Central Experiment Station - Morris

Samuel D. Evans

In 1965 an experiment was initiated on McIntosh silt loam to determine the effect of removal of continuous corn silage and fertilizer application on corn grain and corn silage yields. Rates of fertilizer used were 74 + 48+ 48 and 148 + 96 + 96. All plots received a broadcast application of 10 lbs. of zinc as zinc sulfate in the fall of 1965.

1969 Silage Yields
Dry matter, tons/acre

On plots harvested as grain 1965-69:

Low fertility	(74 + 48 + 48)	- 4.88
High fertility	(148 + 96 + 96)	- 5.68

On plots harvested as silage 1965-69:

Low fertility	(74 + 48 + 48)	- 4.74
High fertility	(148 + 96 + 96)	- 5.07

1969 Grain Yields
Bushels/acre @ 15.5% moisture

On plots harvested as grain 1965-69:

Low fertility	(74 + 48 + 48)	- 79.08
High fertility	(148 + 96 + 96)	- 80.19

In addition an unfertilized, unreplicated check adjacent to the experimental area yielded as follows:

Grain (0 + 0 + 0) - 57.16 bushels/acre

Silage (0 + 0 + 0) - 3.34 tons/acre

There appears to be no reduction in corn yields after removing silage for 5 years. Higher fertility increased silage yields by 0.3 tons/acre, but did not increase grain yields. Yields on fertilized plots were significantly higher than on unfertilized plots.

Variety - Pioneer 3681 Planting date - May 22

CORN IRRIGATION EXPERIMENT

West Central Experiment Station - Morris

S.D. Evans, D.D. Warnes, L.K. Lindor, & R.E. Smith

This experiment was continued as reported in Soil Series 82 (March 1968 and March 1969). Variety - Dekalb XL 306 was planted on May 22, 1969. Atrazine was applied preemergence. Ten inches of water was applied between June 16 and August 29. Rainfall from planting through August 31 was 5.90. inches. The corn was harvested on October 24.

Table 1: Irrigated corn at Morris - 1969

Population treatment	Yield (Bu/A)
Low	103
Med	113
High	120
Nitrogen treatment	
60 lbs.	111
120 lbs.	115
180 lbs.	110
Pop. X Nit. Interaction	
Low x 60	101
Low x 120	108
Low x 180	102
Med x 60	111
Med x 120	116
Med x 180	111
High x 60	121
High x 120	122
High x 180	116

Table 2: Soil test results - Fall 1969

Sample No.	pH	O.M.	P.	K.	Zn	S	Sol. Salts
1	7.7	Hi	12	210	1.8	22	0.8

EFFECT OF HIGH RATE OF PHOSPHORUS WITH AND WITHOUT ZINC ON CORN YIELDS

West Central Experiment Station - Morris

Samuel D. Evans

High rates of phosphorus were applied to a Doland silt loam in the fall of 1967 and again in 1968 to simulate phosphorus induced zinc deficiency on corn. The application of both phosphorus and zinc increased yields and there was no apparent interaction.

Yield in bu./acre @ 15.5% moisture for 1969

Treatment	Yield
check	77.9
60 lbs. P_2O_5	90.4
120 lbs. P_2O_5	92.4
240 lbs. P_2O_5	86.0
10 lbs. zinc as zinc sulfate	94.2
240 lbs. P_2O_5 + lbs. zinc as zinc sulfate	86.3

Variety - Dekalb XL 304 Planting date - May 22

PHOSPHORUS FERTILIZATION OF CONTINUOUS CORN

West Central Experiment Station - Morris

Samuel D. Evans

A phosphorus fertilization experiment on continuous corn was set up in 1965 on Forman clay loam to determine (1) the interaction of row and broadcast levels of phosphorus on corn yields and, (2) the effect of high rates of phosphorus on the zinc content of corn leaves and on corn yields.

All plots received a uniform row application of 10 + 0 + 20. Nitrogen was plowed down in the fall of 1968 at the rate of 120 lbs. of N per acre.

Variety-Dekalb XL 304 Planting date - May 12

Table 1: 1969 yields in bu/acre at 15.5% moisture.

Broadcast P Treatment (lbs./acre)	Row Phosphorus Treatment (lbs./acre)					
	ck	15P	30P	45P	45P+10Zn	Average
ck	48.5	43.0	44.9	40.7	44.8	44.4
45P	42.7	50.8	40.6	44.2	49.2	45.5
Average	45.6	46.9	42.8	42.4	47.0	

Table 2: % Phosphorus and ppm zinc in corn leaves at silking for 1969. Phosphorus is the upper number and zinc is the lower number.

Broadcast P (lbs./acre)	Row Phosphorus Treatment (lbs./acre) ck	15P	30P	45P	45 + 10Zn
ck	.24 / 16	.24 / 16	.26 / 12	.28 / 11	.26 / 26
45P	.28 / 10	.31 / 10	.31 / 11	.31 / 10	.27 / 21
Average	.26 / 13	.28 / 13	.28 / 12	.30 / 10	.26 / 24

Table 3: Phosphorus - Zinc ratio of corn leaves analyzed from 1969 plots.

Broadcast P (lbs./acre)	Row Phosphorus Treatment (lbs./acre) ck	15P	30P	45P	45 + 10Zn
ck	152	144	218	259	98
45P	282	306	277	318	129
Average	217	225	248	288	114

Table 4: Average yield in bu/acre at 15.5% moisture for 1965-69.

Broadcast P (lbs./acre)	Row Phosphorus Treatment (lbs./acre) ck	15P	30P	45P	45P+10Zn	Average
ck	74	72	74	74	77	75
45P	77	76	72	71	76	74
Average	76	74	73	72	76	

PHOSPHORUS AND POTASSIUM FERTILIZATION OF ALFALFA

West Central Experiment Station - Morris

Samuel D. Evans

In the fall of 1966 an alfalfa fertility experiment was established at the station on Forman clay loam (formerly Barnes). Three cuttings were made in 1969 and yields were higher than in previous years, but there were no significant treatments.

Table 1: First Cutting yields - 1969

	K_2O Applied					
P_2O_5 Applied	0	60	120	240	480	Average
	Tons alfalfa hay/A @ 15% moisture					
0	2.3	2.1	2.6	2.4	2.6	2.4
57	2.3	2.5	2.5	2.4	2.5	2.4
114	2.4	2.6	2.3	2.8	2.3	2.5
229	2.4	2.7	2.6	2.6	2.9	2.6
458	2.2	2.7	2.5	2.7	2.8	2.6
Average	2.3	2.5	2.5	2.6	2.6	

Table 2: Total of 3 cuttings - 1969

	K_2O Applied					
P_2O_5 Applied	0	60	120	240	480	Average
	Tons alfalfa hay/A @ 15% moisture					
0	4.3	3.7	4.4	3.9	4.8	4.2
57	4.0	4.3	4.0	4.1	4.5	4.2
114	4.2	4.4	4.0	4.7	4.2	4.3
229	4.1	4.7	4.5	4.4	5.0	4.6
458	4.2	4.8	4.3	4.9	5.0	4.6
Average	4.2	4.4	4.3	4.4	4.7	

Table 3: Analysis of variance - 1969 yields

	1st Cutting	2nd Cutting	3rd Cutting	1969 Total
Reps	NS	*	**	**
Phosphorus rates	NS	NS	NS	NS
Potassium rates	NS	NS	NS	NS
P x K interaction	NS	NS	NS	NS

USE OF SEED INCORPORATED (POP-UP) FERTILIZER

West Central Experiment Station - Morris

Samuel D. Evans

In the spring of 1967 an experiment was initiated to determine the effect of small amounts of seed incorporated fertilizer on early growth and yield of corn. The experiment was set up on a Doland silt loam on which various broadcast rates were applied annually.

Table 1: The effect of fertilizer placement at different broadcast rates on corn yields at Morris in 1969.

Row Treatment
(Yield in bu./acre @ 15.5% moisture)

Broadcast treatment	check	Pop-up(1)	Starter(2)	Pop-up + Starter	Average
100+0+0	82.7	82.3	77.7	80.7	80.8
100+25+25	57.4	67.6	67.6	73.0	66.4
100+50+50	70.7	69.9	64.4	73.0	69.5
100+75+75	67.5	68.9	70.7	70.3	69.4
100+100+100	72.8	78.7	81.3	81.6	78.6
average	70.2	73.5	72.3	75.7	

(1) Pop-up - 37.5 lbs. of 8-32-16

(2) Starter - 150 lbs. of 8-32-16

Yields were quite low due to dry weather and the highest yield was on the treatment with no broadcast P_2O_5 or K_2O and no starter

USE OF VARYING RATES OF NITROGEN & STARTER ON CORN IN 1969

West Central Experiment Station - Morris

Samuel D. Evans

In the spring of 1967 an experiment was initiated on Doland silt loam to determine the effect of varying rates of nitrogen and starter on corn yields.

Table 1; The yield of ear corn in 1969 at Morris with varying rates of nitrogen and starter fertilizer.

Nitrogen lbs./acre	Starter (6-24-24) applied (lbs./acre) 0	50	100	200	average
	(Yield in bu./acre @ 15.5% moisture)				
0	56.3	45.2	52.5	48.3	54.9
50	61.0	43.7	45.6	59.1	59.0
150	63.4	49.6	50.2	55.0	65.1
average	60.2	59.4	56.9	62.0	

Yields were quite variable due to dry weather, but there was a significant effect of nitrogen fertilization. There was no starter effect on nitrogen x starter interaction.

Variety - Dekalb XL 304 Planting date - May 22

YIELDS OF FIELD CORN GROWN EACH OF THIRTEEN YEARS (1957-69) WITH VARYING RATES OF NITROGEN FERTILIZATION AT MORRIS

J.M. MacGregor, S. Evans and G.R. Blake

A continuous corn fertilizer experiment was commenced in 1957 on a non-tiled Barnes loam at the West Central Experiment Station at Morris. Adequate amounts of phosphate and potash were applied annually with four rates of N application. Although a plant population of 16-18,000 corn plants per acre was desired, this was not always obtained, since different methods of seed-bed preparation were employed until 1968. For the past two cropping seasons, the seedbed has been prepared on all treatments by the common method. All vegetative residues remained on the field, either being plowed down or worked into the surface. Ear corn yields and the average for the thirteen years are shown in Table 1. Soil moisture appears to be a limiting factor in corn production.

During the thirteen years of continuous corn, it is evident that while the annual 40 pound per acre N fertilization rate increased ear corn yields approximately 10 bushels per acre, further increases in the rate of annual N fertilization rate did not result in a further increase in corn yields. Soil analyses have shown some accumulation of nitrate nitrogen to a 24 foot depth, although the major portion is present in the upper 8 foot depth.

The sixth corn leaf on all plots were sampled in 1969 at silking and while leaf zinc varied from 30 to 37 ppm on the different treatments, there was no significant treatment affect.

Table 1. Yield of Earn Corn During Thirteen Years (1957-69) When Grown Every Year With Different Rates of Nitrogen Fertilization.

N Appl. (lbs/A)	(a)	Year													13 yr Average
		1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	
		Bushels of ear corn per acre at 15.5% moisture													
0	(S)	65.2	73.2	36.1	53.3	32.3	38.1	62.7	33.2	50.4	49.0	66.8	64.1	47.4	51.7
40	(F)	71.0	81.5	40.9	48.2	48.3	59.0	80.9	34.1	68.3	63.7	69.2	79.6	58.0	61.7
40	(S)	69.4	81.0	41.5	55.0	47.6	62.0	83.5	29.6	75.3	66.3	71.2	70.2	60.2	62.5
80	(S)	72.1	82.4	39.7	53.7	45.0	65.3	77.4	29.1	80.8	75.9	69.7	78.5	59.9	63.8
240	(S)	71.3	80.3	36.8	52.5	46.1	67.1	79.5	24.7	82.8	33.1	71.3	76.0	58.7	60.0

(a) 40 pounds of both phosphate and potash were applied annually to all plots at time of N application.

(S) = Spring

(F) = Fall

NPK FERTILIZATION OF SOYBEANS

West Central Experiment Station - Morris

S. D. Evans and G. E. Ham

A series of plots was established in the fall of 1967 to determine the optimum fertilization rates for sugar beets. The project was discontinued after one cropping year so these plots were put into soybeans in 1969. Chippewa 64 soybeans were planted on one set of plots that had fertilizer in the fall of 1967 and on another set that had fertilizer in the fall of 1968. Fertilizer rates used are given in table 1.

Table 1: Fertilizer rates used in the experiment.
(rates are lbs./acre in the elemental form)

Nitrogen	Phosphorus	Potassium
N_o - 0	P_o - 0	K_o - 0
N_1 - 70	P_1 - 25	K_1 - 25
N_2 - 140	P_2 - 50	K_2 - 50

The elements are applied in all combinations in a 3 X 3 factorial of 2 replications. The soybeans were planted on May 28 and were harvested on October 9.

The experiment was analyzed and there were no significant main effects or interactions. The main effect yields are given in Tables 2 and 3.

Table 2: Yields of soybeans on plots that received fetilizer in the fall of 1967.

N_o	30.3	P_o	31.3	K_o	30.0
N_1	30.8	P_1	30.5	K_1	31.3
N_2	31.4	P_2	30.6	K_2	31.2

Table 3: Yields of soybeans on plots that received fertilizer in the fall of 1968.

N_o	29.3	P_o	30.4	K_o	28.9
N_1	30.6	P_1	30.0	K_1	31.0
N_2	30.3	P_2	29.7	K_2	30.2

Leaves were sampled but they have not yet been analyzed.

Table 4: Soil test results - Fall 1967

Sample No.	pH	O.M.	P	K
1	7.0	5.7	24	370
2	6.7	6.0	26	370