

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	Tillage: No-till
County: Fulton	Soil Test (grid avg): pH 5.4
Location: Delta, Ohio	P 33 ppm (Bray-P1)
Drainage: systematic	K 140 ppm
Previous Crop: Wheat	O.M. 2.6%
Variety: SQC 108	CEC 8.5 meq/100g
Population: 32,000 seeds per acre	Starter Fertilizer: 66-20-90-5S-3B
Plant Date: May 19, 2016	Pre-Sidedress Nitrogen Test: 7 ppm NO ₃ -N
Harvest Date: October 31, 2016	Nitrogen Source: Anhydrous Ammonia
Herbicide: Accuron f,b, Roundup	Rainfall (May – August): 11.6"
Soil Type: Wauseon, Mermill	

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

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

LSD (P<.05, CV 6.39) 18.85

*Based on \$3.50/bu corn and \$.42/lb N (Source: OSUE 2016 Corn Budget)



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. <i>Note</i> : 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 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.

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