Late Season 28% UAN Application and Reduced Rates

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Objective

To determine the effects of nitrogen timing and reduced rates on corn grain yield and profit.

Background

Crop Year: 2016
County: Fulton
Location: Delta, Ohio
Drainage: Systematic
Previous Crop: Soybeans
Plant Date: May 20, 2016
Harvest Date: October 25, 2016
Herbicide: Sharpen, Tripleflex, Atrizine, Roundup PowerMaxx

Soil Type: Nappanee, Mermill loam
Tillage: Minimal tillage
Soil Test (grid avg): pH 6.1
P 18 ppm (Bray-p1)
K 126 ppm
O.M. 3.5%
CEC 10.6 meq/100g
Starter Fertilizer: 55-78-148-4s-1z/acre
Rainfall (May – August): 10.9”

Methods

Four corn nitrogen rates were replicated three times in a randomized complete block design. Plots were 48 rows wide (120 feet) by 600 feet long. The trial was planted, sprayed and harvested with commercial farm equipment. The sidedress treatments were made with commercial anhydrous application equipment and late season nitrogen treatments were made with a high boy sprayer with drop tubes at each row. The total nitrogen budget for this farm was 210 units of nitrogen with a yield goal of 210 bushels per acre. Reduced rates replicated in this trial include .9 lbs of N per anticipated bushel of yield (treatment 3) and .8 lb of N per anticipated bushel of yield (treatment 4). All treatment received 110 units of nitrogen at plant (planter applied + pre-emerge). In this trial the sidedress treatment was made at V3 (June 2nd), and the late season treatment was applied at V10 (June 29th). The first measureable rain (.1”) fell approximately 48 hours after late season application. A corn stalk nitrate test (CSNT) was taken with an average of 12 stalks for every treatment replication (4 tests for each treatment) at black layer. Yields and moistures were measured using a calibrated yield monitor and shrunk to 15% moisture. Rainfall data was recorded at field level by the farmer.

Treatments:
1. Anhydrous sidedress 100 lbs N/ac at V3 (210 lbs total N/ac)
2. Late Season - Full Rate 100 lbs N/ac at V10 (210 lbs total N/ac)
3. Late Season - .9 of Full Rate 78 lbs N/ac at V10 (188 lbs total N/ac)
4. Late Season - .8 of Full Rate 57 lbs N/ac at V10 (167 lbs total N/ac)

Results

Table 1. N Application Timing and Rate in Corn

Nitrogen Application and Source**	Yield (bu/ac)		CSNT (ppm NO_3-N)	System Application Cost ($/ac)*	Return Minus Application Cost ($/ac)*
1. Anhydrous at V3 (100#N/210#TN)	173.9	a	1,055	$55.55	$553
2. Late Season – Full rate V10 (100#N/210#TN)	176.2	a	685	$52.00	$565
3. Late Season - .9 rate at V10 (78#N/188#TN)	174.8	a	1,278	$42.76	$569
4. Late Season - .8 rate at V10 (57#N/167#TN)	175.6	a	693	$33.94	$581
LSD (P<.05, CV 1.77)	6.19				

*Based on $13.55 anhydrous application, $10.00 highboy application, $.42/lb of nitrogen cost and $3.50/bu corn. (Source: OSUE 2016 Corn Budget & Ohio Farm Custom Rates)

**All Systems used 110lb of nitrogen at plant

Table 2. Nitrate Concentration Categories

Nitrate-Nitrogen ppm	Rating	Interpretations[+]
Less than 250	Low	Nitrogen was likely yield limiting during the growing season, especially if the test result is less than 250 ppm.
250-2,000	Optimal	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.
Greater than 2,000	Excess	Excessive nitrogen available to the crop, or some other production factor limited crop growth and yield.

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

Discussion

There was no statistically significant difference for yield among the four nitrogen treatments at this 2016 trial (Table 1). CSNTs indicate that optimal nitrate-N concentrations were achieved using all four treatments and thus nitrogen was not yield limiting (Table 2). This site did experience drought stress from planting through pollination that could have impacted nitrogen uptake and yield results.

A standard economics calculation shows that Treatment 4 (lowest late-season rate) produced the greatest net return of $581/acre after nitrogen and application costs. Treatment 4 also resulted in the lowest commercial nitrogen use efficiency (NUE) of .95 lb N per bushel of corn produced.

With the development and use of in-season nitrogen application equipment, the risk of N loss can be minimized by applying at lower rates and later in season when the corn crop needs it. These returns will vary depending on rainfall, each producer's equipment and nitrogen cost. Further research in the form of multi-year replication will add to the validity of these results.

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