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

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Objective

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

Background

Crop Year: 2017
County: Fulton
Location: Wauseon, Ohio
Drainage: Pattern, 50' laterals
Previous Crop: Soybeans
Plant Date: May 18
Harvest Date: October 16

Tillage: No-till
Herbicide: Bicep II Magnum
Fungicide: Quilt Xcel at VT
Starter Fertilizer: 70-20-90-5S-3B
Pre-Sidedress Nitrogen Test: 12 ppm NO_3-N
Rainfall (April – August): 18.7"

Soil Type: Hoytville loam, Mermill loam
Soil Test (grid avg):
pH 6.7
P 34ppm (Bray-p1)
K 135ppm
O.M. 3.9%
CEC 18.0meq/100

Methods

Four corn nitrogen timing systems were replicated three times in a randomized complete block design. Plots were 24 rows wide (60 ft) by 2,500 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 pounds of nitrogen per acre with a yield goal of 210 bushels per acre. All treatments received 70 pounds of nitrogen per acre at plant (planter applied + pre-emerge). In this trial the sidedress treatment was made on June 13th when five corn leaf collars were present (V5) and 1.1" of rain fell approximately 12 hours after application. The late season treatment was applied on July 19th when twelve leaf corn leaf collars were present (V12). The first significant rain (.85") fell 60 hours after late season application. A corn stalk nitrate test (CSNT) was taken by averaging 1 test of 10 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 ammonia (V5) 140 lbs N/acre
2. Late Season Urea Ammonium Nitrate (UAN) 28% nitrogen (V12) 140 lbs N/acre
3. Split: Sidedress anhydrous ammonia (V5) 70 lbs N/ac and Late Season (UAN) 28% nitrogen (V12) 70 lbs N/ac
4. Late Season (UAN) 28% nitrogen (V12) 98 lbs N/acre

Results

Table 1. N Application Timing in Corn (Anhydrous)

Nitrogen Treatment	Placement	Rate (total N/ac)	Source	Yield (bu/ac)		CSNT (ppm NO_3-N)	NUE Lbs N/bu	System Application Cost ($/ac)*	Return Minus Application Cost ($/ac)
Check @ V5	Gas Injection	210	Anhydrous	209.2	a	458	1.0	$61.15	$671
Late N @ V12	Y-Drops ®	210	28% UAN	211.9	a	972	0.99	$57.60	$684
Split @ V5 & V12	Both	210	Both	214.4	a	1,633	0.98	$71.15	$679
Late N @ V12 (reduced)	Y-Drops ®	168	28% UAN	211.2	a	148	0.80	$42.91	$696
LSD (P<.05, CV 1.43)				6.03					

*Based on $13.55 anhydrous application, $10.00 highboy application, $.34/lb N and $3.50/bu corn. (2016 Ohio Custom Rates)

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 timing systems in 2017. CSNTs indicate that optimal nitrate-N concentrations were achieved using treatment 1 (anhydrous), treatment 2 (late season) and treatment 3 (split V5 & V12). Low nitrate-N concentrations were achieved with treatment 4 (reduced late season).

A standard economics calculation shows that each of the systems have a very similar economic return, with the reduced late season 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 nitrogen loss can be minimized by applying it later in season when needed by the corn crop. Further research in the form of multi-year replication will add to the validity of these results.

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