Soil Science Research Report - 1985

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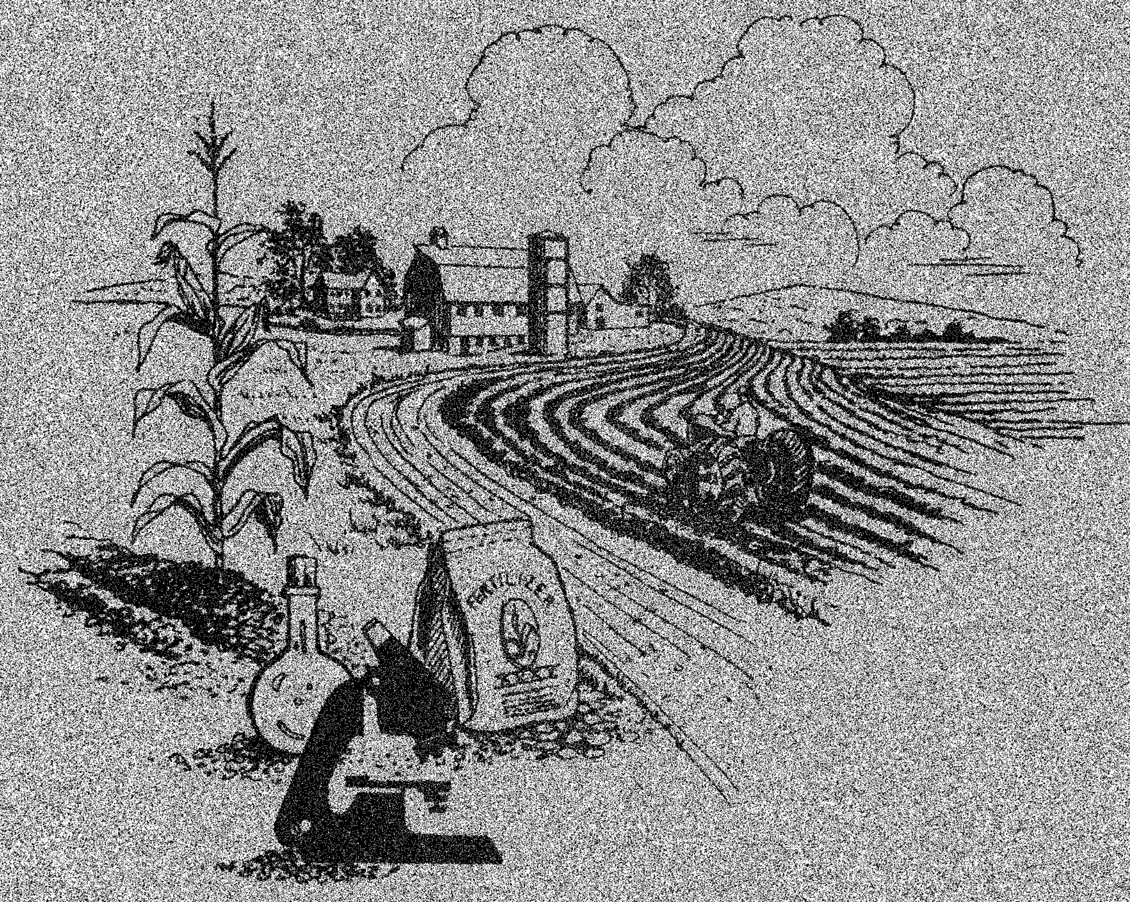

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Effect of Super Slurper and Phosphorus (P)
on Corn and Wheat Yield

D. H. Sander

Objective: To determine the effect of applying super slurper and P fertilizer on the yield of corn and wheat.

Locations: Knox County NE., UNL Experiment Station, Mead, NE and Chase County NE

Procedure:

The following treatments were used in completely randomized designs with four replications on corn and five on wheat.

Treatment No.	Super Slurper (lb/A)	P (lb/A)
1	0	0
2	0	10
3	0	20
4	5	0
5	5	10
6	5	20
7	10	0
8	10	10
9	10	20
10	check	

On corn all plots received 50 (lb/A) N as ammonium nitrate (except the check) at planting. Nitrogen was sidedressed as ammonia at the rate of 130 lb N/ac at the 5 leaf stage at Knox County and 180 lb N/ac at Mead. Super slurper and P was knifed in at planting midway between the rows at Knox County and six inches to the side of the row at Mead. Depth of knifing was 3 to 5 inches. Corn was irrigated by center pivot in Knox County and by sprinkler lines at Mead. Corn was Pioneer 3377 planted at 26,500 plants/ac.

The wheat study utilized similar treatment of P and super slurper but with no nitrogen at planting. Super slurper and P was applied with the seed. Plots were topdressed in the spring with 100 lbs N/ac.

Specific results and conclusions:

Corn

There was no effect of super slurper or P on the yield of corn in Knox County, although the P soil test was low (6.4 ppm, Bray and Kurtz with a pH = 6.8) (Table 1). The reason could have been the poor stand in the experiment.

In Mead there was a response to applied P but super slurper did not affect grain yield. The super slurper by P interaction was nonsignificant in both locations which indicates the response to P was the same at all levels of super slurper.

Wheat

Super slurper increased wheat grain yield significantly in Perkins County by three bushels/ac (Table 2). While applied P increased grain yields by nearly 20 bu/ac, there was no interaction between applied P and super slurper. This indicates that super slurper increased grain yield independently of the applied P. Super slurper apparently affected some yield factor other than P uptake. Super slurper was placed directly with the seed and could have affected germination and final head numbers.

Future Plans:

No further research is presently planned and no proposal was submitted for 1986. Continuation of this research is at the descretion of the Corn Board.

Table 1. Effect of super slurper and P rates on the yield of corn, 1985.

Super Slurper (lb/A)	N (lb/A)	P (lb/A) 0	10	20	Mean
		------- bu/a -------			
		Knox County			
0	50	112	117	120	116
5	50	128	130	108	122
10	50	127	121	118	122
0	0	121	--	--	
Mean		122	123	115	
		Mead			
0	50	161	170	137	156
5	50	160	154	152	156
10	50	161	177	158	165
Mean		161	167	149	

Analysis of Variance

Source of Variation	Knox County	Mead
Super Slurper	NS	NS
P	NS	0.09
N	NS	--
Super slurper*P	NS	NS

Table 2. Effect of Super Slurper and P on yield of winter wheat Perkins Co. NE. 1985

Super slurper lbs/ac	P lbs/ac 0	10	20	Mean
	----- Grain yield bu/ac -----			
0	29	48	48	42
5	30	47	49	42
10	33	51	51	45
Mean	31	49	50	

Analysis of Variance

Super Slurper	0.02 **
P Rate	0.01 ***
Super Slurper*P Rate	NS

Selection of Time and Source of Nitrogen for Increased Efficiency of Applied Nitrogen

R. Fiedler and D.H. Sander

Objectives: To determine: (1) the optimum time of applying nitrogen for maximum wheat yield and grain protein content, and (2) to study the movement of NO_3 from different sources of nitrogen and associated yield performance.

Location of Research: Two locations in Hitchcock County Nebraska (Terrel and Richards farms)

Procedure:

	N source	Time of N Application	Rate of N kg/ha
1.	Anhydrous ammonia-AA	Fall 83	40
2.	" " -AA	Spring 84	40
3.	" " -AA	Fall 84	40
4.	" " -AA	Spring 85	40
5.	" " -AA	Fall 83	80
6.	" " -AA	Spring 84	80
7.	" " -AA	Fall 84	80
8.	" " -AA	Spring 85	80
9.	Calcium Nitrate-CN	Fall 83	40
10.	" " -CN	Spring 84	40
11.	" " -CN	Fall 84	40
12.	" " -CN	Spring 85	40
13.	" " -CN	Fall 83	80
14.	" " -CN	Spring 84	80
15.	" " -CN	Fall 84	80
16.	" " -CN	Spring 85	80
17.	Ammonium Nitrate-AN	Fall 83	40
18.	" " -AN	Spring 84	40
19.	" " -AN	Fall 84	40
20.	" " -AN	Spring 85	40
21.	" " -AN	Fall 83	80
22.	" " -AN	Spring 84	80
23.	" " -AN	Fall 84	80
24.	" " -AN	Spring 85	80
25.	Urea-Ammonium Nitrate-UAN	Fall 83	40
26.	" " " -UAN	Spring 84	40
27.	" " " -UAN	Fall 84	40
28.	" " " -UAN	Spring 85	40
29.	" " " -UAN	Fall 83	80
30.	" " " -UAN	Spring 84	80
31.	" " " -UAN	Fall 84	80
32.	" " " -UAN	Spring 85	80
33.	No N		

Soil samples were taken to a depth of five feet at one foot increments from each treatment before jointing at flowering, and after harvest. Soil moisture was also measured in the root zone by the neutron method.

Specific Results and Conclusions: The soils of the Hitchcock locations were Keith silt loam (Terrel and Richards farms), and both were low in residual NO_3 at the first time of N application. Nitrogen application time, source and rate all significantly affected yield. There was a time by N source interaction, indicating the N sources did not perform the same at the different times of N application (Table 2). The responses were parallel over time for the different sources except AA and AN. The AA dramatically increased yield over the other sources for the fall 1984 application time, while the N varied from lowest to highest yielding at the different time periods at the Terrel location. When N was applied in the Spring 1985, yield was significantly higher than the other times except for the AA source which was higher yielding for the fall 1984 time. There was a source by rate interaction at the Terrel location (Table 1). The sources had parallel responses over rate but there was a larger response to rate of N application for the AA and UAN sources.

Averaging yields for time (Table 3) and source (Table 4) indicate that applying N when the wheat is growing (spring 85) is the best time and AA or CN are the better sources of N for application. These two studies in 1985 and three studies in 1984 indicate that there is no advantage in applying N earlier than seeding time. In a previous study (Smika 1976) on a silt loam soil in the same region of Nebraska with AA as the N source it was concluded that the earlier applied AA moved to greater depth with precipitation received during fallow resulting in greater availability of nitrate-N which increased grain yield and protein content more than later applications. The analysis of the soil NO_3, soil moisture and grain protein content is not completed.

Table 1. Effect of Time Source and Rate of Nitrogen Application on Winter Wheat Grain Yield in Southwest Nebraska. 1985.

Time of N Application	Rate of N Application	Source of Nitrogen Application AN	CN	AA	UAN	Mean
	kg/ha	--- Grain Yield kg/ha x 10^{-2} ---				
		Hitchcock County (Terrel)				
Fall '83	40	41.3	42.8	39.0	36.4	39.7
Spring '84	40	40.1	39.4	36.7	35.3	37.7
Fall '84	40	38.6	42.9	43.8	38.2	40.9
Spring '85	40	43.8	44.0	40.8	42.8	42.8
Mean		40.8	42.3	40.1	38.2	
Fall '83	80	38.1	44.0	45.5	43.0	42.7
Spring '84	80	44.0	43.8	43.2	39.8	42.7
Fall '84	80	40.4	42.9	48.2	44.5	44.0
Spring '85	80	47.6	47.3	47.0	46.6	47.1
Mean		42.5	44.5	46.0	43.5	
Mean		41.7	43.4	43.0	40.8	
No N				32.5		
		Hitchcock County (Richards)				
Fall '83	40	35.9	38.1	38.5	33.0	36.6
Spring '84	40	32.5	35.4	36.8	33.4	34.5
Fall '84	40	32.4	34.1	42.4	36.0	36.2
Spring '85	40	40.9	40.7	34.6	40.1	39.4
Mean		35.4	37.1	38.3	35.8	
Fall '83	80	40.4	46.9	41.5	38.4	41.9
Spring '84	80	38.4	42.9	41.8	42.5	41.4
Fall '84	80	36.4	39.8	49.0	36.7	40.5
Spring '85	80	43.3	45.1	50.1	49.5	47.0
Mean		39.5	43.7	45.6	41.8	
Mean		37.4	40.4	42.1	38.9	
No N				29.6		

Analysis of Variance

Source	Hitchcock Co. Terrel Grain	Hitchcock Co. Richards Grain
Time	.001	.001
Source	.006	.002
Rate	.001	.001
Time*Source	.008	.004
Source*Rate	.01	NS
Time*Rate	NS	NS
Time*Source*Rate	NS	NS

Table 2. Effect of time and source of nitrogen application on winter wheat grain yield in southwest Nebraska. 1985.

Time of N Application	Source of Nitrogen Application			
	AN	CN	AA	UAN
	Grain Yield kg/ha x 10^{-2}			
	Hitchcock County (Terrel)			
Fall '83	39.7	43.4	42.2	39.5
Spring '84	42.3	41.6	40.0	37.5
Fall '84	39.5	42.9	46.0	41.3
Spring '85	46.0	45.7	43.9	44.7
	Hitchcock County (Richards)			
Fall '83	37.8	42.5	40.0	36.1
Spring '84	35.4	39.1	39.3	37.9
Fall '84	34.4	37.0	45.7	36.3
Spring '85	42.1	42.9	43.5	44.8

Table 3. Effect of time of nitrogen application on winter wheat grain yield in southwest Nebraska. 1985

Time of N Application	Hitchcock Co. (Terrel)	Hitchcock Co. (Richards)
	Grain Yield - kg/ha x 10^{-2}	
Fall '83	41.3	39.2
Spring '84	40.3	38.0
Fall '84	42.4	38.3
Spring '85	45.0	43.3

Table 4. Effect of source of nitrogen application on winter wheat grain yield in southwest Nebraska. 1985.

Source of N Application	Hitchcock Co. (Terrel)	Hitchcock Co. (Richards)
	Grain Yield - kg/ha x 10^{-2}	
AN	41.7	37.4
CN	43.4	40.4
AA	43.0	42.1
UAN	40.8	38.9

Effect of Method(s) of Applying P on Winter Wheat Grain Yield

D. H. Sander

Objectives: To determine the most effective method or combination of methods to applying P to winter wheat.

Location of Research: Chase Co. near Imperial, Nebraska, and Gosper Co. near Lexington, Nebraska.

List of Treatments:

Method(s) of applying P	Rate of P-lbs/ac
1. Seed (Sd)	10
2. Seed (Sd)	20
3. Seed (Sd)	30
4. Knife fall (KF)	10
5. Knife fall (KF)	20
6. Knife fall (KF)	30
7. Knife spring (KS)	10
8. Knife spring (KS)	20
9. Knife spring (KS)	30
10. Split: Sd + KF	5 + 5
11. Split: Sd + KF	10 + 10
12. Split: SD + KF	15 + 15
13. Split: SD + KS	5 + 5
14. Split: SD + KS	10 + 10
15. Split: Sd + KS	15 + 15
16. No P	0
17. Dribble (Db)	20
18. Split: Sd + Db	10 + 10

Specific Results and Conclusions:

Wheat grain yields were significantly increased by applied P on both low P soils (Table 1). In Gosper County, knife (fall) produced the highest yield with no difference in rates of application. Splitting the application (Sd+KF) did not increase fertilizer efficiency or yields over knife fall alone. However, splitting the application between seed and knife (spring) seemed to increase yields equal to knife (fall) applications apparently superior to seed alone method of application.

In Chase County, the split treatment of seed + knife (spring) appeared to be the most effective in terms of yield especially at the lowest rate of application (10 lbs P/ac).

Data suggest potential for increasing both wheat grain yields and fertilizer P efficiency by split fall and spring methods of application.

Table 1. Effect of method of P application on wheat grain yields.

Method of P Application	P rate - lbs/ac 10	20	30	Mean
	Gosper County 85-3, bu/ac			
Seed (Sd)	48	54	49	50
Knife Fall (KF)	57	59	61	59
Knife Spring (KS)	49	53	52	51
Split: Sd + KF	57	59	56	58
Split: Sd + KS	56	54	58	56
Mean	54	55	56	
Dribble (Db)		52		
Split: Sd + Db		56		
No P 48				
	Chase County 85-6, bu/ac			
Seed (Sd)	35	34	33	34
Knife Fall (KF)	32	34	44	37
Knife Spring (KS)	31	32	35	33
Split: Sd + KF	33	40	38	37
Split: Sd + KS	38	41	37	39
Mean	34	36	38	
No P 23				

Analysis of Variance

Source	Gosper Co.	Chase Co.
P Rate	NS	.01
Method	.01	.01
P Rate * Method	NS	.01

Effect of Timing of Knifed in P on Winter Wheat Grain Yield

D. H. Sander and R. Fiedler

Objectives: To determine: (1) the effect of time of application of knifed in P and (2) the effect of knifing in P separate from NH_3 or knifing in P with NH_3.

Location of Research: Two locations in Hitchcock County Nebraska (Locations 85-45 and 85-50)

List of Treatments	Time of P application	Rate of P lbs/ac
1. Knifed P with NH_3	Fall 83	10
2. Knifed P (NH_3 knifed separate before seeding)	Fall 83	10
3. Knifed P with NH_3	Fall 83	20
4. Knifed P (NH_3 knifed separate before seeding)	Fall 83	20
5. Knifed P with NH_3	Fall 83	30
6. Knifed P (NH_3 knifed separate before seeding)	Fall 83	30
7. Knifed P with NH_3	Spring 84	10
8. Knifed P (NH_3 knifed separate before seeding)	Spring 84	10
9. Knifed P with NH_3	Spring 84	20
10. Knifed P (NH_3 knifed separate before seeding)	Spring 84	20
11. Knifed P with NH_3	Spring 84	30
12. Knifed P (NH_3 knifed separate before seeding)	Spring 84	30
13. Knifed P with NH_3	Fall 84	10
14. Knifed P (NH_3 knifed separate before seeding)	Fall 84	10
15. Knifed P with NH_3	Fall 84	20
16. Knifed P (NH_3 knifed separate before seeding)	Fall 84	20
17. Knifed P with NH_3	Fall 84	30
18. Knifed P (NH_3 knifed separate before seeding)	Fall 84	30
19. Seed P (NH_3 knifed separate before seeding)	Fall 84	10
20. Seed P (NH_3 knifed separate before seeding)	Fall 84	20
21. Seed P (NH_3 knifed separate before seeding)	Fall 84	30
22. No P		0

Specific Results and Conclusions:

There was not a grain yield response to applied P at either location regardless of time of P application (Table 1 and 2). A phosphorus response had been expected because location 85-45 had a low soil P test level (4.8 $NaHCO_3$-P) and location 85-50 had a medium soil P test level (11.0 $NaHCO_3$-P). There was a time of nitrogen application response (Table 2 and 3). NH_3-N applied with the P in the fall of 1984 was more effective than NH_3-N applied with P in the fall of 1983 or the spring of 1984. The reason for the varying nitrogen response cannot be attributed to nitrogen moving below the rooting zone because there was limited rainfall. It is recommended that the anhydrous ammonia be knifed with P prior to seeding. There are no recommendations for the time of P application since neither experiment showed a response to P application. Three concurrent studies in 1984 have indicated that P can be knifed anytime during fallow. One explanation is that knifing concentrates P in bands with very little soil P contact. Since tillage does not disturb the bands, this method of P application allows the P to remain available over long periods of time.

Table 1. The effect of time and rate of knifed in P on winter wheat grain yield.[1/]

Time of P Application		P rate - lbs/ac			
		10	20	30	Mean
			Hitchcock County 85-45, bu/ac		
Fall 83		63	60	62	62
Spring 84		64	64	67	65
Fall 84		68	66	71	68
Mean		65	63	67	
No P	66				
			Hitchcock County 85-50, bu/ac		
Fall 83		71	69	66	69
Spring 84		67	66	65	66
Fall 84		79	77	78	78
Mean		72	71	70	
No P	74				

Table 2. Analysis of Variance

Source	Hitchcock County 85-45	Hitchcock County 85-50
Time (T)	NS	.01
P rate (R)	NS	NS
Position (P)[1/]	.01	.01
T x R	NS	NS
T x P	.01	.01
R x P	NS	NS
T x R x P	NS	NS

1/ A comparison of time of N application - applied with P at various times or prior to seeding (Fall 84).

Location	$NaHCO_3$ Soil P, ppm
85-45	4.8
85-50	11.0

Table 3. The effect of knifing in P separate or together with ammonia on winter wheat yield.

Time of P application	P Rate - lbs P/ac: 10 Separate	10 with NH_3	20 Separate	20 with NH_3	30 Separate	30 with NH_3
			Hitchcock County 85-45, bu/ac			
Fall '83	65	61	65	57	65	58
Spring '84	72	58	68	61	73	56
Fall '84	66	70	65	68	70	74
Mean	68	63	66	62	69	63
No P	66					
			Hitchcock County 85-50, bu/ac			
Fall '83	78	64	80	58	74	58
Spring '84	76	57	73	59	76	55
Fall '84	82	77	76	77	77	79
Mean	79	66	76	65	76	64
No P	74					

1/ Separate refers to nitrogen application in the fall prior to seeding. With ammonia refers to nitrogen application at time of P application as a "dual placement."

Winter Wheat Yield and Grain Quality as Influenced by Dynam (Lenaire product)

D. H. Sander and Paul Mattern

Objective: To determine the effect of Dynam in combination with various rates of nitrogen (N) and phosphorus (P) in the yield and grain quality of hard winter wheat.

Procedure: A study location was selected in Chase County in 1984 on a Rosebud-Keith complex soil. Soil had an available P level of 5 ppm ($NaHCO_3$-P) and a pH of 7.4. Dynam was broadcast prior to seeding and incorporated with final tillage. Brule wheat was seeded on 9-20-84 at a rate of 45 lbs/ac in 12-inch rows with a John Deere hoe drill. Phosphorus was applied as 0-44-0 with the seed at planting. Nitrogen was topdressed as ammonium nitrate in the spring. Two rows 10 feet long were harvested on 6-25-85 (20 ft^2). The bundles were air dried and threshed for determination of grain and straw yields. The experimental design was a complete randomized block with a factorial treatment arrangement with five replications involving three rates of P Dynam (0, 300, 600 lbs N/ac), two rates of P (0 and 30 lbs P/ac) and two rates of N (0 and 80 lbs N/ac). Stands were excellent and the growing season was above average for the region.

Equal weights of replicated samples from twelve treatments were individually composited to provide an adequate amount of wheat for a processing quality evaluation. The composites were cleaned, blended and 2500 g samples were weighed and tempered to a 15.2% moisture content for 20-24 hours. Tempering is part of the milling procedure which softens the endosperm, the floury portion of the kernel, and toughens the bran layer for a more efficient separation from the flour. Samples were milled on a Buhler Laboratory Mill Model MLU-202 at standard roll settings.

The traditional optimized straight dough 100 g. "pup" loaf baking method was used for the baking evaluation. Two levels of oxidation (potassium bromate) were used for a preliminary screening bake. A final baking was repeated at an optimum oxidation level and a single mixed dough was divided to produce duplicate loaves.

Results and Conclusions:

Grain and Straw Yields

Grain and straw yields were increased significantly by applications of all three variables Dynam, N, and P (Table 1 and 2). Phosphorus application increased yield about 5 bu/ac, while nitrogen significantly increased grain yield by only 2 bu/ac. Interaction between N and P was not apparent. The results of applying Dynam, while significant, are less evident. Grain and straw yields were significantly increased from the 300 to the 600 lb/ac application rate, but both the 300 and 600 lb rates are not different from the check. However, there was a weakly significant P x Dynam interaction indicating that grain yields tended to increase when P and Dynam were applied together. This effect appears primarily at the 600 lb Dynam rate which together with 30 lb P/ac produced the highest yield of 56 bu/ac. While this trend was evident for straw yields, the interaction was not significant. The highest straw yields occurred when both N and P was applied with 600 lb/ac of Dynam which resulted in a significant N x P x Dynam interaction.

In conclusion, Dynam appeared to increase grain and straw yields at the one experimental location studied especially when combined with P applications. Increases were not expected especially since Dynam is primarily a calcium product that would be expected to have properties similar to lime. Since the soil had a pH of 7.4, the product did not affect yield thru its lime properties but apparently affected some other yield factor to a small but positive degree. The products performance could justify a research interest but does not justify economical farmer applications at this time.

Quality Evaluation:

Dynam, per se, appeared to have little effect on milling or baking properties in this study (Table 3). Higher protein levels required slightly higher oxidation levels. Mixing times as determined by the mixograph and the baker were similar for all Dynam treatments. There were no effects on percent milling yield or ash contents which could be related to Dynam treatments. Samples grown from N and P applications had a slight reduction in milling yield at all levels of Dynam. The most dramatic effect was that of loaf volume which was highly correlated with four protein. Protein, in turn, is related to the nitrogen application (Figure 1). The pictures are self-explanatory. Loaf volume is the major quality consideration, for the U.S. baking industry. The best bread scores were related to the higher flour protein, which was influenced by N fertilizer application. On the basis of these Nebraska data one could not recommend Dynam as an improver of milling and baking quality.

Table 1. Effect of N, P, and Dynam on winter wheat yield in a wheat-fallow-wheat cropping system. Perkins County, 1985.

Treatment			Yield	
N	P	Dynam	Grain	Straw
	lbs/ac		bu/ac	lbs/ac
0	0	0	45	2863
0	30	0	52	3633
80	0	0	49	3724
80	30	0	50	3801
0	0	300	43	2842
0	0	600	45	3045
80	0	300	47	3216
80	0	600	47	3280
0	30	300	47	3276
0	30	600	55	3813
80	30	300	52	3902
80	30	600	57	4173

Analysis of Variance

Source of Variation	Probability of > F	
Dynam (D)	0.10	0.11
Nitrogen (N)	0.12	0.001
Phosphorus (P)	0.001	0.001
D x N	NS	NS
D x P	0.20	NS
N X P	NS	NS
D x N x P	NS	0.15

NS indicates not significant or probability of obtaining this F value exceeds 20%.

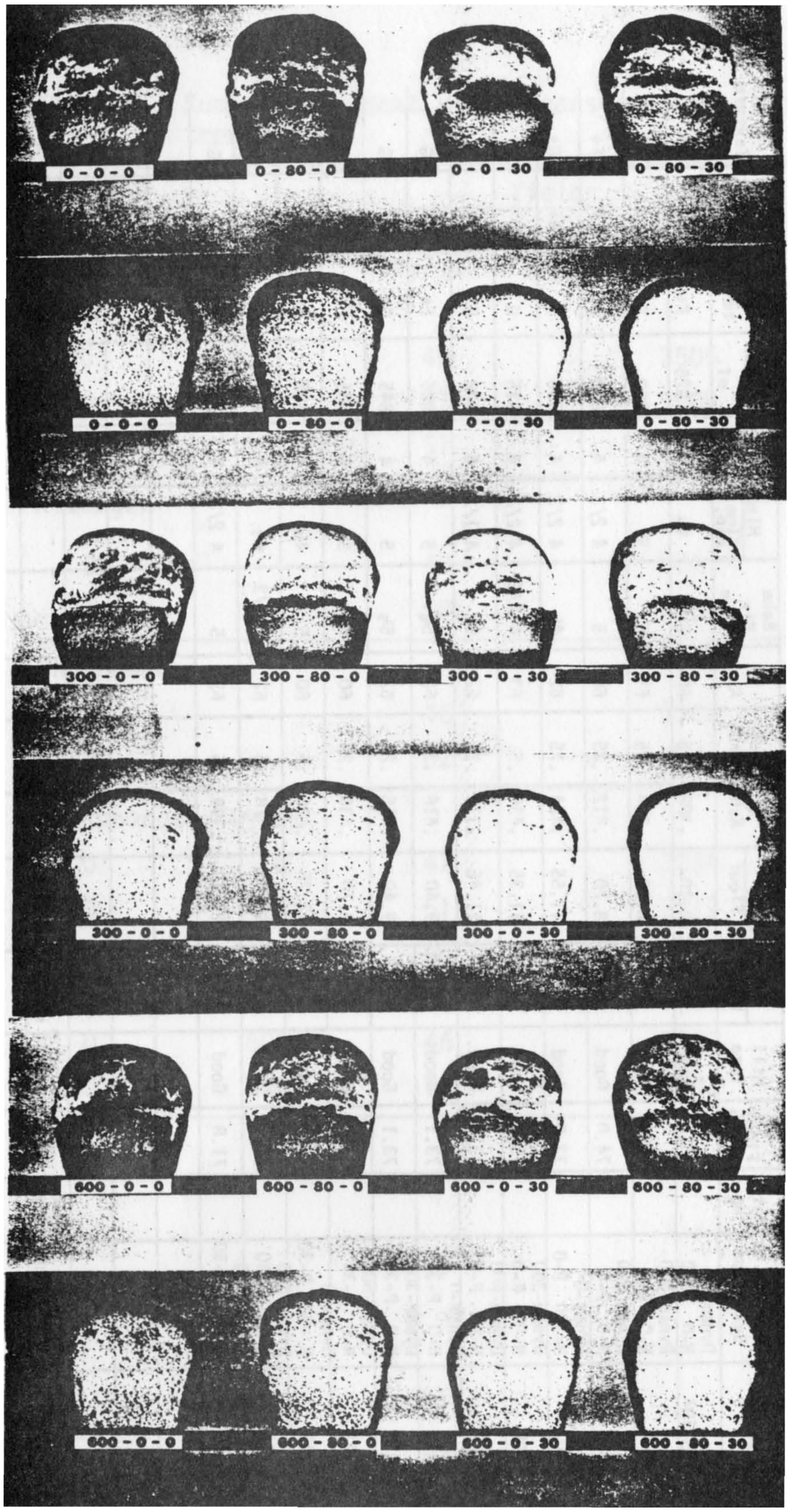
Table 2. Summary of wheat yield means according to treatment.

Treatment		Yield	
		Grain	Straw
lbs/ac		bu/ac	lbs/ac
Dynam			
0		49	3505
300		47	3308
600		51	3578
Nitrogen			
0		48	3245
80		50	3683
Phosphorus			
0		46	3162
30		52	3766
Phosphorus x Dynam			
0	0	47	3294
30	0	51	3717
0	300	45	3029
30	300	50	3589
0	600	46	3163
30	600	56	3993

Table 3. 1985 Lemaire Fertilizer Study
Bake Report[1/]

Lab. No.	Variety or Selection	Entry No.	% Flour Yield	Mill Type	% Protein Wheat	% Protein Flour	% Ash	% mg $KBrO_3$	% Abs.	Bake Mix Time	Mixograph Time min.	Mixograph Tol.	Loaf Volume ml.	External	Grain	Texture
85-104	Dynam-0 N-0 P-0		73.8	Good	10.15	9.10	.388	.25	60	5½	4½	4	825	F+	F+	F+
105	Dynam-300 N-0 P-0		73.9	Good	10.00	8.90	.394	.25	61	5	5	4	820	F+	F+	F+
106	Dynam 600 N-0 P-0		74.0	Good	9.80	8.70	.412	.25	60	5	4 2/3	4	800	F+	F+	F+
107	Dynam-0 N- 80 P-0		72.9	Good	12.75	11.55	.434	.75	62	4½	4 2/3	4	935	G	G+	G+
108	Dynam-300 N-80 P-0		73.3	Good	12.25	11.35	.430	.5	63	4 2/3	4 2/3	4	915	G	G	G
109	Dynam-600 N-80 P-0		73.9	Good	12.40	11.45	.378	.25	62	5	4 1/3	4	900	G	G	G
110	Dynam-0 N-0 P-30		73.1	Good-	10.75	9.40	.416	.25	62	5½	5	4	825	F+	G	G
111	Dynam-300 N-0 P-30		73.1	Good	10.75	9.40	.416	.25	62	5½	5	4	845	G-	G	G
112	Dynam-600 N-0 P-30		73.3	Good	9.95	8.70	.430	.25	60	5½	5	4	765	F	F+	F+
113	Dynam-0 N -80 P-30		71.9	Good	13.45	12.25	.436	.5	60	5	4½	4	855	F+	G+	G+
114	Dynam-300 N-80 P-30		71.9	Good	13.15	12.05	.378	.5	62	5 1/3	4½	4	900	G+	G+	G+
115	Dynam-600 N-80 P-30		71.8	Good	13.10	11.75	.398	.5	63	5	4 2/3	4	930	VG-	G+	G+

1/ All analytical data on a 14% moisture basis.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Effect of Spacing of Phosphorus Fertilizer Band on the Yield and Plant P Uptake of Corn

B. Eghball and D.H. Sander

Objective: To determine the effect of spacing of phosphorus fertilizer band on the yield and plant P uptake of corn.

Procedure: Two different experiments were conducted as follows:

a. Field experiments were established over two years, 1984 and 1985, and two locations, Sherman County and Knox County in Nebraska. Phosphorus fertilizer as ammonium polyphosphate was knifed (dual placed) with anhydrous ammonia at four spacings (30, 45, 60, and 75 cm) perpendicular to the rows. The fertilizer was knifed at 7.5 and 15 cm deep. Nitrogen rates were 75 and 150 kg/ha and P rates were 0, 15 and 30 kg/ha. Soil type used in Sherman County was Hastings silt loam and Moody silt loam in Knox County.

A split plot treatment arrangement in a randomized complete block design was used with 3 replications.

b. A "field pot experiment" was established on the University Field Lab at Mead in 1984 and 85 on a Sharpsburg soil. Phosphorus fertilizer tagged with ^{32}P was injected into the soil 10 cm deep on a circle around a group of 6 plants in the center. The circles were spaced 16, 32, 48 and 64 cm from the plants. The fertilizer solution for each plot was divided into ten parts and were injected in ten spots on the circle's circumference at different placement distances (0, where all the ten parts were injected in one spot, 2.5, 5.0, 7.5 and 10.0 cm) from each other. The P rates were 5 and 10 kg/ha. Nitrogen as ammonium nitrate was broadcast over the plots at a rate of 200 kg/ha.

Plant samples were taken at the seven and 10 leaf stage, and maturity (times 1, 2 and 3) and the percent of P in the plant coming from the fertilizer was calculated (% Y). The data obtained was not normally distributed and was transformed to natural logarithms for statistical analysis.

Results and Discussion:

a. Field experiments

The results from 1984 indicate that corn responsed to applied P and N fertilizers (Table 1). There was no effect of depth of placement on the grain yield. Spacing of dual placed fertilizers affected the grain yield differently. A spacing of 60 cm gave the highest yield, similar to the results obtained in 1983. There was a significant interaction between spacing and applied N. The yield response to spacing was both linear and quadratic and the P effect was only linear (Table 4).

In 1985 although the soil P and N levels were low (8.3 ppm P, Bray and Kurtz #1 and 52 ppm $N\text{-}NO_3^-$), no response to P, N and spacing was observed. Plant emergence was poor resulting in less than optimum plant population. Yields were adjusted for the number of ears harvested and soil P variations, by using covariant analysis.

b. Field pot experiment

The results from both years indicate P fertilizer uptake significantly decreased as the distance of P application from the plant increased (Tables 2 and 3). Placement (distance between fertilizer P injection points) did not effect the P uptake by the plants in all 3 times in 1985 and times 1 and 2 in 1984. The only response to placement was observed in time 3 in 1984 (Table 5). There was a difference between two rates in all times in both years, but in time 1 in 1985 which the rates responded the same. A significant interaction between spacing and rate occurred at all times in 1984, but this interaction was not observed in 1985. The spacing response was linear in both years and at all times. The quadratic effect of spacing was only observed in time 1 in both years. There was a linear response due to placement distances in both years in all times but time 1 in 1984. The uptake from fertilizer was higher when the spots were placed at a greater distance from each other because of increasing the probability of root contacting the fertilizer.

Table 1: Grain yield of corn as affected by rate and knife spacing of phosphorus fertilizer, at two locations and years.

Space (CM)	N (KG/HA)	Depth (CM) 7.5 P (KG/HA) 0	15	30	15 P (KG/HA) 0	15	30	Mean
		---- KG/HA ----						
1984 (Sherman County)								
30	75	7380	8342	8070	7024	9429	8237	8080
30	150	10537	9345	8404	9492	9868	9094	9457
45	75	6293	7296	8969	7129	8404	8467	7760
45	150	8718	8760	10537	8718	9387	10600	9453
60	75	7255	8112	7443	7338	8467	8864	7913
60	150	9429	10161	9679	8990	10662	10495	9903
75	75	7631	7171	7924	7672	6586	8551	7589
75	150	8174	9262	7192	7087	7317	7401	7739
Mean		8177	8556	8527	7931	8765	8964	8487
1985 (Knox County)								
30	75	6188	7296	7735	7902	7317	7087	7254
30	150	7589	7819	6983	6983	6941	6941	7209
45	75	7464	7735	6397	7276	6460	7547	7147
45	150	6690	7066	7004	6962	6314	6711	6791
60	75	6502	6565	6397	7150	6962	7046	6770
60	150	7213	6586	7046	7255	6899	6857	6976
75	75	7359	7171	7234	7694	6356	7568	6976
75	150	6167	6523	8237	6502	6983	7631	7007
Mean		6897	7095	7129	7216	6779	7174	7048

Table 2: Fertilizer P uptake by corn as affected by fertilizer phosphorus spacing, placement and time of plant sampling, 1984.

Distance** (CM)	P (KG/HA)	Placement (CM)* 0	2.5	5.0	7.5	10.0	Mean
		Fertilizer P uptake (%)					
		7 leaf stage (time 1)					
16	5	11.7	20.8	13.8	13.1	14.34	14.8
16	10	34.3	22.7	32.8	32.1	33.4	31.1
32	5	4.0	6.0	5.6	4.6	5.8	5.2
32	10	5.1	4.0	4.0	7.3	7.6	5.6
48	5	2.7	2.5	2.3	2.6	2.7	2.6
48	10	3.6	2.8	2.9	2.3	3.4	3.0
64	5	3.0	2.7	2.4	2.4	2.4	2.6
64	10	2.1	2.4	2.4	2.1	4.0	2.6
Mean		8.3	8.0	8.3	8.3	9.2	8.4
		10 leaf stage (time 2)					
16	5	3.8	5.3	5.3	7.4	6.8	5.7
16	10	12.8	11.6	23.2	12.1	12.9	14.5
32	5	3.1	6.2	3.9	5.9	6.7	5.2
32	10	9.6	8.1	9.6	8.8	9.4	9.1
48	5	5.3	2.8	4.8	3.6	4.3	4.2
48	10	2.4	4.2	3.6	5.0	5.7	4.2
64	5	3.8	3.2	3.8	2.3	2.9	3.2
64	10	3.6	4.6	3.8	2.3	8.5	4.6
Mean		5.6	5.8	7.3	5.9	7.2	6.4
		Maturity (time 3)					
16	5	2.9	4.0	4.1	3.8	3.3	3.6
16	10	5.4	9.6	9.4	8.8	8.5	8.3
32	5	2.6	3.8	3.4	4.7	3.5	3.6
32	10	5.3	6.0	5.1	8.4	12.2	7.4
48	5	4.6	2.5	3.8	3.9	2.6	3.5
48	10	3.2	5.1	3.3	3.7	4.7	4.0
64	5	3.0	2.8	2.6	3.7	3.5	3.1
64	10	3.4	4.1	2.4	3.4	5.1	3.7
Mean		3.8	4.7	4.3	5.1	5.4	4.7

* Refers to distance of P application points from the plants.
** Refers to distance between P application points from each other (10 total spots injected).

Table 3: Fertilizer P uptake by corn as affected by fertilizer phosphorus spacing, placement and time of plant sampling, 1985.

Distance** (CM)	P (KG/HA)	Placement (CM)* 0	2.5	5.0	7.5	10.0	Mean
		Fertilizer P uptake (%)					
		7 leaf stage (time 1)					
16	5	6.3	6.7	6.1	7.4	5.0	6.3
16	10	5.0	6.9	7.4	8.4	5.5	6.6
32	5	0.7	0.7	0.7	3.4	1.6	1.4
32	10	0.9	1.2	0.3	2.9	3.7	1.8
48	5	0.2	0.3	0.2	0.7	0.9	0.5
48	10	0.7	0.7	1.7	0.3	3.9	1.5
64	5	0.0	0.7	0.1	0.0	0.6	0.3
64	10	0.0	1.0	0.0	0.2	1.4	0.5
Mean		1.7	2.3	2.1	2.9	2.8	2.4
		10 leaf stage (time 2)					
16	5	2.1	3.6	1.8	5.1	3.1	3.1
16	10	4.7	5.0	10.2	6.0	3.0	5.8
32	5	1.7	1.7	1.4	2.5	2.4	1.9
32	10	0.7	0.9	1.1	3.2	3.6	1.9
48	5	0.8	0.4	1.4	2.1	1.0	1.1
48	10	0.8	0.1	0.8	0.3	12.5	2.9
64	5	0.4	0.4	0.2	0.1	0.5	0.3
64	10	1.8	0.3	2.2	0.2	0.3	1.0
Mean		1.6	1.6	2.4	2.4	3.3	2.2
		Maturity (time 3)					
16	5	0.8	0.7	0.6	0.9	0.6	0.7
16	10	0.9	1.5	2.2	1.7	1.0	1.5
32	5	0.4	0.4	0.6	0.4	0.7	0.5
32	10	0.5	0.7	0.8	1.2	2.5	1.1
48	5	0.1	0.6	0.6	1.0	0.2	0.5
48	10	0.5	0.8	0.5	0.5	1.6	0.8
64	5	0.0	0.1	0.3	0.1	0.3	0.2
64	10	1.5	0.1	0.4	0.3	0.3	0.5
Mean		0.6	0.6	0.8	0.8	0.8	0.7

* Refers to distance of P application points from the plants.
** Refers to distance between P application points from each other (10 total spots injected).

Table 4: Grain yield analysis of variance for 1984 and 1985 field experiments.

Source	1984 (Sherman C.)		1985 (Knox C.)	
	F	PR>F	F	PR>F
Rep	13.07	0.0001	3.45	0.0358
Spacing (S)	3.05	0.1055	0.78	NS
Nitrogen (N)	28.70	0.0001	0.34	NS
Phosphorus (P)	3.49	0.0354	0.64	NS
Depth (DP)	0.42	NS	0.01	NS
S*N	3.39	0.0221	0.45	NS
S*P	1.41	NS	0.78	NS
S*DP	0.93	NS	0.34	NS
N*P	0.92	NS	0.27	NS
N*DP	1.09	NS	0.97	NS
P*DP	0.80	NS	1.04	NS
S Linear	8.79	0.0040	0.29	NS
S Quad	3.97	0.0499	1.99	NS
P Linear	5.23	0.0249	0.19	NS
P Quad	1.67	NS	0.76	NS

Table 5: Analysis of variance for field pot experiment, 1984 and 1985.

Source	1984			1985		
	Time					
	1	2	3	1	2	3
	PR>F					
Rep	0.0006	0.0001	0.0001	0.0001	0.0001	0.0001
Distance (D)	0.0001	0.0001	0.0001	0.0001	0.0001	0.0004
Placement (PL)	NS	NS	0.0875	NS	NS	NS
Rate (R)	0.0442	0.0001	0.0001	NS	0.0400	0.0002
D*PL	NS	NS	NS	NS	0.0631	NS
D*R	0.0700	0.0080	0.0008	NS	NS	NS
PL*R	NS	NS	0.0618	NS	NS	NS
D*PL*R	NS	NS	NS	NS	NS	NS
D Linear	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
D Quad	0.0001	NS	NS	0.0219	NS	NS
D Cubic	NS	NS	NS	NS	NS	NS
PL Linear	NS	0.0793	0.0205	0.0535	0.0223	0.0876
PL Quad	NS	NS	NS	NS	NS	NS
PL Cubic	NS	NS	NS	NS	NS	NS

High Yield Corn-Soybean-Wheat Rotation Study

R.A. Olson, D.T. Walters, and W.R. Peterson

Objective: To determine nutritional limitations that may exist for high yields in a corn-soybean-wheat rotation on irrigated Sharpsburg sicl and to evaluate relative energy requirements and economic returns compared with monoculture corn.

Procedure: Separate blocks were established in 1981-82 for growing irrigated corn, soybeans, and wheat in rotation such that each crop is produced every year and all compared with adjacent monoculture corn. Rates of N, P and K are included along with singular rates of manure, S, Zn, Cu and B. Highest rates of N are employed for corn, one-half those amounts for wheat and one-fourth for soybeans.

Results: The 1985 growing season proved an excellent one for crop yields (Table 1). This was the first season since the establishment of the rotation that followed a complete cycle of rotation. Both wheat and soybeans achieved top yields with the application of 20T manure applied in alternate years. The addition of supplemental N, P and K with manure (Treatment 9) did not effect any additional yield increase in either wheat or soybeans. Wheat yields, however, were significantly improved when P was added with inorganic N as compared to N alone (Treatment 5). Lodging of wheat at the 80 lb N rate resulted in yields comparable to that of the control.

Corn required substantially more nutrients than provided by manure alone. Highest yields were obtained with the application of supplementary inorganic N and P with manure (Treatment 9). No K response was observed. Corn in rotation resulted in a significant 22 bu/A yield advantage over monoculture corn when averaged over all treatments.

Complete records have been maintained on the economic and energy costs of irrigation, pesticides, fertilizer and tillage. Preliminary analysis of this data suggests that the increased cost of annual irrigation on continuous corn severely limits its profitability when compared to the water savings associated with rotated corn.

Table 1. Grain yields in high yield rotation experiment, 1985. Mead field lab on Sharpsburg sicl.

Treatment1/ lb/A	Average grain yields bu/A2/			
	Rotation			
	Corn	Soybeans	Wheat	Continuous Corn
1. Control	121 a	42 a	42 a	96 a
2. 20T	181 bc	45 a	65 a	153 b
3. 80+0+0	174 b	44 a	48 bc	154 b
4. 160+0+0	173 b	39 a	39 c	161 b
5. 160+40+0	182 bc	43 a	60 ab	153 b
6. 160+40+40	174 b	42 a	58 ab	167 b
7. 160+40+30+20S+10Zn +1B+0.5Cu	192 c	42 a	61 ab	173 b
8. 320+80+80	191 c	46 a	50 bc	162 b
9. 160+40+40+20T manure	203 c	45 a	65 a	172 b

1/ Wheat receives one-half the N rate of corn, soybeans one-fourth.

2/ Means followed by the same letter within a column are not significantly different at the 5% level.

Table 2. Analysis of variance for the comparison of continuous vs. rotated corn yields, 1985.

Source	Prob. > F
Rep	.52
Rotation (R)	.0001
Rep x R	.991
Treatment (T)	.0001
R x T	.94

Fertilizer Management in Reduced Tillage Systems for Sprinkler-Irrigated Corn

W.R. Raun, R.A. Olson, and D.H. Sander

Objectives

(1) To evaluate various phosphorus (P) sources and methods of placement as a means of improving the efficiency of P fertilization in irrigated minimum-till corn.

(2) To evaluate different nitrogen (N) sources and methods of placement as a means of improving the efficiency of N fertilization in irrigated minimum-till corn.

Procedure:

Field studies were conducted during 1983-1985 at the Mead Field Lab on Sharpsburg sicl and on a cooperator's farm on Coly sil near Loup City for meeting the P study objective. A complete factorial randomized complete block design was employed involving four methods of placement, three P sources and rates of 9 and 18 kg P ha^{-1} with repeated treatments on the same plots over the three-year period. Placement methods were: P injected with NH_3 preplant (dual placement); P banded to the side of seed row (5 cm side, 5 cm deep); P banded below the seed (5 cm below); and P broadcast preplant. Solution P sources used were: urea phosphate (UP, 7-18-0); diammonium phosphate (DAP, 12-31-0); and ammonium polyphosphate (APP, 10-34-0). Two check plots (no P) were included in each block. All plots received 200 kg N ha^{-1}, adjusted with NH_3 in accordance with the carrier N of the P source. Corn was planted in 12 rows of 76 cm row width and 10 meters length at seeding rates of 69,000 ha^{-1}. Appropriate pesticides were applied for control of weeds and root worm and irrigation accomplished as needed.

Field experiments for meeting the N study objective were carried out on Sharpsburg sicl at the Mead Field Lab during 1983-1985. An incomplete factorial randomized complete block design was employed with placement methods of: Banded to the side of seed row at planting (BS, 6 cm to side, 6 cm below soil surface); dribble surface band at planting (DS, 6 cm to the side of seed row); broadcast preplant (BRP); NH_3 injected preplant (AA-IP, 15 cm deep, 38 cm knife spacing); and NH_3 injected as delayed sidedressing at 8-leaf stage (AA-SD, 15 cm deep, 76 cm knife spacing) the latter two outside the factorial. Sources of N were: Urea urea phosphate (UPP, 38.2-12.7-0); sulfur coated urea (SCU, 38.7-0-0-13.9S, 28.6% 7-day dissolution rate); urea (UR, 46-0-0); urea ammonium nitrate solution (UAN, 32-0-0); and anhydrous ammonia (AA, 82-0-0) at rates of 90 and 180 kg ha^{-1}. Two check plots (no N) were included in each block. All plots were adjusted by rate for the carrier P and S in the UUP and SCU sources with concentrated superphosphate and elemental sulfur, respectively. Experimental units consisted of 4-row plots with 76-cm row spacing x 19 meters length. Pesticides and irrigation applied were similar to the P study.

Eight ear leaf samples were taken from each plot (outside of harvest area) at early silking. Grain was harvested from two center rows of the P study by plot combine in 1984 and 1985 and by hand harvesting 3 meters of the center 2 rows in 1983, while the N study was combined in 1985 and hand harvested the first 2 years. Grain samples were taken for moisture and total N determination. Hand harvested stalks were cut, weighed, subsampled, ground and analyzed for total N.

Results and Discussion:

The two Mead sites of Sharpsburg sicl are slightly acid in the surface and near neutral in reaction throughout the rest of the 180 cm profile whereas the Loup City site of Coly sil is slightly calcareous and alkaline throughout. Phosphorus level should be considered quite low at all three locations, although larger amounts of available P exist in the Sharpsburg deep subsoil. Residual mineral N on start up was modest at 128 kg ha^{-1} with the Mead P site but rather substantiatial at around 200 kg ha^{-1} with the other two. Soil K is high in the two Sharpsburg plots and very high in the Coly.

P Study

Yield date for the P study (Table 1) reveal a large positive response to P in all years on the Coly soil and with significant rate effect. Dual placed and broadcast preplant P were consistently superior to banding beside or below the seed row on this calcareous soil. The results have been obvious enough to the owner of the land on which the study has been conducted that he has modified his field equipment to apply anhydrous ammonia and a 10-34-0 solution in this manner. The UP source of P has consistently exceeded APP and DAP, probably a result of its acidic character that assists in maintaining P solubility in the calcareous soil medium.

Response to P was hardly evident on the Sharpsburg soil (Table 1) until the third year when, with exceptionally high yields accompanying a cool and moist July and August, a large yield increase to P resulted. The UP carrier again gave evidence of some superiority over the other carriers, but banding beside the seed exceeded the dual and broadcast placements. Seemingly the higher native subsoil P availability in the Sharpsburg could account for this different placement response than realized on Coly.

N Study

Placement and source differences within the factorial portion of the N study were neither large nor consistent (Table 2) such that specific conclusions cannot be drawn from the data. The biggest problem is associated with the 1985 results because of erratic stands and yields, a result of late planting in excessively wet soil. Outside of the factorial, anhydrous ammonia applied either preplant or as a summer sidedressing was quite superior to other carriers. Likely reason is that its deep injection placed the N well below the biomass at the soil surface thereby lessening the N immobilization that occurs with N materials placed near the surface. Fertigation with UAN in three increments did not equal other placements, presumably the result of NH_3 volatilization from the urea component so applied on leaf and soil surfaces.

Conclusions:

Dual placement of NH_3 and P carrier showed particular promise with reduced tillage on the calcareous soil of this study, but banding beside the seed was superior on the slightly acid soil. It is concluded that the existence of greater deep subsoil P reserves in the acid soil accounts for the difference. Higher grain and stover yields and P uptake were obtained with UP than with APP and DAP, possible explanation being in the stronger acidity of the UP especially where used on calcareous soils. There would seem to be good reason for using UP rather than APP solutions in future dual placement studies from this work.

Primary conclusion from the N carrier/method study with reduced tillage is that N should be injected at sufficient depth to prevent immobilization in the surface biomass.

Table 1. Effects of rate, method and source of P on grain yields of irrigated no-till corn at two Nebraska locations, 1983-85.

Evaluation	Yields1/ 1983	1984	1985	Ave.	Total uptake
	------------	------------	kg ha^{-1}	------------	------------
		Loup City, Coly sil			
Rate of P					
0	3491	3129	5500	4040	
9	4891a	5219a	8460b	6190b	16
18	4865a	5921a	10439a	7075a	20
P placement					
Band side seed	4296b	4686b	7536c	5506b	14
Band below seed	4262b	4869b	8932b	6021b	16
Dual placement	5854a	6575a	10695a	7708a	21
Brdcst preplant	5100ab	6149a	10636a	7295a	20
P source					
APP	4451a	5433ab	9442ab	6442b	17
DAP	4911a	4981b	8918b	6270b	17
UP	5271a	6296a	9988a	7185a	20
		Mead, Sharpsburg sicl			
Rate of P					
0	8607	7859	8840	8435	
9	7792a	8746a	14506a	10349a	36
18	8109a	8780a	14923a	10604a	38
P placement					
Band side seed	8279a	9394a	14811a	10828a	38
Band below seed	8131a	8679b	14906a	10572ab	36
Dual placement	7720a	8670b	14372b	10254b	37
Brdcst preplant	7671a	8689b	14396b	10252b	36
P source					
APP	8150a	8759a	13790c	10233b	37
DAP	8058a	8742a	14583b	10461ab	37
UP	7643a	9073a	15492a	10736a	37

1/ Treatment means followed by the same letter are not significantly different at the 0.5 confidence level. Check with 0 rate of P not included in Duncan's multiple range test due to unequal sample size.

Table 2. Effects of rate, method and source of N on grain yields of irrigated no-till corn on Sharpsburg sicl at Mead Nebraska, 1983-85.

	Yields[1/]			
Evaluation	1983	1984	1985	Ave.
	kg ha^{-1}			
Rate of N				
0	3062	3734	5544	4113
90	4770a	8020b	8177a	6955b
180	4870a	9660a	8754a	7760a
N placement				
Band side seed	5022a	9059a	7299a	7127a
Brdcst preplant	4573a	9063a	9557a	7731a
Dribble surface band	4725a	8381a	8541a	7216a
N source				
UUP	5195bc	9134c	8232c	7520b
UAN	4677cd	8216d	9024b	7306bc
Urea	4872c	8721cd	8201c	7265c
SCU	4347d	9299c	8405c	7350bc
Outside factorial				
NH_3 preplant inj.	5518b	10290a	9577a	8458a
NH_3 sidedress inj.	5988a	9767b	9002b	8252a
UAN fertigation	4068d	8211d	9628a	7302bc

1/ Treatment means followed by the same letter are not significantly different at the 0.5 confidence level. Check with 0 rate of N not included in Duncan's multiple range test due to unequal sample size.

GENOTYPIC VARIATION FOR POSTANTHESIS NITROGEN UPTAKE AND DISTRIBUTION BY MAIZE

James S. Schepers

Objective: Determine if ^{15}N applied to the soil at anthesis will be taken up in differential amounts by a "stay green" hybrid (FS 854) with high yield potential (10-year average yield of 270 bu/A, Herman Warsaw, Saybrook, Illinois) and an early senescing hybrid (B73 x Mo17) with stable yield potential over a range of climatic conditions.

Procedure: Both maize hybrids were grown in 1984 at the University of Illinois and in 1985 at the University of Illinois and at Shelton, Nebraska, with 3 replications each year at an average plant population of 60,000 plants/ha in 76-cm rows. Isotopic-N (85.5% ^{15}N-enrichment as KNO_3) was dissolved in water and soil applied to each plot at anthesis.

Plant tissue samples were taken at anthesis, 33 days after anthesis (DAA), and at physiological maturity (60 DAA). At each sampling date the plant material was separated into stalks, leaves above the ear, leaves below the ear, and grain. Total dry matter, total Kjeldahl nitrogen (N), and isotopic-N were determined for each sample.

Experimental Results: Both hydrids produced similar amounts of total dry matter; however, FS 854 partitioned more to the grain (241 bu/A) than B73 x Mo73 (228 bu/A) in 1984 (Figure 1). In 1985, both hybrids yielded 263 bu/A in Illinois; however, under irrigated conditions in Nebraska, yields were 185 and 201 bu/A for FS 854 and B73 x Mo17, respectively.

Nitrogen analysis is presently available for only the 1984 season. Both hybrids had taken up similiar amounts of N at 33 DAA; however, by maturity, FS 854 had taken up 11% more N and maintained 47% more N in the leaves than B73 x Mo17 (Figure 2). Isotopic-N analysis indicated FS 854 took up 12% more tagged-N than B73 x Mo17 at maturity (Figure 3). This additional tagged-N uptake occurred by 33 DAA, but resulted in 22% more tagged-N in the grain than for B73 x Mo17. Both hybrids contained similar amounts of total tagged-N in the leaves at maturity; however, FS 854 distributed 57% of its tagged-N to the upper leaves while B73 xMo17 distributed only 42% to the upper leaves. Since the upper leaves are the last ones to senesce and FS 854 distributed more tagged-N to the upper leaves than B73 x Mo17, it may be that hybrids such as FS 854 have the potential to photosynthesize later into the season and therefore have the potential for increased yields.

Lower yields for FS 854 in Nebraska compared to Illinois are attributed to several weeks of cloudy and overcast weather during anthesis. Growth analysis indicated that total dry matter production was reduced more for FS 854 than B73 x Mo 17. It also appeared that FS 854 was not able to compensate for lower plant populations by increasing ear length. Perhaps this characteristic is overcome by Herman Warsaw who plants FS 854 to attain about 90,000 plants/ha at harvest. Another contributing factor to the high yields by Herman Warsaw is the fact that his field has received manure applications for many years, which may affect the proportion of nitrate- to ammonium-nitrogen available to the crop. In a companion experiment at Nebraska in 1985, applying a total of 67 kg N/ha as dissolved ammonium nitrate in the irrigation water after anthesis resulted in a 10% greater yield for FS 854, but no change in yield for B73 x Mo17.

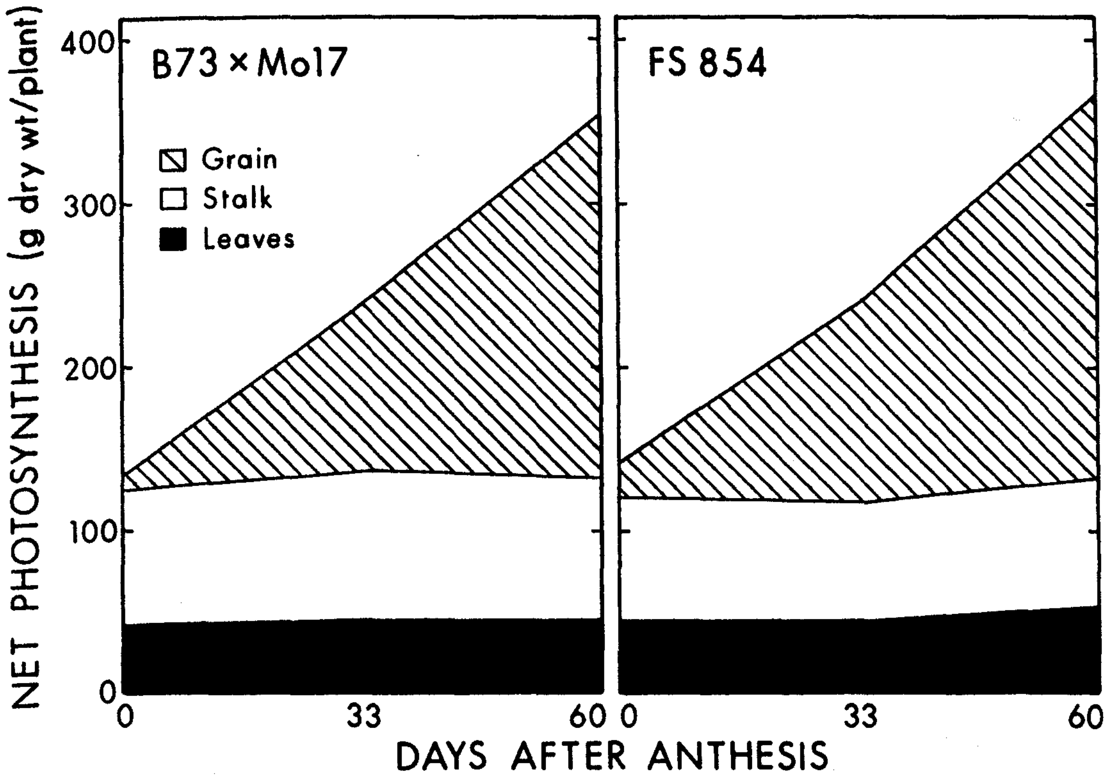


Figure 1. Net photosynthesis (dry matter accumulation) for two maize hybrids in Illinois, 1984.

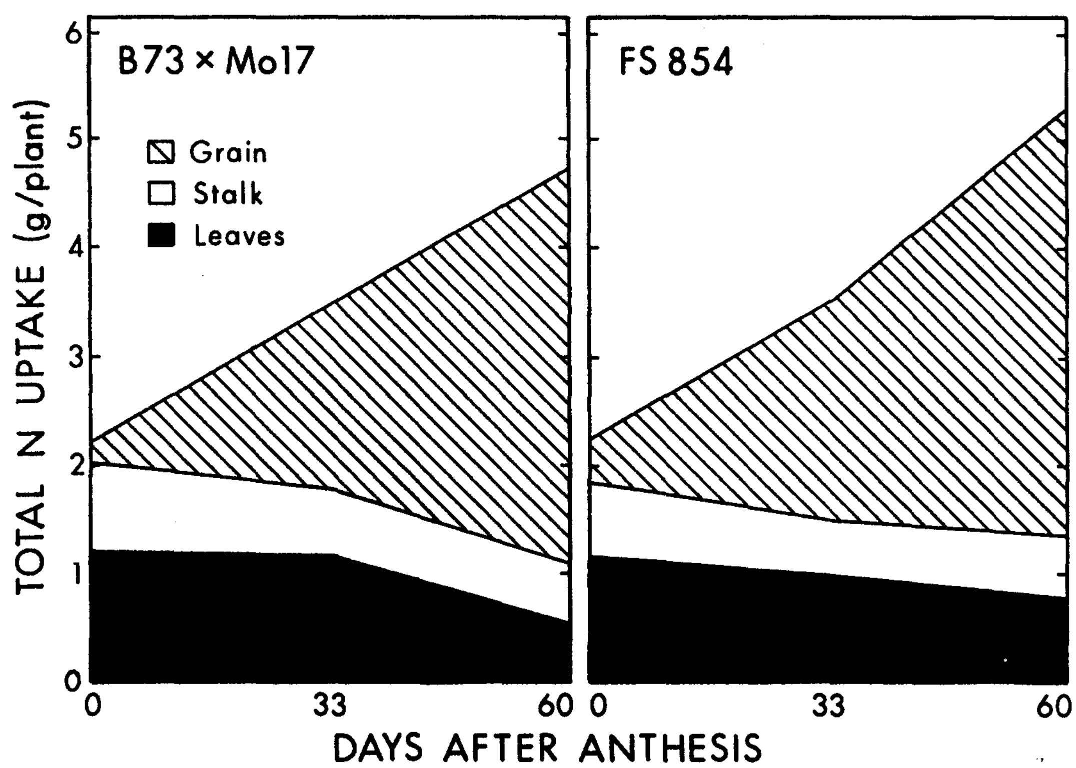


Figure 2. Total N uptake and distribution for two hybrids, 1984.

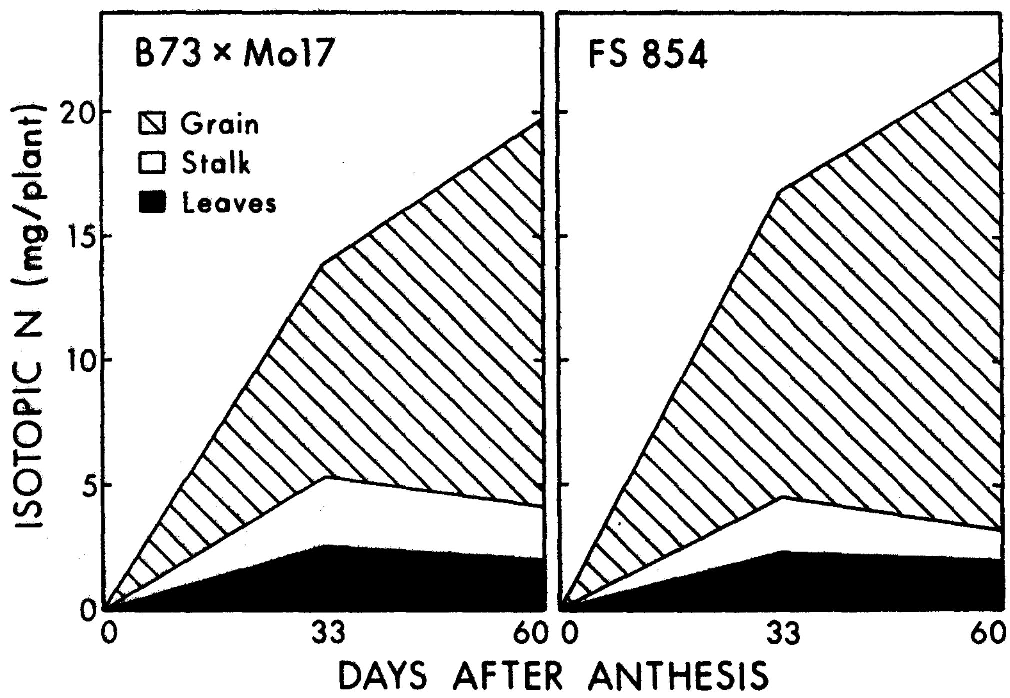


Figure 3. Isotopic-N uptake and distribution of ^{15}N applied at anthesis, 1984.

THE EFFECT OF PLANTING DATE, FERTILIZER RECOMMENDATIONS AND STARTER MATERIAL ON CORN (Zea mays) WHEN GROWN IN A NO-TILL SYSTEM

Charles A. Shapiro

Objective: Starter fertilizers have produced variable effects on yield increases in past studies. Most yield increases due to starters were found on soils with low phosphorus levels. It is recommended that starters be used under stress conditions: early planting dates and cool, wet conditions. No-till production tends to keep soils wetter and cooler than if soils have been tilled. The hypothesis that was studied is that under no-till conditions starter may affect yield, even when no yield affects are found under conventional tillage programs.

The objectives of the research were to:

1. Determine the effect of planting date on yields.
2. Determine the effect of three fertilizer programs on yields.
3. Determine the effect of two starter fertilizer materials on yields.

Procedure: Soil samples were taken in early spring to determine fertilizer recommendations. Fifteen surface cores and five deep samples were taken over a two acre field. The soil was split into two subsamples. One sample was sent to the University of Nebraska Soil Testing Laboratory and the other was sent to A & L Laboratory in Omaha, Nebraska. A & L Laboratory was requested to analyze the sample and report both a Feast[@] and an A & L fertilizer recommendation. The three recommendations were then used as the basis for the three fertilizer recommendations used in the study. The analysis of the soil is reported in Table 1. The three recommendations are reported in Table 2. Treatments with starters applied had the quantity of nutrients subtracted from the broadcast treatments.

Experimental Results: The ANOVA indicates that only planting date affected yield with later planting decreasing average yields (Table 3) 16 bushels per acre. Although the coefficient of variation was an acceptable 12 percent, no significant differences were found among the fertilizer treatments. The high levels of residual nitrate and mineralization of organic nitrogen must have combined to provide enough nitrogen to supply crop needs. A close examination of Table 3 does indicate that the early planting date control treatment was one of the lower yielding treatments. In the second planting date, the control treatment was again one of the lowest yielding, but not the lowest. This indicates that some fertilizer was necessary for optimum yields, but the ammount was not great.

[@]Feast is a registered treademark of Conklin Company, Inc. Use of commercial products or trade names is made with the understanding that no endorsement by the University of Nebraska is implied.

Table 1. Soil test results from spring 1985. NEREC, NE.

Laboratory	Nitrogen[1]	PI Bray[1]	Olsen P	K	S	Zn[2]	OM	pH
	--lbs/A--	-----------------	----------	ppm	----------	-----------------	%	
A & L, Feast	89	8	7	115	6	.5(DTPA)	2.2	7.8
UNL	86	7	6	150	-	.1(Zinc Index)	2.3	7.6

[1]Nitrogen in top 6 ft based on 0-8" and 8-24" sample.
[2]Zinc test from A&L used DPTA extraction; UNL used HCl index.

Table 2. Fertilizer recommendations for a 90 bushel per acre yield goal based on soil test results. NEREC, NE 1985.

Laboratory	N	P_2O_5	K_2O	S	Zn
	-----------	-----------	lbs/acre	-----------	-----------
Feast	70	15	60	10	2.4[2]
A&L	80	60	80	10	3.0
UNL	50	20/40[1]	0	0	16.0

[1]UNL recommendations are different for row applied (20) and Broadcast (40).
[2]Zinc recommended as pts/acre for Feast. Feast recommendation also included 5 gals 9-18-9 as starter.

Table 3. Yield response to planting data and fertilizer practices.

	Broadcast Fertilizers								
	May 7, 1985[1]				May 29, 1985				
Starters	UNL[2]	None	A & L	Mean	UNL	None	A & L	Mean	Overall
	bu/A								
None	134	118	138	130	101	95	103	100	115
Foliar[5]		120				96			
9-18-9	121	127	136[3]	128	97	101	93	97	111
Foliar		123	138			98	112		
10-34-0	133	133	131[4]	132	103	91	100	98	115
Means	129	126	135		100	96	99		

[1]Planting date was only significant treatment effect.
[2]Preplant broadcast rate of 50N-16 Zn adjusted for N in starter. All P in starter.
[3]Preplant broadcast rate of 70N-15P-60K-10S with 5 gals 9-18-9 as starter.
[4]Preplant broadcast rate of 80N-40P-80K-10S-3Zn adjusted for nutrients in starter.
[5]Foliar spray with 16-4-4 was 4.8 gals/acre at silks brown stage.

EFFECT OF ACID FERTILIZER ON CORN (*Zea mays*) GRAIN YIELD

Charles A. Shapiro

Objective: Soils with pH values greater than 7.0 are commonly found in northeast Nebraska. High pH values limit crop growth because they affect phosphorus and iron availability. It is hypothesized that using an acid based fertilizer would promote the transformation of insoluble phosphate compounds into more plant available forms. The quantity of acid needed to lower the soil pH is extremely high, but banded areas that produce temporary pH changes may benefit the corn crop.

An experiment with corn was conducted with the following objectives:

1. Determine the effect of a urea-sulfuric acid (USA) fertilizer compared to anhydrous ammonia.

2. Determine the effect of time of application on corn yield.

3. Determine if there were short term effects on soil chemical properties.

Procedure: A site was selected that was high in pH and was low in phosphorus levels. Soil samples were sent to UN-L soil testing laboratory (UNL) and A & L Soil Testing Laboratories. Fertilizer rates were based on the results. (Table 1 & 2).

Soil samples were taken from the plots on May 30. They were taken at 0-2, 2-4 in. depths over the planted row, and 4-6 and 6-8 in depths over the fertilized band. Soil samples were taken from the sidedress treatments on June 7 at 4-6 in and 6-8 in. For each soil sample 10 cores were collected and composited.

Experimental Results: Yields were statistically equal among the preplant fertilized treatments. They were all higher than the starter alone treatment. Both sidedress treatments yielded less than the preplant treatments. This was probably due to application problems. Yield correlated with grain moisture (negatively), earleaf nitrogen, earleaf phosphorus and early plant nitrogen (data not shown).

Soil samples (Table 3) show only significant increases in extracted phosphorus where starter was applied. No differences were found between the 5-21-0 and the 10-34-0 starter material.

Table 1. Experimental field soil chemical properties and fertilizer recommendations for a yield goal of 90 bu/acre from two soil testing laboratories. NEREC, NE 1985.

Soil Property	Value	Soil Testing Laboratory UNL	A & L
		---------lbs./acre---------	
Nitrate-N		90	85
pH	7.9		
Excess lime	Med.		
Texture	Clay loam		
Bray #1	5	20/40	70
Olsen P	6		
K	168	0	80
Zn(index)	.1	16	3

Table 2. Treatments and appropriate contrasts applied preplant, with starters and sidedress.

Treatments	Yield bu/A
1. Acid preplant (26-0-0-6S) and Acid starter (5-21-0-3S) for a total of (115-53-0).	96
2. Anhydrous Ammonia preplant and APP starter (115-53-0).	100
3. Acid sidedress and Acid starter.	90
4. Anhydrous Ammonia sidedress and APP starter. (115-53-0)	86
5. Anhydrous Ammonia and deep placed phosphorus. (Dual-P.) (110-34-0)	98
6. Anhydrous Ammonia and deep placed phosphorus. (Dual-P.) (120-68-0)	97
7. Starter alone. (10-34-0)	58
8. Anhydrous ammonia alone. (100-0-0)	93

Abbreviation	Contrasts Explanation	
Ck. vs. others	Starter alone vs. all others	**
AA vs. Acid	Both anhydrous treatments compared to acid treatments	
AA with starter vs. wo starter	Average of AA with starter compared to AA alone	
Within Acid	Preplant acid compared to sidedress acid	
Dual vs. Starter	Average of the Dual treatments compared to average of the starter treatments	
Preplant vs. sidedress	Average of all preplant with starters compared to sidedress with starters	*
Dual high vs. low	Dual with 68 lbs P_2O_5 compared to 34 lbs P_2O_5	

*, **, 0.05 and 0.01 probability of differences due to chance alone.

Table 3. Effect of acid fertilizer on selected soil chemical measurements. NEREC. NE 1985.

	Planted Row		Knifed & Fertilizer Row	
TRT	PH2	PH4	PH6	PH8
1. Acid preplant	-	-	7.39	7.56
5-21-0 starter	7.45	7.55	-	-
2. AA preplant	-	-	7.47	7.36
10-34-0 starter	7.46	7.54	-	-
Control (5/30)	7.67	7.52	7.68	7.77
3. Acid sidedress	-	-	7.6	8.0
4. AA sidedress	-	-	7.6	7.7
Control (6/7)	-	-	7.9	7.9
CV	4.0	5.8	6.2	4.6
TRT	BRAY 2	BRAY 4	BRAY 6	BRAY 8
	ppm			
1. Acid preplant	-	-	4.4	3.0
5-21-0 starter	92.5	8.0	-	-
2. AA preplant	-	-	6.8	2.8
10-34-0 starter	55.7	9.8	-	-
Control (5/30)	19.9	3.9	2.1	1.8
3. Acid sidedress	-	-	5.2	1.9
4. AA sidedress	-	-	3.9	2.9
Control (6/7)	-	-	2.6	1.8
CV	74.7	36	108	50.4
Significant F		**		
TRT	SBC 2	SBC 4	SBC 6	SBC 8
	ppm			
1. Acid preplant	-	-	5.8	3.3
5-21-0 starter	89.4	10.7	-	-
2. AA preplant	-	-	6.5	3.3
10-34-0 starter	65.5	11.3	-	-
Control (5/30)	19.3	4.1	3.4	2.8
3. Acid sidedress	-	-	8.1	3.2
4. AA sidedress	-	-	4.4	3.7
Control (6/7)	-	-	3.8	3.5
CV	25.8	32.2	56.6	15.9
Significant F	*	**		
TRT	LIME 2	LIME 4	LIME 6	LIME 8
	Excess lime rating			
1. Acid preplant	-	-	3.0	3.0
5-21-0 starter	3.0	3.2	-	-
2. AA preplant	-	-	2.5	2.0
10-34-0 starter	3.0	2.7	-	-
Control (5/30)	3.0	3.0	3.2	3.2
3. Acid sidedress	-	-	3.0	3.5
4. AA sidedress	-	-	2.3	2.3
Control (6/7)	-	-	3.5	3.3
CV	35.5	38.9	40.2	35.7

Fertilizer applied 5/18/85 preplant and 6/7/85.
Field planted 5/20/85.
Soil sampled 5/30/85 for treatment 1, 2, Control (5/30), number at end of variable is depth of sample in inches.
Soil sampled 6/7/85 for treatment numbers 3, 4, Control (6/7) depth of 2-4, 4 6 inches.

An Evaluation of Foliar Applied Materials on Soybeans

Richard A. Wiese

Lime-induced chlorosis continues to be the cause of soybean yield reductions on high pH soils. Yield reductions of 10 to 15 bushels per acre are commonly experienced by soybean growers on those field soil sites where soybeans turn yellow for a two-week period. Most of the yield losses are eliminated by planting only the tolerant soybean varieties and increasing planting density to at least 12 seeds per foot of row. The use of seed treatment and foliar applied materials have enhanced yields of moderately tolerant varieties. Whether or not foliar applied materials would enhance yields of the most tolerant varieties of soybeans is the objective of this study.

Field sites were selected where soybean chlorosis occurred with regularity in previous growing seasons. In general, the soils can be characterized as somewhat poorly drained, above average in clay content, calcareous in nature, having a high pH ranging from 7.8 to 8.3 in the surface 0 to 8 inches depth and pH ranging above 8.0 at soil depths below 8 inches, and having a variable amount of exchangeable sodium.

Foliar treatments consisting of manganese sulfate, ammonium sulfate, iron sulfate and Fe-EDDHA were applied early at the first visible observation of chlorisis and application was repeated in 10 days. All sulfate materials were applied at rates of 0.35 lbs of sulfur in 20 gallons of water per acre and the Fe-EDDHA was applied at a rate of 0.5 lbs of material per acre for each of the two foliar applications. Only proven tolerant varieties of soybeans were planted and foliar treatment was replicated four times.

Yield increases due to foliar applied materials on chlorosis tolerant soybean varieties have a probability of occurrance around 20%. Yield increases of 3 or more bushels per acre from the foliar materials applied occurred 1 out of 6 experiments with $MnSO_4$, 2 out of 6 experiments with (NHPV4PVPY)PV2PVPYSOPV4PVPY, 3 out of 6 experiments with FeSOPV4PVPY, and 2 out of 6 experiments with Fe-EDDHA.

Effect of Foliar Applied Materials on Mean Soybean Yields
From Six Field Sites.

Field Site	Foliar Applied Material				
	None	$MnSO_4$	$(NH_4)_2SO_4$	$FeSO_4$	Fe-EDDHA
	bu/A				
Saunders 1	19.1	16.9	20.1	20.2	20.7
Saunders 2	19.0	22.8	19.8	17.3	20.6
Dodge 1	51.1	53.4	56.7	55.0	53.4
Dodge 2	21.6	12.7	22.7	25.4	29.1
Merrick	38.9	36.8	39.5	37.6	38.8
Colfax	21.0	23.5	36.6	34.5	28.0
Mean	28.45	27.68	32.57	31.67	31.77

Analysis of Variance

Source	df.	MS	F	P
Total	29			
Field Site	5	915.60	69.701	
Foliar Trt	4	29.020	2.209	0.223
Error	20	13.136		

L.S.D. 0.1 = 3.60
0.2 = 2.77

SOYBEAN VARIETY EVALUATION ON HIGH pH SOIL - 1985 *

E.J. Penas, R.W. Elmore and R.S. Moomaw

Objectives:

1. Evaluate a maximum of approximately 40 soybean varieties to determine their performance under the soil conditions of high pH found in the bottomlands of the Platte Valley and similar soils (pH 7.5 and higher).

2. Characterize the chemical and physical soil properties at each of the test sites and identify the soil series at each site.

3. Evaluate the effect of planting density on chlorosis tolerance of a limited number of soybean varieties.

Procedure:

Fifty-three soybean varieties were planted at four sites (Dawson, Madison, Merrick and Saunders Counties) and fifty-four varieties were planted at two sites (Colfax and Dodge Counties). At each site, plots were replicated six times. At five sites three varieties (Century, Nebsoy and Stine 2920) were planted at three plant densities (4.5, 9.0, and 13.5 seeds per foot of row). All plots were planted in 30 inch rows.

Starting four weeks after planting and at two week intervals, each plot was visually rated for green color (1 = normal green color to 5 = extreme chlorosis and 6 = dead plants). Each site was scored two or three times, except Dawson County where the plot was discarded soon after planting because of poor stand. Seed yields were harvested from 4 sites (Saunders County not harvested because of extreme soil variability).

Experimental Results:

Variety Evaluation Study

Seed yields were harvested from four locations. Table 1 shows the mean seed yields across the four sites. Even though sites were different in terms of seed yield level and degree of chlorosis, which resulted in a site by variety interaction, varieties were significantly different in terms of seed yield when averaged across all four sites. Yields ranged from 17 to 40 bushels per acre.

Thirty-one varieties were in the top group in terms of seed yield (32 to 40 bushels per acre). Stine 2920, the variety being used as the tolerant standard, was at the bottom of the top group. Century, the standard variety used since the beginning of these studies, was not in the top group; however, it was significantly better than the poorest variety, Nebsoy, the tester variety used.

The soybean plants were visually scored for chlorosis at eight weeks after planting at all four sites. Degree of chlorosis was severe at Colfax and Dodge Counties and mild at Madison and Merrick Counties. The difference in sites resulted in a site by variety interaction; however, varieties were significantly different in terms of chlorosis score across all sites. These data are shown in Table 2. Thirty-nine varieties scored in the top group (2.42 to 2.89). All thirty-one varieties that were in the top group in terms of seed yield were also in the top group in terms of chlorosis score.

Figure 1 shows the relationship between seed yield and chlorosis score across the four sites. It is evident that seed yield is well correlated with chlorosis score at eight weeks after planting.

Colfax County. Chlorosis was very severe at this site. Chlorosis scores by variety are shown in Table 3. Thirty-three varieties scored in the top group (3.00 - 3.75). Seed yields by variety are given in Table 4. Twenty-seven varieties are in the top group (20.7 to 35.6 bushels per acre) and all 27 varieties were in the top group in terms of chlorosis score. Figure 2 shows the very strong relationship between chlorosis score and seed yield.

Dodge County. Chlorosis was severe at this site. Chlorosis scores by variety are shown in Table 5. Forty varieties scored in the top group (2.50 - 3.50). Thirty-five varieties were in the top group in terms of seed yield as shown in Table 6 (27.2 to 40.5 bushels per acre). Thirty-two of these varieties were also in the top group in terms of chlorosis score. Figure 3 shows the very strong relationship between chlorosis score and seed yield.

Madison County. Chlorosis was slight at this site. Table 7 lists the varieties according to chlorosis score. Only eight varieties were not in the top group in terms of chlorosis score (2.00 to 2.60). Table 8 gives the seed yield by varieties. Forty-three varieties are in the top group (46.0 to 54.3 bushels per acre). Even though chlorosis was mild at this site and most varieties had good seed yields, seed yield was related to chlorosis score as illustrated in Figure 4.

Merrick County. Chlorosis was slight at this site. Forty-seven of the 53 varieties were in the top group in terms of chlorosis score (1.42 to 2.00) as shown in Table 9. Forty-two varieties are in the top group in terms of seed yield (30.7 to 38.8 bushels per acre). These data are shown in Table 10. Figure 5 shows the relationship between chlorosis score and seed yield. Most of the significant correlation is due to two varieties with chlorosis scores that were poorer than all other varieties and these two varieties were at the bottom in terms of seed yield.

Variety X Density Study

Data from four locations combined are shown in Table 11. Chlorosis score was dependent on site, variety and density of seeding. There were no interactions. Seed yield was dependent on the same factors. Also, there was a site x variety x density interaction. This was due to the degree of chlorosis at each location and its effect on seed yield as influenced by variety and seeding density. Table 12 shows the data from each of the four individual locations.

Colfax County. Chlorosis scores were very high at this location since chlorosis was very severe. Varieties were significantly different. Nebsoy was very poor at this site in terms of chlorosis score and seed yield. Century and Stine 2920 were similar in terms of chlorosis score; however, Stine 2920 had a slightly higher seed yield than did Century. There was no interaction between variety and density in terms of chlorosis score or seed yield.

Dodge County. Chlorosis was very severe in this study. Chlorosis score was influenced by variety but not by seeding density and there was no interaction. Stine 2920 exhibited slightly less chlorosis than did Century; whereas, Nebsoy was very chlorotic. Seed yield was influenced by variety and seeding density with no interaction. Stine 2920 and Century were similar in terms of seed yield and Nebsoy was very poor. Increased seeding rate resulted in higher seed yields, particularly at the 13.5 seeds per foot seeding rate.

Madison County. Chlorosis was moderate in this test. Chlorosis score was influenced by variety and seeding density independently. Stine 2920 and Century were similar in chlorosis score; whereas, Nebsoy was more chlorotic. Seed yield was dependent on variety and seeding density and these two factors did interact. Increasing the seeding rate increased seed yield of all 3 varieties. Stine 2920 and Century were nearly equal in terms of seed yield at the low and high seeding rates; however, 13.5 seeds per foot was necessary with Century to achieve maximum yield. Stine 2920 at 9.0 seeds per foot of row gave nearly maximum seed yield. Seed yield of Nebsoy was lower than for the other two varieties. Yield was reduced about 50% at the 4.5 seeds per foot seeding rate.

Merrick County. Chlorosis was moderate in this test. Chlorosis score and seed yield were influenced by variety and seeding density with no interactions. Stine 2920 and Century were similar in terms of chlorosis score and seed yield. Nebsoy was inferior for chlorosis score and seed yield. Increasing the seeding rate was beneficial for all three varieties in terms of chlorosis and seed yield.

* This research was supported in part by a grant from the Nebraska Soybean Development, Utilization and Marketing Board.

Table 1. 1985 FOUR SITES SEED YIELD

ANALYSIS OF VARIANCE

SOURCE	DF	SS	MS	F	
SITE	3	147607.588	49202.530	742.49	***
VARIETY	51	30355.499	595.206	3.77	***
BLOCK(SITE)	20	25545.958	1277.298	19.15	***
SITE*VARIETY	153	24187.041	158.085	2.37	***
ERROR	994	66315.491	66.716		
TOTAL	1221	295603.519			

EXPERIMENTAL MEAN IS 31.5 C.V. = 25.9%

DUNCAN'S MULTIPLE RANGE TEST (5% PROTECTION LEVEL)
MEANS WITH THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT.

BRAND	ENTRY	MEAN	RANGES OF INSIG. CHANGE
Ohlde	2193	39.7	A
Northrup King	S23-03	38.6	A B
Latham	650	38.1	A B C
Golden Harvest	H1285	37.6	A B C
Jacques	J-103	37.6	A B C
S Brand	S44A	37.5	A B C
Profiseed	PS1152	36.6	A B C D
Superior	SPB308	36.6	A B C D
Fontanelle	F4545	36.6	A B C D
Hoegemeyer	200	36.6	A B C D
Jacques	2386	36.4	A B C D
MSR	Royal	36.1	A B C D E
Dekalb-Pfizer Gen.	CX283	35.8	A B C D E
Fontanelle	F4646	35.7	A B C D E F
Jacobsen	799	34.9	A B C D E F G
Hofler	Gem	34.5	A B C D E F G
Land O'Lakes	L4207	34.2	A B C D E F G
Hoegemeyer	205	34.1	A B C D E F G
-----	Weber	34.1	A B C D E F G
NC+	2D90+	33.9	A B C D E F G
S Brand	S46D	33.8	A B C D E F G
MSR	Royal II	33.6	A B C D E F G
McCubbin	Taylor	33.5	A B C D E F G
S Brand	S47B	33.5	A B C D E F G
Latham	1010	33.3	A B C D E F G
Asgrow	A2187	33.2	A B C D E F G
Golden Harvest	H1233	32.6	A B C D E F G H
Golden Harvest	H1276	32.2	A B C D E F G H
Diamond	TC204A	32.1	A B C D E F G H
Ohlde	2188	32.1	A B C D E F G H
Stine	2920	32.0	A B C D E F G H
Stine	2050+	30.5	B C D E F G H I
Jacques	2786	30.4	B C D E F G H I
Riverside	4041	30.3	B C D E F G H I
Stock	SS462A	29.9	B C D E F G H I
Superior	SPB340	29.4	B C D E F G H I
-----	Century 84	29.1	C D E F G H I
Jacques	J-105	28.9	C D E F G H I J
Land O'Lakes	L2330	28.0	D E F G H I J
-----	Century	27.5	D E F G H I J
Land O'Lakes	L2456	27.2	E F G H I J
McCubbin	EX40510	27.0	E F G H I J
Stock	SS793	26.6	F G H I J
-----	Zane	26.3	G H I J
-----	Logan	26.0	G H I J
-----	Fremont	23.9	H I J K
Northrup King	S27-10	23.8	H I J K
-----	Hack	23.8	H I J K
Dekalb-Pfizer Gen.	CX324	22.8	I J K
Dekalb-Pfizer Gen.	CX350	22.5	I J K
-----	Mead	20.2	J K
-----	Nebsoy	17.3	K

Table 2. 1985 FOUR SITES THIRD CHLOROSIS SCORE

ANALYSIS OF VARIANCE

SOURCE	DF	SS	MS	F	
SITE	3	791.454	263.817	873.72	***
VARIETY	51	161.709	3.171	7.25	***
SITE*VARIETY	153	66.954	0.438	1.45	***
BLOCK(SITE)	20	136.491	6.825	22.60	***
ERROR	994	300.137	0.302		
TOTAL	1221	1458.638			

EXPERIMENTAL MEAN IS 2.82 C.V. = 19.5%

DUNCAN'S MULTIPLE RANGE TEST (5% PROTECTION LEVEL)
MEANS WITH THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT.

BRAND	ENTRY	MEAN	RANGES OF INSIG. CHANGE
Northrup King	S23-03	2.42	A
Jacobsen	799	2.42	A
Ohlde	2193	2.46	A B
Latham	650	2.46	A B
S Brand	S46D	2.48	A B
Fontanelle	F4646	2.48	A B
Superior	SPB308	2.50	A B C
Golden Harvest	H1285	2.50	A B C
Jacques	J-103	2.52	A B C
S Brand	S44A	2.54	A B C
Dekalb-Pfizer Gen.	CX283	2.54	A B C
Stine	2920	2.56	A B C D
Jacques	2386	2.58	A B C D
Profiseed	PS1152	2.58	A B C D
Fontanelle	F4545	2.58	A B C D
-----	Weber	2.60	A B C D E
Ohlde	2188	2.61	A B C D E
Hoegemeyer	200	2.63	A B C D E
Land O'Lakes	L4207	2.63	A B C D E
S Brand	S47B	2.65	A B C D E
NC+	2D90+	2.67	A B C D E
MSR	Royal II	2.67	A B C D E
Riverside	4041	2.67	A B C D E
Hoegemeyer	205	2.70	A B C D E
Golden Harvest	H1233	2.70	A B C D E
Hofler	Gem	2.71	A B C D E
MSR	Royal	2.71	A B C D E
Stine	2050+	2.74	A B C D E
Asgrow	A2187	2.74	A B C D E
Superior	SPB340	2.74	A B C D E
Golden Harvest	H1276	2.75	A B C D E
Diamond	TC204A	2.77	A B C D E
McCubbin	Taylor	2.79	A B C D E F
-----	Century 84	2.80	A B C D E F
Stock	SS462A	2.82	A B C D E F
Jacques	J-105	2.83	A B C D E F
Latham	1010	2.83	A B C D E F
Dekalb-Pfizer Gen.	CX350	2.89	A B C D E F
Jacques	2786	2.89	A B C D E F
Stock	SS793	2.91	B C D E F
-----	Century	2.93	B C D E F
Land O'Lakes	L2330	2.98	C D E F
McCubbin	EX40510	3.04	D E F G
Land O'Lakes	L2456	3.07	E F G
-----	Zane	3.08	E F G
-----	Logan	3.24	F G
-----	Hack	3.42	G H
-----	Fremont	3.46	G H
-----	Mead	3.48	G H
Dekalb-Pfizer Gen.	CX324	3.71	H I
Northrup King	S27-10	3.91	I
-----	Nebsoy	4.06	I

Figure 1. Four Sites 1985 (52 Common Varieties)

Seed Yield vs Third Chlorosis Score

Intercept........................	66.477249
Regression Coefficient..........	-12.415957
Standard Error of the Reg. Coef.	0.909806
Probablilty > Absolute T........	0.0001
Correlation Coefficient.........	-0.71871
Probability > Absolute R	0.0001
Number of Observations	1222
Correlation Coefficient.........	-0.88789
Probability > Absolute R	0.0001
Number of Observations	52

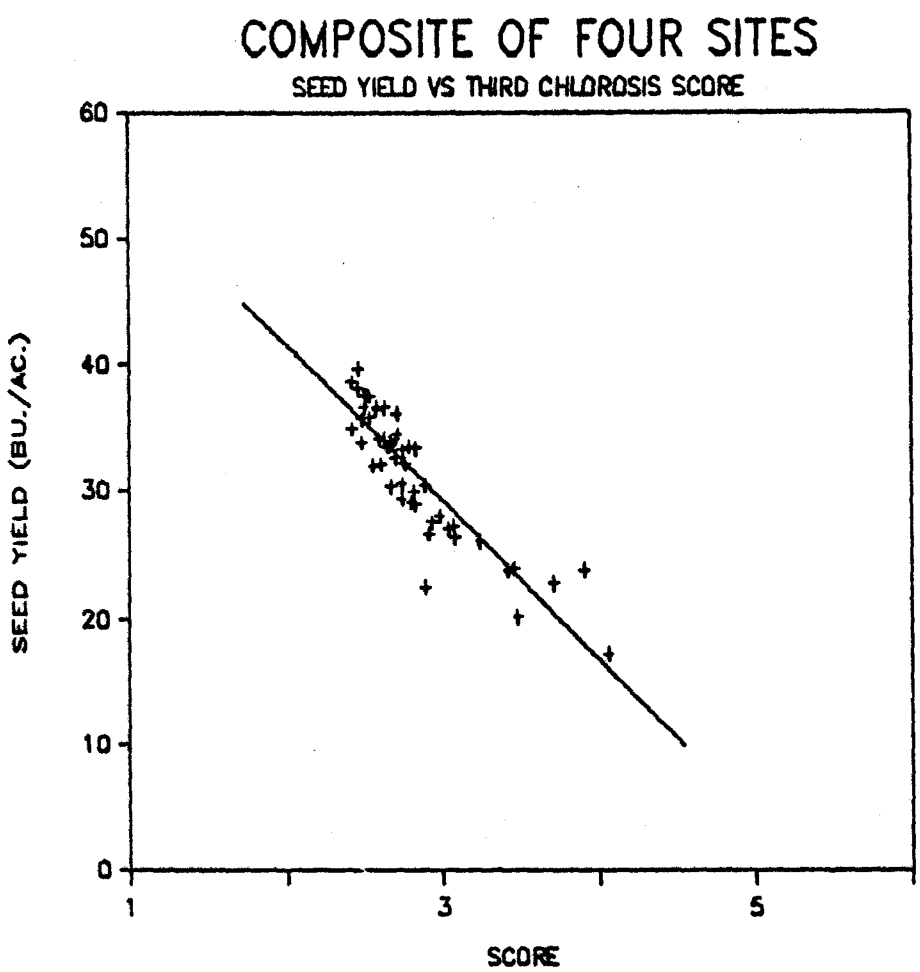


Table 3. 1985 COLFAX COUNTY THIRD CHLOROSIS SCORE

ANALYSIS OF VARIANCE

SOURCE	DF	SS	MS	F	
VARIETY	53	109.951	2.075	7.02	***
BLOCK	5	31.451	6.290	21.29	***
ERROR	265	78.299	0.295		
TOTAL	323	219.701			

EXPERIMENTAL MEAN IS 3.76 C.V. = 14.4%

DUNCAN'S MULTIPLE RANGE TEST (5% PROTECTION LEVEL)
MEANS WITH THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT.

BRAND	ENTRY	MEAN	RANGES OF INSIG. CHANGE
S Brand	S44A	3.00	A
Hofler	Gem	3.08	A B
MSR	Royal	3.08	A B
Latham	650	3.08	A B
Dekalb-Pfizer Gen.	CX283	3.08	A B
Hoegemeyer	200	3.08	A B
Golden Harvest	H1285	3.25	A B C
Fontanelle	F4545	3.25	A B C
Jacques	J-103	3.25	A B C
Hoegemeyer	205	3.25	A B C
-----	Weber	3.25	A B C
Superior	SPB308	3.25	A B C
NC+	2D90+	3.33	A B C D
Northrup King	S23-03	3.33	A B C D
Diamond	TC204A	3.33	A B C D
MSR	Royal II	3.33	A B C D
S Brand	S46D	3.42	A B C D E
Fontanelle	F4646	3.42	A B C D E
Jacobsen	799	3.42	A B C D E
Profiseed	PS1152	3.50	A B C D E F
Ohlde	2193	3.50	A B C D E F
Stine	2050+	3.50	A B C D E F
Land O'Lakes	L4207	3.50	A B C D E F
S Brand	S47B	3.50	A B C D E F
Jacques	2386	3.50	A B C D E F
Latham	1010	3.58	A B C D E F G
Golden Harvest	H1233	3.58	A B C D E F G
Ohlde	2188	3.58	A B C D E F G
-----	Lakota	3.67	A B C D E F G
Asgrow	A2187	3.67	A B C D E F G
Stine	2920	3.67	A B C D E F G
Riverside	4041	3.75	A B C D E F G H
McCubbin	Taylor	3.75	A B C D E F G H
Superior	SPB340	3.83	B C E D F G H I
Stock	SS462A	3.83	B C D E F G H I
Jacques	J-105	3.83	B C D E F G H I
Stock	SS793	3.92	C D E F G H I
Dekalb-Pfizer Gen.	CX350	3.92	C D E F G H I
-----	Century	4.00	C D E F G H I
Land O'Lakes	L2330	4.08	D E F G H I J
Jacques	2786	4.08	D E F G H I J
Golden Harvest	H1276	4.08	D E F G H I J
McCubbin	EX40510	4.08	D E F G H I J
-----	Century 84	4.17	E F G H I J K
Land O'Lakes	L2456	4.25	F G H I J K
-----	Platte	4.25	F G H I J K
-----	Zane	4.50	H I J K L
-----	Mead	4.50	H I J K L
-----	Logan	4.58	I J K L
-----	Fremont	4.75	J K L M
-----	Hack	4.83	K L M
Dekalb-Pfizer Gen.	CX324	5.17	L M
-----	Nebsoy	5.33	M
Northrup King	S27-10	5.42	M

Table 4. 1985 COLFAX COUNTY SEED YIELD

ANALYSIS OF VARIANCE

SOURCE	DF	SS	MS	F	
VARIETY	53	34007.585	641.652	5.86	***
BLOCK	5	8996.449	1799.290	16.44	***
ERROR	265	28995.611	109.417		
TOTAL	323	71999.644			

EXPERIMENTAL MEAN IS 17.66 C.V. = 59.2%

DUNCAN'S MULTIPLE RANGE TEST (5% PROTECTION LEVEL)
MEANS WITH THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT.

BRAND	ENTRY	MEAN	RANGES OF INSIG. CHANGE
Jacques	J-103	35.6	A
Hoegemeyer	200	35.0	A B
Latham	650	31.7	A B C
S Brand	S44A	31.0	A B C
Dekalb-Pfizer Gen.	CX283	30.3	A B C D
MSR	Royal	29.6	A B C D E
Ohlde	2193	29.1	A B C D E
-----	Weber	28.4	A B C D E
Jacques	2386	28.3	A B C D E
Profiseed	PS1152	28.2	A B C D E
Hofler	Gem	27.7	A B C D E
Golden Harvest	H1285	27.2	A B C D E
NC+	2D90+	26.7	A B C D E F
S Brand	S46D	26.3	A B C D E F
Northrup King	S23-03	26.2	A B C D E F
Hoegemeyer	205	25.4	A B C D E F G
Fontanelle	F4646	25.1	A B C D E F G
Fontanelle	F4545	25.1	A B C D E F G
S Brand	S47B	23.9	A B C D E F G H
Superior	SPB308	22.9	A B C D E F G H I
Jacobsen	799	22.8	A B C D E F G H I
Land O'Lakes	L4207	22.3	A B C D E F G H I J
Diamond	TC204A	21.9	A B C D E F G H I J
Latham	1010	21.8	A B C D E F G H I J
MSR	Royal II	21.6	A B C D E F G H I J K
Golden Harvest	H1233	21.5	A B C D E F G H I J K
Asgrow	A2187	20.7	A B C D E F G H I J K
Stine	2050+	20.3	B C D E F G H I J K
Ohlde	2188	18.9	C D E F G H I J K L
Riverside	4041	17.5	C D E F G H I J K L M
McCubbin	Taylor	17.4	C D E F G H I J K L M
Stine	2920	15.6	D E F G H I J K L M N
Stock	SS462A	14.9	E F G H I J K L M N O
-----	Lakota	14.8	F G H I J K L M N O P
Jacques	J-105	12.2	F G H I J K L M N O P
Superior	SPB340	11.8	F G H I J K L M N O P
Stock	SS793	10.7	G H I J K L M N O P
Golden Harvest	H1276	9.9	H I J K L M N O P
McCubbin	EX40510	9.6	H I J K L M N O P
-----	Century	8.9	I J K L M N O P
Land O'Lakes	L2330	8.3	I J K L M N O P
Jacques	2786	8.3	I J K L M N O P
-----	Century 84	7.5	J K L M N O P
Dekalb-Pfizer Gen.	CX350	6.9	K L M N O P
Land O'Lakes	L2456	6.8	K L M N O P
-----	Zane	5.4	L M N O P
-----	Mead	4.0	M N O P
-----	Logan	3.2	M N O P
-----	Platte	3.1	M N O P
-----	Fremont	1.1	N O P
-----	Hack	0.4	O P
Dekalb-Pfizer Gen.	CX324	0.1	P
-----	Nebsoy	0.0	P
Northrup King	S27-10	0.0	P

Figure 2. Colfax County Kenneth Goff

Seed Yield vs Third Chlorosis Score

Intercept.......................	78.370136
Regression Coefficient..........	-16.081384
Standard Error of the Reg. Coef.	0.918039
Probability > Absolute T........	0.0001
Correlation Coefficient.........	-0.88855
Probability > Absolute R	0.0001
Number of Observations	312
Correlation Coefficient.........	-0.92730
Probability > Absolute R	0.0001
Number of Observations	52

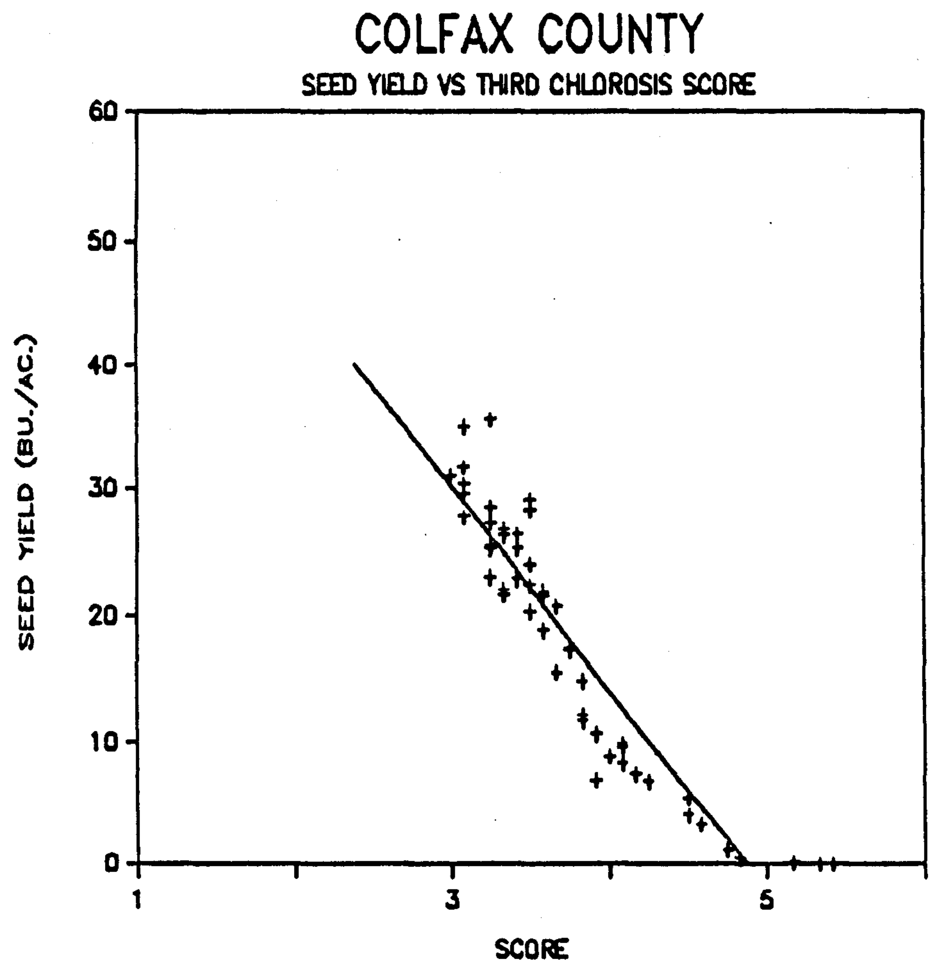


Table 5. 1985 DODGE COUNTY THIRD CHLOROSIS SCORE

ANALYSIS OF VARIANCE

SOURCE	DF	SS	MS	F	
VARIETY	53	67.633	1.276	2.39	***
BLOCK	5	88.272	17.654	33.12	***
ERROR	265	141.269	0.533		
TOTAL	323	297.175			

EXPERIMENTAL MEAN IS 3.38 C.V. = 21.6%

DUNCAN'S MULTIPLE RANGE TEST (5% PROTECTION LEVEL)
MEANS WITH THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT.

BRAND	ENTRY	MEAN	RANGES OF INSIG. CHANGE
Ohlde	2193	2.50	A
Northrup King	S23-03	2.58	A B
Golden Harvest	H1285	2.75	A B C
S Brand	S46D	2.83	A B C D
Jacobsen	799	2.83	A B C D
Stock	SS462A	2.92	A B C D
Superior	SPB308	3.00	A B C D E
Fontanelle	F4646	3.00	A B C D E
Profiseed	PS1152	3.00	A B C D E
Stine	2920	3.00	A B C D E
-----	Weber	3.08	A B C D E
Ohlde	2188	3.08	A B C D E
Riverside	4041	3.08	A B C D E
Jacques	J-103	3.08	A B C D E
-----	Lakota	3.08	A B C D E
Golden Harvest	H1276	3.17	A B C D E F
-----	Century 84	3.17	A B C D E F
Latham	650	3.17	A B C D E F
Jacques	2386	3.17	A B C D E F
Land O'Lakes	L4207	3.25	A B C D E F
Land O'Lakes	L2330	3.25	A B C D E F
Fontanelle	F4545	3.25	A B C D E F
Stock	SS793	3.25	A B C D E F
McCubbin	Taylor	3.25	A B C D E F
Dekalb-Pfizer Gen.	CX283	3.25	A B C D E F
Golden Harvest	H1233	3.25	A B C D E F
S Brand	S47B	3.33	A B C D E F G
Stine	2050+	3.33	A B C D E F G
S Brand	S44A	3.33	A B C D E F G
Dekalb-Pfizer Gen.	CX350	3.33	A B C D E F G
Hoegemeyer	205	3.42	A B C D E F G
-----	Century	3.42	A B C D E F G
Superior	SPB340	3.42	A B C D E F G
NC+	2D90+	3.42	A B C D E F G
Asgrow	A2187	3.42	A B C D E F G
-----	Logan	3.42	A B C D E F G
Jacques	2786	3.50	A B C D E F G
Hoegemeyer	200	3.50	A B C D E F G
MSR	Royal II	3.50	A B C D E F G
Jacques	J-105	3.50	A B C D E F G
Land O'Lakes	L2456	3.58	B C D E F G
Diamond	TC204A	3.58	B C D E F G
MSR	Royal	3.58	B C D E F G
Hofler	Gem	3.58	B C D E F G
-----	Zane	3.58	B C D E F G
McCubbin	EX40510	3.67	C D E F G H
Latham	1010	3.75	C D E F G H
Northrup King	S27-10	3.38	D E F G H
-----	Fremont	4.00	E F G H I
-----	Platte	4.17	G H I
-----	Mead	4.33	G H I
-----	Hack	4.33	G H I
Dekalb-Pfizer Gen.	CX324	4.58	H I
-----	Nebsoy	4.92	I

Table 6. 1985 DODGE COUNTY SEED YIELD

ANALYSIS OF VARIANCE

SOURCE	DF	SS	MS	F	
VARIETY	53	15124.225	285.363	3.25	***
BLOCK	5	14438.756	2887.751	32.90	***
ERROR	265	23257.319	87.764		
TOTAL	323	52820.300			

EXPERIMENTAL MEAN IS 27.9 C.V. = 33.6%

DUNCAN'S MULTIPLE RANGE TEST (5% PROTECTION LEVEL)
MEANS WITH THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT.

BRAND	ENTRY	MEAN	RANGES OF INSIG. CHANGE
Northrup King	S23-03	40.5	A
Ohlde	2193	40.1	A B
Golden Harvest	H1285	38.3	A B C
Profiseed	PS1152	37.4	A B C D
Latham	650	36.8	A B C D E
Fontanelle	F4545	35.6	A B C D E F
-----	Lakota	34.4	A B C D E F G
Superior	SPB308	34.0	A B C D E F G
S Brand	S44A	33.9	A B C D E F G
Stock	SS462A	33.9	A B C D E F G
Jacques	J-103	33.7	A B C D E F G
S Brand	S46D	33.1	A B C D E F G H
Land O'Lakes	L4207	32.8	A B C D E F G H I
Golden Harvest	H1276	32.6	A B C D E F G H I
Land O'Lakes	L2330	32.5	A B C D E F G H I
Golden Harvest	H1233	31.1	A B C D E F G H I
McCubbin	Taylor	31.0	A B C D E F G H I
-----	Century 84	30.6	A B C D E F G H I
Fontanelle	F4646	30.4	A B C D E F G H I J
Jacques	2386	29.7	A B C D E F G H I J
Jacobsen	799	29.6	A B C D E F G H I J
Stine	2920	29.4	A B C D E F G H I J
Land O'Lakes	L2456	29.3	A B C D E F G H I J
Asgrow	A2187	29.2	A B C D E F G H I J
-----	Weber	29.2	A B C D E F G H I J
Jacques	2786	29.1	A B C D E F G H I J
Riverside	4041	28.8	A B C D E F G H I J K
Dekalb-Pfizer Gen.	CX283	28.4	A B C D E F G H I J K
MSR	Royal II	28.2	A B C D E F G H I J K
MSR	Royal	28.2	A B C D E F G H I J K
Hofler	Gem	27.9	A B C D E F G H I J K
NC+	2D90+	27.5	A B C D E F G H I J K L
-----	Logan	27.4	A B C D E F G H I J K L
Superior	SPB340	27.3	A B C D E F G H I J K L
Hoegemeyer	200	27.2	A B C D E F G H I J K L
Ohlde	2188	26.9	B C D E F G H I J K L
Northrup King	S27-10	26.9	B C D E F G H I J K L
S Brand	S47B	26.8	B C D E F G H I J K L
Hoegemeyer	205	25.7	C D E F G H I J K L
Stock	SS793	25.2	C D E F G H I J K L
Stine	2050+	25.1	C D E F G H I J K L
Diamond	TC204A	24.5	D E F G H I J K L M
Jacques	J-105	24.0	D E F G H I J K L M
-----	Century	23.5	E F G H I J K L M
McCubbin	EX40510	23.0	F G H I J K L M
-----	Zane	22.9	F G H I J K L M
-----	Fremont	21.1	G H I J K L M
Latham	1010	19.5	H I J K L M
Dekalb-Pfizer Gen.	CX350	19.2	I J K L M
-----	Hack	17.0	J K L M
-----	Platte	15.6	K L M N
Dekalb-Pfizer Gen.	CX324	14.5	L M N
-----	Mead	12.0	M N
-----	Nebsoy	4.8	N

Figure 3. Dodge County Joe T. Kracl

<u>Seed Yield vs Third Chlorosis Score</u>

Intercept......................	72.706108
Regression Coefficient..........	-13.287302
Standard Error of the Reg. Coef.	0.984489
Probability > Absolute T........	0.0001
Correlation Coefficient.........	-0.87869
Probability > Absolute R	0.0001
Number of Observations	312
Correlation Coefficient.........	-0.88579
Probability > Absolute R	0.0001
Number of Observations	52

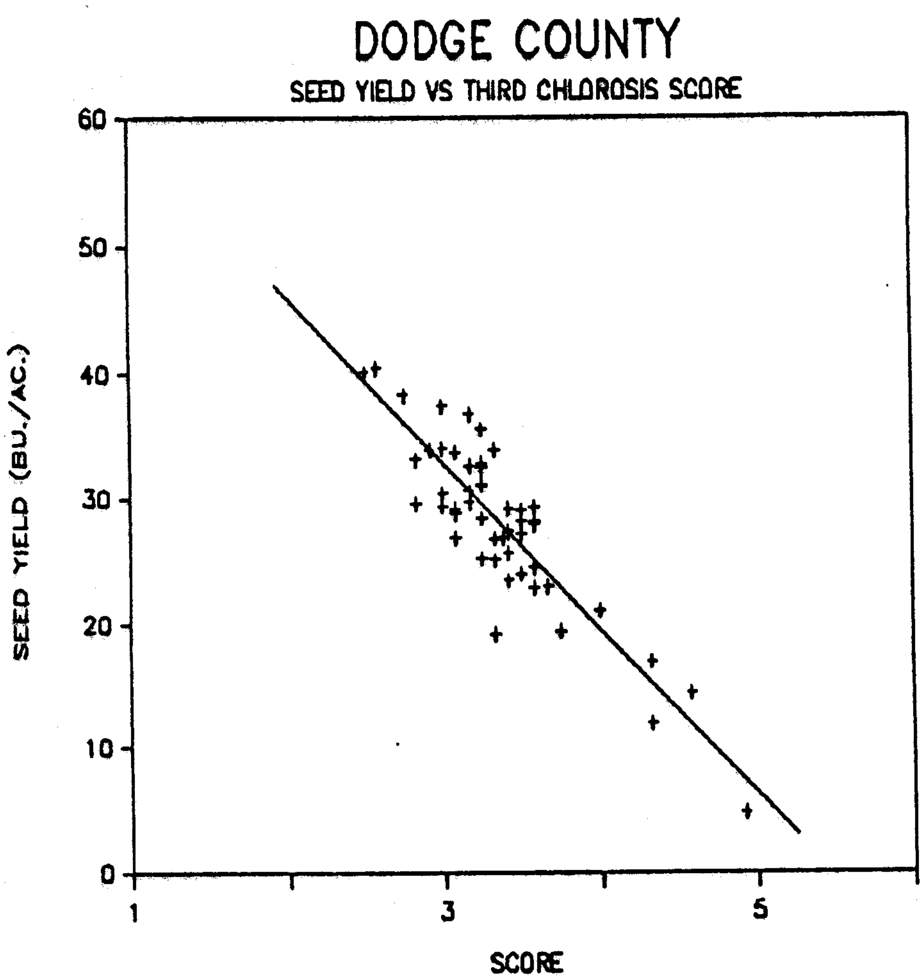


Table 7. 1985 MADSION COUNTY THIRD CHLOROSIS SCORE

ANALYSIS OF VARIANCE

SOURCE	DF	SS	MS	F	
VARIETY	52	20.403	0.392	1.93	***
BLOCK	5	8.542	1.708	8.39	***
ERROR	232	47.259	0.204		
TOTAL	289	76.203			

EXPERIMENTAL MEAN IS 2.36 C.V. = 19.1%

DUNCAN'S MULTIPLE RANGE TEST (5% PROTECTION LEVEL)
MEANS WITH THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT.

BRAND	ENTRY	MEAN	RANGES OF INSIG. CHANGE
Superior	SPB340	2.00	A
Jacobsen	799	2.00	A
Fontanelle	F4646	2.00	A
Latham	650	2.08	A B
Superior	SPB308	2.08	A B
S Brand	S44A	2.08	A B
Ohlde	2188	2.10	A B
Ohlde	2193	2.10	A B
Golden Harvest	H1233	2.13	A B C
Golden Harvest	H1276	2.17	A B C D
Profiseed	PS1152	2.17	A B C D
Fontanelle	F4545	2.17	A B C D
Stine	2920	2.17	A B C D
NC+	2D90+	2.17	A B C D
Jacques	J-103	2.17	A B C D
Riverside	4041	2.20	A B C D
MSR	Royal II	2.20	A B C D
Asgrow	A2187	2.20	A B C D
S Brand	S46D	2.20	A B C D
Land O'Lakes	L4207	2.20	A B C D
Dekalb-Pfizer Gen.	CX283	2.20	A B C D
S Brand	S47B	2.25	A B C D E
Golden Harvest	H1285	2.25	A B C D E
Northrup King	S23-03	2.25	A B C D E
Jacques	2386	2.25	A B C D E
McCubbin	EX40510	2.30	A B C D E
Hoegemeyer	205	2.30	A B C D E
Hoegemeyer	200	2.33	A B C D E F
Latham	1010	2.33	A B C D E F
Hofler	Gem	2.33	A B C D E F
Stock	SS793	2.40	A B C D E F
Land O'Lakes	L2456	2.40	A B C D E F
Stine	2050+	2.40	A B C D E F
-----	Century 84	2.40	A B C D E F
Jacques	2786	2.40	A B C D E F
Jacques	J-105	2.42	A B C D E F
MSR	Royal	2.42	A B C D E F
Diamond	TC204A	2.42	A B C D E F
McCubbin	Taylor	2.42	A B C D E F
-----	Weber	2.42	A B C D E F
----	Hack	2.50	A B C D E F
Stock	SS462A	2.50	A B C D E F
-----	Zane	2.58	A B C D E F
-----	Century	2.60	A B C D E F
Dekalb-Pfizer Gen.	CX350	2.60	A B C D E F
Dekalb-Pfizer Gen.	CX324	2.75	B C D E F
-----	Lakota	2.75	B C D E F
-----	Fremont	2.80	C D E F
-----	Nebsoy	2.83	D E F
-----	Mead	2.90	E F
Land O'Lakes	L2330	3.00	F
-----	Logan	3.00	F
Northrup King	S27-10	3.00	F

Table 8. 1985 MADSION COUNTY SEED YIELD

ANALYSIS OF VARIANCE

SOURCE	DF	SS	MS	F	
VARIETY	52	3708.393	71.315	2.09	***
BLOCK	5	563.776	112.755	3.30	***
ERROR	232	7921.787	34.146		
TOTAL	289	12193.956			

EXPERIMENTAL MEAN IS 48.9 C.V. = 11.9%

DUNCAN'S MULTIPLE RANGE TEST (5% PROTECTION LEVEL)
MEANS WITH THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT.

BRAND	ENTRY	MEAN	RANGES OF INSIG. CHANGE
Superior	SPB308	54.3	A
Latham	1010	54.0	A B
Northrup King	S23-03	53.9	A B C
Fontanelle	F4545	53.8	A B C
Hoegemeyer	205	53.5	A B C
MSR	Royal II	53.3	A B C
Ohlde	2193	53.3	A B C
NC+	2D90+	52.8	A B C D
Latham	650	52.7	A B C D
Dekalb-Pfizer Gen.	CX283	52.5	A B C D E
Jacobsen	799	52.5	A B C D E
Hoegemeyer	200	51.9	A B C D E F
Golden Harvest	H1276	51.8	A B C D E F
Jacques	2786	51.6	A B C D E F
MSR	Royal	51.6	A B C D E F
Superior	SPB340	50.7	A B C D E F
Golden Harvest	H1285	50.7	A B C D E F
Fontanelle	F4646	50.7	A B C D E F
Stock	SS793	50.6	A B C D E F
Hofler	Gem	50.6	A B C D E F
Stine	2920	50.5	A B C D E F
Land O'Lakes	L4207	50.4	A B C D E F
S Brand	S47B	50.4	A B C D E F
Ohlde	2188	50.3	A B C D E F
Northrup King	S27-10	49.8	A B C D E F
Diamond	TC204A	49.7	A B C D E F G
S Brand	S44A	49.2	A B C D E F G
Golden Harvest	H1233	49.1	A B C D E F G
Stock	SS462A	48.9	A B C D E F G H
Jacques	2386	48.9	A B C D E F G H
McCubbin	Taylor	48.4	A B C D E F G H
Profiseed	PS1152	48.4	A B C D E F G H
McCubbin	EX40510	48.1	A B C D E F G H
Asgrow	A2187	47.7	A B C D E F G H
-----	Zane	47.0	A B C D E F G H
-----	Logan	47.0	A B C D E F G H
Land O'Lakes	L2456	46.9	A B C D E F G H
Riverside	4041	46.3	A B C D E F G H
Stine	2050+	46.3	A B C D E F G H
-----	Century	46.1	A B C D E F G H
Dekalb-Pfizer Gen.	CX324	46.1	A B C D E F G H
Jacques	J-105	46.0	A B C D E F G H
-----	Nebsoy	46.0	A B C D E F G H
-----	Hack	45.2	B C D E F G H
S Brand	S46D	45.1	B C D E F G H
-----	Weber	45.0	C D E F G H
-----	Fremont	44.0	D E F G H
Jacques	J-103	43.9	D E F G H
-----	Lakota	43.6	E F G H
-----	Century 84	43.2	F G H
-----	Mead	43.0	F G H
Dekalb-Pfizer Gen.	CX350	41.0	G H
Land O'Lakes	L2330	40.3	H

Figure 4. Madison County Ed Nicolay

<u>Seed Yield vs Third Chlorosis Score</u>

Intercept.......................	67.451431
Regression Coefficient..........	-7.854369
Standard Error of the Reg. Coef.	1.526174
Probability > Absolute T........	0.0001
Correlation Coefficient.........	-0.41165
Probability > Absolute R	0.0001
Number of Observations	286
Correlation Coefficient.........	-0.58846
Probability > Absolute R	0.0001
Number of Observations	52

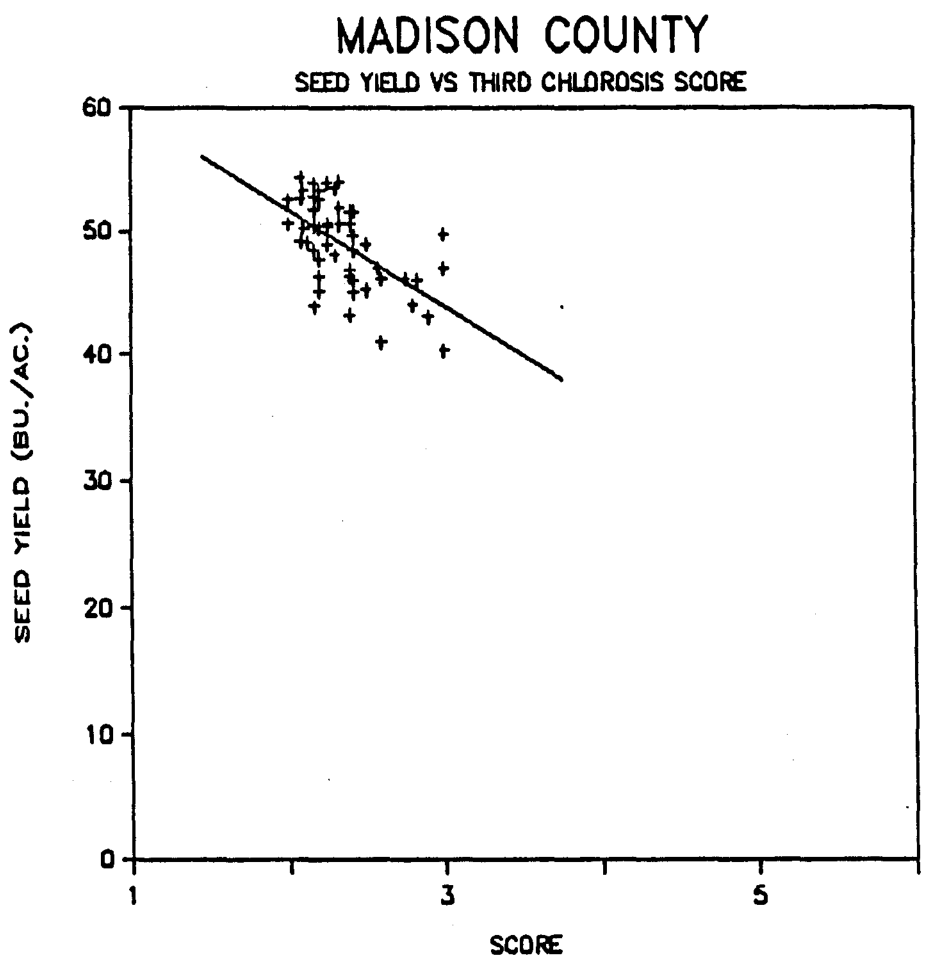


Table 9. 1985 MERRICK COUNTY THIRD CHLOROSIS SCORE

ANALYSIS OF VARIANCE

SOURCE	DF	SS	MS	F	
VARIETY	52	39.874	0.767	4.15	***
BLOCK	5	8.421	1.684	9.11	***
ERROR	260	48.079	0.185		
TOTAL	317	96.374			

EXPERIMENTAL MEAN IS 1.75 C.V. = 24.6%

DUNCAN'S MULTIPLE RANGE TEST (5% PROTECTION LEVEL)
MEANS WITH THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT.

BRAND	ENTRY	MEAN	RANGES OF INSIG. CHANGE
S Brand	S46D	1.42	A
Jacobsen	799	1.42	A
Stine	2920	1.42	A
-----	Century 84	1.42	A
Jacques	2386	1.42	A
Land O'Lakes	L4207	1.50	A B
Jacques	2786	1.50	A B
S Brand	S47B	1.50	A B
Fontanelle	F4646	1.50	A B
Northrup King	S23-03	1.50	A B
Latham	650	1.50	A B
Riverside	4041	1.58	A B C
Golden Harvest	H1276	1.58	A B C
Ohlde	2188	1.58	A B C
Land O'Lakes	L2330	1.58	A B C
MSR	Royal II	1.58	A B C
Jacques	J-105	1.58	A B C
Asgrow	A2187	1.58	A B C
Hoegemeyer	200	1.58	A B C
Jacques	J-103	1.58	A B C
Dekalb-Pfizer Gen.	CX283	1.58	A B C
Superior	SPB340	1.58	A B C
-----	Weber	1.67	A B C
Stine	2050+	1.67	A B C
-----	Century	1.67	A B C
Superior	SPB308	1.67	A B C
Fontanelle	F4545	1.67	A B C
Latham	1010	1.67	A B C
Profiseed	PS1152	1.67	A B C
Dekalb-Pfizer Gen.	CX350	1.67	A B C
Golden Harvest	H1233	1.67	A B C
-----	Zane	1.67	A B C
Ohlde	2193	1.67	A B C
Diamond	TC204A	1.75	A B C D
NC+	2D90+	1.75	A B C D
MSR	Royal	1.75	A B C D
McCubbin	Taylor	1.75	A B C D
Golden Harvest	H1285	1.75	A B C D
S Brand	S44A	1.75	A B C D
Hoegemeyer	205	1.75	A B C D
Hofler	Gem	1.83	A B C D
-----	Logan	1.92	A B C D
Stock	SS462A	1.92	A B C D
Land O'Lakes	L2456	1.91	A B C D
-----	Hack	2.00	A B C D
Stock	SS793	2.00	A B C D
McCubbin	EX40510	2.00	A B C D
-----	Mead	2.08	B C D
-----	Fremont	2.17	C D
-----	Platte	2.17	C D
Dekalb-Pfizer Gen.	CX324	2.33	D
-----	Nebsoy	3.17	E
Northrup King	S27-10	3.25	E

Table 10. 1985 MERRICK COUNTY SEED YIELD

ANALYSIS OF VARIANCE

SOURCE	DF	SS	MS	F	
VARIETY	52	5288.376	101.700	3.09	***
BLOCK	5	1712.208	342.442	10.42	***
ERROR	260	8543.783	32.861		
TOTAL	317	15544.367			

EXPERIMENTAL MEAN IS 32.48 C.V. = 17.6%

DUNCAN'S MULTIPLE RANGE TEST (5% PROTECTION LEVEL)
MEANS WITH THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT.

BRAND	ENTRY	MEAN	RANGES OF INSIG. CHANGE
Jacques	2386	38.8	A
Ohlde	2193	38.5	A
Latham	1010	38.0	A B
Asgrow	A2187	37.7	A B
McCubbin	Taylor	37.3	A B C
-----	Century 84	37.3	A B C
Jacques	J-103	37.2	A B C
Fontanelle	F4646	36.6	A B C D
Jacques	2786	36.1	A B C D
S Brand	S44A	35.8	A B C D
Superior	SPB308	35.3	A B C D
Hoegemeyer	205	35.2	A B C D
Ohlde	2188	35.2	A B C D
MSR	Royal	34.8	A B C D
Jacobsen	799	34.7	A B C D
Dekalb-Pfzer Gen.	CX283	34.6	A B C D
Golden Harvest	H1276	34.5	A B C D
MSR	Royal II	34.5	A B C D
-----	Century	34.4	A B C D
Golden Harvest	H1285	34.4	A B C D
Golden Harvest	H1233	34 0	A B C D E
-----	Weber	33.8	A B C D E
Land O'Lakes	L4207	33.8	A B C D E
Northrup King	S23-03	33.7	A B C D E
Jacques	J-105	33.4	A B C D E F
Stine	2050+	33.0	A B C D E F
S Brand	S47B	32.9	A B C D E F G
-----	Fremont	32.7	A B C D E F G
S Brand	S46D	32.7	A B C D E F G
Stine	2920	32.7	A B C D E F G
Profiseed	PS1152	32.6	A B C D E F G
Diamond	TC204A	32.5	A B C D E F G
-----	Hack	32.4	A B C D E F G
Hoegemeyer	200	32.2	A B C D E F G
Fontanelle	F4545	32.1	A B C D E F G
Hofler	Gem	31.9	A B C D E F G
Riverside	4041	31.5	A B C D E F G H
Superior	SPB340	31.4	A B C D E F G H
Latham	650	31.1	A B C D E F G H
Land O'Lakes	L2330	31.0	A B C D E F G H
McCubbin	EX40510	30.9	A B C D E F G H
Dekalb-Pfizer Gen.	CX324	30.7	A B C D E F G H I
-----	Zane	30.0	B C D E F G H I
-----	Logan	29.9	B C D E F G H I
Land O'Lakes	L2456	29.1	C D E F G H I
NC+	2D90+	28.4	D E F G H I
Stock	SS462A	28.4	D E F G H I
Dekalb-Pfzier Gen.	CX350	26.1	E F G H I
-----	Mead	25.3	F G H I J
-----	Platte	24.9	G H I J
Stock	SS793	23.9	H I J
Northrup King	S27-10	23.0	I J
-----	Nebsoy	18.7	J

Figure 5. Merrick County Norm Krug

Seed Yield vs Third Chlorosis Score

Intercept......................	45.788950
Regression Coefficient..........	-7.546597
Standard Error of the Reg. Coef.	1.181251
Probability > Absolute T........	0.0001
Correlation Coefficient.........	-0.42862
Probability > Absolute R	0.0001
Number of Observations	312
Correlation Coefficient.........	-0.67039
Probability > Absolute R	0.0001
Number of Observations	52

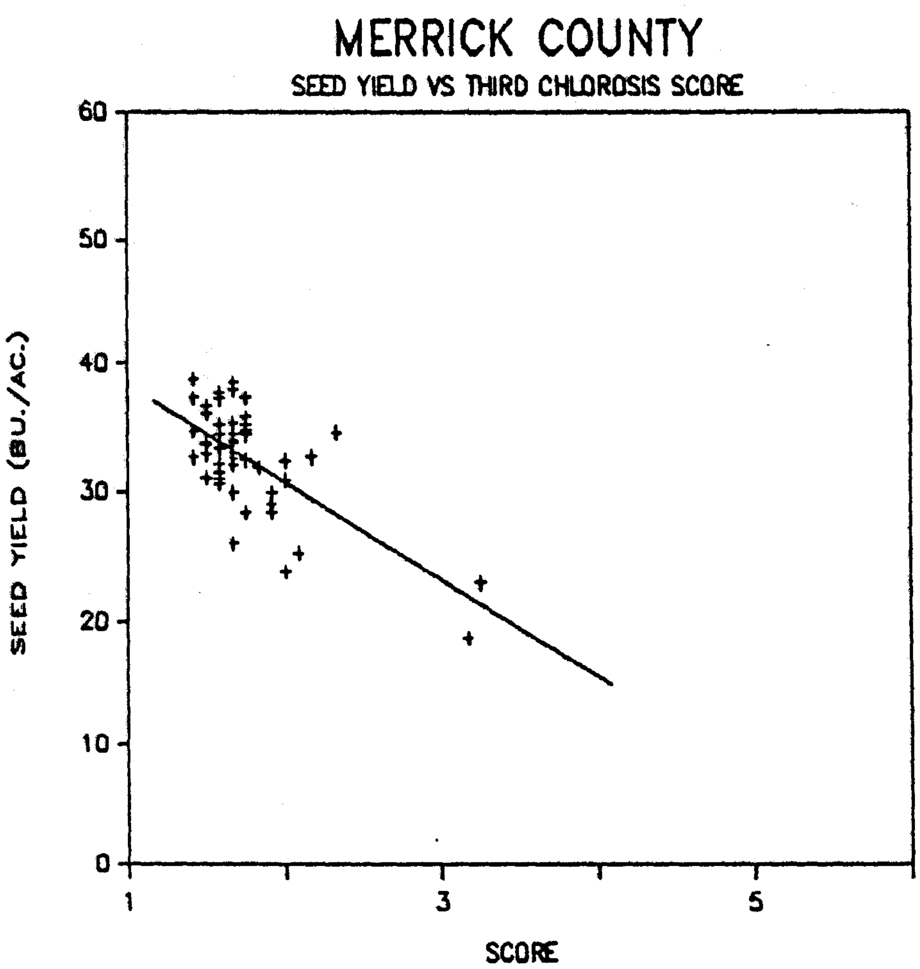


Table 11. MEANS ACROSS FOUR SITES THIRD CHLOROSIS SCORE

VARIETY	SEED DENSITY, SEEDS/FOOT. 4.5	9.0	13.5	Mean	
--- Century	3.56	2.97	2.62	3.05	
--- Nebsoy	4.74	4.24	3.74	4.23	
Stine 2920	3.26	2.71	2.53	2.83	
Mean	3.85	3.30	2.96	3.37	CV. = 17.2%

THIRD SCORE ANALYSIS OF VARIANCE

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	
Site	3	77.653	25.884	76.71	***
Variety	2	58.127	29.064	86.14	***
Density	2	20.657	10.328	30.61	***
Block(Site)	16	15.168	1.167		
Site*Variety	6	2.276	0.379	1.12	N.S.
Site*Density	6	2.275	0.379	1.12	N.S.
Variety*Density	4	0.539	0.135	0.40	N.S.
Site*Variety*Density	12	6.479	0.540	1.60	N.S.
Error	104	35.091	0.337		
Total	152	218.265			

MEANS ACROSS FOUR SITES SEED YIELD

VARIETY	SEED DENSITY, SEEDS/FOOT. 4.5	9.0	13.5	Mean	
--- Century	20.7	29.8	35.0	28.6	
--- Nebsoy	9.8	19.4	23.1	17.3	
Stine 2920	25.9	31.9	38.8	32.2	
Mean	18.8	26.9	32.5	26.0	CV. = 25.5 %

SEED YIELD ANALYSIS OF VARIANCE

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	
Site	3	31174.955	10591.652	235.08	***
Variety	2	6122.262	3061.131	69.25	***
Density	2	4672.787	2336.394	52.85	***
Block(Site)	13	1278.335	98.333		
Site*Variety	6	280.858	46.810	1.06	N.S.
Site*Density	6	456.837	76.140	1.72	N.S.
Variety*Density	4	33.226	8.307	0.19	N.S.
Site*Variety*Density	12	1375.120	114.593	2.59	***
Error	100	4420.529	44.205		
Total	148	49814.910			

Table 12. 1985 PLATTE VALLEY YELLOWS VARIETY X SEEDING DENSITY

COLFAX COUNTY THIRD CHLOROSIS SCORE

VARIETY	SEED DENSITY, SEEDS/FOOT.			
	4.5	9.0	13.5	Mean
--- Century	4.17	3.67	3.17	3.67
--- Nebsoy	5.67	5.17	4.83	5.22
Stine 2920	3.67	3.67	3.50	3.61
Mean	4.50	4.17	3.83	4.17

C.V. = 7.6%

Variety *** Density *** V X D N.S. Block *

COLFAX COUNTY SEED YIELD

VARIETY	SEED DENSITY, SEEDS/FOOT.			
	4.5	9.0	13.5	Mean
--- Century	0.6	12.4	13.8	8.9
--- Nebsoy	0.0	0.6	0.0	0.2
Stine 2920	7.4	15.6	17.6	13.5
Mean	2.7	9.5	10.5	7.6

C.V. = 100.4%

Variety *** Density * V X D N.S. Block *

DODGE COUNTY THIRD CHLOROSIS SCORE

VARIETY	SEED DENSITY, SEEDS/FOOT.			
	4.5	9.0	13.5	Mean
--- Century	4.50	3.83	4.50	4.28
--- Nebsoy	5.50	5.67	4.33	5.17
Stine 2920	4.50	4.00	3.17	3.89
Mean	4.83	4.50	4.00	4.44

C.V. = 19.2%

Variety ** Density N.S. V X D N.S. Block N.S.

DODGE COUNTY SEED YIELD

VARIETY	SEED DENSITY, SEEDS/FOOT.			
	4.5	9.0	13.5	Mean
--- Century	8.0	16.9	13.5	12.8
--- Nebsoy	2.3	0.7	9.0	4.0
Stine 2920	8.6	10.9	29.5	16.3
Mean	6.3	9.5	17.3	11.0

C.V. = 86.2%

Variety ** Density * V X D N.S. Block N.S.

Table 12 cont. MADISON COUNTY THIRD CHLOROSIS SCORE

VARIETY	SEED DENSITY, SEEDS/FOOT.			
	4.5	9.0	13.5	Mean
--- Century	3.17	2.92	2.33	2.80
--- Nebsoy	4.33	3.42	3.50	3.75
Stine 2920	2.83	2.50	2.41	2.58
Mean	3.44	2.94	2.75	3.05

C.V. = 18.9%

Variety *** Density *** V X D N.S. Block ***

MADISON COUNTY SEED YIELD

VARIETY	SEED DENSITY, SEEDS/FOOT.			
	4.5	9.0	13.5	Mean
--- Century	41.4	45.2	52.8	46.8
--- Nebsoy	20.7	43.8	44.1	35.7
Stine 2920	43.7	50.6	53.5	49.2
Mean	34.9	46.4	50.5	43.9

C.V. = 11.4%

Variety *** Density *** V X D *** Block ***

MERRICK COUNTY THIRD CHLOROSIS SCORE

VARIETY	SEED DENSITY, SEEDS/FOOT.			
	4.5	9.0	13.5	Mean
--- Century	3.10	2.10	1.50	2.23
--- Nebsoy	4.20	3.80	3.00	3.67
Stine 2920	2.80	1.60	1.70	2.03
Mean	3.37	2.50	2.07	2.64

C.V. = 19.5%

Variety *** Density *** V X D N.S. Block ***

MERRICK COUNTY SEED YIELD

VARIETY	SEED DENSITY, SEEDS/FOOT.			
	4.5	9.0	13.5	Mean
--- Century	19.8	32.5	39.2	30.5
--- Nebsoy	7.1	12.6	24.5	14.7
Stine 2920	25.9	35.6	39.6	33.7
Mean	17.6	26.9	34.5	26.3

C.V. = 22.7%

Variety *** Density *** V X D N.S. Block **

DYNAMICS OF WATER IN RIGID AND SWELLING SOILS

D. Swartzendruber

Objective:

The general objective of this project is to analyze and quantify the processes by which water flows into and through porous media and soils under both saturated and unsaturated conditions. Swelling and nonswelling soils are considered.

Procedure:

As far as reasonably possible, each flow process is approached as a mathematical boundary-value problem to be solved by classical mathematical means or by computer if necessary. Experiments are conducted in the laboratory with vertical flow columns on which measurements of water content and soil bulk density are obtained by the attenuation of dual-energy gamma radiation. Other flow measurements are taken as needed.

Results and Discussion:

A quasi mathematical solution to Richards' equation was developed and completed for one-dimensional downward infiltration of water into soil. At infinite times, the quasi solution becomes identical to the Philip solution for asympototically large times. At moderate and small times, the quasi solution is matched with the Philip square-root-of-time series solution, which defines a new set of functions (of water content) that characterize the infiltration behavior of the soil. When evaluated for the so-called Yolo light clay of Philip, the new functions described the water-content profiles with excellent accuracy.

The quasi solution was integrated to yield a general and relatively simple form of infiltration equation, for cumulative quantity of water infiltrated versus time. This equation could be fitted very precisely by least squares to field data obtained with ring infiltrometers under different cropping sequences of soybean, sorghum, corn and fallow on Sharpsburg silty clay loam near Mead, Nebraska. On the basis of the fitted equation parameters, continuous sorghum maintained a statistically significant, higher infiltration capability than did continuous corn.

Laboratory experimentation was conducted on downward water entry into upward expanding columns of an equal-part mixture of Wyoming bentonite and quartz silt. A load stress of either 1.2, 2.4, 4.8, or 9.6 kPa, applied on the water applicator in contact with the upward-moving top end of the wetted bentonite-silt, enabled dependable internal measurements of water content and bulk density to be taken with a dual-energy beam of gamma rays. Data analysis is underway to determine whether for the wetting and expanding bentonite-silt the void ratio is a unique function of the volumetric water content.

Water and Nitrogen Interactions in Dryland Cropping Systems

Robert M. Aiken and Michael D. Jawson

Objectives

1) Analyze components of crop water budgets for dryland corn, alfalfa and soybeans to evaluate improved use of rainfall.

2) Analyze the influence of soil wetting and drying cycles on nitrogen transformations with emphasis on soil respiration, mineralization of organic matter and availability of mineral forms of nitrogen in soil under corn, alfalfa and soybeans.

Procedure

A diversified grain/livestock farm in Cedar County, Nebraska was selected as the primary study site. Soil moisture and nitrogen conditions determined at three-day intervals include precipitation, stored soil water (0 - 1.5 m), mineral and organic N (0 - 0.3 m), and soil respiration (0 - 0.08 m). These parameters were determined throughout the 1984 cropping season for a Nora silt loam soil under alfalfa, corn and soybean crops. The influence of crop on water and nitrogen interactions is determined by graphical and time-series statistical analysis.

Experimental Results

Crop Water Use

Changes in stored soil moisture (Figure 1) result from dynamic processes including water infiltration from rain (excluding runoff), surface evaporation, transpiration by plants, and drainage below the root zone. Initial conditions consisted of less stored soil moisture (2") for alfalfa compared with corn due to early season transpiration by alfalfa. Recharge and depletion of stored soil moisture are similar for both crops through the season. Presumably, most rainfall ran off the soybean field prior to the late planting date for the stored soil moisture in the rooting zone approaches field capacity. Recharge and evapotranspiration patterns are similar to alfalfa and corn following leaf energence. Little difference was observed in stored soil moisture for each crop at the end of the cropping season.

The fact that stored soil moisture at final harvest was nearly identical for alfalfa, corn and soybean may be expected, for evapotranspiration demand is typically greater than precipitation in late summer in this region. This suggests a given crop-type offers little competitive advantage for recharge of stored soil moisture at the end of the cropping season. Perennial crops may deplete stored soil water after harvest and into the following season if crop transpiration is allowed to continue unchecked.

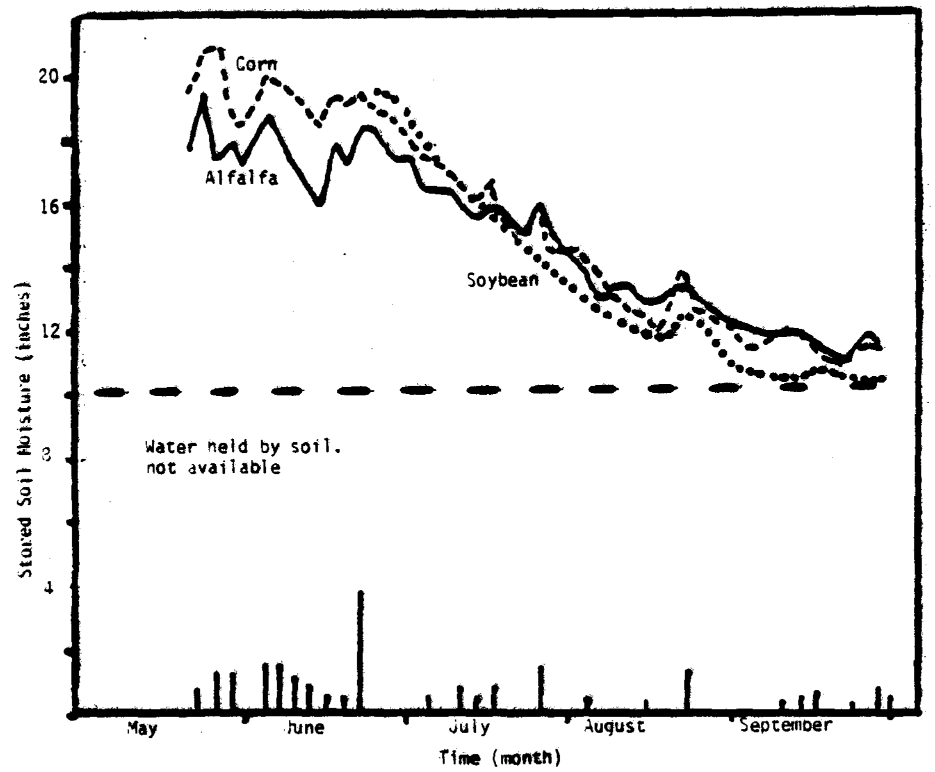


Figure 1: Stored soil moisture for corn, soybean, and alfalfa in Cedar County, NE for the 1984 growing season.

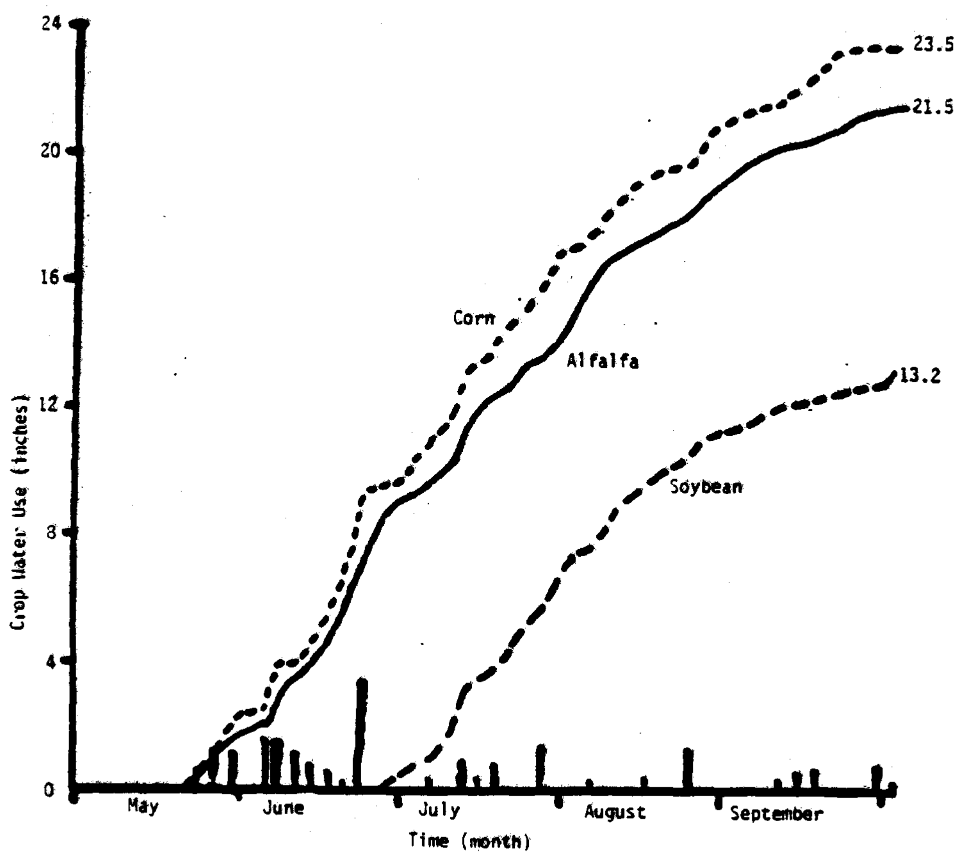


Figure 2: Crop water use for corn, soybean and alfalfa in Cedar County, NE for the 1984 growing season.

Crop water use (calculated as 'Rainfall' - 'Change in Stored Soil Moisture' - 'Drainage' = 'Crop Water Use') is similar for all crops once leaf emergence occurs (see Figure 2). But crop response to rainfall events suggests the crops differ in infiltration, runoff and surface evaporation rates. Seasonal crop water use is much lower for soybeans than for alfalfa or corn due to the late planting date.

All crops used similar amounts of water once leaf emergence occurred. This may be expected, for each crop tends to optimize leaf surface area and depth of rooting zone; under these conditions, transpiration is largely governed by prevailing weather conditions as modified by crop leaf stomatal behavior. The crops differ primarily in the time of leaf emergence. The perennial growth habit of alfalfa permits early leaf emergence, resulting in early growth response to available moisture and highest biomass productivity per inch of water used.

Organic Matter Mineralization

Soil moisture conditions in the surface 8 cm (see Figure 3) show dramatic change with a general seasonal decline modified by rainfall and evapotranspiration. Soil moisture is expressed as water-filled pore space (WFPS), for most biological activity occurs in the context of soil pores. The soil surface zone is generally drier under corn than under alfalfa.

The relation between soil respiration and ammonium release is shown in Figures 4 and 5. Microbial activity is high during the spring and soil organisms effectively 'scavange' the available ammonium-N. Ammonium is released during the summer when microbial activity declines; release is greatest under corn where the dry conditions are less favorable for microbial activity.

Wetting and drying cycles play an important role in release of mineral nutrients. These cycles appear to stimulate microbial activity during the spring when carbon and nitrogen rich crop residues are available for decomposition. Soil microbes effectively 'scavange' available nutrients during this period; spring grain crops such as oats and wheat may experience nutrient stress under low-input farming practices. The release of inorganic nutrients appears to occur during the summer-when in heavy demand for full-season grain crops.

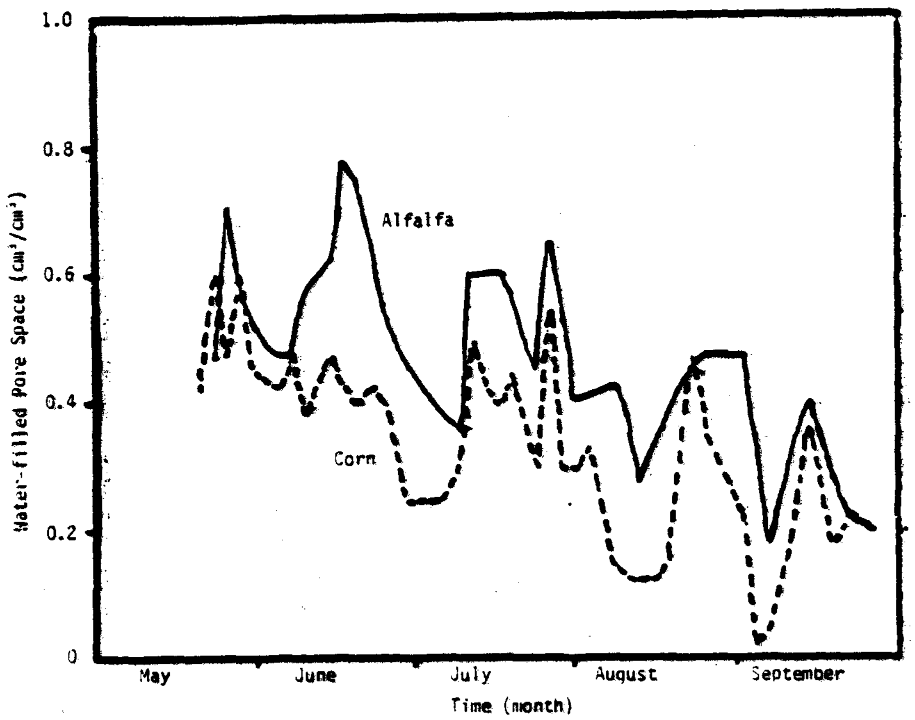


Figure 3: Soil moisture at the 0-15 cm depth expressed as water-filled pore space for corn and alfalfa in Cedar County, NE for the 1984 growing season.

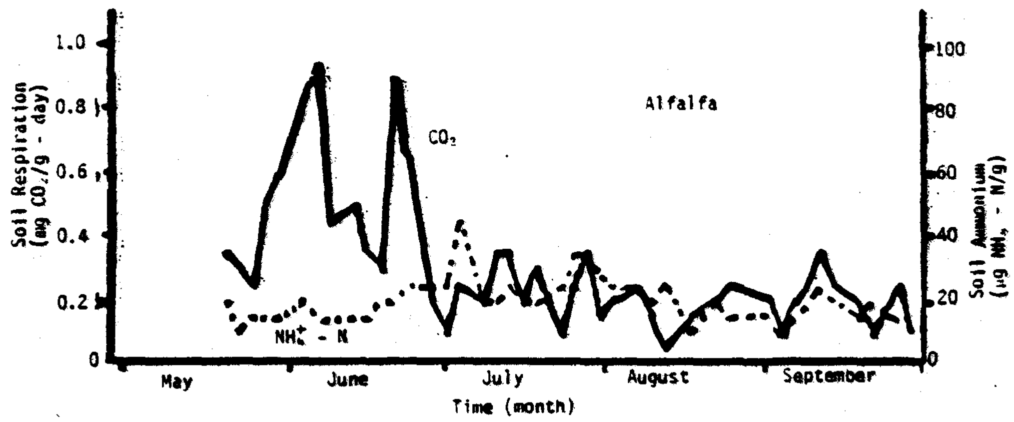


Figure 4: Soil respiration rate and ammonium levels in soil used for alfalfa production.

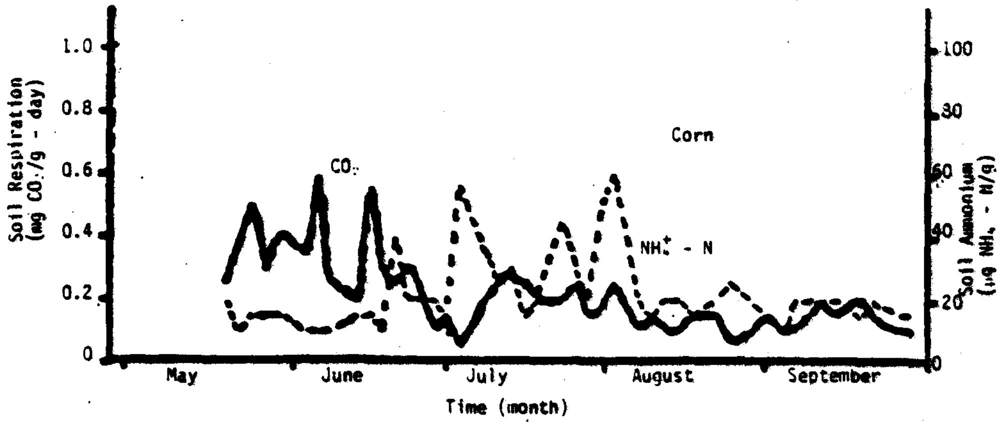


Figure 5: Soil respiration rate and ammonium levels in soil used for corn production.

FERTILIZER MANAGEMENT FOR NATIVE SUBIRRIGATED MEADOWS

Gary W. Hergert, Pat Reece and Jim Nichols

Objective: (1) Determine nutrients needed and rates required for improving forage production of native subirrigated meadows.
(2) Determine the effect of fertilization on protein content and IVDMD of forage.

Procedure: Plots were established in one of the native wet meadow areas of the Gudmundsen Sandhills Lab during 1982. Little research on wet meadows has been conducted since about 1970 (Daigger and Burzlaff, SB 521, 1972). A three-factor factional design with four replications was used. N at 0, 40, 80, and 120 lbs/A, P_2O_5 at 0 and 40 lbs/A, and S at 0 and 20 lbs/A were combined factionally. Fertilizer was applied during April of 1982, 1983, 1984 and 1985. Forage was harvested in early- to mid-July all years.

Data were averaged over the four years because plant response and treatment effects were the same each year. No significant interactions were noted any year on yield.

N, P, and S all significantly increased yields (Table 1). Since no interactions were significant, only the means for main effects are given in Table 2. Highest yields were produced by the combination of N, P, and S (Figure 1). The additive effects of P and S are shown clearly. Lines are best "eyeball" approximations as regressions have not been completed.

Crude protein and IVDMD were both decreased by N rate (Tables 1 and 2). This decrease may be primarily related to stage of cutting although cuttings were typical of local rancher practice. Although the decrease in forage protein and IVDMD were statistically significant, they are of little practical significance when compared to the markedly increased forage production. All plots were harvested in early stages of anthesis for most species.

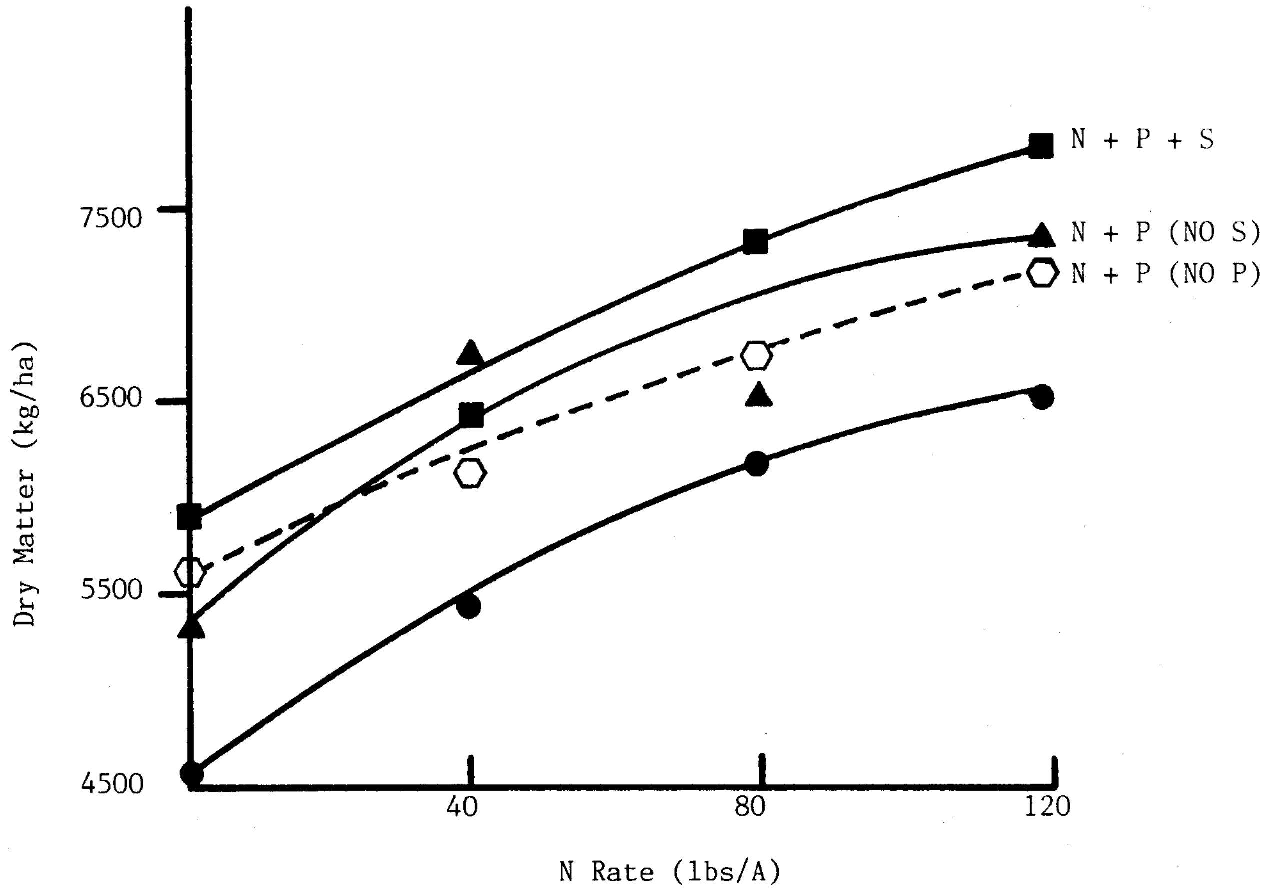
If highest yields are the goal, a mixture of N, P, and S will be required on wet meadows. Economic analysis of this data is still required to determine the most profitable fertilization rate.

Table 1. ANOVA for the meadow fertilization study at the Gudmundsen Sandhills Lab, 1982-1985.

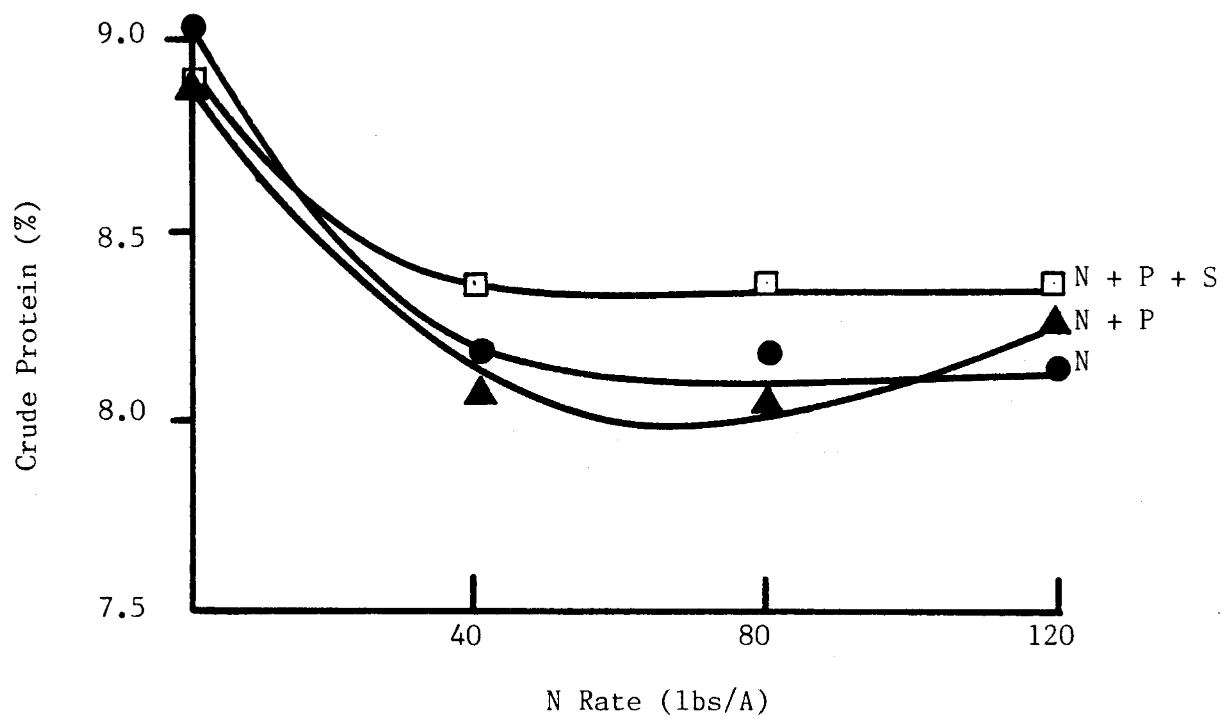
Source	Four Year Average: Dry Matter	Crude Protein	IVDMD
	PR > F		
N	.001	.001	.001
P	.001	.39	.68
N*P	.68	.78	.51
S	.001	.75	.06
N*S	.36	.37	.20
P*S	.32	.06	.35
N*P*S	.38	.33	.29

Table 2. Treatment effects of N, P, and S on forage yield and quality of subirrigated meadow hay.

	4 Year Average: DM Kg/ha	CP %	IVDMD %
N			
0	5370	8.84	54.8
40	6210	8.16	54.4
80	6690	8.11	53.5
120	7160	8.31	52.1
P_2O_5			
0	6030	8.32	53.8
40	6680	8.39	53.6
S			
0	6100	8.34	54.2
20	6610	8.37	53.2



Dry Matter (kg/ha)
7500
6500
5500
4500
40
80
120
N Rate (lbs/A)
N + P + S
N + P (NO S)
N + P (NO P)



Crude Protein (%)
9.0
8.5
8.0
7.5
40
80
120
N Rate (lbs/A)
N + P + S
N + P
N

VOLCANIC ASH AND ASSOCIATED CLAY MINERALS IN MITCHELL AND TRIPP SOILS

D. T. Lewis

Soils in the Mitchell and Tripp Series are some of the most intensively farmed soils in the valley of the North Platte River in the Panhandle of Nebraska. As part of an overall effort to determine the properties and classification of these soils, mineralogy of the sand, silt and clay fractions was determined. These soils are associated with parent materials that are known to contain rather large amounts of volcanic ash. Ash and its weathering products, such as allophane, apparently have an effect on water and cation holding capacities of soils, and if allophane is present, it may affect phosphorus fertility relationships as well.

Data suggested (Table 1) that both these soils contained a great deal of volcanic ash in their sand and silt fractions. It appears that as ash content increased, so did the total surface area of these soils (Table 2). Clay types were mostly hydrous micas (dioctahedral and trioctahedral vermiculite) and semectites. These did not appear to change greatly in amount between the various soil horizons. X-ray patterns suggested that interstratified clays existed in the soils as well, and suggested the presence of allophane. An established indicator of allophane is the pH of the soil after reacting with IN NaF. If this pH is greater than 9.4 allophane is thought to be present. It appears (Table 3) that following the above criterion, both soils contained allophane. We plan to follow this up with a study of this allophane and its effect on phosphorus applied to these soils.

Table 1. Light minerals (<2.85 g/cc) in sand and coarse silt fractions. Total light minerals are a percent (by weight) of the sand and coarse silt fractions. Specific minerals are a percent of the light minerals as determined by a line count method under the polarizying microscope.

Horizon	Total light minerals	Volcanic glass (ash)	Feldspars	Quartz	Unknown[1]	Quartz/Feldspar ratio
			Mitchell (Area 1, Site 1)			
AP	97.2	38.4	15.1	30.5	16.0	2.0
A	97.1	40.8	16.2	29.1	13.9	1.8
Ac1	97.0	42.1	16.0	30.0	11.9	1.9
Ac2	97.1	45.6	15.8	32.4	6.2	2.1
C1	97.8	51.8	15.6	28.4	4.2	1.8
C2	97.0	52.2	14.8	28.2	4.8	1.9
C3	97.0	48.1	15.2	30.0	6.7	2.0
			Tripp (Area 2, Site 1)			
AP	97.1	30.5	15.8	464.0	7.7	1.5
A	97.0	32.8	16.0	40.2	11.0	2.5
Bw1	97.1	31.6	14.4	45.9	8.1	3.2
Bs2	97.0	26.0	14.8	48.0	11.2	1.8
Bc	97.0	40.2	15.8	37.6	6.4	2.4
Ck	97.1	30.6	18.5	40.7	10.2	2.2

[1]Unknown minerals were those grains that appeared to be weathered so strongly that their optical properties could not be used in identification.

Table 2. Particle size distribution, bulk density and total soil surface area.

Horizon	Sand (%) vfs	fs	ms	cs	vcs	Total	Silt %	Clay %	Bulk Density[1] g/cc	Surface Area[2] m^2/g
						Mitchell				
AP	20	4	2	-	-	26	51	23	1.4	116.6
A	19	2	2	-	-	23	49	27	1.5	127.8
AC1	18	3	1	-	-	22	52	26	1.3	103.2
AC2	18	3	1	-	-	22	62	16	1.1	138.9
C1	18	4	1	-	-	23	60	17	1.1	186.5
C2	18	3	1	-	-	22	61	17		162.6
C3	18	4	1	-	-	23	60	17		185.8
C4	18	4	1	1	-	24	67	9		163.2
						Tripp				
AP	39	10	2	1	-	52	31	17	1.40	46.1
A	41	12	2	1	-	56	31	13	1.44	50.9
Bw1	40	15	3	1	-	60	24	16	1.31	42.3
Bw2	40	13	2	1	-	57	25	18	1.26	48.5
Bck	36	8	2	1	-	47	45	8	1.17	49.9
Ck1	33	11	2	1	-	47	45	8	1.27	50.4
Ck2	41	10	1	-	-	52	39	9		61.7

Table 3. Estimation of allophane content in Mitchell and Tripp soils by 1N NaF method.

Horizon	Depth (cm)	Volcanic Glass	pH
		- - - - % - - - -	- - - 1N NaF - - -
		Pediment	
AP	0-20	38.4	9.6*
A1	20-28	40.8	9.6*
AC1	28-38	42.1	9.7*
AC2	38-53	45.6	10.0*
C1	53-81	51.8	10.2*
C2	81-109	52.2	10.2*
C3	109-155	48.1	10.1*
		Terrace	
AP	0-15	30.5	9.6*
A1	15-28	32.8	9.5*
Bw1	28-53	31.6	9.6*
Bw2	53-84	26.0	10.2*
Bck	84-122	40.2	10.3*
Ck1	122-132	30.6	10.2*

* Appreciable allophane content (ph of 9.4 or more) Fields and Perrott (1966) pointed out that the pH of a suspension that contains one gram of soil in a 50 ml of 1N NaF was 9.4 after 2 minutes if its allophane content was appreciable.

Variation in Soil Properties Along a Hillslope

Alice J. Jones

Objectives: The objectives of this study are to 1) identify changes in soil properties along a hillslope, and 2) equate the variation in these properties to the erosion process.

Procedures: A Wymore silty clay soil in NW Otoe Co. was selected for study. The field was disked and planted to corn in the spring of 1985. The corn was planted on the contour using a 0.9 m row spacing. Soil samples from the 0-2.5 cm depth were collected at 5.4 m intervals along the hillslope. Three samples were collected at each location for purposes of replication. Samples were brought to the laboratory, air dried and analyzed for aggregate size, aggregate stability, and particle size distribution. Chemical properties which may vary along the hillslope are currently being evaluated.

Results and Discussion: Particle size distribution varied from 18 to 22% for clay, 60 to 77% for silt and 3 to 17% for sand along the hillslope (Fig. 1 a,b,c). Near the base of the hill clay and sand content increase and silt content decreased. The usual sorting of soil particles in the erosion process would suggest that the finer particles would erode off the hillslope to a larger extent than the coarser particles; however, this was not the case on the Wymore soil. Also, if the base of the hillslope were a major area of deposition, sand would be expected to accumulate. Clay particles would be expected to move further downslope.

Clay particles could be transported and deposited at the base of the hillslope in aggregate form. Aggregates were more stable and had a greater mean weight diameter at the base of the hillslope than at the upper portion (Fig. 1 d,e). The majority of these aggregates were in the size range of 0.25 to 1 mm (Fig. 2). Approximately 50% of the air dried aggregates (greater than 4.76 mm) were silt and clay particles aggregated into sand sized particles.

The aggregates could have been transported from the upper to the lower portion of the hillslope or they may have been transported as individual particles or smaller aggregates, deposited and then formed in place.

Further evaluation of organic matter, iron oxide, and cesium content should help to more fully explain the relationship between soil erosion processes and these soil physical properties.

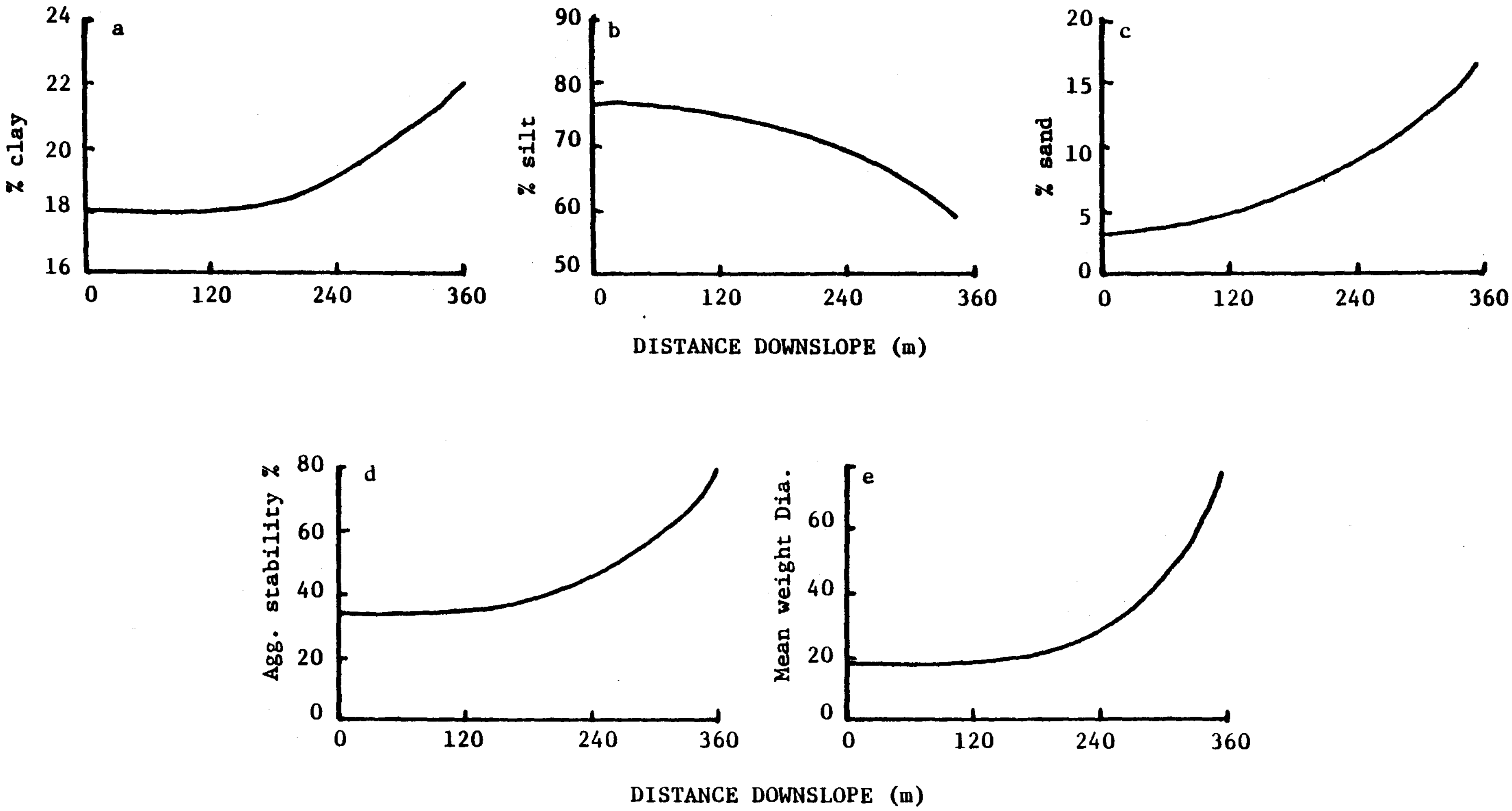


Figure 1. Particle size distribution, aggregate stability and mean weight diameter of aggregates for Wymore silty clay along a hillslope. Otoe Co. 1985.

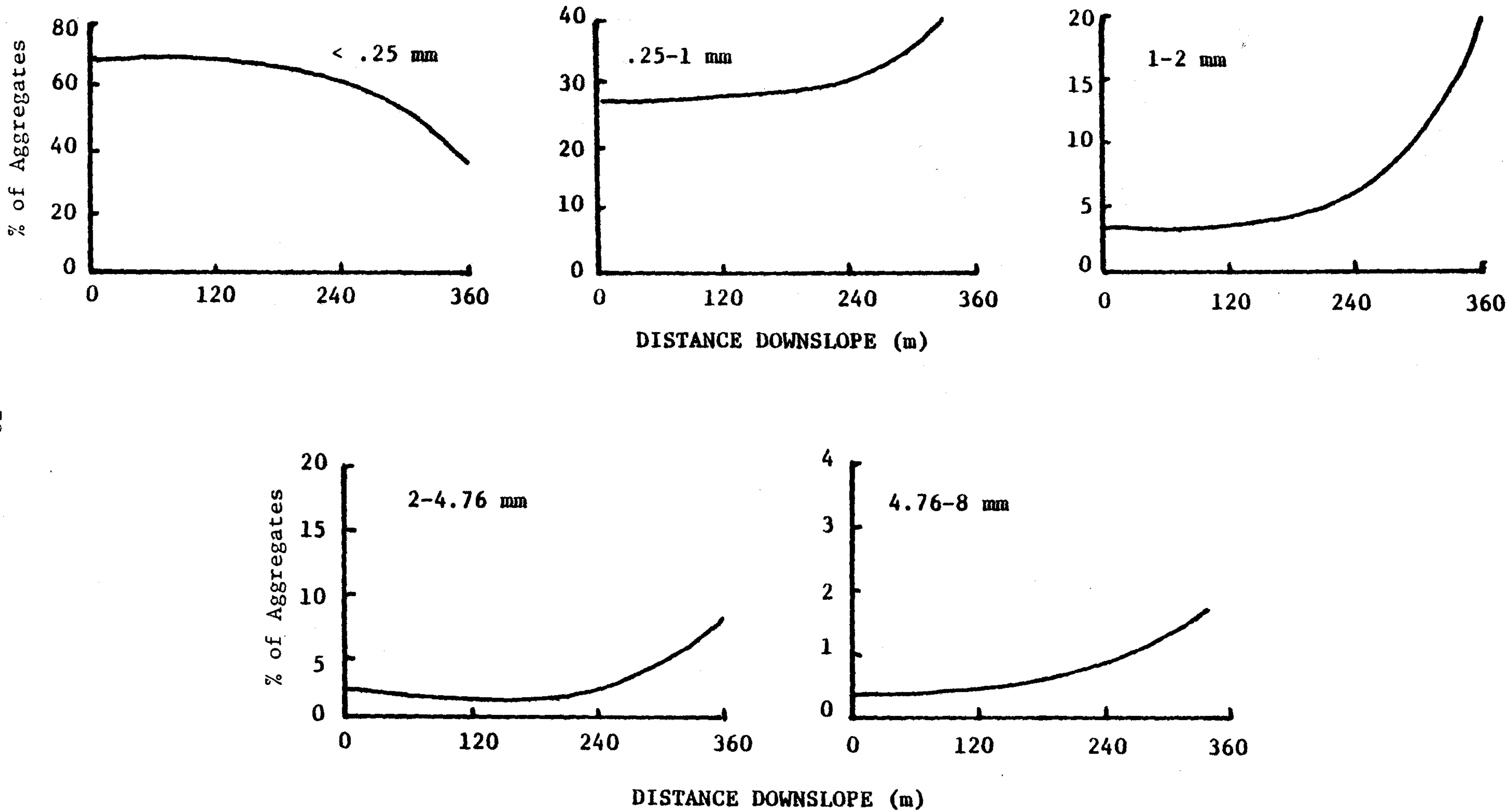


Figure 2. Distribution of aggregates by size class for Wymore silty clay along a hillslope. Otoe Co. 1985.

Soil Test Lab Comparison Results for 1985

G.W. Hergert, D.H. Sander, R.B. Ferguson, C.A. Shapiro,
F.N. Anderson, R.A. Olson and P.H. Grabouski

Objectives:

Properly correlated and calibrated soil testing is a valuable tool in making fertilizer recommendations. The overall objective of these experiments is to demonstrate this fact and to promote uniform fertilizer recommendations. Large differences among fertilizer recommendations from various labs for the same field and crop have been noted for years by farmers. This provided the impetus for the initiation of this study. The second objective of this study is to determine if University fertilizer recommendations are indeed adequate to produce optimum economic yields. The data presented in this report are given to show the effect of yield and fertilizer costs of fertilizer recommendations based on soil samples sent to various soil testing laboratories. A complete report and summary through 1984 is available as Agronomy Department Report No. 49.

Procedures:

Soil samples taken from the replicated treatment areas for each lab are sent to the soil testing laboratories annually. Samples are sent in usually under a local farmer's name. Fertilizer history is provided and a yield goal is requested to provide fertilizer recommendations. All of the fertilizer recommended by the laboratory is applied. In the fall grain yields are harvested to determine yields. Standard prices for various fertilizer nutrients averaged across the state during the spring of the year are used to calculate fertilizer cost at each location.

1985 Results:

Soil test lab comparison experiments were run at five locations during 1985. Tables 1-5 contain soil test results, fertilizer recommendations and costs, grain yields and grain moisture as well as long term yield averages and costs where appropriate. Soil test values between laboratories cannot be compared because different laboratories have recommended different amounts of fertilizer over time which will affect the soil test results. In general there is little question about the analytical capability of most of the laboratories. The chief objective is to compare how those results are interpreted.

The results from 1985 are consistent with the previous years of this study. Over the years larger quantities of fertilizers have been recommended by the private labs A to D than laboratory E. The "over years analysis" shows that fertilizer costs are reduced and yields maintained when using recommendations from laboratory E (UNL). This is a consistent conclusion over time and throughout the various locations in Nebraska. A complete over year analysis (Agronomy Department Report No. 49) shows however, that the experiment is having some influence. A comparison of the mean pounds of nitrogen, phosphorus, potassium and sulfur recommended for the years 1974 to 1976 and the period 1982 to 1984 shows that all recommendations have significantly decreased for the four commercial labs A to D.

Table 1. Soil test results, fertilizer recommendations, fertilizer costs, grain yields, and long term total grain yields for the WEST CENTRAL RESEARCH AND EXTENSION CENTER (North Platte) site on Cozad silt, 1% slope. 1985.

Measurement	Soil Test Results by Labs				
	A	B	C[1]	D[1]	E (UNL)
pH	6.4	6.8	6.4	5.4	6.3
pH (Buffer)	7.2	7.3	6.5	6.5	---
Phosphorus, ppm	39	37H	108	104	29
Potassium, ppm	498	470H	480	776	590
Organic Matter, %	1.9	1.6	2.0	1.5	1.9
Nitrate-N, ppm	144 (#/A)	12L	NIL	11.4	76 (#/A)
Calcium, ppm	1449	2400M	3600	2064	---
Magnesium, ppm	204	330H	280	364	---
Sulfate-S, ppm	9	12L	31	----	---
Zinc, ppm	2.8	2.6H	----	----	13
Iron, ppm	17.0	20H	5.2	----	---
Manganese, ppm	15.6	12.5M	17.1	----	---
Copper, ppm	0.6	0.9M	2.3	----	---
Boron, ppm	0.8	---	1.1	----	---
Chlorine, ppm	---	---	20	---	---
Sodium, ppm	20	40M	68	---	---
CEC, meq/100g	11.6	16.1	----	13.7	---
Nutrient	**Suggested Fertilizer Program for 170 bu/A (#/A)**				
Nitrogen	120	200	190	220	160
Phosphorus	30	30	20	---	---
Potassium	30	35	---	---	---
Magnesium	20	25	10	---	---
Sulfur	5	35	50	---	---
Zinc	---	---	5	---	---
Iron	---	---	---	---	---
Manganese	---	2	---	---	---
Copper	---	0.5	---	---	---
Boron	1	---	0.5	---	---
Lime T/A	---	---	0.75[2]	2.0[2]	---
	Fertilizer Costs, $/A				
1985	49	73	63	46	34
1974-1985 average	49	58	58	41	25
	Grain Yield, bu/A				
1985	187a[3]	190a	193a	193a	188a
1974-1985 average	170a	175a	170a	171a	171a
1985 % moisture	18.1a	17.7a	18.3a	18.0a	18.4a

[1]Uses lbs/A instead of ppm
[2]Not applied
[3]Yields followed by the same letter are not significantly different at the 5% level.

Table 2. Soil test results, fertilizer recommendations, fertilizer cost and grain yields for the site on a sandy loam soil. Merrick County. Moisture % not given. 1985.

Measurement	A	B	C	D	E(UNL)	F
	Soil Test Results by Labs[1]					
pH	7.0	6.4	6.8	6.7	6.5	6.7
pH (Buffer)	---	7.2	6.9	---	---	---
Phosphorus, ppm	24	42	23	1.8	16	16
Potassium, ppm	229	330	285	258	317	213
Organic Matter, %	2.7	1.8	1.9	2.9	2.4	2.1
Nitrate-N, ppm	26	32	33	62	23	24
Calcium, ppm	1500	2600	1920	1600	---	1775
Magnesium, ppm	186	190	132	211	---	186
Sulfate-S, ppm	4	15	1	6	3	6
Zinc, ppm	1.6	2.2	2.5	2.3	5.5	1.47
Iron, ppm	36.2	46	34.8	35	50	43.1
Manganese, ppm	13.5	18	13.6	13	17.1	18.2
Copper, ppm	0.8	0.9	0.6	0.7	0.76	0.76
Boron, ppm	0.5	---	0.4	0.8	1.26	---
Chlorine, ppm	---	---	---	---	---	---
Sodium, %	30	21	9	82	---	20
CEC, meq/100g	9.8	15.5	12.5	10.8	---	11
Nutrient	Suggested Fertilizer Program for 200 bu/A (#/A)[2]					
Nitrogen	260	255	260	230	200	235
Phosphorus	90	---	20	100	---	45
Potassium	30	95	---	20	---	---
Magnesium	20	45	---	---	---	---
Sulfur	25	35	---	---	---	14
Zinc	---	3	---	2	---	---
Iron	---	---	---	---	---	---
Manganese	---	---	---	---	---	---
Copper	---	---	---	---	---	---
Boron	---	---	---	---	---	---
Lime	---	---	---	---	---	---
	Fertilizer Costs, $/A					
1985	79	77	44	67	32	50
1982-1985 average	73	80	42	59	27	44
	Corn Grain, bu/A					
1985	208a[4]	207a	199a	214a	198a	207a
1983-1985 average[3]	177a	181a	184a	185a	183a	187a

[1]1984 results; plot not sampled in 1985.
[2]Based on 1984 results.
[3]Plots hailed out 1982.
[4]Yieldsfollowed by the same letter are not significantly different at the 5% level of probability. Irrigation water supplied about 140 lbs N per acre per season.

Table 3. Soil test results, fertilizer recommendations, fertilizer costs, grain yield and total grain yield for the Mead location, Sharpsburg silty clay loam, 3% slope; 1985.

Measurement	Soil Test Results by Labs				
	A	B	C	D	E(UNL)
pH	6.1	6.3	6.5	5.9	6.6
pH (Buffer)	6.8	7.1	---	6.7	---
Phosphorus, ppm	29	26M	102	27H	11L
Potassium, ppm	286	420H	320	396VH	302VH
Organic Matter, %	2.3	1.7	2.3	3.2M	2.4
Nitrate-N, ppm	5[2]	7L[2]	NIL[2]	2[3] (1,3)	71[4]
Calcium, ppm	1908	3400H	3200	1880M	---
Magnesium, ppm	290	560VH	570	339VH	---
Sulfate-S, ppm	7	12L	44	5L	---
Zinc, ppm	2.0	2.3M	1.02	2.7M	7.7H
Iron, ppm	32.5	37VA	11.5	45VH	---
Manganese, ppm	15.2	17H	20.7	26H	---
Copper, ppm	1.0	1.4H	2.4	1.4H	---
Boron, ppm	0.8	1.4M	1.6	1.3H	---
Chlorine, ppm	---	---	20	---	---
Sodium, %	38	85M	52	66L	---
CEC, meq/100g	15.9	23.1	---	16.3	---
Nutrient	**Suggested Fertilizer Program[2] for 170 bu/A (#/A)**				
Nitrogen	230	215	160	175	160
Phosphorus	75	55	--	55	40
Potassium	30	45	---	---	---
Magnesium	---	---	---	---	---
Sulfur	10	35	20	19	---
Zinc	---	2	---	2	---
Iron	---	---	---	---	---
Manganese	---	---	---	---	---
Copper	---	---	---	---	---
Boron	1	0.5	---	---	---
Lime	---	---	---	---	---
	Fertilizer Costs, $/A				
1985	63	59	28	46	34
1973-1985 average	62	60	64	50	32
	Grain Yield, bu/A				
1985	199	183	185	198	195
1973-1985 average	158a	153a	151a	154a	153a
Moisture %	22	21	21	22	21

[1]All ppm on elemental basis except where noted and Lab C which reported in lbs/A.
[2]0-6" sample
[3]0-6" and (6-48") sample
[4]Lbs/A to a depth of 6 feet

Table 4. Soil test results, fertilizer recommendations, fertilizer cost, and grain yield for 1985 and total fertilizer costs 1974-1985 for the NORTHEAST RESEARCH AND EXTENSION CENTER (Concord) dryland location. Moody-Nora silt loam, 5% slope, moisture % not given. 1985.

Measurement	Soil Test Results by Labs				
	A	B	C	D	E(UNL)
pH	6.0	6.1	5.6	6.2	6.3
pH (Buffer)	6.7	7.1	---	6.7	---
Phosphorus, ppm	28	15	56	24	25
Potassium, ppm	317	310	270	296	425
Organic Matter, %	3.1	1.9	3.2	3.7	2
Nitrate-N (0-8), ppm	2	4	NIL	9	3.5
Nitrate-N (8-24), ppm	---	---	---	6	1.7
Calcium, ppm	2530	3700	3500	2510	---
Magnesium, ppm	462	620	850	522	---
Sulfate-S, ppm	7	12	4	4	2
Zinc, ppm	1.3	1.5	1.4	1.5	6.1
Iron, ppm	45.6	36	13.2	54	---
Manganese, ppm	34.6	20	35.1	46	---
Copper, ppm	1.5	1.5	2.9	1.7	---
Boron, ppm	---	---	1.2	1.2	---
Chlorine, ppm	---	---	20	---	---
Sodium, %	37	30	23	---	---
CEC, meq/100g	---	24.6	---	---	---
Nutrient	Suggested Fertilizer Program[1] for 90 bu/A (#/A)				
Nitrogen	100	110	60	85	110
Phosphorus	40	55	---	30	---
Potassium	30	20	---	---	---
Magnesium	---	---	---	---	---
Sulfur	5	20	20	10	---
Zinc	---	2	---	2	---
Iron	---	---	---	---	---
Manganese	---	---	---	---	---
Copper	---	---	---	---	---
Boron	---	---	---	---	---
Lime (T/A)	1.5	---	2.75	1.35	---
	Fertilizer Costs, $/A				
1985	30	41	13	24	17
1974-1985 average	25	25	25	26	13
	Grain Yield, bu/A				
1985	104a	103a	97a	101a	110a[2]
1974-1985 average[1]	95a	94a	95a	93a	96a

[1]Drought in 1974 and 1976 produced no or very low yields.

[2]Yields followed by same letters are not significantly different at the 5% level.

Table 5. Soil tests results, fertilizer recommendations, fertilizer costs, grain yield and total fertilizer costs for 1981 - 1985. Irrigated corn PANHANDLE RESEARCH AND EXTENSION CENTER. 1985.

Measurement	Soil Test Results by Labs				
	A	B	C	D[1]	E(UNL)
pH	7.4	7.7	7.8	7.0	7.6
pH (Buffer)	---	---	---	---	---
Phosphorus, ppm	13	20	36	131	16
Potassium, ppm	307	300	358	330	338
Organic Matter, %	1.2	0.8	0.8	1.0	1.1
Nitrate-N, ppm	9	4	16	30	7.2
Calcium, ppm	1435	2700	1420	2570	---
Magnesium, ppm	308	420	313	570	---
Sulfate-S, ppm	11	14	6	36	---
Zinc, ppm	6.2	4.3	4.5	0.28	3.2
Iron, ppm	7.5	14	8	6.1	---
Manganese, ppm	5.4	7.9	12	9.4	---
Copper, ppm	0.9	2.5	1.4	2.2	---
Boron, ppm	0.5	---	0.9	1.3	---
Chlorine, ppm	---	---	---	20	---
Sodium, ppm	2.1%	100	114	165	---
CEC, meq/100g	10.8	18.2	11.1	---	---
Nutrient	**Suggested Fertilizer Program for 170 bu/A (#/A)**				
Nitrogen	210	180	210	180	170
Phosphorus	75	80	20	---	---
Potassium	15	65	---	60	---
Magnesium	---	---	---	---	---
Sulfur	5	15	16	40	---
Zinc	---	---	---	8	---
Iron	4	---	2	---	---
Manganese	---	3	---	---	---
Copper	---	2.5	---	---	---
Boron	1.25	---	---	0.5	---
Lime	---	---	---	---	---
	Fertilizer Costs, $/A				
1985	57	68	35	67	26
1981-1985 average	59	72	63	65	30
	Grain Yield, bu/A				
1985	125	120	118	124	123
1981-1985 average	138	138	136	135	139

[1]In lbs/A.