Late Season 28% Nitrogen Application vs. Anhydrous at Sidedress for Corn Yield

Eric Richer, Ohio State University Extension Educator, Fulton County, Ohio
Ben Eggers, Ohio State University Agronomy Intern, Fulton County, Ohio

Objective

To determine the effects of nitrogen timing on corn grain yield and profitability.

Background

Crop Year: 2016
County: Fulton
Location: Wauseon, Ohio
Drainage: systematic, 50' laterals
Previous Crop: Wheat
Plant Date: May 21, 2016
Harvest Date: October 31, 2016
Herbicide: 2-4d, Glyphosate, Acuron
Fungicide: Quilt Xcel at VT

Soil Type: Haskins loam, Rimer sand
Tillage: Fall finisher, stale seedbed
Soil Test (grid avg): pH 6.3
P 43ppm (Bray-p1)
K 145ppm
O.M. 2.8%
CEC 8.1
Starter Fertilizer: 70-20-90-5S-3B
Pre-Sidedress Nitrogen Test: 16 ppm NO_3-N
Rainfall (May – August): 14.1"

Methods

Three corn nitrogen timing systems were replicated three times in a randomized complete block design. Plots were 24 rows wide (60 ft) by 2,200 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. All treatment received 70 units of nitrogen at plant (planter applied + pre-emerge). In this trial the sidedress treatment was made at V5 (June 11th), and the late season treatment was applied at V12 (July12th). The first significant rain (.28") fell 60 hours after late season application. A corn stalk nitrate test (CSNT) was taken by averaging 1 test 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 (Table 1). Rainfall data was recorded by farmer at field level.

Treatments:

1. Sidedress anhydrous (V5) 140 lbs N/acre
2. Late Season 28% (V12) 140 lbs N/acre
3. Split: Sidedress anhydrous (V5) 70 lbs N/ac and Late Season 28% (V12) 70 lbs N/ac
4. Zero Rate - 30 lbs N/acre (unreplicated)

Results

Table 1. N Application Timing in Corn (Anhydrous)

Nitrogen Application and Source**	Yield (bu/ac)		CSNT (ppm NO_3-N)	System Application Cost ($/ac)*	Return Minus Application Cost ($/ac)*
Anhydrous (V5)	212.8	a	3,324	$13.55	$731
Late (V12)	211.2	a	1,706	$10.00	$729
Split (V5 & V12)	214.4	a	1,701	$23.55	$727
Zero Rate (30#)	133.1	b	62	-	$466
LSD (P<.05, CV 1.8)	8.7				

*Based on $13.55 anhydrous application, $10.00 highboy application, and $3.50/bu corn. (Source: 2016 Corn Ohio Custom Rates)

**All Systems used 140 lbs N/ac in season, 70 lbs N/ac at plant; zero rate unreplicated.

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 three nitrogen timing systems in 2016 except for the zero/low rate, which is the unreplicated check for this trial (Table 1). CSNTs indicate that optimal nitrate-N concentrations where achieved using treatment 2 (late season) and treatment 3 (split V5 & V12). Excess nitrate-N concentrations were achieved with treatment 1 (anhydrous). A CSNT for the zero/low rate of 30 lbs Total N/acre shows that this rate yield limiting (Table 2).

A standard economics calculation shows that each of the systems have a very similar economic return, with the anhydrous system showing a slight economic edge in this trial. These returns will also vary depending on each producer's equipment and nitrogen cost.

With the development and use of in-season nitrogen application equipment, the risk of N loss can be minimized by applying later in season when the corn crop needs it. Further research in the form of multi-year replication will add to the validity of these results.

Acknowledgement

The authors express appreciation to on-farm collaborator Larry Richer for conducting this trial. Thanks to the Culman Lab at OARDC for processing CSNT tests and to the Ohio Corn Checkoff Board for supporting this research.