Comparing Nitrogen Sources and Rates on Lakebed Soils in Northwest Ohio, 1998-1999

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Objective

To observe yield response and post-mortem stalk nitrate nitrogen concentration of corn when 28% UAN and 82% anhydrous ammonia are supplied at different rates on lakebed soils..

Background

Cooperator:	Hoytville Branch OARDC	Variety:	Pioneer 34G81
County:	Henry	Planting Date:	May 3, 1999
Soil Type:	Hoytville clay loam	Planting Rate:	30,000 seeds/A
Tillage:	Field cultivator	Harvest Date:	October 11, 1999
Previous Crop:	Soybeans	Harvest Population:	26,000 plants/A

Methods

Corn was planted in the spring of 1999. Starter fertilizer at the rate of 40 pounds of actual N per acre was applied in a 2x2 placement to all plots. Plot design was a randomized split block design with four replications. N application rates were the treatments assigned to the main plots with fertilizer type assigned to the subplots.

At V5-V6 stage of corn growth, 28% UAN and 82% anhydrous ammonia was applied to make a total nitrogen application of 40, 60, 120, 180, and 240 pounds of actual N per acre. The 28% UAN was applied with a solid stream injector behind a no-till coulter. In the fall, a stalk nitrate test was taken at one to three weeks after corn kernel black layer.

On August 18, 1999, when the corn was in R4 growth stage, the number of green, healthy leaves below the ear leaf were counted. This provides an index of firing, a common symptom of nitrogen deficiency. Leaf health could provide an efficient means of determining if the adequate nitrogen nutrition was provided. When field check strips are provided with varying N rates, some research has shown that the index of leaf health can be as accurate as lab analyzed leaf tissue to identify low/ sufficient nitrogen conditions. This may provide farmers a tool to observe field response to nitrogen.

This is the second year of the nitrogen rate by source study. The first-year experiment was the same design and treatments as the 1999 study except no healthy leaf counts were taken. Results of the 1998 study are included below.

Results

Table 1 shows data from 1999. Yields were significantly different between the 40- and 60-pound total N rate when compared to the 120, 180, and 240 rates. The three higher rates were not significantly different.

Postmortem NO3-N stalk tests are a possible measure of nitrogen availability to the plant during the growing season. Corn plants generally have 10 to 15% total nitrogen uptake in the stalk at season end.

Iowa State data suggest that stalk N levels less than 250 PPM indicate a high probability that higher N rates would have increased yield. NO3-N at 250 to 700 PPM is considered close to the minimal amount to meet crop needs. A test at the 701 to 2,000 PPM level indicates a high probability that N was within the range for optimum corn yield. A test greater than 2,000 PPM indicates N availability was greater than crop needs for optimum yield.

Postmortem stalk NO3-N data in Table 1 show a higher accumulation of NO3-N in the stalk with increasing rates of nitrogen with the 240 rate significantly higher than the 40, 60, and 120 rate of nitrogen. The three rates with the highest yield also fall near the 701 to 2,000 PPM level suggested as the optimum by Iowa State recommendations.

Healthy leaf-count data may serve a purpose in evaluating N programs. The trend was for more healthy green-leaf counts below the ear leaf as N rates increased. The 180 and 240 rate were significantly higher than the 40 and 60 rate.

When comparing anhydrous ammonia and 28% UAN in 1999 (Table 2), there was no significant difference between the two nitrogen sources for yield, stalk NO3-N, or healthy leaf count. In 1998 (Table 4), anhydrous ammonia had a significantly greater yield and accumulation of stalk NO3-N when compared to 28% UAN. This would correspond to research results from other investigators where N sources can vary in yield response depending upon yield conditions.

Yield and stalk results from 1998 had similar results to 1999 data when rates were compared. Table 3 shows nitrogen rates of 120, 180, and 240 out yielded the 40- and 60-pound rates. The 180 and 240 nitrogen rates showed stalk NO3-N accumulation being within the sufficient range (701 to 2,000). The 120 rate was not significantly different in yield but was in the 250 to 700 PPM range, which is considered close to the minimal amount to meet crop needs. In 1998 and 1999, 120 rate was adequate to maximize yield.

Table 1. Average Yield, Postmortem Stalk NO_3-N, and Leaf Count by Rate for 1999.

Nitrogen Rate (Total lbs N per Acre)	Yield (bu/A @ 15%)	Stalk NO_3-N (ppm)	Leaf Count Below the Ear Leaf
40	156.1	173.8	3.9
60	158.2	301.3	4
120	179.3	695	4.4
180	182.7	708.8	4.8
240	174.7	1,553.80	4.9
LSD (0.05)	10.6	849.1	0.7

Table 2. Average Yield, Postmortem Stalk NO_3-N, and Leaf Count by Rate for 1999.

Nitrogen Source	Yield (bu/A @ 15%)	Stalk NO_3-N (ppm)	Leaf Count Below the Ear Leaf
Anhydrous Ammonia	171.9	576	4.3
28% Urea Ammonium Nitrate	168.5	797	4.5
LSD (0.05)	NS	NS	NS

Table 3. Average Yield and Postmortem Stalk NO_3-N for 1998.

Nitrogen Rate (Total lbs N per Acre)	Yield (bu/A @ 15%)	Stalk NO_3-N (ppm)
40	142.2	72.1
60	188.4	91.2
120	208.9	408.6
180	213	1,048.10
240	211.2	844.5
LSD (0.05)	13	587.3

Table 4. Average Yield and Postmortem Stalk NO_3-N for 1998.

Nitrogen Source	Yield (bu/A @ 15%)	Stalk NO_3-N (ppm)
Anhydrous Ammonia	196.1	595.1
28% Urea Ammonium Nitrate	189.4	390.7
LSD (0.05)	5.0	144.9

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