Soil Science Research Report - 1984

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DEPARTMENT OF AGRONOMY
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SOIL SCIENCE RESEARCH REPORT - 1984

Department of Agronomy
University of Nebraska-Lincoln
Lincoln, Nebraska

FACULTY

Personnel located at Department of Agronomy; University of Nebraska; Keim Hall; East Campus; Lincoln, Nebraska 68583.

Leon Chesnin, Waste Management
John W. Doran, USDA-SEA - Soil Microbiology
James Ellis, USDA-SEA - Soil Microbiology
Michael D. Jawson, Soil Microbiology
Delno Knudsen, Soil Fertility
David T. Lewis, Soil Classification
Dennis McCallister, Soil Chemistry
Lloyd N. Mielke, USDA-SEA - Soil Physics
Robert A. Olson, Soil Fertility
James Power, USDA-SEA - Soil Fertility
Donald H. Sander, Soil Fertility
James S. Schepers, USDA-SEA - Soil Chemistry
Joseph Skopp, Soil Physics
Robert C. Sorensen, Soil Chemistry
Dale Swartzendruber, Soil Physics
Daniel T. Walters, Soil Management
Richard A. Wiese, Soil Fertility

Personnel located at Panhandle R & E Center; 4502 Avenue I; Scottsbluff, Nebraska 69361:

Frank A. Anderson, Soil Fertility
John L. Havlin, Soil and Crop Management

Personnel located at West Central R & E Center; Box #46A; North Platte, Nebraska 69101:

Phillip Grabouski, Agronomist
Gary W. Hergert, Soil Fertility

Personnel located at South Central R & E Center; Box 66; Clay Center, Nebraska 68933

Richard Ferguson, Soil Fertility

Personnel located at Northeast R & E Center; Concord, Nebraska 68728:

Charles Shapiro, Soil Fertility

Personnel located at Southeast Extension Headquarters; Mussehl Hall; East Campus; Lincoln, Nebraska 68583.

Edwin J. Penas, Soil Fertility

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Other Experiments

Effect of Irrigation on salt and sodium content of salt affected soils in Central Nebraska

David T. Lewis and K. Z. Al-Janabi

We selected a map unit of Halaquepts in Merrick County. The map unit had 3 cultivation practices associated with it. One was a pasture that did not appear to ever have been cultivated. A second was in cropland that had been furrow-irrigated for at least 7 years. The third was a pasture recently broken from sod and put under furrow irrigation. It had been irrigated for 2 seasons. The intent was to determine whether or not irrigation was causing an increase in the salt content of these soils as it appeared to be doing. The irrigated field had salt crusts on its surface much of the year, and the farmer was certain that this was caused by the irrigation he was using.

A summary of the results obtained is in Table 1. There did not appear to be any tendency for irrigation to increase salts, in spite of the salt crust on the surface of the irrigated fields. Percent salt in the upper 2 cm of this field was between 0.8 and 0.9 percent. In spite of this, percent salt, SAR, and exchangeable sodium appeared to be less in the irrigated fields than in the pasture. However, these differences were significant (5%) in only a few instances.

Water quality analysis at the study site is in Table 2. The irrigation water was much the same in ion content as the Platte River water. This is not surprising since the site was about a mile from the River, and the water was being pumped from gravel at a depth of about 12 feet. One factor worthy of note is the SAR of the water beneath the irrigated field. It is much higher than ground water from beneath the pasture. Perhaps sodium is being leeched from those soils.

In summary, the data point to salinity reduction by irrigation, rather than the reverse. The irrigation appears to mainly redistribute the salts, cuasing them to concentrate during drying periods in the upper few cm of the irrigated soil.

Table 1. Percent soluble salts (Pss) Sodium adsorption ratio (SAR) and percent exchangeable sodium (ESP) for pedons in 3 land uses at 3 times of sampling.

	Pss			SAR			ESP		
	May	Nov.	June	May	Nov.	June	May	Nov.	June
					A Horizon				
Pasture	.12a	.11a	.07a	27.5a	21.0a	20.2a	33.6a	32.2a	28.3a
Irrigated	.07a	.08a	.07a	19.6a	17.6a	17.4a	28.3a	30.5a	24.1ab
Newly Irrigated	.04a	.07a	.07a	17.4a	15.6a	13.8a	25.0a	24.3a	21.1b
					B Horizon				
Pasture	.28a	.25a	.21a	47.2a	34.9a	33.5a	47.8a	45.6a	39.8a
Irrigated	.16b	.13b	.15a	39.6a	26.4b	26.9ab	45.8a	41.4a	33.9ab
Newly Irrigated	.17b	.12b	.14a	38.4a	25.5b	24.4b	40.3a	37.6a	31.4b

All values are an average of 20 observations.

The letters a and b designate grouping of means according to Duncans multiple range test.

Table 2. Water quality analysis.

Sample Taken	Ca	Ng	Na	K	CO_3	HCO_3	SO_4	Cl	pH	EC	SAR
	mg/l									in mohs/cm	
Platte River Water											
Sept.	3.2	1.8	3.7	0.4	0.2	3.7	4.0	0.9	8.5	0.9	2.3
June	3.8	2.0	3.6	0.4	0.5	3.7	4.4	1.1	8.7	0.9	2.1
Ground Water (Pasture)											
Sept.	4.7	1.8	3.1	0.3	0.1	6.3	1.8	0.5	8.6	0.9	1.7
June	2.8	1.6	3.6	0.2	0.4	4.3	1.8	0.4	8.6	0.8	2.5
Ground Water (Irrigated Field)											
Sept.	1.7	1.1	7.2	0.4	0.5	7.5	2.4	0.6	8.6	1.0	6.2
June	1.0	0.6	6.8	0.2	0.3	6.3	2.2	0.5	8.6	0.8	7.6
Irrigation Water											
August	1.8	2.0	3.2	0.3	0.2	3.2	3.1	0.6	8.6	0.7	2.3

PHYSICS OF WATER IN SOILS AND POROUS MEDIA

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:

An inclusive equation for water infiltration into soil has now been comprehensively compared with eleven different infiltration equations proposed in the literature. Using only three parameters in the inclusive equation, all eleven of the other equations can be expressed within $\pm$ 0.3% over the complete time range of infiltration. This means that only the inclusive equation need be fitted to experimental data, with each of the eleven equations being represented by a different set of three parameters in the inclusive equation. Experimental field infiltration data, for eight different cropping sequences of soybean, corn, and sorghum, were very successfully fitted by the inclusive equation, with statistical analyses indicating that the infiltration status of field soils can be characterized by the parameters of the inclusive equation.

For the inclusive equation, originally conceived as empirical, an undergirding new mathematical form has also been found. This new form has now been very closely linked to an existing general and exact mathematical solution of the infiltration process. Water content profiles predicted by the new form have been found to be in excellent numerical agreement with the existing exact solution. Hence, the theoretical and physical foundation of the inclusive infiltration equation is now firmly established.

In experiments on water entry into a highly swelling equal-part mixture of Wyoming bentonite and quartz silt, the upward-swelling bentonite-silt surface became rounded rather than moving upward uniformly. Imposition of loading stress, upon the water applicator in contact with the upward-swelling bentonite-silt surface, seems to have corrected the problem. Different loading stresses will be imposed in a series of infiltration experiments, to find the smallest effective loading and to assess the effect of loading on the process of water infiltration into upward-swelling porous media.

TITLE: Objective Indices of Water Regimes for Comparison Purposes.

AUTHOR: Joe Skopp

OBJECTIVE:

Comparison of field experiments at different sites or in different years are confounded by a number of effects. One of these effects is differences in soil moisture regimes. This work was undertaken to provide quantitative indices which provide a means of fair comparison.

PROCEDURE:

Seasonal moisture content data is interpreted as a frequency distribution. Alternative ways of characterizing distributions provide the basis for defining indices. Moment analysis provides the simplest technique for transforming the distribution into orthogonal statistics which can be used in analysis of variance.

RESULTS:

Table 1 shows the application of these techniques to data collected by Dr. W. Wilhelm, USDA. Four different tillage treatments were monitored for moisture content. The moment analysis is presented only for the topmost soil horizon that was observed. The data should be interpreted as an illustration of the technique since the error is due not to variability so much as to insufficient number of observation points.

TABLE 1

Indices of Moisture Regime Applied
To Alternate Tillage Systems

Tillage System	First Moment	Second Moment
Plow	.217 ± .028	$.47 \pm .11 \times 10^{-2}$
Disk	.235 ± .011	$.50 \pm .12 \times 10^{-2}$
Chisel	.250 ± .009	$.38 \pm .05 \times 10^{-2}$
No Till	.239 ± .018	$.47 \pm .09 \times 10^{-2}$

Note: First moment indicates average water content. Second moment moment indicates variation in water content.

Title: Effects of Oscillations in Water Levels on Nutrient Uptake.

Researchers: David Kargbo, Joesph Skopp, and Delno Knudsen

Objective:

To evaluate the role of different transport mechanisms on nutrient uptake by corn. The degree of mixing is the variable of concern which is controlled by watering frequency and relative humidity. The hypothesis is that greater mixing of soil solution will result in greater nutrient uptake. Hence, uptake is limited by processes other than mass flow or diffusion.

Procedure:

Corn (Zea mays L.) was grown in a growth chamber for fourteen days at 35% relative humidity (RH) or at 55% RH. Three soils were watered to field capacity and allowed to dry to a minimum water content which varied with the treatment and soil. Phosphorus and potassium uptake at sampling time was determined. Diffusion coefficients were also determined so that the influence of diffusion relative to mass flow could be evaluated.

Experimental Results:

The data are summarized in Table 1. Differences in P and K uptake at different levels of minimum water content were nonsignificant at 55% RH. Differences in diffusion coefficients were observed implying that diffusion is not limiting at 55% RH. At 35% RH significant effects were observed of different minimum water contents on P and K uptake in the sandy soils and of P uptake in the silt loam. This effect cannot be attributed to diffusion directly to the root, but must be due to indirect transport mechanisms. This means that mixing between the bulk soil solution and the transpiration stream is a major factor limiting ultimate nutrient uptake when high transpiration conditions occur. This suggests that higher frequency irrigations are more effective at moving nutrient to the plant.

Yield, Water Use, and Nutrient Uptake of Corn Hybrids Under Varied Irrigation and Nitrogen Regimes

M. B. Halitligil, R. A. Olson and W. A. Compton

Objective: To determine the impacts of varied water and N regimes on (a) yields and water use by six irrigated corn hybrids and (b) nutrient uptake by those hybrids.

Procedure: Two field experiments were conducted on each of Sharpsburg sicl (Mead Field Lab) and Zook sicl (Agronomy Farm) in two separate years. One was an irrigation and N rate experiment and the other an irrigation timing experiment. Hail eliminated the crop in one year on the Agronomy Farm such that results exist for two trials of the first experiment and three of the latter. Four inch diameter cores of soil were collected to a depth of four feet by one-foot increments for the high and low irrigation rates of the Mead site for investigating root development of three hybrids under field conditions. Soil was carefully washed from the roots which were then dried, weighed and recorded as dry weight/cm^3 of soil.

The six corn hybrids were planted in 30" rows in basins of 10 ft x 17 ft with irrigation measured on through water meters. Soil moisture measurements were made biweekly by neutron probe to a 5-1/2 ft depth. Water timing and rates and N rates employed are expressed in the data tables.

Experimental Results: Average results for the two irrigation and N rate experiments are given in Table 1. Highest grain, stover and total yields were generally obtained by the B73 x Mo 17 hybrid. No significant effects of irrigation rate treatments were found, although a general trend of decreasing yield from high to lower irrigation rates was evident. Average growing season rainfall for the two sites was 15" and being fairly well distributed there was limited need for supplemental water.

Increasing N rate significantly increased both grain and stover yields, but there was no hybrid x N rate interaction indicating hybrid responses to N were similar. Soil moisture extraction patterns of three hybrids for which detailed moisture measurements were made were similar. Yields and ET decreased somewhat from the high to low irrigation rates but WUE increased. The decrease in ET was much greater than the decrease in total yield resulting in the distinctly higher WUE with the low irrigation rate.

The root weights expressed in Table 1 reveal an added development of roots with the heavy over light irrigation routine for all hybrids. Most important, however, is the distinctly greater mass of roots under B 73 x Mo 17 than under the other hybrids. Not only were there more roots in total as expressed here but more were found in each increment of depth sampled through 4 feet. These data suggest that root development may be one of the major factors accounting for the observed yield preeminence of this hybrid.

Highest grain, stover and total yields were obtained by B 73 x Mo 17 and N 714 in the irrigation timing experiment (Table 2). There was also a benefit to all yield components for the light, frequent irrigation system. Thus, the same total amount of water applied in four 1-1/2" increments instead of one 6" or two 3" increments resulted in an average grain yield increase across all hybrids of 13 bu/a. Soil moisture depletion was greater under the two high irrigation rates than the light frequent which combined with higher yields from the latter gave a distinctly higher WUE for the light frequent mode. There being both greater crop N uptake and more soil residual NO_3-N with the lighter rate makes apparent the interdependence of irrigation water and N management, denitrification presumably accounting for the reduced N efficiency with higher irrigation rates.

Nitrogen uptake of the various hybrids was fairly well controlled by yield. Other nutrients, too, were increased in total uptake as larger yields were obtained but with some important discrepancies among hybrids (Table 3). The B 73 x Mo 17 absorbed total N, K, and Mg in larger amounts than other hybrids in approximate proportion to its greater yield, but it contained disproportionately more of Ca, P, S, Fe, Cu, and Zn and less of Cl and Mn, nutrients that can be depressive to yield when absorbed excessively. The second portion of Table 3 shows that with higher levels of N fertilization the uptake of every element studied was increased, usually more than yield was increased, giving evidence that N rates above that for most economic yield will deplete soil reserves of other nutrients more rapidly than necessary. The third part of this table likewise reveals greatly increased uptake of Fe and Mn from the higher irrigation level quite out of proportion to the yield increase.

Table 1. Average grain, stover, and total DM yields, root mass, evapotranspiration (ET) and water-use efficiency (WUE), of field grown corn hybrids as influenced by irrigation rate and N fertilization.[a]

Hybrid and Measurement	Irrigation and Fertilizer Treatment[b]					
	W_1		W_2		W_3	
	N_1	N_2	N_1	N_2	N_1	N_2
Grain yield, bu/a						
B 73 x Mo 17	259a[e]	281a	257a	252a	244a	252a
N 28 x Mo 17	219b	232bc	226b	206b	213b	228b
N 611	233ab	241b	219b	226b	204b	213b
N 714	219b	248b	228b	254a	212b	219b
Pioneer 3388	208b	221c	202c	212b	201b	213b
Pioneer 3386	217b	232bc	202c	223b	193b	217b
Stover DM yield, t/a						
B 73 x Mo 17	3.56a	4.18a	3.87a	3.87a	3.26a	3.61a
N 28 x Mo 17	3.17a	3.48ab	3.26ab	3.48ab	2.77b	2.99ab
N 611	2.99a	3.04b	2.86b	2.90b	2.86ab	3.17ab
N 714	3.43a	3.96a	3.70a	4.18a	3.08a	3.34a
Pioneer 3388	2.99a	3.17b	2.73b	3.08b	2.90ab	2.99ab
Pioneer 3386	2.82a	3.12b	2.90b	2.99b	2.64b	2.73b
Total DM yield, t/a						
B 73 x Mo 17	9.81a	10.96a	10.08a	9.94a	9.15a	9.68a
N 28 x Mo 17	8.45b	9.06b	8.71ab	8.45b	7.92b	8.49b
N 611	8.62b	8.84b	8.14b	8.36b	7.79b	8.32b
N 714	8.71b	9.94b	9.20ab	10.30a	8.18b	8.67b
Pioneer 3388	8.01b	8.49b	7.61b	8.18b	7.74b	8.14b
Pioneer 3386	8.05b	8.71b	7.79b	8.36b	7.30c	7.96b
Root mass[c],	——— g DM/cm³ x 10³					
B 73 x Mo 17		11.5a				9.4a
N 611		8.8b				6.9b
Pioneer 3388		7.6b				7.5b
Et[d], inches						
B 73 x Mo 17		22.2		19.3		17.0
N 611		22.0		19.1		16.5
Pioneer 3388		22.3		19.1		17.0
WUE[d],	——— lbs dry grain/inch					
B 73 x Mo 17		610		629		714
N 611		528		571		624
Pioneer 3388		477		535		606

a Average of two field experiments conducted at Havelock and Mead (each no. is average of eight observations).

b W_1=9 inches irrigation water, W_2=6 inches, W_3=3 inches; N_1=90 lb N/a, N_2=180 lb N/a.

c Each no. is average of four observations from the W_1 and W_3 high N treatments at Mead to four foot depth.

d Each no. is average of eight observations obtained from the W_1, W_2, and W_3 high N treatments of Havelock and Mead sites; WUE calculated from dry grain yield.

e Averages followed by same letter within a column not significantly different at 5% level.

Table 2. Average grain, stover and total DM yields, evapotranspiration (ET and water use efficiency (WUE) of field grown corn hybrids as influenced by irrigation timing.[a]

Hybrid and Measurement	Irrigation Timing[b]		
	T_1 (one application)	T_2 (two applications)	T_3 (four applications)
Grain yield, bu/a			
B 73 x Mo 17	230a[c]	244a	248a
N 28 x Mo 17	217b	208b	221b
N 611	221a	226a	233a
N 714	215b	239a	250a
Pioneer 3388	192c	192b	210b
Pioneer 3386	208b	212b	228a
Stover DM yield, t/a			
B 73 x Mo 17	4.00a	3.78ab	3.87ab
N 28 x Mo 17	3.08b	3.48b	3.30b
N 611	3.17b	3.21b	3.43b
N 714	4.53a	4.44a	4.66a
Pioneer 3388	3.12b	2.95b	3.21b
Pioneer 3386	3.39b	3.34b	3.52b
Total DM yield, t/a			
B 73 x Mo 17	9.55a	9.68a	9.86ab
N 28 x Mo 17	8.32b	8.49ab	8.62b
N 611	8.49ab	8.67ab	9.06ab
N 714	9.72a	10.21a	10.69a
Pioneer 3388	7.74b	7.57b	8.27b
Pioneer 3386	8.40ab	8.45ab	9.02ab
ET, inches			
B 73 x Mo 17	22.6	22.3	21.9
N 611	22.8	22.2	21.5
Pioneer 3388	23.0	22.2	21.8
WUE, lbs dry grain/inch			
B 73 x Mo 17	491	529	547
N 611	467	492	524
Pioneer 3388	402	416	464

[a] Average of three field experiments conducted at Mead and Havelock (90 lb N/a applied to all plots as a summer sidedressing; each no. is average of 12 observations).

[b] Timing of irrigation occurred at ridging (one application), ridging and tasseling (two applications), and ridging + tasseling + midsilk + grain fill (four applications), each to a total of 6 inches applied.

[c] Averages followed by the same letter within a column not significantly different at the 5% level.

Table 3. Influence of hybrid, N rate and irrigation level on total uptake of several essential plant nutrients.

Hybrid and Measurement	Ca	K	Mg	P	Cl	S	Mn	Fe	Cu	Zn	Yield increase, %
Nutrient uptake, lb/a											
B 73 x Mo 17	49a[b]	328a	38a	40a	23b	21a	.38b	1.67a	.08a	.26a	
N 611	40b	275b	33b	33b	25ab	20a	.38b	1.27b	.05b	.23b	
Pioneer 3388	38b	278b	31c	28c	26a	15b	.44a	1.33b	.06b	.21b	
Increased nutrient uptake, high over low N rate, %											
Mead site	10	8	11	23	23	12	27	57	42	11	6
Havelock site	18	6	29	9	33	3	30	17	75	1	9
Increased nutrient uptake, high over low irrigation rate, %											
Mead site	1	11	11	8	14	10	36	62	8	15	13
Havelock site	0	12	-2	0	10	19	22	56	8	16	5

[a] Average of two irrigation rate experiments of high N fertilization rate conducted at Mead and Havelock (each no. is average of 16 observations).

[b] Values followed by same letter within a column not significantly different at 5% level.

EFFECT OF SPRINKLER IRRIGATION TIMING AND AMOUNT ON YIELD OF DIFFERENT WINTER WHEAT VARIETIES

Gary W. Hergert, Phil H. Grabouski, and Don Sander

Objective: 1. Evaluate the yield potential of three winter wheat varieties under a line source (gradient) irrigation system.
2. Determine the effect of different N timings on wheat production under an irrigation gradient.

There is increased interest in growing wheat under center pivot irrigation on sandy soils. In addition to the high pumping costs inherent in corn production, many areas have either declining water tables or have low volume wells. Winter wheat is a very water efficient crop. Its primary growth and reproductive stages occur early in the year when air temperatures and evaporation are low; therefore, winter wheat requires far less irrigation than summer grown row crops. Since wheat has typically been a dryland crop in Nebraska, little information is available on optimizing irrigation water application rates and timing. Adding to farmer interest are several new short-strawed high yield potential varieties that need to be evaluated under irrigation. Nitrogen management for irrigated winter wheat also has not been studied sufficiently in Nebraska.

This study was conducted at the UNL Sandhills Ag Lab for three years on a Valentine sand. A line source sprinkler system was used. This allowed a soil water gradient ranging from dryland to fully irrigated conditions across a 60-foot plot. Since irrigation levels are not randomized, no direct statistical comparisons can be made for irrigation levels.

The experimental design was a split plot-factional, replicated five times. Three nitrogen rates (40, 80, 120 lb N/A) were combined factionally with two N timings. The N timings were: 1) 1/3 N preplant in the fall with the remaining 2/3 applied near mid-April when wheat came out of dormancy and 2) 1/3 N preplant, 1/3 in April, and 1/3 at boot. The three equal applications were intended to simulate an N application that might be used through a pivot. Ammonium nitrate was hand spread at the different times. The 3 x 2 N x time plots were split and planted to three varieties - Brule, Centurk 78, and Vona. Data were taken for grain and straw yield and N content.

Results: Irrigations for 1982, 1983, and 1984 were 3.0. 3.5, and 2.0 inches in two or three applications. Irrigation had no effect on grain yields in 1982 and 1983. In 1984, the dryland side produced an average of 56.6 bu/A, medium irrigation 60.1, and fully irrigated 63.6 bu. The irrigation effect was probably significant in 1984 as this was the only year out of the three where a gradient in plant height was noted.

The effects of N rate, N timing, varieties, and all interactions were consistent across all irrigation levels. Data presented will be for the fully irrigated side (Tables 1 and 2). In the falls of 1981 and 1983, wheat was planted into short oat stubble. The 1983 crop (planted fall 1982) was planted directly into the 1982 plots. A severe hail in October thinned the stand and caused poor tillering. Top wheat yields in 1983 were around 36 bu/A.

Table 1. AOV source effects for irrigated wheat, grain yield, and grain %N at SAL.

Grain Yield			
Source	1982	1983	1984
	- - - - PR > F - - -		
N Rate (R)	.02	.01	.02
N Split (S)	.26	.45	.16
R*S	.31	.05	.35
Variety (V)	.12	.81	.23
RxV	.29	.13	.33
SxV	.22	.39	.24
R*S*V	.12	.89	.80

Grain % N			
Source	1982	1983	1984
	- - - - PR > F - - -		
N Rate (R)	.01	.01	.01
N Split (S)	.01	.01	.01
R*S	.33	.14	.16
Variety (V)	.01	.04	.39
RxV	.39	.67	.63
SxV	.33	.97	.34
R*S*V	.90	.37	.12

Table 2. Treatment means for irrigated wheat yields and grain % N at SAL.

N Rate	N Split	1982	1983	1984
		- - - -	bu/A	- - - -
40	2	60	32	61
40	3	55	27	56
80	2	69	35	72
80	3	63	34	63
120	2	64	35	68
120	3	66	37	69
Brule		61	33	65
Centurk 78		64	33	66
Vona		63	32	63

N Rate	N Split	1982	1983	1984
		- - - - -	%	- - - - -
40	2	2.19	2.28	1.69
40	3	2.39	2.21	1.82
80	2	2.41	2.36	1.89
80	3	2.89	2.49	2.18
120	2	2.67	2.62	2.08
120	3	2.86	2.63	2.49
Brule		2.70	2.42	2.01
Centurk 78		2.58	2.48	2.05
Vona		2.42	2.40	2.00

N rate and N split were the main factors affecting grain yield. The three varieties produced similar yields (Table 2). Variety differences were noted for grain %N content, however. The effects of N rate and N split on yield showed that 80 lbs N put on in two applications maximized yields in 1982 and 1984 (Fig. 1). The delay of N using the three applications was not as effective. In both N responsive years (1982 and 1984), the 120 lb N rate applied 1/3 fall and 2/3 April depressed yields compared to the 80 lb rate. The 1/3 fall - 2/3 April application appears to be a better timing even on a sandy soil than the three-way split.

Grain protein was higher for the three-way split than the two-way (Fig. 2), except in 1983 when yields were depressed due to hail the previous fall. This supports other work which indicates later N applications may favor direct translation to the grain.

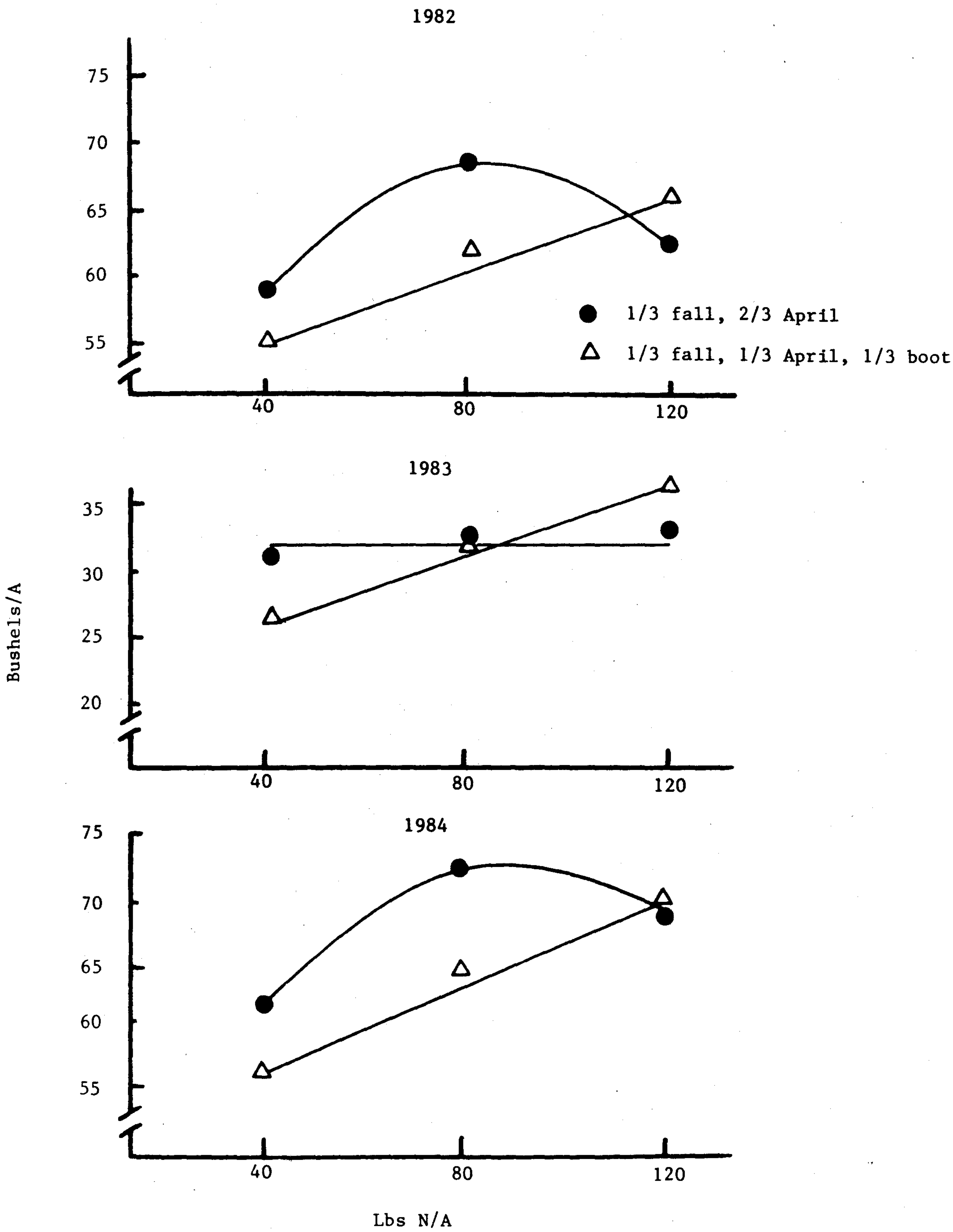


Figure 1. Effect of N rate and timing on grain field of irrigated wheat on a Valentine Sand.

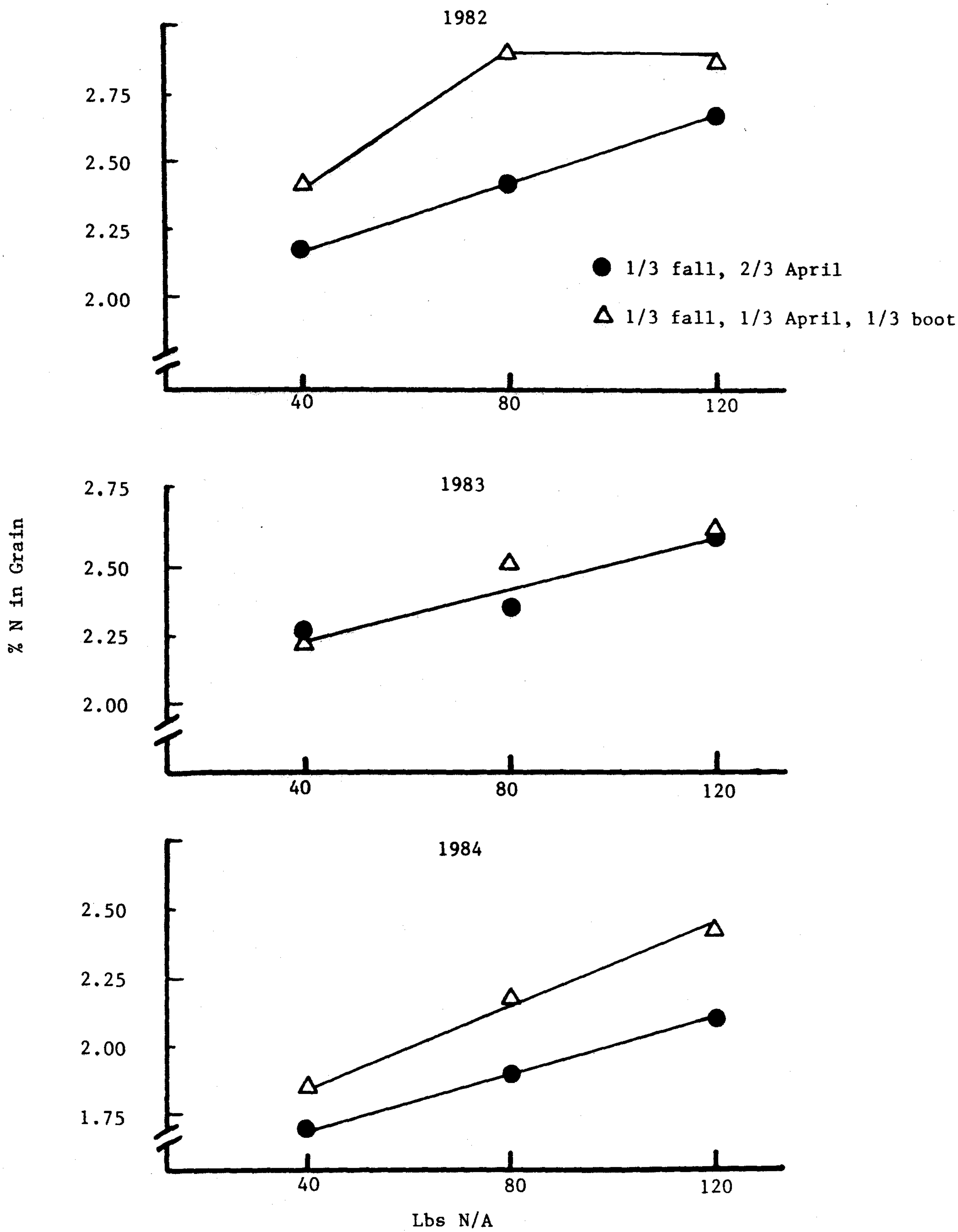


Figure 2. Effect of N rate and timing on grain % N in irrigated wheat grain on a Valentine Sand.

Response of Irrigated Corn Yields to Nitrogen Sources Applied with a Urease Inhibitor

W. R. Raun, D. H. Sander, R. A. Olson, and E. T. Clark

Objective: To evaluate the effect of one urease inhibitor at three rates, two methods of application and two sources of urea on the yield of irrigated corn.

Procedure: The experimental site for the study was at the Mead Field Lab on Sharpsburg sicl with soil properties as detailed in Table 1. A completely randomized design was used for the 14 treatments which included three replications. An adapted Buffalo All-Flex till planter was used for planting. The anhydrous ammonia sidedress treatment was injected at a depth of six inches. The UAN had an analysis of 32-0-0 with a weight of 10.97 lbs/gal.

An extremely wet spring delayed the application of all treatments. Constant monitoring of weather forecasting was made in an attempt to apply the treatments within a 5-day dry period. However, the evening following treatment applications, .57 inches of rain was received.

Earlier plans were made to both plant and apply the treatments on June 1. Therefore the urease inhibitor provided was mixed with the UAN the previous evening. Due to further changes in the weather forecast, treatment applications were delayed. In order to obtain any kind of reliable yield data, it was then decided to plant the entire study in hopes of obtaining a suitable time to sidedress all treatments. Within the month of June and the first two weeks of July, 20-30% chances of rain were forecast daily. The time for application was then made simply out of necessity (Table 2).

In the thirty-five days that the urease inhibitor remained mixed with the UAN, considerable changes took place for both the low and high rates of inhibitor-UAN mixture. Both solutions were extremely dark at the time of application. Both solutions were also characterized by a strong sulfur smell (possible reaction with the ammonium thiosulfate present in our UAN source). Samples of both solutions have been stored and pictures of the solutions at the time of application were taken.

Results and Discussion: No yield response could be attributed to the urease inhibitor employed from either rate or method. Broadcast methods of application provided superior yields to dribble surface band, but methods did not respond the same over the rate of inhibitor as is noted in Table 3. Sources analyzed over methods and inhibitor rates demonstrated slightly higher yields for urea over UAN (Table 4). Rates of inhibitor did not respond consistently over the two sources used.

Table 1. Soil test levels, cultural practices and site description, 1984.

Soil:	Sharpsburg silty clay loam, Mead Field Lab				
Plot Management:	May 14 Disked previous years corn stubble May 30 Application of 1 pt Roundup/ac June 6 Applied 2 qts Atrazine/ac 2 qts Lasso/ac 1 qt 2-4,D/ac				
Planting:	June 6 Pioneer 3377 F14 med-flat 28,000 seeds/ac 13 oz Counter/1000 linear ft				
Treatment Data:	May 31 Mixed urease inhibitor with UAN source (32-0-0) July 5 Applied all treatments (6.7% moisture in surface 1 cm of soil)				
Surface Soil pH:	6.0				
Soil Test Data:		N ppm	NH_4-N ppm	P ppm	K ppm
	0-1'	3.3	6.4	12.0	301
	1-2'	2.8	4.3	4.9	216
	2-3'	2.0	4.1	9.9	186
	3-4'	1.8	3.5	12.3	205
	4-5'	2.5	3.0	12.3	189
	5-6'	2.5	4.4	17.0	192
Surface Residue:	approximately 50% coverage = 1514 lbs surface residue/ac				

Inhibitor N-(n-butyl) thiophosphoric triamide
[n-$C_4H_9NHP(S)(NH_2)_2$]

Table 2. Temperature, precipitation and soil moisture data prior to and following treatment applications, 1984.

Date	Lo Temperature	Hi Temperature	Precipitation	Surface Soil Moisture
	°F	°F	in.	%
July 3	66	92	.54	
July 4	64	92	--	
July 5	58	86	--	6.7
July 6	57	84	.57	30.9
July 7	49	77	--	
July 8	53	102	--	7.0
July 9	72	101	--	
July 10	73	90	--	
July 11	58	87	--	5.2
July 12	59	89	--	
July 13	57	96	--	
July 14	66	95	--	
July 15	60	95	--	
July 16	56	91	--	
July 17	58	90	--	
July 18	53	87	--	
July 19	61	95	--	
July 20	69	94	--	
July 21	70	95	--	

Table 3. Urease inhibitor study on irrigated corn, 1984.

Treatment			Corn Yields		
N carrier		Inhibitor	Grain		Stover
		lb/ac	bu/ac	kg/ha	lb/ac
1.	Urea Broadcast	0.00	111.9	7020.9	2323.4
2.	Urea Broadcast	0.38	103.4	6485.9	1829.5
3.	Urea Broadcast	1.52	120.8	7574.3	2352.2
4.	Urea DSB	0.00	101.3	6352.2	2265.1
5.	Urea DSB	0.38	109.1	6843.8	2061.7
6.	Urea DSB	1.52	106.9	6706.5	2236.0
7.	UAN Broadcast	0.00	112.9	7079.4	2032.8
8.	UAN Broadcast	0.38	108.6	6813.4	2323.2
9.	UAN Broadcast	1.52	104.5	6556.9	2236.0
10.	UAN DSB	0.00	84.7	5313.7	2236.0
11.	UAN DSB	0.38	110.3	6920.3	2555.5
12.	UAN DSB	1.52	96.1	6030.2	2148.9
13.	No N	0.00	71.6	4489.2	1887.6
14.	NH_3 IS	0.00	116.1	7282.8	1916.6

NH_3 IS: Anhydrous ammonia injected sidedress

DSB: Dribble surface band

Urea: 45-0-0

UAN: 32-0-0

All treated plots received 75 lb N/ac on July 5, 7-leaf growth stage.

Table 4. Yield means, analysis and contrast data.

Comparison	Grain Yield, bu/ac
Method	
Broadcast (surface sidedress)	110.4
Dribble surface band (sidedress	101.4
Source	
UAN	102.9
Urea	108.9
Inhibitor Rate	
0.00	102.7
0.38	107.8
1.52	107.1

Dependent Variable: Yield

Analysis of Variance (minus checks and NH_3 IS)

	df	PR > F
Model	11	
Method	1	.0383
Source	1	.1523
Inhibitor Rate	2	.5449
Method * Inh Rate	2	.0843
Method * Source	1	.5182
Source * Inh Rate	2	.2547
Method * Source * Inh Rate	2	.5234
Error	24	
Corrected Total	35	

(Table 4. Continued on next page)

Table 4. Yield means, analysis and contrast date (continued)

Dependent Variable: Yield

Analysis of Variance (ALL TREATMENTS)	df	PR > F
Model	13	
Trt	13	.0053
Error	28	
Corrected Total	41	
Contrasts:		
Inhibitor vs No inhibitor	1	.2915
Check vs Rest	1	.0001
.38 vs 1.52 (inh rate)	1	.8805
Bcast vs DSB	1	.0419
NH_3 vs Rest	1	.0989

Method * Inhibitor Rate

Broadcast N	Grain yield, bu/a
0.00 Inhibitor	112.4
0.38 "	106.0
1.58 "	112.6
Dribble surface band	
0.00 Inhibitor	93.0
0.38 "	109.7
1.58 "	101.5

Source * Inhibitor Rate

Urea	
0.00	106.6
0.38	106.3
1.58	113.9
UAN	
0.00	98.8
0.38	109.5
1.58	100.3

COMPARISONS OF N SOURCES FOR CORN PLANTED IN UNTILLED WINTER WHEAT STUBBLE

Gary W. Hergert

Objective: Determine the effect of different N rates and N sources on the production of ecofallow corn.

Procedures: Field experiments were begun in 1979 to determine the effect of three N sources and six N rates on grain yield of ecofallow corn. The sites used were in farmer fields in south west central Nebraska and at the University of Nebraska-Lincoln West Central Research and Extension Center Dryland Farm near North Platte, Nebraska.

The experimental design was a randomized complete block replicated four times. Ammonium nitrate (AN), urea ammonium nitrate (UAN) and urea (U) were the three N sources used. Five N rates (25, 50, 75, 100, and 125 lbs N/A) plus a zero N check were combined factorially with N sources. AN and U were broadcast by hand or with a Barber spreader. UAN was applied with a field plot sprayer pressurized by CO_2. Fertilizer application date varied due to spring weather conditions. Plot size ranged from four to six 30 inch rows by 50 to 75 feet in length. Two 30 foot rows were hand picked in each plot for grain yield which was determined at 15.5% moisture. For the moisture storage and cropping year (September 1 to the next September) departures from the 75 year normal of 19.3 inches precipitation were +2.6, -2.5, and +4.5 inches for 1979, 1980, 1981 at North Platte. Yield maximums for these three years reflect this general pattern of moisture distribution for all locations (Table 1).

All sites responded to N although response in 1980 was limited due to drought (Table 1). Treatment effects from the analysis of variance (AOV) are summarized in Table 2. Nitrogen sources were significantly different at only two of the eight locations but the general ranking in effect on grain yield was AN=UAN>U. The N rate by nitrogen source interaction was significant at three of the locations also indicating differing source performance.

The N source differences were most pronounced in 1979 and 1981 when precipitation was somewhat above normal and crop response to N application was high. Orthogonal single degree of freedom tests comparing AN vs UAN and AN + UAN vs U were determined for N source. Results showed AN = UAN at all locations except site I where AN was significantly better than UAN. At three of the sites U was significantly lower than AN + UAN. N losses would be more influential on yield response during wet years than dry due to crop N demand.

To determine source performance over sites, data from each location was transformed into relative yields by dividing individual yields by maximum yield for a location. Maximum yield (100%) at each location was selected from best fitting response curves. The data were divided into two groups; wet years (sites I, V, VI, VII, VIII) and dry years (sites II, III, IV) and a combined analysis of variance was performed . A Bartletts test for homogeneity of variance among sites was not significant for either group indicating the suitability of combining the data. The AOV effects combined over sites are presented in Table 3. Site-years were considered a random variable to apply results over the geographical region of the experiments. Nitrogen rate and N source were significantly different only for the wet year data set.

The orthogonal comparisons of AN vs UAN and AN + UAN vs U showed AN>UAN (PR>F=0.21) and AN + UAN>U (PR>F=0.01). While a probability level of 0.2 (AN vs UAN) is not considered large, it does have practical significance and indicates that farmers may see slight differences in performance between AN and UAN in some years. Because none of the two or three way interaction terms were significant, regression analysis by N source for relative yield vs N rate can best show N source performance. The regression equations for relative yield including the check are:

$$\hat{Y}_{AN} = 78 + 0.489\ (\text{N Rate}) - 0.00256\ (\text{N Rate})^2 \qquad R^2 = 0.92$$

$$\hat{Y}_{UAN} = 79 + 0.361\ (\text{N Rate}) - 0.00154\ (\text{N Rate})^2 \qquad 0.99$$

$$\hat{Y}_{U} = 76 + 0.347\ (\text{N Rate}) - 0.00145\ (\text{N Rate})^2 \qquad 0.99$$

The quadratic model provided a good fit of all the data and shows that the N response differed between sources (Fig. 1). Since no direct measurements of N loss were made it can only be assumed that N sources differed because of differential N loss.

The AOV over sites for the three dry years showed no significant differences among N sources. The significant two and three way interactions may be explained by the high variability within each site. The overall N response regression equation including the check is:

$$\hat{Y}_{All\ N} = 77 + 0.561\ (\text{N Rate}) - 0.00457\ (\text{N Rate})^2 \qquad R^2 = 0.81$$

N rates above 60 lbs N/A did depress yields somewhat, which is not uncommon for N effects on yield in drought years (Fig. 2). Near maximum yield was attained with 60 to 70 lbs N/A, however, from AN and UAN during the wetter years.

The dilemma of N management in this dryland system is to have sufficient N available to the crop if rainfall and moisture availability is normal to above normal while not applying too much N which can depress yields if a drier than normal year occurs. Selection of the proper N source and/or method of application is necessary to assure consistent grain yields. Yield goals of 80-90 bu/A are realistic for years with normal to above normal precipitation.

The importance of considering residual soil nitrate when making N recommendations is shown by a plot of yield increase (maximum yield from N application minus check yield with no N) vs. soil NO_3-N content (Figure 3). The regression equation (excluding Site II) is

$$\hat{Y}_{\text{Yield Increase}} = 41 - 0.20\ (NO_3\text{-N in 6 feet}) \qquad \underline{R^2}\ 0.70$$

where Y is yield increase in bushels per acre.

The current N recommendation algorithm used by the University of Nebraska Soil Testing Laboratory adjusts corn N recommendations by using residual NO_3 measured in subsoil samples from a two foot or greater depth (Wiese and Peñas, 1979). A comparison of N rate required to produce maximum yield at each location vs. residual NO_3 at each site is shown in Figure 4. The reference line is N recommended by the algorithm for a 90 bu/A yield goal. With this limited number of sites the relationship is not perfect but it does conform to the general relationship which is based on at least 40 site years of data.

If no information on residual soil nitrate was available a yield goal of 70 to 90 bu/A would be realistic for most farmers to use. An N rate of 75 lbs N/A would produce maximum yields in most years but not be so high to sufficiently reduce yields in very dry years. Using a yield goal of 70 to 90 bu/A and deep soil samples for residual nitrate would be a better way of determining N rate as indicated by the data. Surface applications of AN or UAN should attain that yield. Urea, if used, should be injected.

Table 1. Effect of N rate and source on grain yield of ecofallow corn.

Site	Year	N Source	0	25	50	75	100	125	Mean
			------------	----	bu/A	----	------------		
I	1979	AN	71	97	103	100	101	102	101
		UAN	71	87	94	103	101	97	96
		U	71	87	90	90	89	95	90
II	1980	AN	41	52	52	48	50	46	50
		UAN	41	45	46	41	49	51	46
		U	41	41	53	48	49	52	49
III	1980	AN	36	44	46	46	41	*	44
		UAN	36	47	48	43	46	*	46
		U	36	52	45	42	39	*	45
IV	1980	AN	25	30	28	27	28	*	28
		UAN	25	22	40	31	33	*	32
		U	25	26	33	36	26	*	30
V	1981	AN	84	90	98	107	101	114	102
		UAN	84	88	97	99	111	112	102
		U	84	94	99	98	110	105	101
VI	1981	AN	88	103	102	114	111	114	109
		UAN	88	108	104	111	105	117	109
		U	88	91	104	111	111	107	105
VII	1981	AN	109	131	134	142	143	138	138
		UAN	109	131	127	139	142	135	134
		U	109	123	128	133	133	138	131
VIII	1981	AN	74	95	105	95	99	101	99
		UAN	74	84	96	101	108	102	98
		U	74	87	89	100	98	104	94

* Rate not used.

Table 2. Analysis of variance effects and probability levels for each site.

Site	N Rate	N Source	Rate x Source
		PR > F	
I	.10	.01	.52
II	.07	.37	.36
III	.10	.44	.25
IV	.05	.47	.07
V	.01	.92	.11
VI	.01	.11	.12
VII	.07	.19	.98
VIII	.10	.51	.46

Table 3. Analysis of relative grain yields combined over sites for wet and dry years (excluding check yields).

Source of Variation	df	Wet Years	Dry Years
		PR > F	
Replication	3	.31	.63
Site	4	NT	NT
N Rate	4	.01	.38
N Source	2	.01	.87
NR x NS	8	.78	.80
Site x NR	16	.67	.04
Site x NS	8	.55	.31
Site x NR x NS	32	.30	.03

NT = No Test

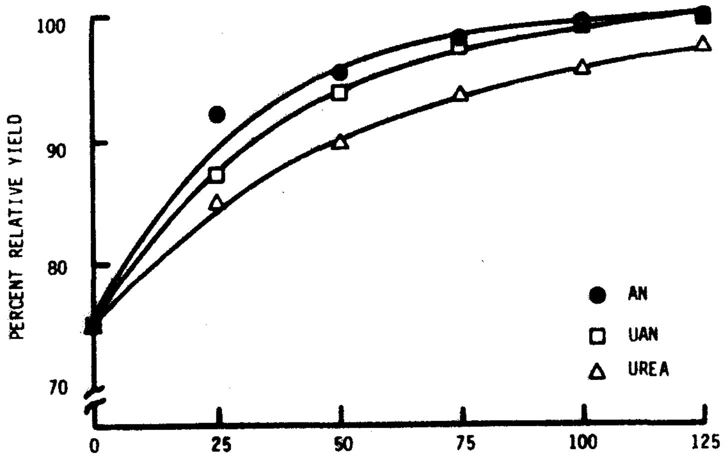


Figure 1. Relative grain yield as affected by N rate and N source during wet years.

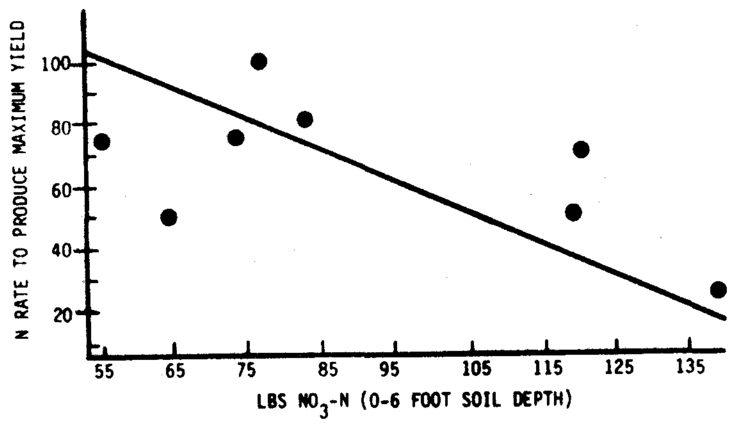


Figure 4. Relationship between N rate required for maximum yield and residual soil nitrate level.

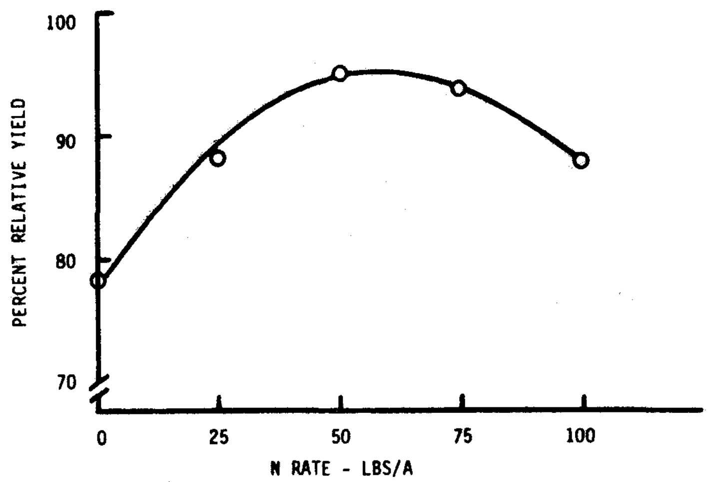


Figure 2. Relative grain yield as affected by N rate during dry years.

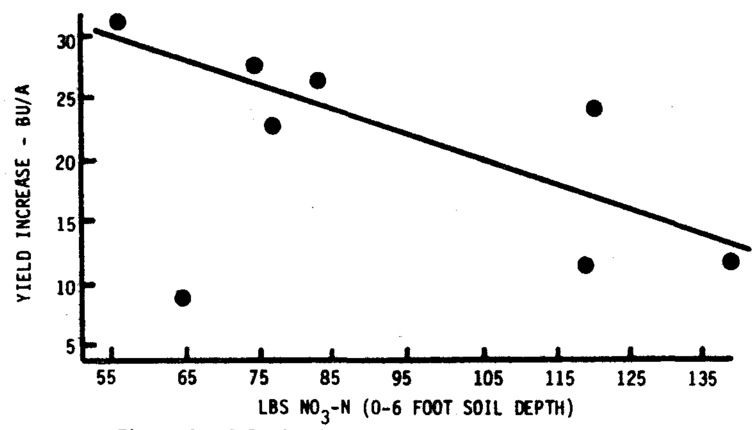


Figure 3. Relationship between grain yield increase and residual soil nitrate levels.

Increased Nitrogen Utilization by Corn

K. D. Frank, G. W. Hergert, J. S. Schepers, and G. E. Varvel

Objectives:

1. To investigate N uptake efficiency by corn from fertilizer applied in irrigation water.
2. To investigate N uptake efficiency by corn from residual nitrate in the soil as affected by preplant N fertilizer.

Procedure:

Two experiments, one at Clay Center and the other at North Platte were utilized. Both experiments were established on areas known to have a low level of residual nitrate and large enough to be able to conduct experiments for three years without confounding of the data. Previous crop at Clay Center and North Platte was soybean and corn, respectively.

Soil samples were taken prior to initiation of the experiments at both locations. Sampling depths were 0-6", 6-12" and then on down to 6 feet in foot increments. Samples were analyzed for nitrate and ammonium-N. Surface samples (0-6" and 6-12") were also analyzed for pH, Bray P, etc. to quantify chemical properties at both locations.

Two approaches, one to establish three different N regimes for the 1985 growing season and the other to establish N treatments for the 1984 season, were utilized. Three N rates (0, 75, and 150 lb/A) were applied preplant to a sufficient number of plots to establish relative N regimes of low, medium, and high for the 1985 season. Treatments for 1984 included three plots where three irrigation applications received 25 lb/A N each time. Tagged N was added to one of these fertigations treatments: first; second; or third; depending on the treatment. In addition, preplant N applications of 0 and 75 lb/A N were made to four plots. Separate plots within each of the rates were then tagged with a small amount of highly enriched N at the 18 or 30 inch depth to evaluate the effect of the surface applied N on utilization of residual nitrate from that depth. A randomized complete block design with five replications was used at both locations.

Samples taken were grain and total plant dry matter yield at maturity. All samples have been analyzed for total N content and tagged-N enrichment analyses are in process. Soil samples were taken by foot increments to 6 feet from the the three N rate plots for nitrate analysis after the crop was removed. These data will permit calculation of the N use efficiency and depth of nitrate leaching under the those different treatments.

Experimental Results:

Grain yield data from the two locations is presented in Fig. 1. The Clay Center site, with its higher organic matter content, produced a higher yield with no fertilizer N. Both locations responded positively to fertilizer N application with the 150 lb/A rate yielding approximately the same at both locations. The 75 lb/A rate was least effective at Clay Center when applied preplant and most effective when applied in the irrigation water (25 lb/A during each of three irrigations). Comparison of apparent N recovery from these two methods of application indicated that most of the preplant N at Clay Center was lost (Fig. 2). Heavy spring and early summer rains at Clay Center probably resulted in the N from the preplant application being leached down in the profile. This was not the case at North Platte (Fig. 2) and similar apparent N recoveries were obtained among the preplant and irrigation N applications. Yield results at North Platte also indicated no difference between method of application (Fig. 1).

Tagged-N enrichment analyses are not complete at this time, therefore those results will be included in future reports.

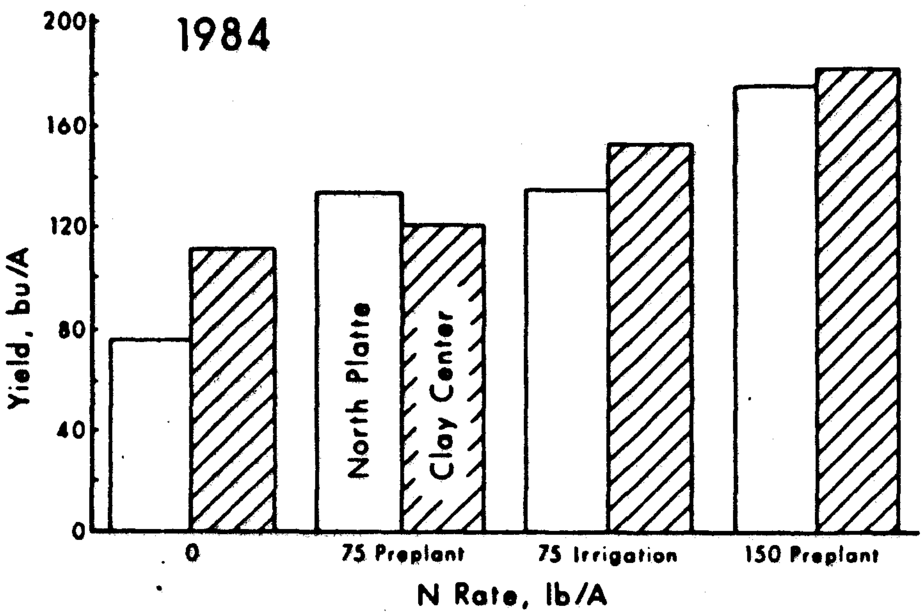


Fig. 1. Corn grain yield at North Platte and Clay Center as affected by N rates and application methods.

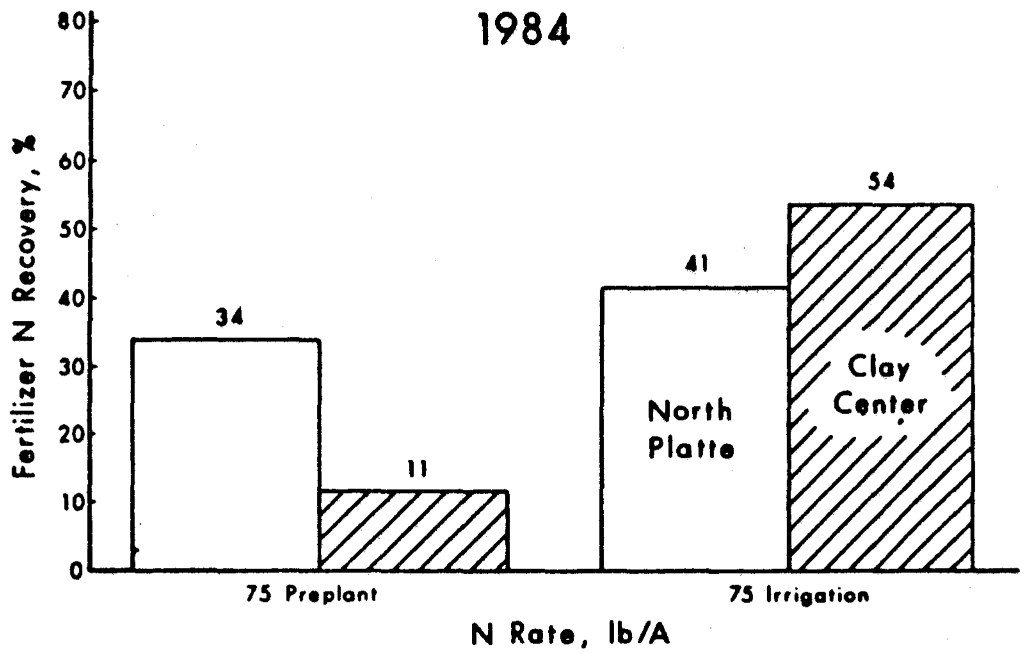


Fig. 2. Fertilizer N recovery (N recovered in the plant from the treatment minus N recovered in the plant from the check treatment/ N applied in the treatment) of the preplant and irrigation applications of N at North Platte and Clay Center.

Pressure Injection of UAN for Irrigated Corn

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

Objective: It was the purpose of this study to determine the effectiveness of UAN pressure injected as N source for irrigated corn.

Procedure: 'Pioneer 3377' was planted on May 20 in 36" row spacing at 28,000 seeds per acre on Sharpsburg sicl at the Mead Field Lab. Nitrogen was sidedressed on June 30 at the 10-12 leaf stage in a 3 x 3 method x rate factorial combination with rates of 0, 45, 90, 135 lbs/a. UAN (32-0-0) pressure injected (2000 pst), or dribbled in a surface band was further compared with NH_3 (82-0-0) injected.

Results and Discussion: Pressure injection treatments are aimed at applying liquid forms of urea fertilizers (UAN) below the soil surface such that surface volatilization of ammonia is reduced. Data from this study indicate that this method was superior to dribble surface band technique at a rate of 90 lb N/a (Table 1). However, at the higher rate of 135 lb N/a, no differences between these two methods was demonstrated. Yields peaked for NH_3 injected sidedress treatments at 45 lb N/a. At this low rate, NH_3 injected sidedress was superior to either pressure injection or dribble surface band treatments at the highest rate of applied N (Table 1 & Figure 1).

Table 1. Influence of placement, rate, and kind of N carrier on yield of irrigated corn.

Treatment	Rate	Grain Yield
	lb N/a	bu/a
Check	0	134
Check	0	170
NH_3		
Injected sidedress	45	187
" "	90	187
" "	135	188
UAN		
Dribble surface band	45	162
" " "	90	169
" " "	135	175
UAN		
Pressure injection	45	162
" "	90	179
" "	135	179

Comparisons

N rate	bu/a
0	152
45	170
90	178
135	181

N Method	bu/a
NH_3 injected	187
UAN press. inj	173
UAN dribble bd	168

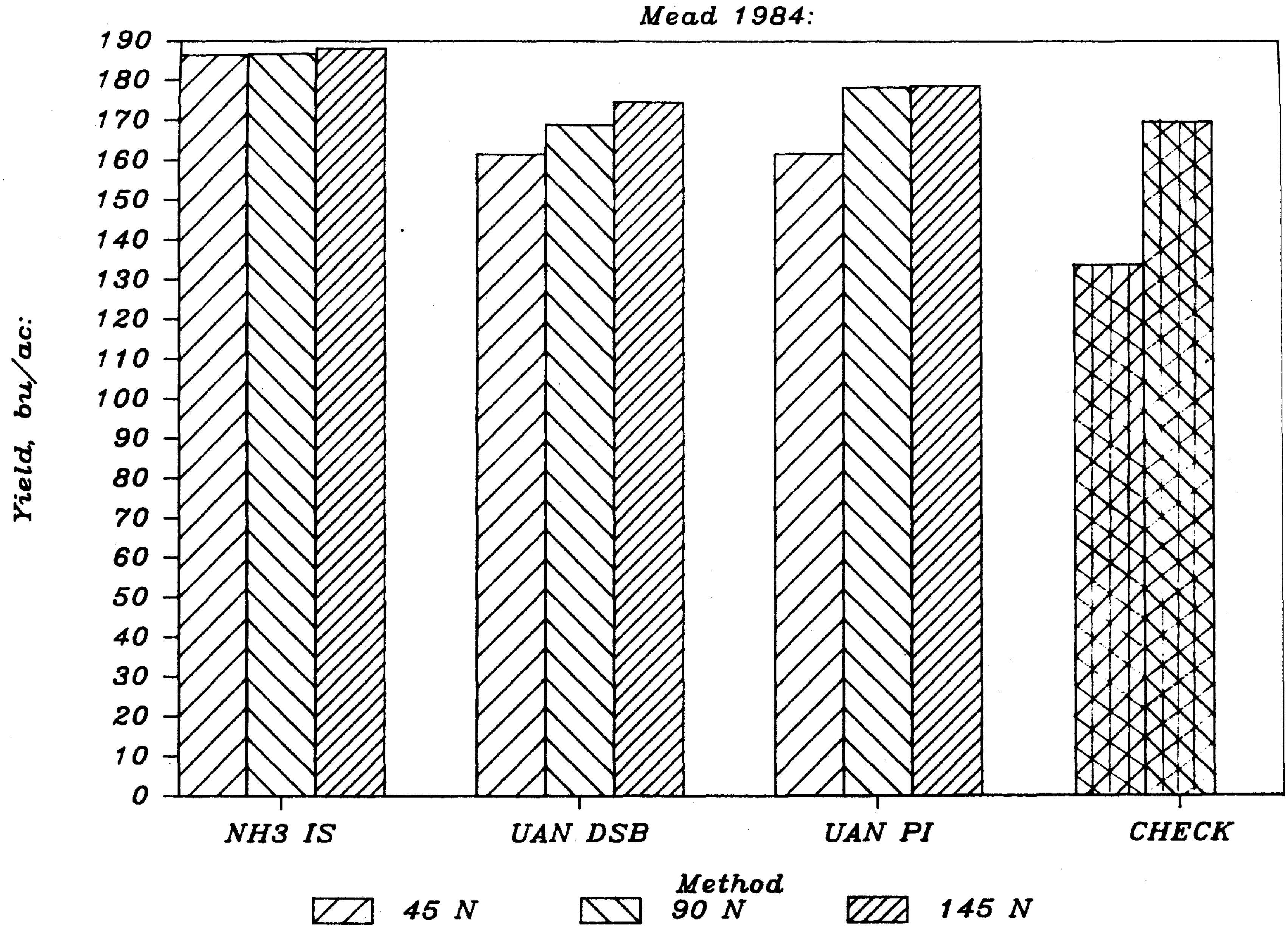
AOV (minus checks)

	df	PR>F
Model	11	
rep	2	.0011**
method	2	.0369*
rate	2	.2994
method x rate	4	.8568
Error	21	
Corrected total	32	

CONTRASTS

	PR>F
Checks vs Rest	.0022**
NH_{3is} vs UAN_{pi}	.0646
UAN_{dsb} vs UAN_{PI}	.5367
UAN_{dsb} vs NH_{3is}	.0177**

FIGURE 1. Method of N Applied vs Yield:



Crop and Soil Response to Applied P and K
In a Long-term Buildup/Depletion Study

R. A. Olson, G. W. Rehm, C. A. Shapiro and F. A. Anderson

Objectives:

1. Determine level of soil P and K required for assuring most economic yields of corn and wheat.

2. Establish required rates of P and K for maintaining adequate soil test levels for optimum yields on representative Nebraska soils.

Procedure: This experiment is conducted with irrigated corn on Sharpsburg sicl the Mead Field Lab, non-irrigated corn on Moody-Nora sil at the Northeast Station, and non-irrigated wheat on Keith sil and Rosebud fsal on the High Plains Ag Lab. There were no yield results for wheat in 1982 and 1984 because of hail damage, accordingly, only data for the corn plots are presented here. All P and K treatments are broadcast before final tillage and planting except for one row treatment at planting on the Mead Lab site.

Results and Discussion: There was no significant effect of P or K treatments on yield of corn at either location in 1983 or 1984 (Tables 1 and 2).

The long term average reveals optimum yield on both soils with somewhat more than 10 lbs P applied annually. There has been no positive yield response to applied K on either soil, although a decided trend of yield reduction exists with the heavier K rate and with row application of the low rate. Precisely why this has occurred is not clear, but it certainly raises question to the practice of adding more nutrient to a soil that is already high to very high in that element.

Surface soil test P of the control plot has declined only slightly over the 12-year period despite yields averaging in excess of 150 bu/a on Sharpsburg and around 110 bu/a on Moody-Nora. On both soils 10 lbs applied P has approximately maintained soil P at its original level, 20 lbs has substantially increased and 30 lbs more than doubled it (See Figure 1 for Sharpsburg).

Surface soil test K has not changed perceptibly in the Sharpsburg soil even in the control plots and that added in the treated plots has disappeared in the large existing pool. Soil K appeared to be declining in the Moody-Nora soil through 1980 but was back up to the original values after the wet springs of 1982 through 1984. The annual K treatments are now showing a divergence from the check on this soil with actual buildup occurring in soil K with both 25 and 50 lb K rates.

These long term data confirm the fallacy of the 'maintenance' concept of crop fertilization for these loess-derived soils. A crop removal 'maintenance' amount of approximately 30 lbs P would be called for annually on the Sharpsburg at the 165 bu/a average yield level achieved, correspondingly slightly over 20 lbs P for Moody-Nora. These rates are above the yield response range and are rapidly increasing soil test levels. In effect, the maintenance approach to fertilization discounts the soil's inherent nutrient delivery potential.

Table 1. Grain yield and soil test response to applied P and K in a long term P and K buildup/depletion study with irrigated corn on Sharpsburg sicl, Mead Field Lab, 1973-83.

Treatment[1/] P	K	Application Schedule	Grain Yield 1983	1973-83	Soil Test P (surface)[2/] 1973	1977	1983	Soil Test K (surface)[2/] 1973	1977	1983
			bu/a			ppm			ppm	
0	0	Control	90	158	15	14	7	320	320	329
10	0	Every year @	107	161	15	18	10	311	347	319
20	0	Every year @	108	165	16	24	18	310	337	312
30	0	Every year @	102	165	19	34	34	300	334	326
20	0	Every other year @	112	158	16	30	11	300	391	313
30	0	Every 3rd year @	114	163	25	21	11	288	360	300
60	0	Every other year @	115	162	22	51	30	283	402	290
60	0	Every 6th year @	107	156	30	19	15	288	377	288
20	25	Every year @	113	166	16	30	18	296	389	297
20	50	Every year @	116	159	14	24	20	296	326	329
10	25	Every year row @	121	157	11	18	12	268	420	309
			NS							

1/ Uniform N application made across all plots for optimum yield (160 lbs N/a in 1983); P and K treatments broadcast before final tillage except for indicated row application; grain yield on 15.5% moisture basis. An @ indicates treatment made in 1983. Means followed by the same letter are not significantly different ($p = 0.05$) based on Duncan's Multiple Range Test.

2/ Soil P by Bray and Kurtz no. 1 extraction; soil K is exchangeable with NH_4OAc extraction.

Table 2. Grain yield and soil test response to applied P and K in a long term P and K buildup/depletion study with irrigated corn on Moody-Nora sicl, Northeast Station, 1973-84.

Treatment1/ P	K	Application Schedule	Grain yield2/ 1984	1973-84	Soil Test P (surface)3/ 1973	1977	1984	Soil Test K (surface)3/ 1973	1977	1984
			bu/a			ppm			ppm	
0	0	Control	128	110	10	9	9	223	195	194
10	0	Every year @	124	115	9	13	11	220	179	194
20	0	Every year @	124	117	12	16	20	228	187	190
30	0	Every year @	127	116	22	27	18	234	198	212
20	0	Every other year @	117	112	9	12	9	218	196	214
30	0	Every 3rd year @	127	113	17	12	10	224	190	206
60	0	Every other year	130	116	11	22	30	213	202	214
60	0	Every 6th year	130	114	11	11	8	202	189	202
20	25	Every year @	127	116	10	16	18	220	204	208
20	50	Every year @	124	113	11	19	17	238	218	258
			NS							

1/ Uniform N application made across all plots for optimum yield (80 lbs N/a in 1984 P and K treatments broadcast before final tillage; grain yield on 15.5% moisture basis. An @ indicates treatment made in 1984. Means followed by the same letter are not significantly different (p = 0.05) based on Duncan's Multiple Range Test.

2/ No yield in 1974 due to drouth.

3/ Soil P by Bray and Kurtz no. 1 extraction; soil K is exchangeable with NH_4OAc extraction.

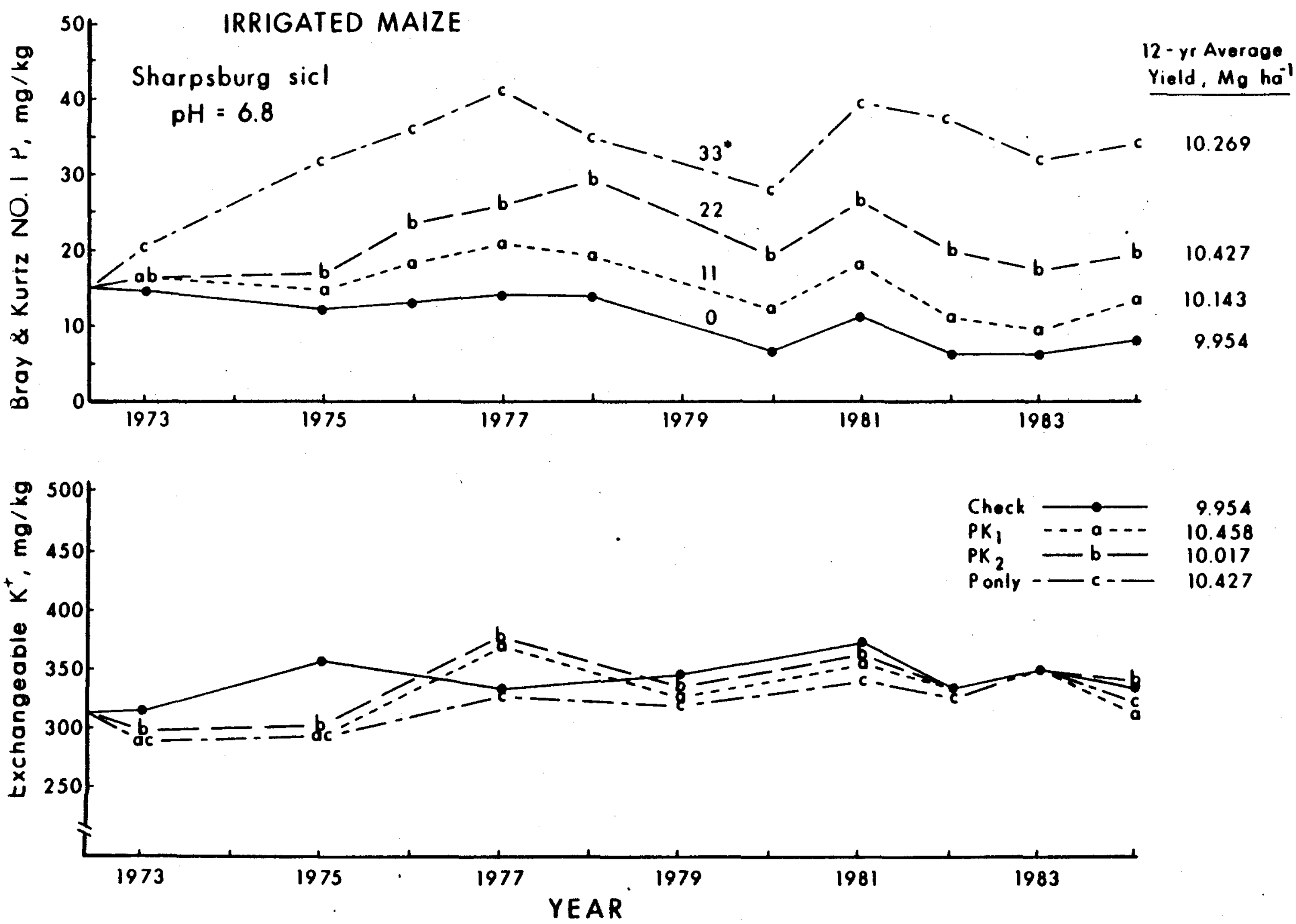


Figure 1. Soil test P (top) and soil test K (bottom) changes with time in the irrigated corn study on Sharpsburg sicl (1973-83). * indicates rate of P in kg/ha applied annually.

INCREASING THE EFFICIENCY OF P FERTILIZERS

D. H. Sander

Objectives: To study several different factors that may affect fertilizer P efficiency as follows:

a) to determine the effect of different particle sizes on fertilizer P efficiency.

b) to determine the effect of placement location of fertilizer P on wheat yield.

c) to determine the effect of superslurper on fertilizer P efficiency.

Procedures:

a) Three experiments were harvested in 1984--two on wheat in western Nebraska (Perkins and Chase counties) and one on irrigated corn at the Mead Research Farm to study the effect of particle size on fertilizer P efficiency. The wheat experiments included five different particle sizes of 11-55-0 formulated by TVA in the following sizes: -250, -150 +250, -42 +65, -14 +20, and +6 mesh. These different particle sizes were seed applied at 0, 7.5, 15.0, and 22.0 lbs P/ac with five replications. The corn experiment included four particle sizes (-250, -42 +65, +6 mesh, and a 0.328g pellet) row applied at 12 lbs P/ac with four replications. Corn (Pioneer 3377) was planted June 1 at a population of 28,600 plants/ac. Wheat was Centurk planted about September 25. Nitrogen was topdressed in the spring at a rate of 80 lbs N/ac and corn was sidedressed with 180 lbs N/ac.

b) Two experiments were established in southwest Nebraska (Perkins and Chase counties) in which P (liquid 10-34-0) was knifed-in (12-inch spacing) at depths of 2, 4, 6, and 8 inches deep directly below seed and between the wheat rows at planting time to study the effect of P placement location on wheat yields. P was applied at a rate of 12 lbs P/ac. Nitrogen was topdressed in the spring at a rate of 80 lbs N/ac.

c) Two experiments were established on corn to study the effect of "superslurper" (SS) on P fertilizer efficiency. Experiments were located in Sherman County near Loup City and at the Mead Research Farm. Studies involved P and SS placement as a row application to the side of the row at Mead and was knifed-in to a depth of 6 inches in 12-inch spacings at Sherman County. Treatments included 0, 5, and 10 lbs superslurper/ac in all combinations with 0, 10, and 20 lbs P/ac. Nitrogen was also applied at 50 lbs N/ac. Plots received 150 lbs N/ac preplant at Sherman County and was sidedressed at Mead. Pioneer 3377 was planted in 30-inch rows at 28,600 seeds/ac at Mead and in 36-inch rows at a population of 14,000 seeds/ac at the Sherman County location.

Experimental Results:

a) Corn yield at Mead was not significantly affected by P fertilizer particle size but there was a trend for the larger sizes to be more effective (Table 1). Wheat yields were significantly affected by particle size at the Chase County location where application of the -42 +65 mesh size resulted in the highest yield (Table 2). Applied P did not affect wheat grain yield at the Perkins County site although the P soil test was very low (4 ppm). However, there was a trend for the largest size to be more effective at the low P rate.

b) In row placement of P fertilizer was more effective than between row application at Chase County Location. Wheat yield was not affected by depth of application until the depth reached 8 inches. The 8-inch depth resulted in yields that were significantly less than the 2, 4, and 6-inch depths. P application did not affect yields at the Perkins County location.

c) "SS" is a product that absorbs many times its weight of water. Since the spring of 1984 was very wet at both locations, SS would be expected to have no affect on P fertilizer efficiency. While corn yield responded very weakly at Mead, P application increased corn yield significantly at the Sherman County location (Table 4). However, SS did not affect the efficiency of P fertilizer application.

Table 1. Effect of different particle sizes of P fertilizer on corn grain yield. Mead Research Farm 1984.

Particle Size	Corn yield Bu/ac
Check (No P)	109
-250 mesh	102
-42 +65	100
+6	120
0.328g pellet	119
LSD .05 = 23 bu/ac	

Table 2. Effect of different particle sizes of P fertilizer on wheat grain yields. Southwest Nebraska. 1984

	P Rate - lbs/ac			
Particle size-mesh	7.5	15.0	22.5	Mean
		Chase County 84-3, bu/ac		
-250	41	51	54	50
-150 +250	42	52	55	53
-42 +65	48	55	56	54
-14 +20	48	53	57	50
+6	46	47	57	49
No P = 33	45	52	56	
		Perkins County 84-47		
-250	57	61	62	61
-150 +250	56	59	61	59
-42 +65	59	62	61	60
-14 +20	58	58	61	59
+6	65	59	58	60
NO P = 49	59	60	61	

Analysis of Variance

Source	Chase Co.	Perkins Co.
P rate (R)	.01	NS
Size (S)	.05	NS
S X R	NS	.17

Table 3. Effect of P placement location on winter wheat grain yield. 1984.

Depth of Application	P Placement Location - 1 In Row	Between Row	Mean
	bu/ac		
	Case County 84-3		
2	55	50	52
4	56	47	52
6	54	46	50
8	46	40	43
Mean	53	46	49
No P	35		
	Perkins Co 84-47		
2	57	54	56
4	45	53	49
6	51	55	53
8	54	53	54
Mean	52	54	53
No P	54		

Analysis of Variance

Source	Chase Co.	Perkins Co.
Depth (D)	.04	NS
Placement (P)	.08	NS
D X P	NS	NS

Table 4. Effect of "superslurper" on corn yields at two locations in Nebraska. 1984

Treatment1/			Location2/	
SS	P	N	Mead	Sherman County
lbs/ac			bu/ac	
0	0	50	92	80
0	10	50	94	118
0	20	50	102	134
5	0	50	98	105
5	10	50	100	123
5	20	50	95	124
10	0	50	102	89
10	10	50	89	106
10	20	50	103	128
0	0	0	75	--

Analysis of Variance

	Mead	Sherman County
SS	NS	NS
P rate	NS	**
SS x P rate	NS	NS

1/ P fertilizer was 18-46-0 and N was 33-0-0 at planting time.
SS = superslurper

2/ All plots received 150 lbs N/ac as ammonia (sidedressed at Mead and preplanted at Sherman Co.)

PHOSPHORUS RATE AND METHOD OF APPLICATION FOR GRAIN SORGHUM

E.J. Penas and D.H. Sander

Objectives:

1. Compare beside the row placement and preplant band application of phosphorus on grain sorghum.

2. Evaluate the residual effects of phosphorus which was applied broadcast, in preplant bands, and with the seed on wheat the previous year.

Procedure: This study was established on a site that was a winter wheat experiment the previous year. Soil test characteristics are reported in Table 1. Rates of phosphorus had been used on wheat (23, 46, and 69 pounds P_2O_5 per acre) and were applied in three methods: broadcast, in preplant bands with and without N-Serve, and with the seed. Spring applications had been planned within the wheat experiment which were not accomplished; thus, extra plots were available for this experiment.

Those plots that received phosphorus treatments on wheat, plus the check, received only nitrogen for the grain sorghum. A constant rate of 80 pounds of nitrogen was used for the study. Those plots that received phosphorus in preplant bands with N-Serve were used for the second application of phosphorus in preplant bands. Plots that had been planned for spring application of phosphorus were used for the row (2 x 2 placement) and preplant band treatments for the grain sorghum.

The preplant bands were spaced 12 inches for both the wheat and grain sorghum and applied 4 to 6 inches deep. Grain sorghum was planted in 24 inch rows. Planting was delayed by weather; thus, an early hybrid (Pioneer 8855) was planted on June 28, 1984.

Experimental Results: Grain yields were determined and are reported in Table 2 at 14% grain moisture. Grain yields were significantly increased by phosphorus fertilizer on this very low phosphorus soil. Both row and knife applied phosphorus increased grain yields and were equally effective. Yields were increased with increasing rates of phosphorus. There was a significant effect of residual phosphorus after the wheat where the phosphorus was knifed before wheat seeding. Residual effects of phosphorus were not measured where the phosphorus fertilizer was broadcast, dribbled or applied with the seed for wheat. Where the phosphorus was knifed for the wheat and then re-applied by knife on the sorghum, the applications seemed to be additive. An application of 23 pounds P_2O_5 per acre on the wheat and another 23 pounds for grain sorghum gave a grain yield equivalent to 46 pounds P_2O_5 per acre on the grain sorghum. Likewise, 46 pounds P_2O_5 per acre on the wheat and grain sorghum was as effective as 69 pounds P_2O_5 per acre on the grain sorghum alone.

The data from the 1984 wheat and 1985 grain sorghum suggest that the knife application of phosphorus is one of the most effective methods of applying phosphorus and will result in increased effectiveness in terms of residual or carry-over from previous years.

Table 1. Soil Test Characteristics of Grain Sorghum Test Plot Site in Saunders County, 1984.

Soil pH	5.3
Buffer pH	6.3
Phosphorus, ppm	4
Potassium, ppm	201
Organic Matter, %	2.7

Table 2. Grain Sorghum Yield, bu/ac., as Influenced by Phosphorus Fertilizer Rate and Method of Application, 1984.

	P_2O_5, lbs/ac		
Method of Application	23	46	69
None	(27)		
Broadcast Residual	26	28	30
Seed Residual	20	24	29
Knife Residual	31	32	41
Dribble Residual	--	29	--
Row Applied	37	43	51
Knife Applied	36	41	50
Knife Residual & Applied	41	50	52

FERTILIZER MANAGEMENT FOR NATIVE SUBIRRIGATED MEADOWS

Gary W. Hergert, Jim Nichols, and Pat Reece

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 Gudmandsen 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, and 1984. 1984 data are not available, but the study is being continued for 1985. Forage was harvested in early- to mid-July both years.

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. Production was maximized with 80# N (Fig. 1).

Crude protein and IVDMD were both decreased by N rate (Tables 1 and 2). This decrease may be primarily related to stage of cutting. During 1982 and 1983 plots were harvested when seed heads were emerged. Earlier harvests should produce a higher quality forage and may show beneficial effects from N on quality and yield. An earlier harvest is planned for 1985.

Table 1. ANOVA for the Meadow Fertilization at the Gudmundsen Sandhills Lab.

Source	1983 Dry Matter	1983 Crude Protein	1983 IVDMD	1982 Dry Matter	1982 Crude Protein	1982 IVDMD
	- - - - - - - - PR > F - - - -					
N	.01	.01	.02	.01	.10	.01
P	.01	.25	.68	.01	.14	.30
N*P	.54	.74	.18	.79	.82	.35
S	.01	.26	.06	.06	.98	.14
N*S	.32	.28	.17	.69	.78	.98
P*S	.15	.60	.70	.25	.17	.12
N*P*S	.39	.80	.44	.81	.89	.54

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

	1982 DM Kg/ha	1982 CP %	1982 IVDMD %	1983 DM Kg/ha	1983 CP %	1983 IVDMD %
N						
0	4600	8.54	50.5	6245	9.10	56.3
40	5790	8.12	48.6	7415	7.97	54.2
80	6405	7.88	47.6	7860	8.04	54.0
120	6845	8.35	46.8	7980	8.23	53.2
P_2O_5						
0	5560	8.08	48.7	7110	8.23	54.6
40	6260	8.37	48.00	7640	8.44	54.3
S						
0	5700	8.22	48.8	7110	8.23	55.1
20	6120	8.22	47.9	7640	8.44	53.7

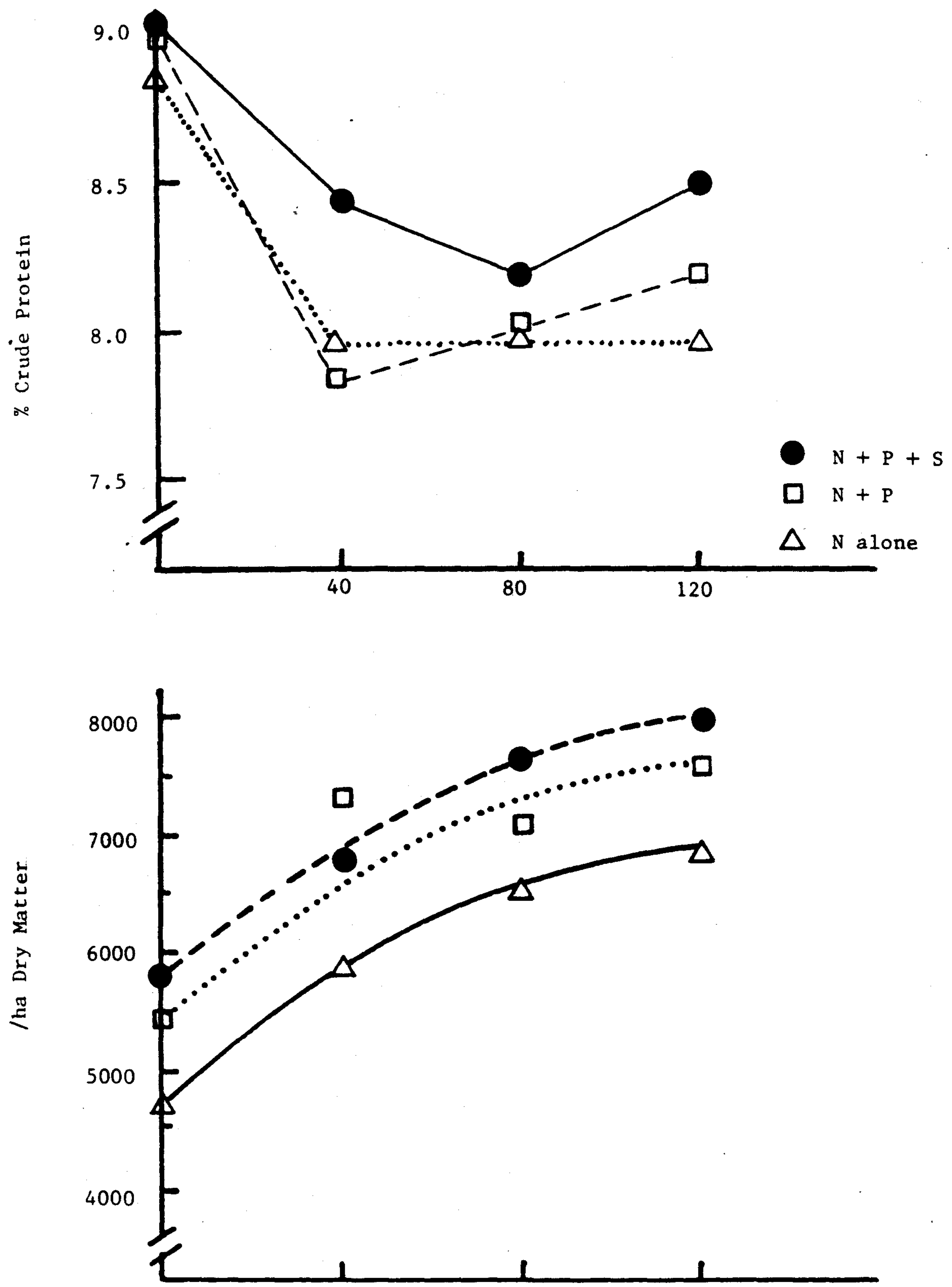


Figure 1. Native hay yields and crude protein.

SOURCES OF NITROGEN USED IN CORN AND SOYBEAN PRODUCTION AS AFFECTED BY CROP RESIDUES

J. F. Power, W. W. Wilhelm, and J. W. Doran

Objective: To determine where the nitrogen used by no-till corn and soybean comes from, and how this is affected by quantity of crop residues.

Procedure: Dryland corn and soybean were cropped continuously with no tillage on a Crete-Butler silty clay loam at Lincoln for several years. Crop residues were surface-applied at rates of 0, 0.5, 1.0, and 1.5 times the quantity of residues produced by the previous crop. After several years, crop residues that contained isotopically tagged nitrogen were applied, and the amount of this tagged nitrogen used by the next crop of corn and soybean was measured. Likewise, fertilizer nitrogen applied (40 lb/acre) was also tagged so that nitrogen taken up from the fertilizer could be determined.

Experimental Results: Grain production of both corn and soybean increased as quantity of crop residues left on the soil surface increased (Table 1). The range in corn yields was 57 (no residue) to 92 bu/acre (150% of last year's residues). For soybean, the range was from 22 (0%) to 42 (100%) bu/acre. Stover and straw yields of both crops likewise increased as residue rate increased.

Little, if any, of the nitrogen in the corn residues was used by the next corn crop (Table 2), regardless of rate of residue used. Uptake of both fertilizer and soil nitrogen by corn increased with increased crop residue rate. However, for all residue rates, 80 to 85% of the nitrogen used by the corn came from the mineralization and uptake of the native soil organic nitrogen already in the soil organic matter. Only 15 to 38% of the fertilizer nitrogen applied was used.

For soybean, particularly at the higher residue rates, most of the nitrogen originally present in the soybean residues were used by the next soybean crop (Table 2). Fertilizer nitrogen uptake increased slightly with increased residue rate, but resdidue rate had little effect on soil (and biologically fixed) nitrogen uptake once the rate reached at least 50%; however, total uptake increased with increased residue rate. About 38 to 58% of the fertilizer nitrogen applied was recovered in the soybean crop.

These results indicate that, in no-till agriculture, little of the nitrogen contained in corn residues becomes available to the following crops, whereas nitrogen in soybean residues is readily available. Corn residues are lower in nitrogen content and can tie up more fertilizer nitrogen than soybean residues. Thus, a much higher percentage of the nitrogen in corn comes from mineralization of the soil organic nitrogen than occurs for soybean.

Table 1. Corn and soybean production as affected by rate of crop residue on soil surface (no till).

	Residue rate (% of that produced previous year)			
	0	50	100	150
Corn				
Grain (bu/acre)	57	67	79	92
Stover (lb/acre)	2730	3800	4760	5230
Soybean				
Grain (bu/acre)	22	31	39	42
Stover (lb/acre)	2100	3620	4200	4800

Table 2. Source of nitrogen taken up by no-till corn and soybean as affected by crop residues.

% of residues from previous crop	Source of N in crop			
	Residues	Fertilizer	Soil*	Total
	----------lb N/acre----------			
Corn				
0	0	7	65	72
50	0	12	86	98
100	1	12	102	115
150	0	15	112	127
Soybean				
0	0	15	75	90
50	1	20	111	132
100	34	20	104	158
150	56	23	94	173

*For soybean, soil plus N fixed by root nodules.

Corn Yields as Effected by Five Tillage-Residue Techniques and Four N Rates Applied as Broadcast and Sidedress

A. L. Sims, R. A. Olson, J. S. Schepers, J. F. Powers

Objectives:

1. To determine the effect of five tillage-residue management techniques on corn yields.

2. To determine the effect of four rates of N applied at two times within each tillage-residue treatment on corn yields.

Procedure:

Corn was planted in an irrigated Sharpsburg sicl at the Mead Agronomy Farm and in an irrigated Hastings sil at the South Central Station at Clay Center. The corn was planted in 30" rows at a population of 30000+. Tillage-residue combination treatments were applied as no-tillage with residue removed (NT OFF), no-tillage with residue left on the surface (NT ON), tillage with residue removed (TL OFF), tillage with residue tilled in (TL IN), and tillage with residue left on the surface (TL ON). Tillage in this case was done by disking once. N was applied as NH_4NO_3 at four rates of 0, 50, 100, 150 lbs/A. Plots were split so N could be applied as surface broadcast at planting and as a sidedress at the 6 leaf stage. Sidedress treatments were applied at about 2" below the soil surface and 6" away from the corn row. Harvesting was done by hand from two 10' rows from the center of the plots. All treatments were replicated four times at each site.

Experimental Results

Statistical analysis has not been done at the time of this writing but Figure 1 and 2 show some of the relationships of yield means.

Clay Center

Figure 1a and 1b show indications of interactions of tillage-residue treatments with yields over the entire range of N treatments. However the signicance of these interactions are not yet known. Broadcast yields ranged from 58.4 to 151.3 bu/A and the sidedress yields ranged from 84.5 to 143.9 bu/A. As can be seen in Figure 1a, yields were maximized at the 100 lb N rate in four of tillage-residue treatments. The broadcast treatments indicate that only the TL IN treatment was maximized at the 100 lb N rate. In both N application methods the TL ON yields did not reach a maximum at the 150 lb N rate. These graphs indicate that sidressing N is an advantage only at 100lbs of N or less. TL ON treatments may not have reached a maximum because of increased immobilization of N caused by aeration of the soil through tillage and a steady supply of C substate from the residue on the surface stimulating a more sustained microbial activity. Broadcast treatments showed an increase in yields at the 150 lb N rate over the sidedress treatments by as much as 12 bu/A.

Mead

Figure 2a and 2b show the graphical results of the Mead experiment. Again there is an indication of interactions between the tillage- residue treatments and yields over all N rates. The significance is not yet known. Broadcast yields ranged from 54.7 to 122.8 bu/A and the sidedress yields ranged from 80.5 to 148.9 bu/A. The sidedressed N had a consistent advantage over the broadcast treatments. Wet and cool soil conditions at the time of broadcast application may have resulted in the loss of N through volatilization. This reason and that other reserch has shown that sidedressing N on corn is more efficient than broadcasting may account for the sidedress advantage.

The relationships of the tillage-residue treatments and yields appears to be the same in both the broadcast and sidedress treatments except they occur at different yield levels. As at Clay Center the TL ON never reached a maximum level , however, the NT OFF treatment leveled off between 50 and 100 lb N rate then rose by 20 bu/A at the 150 lb N rate for both the broadcast and sidedress. All other tillage-residue treatments maximized or nearly so at the 100 lb N rate for both application methods.

Summary

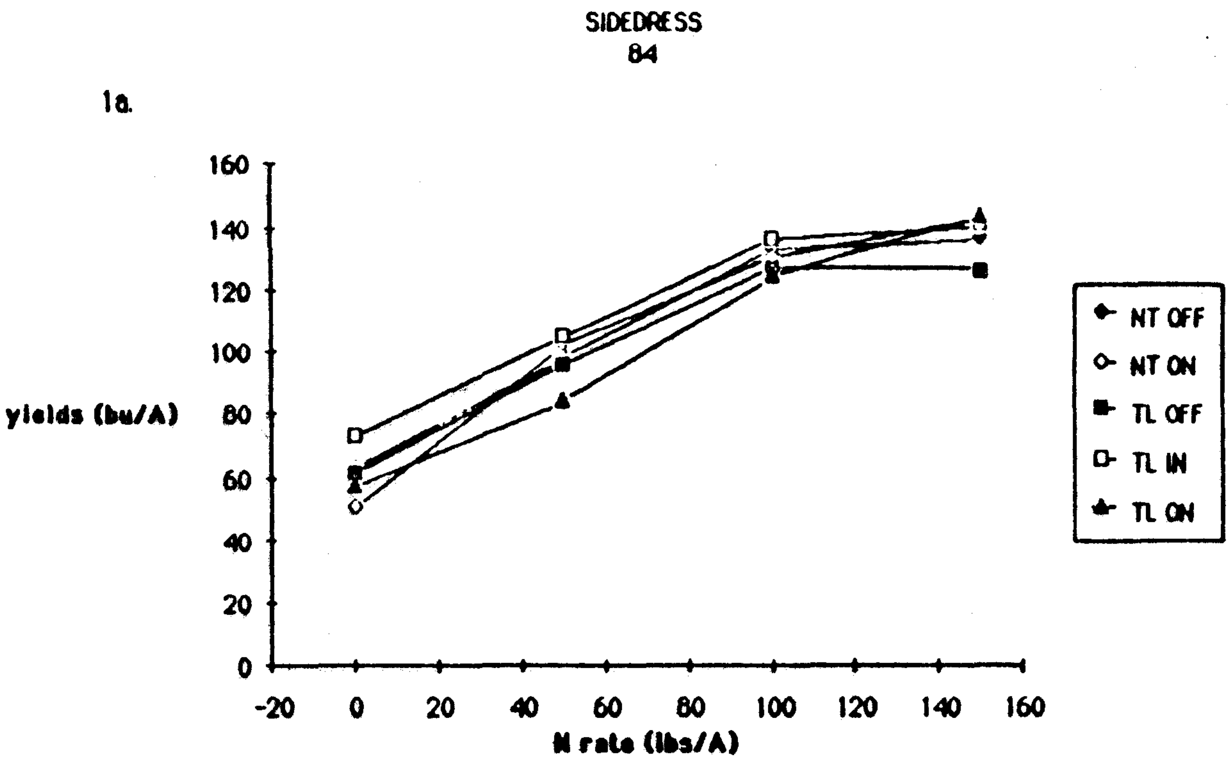
This brief desription of the data show differing results between the two sites. Part of this difference could be attributed to the two different soil types and the weather conditions being somewhat different between the two locations. Mead corn was planted in mid May when soil conditions were wet and somewhat cool while the Clay Center corn was planted in mid June because of complicating problems of weather and wildlife wiping out an earlier planted crop.

Tagged N was applied at both sites in the 50 and 100 lb N rates in both the sidedress and the broadcast treatments. Analysis of the the corn and soil samples hopefully will show more information about the uptake, cycling, volatilization, and leaching when the crop and soil samples are analized.

Figure 1

Graphical relationships of Tillage-Residue treatments to Yields compared over all N rates for Clay Center.

1a.



1b.

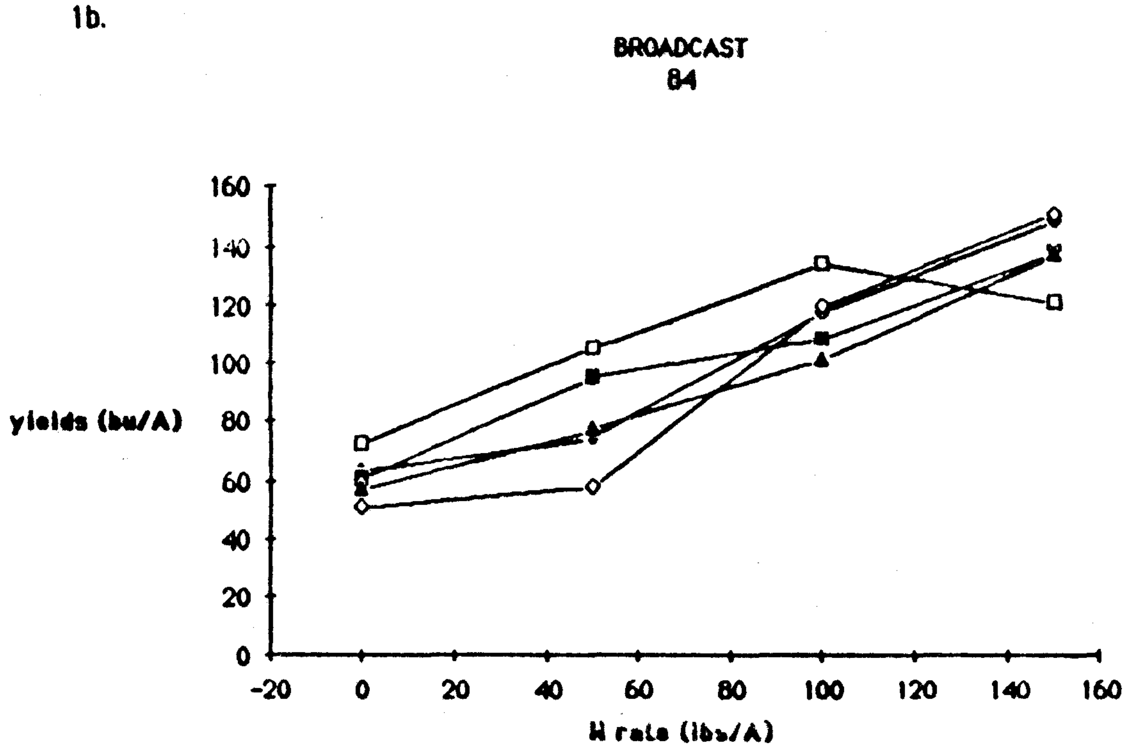
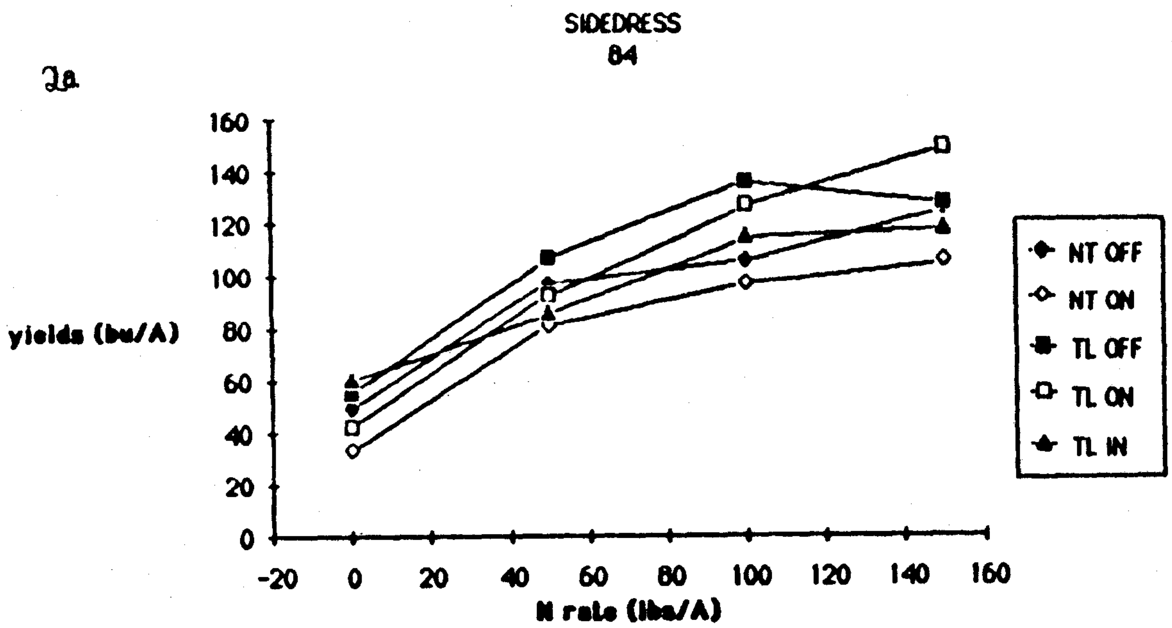


Figure 2

Graphical relationships of Tillage-Residue treatments to Yields compared over all N rates for Mead.

2a.



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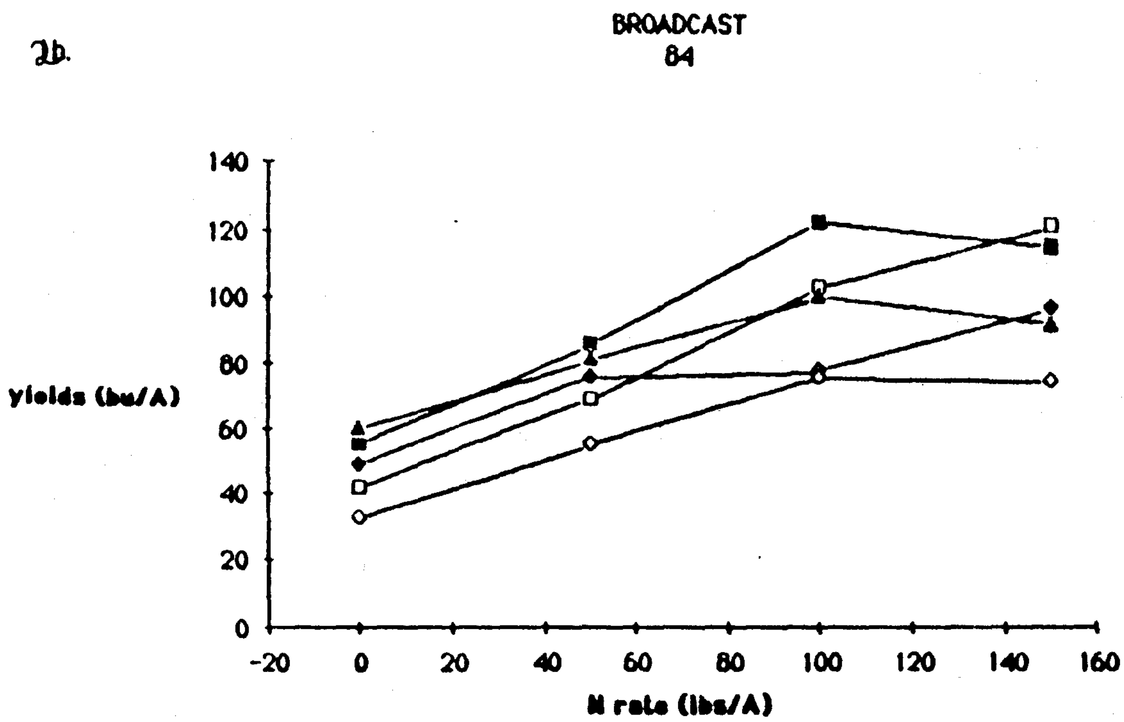

Interseeding Alfalfa or Rye in Irrigated Corn Production

G. J. Teichmeier and R. A. Olson

Objective: To determine benefits that might be derived from interseeding alfalfa on low N plots and rye on high N plots with irrigated continuous corn production.

Procedure: This is part of a long-term N management study on Sharpsburg sicl with corn irrigated in furrows. Beginning in 1974 the 240 lb N plots were split with half interseeded to rye immediately after ridging. Correspondingly, check plots were split beginning in 1977 with half seeded to alfalfa after ridging. These green manure crops were then allowed to grow until primary tillage or till planting was done in the following spring.

Experimental Results: Yield benefits during the early years of this study were not promising. From 1979 onwards, however, the interseeded alfalfa has consistently increased yields on those plots where no N was applied. The average 13 bu/a increase for the 1977-84 period would certainly warrant the cost and effort of alfalfa seeding.

As with alfalfa, rye interseeding was delayed in showing a benefit, but from 1981 onwards yield increases have been consistent. The 11 bu/a increase for the 11-year period reflects a definite economic advantage for the practice.

Apparently part of the benefit from the interseeding practice can be attributed to enhanced N availability for the corn. This is indicated by the enhanced soil mineralization potential of samples collected in 1984 (hydrolyzable N procedure). But there is undoubtedly other improvements, physical or otherwise, effected by the rye and alfalfa growth creating a more favorable environment for nutrient release and uptake that is so commonly observed in rotation systems compared to monoculture.

The results presented here are not as good as should have been if good stands of the rye and alfalfa had been acquired in all years. Moisture availability in relation to timeliness of rainfall and irrigation has been critical with the surface seeding operation. The new seeding was lost on occasions when a week or so passed following germination without a moisture increment, especially on the ridges. It seems likely that the interseeding practice would work better with sprinkler than furrow irrigated fields. Somewhat earlier seeding as could be accomplished without the ridging operation would be helpful, assured frequency of a moisture increment would be greater, and much of the seed would not be subtended on a ridge that dries out rapidly between moisture events.

Table 1. Influence of Interseeded Rye or Alfalfa on Irrigated Corn Yields, Sharpsburg Sicl, Mead Field Lab, 1974-1984.

Year	No N: With Alfalfa	No N: w/o Alfalfa	240 N: With Rye	240 N: Without Rye
	bu/a			
1974	--	--	87	98
1975	--	--	128	129
1976	--	--	133	115
1977	86	85	111	109
1978	146	152	165	178
1979	144	96	--	--
1980	70	59	126	125
1981	121	109	171	142
1982	93	72	181	149
1983	64	53	145	120
1984	61	51	133	101
Ave.	98	85	138	127
	Mineralizable NH_4^+ in Soil, ppm N			
1984	64	60	76	69

High Yield Corn-Soybeans-Wheat Rotation Study

R. A. Olson, W. R. Raun and G. J. Teichmeier

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.

Good yields of all crops have been acquired during the three years of study to date despite excessively wet springs and summer drouths. The one exception is the loss of wheat to winter kill in 1984 (Table 1). Both wheat and soybeans have achieved top yields with 20 tons manure applied in alternate years, giving evidence of response to both N and P in the manure. Corn, however, has required substantially more of nutrients than provided by the manure, the latter being approximately equivalent to 80 lbs inorganic fertilizer N/a after two manure cycles. Monoculture corn adjacent has approximately equalled the rotation corn at this early stage with N only applied, but appears to have dropped off with higher N plus P treatment.

A reasonable equilibrium with treatments has probably been reached after these first three years. Henceforth we anticipate calculating the total energy inputs and costs for fertilizers, irrigation and tillage and equating these in economic analyses with crops harvested for comparison of the rotation and monoculture systems.

Table 1. Grain yields in high yield rotation experiment, 1982-84. Mead Field Lab on Sharpsburg sicl.

Treatment[1/]	Average grain yields, bu/a			
	---------- Rotation --------			
	Corn	Soybeans	Wheat	Continuous Corn
Control	95	42	29	91
20T manure (alt. years)	133	50	44	--
80+0+0	129	46	35	135
160+0+0	141	47	37	144
160+40+0	150	50	44	148
160+40+40	158	47	46	--
160+40+40+20S+10Zn +1B+0.5Cu	158	48	46	--
320+80+80	166	52	45	144[2/]
160+40+40+20T manure	165	52	45	--

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

2/ N rate of 240 rather than 320 and no K.

PLACEMENT OF N AND P FERTILIZERS FOR MINIMUM TILL CORN UNDER SPRINKLER IRRIGATION

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

Objective: To evaluate different N and P sources and methods of placement for improving fertilizer use efficiency in sprinkler irrigated corn.

Procedure: The N study was established in 1983 and 1984 on the Mead Field Lab on Sharpsburg sicl using an adapted Buffalo All-Flex Till Planter* for both planting and preplant treatments. Experimental design was an incomplete factorial randomized complete block involving six placement methods, five carriers, and two rates (plus check). Sidedress and preplant injection involved only NH_3, and UAN was the only source with which fertigation was employed. P and S were applied supplementally to plots as needed for balancing the P of urea ureaphosphate or the S of S-coated urea.

The P study was conducted at two sites in 1983 and 1984, on Sharpsburg sicl on the Mead Field Lab and Coly sil on the Raun farm in Loup County with the same Buffalo planter. A complete factorial randomized complete block design was employed involving four methods, three carriers and two rates (plus check) with all carriers applied in liquid form. A uniform 200 kg/ha N rate was used, adjusted with NH_3 to compensate varied N composition of the P sources.

All plots were planted into corn stover residue, receiving no tillage beyond that afforded by the planter and were sprinkler irrigated.

Results and Discussion - N study : Consistent with results found in 1983, the main effect of treatments was highly significant (Table 2). Yield responses to N fertilization, from 90 to 180 kg/ha were found in 1984. Extremely hot and dry conditions in 1983 prevented any yield response beyond 90 kg/ha applied N.

Although "factorial treatments vs remaining treatments" was not significant in either 1983 or 1984, both anhydrous ammonia (injected preplant and sidedressed at the 8 leaf stage) treatments demonstrated superior yields to the methods employed within the factorial. This effect is confounded within the "factorial vs remaining" test due to the presence of the poor yielding fertigation method within the "remaining treatments."

Within the factorial arrangement, a significant source effect was found. Sulfur coated urea and urea ureaphosphate demonstrated superior yields to either urea or urea ammonium nitrate sources. However, no differences were found between sulfur coated urea and urea urea phosphate or between urea and urea ammonium nitrate. Yields peaked at the 90 kg/ha rate for the urea ureaphosphate source. All other sources demonstrated further increase in yield from the 180 kg/ha rate. Yields for UUP at the 90 kg/ha N rate were not significantly different from those obtained at the 180 kg/ha N rate for UAN, SCU and UREA.

1/ This study is carried out in cooperation with the Tennessee Valley Authority

* Equipment provided by Fleischer Mfg. Co., Columbus, NE

The incorporation of the sulfur coated urea source (i.e., band to the side of the seed) demonstrated a decrease in yield relative to the dribble surface band and broadcast preplant methods at the 180 kg/ha N rate. The exact opposite was found at the low N rate. While there was no yield response beyond 90 kg/ha N for UUP, yields nearly doubled at the 180 kg/ha N rate for the UAN source.

Results and Discussion - P Study:

Loup City 1984: At this site, significant method, source and replication effects were found. Dual placement and broadcast preplant treatments were found to have higher yields than the band to the side of the seed and band below the seed treatments. Urea phosphate demonstrated significantly higher yields than either ammonium polyphosphate or diammonium phosphate sources at the .10 level of significance. However, in 1983, there were no yield differences that could be attributed to the source main effect. Therefore this coming year's data should provide some insight into the long term effects of the different sources used on minimum tillage corn.

Yields at this site continued below that expected for irrigated corn in Nebraska. The site selected is located on an eroded hillside where low surface and subsurface soil P levels (Bray & Kurtz P-1) exist.

Mead 1984: At this location, the only main effect that was significant at a .15 level of significance was method. However, the contrasts among methods demonstrated differences at the .05 level between 1) band below and band to the side of the seed treatments, 2) band to the side of the seed and broadcast preplant treatments, and 3) band to the side of the seed and dual placement treatments. Band to the side of the seed was in effect a superior method of placement compared to the other three methods employed at this location in 1984.

Consistent with 1983 results, yields failed to respond to applied P and or the source of P used at Mead.

Table 1. N and P Placement for Irrigated Corn with Reduced Tillage, 1983 and 1984.[1/]

N Study

N Rate (across all carriers, methods)	1983 (kg/ha)	1984 (kg/ha)
0	3062	3734
80	4895	8237
160	4818	9787
Carrier (all rates, placements)		
NH_3	5753	10029
UUP	5195	9134
UAN	4525	8216
UREA	4872	8721
SCU	4347	9299
Check	3062	3734
Placement		
Sidedress	5988	9767
Injected preplant	5518	10290
Band side	5022	9059
Dribble surface band	4725	8381
Bndcst preplant	4572	9063
Fertigation	4068	8210

P Study

P Rate (all carriers, placements) kg/ha	- - - - - kg/ha - - - - -			
	Loup City		Mead	
	1983	1984	1983	1984
0	3491	3129	8607	7859
9	4891	5219	7792	8746
18	4865	5921	8109	8780
P placement (all rates, carriers)				
Band side	4296	4686	8279	8679
Band below	4262	4869	8131	8670
Dual placement	5854	6575	7720	8670
Bdcst preplant	5100	6149	7671	86[illegible]9
P carrier (all rates, placements)				
APP	4451	5433	8150	8759
DAP	4911	4981	8058	8742
UP	5271	6296	7643	9073

1/ Soils were Sharpsburg sicl at Mead, pH 6.0 and 6.2 and B and K P1 of 14.7 and 9.1 ug/g for the N and P studies, respectively. The Loup City site on Coly sil had pH of 7.4 and B and K P1 of 6.2 ug/g.

Table 2. N Study Analysis of Variance for Grain Yield as Influenced by Replication, Method, Source Rate and Interaction Variables, 1983-1984.

Year Source	df	F	1983 PR>F	(num df, den df)	C.V.
Model	33	1.95	.0116	(33,62)	22.6
Rep	2	3.88	.0259	(2,62)	
Trt	31	1.83	.0220	(31,62)	
Chk vs oth	1	15.75		(1,62)**	
among chk	1				
among oth	29				
Factorial part	23	1.04		(23,62)	
Rates	1	.17		(1,62)	
Methods	2	1.09		(2,62)	
Sources	3	1.98		(3,62)	
Rate*Method	2	2.88		(2,62)*	
Rate*Source	3	.41		(3,62)	
Method*Source	6	.73		(6.62)	
R*M*S	6	.69		(6,62)	
Fac vs rem	1	2.19		(1,62)	
among rem	5				
Error	62				
Year			1984		
Model	33	6.92	.0001	(33,62)	14.36
Rep	2	14.53	.0001	(2,62)	
Trt	31	6.43	.0001	(31,62)	
chk vs oth	1	9.98		(1,62) **	
among chk	1				
among oth	29				
Factorial part	23	3.64		(23,62) **	
Rates	1	31.55		(1,62) **	
Methods	2	2.50		(2,62)	
Sources	3	2.74		(3,62) .06	
Rate*Method	2	1.05		(2,62)	
Rate*Source	3	4.79		(3,62) **	
Method*Source	6	1.70		(6,62)	
R*M*S	6	2.07		(6,62)	
Fac vs rem	1	2.85		(1,62)	
among rem	5				
Error	62				

* and ** indicate significance at the .05 and .01 levels respectively.

Table 3. P Study Analysis of Variance for Grain Yield as Influenced by Replication, Method, P Source, Rate and Interaction Variables, 1983 and 1984.

1983		Loup City			Mead		
Source	df	F	PR>F	C.V.	F	PR>F	C.V.
Model	25	1.90	.0294	28.11	.89	.6107	21.73
Rep	2	3.15	.0522		3.28	.0465	
Method	3	5.49	.0026		.55	NS	
Source	2	2.16	.1270		.59	NS	
Rate	1	.01	NS		.61	NS	
M*S	6	1.96	.0917		.66	NS	
M*Rate	3	.50	NS		.22	NS	
S*Rate	2	.51	NS		.44	NS	
M*S*Rate	6	1.02	NS		1.15	NS	
Error	46						
		R square .507			R square .327		
1984		Loup City			Mead		
Model	25	3.04	.0005	26.78	1.73	.0604	11.01
Rep	2	6.02	.0048		7.39	.0019	
Method	3	7.06	.0005		2.20	.1034	
Source	2	4.81	.0126		0.80	NS	
Rate	1	3.99	.0518		0.80	NS	
M*S	6	2.75	.0227		1.17	NS	
M*Rate	3	3.06	.0375		0.64	NS	
S*Rate	2	0.27	NS		1.25	NS	
M*S*Rate	6	0.51	NS		1.32	NS	
Error	46						
		R square .623			R square .520		

Contrast	Loup City df	Loup City PR>F	Mead df	Mead PR>F
9 kg/ha vs 18	1	.0518	1	NS
UP vs DAP	1	.0038	1	NS
APP vs DAP	1	NS	1	NS
APP vs UP	1	.0510	1	NS
BB vs BR	1	.0133	1	NS
BB vs BS	1	NS	1	.0494
BB vs DP	1	.0013	1	NS
BR vs BS	1	.0051	1	.0321
BR vs DP	1	NS	1	NS
BS vs DP	1	.0004	1	.0335

BB (Band Below
BS (Band Side)
BR (Broadcast Pre-plant)
DP (Dual Placement)

THE SALT EFFECT OF UREA PHOSPHATE AND AMMONIUM POLYPHOSPHATE AS INFLUENCED BY THE ADDITION OF CLAY

Gary W. Hergert, WCREC; Ken D. Frank (formerly at SCREC);
George W. Rehm (formerly at NEREC); and Don Sander

Objective: Evaluate the salt effect of urea phosphate and ammonium polyphosphate based fertilizers, with and without 2% clay, applied at different rates of salt (N + K) on emergence and early plant growth of corn.

Procedure: This study was conducted at three locations in Nebraska during the 1982 growing season. Three fertilizer materials (10-34-0, 7-21-7, and 8-20-0) formulated with and without 2% clay were applied at rates to supply 0, 12, 24, and 36 lb. of "salt" per acre. The amount of salt was calculated by adding the amount of N to the amount of K applied per acre. A randomized complete block design with 4 replications was used at each location. The 8-20-0 was a urea phosphate formulated by TVA.

The soil at the North Plate (Sandhills Ag Lab) site was a Valentine loamy fine sand. The corn (Pioneer 3732) was planted on May 7 at a population of 29,500 plants per acre.

The soil at the Clay Center site was a Hastings silt loam. This site was planted to Pioneer 3382 on May 10. The planted population at this site was approximately 33,000 plants/acre.

The soil at the experimental site at the Northeast Experiment Station was classified as an Alcester silt loam. The corn (Golden Harvest 2445) was planted at this site on June 10. The planted population was 18,905 plants/acre.

At all locations, the fertilizer materials were placed in direct contact with the seed. This required some modification of the planter units used. However, every effort was made to insure that the fertilizer was placed as close as possible to the seed. The row spacing was 30 inches at all sites.

Stand counts were taken at 3 to 4 weeks after emergence at all locations. Additional counts were taken at 5 and 7 weeks after emergence at the Clay Center location. Whole plant samples were collected and weighed at the time of the initial stand count. Grain yields were recorded at the Northeast Station.

Results and Discussion: The effects of rate of "salt" applied, material, and clay addition on stand emergence are summarized in Tables 1, 2, and 3. There were no significant interactions among variables at any location, therefore, main effects are summarized in these tables.

Although there was variation with respect to planting date, planted population and other management practices within locations, there were consistent effects across locations. Neither the fertilizer material used nor the presence of clay had any significant effect on emerged stand at Clay Center and the Northeast Station. Single degree of freedom tests showed fertilizer source differences at the North Plate location but no effect of clay (Tables 2 and 3).

The amount of "salt" applied did affect corn emergence. At North Platte, stand reductions were measured when the rate of "salt" applied exceeded 12 lb/acre. The 10-34-0 had the largest effect on stand, especially the 36 lb rate (Fig. 1). Amazingly, the seed would tolerate 24 lb salt with minimal (less than 10%) stand reduction for all fertilizers. Clay addition did not reduce salt injury. The 7-21-7 caused the least amount of damage. The soil was fairly dry at planting, but the seed was planted into moist soil. No rain occurred until Monday the 19th, so there was time for salt injury as the seed imbibed water. Data would indicate more "salt" effect from NH_4^+ than K.

The application of 36 lb of "salt" per acre reduced stand emergence at the Clay Center and Northeast Station locations.

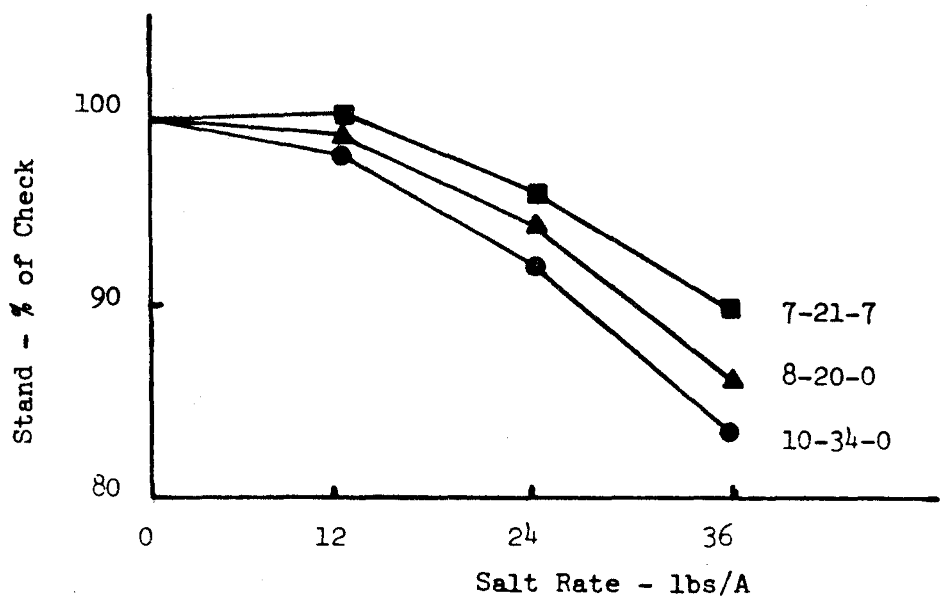

Figure 1. Effect of fertilizer sources on plant population (Sandhills Ag Lab).

Based on research conducted to date, the effect of "salt" on corn emergence is related to the moisture content of the soil at planting. The effect has generally been more severe at lower moisture contents. The soil moisture was either high or excessive during the early portion of the 1982 growing season for most of Nebraska. Therefore, damage from any fertilizer applied in association with the seed would be expected to be limited. The sandy soil at the North Platte site was not as wet at planting as the silt loam soils at the other sites. Consequently, it is not surprising that the 24 lb/acre rate of salt reduced the stand at this site.

Although planting at the Northeast Station site was delayed until June 10, the moisture content of the soil near the seed was in excess of 18%. This apparently was enough moisture to reduce any adverse effects of the lower rates of "salt" applied close to the seed.

Plant weight data from Clay Center and Northeast Station locations are summarized in Tables 4, 5, and 6. Plant weights were increased by rate of application of fertilizer at the Clay Center site. This variable had no effect on the weight of plants from the Northeast Station. The fertilizer material used, as well as the presence of clay, had no effect on plant weight at either location.

At the Northeast Station neither rate of "salt" applied, fertilizer material, nor presence of clay had any significant effect on grain yield. Although the application of 36 lb salt per acre reduced the emergence, this reduction was not reflected in yield. The corn crop was apparently able to compensate by forming larger ears on the plants which did emerge. Yields were not harvested at the Clay Center or North Platte locations.

Funding for this research and fertilizers were provided by TVA.

Table 1. The effect of rate of "salt" applied on emerged stand measured 3-4 weeks after emergence.

	Location		
"Salt" Applied	North Platte	Clay Center	Northeast Station
lb/acre	plants/acre		
0	28,295 a	34,979 a	18,817 a
12	28,223 a	34,717 a	18,817 a
24	26,662 b	34,020 a	17,772 a
36	24,530 c	32,322 b	16,553 b

Table 2. Corn emergence measured 3-4 weeks after emergence as affected by the fertilizer material applied.

	Location		
Material	North Platte	Clay Center	Northeast Station
	plants/acre		
10-34-0	25,792 a	33,759 a	17,250 a
7-21-7	27,189 c	34,739 a	17,076 a
8-20-0	26,436 b	33,519 a	18,295 a

Table 3. The influence of clay formulated with 3 fertilizer materials on corn emergence measured 3-4 weeks after emergence.

	Location		
	North Platte	Clay Center	Northeast Station
	plants/acre		
No clay added	26,711 a	34,035 a	17,947 a
clay added	26,233 a	33,977 a	17,773 a

Table 4. The effect of rate of "salt" applied on weight of young corn plants.

"Salt" Applied	Location: Clay Center	Location: Northeast Station
lb/acre	g/plant	g/plant
0	97 a	19.5 a
12	113 b	20.7 a
24	135 c	21.0 a
36	129 c	20.0 a

Table 5. Weight of young corn plants as affected by the fertilizer material applied.

Material	Location: Clay Center	Location: Northeast Station
	g/plant	g/plant
10-34-0	122	19.3
7-21-7	130	20.8
8-20-0	126	21.3

Table 6. The effect of the presence of clay in a fertilizer material on the weight of young corn plants.

	Location: Clay Center	Location: Northeast Station
	g/plant	g/plant
No clay added	128	20.0
clay added	124	20.5

Emergence of Corn as Affected by Source and Rate of Solution Fertilizers Applied with the Seed

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

Objectives: Salt rates of 5 and 5 to 7 lbs of salt applied with the seed have generally been considered safe for sandy and non sandy soils, respectively. Current applications of the salt index do not consider added salting agents other than N and K_2O. In light of the different rates at which delayed emergence or reductions in stands have been found, and because current recommendations are made that exceed these "safe" rates, the objectives of this study were to determine 1) the effect of rate of applied salt with the seed and 2) the effect of the sources used on emergence of corn in a fine textured soil.

Procedure: Three experiments were established in 1984 at the Mead Field Laboratory on a Sharpsburg silty clay loam (Typic Argiudoll). Planting of each experiment took place on June 8, June 27, and July 24, respectively. These three dates were selected to obtain different environmental conditions for corn emergence. The first experiment employed a completely randomized design with a full rep by rate by source factorial arrangement. Three rates (5, 10, and 20 lb/ac) of applied salt (N + K_2O) were used. The four sources included 1) 7-21-7 [white acid polyphosphate + KCl] , 2) 7-21-7T [7-21-7 + ammonium thiosulfate], 3) 9-18-9 [concentrated phosphoric acid + potassium hydroxide] and 4) 10-34-0 [green acid ammonium polyphosphate]. One, two and four gallons of ammonium thiosulfate/ac were applied with rates of 5, 10 and 20 lb of salt, respectively. Only the added N from the ammonium thiosulfate (when mixed with 7-21-7) was used when determining the respective salt rates. The second and third experiments were established using a randomized complete block design with a full rep by rate by source factorial arrangement. The sources used for the second and third experiments were consistent with the first study. The second and third experiments included an additional rate of 15 pounds of salt per acre applied with the seed. In each experiment, check plots (o lbs/ac applied salt) were replicated for each rate and source used (8 and 12 checks respectively for the two designs).

'Pioneer 3377' corn was planted for each experiment. The center 10 ft from 30 ft plots was marked to determine the number of seeds emerged at periodic times following planting. Emergence counts were continued for each study until there were no further changes in the number of plants emerged. A population of 28,260 seeds/ac planted in 30-inch rows was used for all three experiments. Sixteen plants per 10 linear feet represented 100% emergence.

Results and Discussion: This study demonstrates that for all sources included, salt rates of 5 lbs applied with the seed can reduce stands significantly under extremely wet and dry conditions (exp #1, exp #3). All rates equalling or exceeding 10 lbs of salt applied with the seed for all sources and experiments generally reduced the number of emerged plants by more than 7%. Rates of 5 and 5 to 7 lbs of salt/ac applied with the seed of corn are considered safe for sandy and no sandy soils, respectively. These rates of salt applied with the seed proved to be reliable for the second study but did not hold true for either of the first or third experiments. Modeling provided some success in predicting emerged plants, however, broad ranges in the equations and correlations were found for the existing environments. Late emerged plants were found in all experiments for all sources at higher rates of applied salt which would simply become weeds. Sources were found to respond the same over environments and rates. This suggests that current recommendations of reduced "salting effects" due to sources may not be as important a factor as contended by some. Future changes in the determined salt index must be established that include carrier sources other than N and K while at the same time considering the form of N and K used in the solution source. At a given "salt rate" it would be therefore difficult to relate the starter effect of each material due to the differences in the phosphorus carriers.

Table 1. Precipation prior to and following planting for experiments 1, 2, and 3.

Environment	Experiment #1			Experiment #2			Experiment #3		
	Date of Emergence Count	Date of Rain	(in)	Date of Emergence Count	Date of Rain	(in)	Date of Emergence Count	Date of Rain	(in)
		Jn 2	1.31	Jy 2				Jy 17	.18
		Jn 4	.26	Jy 3	Jy 3	.02		Jy 26	.35
		Jn 5	.38	Jy 4	Jy 4	.52	Jy 30		
		Jn 9	1.10	Jy 5			Jy 31		
		Jn 11	.22	Jy 6	Jy 6	.57	Ag 1		
		Jn 12	1.05	Jy 10			Ag 2		
		Jn 13	.80	Jy 12			Ag 4	Ag 4	.02
		Jn 15	.27	Jy 16			Ag 6		
		Jn 17	1.06				Ag 8		
	Jn 18	Jn 18	.08				Ag 15		
	Jn 19							Ag 20	1.25*
	Jn 20							Ag 21	.95
	Jn 21						Ag 24		
	Jn 25						Ag 27		
							Ag 31		
								Sp 2	1.10
								Sp 4	.05
								Sp 8	.12
								Sp 10	.02
							Sp 18		
Planting:	June 8			June 27			July 24		
Moisture % Soil 2"	21%			7%			5%		
Soil pH	6.3			6.3			6.5		
B&K P 1	15 ug/g			15 ug/g			17 ug/g		

*artificial watering

Table 2. Emergence Percentages for Sources and Rates, Experiments 1, 2, and 3.

Exp. and Count Date	Check	7-21-7T 5	7-21-7T 10	7-21-7T 15	7-21-7T 20	7-21-7 5	7-21-7 10	7-21-7 15	7-21-7 20	9-18-9 5	9-18-9 10	9-18-9 15	9-18-9 20	10-34-0 5	10-34-0 10	10-34-0 15	10-34-0 20
		percent of total															
Exp #1 June 25	88	69	50		63	63	66		44	63	53		38	66	78		53
Exp #2 July 4	28	48	38	2	4	35	10	17	15	50	33	15	19	31	10	10	10
Exp #2 July 10	96	94	91	83	75	94	89	91	77	100	94	83	88	94	89	85	79
Exp #3 Aug 6	87	64	58	48	46	71	75	41	35	83	54	63	50	83	50	35	71
Exp #3 Aug 31	89	69	66	52	50	75	75	60	56	85	77	71	71	85	77	41	81

EFFECTIVENESS OF LEMAIRE PRODUCTS IN SOYBEAN PRODUCTION

C.A. Shapiro

Objective: To evaluate Lemaire Dynam and Stimulgine A in the production of soybeans.

1. Determine if Stimulgine A was effective in reversing atrazine toxicity effects on soybeans.

2. Determine if Dynam was effective in increasing yield of soybeans.

Procedure: These two projects are distinct and were conducted separately.

Stimulgine `A´

1. Five rates of atrazine were applied on May 22, 1984. Century soybeans were planted June 20, 1984.

2. When atrazine toxicity symptoms were evident Stimulgine `A´ was sprayed once or twice for each atrazine rate. Damage ratings and grain yield were collected.

Dynam

1. The Dynam material was analyzed for mineral nutrients (Table 1). A composite treatment that had the same nutrients as the Dynam was mixed and included as a treatment.

2. A site on station was selected that was moderate in phosphorus (Table 2). The full fertilization treatment was based on the soil p levels.

3. Leaf samples were taken at flowering and analyzed for N, P, K, S, Cu, Fe.

4. Grain yield was also collected.

Experimental Results: Stimulgine - Yields were reduced by atrazine pre-treatment and this was collaborated by the damage ratings (Table 3).

No Stimulgine `A´ applications helped soybeans resist atrazine toxicity. Increased atrazine rates increased yield reductions. Control yields were lowered due to weed pressure. Control treatments had no herbicide, so the low level of atrazine reduced weeds, but did not affect soybean yields.

This material has alleged phyto-stimulation properties that would be difficult to analyze. Consequently no analysis were performed.

Dynam - Yields were not increased by Dynam (Table 4) or the normal fertilizer program. The late planting date and an early frost lowered yield levels. Dynam is mainly a liming material and is an unlikely yield stimulator for northeast Nebraska.

Leaf tissue nitrogen analysis indicated no difference due to treatment.

Table 1. Mineral analysis of Lemaire product, Dynam, by X-ray fluorescense and composite treatment for Dynam experiment. June 1984. UN-L Soil Testing Laboratory.

Element	Concentration	@446 lbs Dynam #/ Acre Nutrient	In Composite Fertilizer[1]
N	0.72%	3.21	Yes
Ca	0.32%	142.7	Yes
Mg	3.3%	14.72	Yes
K	0.10%	0.446	No
P	0.12%	0.535	No
S	0.28%	1.249	Yes
Cl	0.18%	0.803	No
Si	1.10%	4.91	No
Mn	29 ppm	0.013	No
Fe	427 ppm	0.190	No
Cn	3 ppm		No
Zn	4 ppm		Yes(2.5 lbs/A)
Mo	10 ppm		No

[1]Composite of MgO, Lime, Urea, $ZnSO_4$. Other elements may be present as impurities in these fertilizer sources.

Table 2. Soil analysis results and full fertilization for Dynam test site. Concord, NE 1984.

Nutrient	Depth 0-8"	8-30"	Fertilizer Applied
			lbs/A
NaBicarb P	13.3 ppm	2.8	20 P_2O_5
NH_4-N	34.9 ppm	3.7	
Total N	.125%	.059%	(interpreted as NH_4-N+ O.M.-N)
NO_3-N	31.0 ppm	1.9	
DPTA			
Zn	.44	.22	10 lbs Zn as $ZnSO_4$
Fe	9.4	10.7	
Mn	9.6	10.5	
Ca	.97	1.00	
pH	7.9	8.1	
OM	1.8	.8	

Table 3. Effect of atrazine pre-treatments on damage ratings and yield of soybeans. Concord, NE. 1984.

Atrazine Rate (AI)	Damage Rating[1]	Yield[1]
lb/Acre		-bu/Acre-
0	0.4 a	29 a
0.2	0.2 a	33 a
0.4	0.2 a	32 a
0.8	1.3 b	31 a
1.6	3.1 c	18 b

[1]Effect of Stimulgine 'A' was not significant. No significant interaction between Atrazine and Stimulgine 'A'.

Table 4. Treatments included in "Dynam" soybean fertilizer experiment. Concord, NE. 1984.

Treatment	Regular Fertilizer[1]	Special Additive[2]	Soybean Yield	Leaf Nitrogen
			-bu/A-	-%-
1	0	Dynam	17.3	5.1
2	0	Composite	19.9	4.9
3	0	None	18.5	5.0
4	1/2 rate	Dynam	17.6	5.4
5	1/2 rate	Composite	20.4	5.3
6	1/2 rate	None	15.8	4.9
7	Full	Dynam	18.9	5.1
8	Full	Composite	20.5	4.8
9	Full	None	18.0	4.7
	LSD .05		NS	NS

[1]1/2 rate is 10 lbs/Acre P_2O_5 and 5 lbs Zn/acre as Zn SO_4.
[2]Dynam rate at 446 lbs/acre
[3]Composite to simulate major nutrients in 446 lbs Dynam.

POTASSIUM RELEASE FROM COARSE-TEXTURED
FELDSPATHIC SOILS

D. L. McCallister

Objective: 1. To characterize the potassium (K) fractions in several coarse-textured feldspathic soils.

2. To determine the K released from different size separates in such soils.

Procedures: A group of soils typical of the Nebraska Sandhills was sampled in July 1984. Both A and C horizons of these soils, as well as the A horizon of a fine-textured soil typical of eastern Nebraska, were extracted with various reagents to arrive at estimates of the various K "pools". These pools are usually described as available, slowly available, and unavailable, although there is some movement of K among them. The soils were characterized with respect to their particle size distribution, chemical properties, and mineral distribution.

Experimental Results: Table 1 illustrates the chemical and physical properties of the 5 soils in the study. The 4 Sandhills soils have predictably coarse textures and low cation exchange capacities, as well as pH values near or above neutrality. The finer textured Sharpsburg has a higher CEC but lower pH due to leaching. Available potassium content based on routine soil test procedures was diagnosed as high or very high for all except the Valentine (E) C horizon sample, which was medium (Table 2). Thus no immediate K deficiencies would be expected on any soil tested. The quantities of slowly available K in the soils are not greatly different either, but still follow approximately the clay content in the soils (Table 2). The unavailable or total K content of the soils varies by only about 20%, despite their wide textural differences. This is due to the presence of different K-bearing minerals, micas in the Sharpsburg, and feldspars in the Sandhills soils. By itself, however, total K has not been found to be a good predictor of plant availability.

Because most K which is or will become rapidly available to plants is usually assumed to be in the clay fraction, this size fraction was analyzed in the same way as the whole soil. The differences in slowly available K which appeared for the whole soils are gone (Table 3) indicating a similarity in the clay mineralogy of the soils. This was confirmed by x-ray diffraction analysis. If it is assumed, however, that the clay fraction of these soils is the only source of slowly available K, and calculations are made using slowly available K from clay to predict slowly available K in the whole soil, there is a consistent under estimation of about 50%. This can be seen by comparing the next to last column of Table 2 with the last column of Table 3. Thus a substantial portion of the long-term K release in all of the soils studied will come from the silt or sand size fraction. Even under intensive cropping, these sandy soils would not appear to be prone to developing K deficiencies in the first years of row crop production.

Table 1. Chemical and physical properties of soils sampled.[1]

Soil series	Horizon	pH	Organic matter	Cation exchange capacity	Sand	Silt	Clay
			%	(meq/100g)	- - - - -	%	- - - - -
Valentine (B)[2]	A	6.6	1.4	5.1	82.5	11.9	5.6
	C	7.0	0.6	6.5	80.6	12.6	6.8
Valentine (E)[2]	A	7.0	0.6	3.4	93.2	3.8	3.0
	C	6.8	0.3	3.1	93.9	2.7	3.4
Elsmere	A	6.9	2.6	10.4	72.9	18.9	8.2
	C	8.6	0.6	6.1	80.2	14.6	5.2
Dunday	A	6.4	2.0	6.8	79.8	13.9	6.4
	C	7.1	0.6	6.4	80.3	12.1	7.6
Sharpsburg	A	5.5	4.2	25.5	1.4	69.4	29.3

[1] All values are means of duplicate determinations.

[2] Letters in parentheses refer to topography of location where soil series was sampled: B = nearly level; E = rolling.

Table 2. Potassium fractions in whole soils.

Soil series	Horizon	Available[1]	Slowly available[2]	Unavailable[3]
		ppm		
Valentine (B)	A	175	722	17,400
	C	164	732	17,100
Valentine (E)	A	134	476	17,400
	C	86	425	17,000
Elsmere	A	258	1080	18,900
	C	132	733	17,800
Dunday	A	479	1100	18,500
	C	129	797	17,600
Sharpsburg	A	508	2430	19,300

1 By soil test ammonium acetate extraction.

2 By boiling nitric acid extraction.

3 By total dissolution in perchloric and hydrofluoric acids.

Table 3. Potassium fractions in soil clays and predicted slowly available whole soil K.

Soil series	Horizon	Available[1]	Slowly available[2]	Unavailable[3]	Predicted slowly available
		ppm			
Valentine (B)	A	--	3710	17,400	386
	C	--	3460	17,600	400
Valentine (E)	A	--	3590	15,800	216
	C	--	3670	16,700	204
Elsmere	A	--	3700	18,300	580
	C	--	3530	18,300	326
Dunday	A	--	3410	19,100	656
	C	--	3490	18,000	402
Sharpsburg	A	--	3670	21,700	1600

[1] Available K not measured for clay size fractions because particle size separation required its removal.

[2] By boiling nitric acid extraction.

[3] By total dissolution in perchloric and hydrofluoric acids.

RESIDUAL EFFECTS OF ETRIDIAZOL ON A SHARPSBURG SILTY CLAY LOAM

C. A. Shapiro and A. D. Flowerday

Objective: Determine if nitrification inhibitor applications would have effects on grain yields the year following application.

Procedure: Experiments using nitrogen rates and carriers in combination with etridiazol were conducted between 1977 and 1980. Corn was grown in 1978 (Cr77E3) and 1979 (Cr277E4) following the 1977 (C77E2) corn experiment. Corn was grown in 1979 (Cr78E7) following the 1978 (C78E6) corn experiment. Sorghum was grown in 1980 (Cr79SE9) following the 1979 (C79E8) corn experiment. Sorghum was grown in 1980 (Sr79E11) following the 1979 (S79E10) sorghum experiment. In 1980 the plots were split in experiment Sr79E11. Eighty pounds of nitrogen as anhydrous was applied on half the plots.

Experimental results: No residual effects of etridiazol on grain yield were found in the residual studies (Table 1). Experiment Cr277E4 had severe stand emergence problems and had to be replanted. Yields were severely reduced and are not reported. In 1980 on the sorghum following sorghum there was no yield increase due to applied nitrogen in 1980.

There was a slight trend towards increased yield with higher previous year nitrogen treatments, but no experiment had statistically significant previous year treatment effects.

Table 1. Effect of Residual Nitrogen on Corn and Sorghum Grain Yield. Mead, Ne. 1978 - 1980.

Previous Year Nitrogen Rate	Yield				
	bu/A				
No Nitrogen	91	88			
40 lbs		96		97	103
80 lbs	88	92	88	102	101
120 lbs	89	91	88	107	96
160 lbs	97	101	94		
Year N applied	1977	1978	1979	1979	1979 & 1980
Year Yield	1978	1979	1980	1980	1980
Exp	Cr77E3	Cr78E7	Cr79SE9	Sr79E11	Sr79E11
Crop (Previous year)	Corn	Corn	Corn	Sorghum	Sorghum[1]
Crop (Residual year)	Corn	Corn	Sorghum	Sorghum	Sorghum
Effect of previous Etridiazol	NS[2]	NS[2]	NS[2]	NS[2]	
Effect of previous Nitrogen	NS	NS	NS	NS	NS

[1] 80 lbs Nitrogen applied in 1980.
[2] NS - Non-significant ANOVA at 5% level.

Soil Test Comparison Results for 1984

R.A. Olson, P.H. Grabouski, F.N. Anderson, K. Frank, and C.A. Shapiro

Objectives:

Determine the effect on yield and fertilizer cost of fertilizer recommendations based on soil samples sent to various soil testing laboratories. A complete report and summary through 1983 is available as Agronomy Department Report 44.

Procedures:

Soil samples are sent to soil testing laboratories annually. The fertilizer recommendations are applied and subsequent yields are compared. In addition cost of applied fertilizer is calculated and compared. The location at the South Central Station was not harvested in 1984 due to stand variability.

The plot established at the South Central Station was last fertilized in 1979. The plots have been rotated with soybeans and corn with no fertilizer applied. Two off-station experiments were established in 1982, one in Phelps County on a Holdrege sil with all top soil removed, and the other on a deep sandy loam in Merrick County. Laboratories A, B, D, and E are the same as the other experiments while C and F are new additions.

1984 Results:

Tables 1 - 7 contain soil test results, fertilizer recommendations and costs, grain yields as well as long term yields and costs where appropriate. Note that comparison of soil test values across years for different laboratories is not valid because all laboratories did not recommend similar nutrient amounts.

Table 4 contains the yield of soybeans and corn as influenced by fertilizer applied up to 1979.

As in prior years, there were differences in amount and cost of fertilizer recommended but little difference in grain yield.

Table 1. Soil test results, fertilizer recommendations, fertilizer costs, grain yields, and long term total grain yields for the NORTH PLATTE STATION site on Cozad sil. 1984.

	Soil Test Results by Labs					
Measurement	A	B	C	D	E(UNL)	Check
pH	6.4	6.7	6.4	6.5	6.6	
pH (Buffer)	7.2	7.3	---	7.0	---	
Phosphorus, ppm	41	40	143[1]	80[1]	18	
Potassium, ppm	576	440	570[1]	850[1]	530	
Organic Matter, %	2.3	1.2	1.7	1.5	1.7	
Nitrate-N, ppm	10	6	20	11.4	121	(lbs/A)
Calcium, ppm	1665	2520	2300[1]	2284[1]	---	
Magnesium, ppm	247	290	360[1]	380[1]	---	
Sulfate-S, ppm	8	16	86[1]	5	---	
Zinc, ppm	2.8	2.7	1.33	1.87	9.5	
Iron, ppm	19.6	26.0	8.1	21	---	
Manganese, ppm	17.9	13.3	31.1	21.3	---	
Copper, ppm	0.7	0.8	2.7	.66	---	
Boron, ppm	0.6	---	2.1	0.1	---	
Chlorine, ppm	---	---	20	---	---	
Sodium, %	33	20	30	---	---	
CEC, meq/100g	13.2	16.2	---	9.4	---	
Nutrient	**Suggested Fertilizer Program, #/A[2]**					
Nitrogen	215	215	70	220	110	
Phosphorus	30	30	---	---	---	
Potassium	30	45	---	---	---	
Magnesium	---	30	---	---	---	
Sulfur	5	30	---	15	---	
Zinc	---	---	---	---	---	
Iron	---	---	---	---	---	
Manganese	---	---	---	---	---	
Copper	---	0.5	---	---	---	
Boron	1	---	---	1	---	
Lime	---	---	---	---	---	
	Fertilizer Costs, $/A					
1984	59	73	36	51	23	
1981-1984	539	627	638	451	264	
	Grain Yield, bu/A					
1984	199	198	189	202	195	
1974-1984	1859	1914	1848	1859	1870	

[1]In lbs/A.
[2]Yield goal of 170 bu/A.

Table 2. Soil test results, fertilizer recommendations, fertilizer costs, grain yield, and total grain yield for the site on Holdrege silt loam. 1984. Phelps County.

	Soil Test Results by Labs						
Measurement	A	B	C	D	E(UNL)	F	Check
pH	7.4	6.8	6.8	7.9	7.3	7.3	
pH (Buffer)	---	7.3	6.8	---	---	---	
Phosphorus, ppm	25	42	24	35	23	21	
Potassium, ppm	514	510	548	474	574	391	
Organic Matter, %	1.4	0.9	0.8	1.4	0.9	1.0	
Nitrate-N, ppm	90	42	51	74	28	26	
Calcium, ppm	3750	4450	2820	2000	---	2677	
Magnesium, ppm	588	600	659	577	---	509	
Sulfate-S, ppm	4	15	1	5	2	8	
Zinc, ppm	2.3	1.4	0.7	2.0	10	1.33	
Iron, ppm	10.9	8.0	15.9	15	13.3	17.2	
Manganese, ppm	5.9	9.0	5.0	8	6.5	10.2	
Copper, ppm	1.1	1.5	1.2	1.0	1.33	1.15	
Boron, ppm	0.7	---	0.7	1.1	0.72	---	
Chlorine, ppm	---	---	---	---	---	---	
Sodium, %	71	70	53	95	---	60	
CEC, meq/100g	25.3	28.8	23.2	16.4	---	19	
Nutrient	Suggested Fertilizer Program, #/A[1]						
Nitrogen	210	180	180	190	180	165	
Phosphorus	35	---	20	20	---	30	
Potassium	30	---	---	---	---	---	
Magnesium	---	---	---	---	---	---	
Sulfur	20	20	25	20	---	8	
Zinc	---	4	5	3	---	---	
Iron	---	---	---	---	---	---	
Manganese	---	2	---	2	---	---	
Copper	---	---	---	---	---	---	
Boron	---	---	---	---	---	---	
Gypsum	---	---	---	---	---	---	
	Fertilizer Costs, $/A						
1984	48.50	36.10	41.70	41.90	27.00	34.15	
1982-1984	179	164	113	208	76	103	
	Grain Yield, bu/A						
1984	141a	143a	148a	144a	148a	154a	12b[2]
1982-1984	357	374	372	376	363	381	49

[1]Yield goal 170 bu/A.
[2]Yields followed by the same letter are not significantly different at the 5% level of probability.

Table 3. Soil test results, fertilizer recommendations, fertilizer cost and grain yields for the site on a sandy loam soil. Merrick County. 1984.

	Soil Test Results by Labs						
Measurement	A	B	C	D	E(UNL)	F	Check
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, #/A[1]						
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	1.25	---	---	1	---	---	
	Fertilizer Costs, $/A						
1984	82.15	77.40	44.20	71.50	30.00	49.75	0
1983	72.32	84.30	40.40	39.75	23.75	33.65	0
	Corn Grain, bu/A						
1984	214a[3]	213a	216a	224a	211a	222a	167b[4]
1983[2]	177a[3]	181a	184a	185a	183a	187a	164b[4]

[1] Yield goal 200 bu/A.
[2] Plots hailed out 1982.
[3] Yields followed by the same letter are not significantly different at the 5% level of probability.
[4] Irrigation water supplied about 140 lbs N per acre per season.

Table 4. Carry-over effect of nutrients applied to irrigated corn for six years 1974-1979 on soybean yields also the influence of previous applied nutrients and soybeans on irrigated corn yield with no additional applied fertilizer. SOUTH CENTRAL STATION. 1980-1983.

Nutrient/Yield	Total Nutrients Applied 1974-1979 by Labs Lbs./A					
	A	B	C	D	E(UNL)	Check
Nitrogen	1274	1197	1340	1180	1065	0
Phosphorus	540	330	270	317	40	0
Potassium	285	180	---	---	---	0
Magnesium	30	115	5	---	---	0
Sulfur	150	190	300	25	---	0
Zinc	18	12	36	4	7	0
Manganese	6.5	---	16	---	---	0
Copper	1	1	5	---	---	0
Boron	3	3	4	---	---	0
Lime	3000	2000	4400	2000	5000	0
Soybean Yield 1/ 1980 bu/A	50	51	50	50	49	49
Corn Yield 1981 bu/A	180	165	177	185	173	169
Soybean Yield 1982 bu/A	34	34	33	38	30	39
Corn Yield 1983 bu/A	148	148	146	148	151	147

1/ No significant differences in soybean or corn yields across years.

Table 5. Soil test results, fertilizer recommendations, fertilizer costs, grain yield and total grain yield for the Mead location. 1984.

Measurement	A	B	C	D	E(UNL)	Check
	Soil Test Results by Labs					
pH	6.5	6.6	6.5	6.6	6.0	
pH (Buffer)	---	7.2	---	6.9	6.6	
Phosphorus, ppm	44	29	---	23	18	
Potassium, ppm	299	360	360[1]	362	285	
Organic Matter, %	2.5	1.8	2.6	2.7	2.2	
Nitrate-N, ppm	11	6	0[1]	73	206	
Calcium, ppm	2191	313	2000[1]	2230	---	
Magnesium, ppm	356	460	770[1]	429	---	
Sulfate-S, ppm	9	12	46[1]	4	---	
Zinc, ppm	3.1	1.9	1.53[1]	3.5	---	
Iron, ppm	45.7	23	11[1]	---	---	
Manganese, ppm	14	8.3	17.1[1]	---	---	
Copper, ppm	1.2	0.8	2.5[1]	---	---	
Boron, ppm	0.9	---	1.4	---	---	
Chlorine, ppm	---	---	20	---	---	
Sodium, %	47	67	118	---	---	
CEC, meq/100g	14.8	20.7	---	16.7	---	
Nutrient	Suggested Fertilizer Program, #/A[2]					
Nitrogen	195	205	120	175	60	
Phosphorus	---	35	20	60	---	
Potassium	30	50	---	---	---	
Magnesium	---	---	---	---	---	
Sulfur	---	30	---	18	---	
Zinc	---	2	---	---	---	
Iron	---	---	---	---	---	
Manganese	---	2	---	---	---	
Copper	---	---	---	---	---	
Boron	---	---	---	---	---	
Lime	---	---	---	---	---	
	Fertilizer Costs, $/A					
1984	33.15	55.65	23.20	45.85	9.00	
1973-1984	744	715	799	610	380	
	Grain Yield, Bu/A[2]					
1984	121	116	106	114	110	
1973-1984	1860	1800	1776	1800	1800	

[1] In lbs/A.
[2] Yield goal 160 bu/A.

Table 6. Soil test results, fertilizer recommendations, fertilizer cost, and grain yield for 1984 and total fertilizer costs 1974-1984 for the NORTHEAST STATION dryland location.

Measurement	Soil Test Results by Labs					
	A	B	C	D	E(UNL)	Check
pH	5.9	5.6	5.9	5.8	5.9	
pH (Buffer)	6.8	6.7	---	6.3	6.7	
Phosphorus, ppm	37	40	44	39	22	
Potassium, ppm	302	280	270	310	268	
Organic Matter, %	2.3	2.4	2.9	3.7	3.0	
Nitrate-N, ppm	---	---	---	---	---	
Calcium, ppm	2478	3200	3600	1950	---	
Magnesium, ppm	517	410	800	519	---	
Sulfate-S, ppm	13	20	6	---	5	
Zinc, ppm	3	2.1	0.85	---	1.31	
Iron, ppm	48	50	13.2	---	4.6	
Manganese, ppm	53.3	30	70.7	---	53	
Copper, ppm	1.8	1.8	2.5	---	1.51	
Boron, ppm	1.7	1.2	2.4	---	1.29	
Chlorine, ppm	---	---	20	---	---	
Sodium, %	---	37	32	---	---	
CEC, meq/100g	20.7	23.3	---	18.2	---	
Nutrient	**Suggested Fertilizer Program, #/A[1]**					
Nitrogen	85	100	70	75	90	
Phosphorus	30	---	40	20	---	
Potassium	30	25	50	---	---	
Magnesium	---	---	---	---	---	
Sulfur	---	10	30	---	---	
Zinc	---	1	3	---	---	
Iron	---	---	---	---	---	
Manganese	---	---	---	---	---	
Copper	---	---	---	---	---	
Boron	---	---	---	---	---	
Lime	1	1.5	1.6	2	1.5	
	Fertilizer Costs, $/A					
1984	24.45	20.25	36.10	16.45	13.50	
1974-1984	273	263	284	293	137	
	Grain Yield, bu/A					
1984	111a	115a	109a	112a	111a[2]	
1974-1984	1033	1030	1041	1031	1046	

[1]Yield goal 90 bu/A.
[2]Yields followed by same letters are not significantly different at the 5% level.

Table 7. Soil tests results, fertilizer recommendations, fertilizer costs, grain yield and total fertilizer costs for 1981 - 1984. Irrigated corn Scottsbluff Ag Lab.

	Soil Test Results by Labs					
Measurement	A	B	C	D	E(UNL)	Check
pH	7.4	7.7	7.8	7.4	7.3	
pH (Buffer)	---	---	---	---	---	
Phosphorus, ppm	13	24	17	63[1]	19	
Potassium, ppm	307	360	246	240[1]	248	
Organic Matter, %	1.2	0.7	1	0.9	1.0	
Nitrate-N, ppm	9	20	14	---	7.2	
Calcium, ppm	1435	3500	1620	2100[1]	---	
Magnesium, ppm	308	370	357	450[1]	---	
Sulfate-S, ppm	11	18	5	20[1]	6	
Zinc, ppm	6.2	5.2	3.3	0.35[1]	3.9	
Iron, ppm	7.5	10	5	4.7[1]	7.2	
Manganese, ppm	5.4	8	3	15[1]	6.3	
Copper, ppm	0.9	1.5	0.8	2.3[1]	1	
Boron, ppm	0.5	---	0.7	0.7[1]	---	
Chlorine, ppm	---	---	---	20[1]	---	
Sodium, %	2.1	50	---	158[1]	---	
CEC, meq/100g	10.8	21.7	11.7	---	---	
Nutrient	Suggested Fertilizer Program, #/A[2]					
Nitrogen	210	170	170	210	170	
Phosphorus	75	55	30	60	---	
Potassium	15	65	40	50	---	
Magnesium	---	---	---	---	---	
Sulfur	5	20	20	17	---	
Zinc	---	---	5	---	---	
Iron	4	---	---	2	---	
Manganese	---	3	---	5	---	
Copper	---	---	---	1	---	
Boron	1.25	---	---	1	---	
Lime	---	---	---	---	---	
	Fertilizer Costs, $/A					
1984	66.27	62.50	52.73	76.28	31.28	
1981-1984	238	291	281	260	123	
	Grain Yield, bu/A					
1984	168	162	152	157	157	38
1981-1984	565	571	572	551	574	72[3]

[1] In lbs/A.
[2] Yield goal 170 bu/A.
[3] Yields taken in 1983 + 1984. No fertilizer since 1980.

SOYBEAN VARIETY EVALUATION ON HIGH pH SOIL

E.J. Penas, R.W. Elmore, R.S. Moomaw and P.H. Grabouski

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: Forty-seven soybean varieties were planted at four sites (Colfax, Dixon, Lincoln and Merrick Counties) and forty-eight varieties were planted at two sites (Dodge and Saunders Counties). At each site, plots were replicated six times. Also at each site, three varieties (Century, Nebsoy and Stine 2920) were planted at three plant densities (4.5, 9.0, 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 Saunders County where soybeans did not exhibit chlorosis. Seed yields were harvested for all six sites.

Experimental Results:

Variety Evaluation Study

Seed yields were harvested from all six locations. Table 1 shows mean seed yields across the six sites. Yields ranged from 9 to 27 bushels per acre. Twenty-five varieties were in the top group in terms of seed yield (22 - 27 bushels per acre). Century, the standard variety being used in this study, yielded with the top group. Nebsoy, the tester variety being used, yielded the poorest.

Since the Saunders County site did not exhibit chlorosis, seed yields from that site were deleted from the means. Table 2 shows the mean seed yields from the five sites. The same 25 varieties as in the six-site mean were in the top group plus one additional variety (yield range of 21 to 28 bushels per acre).

Five sites were visually score for chlorosis eight weeks after planting. Table 3 gives the mean chlorosis score by varieties. The 26 varieties that were in the top group in terms of seed yield were also in the top group of 29 in terms of chlorosis score (score range of 2.3 to 3.0)

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

Colfax County. Chlorosis was moderate at this site. Chlorosis scores by varieties are shown in Table 4. Over one-half of the varieties scored in the top group (1.60 - 2.60). Seed yield by varieties is given in Table 5. Again, over half of the varieties are in the top group in terms of seed yield (16-21 bu/ac) which includes all those in the top group in terms of chlorosis score except Century. Figure 2 shows this strong relationship between seed yield and chlorosis score.

Dixon County. Chlorosis was mild at this location. Table 6 shows the chlorosis score by varieties. Almost one-half of the varieties scored in the top group (1.58 - 2.03). Seed yields are shown by varieties in Table 7. Two varieties, McCubbin Taylor and S Brand S46D, are in the top group with yields of 24 and 21 bushels per acre respectively. The relationships of seed yield to chlorosis score is shown in Figure 3. The relationship is significant; however, it is not as strong as at the three sites where chlorosis was more severe.

Dodge County. Chlorosis was moderate at this site as shown in Table 8. Twenty-seven of the 48 varieties scored in the top group (1.50 - 2.75). Seed yields for each variety are shown in Table 9. One-half of the varieties were in the top group in terms of seed yield, (31 - 42 bushels per acre), and 22 of these were in the top group in terms of chlorosis score. Figure 4 shows the very strong relationship between seed yield and chlorosis score at this site.

Lincoln County. Chlorosis was severe at this site. Table 10 shows the chlorosis scores for varieties at this site. Over half of the varieties scored in the top group and even these showed considerable chlorosis (3.64 - 4.56). In Table 11 are the seed yields for each of the varieties. Twenty-five varieties are in the top group (13 - 26 bushels per acre) and 23 of these were also in the top group in terms of chlorosis score. Relationship of seed yield and chlorosis score was strong as is shown in Figure 5. Seed yields were obviously reduced by the high degree of chlorosis.

Merrick County. Chlorosis was mild at this site and the chlorosis score for each variety is shown in Table 12. Over one-half of the varieties scored in the top group (2.42 - 2.75) and 22 of these were in the top group in terms of seed yield (28 - 37 bushels per acre) as shown in Table 13. Figure 6 shows the relationship between seed yield and chlorosis score which is not as strong at this site as at the three sites where chlorosis was more severe.

Saunders County. Seed yields for each variety and shown in Table 14. Since chlorosis was not a problem at this site over two-thirds of the varieties yielded in the top group. Nebsoy, the tester variety used, had the poorest yield.

Variety X Density Study

Data for this study are shown in Table 15. Varieties were different in terms of chlorosis score at the five sites where this evaluation was made. Nebsoy had the poorest chlorosis score at all sites and Stine 2920 had the best score at 4 sites (Colfax, Dixon, and Dodge and Lincoln Counties). Century scored intermediate at four sites and was equal to Stine 2920 at one site (Merrick County).

Increasing seeding density from 4.5 to 13.5 seeds per foot of row improved chlorosis score at all sites; however, 9.0 seeds per foot was adequate where chlorosis was mild (Dixon and Merrick Counties).

There were significant variety x density interactions at three sites. At Dodge and Lincoln Counties, where chlorosis was moderate to severe, increasing seeding rate did not improve the performance of a poor variety (Nebsoy) but did improved the performance of an intermediate variety (Century) in Dodge County or a tolerant variety (Stine 2920) at Lincoln County.

Seed yields were dependent on variety and plant density at all six sites. Nebsoy had the lowest yield at all sites. Seed yields of Century and Stine 2920 were similar at 4 sites (Dixon, Lincoln, Merrick and Saunders Counties). Stine 2920 had higher yields than Century at 2 sites (Colfax and Dodge Counties).

There was a significant variety x density interaction at 3 sites. At Dixon County, increasing the planting rate from 4.5 to 13.5 seeds per foot of row increased the seed yield of Century and Stine 2920, but not for Nebsoy. At Dodge County, increasing the seeding rate did not increase the seed yield for Nebsoy; however, it did increase the yield for the other 2 varieties. For Century, 13.5 seeds per foot were needed; whereas, 9.0 seeds per foot was nearly adequate for Stine 2920. At Lincoln County, increasing seeding rate of Nebsoy did not increase seed yield. Increasing seeding rate to 9.0 seeds per foot of row increased seed yield of both Century and Stine 2920. Increasing seeding rate from 9.0 to 13.5 seeds per foot of row gave an additional seed yield increase for Stine 2920, but not for Century.

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Table 1. MEANS OF SEED YIELD OF SIX SITES

ANALYSIS OF VARIANCE

SOURCE	DF	SS	MS	F
SITE	5	10612.37	2122.47	125.30 ***
VARIETY	46	5353.19	116.37	6.87 ***
ERROR	230	3896.06	16.94	
TOTAL	281	19861.62		

STANDARD ERROR OF A TREATMENT MEAN = 1.6802
LEAST SIGNIFICANT DIFFERENCE 5% = 4.6574
EXPERIMENTAL MEAN IS 20.08 CV = 20.50%

DUNCAN'S MULTIPLE RANGE TEST (5% PROTECTION LEVEL)

BRAND	ENTRY	MEAN	RANGE OF INSIG. CHANGE
MCCUBBIN	TAYLOR	26.84	I
HOEGEMEYER	205	25.61	I I
DEKALB-PFIZER	CX283	25.56	I I
GOLDEN HARVEST	H1285	25.42	I I
AGRI-GOLD	AG-ROYAL	24.82	I I I
NC+	2090+	24.55	I I II
STINE	2920	24.43	I I II
S BRAND	S478	24.23	I I III
S BRAND	S460	24.13	I I III
SUPERIOR	SPB308	23.94	I I III
FONTANELLE	F4545	23.69	I I IIII
STINE	2050+	23.68	I I IIII
LAND O'LAKES	L4207	23.56	I I IIII
STOCK	SS462A	23.27	I I IIIII
LAND O'LAKES	L4106	23.08	I I IIIII
STOCK	SS793	22.71	I I IIIIII
----	CENTURY	22.41	I I IIIIII
HOEGEMEYER	200	22.38	I I IIIIII
SUPERIOR	SPB340	22.19	I I IIIIIII
JACQUES	J-105	22.18	I I IIIIIII
JACQUES	J-103	22.14	I I IIIIIII
HOFLER	GEM	21.81	I I IIIIIIII
GOLDEN HARVEST	X233	21.67	I I IIIIIIII
----	WEBER	21.57	I I IIIIIIIII
AGRI-GOLD	AG-ROYAL II	21.51	I I IIIIIIIII
S BRAND	S44A	21.02	II IIIIIIIII
DIAMOND	D220	21.02	II IIIIIIIII
----	ELGIN	19.68	I IIIIIIIIII
DEKALB-PFIZER	CX350	19.42	II IIIIIIIIII
----	CORSOY 79	19.06	IIIIIIIIIIII
----	MEAD	18.54	IIIIIIIIIII
STINE	3500	18.21	IIIIIIIIII
DIAMOND	TC204A	17.62	IIIIIIIII
HOEGEMEYER	264	17.21	IIIIIIII
----	HARPER	16.58	IIIIIII
----	PLATTE	16.34	IIIIII
STOCK	SS500	16.01	IIIII
HOFLER	TOPAZ	15.94	IIIII
----	WILL	15.49	IIII
MIDWEST OIL	397	15.11	I II
----	WILLIAMS 79	14.60	IIII
----	WINCHESTER	14.48	IIII
----	CUMBERLAND	14.25	IIII
----	WILLIAMS	13.81	III
----	WILLIAMS 82	13.60	II
DIAMOND	D310	9.58	II
----	NEBSOY	8.54	I

Table 2. MEANS OF SEED YIELD OF FIVE SITES

ANALYSIS OF VARIANCE

SOURCE	DF	SS	MS	F
SITES	4	10578.37	2644.59	142.66 ***
VARIETY	46	5494.12	119.44	6.44 ***
ERROR	184	3411.00	18.54	
TOTAL	234.	19483.50		

STANDARD ERROR OF A TREATMENT MEAN = 1.9255
LEAST SIGNIFICANT DIFFERENCE 5% = 5.3373
EXPERIMENTAL MEAN IS 19.92 CV = 21.61%

DUNCAN'S MULTIPLE RANGE TEST (5% PROTECTION LEVEL)

BRAND	ENTRY	MEAN	RANGES OF INSIG. CHANGE
MCCUBBIN	TAYLOR	27.56	I
DEKALB-PFIZER	CX283	26.32	II
HOEGEMEYER	205	26.26	II
GOLDEN HARVEST	H1285	25.73	II I
NC+	2090+	25.20	II II
AGRI-GOLD	AG-ROYAL	24.91	II II
SUPERIOR	SPB308	24.64	II II
STINE	2920	24.56	II II
S BRAND	S478	24.45	II II
FONTANELLE	F4545	24.25	II III
S BRAND	S46D	24.22	II III
STINE	2050+	23.74	II IIII
LAND O'LAKES	L4207	23.68	II IIII
STOCK	SS462A	23.65	II IIII
STOCK	SS793	23.44	II IIIII
LAND O'LAKES	L4106	22.99	II IIIII
SUPERIOR	SPB340	22.92	II IIIII
—	CENTURY	22.19	II IIIIII
—	WEBER	22.19	II IIIIII
JACQUES	J-105	22.11	II IIIIIII
HOEGEMEYER	200	22.11	II IIIIIII
HOFLER	GEM	21.86	II IIIIIII
GOLDEN HARVEST	X233	21.78	II IIIIIII
JACQUES	J-103	21.78	II IIIIIII
AGRI-GOLD	AG-ROYAL II	21.50	III IIIIIII
S BRAND	S44A	21.16	IIII IIIIIII
DIAMOND	D220	20.44	III IIIIIIII
DEKALB-PFIZER	CX350	19.55	II IIIIIIIII
—	CORSOY 79	19.02	IIIIIIIIIII
—	ELGIN	18.92	IIIIIIIIIII
—	MEAD	17.79	IIIIIIIIII
DIAMOND	TC204A	17.50	IIIIIIIII
STINE	3500	17.03	IIIIIIII
HOEGEMEYER	264	16.99	IIIIIIII
—	HARPER	15.88	IIIIIII
STOCK	SS500	15.63	IIIIII
—	PLATTE	15.12	IIIII
HOFLER	TOPAZ	15.06	IIIII
MIDWEST OIL	397	14.93	I III
—	WILL	14.65	IIII
—	WILLIAMS 79	13.74	IIII
—	CUMBERLAND	13.53	IIII
—	WINCHESTER	13.34	IIII
—	WILLIAMS	12.88	III
—	WILLIAMS 82	12.69	III
DIAMOND	D310	8.44	II
—	NEBSOY	7.94	I

Table 3. MEANS OF THIRD CHLOROSIS SCORES OF FIVE SITES

ANALYSIS OF VARIANCE

SOURCE	DF	SS	MS	F
SITES	4	163.56	40.89	199.84 ***
VARIETY	46	52.75	1.15	5.60 ***
ERROR	184	37.65	0.20	
TOTAL	234	253.96		

STANDARD ERROR OF A TREATMENT MEAN = 0.2023
LEAST SIGNIFICANT DIFFERENCE 5% = 0.5607
EXPERIMENTAL MEAN IS 2.95 CV = 15.31%

DUNCAN'S MULTIPLE RANGE TEST (5% PROTECTION LEVEL)

BRAND	ENTRY	MEAN	RANGES OF INSIG. CHANGE
----	NEBSOY	4.22	I
DIAMOND	D310	4.21	I
HOFLER	TOPAZ	3.82	II
----	CUMBERLAND	3.61	II I
----	WILL	3.54	I II
STOCK	SS500	3.50	I II
----	WILLIAMS 79	3.46	I III
----	PLATTE	3.45	I IIII
----	WINCHESTER	3.44	I IIII
----	WILLIAMS 82	3.41	I IIII
----	ELGIN	3.33	I IIIII
STINE	3500	3.31	I IIIIII
MIDWEST OIL	397	3.29	I IIIIII
----	WILLIAMS	3.28	I IIIIII
DIAMOND	D220	3.22	I IIIIIII
----	MEAD	3.19	I IIIIIIII
----	CORSOY 79	3.19	I IIIIIIII
----	HARPER	3.11	IIIIIIIII
DIAMOND	TC204A	2.96	IIIIIIIIII
HOEGEMEYER	264	2.95	IIIIIIIIII
JACQUES	J-105	2.91	IIIIIIIII
AGRI-GOLD	AG-ROYAL II	2.91	IIIIIIIII
GOLDEN HARVEST	X233	2.81	IIIIIIII
LAND O'LAKES	L4207	2.80	IIIIIIII
----	CENTURY	2.78	IIIIIIII
HOFLER	GEM	2.77	IIIIIII
LAND O'LAKES	L4106	2.72	IIIIII
STOCK	SS793	2.71	IIIIII
S BRAND	S44A	2.68	IIIIII
STOCK	SS462A	2.64	IIIIII
JACQUES	J-103	2.63	IIIII
STINE	2050+	2.63	IIIII
S BRAND	S460	2.57	IIII
AGRI-GOLD	AG-ROYAL	2.55	IIII
HOEGEMEYER	200	2.55	IIII
GOLDEN HARVEST	H1285	2.53	IIII
FONTANELLE	F4545	2.53	III
NC+	2090+	2.52	III
DEKALB-PFIZER	CX350	2.52	III
----	WEBER	2.52	III
SUPERIOR	SPB340	2.51	III
HOEGEMEYER	205	2.51	III
S BRAND	S478	2.50	III
STINE	2920	2.47	II
MCCUBBIN	TAYLOR	2.40	I
SUPERIOR	SPB308	2.37	I
DEKALB-PFIZER	CX283	2.30	I

Figure 1.

MEANS OF SEED YIELD OF 5 SITES
VS
MEANS OF THIRD CHLOROSIS SCORES OF 5 SITES

INTERCEPT....................	47.97003
REGRESSION COEFFICIENT.......	-9.49600
STD. ERROR OF REG. COEF......	0.555
COMPUTED T-VALUE.............	-17.109
CORRELATION COEFFICIENT......	-0.931
STANDARD ERROR OF ESTIMATE...	1.804

ANALYSIS OF VARIANCE FOR THE REGRESSION

SOURCE OF VARI.	D.F.	SUM OF SQ.	MEAN SQ.	F VALUE
ATTRIBUTABLE TO REG.	1	952.354	952.354	292.705 ***
DEVIATION FROM REG.	45	146.414	3.254	
TOTAL	46	1098.767		

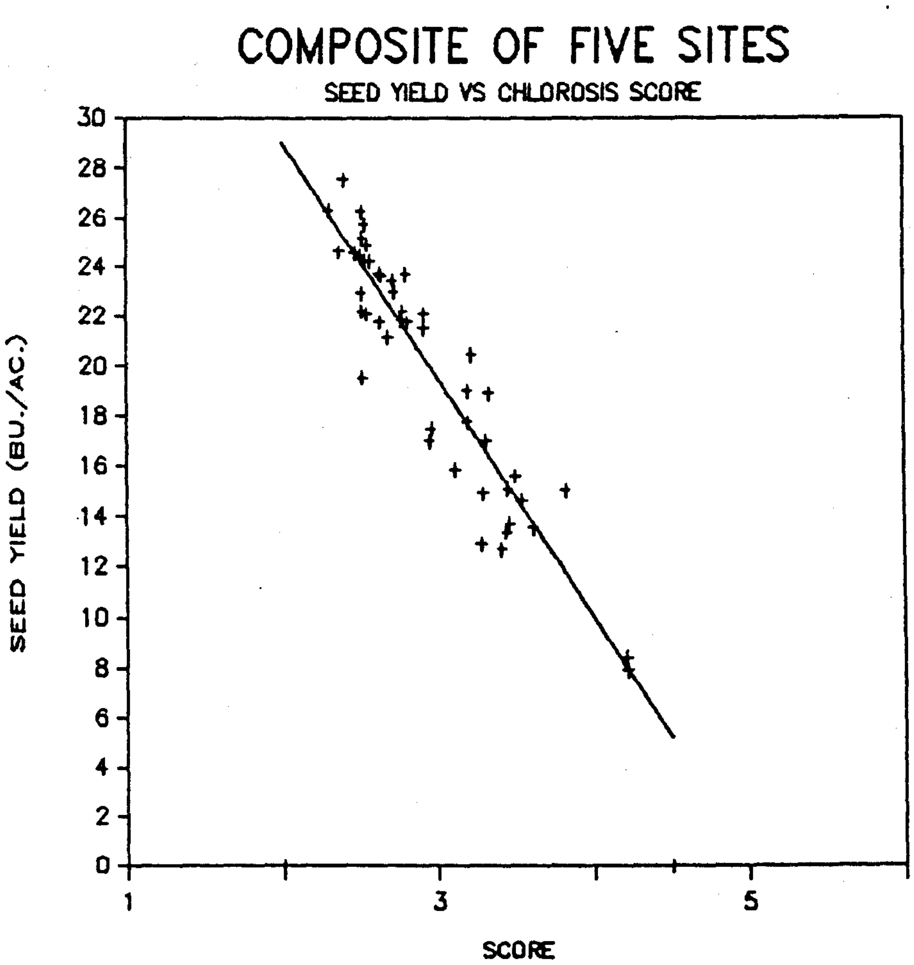

Table 4. COLFAX COUNTY THIRD CHLOROSIS SCORE

ANALYSIS OF VARIANCE

SOURCE	DF	SS	MS	F	
BLOCK	4	12.88	3.22	7.08	***
VARIETY	46	119.55	2.60	5.71	***
ERROR	184	83.73	0.46		
TOTAL	234	216.16			

STANDARD ERROR OF A TREATMENT MEAN = 0.3017
LEAST SIGNIFICANT DIFFERENCE 5% = 0.8362
EXPERIMENTAL MEAN IS 2.56 CV = 26.39%

DUNCAN'S MULTIPLE RANGE TEST (5% PROTECTION LEVEL)

BRAND	ENTRY	MEAN	RANGES OF INSIG. CHANGE
DIAMOND	0310	5.10	I
----	NEBSOY	3.96	I
HOFLER	TOPAZ	3.90	II
----	CORSOY 79	3.48	II I
----	ELGIN	3.34	II II
DIAMOND	0220	3.30	II III
----	WILL	3.30	II III
STOCK	SS500	3.24	II III
----	PLATTE	3.20	II IIII
----	WILLIAMS 79	3.18	II IIII
----	WILLIAMS 82	3.10	II IIIII
----	CUMBERLAND	3.10	II IIIII
HOEGEMEYER	264	3.00	II IIIIII
----	WINCHESTER	3.00	II IIIIII
MIDWEST OIL	397	2.96	II IIIIII
----	WILLIAMS	2.92	I IIIIIII
STINE	3500	2.80	IIIIIIII
JACQUES	J-105	2.70	IIIIIIII
----	HARPER	2.64	IIIIIIII
----	MEAD	2.60	IIIIIIIIII
STOCK	SS793	2.40	IIIIIIII
LAND O'LAKES	L4106	2.40	IIIIIIII
HOFLER	GEM	2.40	IIIIIIII
AGRI-GOLD	AG-ROYAL	2.40	IIIIIIII
MCCUBBIN	TAYLOR	2.30	IIIIIII
LAND O'LAKES	L4207	2.30	IIIIIII
HOEGEMEYER	205	2.30	IIIIIII
----	CENTURY	2.30	IIIIIII
GOLDEN HARVEST	X233	2.20	IIIIII
STINE	2050+	2.10	IIIII
S BRAND	S44A	2.10	IIIII
AGRI-GOLD	AG-ROYAL II	2.10	IIIII
SUPERIOR	SPB308	2.00	IIII
GOLDEN HARVEST	H1285	2.00	IIII
DIAMOND	TC204A	2.00	IIII
HOEGEMEYER	200	1.98	IIII
JACQUES	J-103	1.92	III
FONTANELLE	F4545	1.92	III
STINE	2920	1.90	III
S BRAND	S478	1.90	III
DEKALB-PFIZER	CX350	1.90	III
----	WEBER	1.90	III
S BRAND	S460	1.80	II
NC+	2090+	1.80	II
DEKALB-PFIZER	CX283	1.80	II
SUPERIOR	SPB340	1.60	I
STOCK	SS462A	1.60	I

Table 5. COLFAX COUNTY SEED YIELD

ANALYSIS OF VARIANCE

SOURCE	DF	SS	MS	F	
BLOCK	4	173.59	43.40	5.07	***
VARIETY	46	2834.91	61.63	7.21	***
ERROR	184	1573.84	8.55		
TOTAL	234	4582.35			

STANDARD ERROR OF A TREATMENT MEAN = 1.3079
LEAST SIGNIFICANT DIFFERENCE 5% = 3.6254
EXPERIMENTAL MEAN IS 16.27 CV = 17.98

DUNCAN'S MULTIPLE RANGE TEST (5% PROTECTION LEVEL)

BRAND	ENTRY	MEAN	RANGE OF INSIG. CHANGE
AGRI-GOLD	AG-ROYAL II	20.60	I
S BRAND	S47B	20.32	I
STOCK	SS462A	20.14	I
S BRAND	S460	20.04	I
LAND O'LAKES	L4207	19.90	I
DEKALB-PFIZER	CX283	19.74	I I
GOLDEN HARVEST	H1285	19.64	I II
SUPERIOR	SPB308	19.64	I II
S BRAND	S44A	19.36	I II
AGRI-GOLD	AG-ROYAL	19.30	I II
STINE	2920	19.28	I II
FONTANELLE	F4545	19.00	I II
GOLDEN HARVEST	X233	18.80	I III
HOEGEMEYER	205	18.60	I IIII
NC+	2090+	18.58	I IIII
LAND O'LAKES	L4106	18.54	I IIII
MCCUBBIN	TAYLOR	18.28	I IIIII
STINE	2050+	18.12	I IIIII
JACQUES	J-105	18.12	I IIIII
HOEGEMEYER	264	17.82	I IIIIII
JACQUES	J-103	17.62	I IIIIII
STOCK	SS793	17.58	I IIIIII
HOFLER	GEM	17.54	I IIIIII
HOEGEMEYER	200	17.24	I IIIIII
—	WEBER	17.04	I IIIIIII
—	MEAD	17.00	I IIIIIII
DEKALB-PFIZER	CX350	16.78	I IIIIIIII
SUPERIOR	SPB340	16.46	I IIIIIIII
DIAMOND	TC204A	16.28	I IIIIIIIII
—	CENTURY	15.42	IIIIIIIIIII
STINE	3500	15.24	IIIIIIIIII
—	WINCHESTER	14.40	IIIIIIIII
—	ELGIN	14.28	IIIIIIII
DIAMOND	D220	14.20	IIIIIIII
—	HARPER	14.08	IIIIIII
—	CORSOY 79	13.66	IIIIII
—	WILL	13.52	IIIIII
—	WILLIAMS	13.46	IIIIII
—	WILLIAMS 79	12.82	IIIII
HOFLER	TOPAZ	12.70	IIIII
STOCK	SS500	12.56	IIII
—	PLATTE	12.56	IIII
—	WILLIAMS 82	12.42	IIII
—	CUMBERLAND	11.94	III
MIDWEST OIL	397	11.34	II
—	NEBSOY	10.26	I
DIAMOND	D310	2.46	

Table 7. DIXON COUNTY SEED YIELD

ANALYSIS OF VARIANCE

SOURCE	DF	SS	MS	F
BLOCK	5	2670.43	534.09	45.70 ***
VARIETY	46	5475.58	119.03	10.18 ***
ERROR	230	2688.19	11.69	
TOTAL	281	10834.20		

STANDARD ERROR OF A TREATMENT MEAN = 1.3957
LEAST SIGNIFICANT DIFFERENCE 5% = 3.8687
EXPERIMENTAL MEAN IS 14.84 CV = 23.04%

DUNCAN'S MULTIPLE RANGE TEST (5% PROTECTION LEVEL)

BRAND	ENTRY	MEAN	RANGES OF INSIG. CHANGE
MCCUBBIN	TAYLOR	24.10	I
S BRAND	S460	20.62	II
S BRAND	S478	19.72	II
NC+	2D90+	19.15	III
SUPERIOR	SPB308	19.10	III
GOLDEN HARVEST	H1285	18.87	IIII
HOEGEMEYER	205	18.62	IIII
----	CORSOY	18.60	IIII
STOCK	SS462A	18.47	IIII
----	WEBER	18.47	IIII
----	ELGIN	18.15	IIII
DEKALB-PFIZER	CX283	17.90	IIIII
FONTANELLE	F4545	17.87	IIIII
AGRI-GOLD	AG-ROYAL	17.65	IIIIII
STINE	2050+	17.57	IIIIII
----	CENTURY	17.45	IIIIIII
AGRI-GOLD	AG-ROYAL II	17.33	IIIIIII
STOCK	SS793	17.30	IIIIIII
STINE	2920	17.15	IIIIIII
JACQUES	J-103	17.15	IIIIIIII
S BRAND	S44A	17.08	IIIIIIII
SUPERIOR	SPB340	16.93	IIIIIIII
DIAMOND	D220	16.92	IIIIIIII
LAND O'LAKES	L4207	16.50	IIIIIIII
HOFLER	GEM	16.37	IIIIIIII
GOLDEN HARVEST	X233	16.37	IIIIIIII
HOEGEMEYER	200	16.33	IIIIIIII
----	PLATTE	15.17	IIIIIIII
LAND O'LAKES	L4106	14.95	IIIIIIII
DEKALB-PFIZER	CX350	14.22	IIIIIIII
STOCK	SS500	13.25	I IIIIIII
JACQUES	J-105	13.08	I IIIIII
HOFLER	TOPAZ	12.80	I IIIII
STINE	3500	12.58	I IIII
MIDWEST OIL	397	12.48	I IIII
----	MEAD	11.63	II III
DIAMOND	TC204A	10.82	III III
----	HARPER	10.47	IIII II
----	WILL	10.30	IIII I
----	WINCHESTER	8.98	IIIII
----	WILLIAMS 79	8.98	IIIII
----	CUMBERLAND	7.68	IIII
DIAMOND	D310	7.67	IIII
----	WILLIAMS 82	7.22	IIII
HOEGEMEYER	264	6.72	III
----	WILLIAMS	6.08	II
----	NEBSOY	4.60	I

Figure 3. DIXON COUNTY IRVIN HAISCH

SEED YIELD VS THIRD CHLOROSIS SCORE

INTERCEPT....................	37.62204
REGRESSION COEFFICIENT.......	-11.04884
STD. ERROR OF REG. COEF......	1.556
COMPUTED T-VALUE.............	-7.101
CORRELATION COEFFICIENT......	-0.727
STANDARD ERROR OF ESTIMATE...	3.093

ANALYSIS OF VARIANCE FOR THE REGRESSION

SOURCE OF VARI.	D.F.	SUM OF SQ.	MEAN SQ.	F VALUE
ATTRIBUTABLE TO REG.	1	482.346	482.346	50.431 ***
DEVIATION FROM REG.	45	430.404	9.565	
TOTAL	46	912.750		

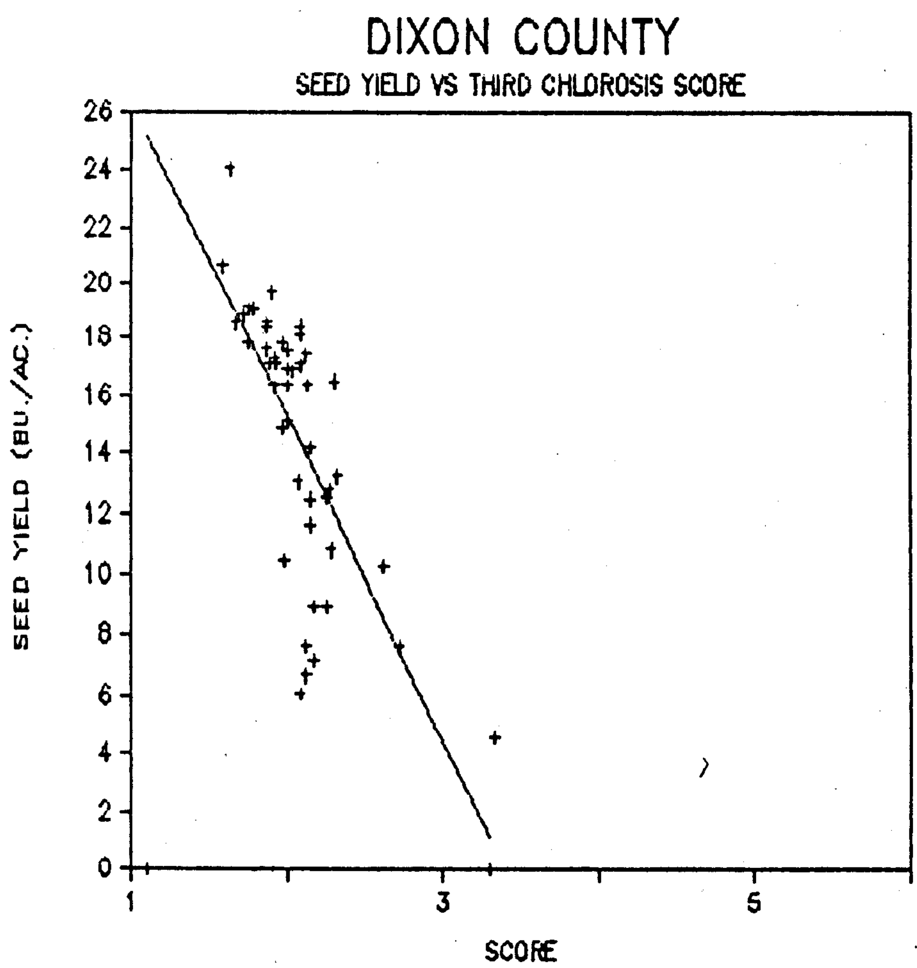

Table 8. DODGE COUNTY THIRD CHLOROSIS SCORE

ANALYSIS OF VARIANCE

SOURCE	DF	SS	MS	F
BLOCK	5	106.57	21.31	26.04 ***
VARIETY	47	298.86	6.36	7.77 ***
ERROR	235	192.33	0.82	
TOTAL	287	597.75		

STANDARD ERROR OF A TREATMENT MEAN = 0.3693
LEAST SIGNIFICANT DIFFERENCE 5% = 1.0237
EXPERIMENTAL MEAN IS 2.90 CV = 31.23%

DUNCAN'S MULTIPLE RANGE TEST (5% PROTECTION LEVEL)

BRAND	ENTRY	MEAN	RANGES OF INSIG. CHANGE
DIAMOND	D310	5.08	I
----	NEBSOY	5.07	I
----	CUMBERLAND	4.92	II
LAND O'LAKES	3665	4.83	II
HOFLER	TOPAZ	4.25	III
----	WILL	4.25	III
STOCK	SS500	4.22	III
----	WILLIAMS 82	4.03	III I
----	HARPER	3.92	III II
----	WINCHESTER	3.88	III III
----	ELGIN	3.83	II III
DIAMOND	D220	3.75	II IIII
----	PLATTE	3.72	II IIII
----	WILLIAMS 79	3.58	I IIIII
----	MEAD	3.50	I IIIIII
----	WILLIAMS	3.42	I IIIIIII
MIDWEST OIL	397	3.33	I IIIIIIII
STINE	3500	3.25	I IIIIIIIII
STOCK	SS462A	3.08	I IIIIIIIIII
----	CORSOY 79	3.08	I IIIIIIIIII
JACQUES	J-103	2.80	IIIIIIIIIII
HOEGEMEYER	264	2.75	IIIIIIIIIII
AGRI-GOLD	AG-ROYAL	2.75	IIIIIIIIIII
DIAMOND	TC204A	2.67	IIIIIIIIII
----	CENTURY	2.67	IIIIIIIIII
LAND O'LAKES	L4207	2.58	IIIIIIIII
JACQUES	J-105	2.42	IIIIIIII
SUPERIOR	SPB340	2.33	IIIIIII
HOFLER	GEM	2.33	IIIIIII
S BRAND	S460	2.25	IIIIII
LAND O'LAKES	L4106	2.25	IIIIII
HOEGEMEYER	200	2.25	IIIIII
FONTANELLE	F4545	2.25	IIIIII
STOCK	SS793	2.17	IIIIII
----	WEBER	2.17	IIIIII
STINE	2920	2.08	IIIII
STINE	2050+	2.08	IIIII
S BRAND	S44A	2.08	IIIII
DEKALB-PFIZER	CX350	2.00	IIII
GOLDEN HARVEST	H1285	1.92	III
SUPERIOR	SPB308	1.83	III
S BRAND	S47B	1.75	II
NC+	2090+	1.75	II
GOLDEN HARVEST	X233	1.67	II
MCCUBBIN	TAYLOR	1.58	II
DEKALB-PFIZER	CX283	1.58	II
AGRI-GOLD	AG-ROYAL	1.58	II
HOEGEMEYER	205	1.50	I

Table 9. DODGE COUNTY SEED YIELD

ANALYSIS OF VARIANCE

SOURCE	DF	SS	MS	F	
BLOCK	5	5687.69	1137.54	15.44	***
VARIETY	47	32258.06	686.34	9.32	***
ERROR	235	17313.81	73.68		
TOTAL	287	55259.56			

STANDARD ERROR OF A TREATMENT MEAN = 3.5042
LEAST SIGNIFICANT DIFFERENCE 5% = 9.7131
EXPERIMENTAL MEAN IS 27.18 CV = 31.58%

DUNCAN'S MULTIPLE RANGE TEST (5% PROTECTION LEVEL)

BRAND	ENTRY	MEAN	RANGES OF INSIG. CHANGE
MCCUBBIN	TAYLOR	41.87	I
DEKALB-PFIZER	CX283	41.58	I
NC+	2D90+	40.92	I I
S BRAND	S47B	40.80	I I
HOEGEMEYER	205	40.73	I I
SUPERIOR	SPB308	39.87	I II
GOLDEN HARVEST	X233	39.03	I II
AGRI-GOLD	AG-ROYAL	38.67	II II
GOLDEN HARVEST	H1285	37.37	III II
STINE	2920	37.22	III II
STINE	2050+	36.82	III III
STOCK	SS793	35.93	III III
S BRAND	S44A	35.58	III III
HOEGEMEYER	200	34.78	III IIII
FONTANELLE	F4545	34.12	IIII IIII
S BRAND	S460	34.03	IIII IIII
——	CENTURY	33.78	IIIII IIII
AGRI-GOLD	AG-ROYAL II	33.52	IIIII IIII
HOFLER	GEM	33.30	IIIIII IIII
JACQUES	J-103	32.73	IIIIIII IIII
SUPERIOR	SPB340	32.38	IIIIIII IIII
JACQUES	J-105	31.80	IIIIIII IIII
LAND O'LAKES	L4106	31.42	IIIIIII IIII
STOCK	SS462A	31.33	IIIIIII IIII
——	WEBER	29.08	IIIIIIIIIII
LAND O'LAKES	L4207	28.78	IIIIII IIII
——	CORSOY 79	26.80	IIIIIIIIII
DEKALB-PFIZER	CX350	25.60	IIIII IIII
DIAMOND	TC204A	25.28	IIII IIIII
HOEGEMEYER	Z64	23.57	IIIIIIIII
MIDWEST OIL	397	22.73	IIIIIIII
DIAMOND	D220	22.18	III IIII
——	PLATTE	21.70	II IIIII
——	MEAD	21.32	I IIIII
STINE	3500	21.08	I IIIII
——	ELGIN	19.45	IIIIII
——	WILLIAMS	18.65	IIIIIII
——	WILLIAMS 79	18.40	IIIIIII
STOCK	SS500	15.90	IIIIIII
——	WINCHESTER	15.23	IIIIIII
——	HARPER	15.15	IIIIIII
——	WILLIAMS 82	13.60	IIIIII
——	WILL	13.02	IIIII
HOFLER	TOPAZ	10.17	IIII
——	CUMBERLAND	9.38	III
LAND O'LAKES	L3665	7.18	II
DIAMOND	D310	5.63	I
——	NEBSOY	5.33	I

Figure 4.

DODGE COUNTY JOE KRACL

SEED YIELD VS THIRD CHLOROSIS SCORE

INTERCEPT....................	56.12117
REGRESSION COEFFICIENT.......	-9.99090
STD. ERROR OF REG. COEF......	0.419
COMPUTED T-VALUE.............	-23.840
CORRELATION COEFFICIENT......	-0.962
STANDARD ERROR OF ESTIMATE...	2.958

ANALYSIS OF VARIANCE FOR THE REGRESSION

SOURCE OF VARI.	D.F.	SUM OF SQ.	MEAN SQ.	F VALUE
ATTRIBUTABLE TO REG.	1	4974.176	4974.176	568.356 ***
DEVIATION FROM REG.	46	402.586	8.752	
TOTAL	47	5376.762		

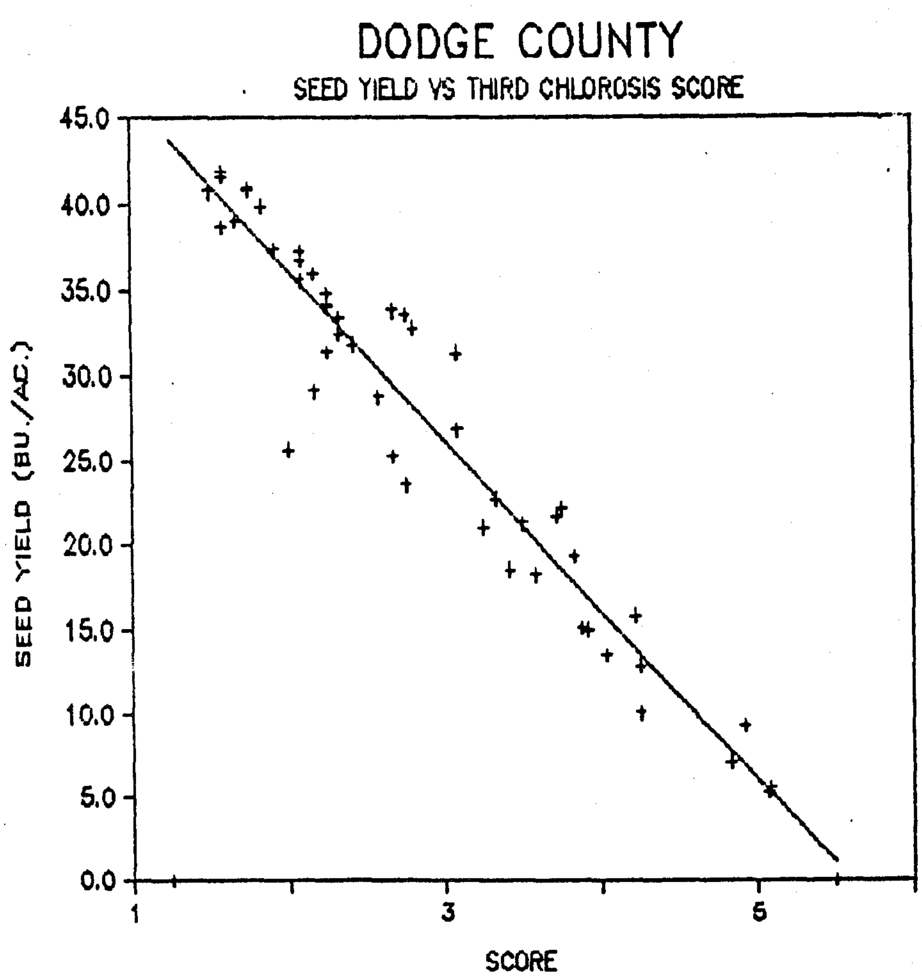

Table 10. LINCOLN COUNTY THIRD CHLOROSIS SCORE

ANALYSIS OF VARIANCE

SOURCE	DF	SS	MS	F	
BLOCK	4	18.55	4.64	11.32	***
VARIETY	46	75.97	1.65	4.03	***
ERROR	184	75.36	0.41		
TOTAL	234	169.88			

STANDARD ERROR OF A TREATMENT MEAN = 0.2862
LEAST SIGNIFICANT DIFFERENCE 5% = 0.7933
EXPERIMENTAL MEAN IS 4.53 CV = 14.13

DUNCAN'S MULTIPLE RANGE TEST (5% PROTECTION LEVEL)

BRAND	ENTRY	MEAN	RANGES OF INSIG. CHANGE
---	NEBSOY	5.84	I
STINE	3500	5.58	I I
HOFLER	TOPAZ	5.58	I I
DIAMOND	D310	5.32	I II
---	WILLIAMS 79	5.30	I II
GOLDEN HARVEST	X233	5.20	I III
---	WINCHESTER	5.16	I IIII
---	CUMBERLAND	5.16	I IIII
---	PLATTE	5.14	I IIII
AGRI-GOLD	AG-ROYAL II	5.12	I IIIII
---	CORSOY 79	5.12	I IIIII
---	MEAD	5.10	I IIIIII
DIAMOND	TC204A	5.04	I IIIIII
MIDWEST OIL	397	5.02	I IIIIIII
---	WILLIAMS	4.90	I IIIIIIII
STOCK	S5500	4.80	IIIIIIIII
---	WILLIAMS 82	4.74	IIIIIIIII
JACQUES	J-105	4.70	IIIIIIIIII
---	WILL	4.62	IIIIIIIIIII
---	ELGIN	4.56	IIIIIIIIIII
S BRAND	S460	4.46	IIIIIIIIIII
DIAMOND	D220	4.44	IIIIIIIIIII
STOCK	S5793	4.40	IIIIIIIIIII
S BRAND	S44A	4.40	IIIIIIIIIII
NC+	2D90+	4.40	IIIIIIIIIII
HOFLER	GEM	4.38	IIIIIIIIIII
---	HARPER	4.36	IIIIIIIIIII
---	CENTURY	4.32	IIIIIIIIII
LAND O'LAKES	L4207	4.30	IIIIIIIIII
HOEGEMEYER	205	4.22	IIIIIIIII
STINE	2050+	4.20	IIIIIIIII
GOLDEN HARVEST	H1285	4.20	IIIIIIIII
LAND O'LAKES	L4106	4.16	IIIIIIII
SUPERIOR	SPB340	4.14	IIIIIII
S BRAND	S478	4.14	IIIIIII
AGRI-GOLD	AG-ROYAL	4.14	IIIIIII
MCCUBBIN	TAYLOR	4.06	IIIIII
HOEGEMEYER	264	4.04	IIIII
HOEGEMEYER	200	4.00	IIIII
STOCK	S5462A	3.92	IIII
STINE	2920	3.88	IIII
JACQUES	J-103	3.88	IIII
FONTANELLE	F4545	3.74	III
---	WEBER	3.70	II
SUPERIOR	SPB308	3.68	II
DEKALB-PFIZER	CX283	3.68	II
DEKALB-PFIZER	CX350	3.64	I

Table 11. LINCOLN COUNTY SEED YIELD

ANALYSIS OF VARIANCE

SOURCE	DF	SS	MS	F	
BLOCK	4	910.52	227.63	5.22	***
VARIETY	46	5957.33	129.51	2.97	***
ERROR	184	8028.07	43.63		
TOTAL	234	14895.93			

STANDARD ERROR OF A TREATMENT MEAN = 2.9540
LEAST SIGNIFICANT DIFFERENCE 5% = 8.1881
EXPERIMENTAL MEAN IS 12.50 CV = 52.86%

DUNCAN'S MULTIPLE RANGE TEST (5% PROTECTION LEVEL)

BRAND	ENTRY	MEAN	RANGES OF INSIG. CHANGE
LAND O'LAKES	L4106	22.68	I
STINE	2920	22.06	II
DEKALB-PFIZER	CX283	20.12	II I
GOLDEN HARVEST	H1285	19.26	II II
FONTANELLE	F4545	18.50	II III
HOEGEMEYER	205	17.70	II IIII
DEKALB-PFIZER	CX350	17.56	II IIII
LAND O'LAKES	L4207	17.50	II IIII
JACQUES	J-103	16.92	II IIIII
STOCK	SS462A	16.74	II IIIII
SUPERIOR	SPB340	16.54	II IIIII
MCCUBBIN	TAYLOR	16.48	II IIIII
JACQUES	J-105	16.24	II IIIII
S BRAND	S478	15.92	II IIIIII
AGRI-GOLD	AG-ROYAL	15.54	II IIIIII
STOCK	SS793	15.08	II IIIIII
SUPERIOR	SPB308	14.86	II IIIIII
----	WEBER	14.72	II IIIIII
NC+	2090+	14.68	II IIIIII
S BRAND	S460	14.32	II IIIIII
HOEGEMEYER	200	14.02	II IIIIII
DIAMOND	DZ20	13.56	II IIIIIII
STINE	2050+	13.22	IIIIIIIIII
----	HARPER	12.76	IIIIIIIIII
----	ELGIN	12.68	IIIIIIIIII
HOEGEMEYER	264	12.26	I IIIIIIII
HOFLER	GEM	11.74	IIIIIIII
DIAMOND	TC204A	10.80	IIIIIIIII
----	CENTURY	10.44	IIIIIIIIII
----	WILLIAMS 82	10.30	IIIIIIIIII
MIDWEST OIL	397	10.06	IIIIIIIIII
GOLDEN HARVEST	X233	9.88	IIIIIIIII
----	WILL	9.88	IIIIIIIII
S BRAND	S44A	9.64	IIIIIIIII
STOCK	SS500	9.54	IIIIIIIII
----	WILLIAMS	9.52	IIIIIIIII
----	CUMBERLAND	9.36	IIIIIIIII
HOFLER	TOPAZ	8.64	IIIIIIII
----	WILLIAMS 79	8.38	IIIIIII
AGRI-GOLD	AG-ROYAL II	7.86	IIIIIII
----	MEAD	7.24	IIIIII
----	WINCHESTER	6.88	IIIIII
----	PLATTE	5.96	IIIII
----	CORSOY 79	3.86	IIII
DIAMOND	D310	3.40	III
STINE	3500	1.36	II
----	NEBSOY	0.66	I

Figure 5.

LINCOLN COUNTY   ERNEST MEHL

SEED YIELD VS THIRD CHLOROSIS SCORE

INTERCEPT....................	46.66870
REGRESSION COEFFICIENT.......	-7.54385
STD. ERROR OF REG. COEF......	0.692
COMPUTED T-VALUE............	-10.899
CORRELATION COEFFICIENT......	-0.852
STANDARD ERROR OF ESTIMATE...	2.698

ANALYSIS OF VARIANCE FOR THE REGRESSION

SOURCE OF VARI.	D.F.	SUM OF SQ.	MEAN SQ.	F VALUE
ATTRIBUTABLE TO REG.	1	864.701	864.701	118.792 ***
DEVIATION FROM REG.	45	327.560	7.279	
TOTAL	46	1192.261		

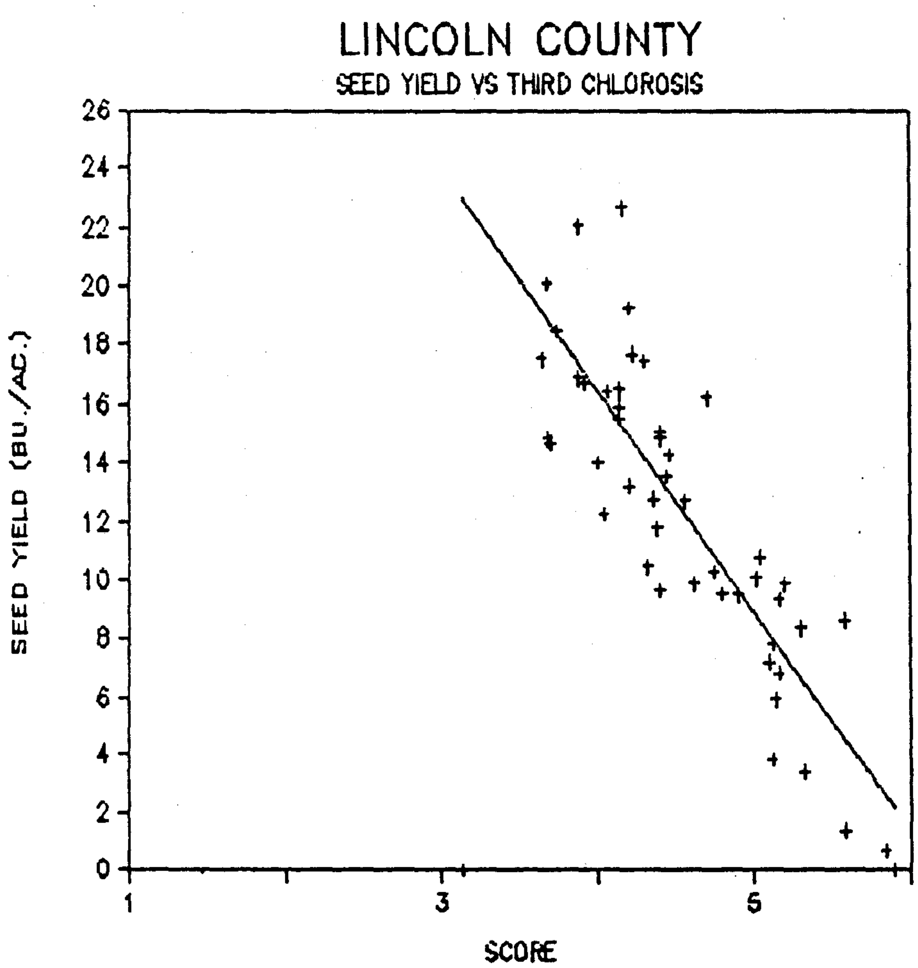

Table 12. MERRICK COUNTY THIRD CHLOROSIS SCORE

ANALYSIS OF VARIANCE

SOURCE	DF	SS	MS	F	
BLOCK	5	9.62	1.92	22.31	***
VARIETY	46	8.08	0.18	2.04	***
ERROR	230	19.84	0.09		
TOTAL	281	37.54			

STANDARD ERROR OF A TREATMENT MEAN = 0.1199
LEAST SIGNIFICANT DIFFERENCE 5% = 0.3323
EXPERIMENTAL MEAN IS 2.77 CV = 10.61

DUNCAN'S MULTIPLE RANGE TEST (5% PROTECTION LEVEL)

BRAND	ENTRY	MEAN	RANGES OF INSIG. CHANGE
----	PLATTE	3.17	I
HOFLER	TOPAZ	3.08	II
----	WILLIAMS	3.08	II
MIDWEST OIL	397	3.00	III
----	WINCHESTER	3.00	III
----	WILLIAMS 82	3.00	III
----	WILLIAMS 79	3.00	III
STOCK	SS500	2.92	IIII
NC+	2D90+	2.92	IIII
DEKALB-PFIZER	CX350	2.92	IIII
----	WILL	2.92	IIII
----	NEBSOY	2.92	IIII
S BRAND	S47B	2.83	IIIII
LAND O'LAKES	L4106	2.83	IIIII
HOEGEMEYER	264	2.83	IIIII
GOLDEN HARVEST	X233	2.83	IIIII
GOLDEN HARVEST	H1285	2.83	IIIII
DIAMOND	D310	2.83	IIIII
DIAMOND	TC204A	2.83	IIIII
----	ELGIN	2.83	IIIII
STOCK	SS462A	2.75	IIIII
STINE	2050+	2.75	IIIII
S BRAND	S46D	2.75	IIIII
S BRAND	S44A	2.75	IIIII
HOFLER	GEM	2.75	IIIII
FONTANELLE	F4545	2.75	IIIII
AGRI-GOLD	AG-ROYAL	2.75	IIIII
----	WEBER	2.75	IIIII
----	CUMBERLAND	2.75	IIIII
STOCK	SS793	2.67	IIII
STINE	3500	2.67	IIII
JACQUES	J-105	2.67	IIII
JACQUES	J-103	2.67	IIII
HOEGEMEYER	205	2.67	IIII
DEKALB-PFIZER	CX283	2.67	IIII
AGRI-GOLD	AG-ROYAL II	2.67	IIII
----	HARPER	2.67	IIII
SUPERIOR	SPB308	2.58	III
STINE	2920	2.58	III
HOEGEMEYER	200	2.58	III
DIAMOND	D220	2.58	III
----	MEAD	2.58	III
----	CORSOY 79	2.58	III
SUPERIOR	SPB340	2.50	II
LAND O'LAKES	L4207	2.50	II
----	CENTURY	2.50	II
MCCUBBIN	TAYLOR	2.42	I

Table 13.

MERRICK COUNTY SEED YIELD

ANALYSIS OF VARIANCE

SOURCE	DF	SS	MS	F
BLOCK	5	5731.00	1146.20	23.69 ***
VARIETY	46	7818.31	169.96	3.51 ***
ERROR	230	11129.87	48.39	
TOTAL	281	24679.19		

STANDARD ERROR OF A TREATMENT MEAN = 2.8399
LEAST SIGNIFICANT DIFFERENCE 5% = 7.8718
EXPERIMENTAL MEAN IS 28.18 CV = 24.69%

DUNCAN'S MULTIPLE RANGE TEST
(5% PROTECTION LEVEL)

BRAND	ENTRY	MEAN	RANGES OF INSIG. CHANGE
MCCUBBIN	TAYLOR	37.18	I
LAND O'LAKES	L4207	35.73	I I
HOEGEMEYER	205	35.63	I I
DIAMOND	D220	35.33	I I
STINE	3500	34.88	I II
---	CENTURY	33.88	I III
GOLDEN HARVEST	H1285	33.53	I IIII
AGRI-GOLD	AG-ROYAL	33.40	I IIII
STINE	2050+	32.98	I IIIII
NC+	2090+	32.47	I IIIIII
SUPERIOR	SPB340	32.28	I IIIIII
DEKALB-PFIZER	CX283	32.25	I IIIIII
---	CORSOY 79	32.20	I IIIIII
S BRAND	S460	32.10	I IIIIII
FONTANELLE	F4545	31.75	I IIIIII
---	MEAD	31.75	I IIIIII
STOCK	SS462A	31.55	I IIIIII
JACQUES	J-105	31.33	I IIIIII
STOCK	SS793	31.32	I IIIIII
HOFLER	TOPAZ	31.00	I IIIIIII
HOFLER	GEM	30.33	I IIIIIIII
---	ELGIN	30.02	I IIIIIIII
SUPERIOR	SPB308	29.92	I IIIIIIII
---	CUMBERLAND	29.27	I IIIIIIIII
AGRI-GOLD	AG-ROYAL II	28.20	I IIIIIIIIII
HOEGEMEYER	200	28.17	I IIIIIIIIII
LAND O'LAKES	L4106	27.37	IIIIIIIIIII
STINE	2920	27.07	IIIIIIIIIII
STOCK	SS500	26.92	IIIIIIIIIII
---	HARPER	26.92	IIIIIIIIIII
---	WILL	26.53	IIIIIIIIIII
S BRAND	S478	25.48	IIIIIIIIIII
GOLDEN HARVEST	X233	24.82	IIIIIIIIII
HOEGEMEYER	264	24.58	IIIIIIIIII
JACQUES	J-103	24.47	IIIIIIIIII
DIAMOND	TC204A	24.32	IIIIIIIIII
S BRAND	S44A	24.15	IIIIIIIII
DEKALB-PFIZER	CX350	23.57	IIIIIIII
DIAMOND	D310	23.02	IIIIIII
---	WEBER	21.63	IIIIII
---	WINCHESTER	21.23	IIIII
---	PLATTE	20.20	IIII
---	WILLIAMS 79	20.13	IIII
---	WILLIAMS 82	19.92	IIII
---	NEBSOY	18.87	III
MIDWEST OIL	397	18.05	II
---	WILLIAMS	16.68	I

Figure 6.

MERRICK COUNTY   NORM KRUG

SEED YIELD VS THIRD CHLOROSIS SCORE

INTERCEPT....................	88.12914
REGRESSION COEFFICIENT.......	-21.66129
STD. ERROR OF REG. COEF......	3.328
COMPUTED T-VALUE.............	-6.509
CORRELATION COEFFICIENT......	-0.696
STANDARD ERROR OF ESTIMATE...	3.861

ANALYSIS OF VARIANCE FOR THE REGRESSION

SOURCE OF VARI.	D.F.	SUM OF SQ.	MEAN SQ.	F VALUE
ATTRIBUTABLE TO REG.	1	631.668	631.668	42.367 ***
DEVIATION FROM REG.	45	670.922	14.909	
TOTAL	46	1302.590		

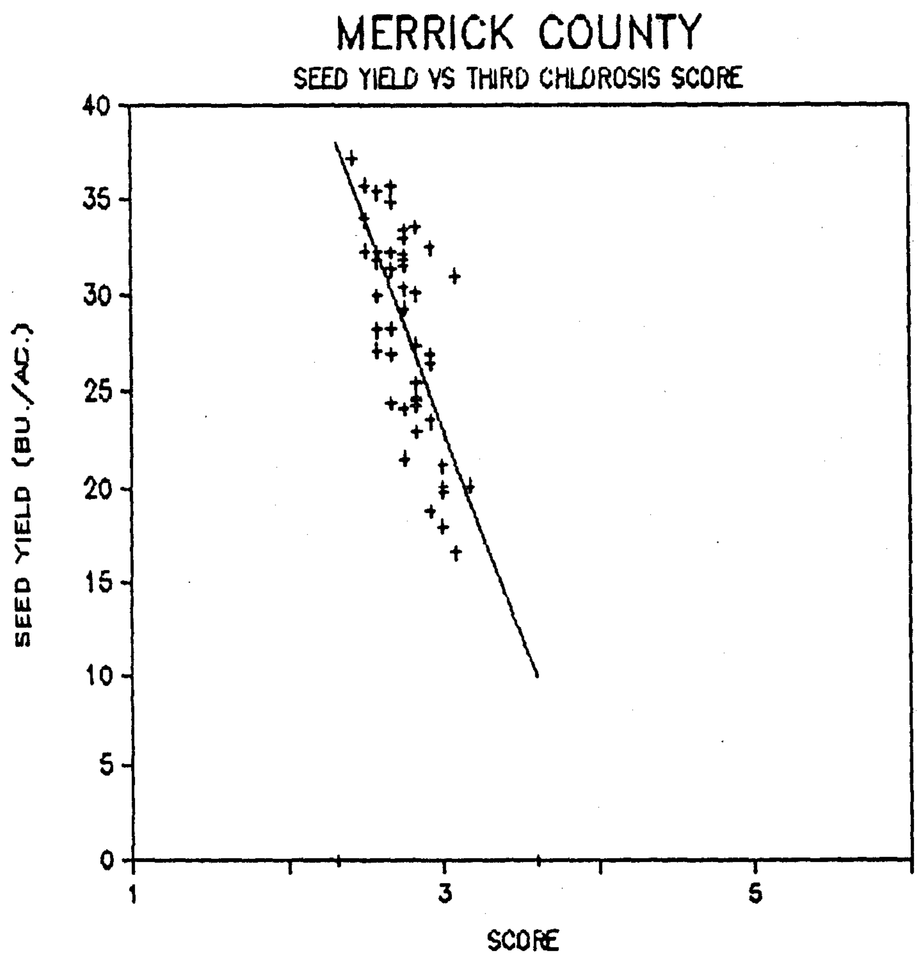

Table 14. PVY 1984 SEED YIELD SAUNDERS CO.

ANALYSIS OF VARIANCE

SOURCE	DF	SS	MS	F	
REP	5.	2757.56	551.51	39.02	***
TREATS	47.	2083.31	44.33	3.14	***
ERROR	235.	3321.19	14.13		
TOTAL	287.	8162.06			

STANDARD ERROR OF A TREATMENT MEAN = 1.5347
LEAST SIGNIFICANT DIFFERENCE 5% = 4.2541
EXPERIMENTAL MEAN IS 20.88 CV = 18.01%

DUNCAN'S MULTIPLE RANGE TEST (5 % PROTECTION LEVEL)

BRAND	ENTRY	MEAN	RANGES OF INSIG. CHANGE
AGRI-GOLD	AG-ROYAL	24.38	I
STINE	3500	24.15	II
JACQUES	J-103	23.93	III
DIAMOND	D220	23.92	III
GOLDEN HARVEST	H1285	23.88	III
STINE	2920	23.83	III
HOEGEMEYER	200	23.73	IIII
S BRAND	S46D	23.68	IIIII
LAND O'LAKES	L4106	23.55	IIIIII
---	ELGIN	23.52	IIIIII
---	CENTURY	23.48	IIIIII
STINE	2050+	23.40	IIIIIII
MCCUBBIN	TAYLOR	23.25	IIIIIIII
S BRAND	S47B	23.15	IIIIIIII
LAND O'LAKES	L4207	22.93	I IIIIIIII
JACQUES	J-105	22.53	I IIIIIIII
---	PLATTE	22.48	I IIIIIIII
HOEGEMEYER	205	22.40	I IIIIIIII
---	MEAD	22.32	I IIIIIIII
LAND O'LAKES	3665	22.00	I IIIIIIII
DEKALB-PFIZER	CX283	21.78	I IIIIIIII
HOFLER	GEM	21.57	I IIIIIIII
AGRI-GOLD	AG-ROYAL II	21.57	I IIIIIIII
STOCK	SS462A	21.40	I IIIIIIII
NC+	2090+	21.35	I IIIIIIII
GOLDEN HARVEST	X233	21.13	I IIIIIIIII
FONTANELLE	F4545	20.93	I IIIIIIIII
SUPERIOR	SPB308	20.45	IIIIIIIIIII
HOFLER	TOPAZ	20.33	IIIIIIIIIII
S BRAND	S44A	20.30	IIIIIIIIIII
---	WINCHESTER	20.17	IIIIIIIIIII
---	HARPER	20.10	IIIIIIIIIII
---	WILL	19.72	IIIIIIIIIII
---	CORSOY 79	19.22	IIIIIIIIIII
STOCK	SS793	19.03	IIIIIIIIII
---	WILLIAMS 79	18.87	IIIIIIIII
DEKALB-PFIZER	CX350	18.77	IIIIIIIII
SUPERIOR	SPB340	18.57	IIIIIIII
---	WILLIAMS	18.50	IIIIIIII
---	WEBER	18.47	IIIIIII
HOEGEMEYER	264	18.33	IIIIII
DIAMOND	TC204A	18.20	IIIII
---	WILLIAMS 82	18.12	IIII
---	CUMBERLAND	17.90	III
STOCK	SS500	17.87	III
MIDWEST OIL	397	16.02	II
DIAMOND	D310	15.32	II
---	NEBSOY	11.52	I

Table 15. COLFAX COUNTY VARIETY X SEED DENSITY

THIRD CHLOROSIS SCORE

VARIETY		SEED DENSITY, SEEDS/FT. 4.5	9.0	13.5	MEAN
---	CENTURY	3.80	3.30	2.60	3.23
---	NEBSOY	5.22	4.60	4.40	4.74
STINE	2920	2.10	1.80	1.30	1.73
	MEAN	3.70	3.23	2.77	3.24

VARIETY *** DENSITY ** V X D n.s.

SEED YIELD

VARIETY		SEED DENSITY, SEEDS/FT. 4.5	9.0	13.5	MEAN
---	CENTURY	9.9	13.4	21.3	14.9
---	NEBSOY	1.4	4.0	7.9	4.4
STINE	2920	21.7	25.9	24.7	24.1
	MEAN	11.0	14.4	18.0	14.5

VARIETY *** DENSITY *** V X D n.s.

DIXON COUNTY VARIETY X SEED DENSITY

THIRD CHLOROSIS SCORE

VARIETY		SEED DENSITY, SEEDS/FT. 4.5	9.0	13.5	MEAN
---	CENTURY	2.40	2.17	2.18	2.25
---	NEBSOY	3.30	2.58	2.97	2.95
STINE	2920	2.25	1.90	1.78	1.98
	MEAN	2.65	2.22	2.31	2.39

VARIETY *** DENSITY *** V X D n.s.

SEED YIELD

VARIETY		SEED DENSITY, SEEDS/FT. 4.5	9.0	13.5	MEAN
---	CENTURY	10.8	14.5	17.6	14.3
---	NEBSOY	2.5	7.5	5.6	5.2
STINE	2920	10.4	13.0	17.5	13.6
	MEAN	7.9	11.7	13.6	11.0

VARIETY *** DENSITY *** V X D *

Table 15. (Cont) DODGE COUNTY VARIETY X SEED DENSITY

THIRD CHLOROSIS SCORE

VARIETY		SEED DENSITY, SEEDS/FT. 4.5	9.0	13.5	MEAN
---	CENTURY	3.50	3.60	2.54	3.21
---	NEBSOY	5.40	5.46	5.20	5.35
STINE	2920	3.60	2.20	2.10	2.63
	MEAN	4.17	3.75	3.28	3.73

VARIETY *** DENSITY *** V X D *

SEED YIELD

VARIETY		SEED DENSITY, SEEDS/FT. 4.5	9.0	13.5	MEAN
---	CENTURY	15.8	19.2	32.3	22.4
---	NEBSOY	2.7	3.7	2.3	2.9
STINE	2920	12.2	34.0	37.2	27.8
	MEAN	10.2	19.0	23.3	17.7

VARIETY *** DENSITY *** V X D ***

LINCOLN COUNTY VARIETY X SEED DENSITY

THIRD CHLOROSIS SCORE

VARIETY		SEED DENSITY, SEEDS/FT. 4.5	9.0	13.5	MEAN
---	CENTURY	4.83	4.00	4.00	4.28
---	NEBSOY	6.00	5.77	5.67	5.81
STINE	2920	5.17	4.00	3.33	4.16
	MEAN	5.33	4.59	4.33	4.75

VARIETY *** DENSITY *** V X D **

SEED YIELD

VARIETY		SEED DENSITY, SEEDS/FT. 4.5	9.0	13.5	MEAN
---	CENTURY	6.0	14.3	14.9	11.7
---	NEBSOY	0.0	1.0	1.3	0.8
STINE	2920	2.9	14.1	20.6	12.5
	MEAN	3.0	9.8	12.3	8.3

VARIETY *** DENSITY *** V X D ***

Table 15. (Cont) MERRICK COUNTY VARIETY X SEED DENSITY

THIRD CHLOROSIS SCORE

VARIETY		SEED DENSITY, SEEDS/FT. 4.5	9.0	13.5	MEAN
---	CENTURY	2.83	2.67	2.50	2.67
---	NEBSOY	3.58	3.17	3.00	3.25
STINE	2920	2.75	2.67	2.83	2.75
	MEAN	3.39	2.84	2.78	2.89

VARIETY *** DENSITY *** V X D **

SEED YIELD

VARIETY		SEED DENSITY, SEEDS/FT. 4.5	9.0	13.5	MEAN
---	CENTURY	15.2	22.6	33.8	23.9
---	NEBSOY	4.8	9.1	21.5	11.8
STINE	2920	15.8	24.9	34.5	25.0
	MEAN	11.9	18.8	29.9	20.2

VARIETY *** DENSITY *** V X D n.s.

SAUNDERS COUNTY VARIETY X SEED DENSITY

SEED YIELD

VARIETY		SEED DENSITY, SEEDS/FT. 4.5	9.0	13.5	MEAN
---	CENTURY	18.9	24.8	28.5	24.1
---	NEBSOY	11.6	15.8	21.8	16.4
STINE	2920	21.9	25.4	28.0	25.1
	MEAN	17.5	22.0	26.1	21.9

VARIETY *** DENSITY *** V X D n.s.

MEANS OF SEED YIELD OF SIX SITES

SEED YIELD

VARIETY		SEED DENSITY, SEEDS/FT. 4.5	9.0	13.5	MEAN
---	CENTURY	12.7	18.1	24.7	18.5
---	NEBSOY	3.8	6.9	6.9	5.9
STINE	2920	14.2	22.9	27.1	21.3
	MEAN	10.2	16.0	19.6	15.3

VARIETY *** DENSITY *** V X D n.s. SITE ***

Table 15. (Cont) FIVE SITES VARIETY X SEED DENSITY

THIRD CHLOROSIS SCORE

VARIETY		SEED DENSITY, SEEDS/FT. 4.5	9.0	13.5	MEAN
---	CENTURY	3.53	3.17	2.80	3.17
---	NEBSOY	4.70	4.33	4.26	4.43
STINE	2920	3.22	2.51	2.36	2.70
	MEAN	3.82	3.34	3.14	3.43

VARIETY *** DENSITY ** V X D N.S. SITE ***

SEED YIELD

VARIETY		SEED DENSITY, SEEDS/FT. 4.5	9.0	13.5	MEAN
---	CENTURY	11.5	16.8	24.0	17.4
---	NEBSOY	2.3	5.1	7.7	5.0
STINE	2920	12.6	22.4	26.9	20.6
	MEAN	8.8	14.7	19.5	14.4

VARIETY *** DENSITY *** V X D n.s. SITE ***

EFFECT OF ETRIDIAZOL ON IRRIGATED CORN YIELDS

C. A. Shapiro and A. D. Flowerday

Objective: Determine the effect of the nitrification inhibitor, etridiazol, on corn yields and the optimum combination of etridiazol rate and nitrogen rate. Determine if etridiazol was more effective with any particular nitrogen carrier.

Procedure: Pre-plant etridiazol applications were applied with rates of UAN solutions, urea and anhydrous ammonia. Yields were collected. All experiments were conducted on a Sharpsburg silty clay loam (Mead, Ne).

Experimental Results: Varied nitrogen rates, nitrogen carriers and etridiazol rates make combination of years difficult (Table 1). Overall effect of using a nitrification inhibitor was minimal. In three years (1977, 1978, 1981) nitrogen application increased yields. Etridiazol increased yields in 1981 in an experiment with anhydrous ammonia. Nitrogen carriers were combined in Table 1 since there were no significant differences among nitrogen carriers. Rainfall and climate combined produced an environment that did not promote rapid leaching or denitrification of nitrogen. In highly fertile soils where little nitrogen additions are needed, a nitrification inhibitor has little potential for increasing yields when spring applied.

Table 1. Effect of Etridizol and Nitrogen rate on Corn Grain Yield. Mead, NE.

Nitrogen rate	1977[1] Etridiazol, lbs/Acre			1978[1] Etridiazol, lbs/Acre			1979[2] Etridiazol, lbs/Acre			1981[3]			1981[4]		
	0	.5	1.0	0	.5	1.0	0	.25	.50	0	.37	.50	0	.37	.50
lbs/Acre	bu/A														
0	77			150	167	140							168		
40				167	173	185	137	143	138						
80	93	92	96	168	168	175	136	145	135	145	150	134	162	166	180
120	91	96	101	185	192	188	141	138	131						
160	95		88	186	187	174				154	146	152	153	157	167
ANOVA															
Nitrogen	ch vs. other[5]			ch vs. others[5] nitrogen linear[5]			NS			ch vs. others[5]			NS		
Etridiazol	NS			NS			NS			NS			Etridiazol'		

[1]Nitrogen as Urea
[2]Means of Urea and Solution N
[3]Means of Solution N and Anhydrous Ammonia
[4]Nitrogen as Anhydrous Ammonia
[5]Significant effect at 5% level