Corn Yield Response to Nitrogen Rate - Delta
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Objective
To determine the effects of nitrogen rate on corn grain yield and profitability.

Background

Crop Year: 2016
County: Fulton
Location: Delta, Ohio
Drainage: systematic
Previous Crop: Wheat
Population: 32,000 seeds per acre
Plant Date: May 19, 2016
Harvest Date: October 31, 2016
Herbicide: Accuron f,b, Roundup
Soil Type: Wauseon, Mermill

Tillage: No-till
Soil Test (grid avg): pH 5.4
P 33 ppm (Bray-P1)
K 140 ppm
O.M. 2.6%
CEC 8.5 meq/100g

Tillage: No-till
Starter Fertilizer: 66-20-90-5S-3B
Pre-Sidedress Nitrogen Test: 7 ppm NO3-N
Nitrogen Source: Anhydrous Ammonia
Rainfall (May – August): 11.6”

Methods
Four corn nitrogen rates were replicated four times in a randomized complete block design. Plots were 12 rows wide (30 ft), by 1200 feet long. The trial was planted, sprayed and harvested with commercial farm equipment. The treatments were made with commercial nitrogen application equipment. All treatment received 66 units of nitrogen at plant (planter applied + pre-emerge herbicide program). Corn was sidedressed with the balance of the total N rate for the trial when corn was at vegetative growth stage 6 (V6). At approximately 5-10 days after black layer, a corn stalk nitrate test (CSNT) was measured by taking the average of 12 stalks or every treatment replication (4 tests for each treatment). Yields and moistures were measured using a calibrated yield monitor and shrunk to 15% moisture. Rainfall data was recorded by farmer at field level.

Treatments: 1. 90 lbs. Total N/acre
2. 150 lbs. Total N/acre
3. 210 lbs. Total N/acre
4. 270 lbs. Total N/acre

Results

Table 1. Corn Yield Response to Nitrogen Rate - Delta

<table>
<thead>
<tr>
<th>Nitrogen Rate (lbs/ac)</th>
<th>Yield (bu/ac)</th>
<th>NUE (lb N/bu)</th>
<th>CSNT (ppm nitrate N)</th>
<th>Return Minus N Cost* ($/ac)</th>
</tr>
</thead>
<tbody>
<tr>
<td>90</td>
<td>180.8 a</td>
<td>0.50</td>
<td>158</td>
<td>$595</td>
</tr>
<tr>
<td>150</td>
<td>194.5 a</td>
<td>0.77</td>
<td>1592</td>
<td>$618</td>
</tr>
<tr>
<td>210</td>
<td>183.9 a</td>
<td>1.14</td>
<td>1551</td>
<td>$555</td>
</tr>
<tr>
<td>270</td>
<td>178.6 a</td>
<td>1.51</td>
<td>3030</td>
<td>$512</td>
</tr>
</tbody>
</table>

LSD (P<.05, CV 6.39) 18.85

*Based on $3.50/bu corn and $.42/lb N (Source: OSUE 2016 Corn Budget)
Discussion:
There was no statistically significant difference for yield among the four nitrogen rates. CSNTs indicate that optimal nitrate-N concentrations were achieved at the 150 and 210 lb. rates and excess nitrate-N concentrations at the 270 lb, rate (see Table 2). A CSNT for the lowest rate of 90 lbs Total N/acre was most likely yield limiting.

A standard economics calculation shows that the maximum economic return rate is 150 lbs of total nitrogen, netting $618/acre after nitrogen cost. At the economic optimum rate, the commercial nitrogen use efficiency (NUE) proved to be .77 lb of nitrogen per bushel of corn.

Economic optimum nitrogen rates vary greatly by nitrogen cost, corn price, soil type, rainfall timing and amounts, application practices and other factors. Conducting nitrogen rate trials on a specific farm is the best way to determine the economic optimum rate for that farm.

Acknowledgement
The author wishes to express appreciation to on-farm collaborator Prentiss Farms for conducting this trial. Thanks to agronomy intern Ben Eggers for assistance with data collection. Thanks to Dr. Steve Culman and Anthony Fulford at OARDC for processing CSNT tests and to the Ohio Corn Checkoff Board for supporting this research.

<table>
<thead>
<tr>
<th>Nitrate-Nitrogen ppm</th>
<th>Rating</th>
<th>Interpretations +</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 250</td>
<td>Low</td>
<td>Nitrogen was likely yield limiting during the growing season, especially if the test result is less than 250 ppm.</td>
</tr>
<tr>
<td>250-2,000</td>
<td>Optimal</td>
<td>Grain yield was not limited by the amount of nitrogen available to the crop. Note: the high end of this category is appropriate when nitrogen prices are low and corn prices high. The low end of this category is appropriate when nitrogen prices are high and corn prices low.</td>
</tr>
<tr>
<td>Greater than 2,000</td>
<td>Excess</td>
<td>Excessive nitrogen available to the crop, or some other production factor limited crop growth and yield.</td>
</tr>
</tbody>
</table>

* Corn Stalk Nitrate Tests-Research and Recommendation Update, Purdue University, 15 September 2014.

For more information on this trial, contact:
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