

# Corn Yield Response to Nitrogen Rate - Metamora

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## Objective

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

## Background

Crop Year: 2016	Tillage: Fall disc rip f.b. spring finisher
County: Fulton	Soil Test (grid avg):pH 5.7
Location: Metamora, Ohio	P 31 ppm (Bray-P1)
Drainage: systematic, 40' laterals	K 123 ppm
Previous Crop: Soybeans	O.M. 2.1%
Variety: Great Lakes 5470	CEC 6.9 meq/100g
Population: 34,200 seeds per acre	Starter Fertilizer: 21-31-150/ac
Plant Date: May 8, 2016	Pre-Sidedress Nitrogen Test: 9 ppm NO <sub>3</sub> -N
Harvest Date: October 24, 2016	Nitrogen Source: Anhydrous Ammonia
Herbicide: Capreno and Atrazine (Post-emerge)	Rainfall (May – August): 14.3"
Soil Type: Brady, Millgrove	

## Methods

Five corn nitrogen rates were replicated four times in a randomized complete block design. Plots were 16 rows wide (40 feet) by 1320 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 21 units of nitrogen at plant and the balance of the total nitrogen rate at sidedress during growth stage V5-V6. A corn stalk nitrate test (CSNT) was taken for every replication and then averaged. Yields and moistures were measured using a calibrated yield monitor and shrunk to 15% moisture. Precipitation data was recorded by the farmer.

Treatments:	1. Check (Zero/Low Rate)
	2. 75 lbs Total N/ac
	3. 150 lbs Total N/ac
	4. 225 lbs Total N/ac
	5. 300 lbs Total N/ac

## Results

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Nitrogen Rate (lbs/ac)*	Yield (bu/ac)	NUE (lbN/bu)	CSNT (ppm nitrate N)	Return Minus N Cost** (\$/ac)
21	135.0 e	0.16	73	\$464
75	164.8 d	0.46	56	\$545
150	181.5 c	0.83	124	\$572
225	187.0 b	1.20	532	\$560
300	193.0 a	1.55	775	\$550

LSD (P<.05, CV 1.23) 3.56

\* 21 lbs/ac rate was unreplicated, planter applied only; not used in discussion.

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



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Table 2. Nitrate Concentration Categories		
Nitrate-Nitrogen ppm	Rating	Interpretations <sup>+</sup>
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.

<sup>+</sup> *Corn Stalk Nitrate Tests-Research and Recommendation Update* , Purdue University, 15 September 2014.

### Discussion:

There was a statistical significant difference for yield among the 4 replicated nitrogen rates at this site in 2016. The highest statistically significant yield was 193 bu/ac using a total nitrogen rate of 300 lbs/ac. The lowest statistically significant replicated yield was 164.8 bu/ac using a total nitrogen rate of 75 lbs/ac. A CSNT indicates that optimal nitrate-N concentrations were achieved at the 225-300 lbs/ac rate, but rates of 150 lbs/ac and lower could have been yield limiting.

However, a standard economics calculation shows that the maximum economic return rate is 150 lbs of total nitrogen, netting \$572/acre after nitrogen cost. At the economic optimum rate, the commercial nitrogen use efficiency (NUE) proved to be .83 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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