INFLUENCE OF NITROPYRIN ON NITRATE CONCENTRATION IN SOILS

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Introduction

In central Ohio most of the water used for drinking comes from the Scioto River Watershed. This water shed in primarily composed of farmland in which corn and soybeans are the dominant crops. Periodically the nitrogen in the Scioto River exceeds safe drinking water standards of 10 ppm nitrate nitrogen. Several EPA studies have concluded the high nitrate nitrogen levels are the results of nitrate flushes through the underground tile in agricultural fields. These flushes of high nitrates usually from late February to early June following a year in which crop production was below average. The length of time when nitrates are high in the river is usually 3 to 5 days. This would suggest that the excess nitrate nitrogen is moving through the soil profile in narrow bands, but at high concentrations.

This study was designed to determine if adding a nitrification inhibitor (Nserve) to ammonium forms of nitrogen could slow down the conversion of ammonium nitrogen to nitrate nitrogen and broaden the band of nitrate nitrogen in the soil profile. If this occurred the concentration of nitrate nitrogen reaching the soil tile system should be lower at any point in time.

Methods

In 1994 a three year field study was started at Columbus, Ohio within the Scioto River watershed on a Kokomo Silty Clay Loam soil. Two nitrogen carriers, anhydrous ammonia and 28% N as UAN, with and without Nserve, were injected on 30 inch centers before planting. Injected depths were approximately 8 inches for anhydrous ammonia and 4 inches for the UAN. In 1995 and 1996, soil samples were taken directly through the nitrogen band, approximately 1 month after nitrogen application and after corn harvest in October. Nitrogen content of the soil was determined on all soil samples. Lysimiters were buried in 1995 at depths of 1, 2 and 3 feet directly through the nitrogen bands for the anhydrous ammonia treatments. Water was extracted after ever major rain event (approximately 0.5 inches or greater). Nitrate levels in the extracted water were determined.

Results

Grain yields for the four nitrogen treatment plus a control is presented in table 1. In 1994, April and May were relatively dry but the rest of the season had above average rainfall, see figure 1. With this moisture pattern little grain yield response from Nserve would be expected. In 1995 and 1996 rainfall was above average from April until August. A grain yield response was observed for Nserve when used with anhydrous ammonia. No response was measured when Nserve was included with UAN.

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Spring, soil nitrate values for 1995 and 1996 and ammonium values for 1996 are presented for both nitrogen carriers in figures 2-5. When Nserve was included in either carrier, the quantity of nitrate nitrogen approximately one month after application was reduced significantly. The amount of ammonium nitrogen remaining in the soil at this time was higher when Nserve was included. At then end of the season soil nitrate analysis were completed and are presented in figures 6-9. Both nitrate and ammonium values were low for the end of the season. There were no significant differences among treatments in 1995 or 1996.

Nitrate contents of soil water extracted throughout the 1996 season are presented in figures 10-14. Adding Nserve in anhydrous ammonia decreased the amounts of nitrate nitrogen in the soil water throughout the growing season.

Summary and Conclusions

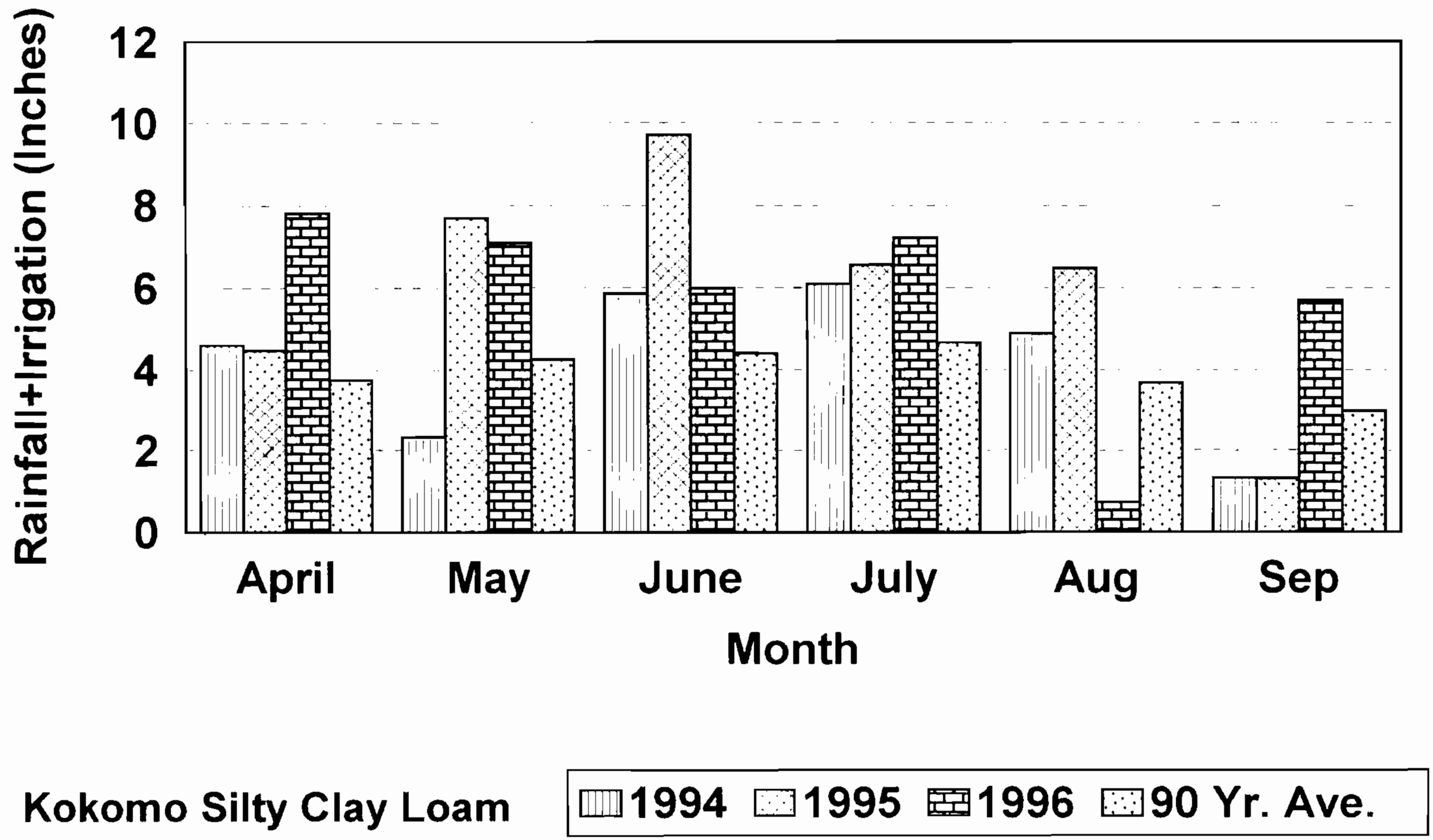
Adding Nserve with applications of nitrogen can decrease the levels of nitrate found within the soil in the soil and soil solution significantly. The amounts of nitrate nitrogen available for leaching at any point in time is approximately 50 percent of what would have been present if Nserve was not included.

Table 1
The Effects of Nitrogen Treatment on Corn Grain Yields.

	Year			
	1994	1995	1996	Average
N Treatment	Yield, bu/a			
Control	135	100	69	101
120 lbs N/A NH3-N	205	103	103	137
120 lbs N/A NH3-N + Nserve	192	143	123	153
120 lbs N/A 28% UAN	207	150	122	160
120 lbs N/A 28% UAN + Nserve	211	132	121	155
LSD 0.05	22	31	20	14

Figure 1 Rainfall + Irrigation During Growing Season

Don Scott Farm - Columbus, OH 1994-96



Kokomo Silty Clay Loam

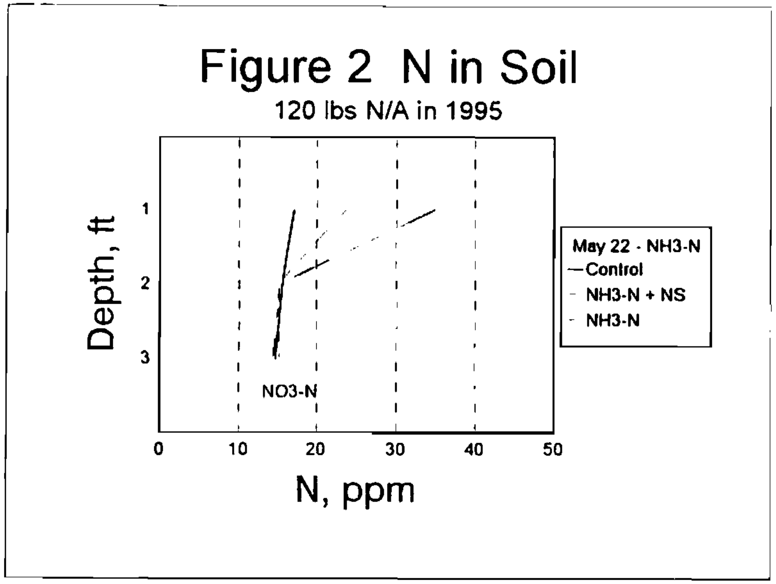


Figure 2 N in Soil
120 lbs N/A in 1995
Depth, ft
1
2
3
NO3-N
0
10
20
30
40
50
N, ppm
May 22 - NH3-N
—Control
NH3-N + NS
NH3-N

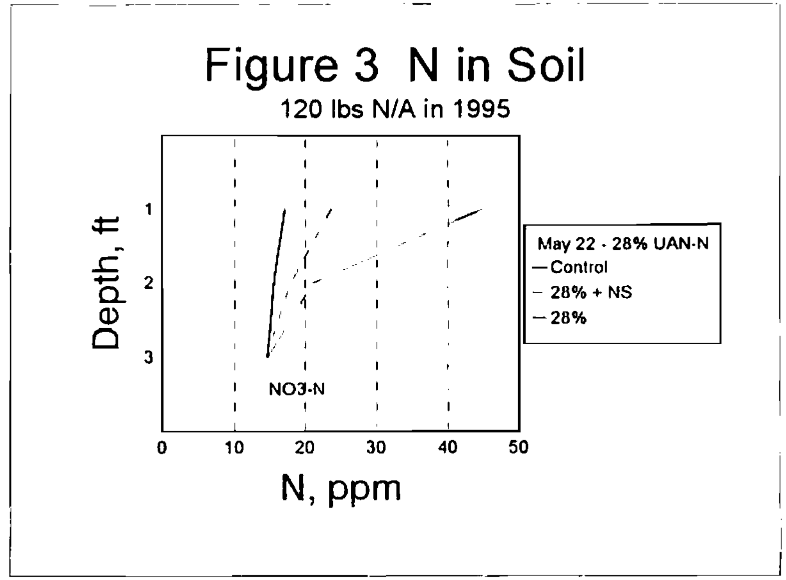


Figure 3 N in Soil
120 lbs N/A in 1995
Depth, ft
1
2
3
NO3-N
0
10
20
30
40
50
N, ppm
May 22 - 28% UAN-N
—Control
28% + NS
28%

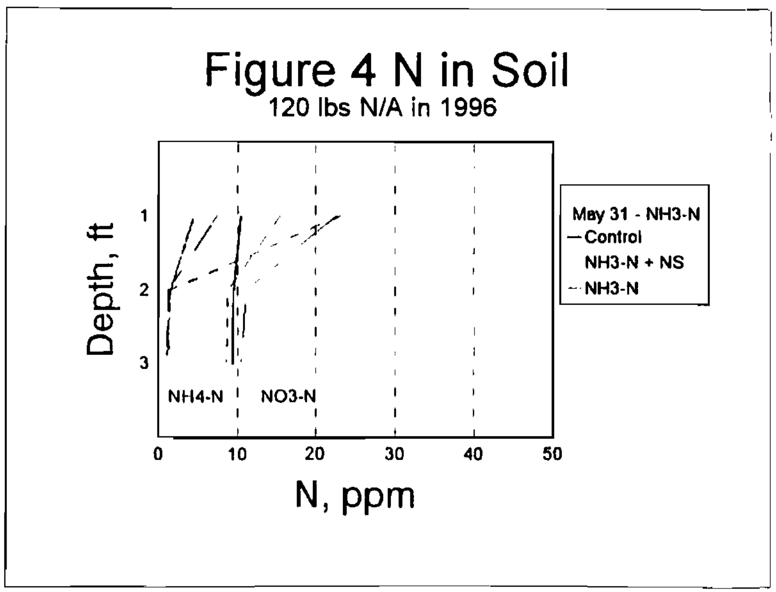


Figure 4 N in Soil
120 lbs N/A in 1996
Depth, ft
1
2
3
NH4-N
NO3-N
0
10
20
30
40
50
N, ppm
May 31 - NH3-N
—Control
NH3-N + NS
NH3-N

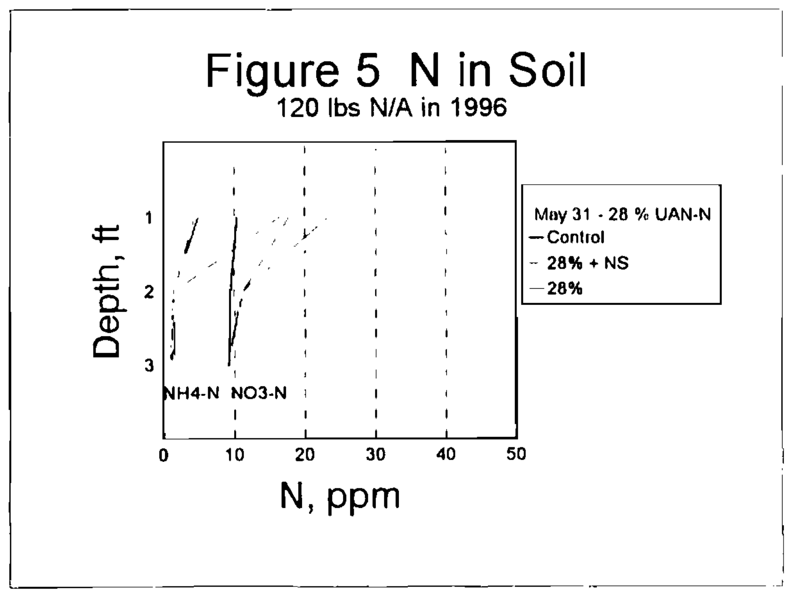


Figure 5 N in Soil
120 lbs N/A in 1996
Depth, ft
1
2
3
NH4-N
NO3-N
0
10
20
30
40
50
N, ppm
May 31 - 28 % UAN-N
—Control
28% + NS
28%

Figure 6 N in Soil
120 lbs N/A in 1995

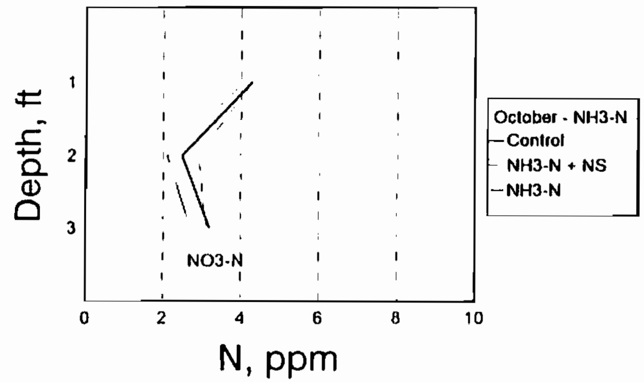


Figure 7 N in Soil
120 lbs N/A in 1995

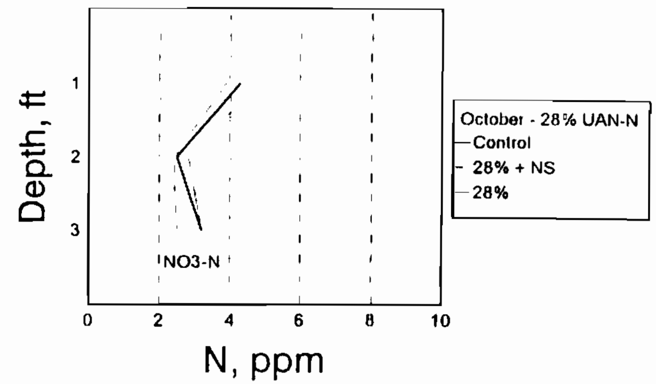


Figure 8 N in Soil
120 lbs N/A in 1996

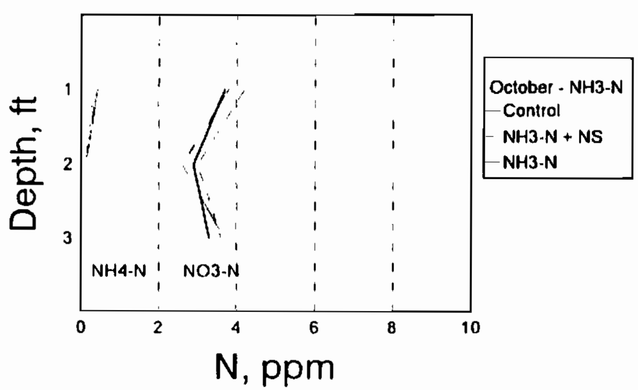


Figure 9 N in Soil
120 lbs N/A in 1996

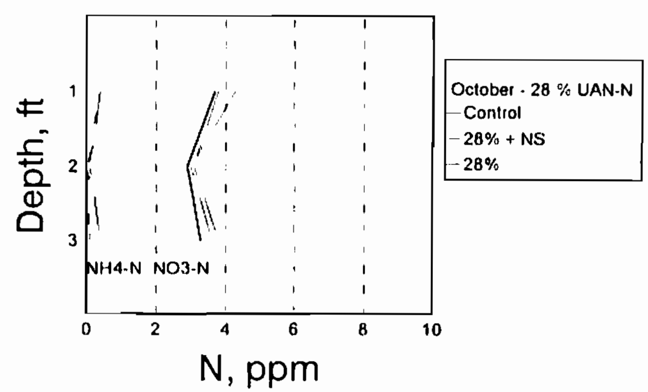


Figure 10 Nitrate N in Soil Water
120 lbs N/A in 1996

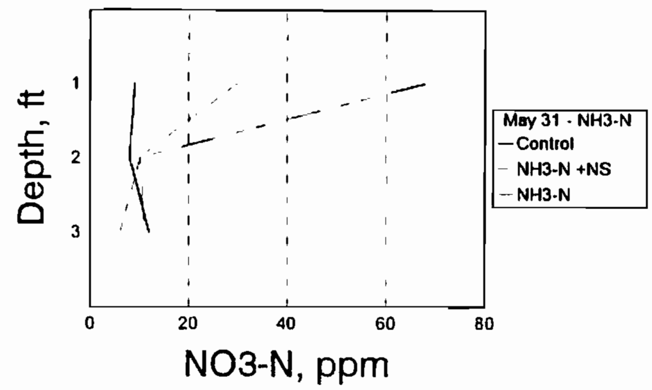


Figure 11 Nitrate N in Soil Water
120 lbs N/A in 1996

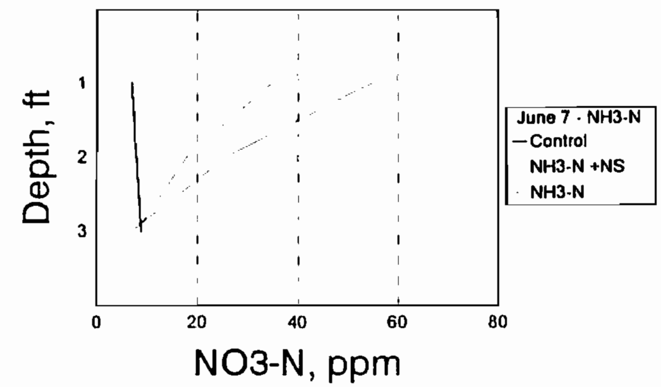


Figure 12 Nitrate N in Soil Water
120 lbs N/A in 1996

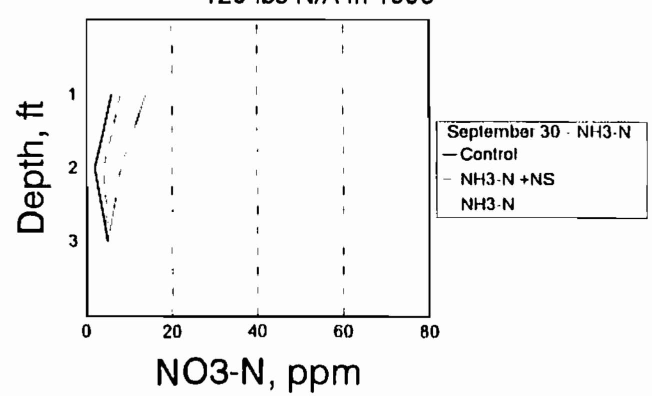
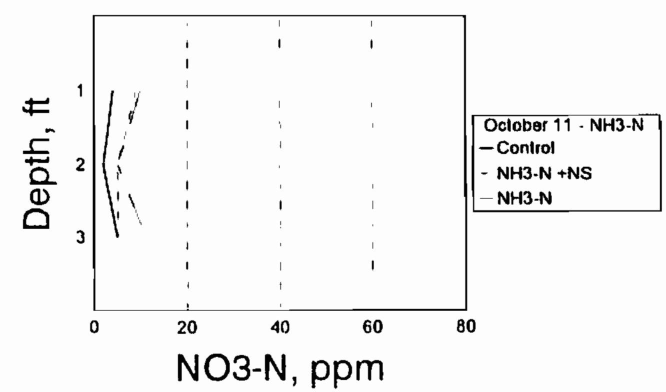


Figure 13 Nitrate N in Soil Water
120 lbs N/A in 1996



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