Evaluation of Corn Nitrogen Recommendation Tools for Improving Nitrogen Use Efficiency

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BACKGROUND & INTRODUCTION

- ✓ Publicly available nitrogen tools can be used to optimize nitrogen inputs and improve nitrogen use efficiency (NUE).
- ✓ These tools do fail when they underestimate or overestimate nitrogen recommendations, leading to unwanted consequences with either low economic returns or higher nitrogen losses.

OBJECTIVES

- ✓ Evaluate publicly available corn nitrogen recommendation tools to estimate the economic optimum nitrogen rate (EONR).
- ✓ Assess the agronomic and environmental performance of corn recommendation tools in the Bazile Groundwater Management Area (BGMA).

METHODS

- ✓ Site: Creighton, BGMA (loamy sand soil) during the year 2021.
- ✓ Six N rates were applied to calculate site-specific EONR and compare N recommendations from yield goal-based models.

Developer	Model	Recommended	Applied	Preplant		V4	V8	V12	VT
N Source				MAP	Agrotain	Urea Ammonium Nitrate			
Method					Spread	Sidedress	Fertigation		
	N ramp	14	14	14	0	0	0	0	0
		74	74		20	10	10	10	10
		134	134		40	10	10	30	30
		194	194		60	30	30	30	30
		254	254		80	70	30	30	30
		314	314		100	110	30	30	30
UNL	Maize-N	253	253		60	73	30	30	30
	UNL-N	237	237		60	89	30	30	30
	Canopy Sensor	171	164		60	0	30	30	30
Industry	Adapt-N	224	164		60	30	20	20	20
	Granular	224	164		60	30	20	20	20

- ✓ Suction cup lysimeters were installed to collect water samples following rainfall and/or irrigation events.
- ✓ Water samples were analyzed for nitrate concentrations using the colorimetric method.

RESULTS

- ✓ Nitrogen recommendation from UNL-N was within EONR range, Maize-N recommendation was above EONR range, while Adapt-N, Granular, and Canopy sensor recommended lower rate than the EONR (Figure 1).
- ✓ The corn grain yield for all models except Canopy Sensor (having 21% less) was at par with the yield at EONR (bu/acre) (Figure 2).
- ✓ Nitrate leaching concentration for Maize-N and UNL was 18% higher and 2% lower than EONR, respectively (Figure 3).
- ✓ Nitrate leaching concentration for Granular, Adapt-N, and Canopy Sensor was 26%, 29%, and 38% lower than nitrate concentrations at EONR (Figure 3).

DISCUSSION

- ✓ For corn grain yield, all nitrogen models except canopy sensor had similar performance.
- ✓ Among all models, the UNL-N algorithm matched closely to EONR for grain yield and nitrate leaching, while Maize-N had the least match for nitrate leaching compared to EONR.
- ✓ Adapt-N, Granular, and Canopy sensor had better environmental performance compared to EONR.

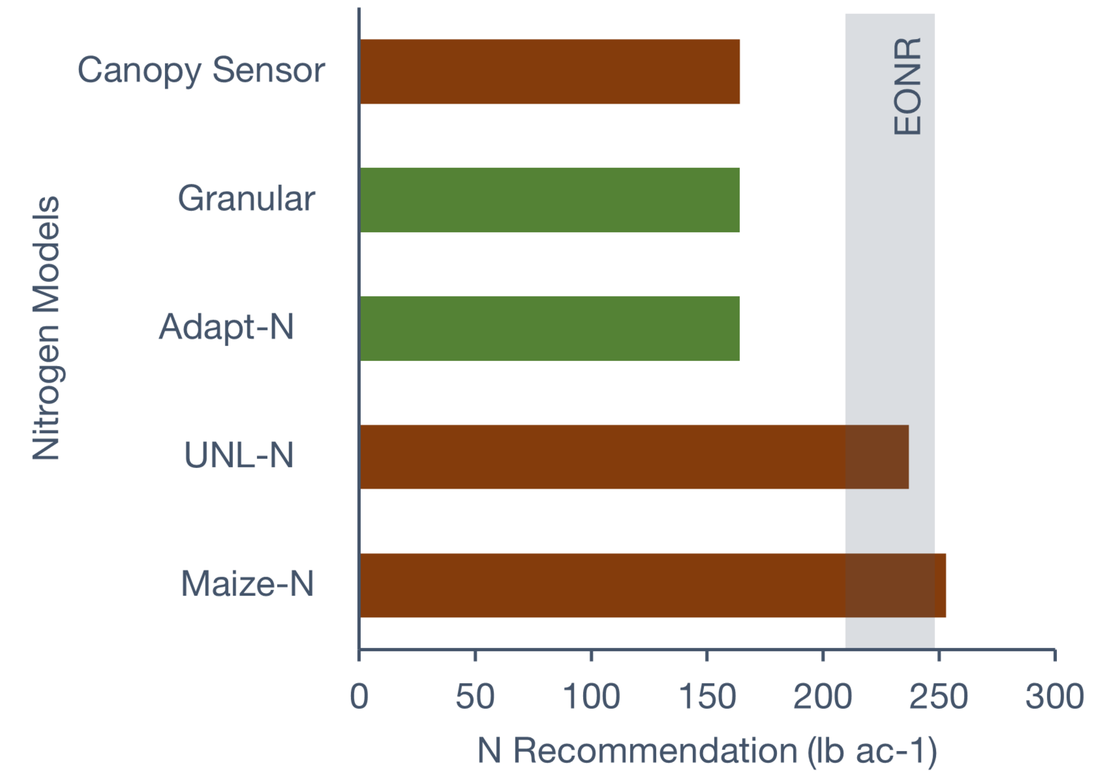

Figure 1: Comparison of Nitrogen recommendation by different models than EONR. The dark brown color bars indicate model by the University of Nebraska – Lincoln and green are the industry models.

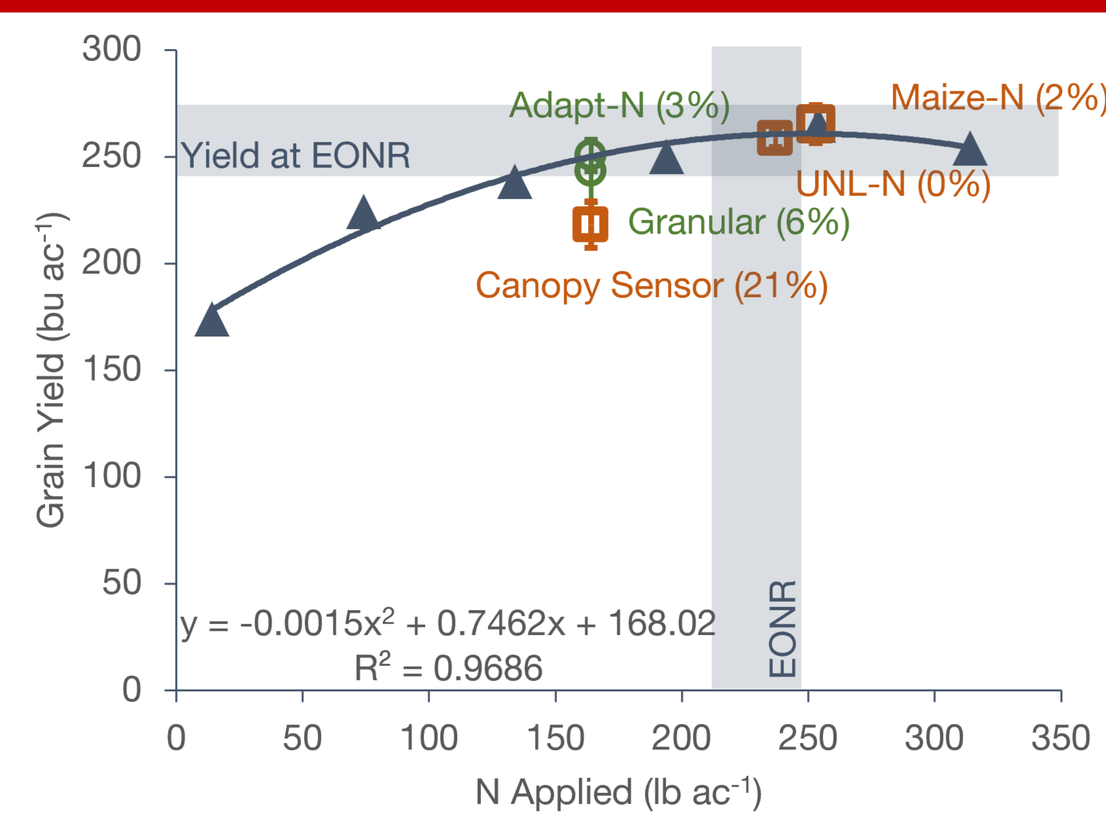

Figure 2: Response of con grain yield to nitrogen rate. The brown-colored hollow squares indicate UNL models. The green-colored hollow circles indicate industry models. Error bars show a 95% confidence interval.

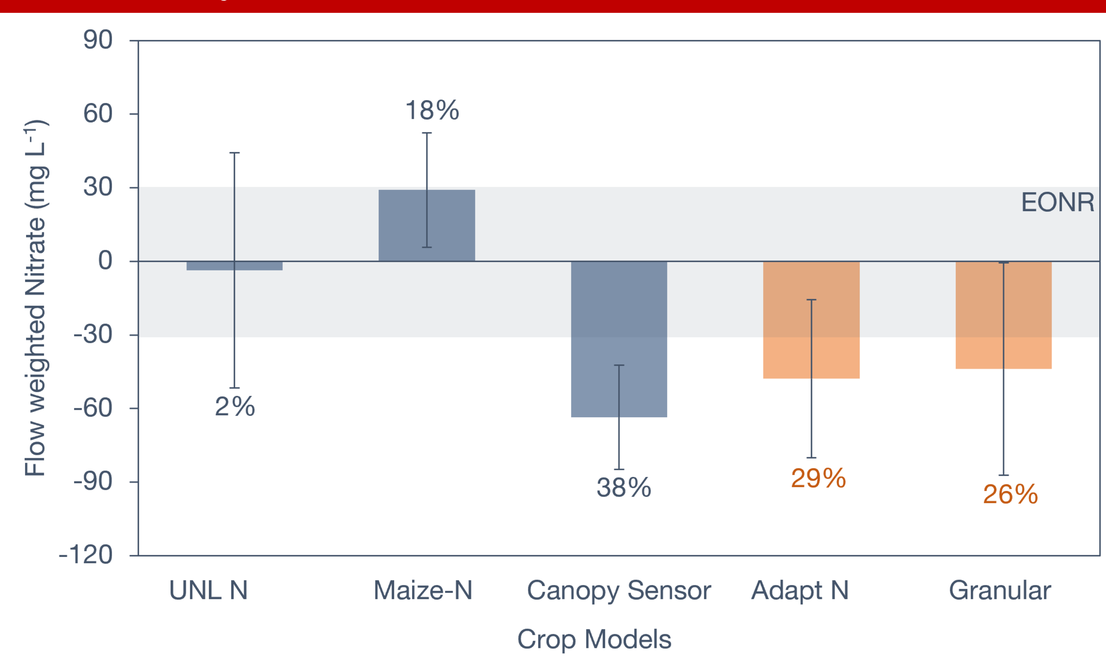

Figure 3: Nitrate leaching concentrations of corn Nitrogen Recommendation Models as compared to nitrate leaching concentrations at EONR. Error bars indicate standard error.

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