Corn Response to Nitrogen Rates

Trial Objective

- The optimum nitrogen (N) rate for corn can be difficult to determine. Inadequate N can cause a noticeable reduction in yield while excess, unused N reduces the return on N investment and can have negative environmental impacts.
- The objective of this study was to evaluate the response of corn products to different N rates.

Research Site Details

Location	Soil Type	Previous Crop	Tillage Type	Planting Date	Harvest Date	Potential Yield (bu/acre)	Seeding Rate (seeds/acre)
Gothenburg, NE	Hord silt loam	Corn	No tillage	4/30/20	11/4/20	250	36K

- The study was set up as a split-plot design with four replications.
- Four different relative maturity (RM) corn products (109RM, 111RM, 112RM, and 114RM) were evaluated under six different N rates (0, 60, 120, 180, 240, and 300 lb N/acre). Nitrogen was applied with 360 Y-DROP® fertilizer tube attachments at the V6 growth stage on 6/18/20.
- Weeds were uniformly controlled, and no insecticides or fungicides were applied.
- Grain weight and grain moisture were collected to calculate yield.

Figure 1. The yellow coloration of the corn leaves on the left (0 lb N/acre) indicate the beginning of a N deficiency compared to the dark green of the leaves to the right (60 lb N/acre).

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Understanding the Results

Table 1. Residual N in the soil profile prior to 2020 N application.

2020 N Treatment (lb N/acre)	0-8-ft Depth (lb N-NO3-/acre)	8-24-ft Depth (lb N-NO3-/acre)	Total N in Top 24-ft of Soil (lb N-NO3-/acre)
0	7	8	15
60	8	10	18
120	5	8	13
180	9	17	26
240	14	17	31
300	12	27	39

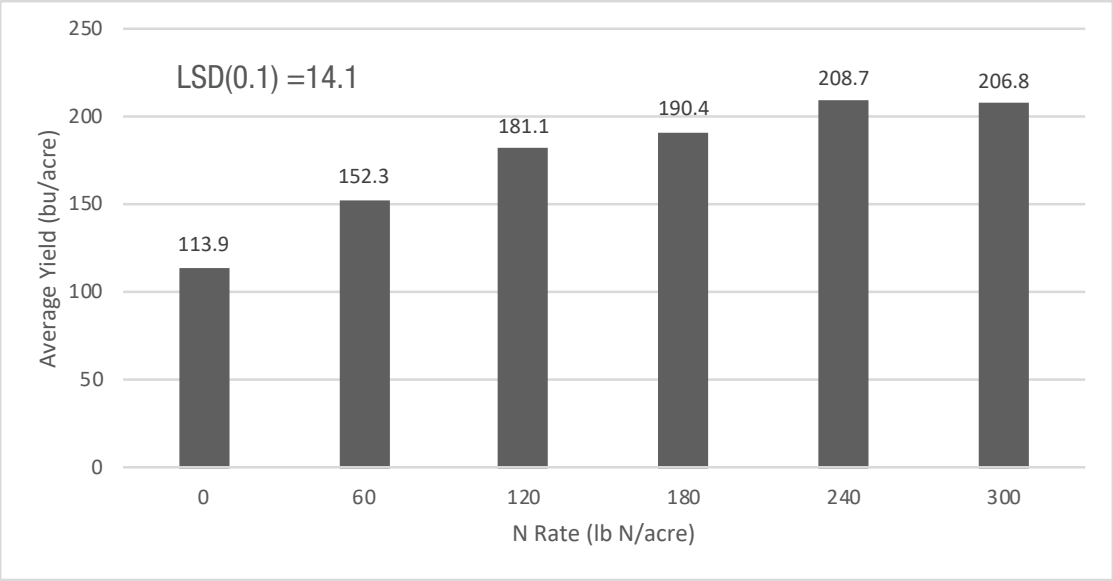

Figure 2. Average yield response to N application rates.

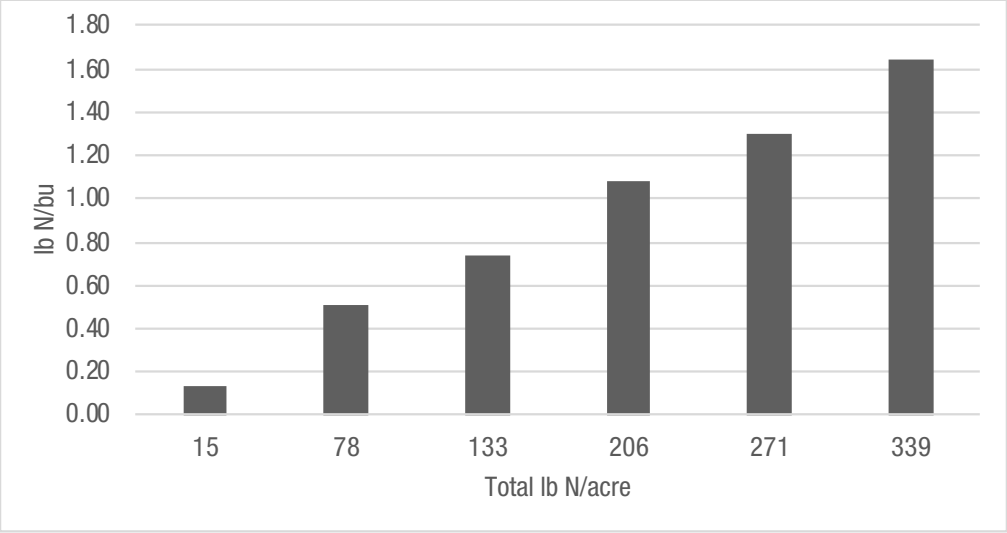

Figure 3. Pounds of N to produce one bushel of grain based on total available N per acre (including residual soil N).

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Table 2. Estimated N fertilizer cost, yield revenue, and return on N investment.

2020 N Treatment (lb N/acre)	N Fertilizer Cost ($ lb N/acre)[1]	Yield Revenue ($/acre)[2]	Return on Nitrogen Investment[3]
0	$0.00	$432.82	$0.00
60	$22.50	$578.74	$6.49
120	$45.00	$688.18	$4.86
180	$67.50	$723.52	$1.57
240	$90.00	$793.06	$3.09
300	$112.50	$785.84	-$0.32

[1]Based on cost of 32-0-0 at $240.00 per ton. Price is subject to change.
[2]Based on price of corn at $3.80 per bushel. Price is subject to change
[3]Dollars returned per dollar invested in N over previous N treatment.

- There was no N rate by corn product interaction, so data were averaged across corn products.
- The previous crop was corn which depleted the soil profile of N and other nutrients. The residual N in the top two feet of soil is shown in Table 1.
- As N rate increased, yield increased until it reached a maximum at 240 lb N/acre (Figure 2).
- The amount of N to produce on bushel of grain increased as the applied N rate increased. More N was needed to produce one bushel of grain at the higher N rates compared to the lower N rates (Figure 3).
- As N fertilizer cost increased, the return on N investment decreased. For this trial, the largest return on N investment was at the 60 lb N/acre rate and the lowest return was at the 300 lb N/acre rate (Table 2).

Key Learnings

- The law of diminishing returns is illustrated in this study with more value observed from the first 60 lb N/acre applied compared to the last 60 lb N/acre.
- Nitrogen application rates are a key factor in maximizing yield. Determining residual N in the soil in combination with a N application rate that maximizes return on N investment should be taken into consideration when developing a cost-effective fertility program.

Legal Statements

The information discussed in this report is from a single site, replicated demonstration. This informational piece is designed to report the results of this demonstration and is not intended to infer any confirmed trends. Please use this information accordingly.

Performance may vary, from location to location and from year to year, as local growing, soil and weather conditions may vary. Growers should evaluate data from multiple locations and years whenever possible and should consider the impacts of these conditions on the grower's fields.