Investigating physiological impacts of excessive nitrogen in corn

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Objective

The objective of this study is to explore the impacts of excessive nitrogen application on corn that could lead to a decline in grain yield.

Materials and Methods

Nitrogen rate trials were conducted in 2024 and 2025 at the ISU NE Research Farm near Nashua, IA. Corn was planted on 04/25/2024 and 05/04/2025 at a rate of 33,700 and 33,700 plants/ac, respectively. Corn was harvested on 10/10/2024 and 10/13/2025 with grain yield reported at 15% moisture. Nitrogen was applied in a single application as urea on 04/05/2024 and 04/11/2025, the fertilizer application was followed by the pass of a field cultivator. The N rates tested in this study were modified for 2025 (replacing 150, with 125 and 175 lbs N/acre). The economic optimum nitrogen rate (EONR) was calculated using a quadratic-plateau statistical model and a price ratio of 0.1 ($0.41/ lbs N to $4.10/bu). Biomass samples were collected at R6 and divided into individual components of: leaves, stem, extra (tassel and husk), cob, and grain (2025 not yet available). Following harvest soil cores were collected to a depth of 3 ft for the 0, 300, and 600 lbs N/acre to evaluate the root mass and length (2025 not yet available).

Results and Discussion

Grain yield was significantly impacted by nitrogen rate for both years of data (Fig 1). The calculated EONRs for 2024 and 2025 were 298 and 215 lbs N/acre with associated grain yields of 271 and 261 bu/acre. No yield decline was detected in either year of data collection when nitrogen was applied in excess of the EONR (Figure 1 and Table 1). Two years of data collection for this project demonstrated a single year of high nitrogen application did not hinder the productivity of grain corn. Below and aboveground plant tissue was not negatively impacted with limited or excessive nitrogen.

Acknowledgements

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Figure 1. Grain yield response to applied N rate (lbs N/acre). Dotted vertical line indicates where the EONR falls on the response curve. 2024 is represented as red and 2025 is represented as blue.

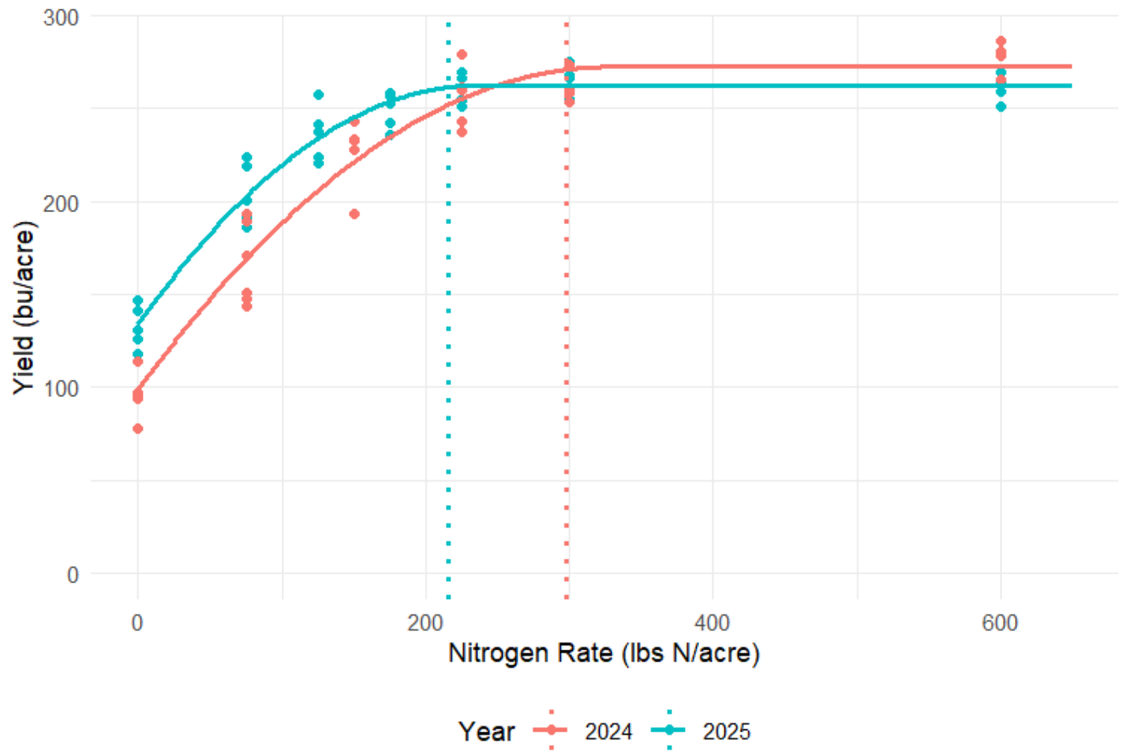

Table 1. Summary of combine grain yield at 15% moisture, root biomass (lbs/acre), and R6 total aboveground biomass (lbs/acre).

	Grain Yield (bu/acre)		Post Harvest Root Biomass (lbs/acre)	R6 Total Aboveground Biomass (lbs/acre)
Year	2024	2025	2024	2024
N Rate				
0	99 e	133 e	2050 b	11070 c
75	166 d	204 d		15504 b
125		236 c		
150	227 c			23523 a
175		249 bc		
225	254 b	259 ab		23048 a
300	263 ab	265 a	3000 b	23600 a
600	279 a	265 a	4244 a	24178 a