

Gaska NOPP Report

Dodge County

Data Collection Began: 2023
Data Collection Ended: 2024
Site Years: 2

Collaborators:

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Takeaways

- **Economic optimum nitrogen rate (EONR) was 161 lb-N/ac in 2023 at a yield of 203 bu/ac**
- **In 2024, high variability in the field due to a wet spring caused corn yield to not reach a plateau**
 - **Max yield 189 bu/ac**
- **No difference in post-harvest soil nitrate across N rates**



Extension

UNIVERSITY OF WISCONSIN-MADISON



Nitrogen use efficiency for corn in the Rock River Basin

Overview

The Upper Rock River Basin is characterized by Silurian dolomitic bedrock, making it prone to groundwater pollution. The Dodge County Farmers Healthy Soil Healthy Water producer-led group aimed to reduce nutrient losses and improve farmer profitability by conducting on-farm nitrogen rate trials paired with extensive soil sampling. This report focuses on one of thirteen sites in the area conducting this trial.

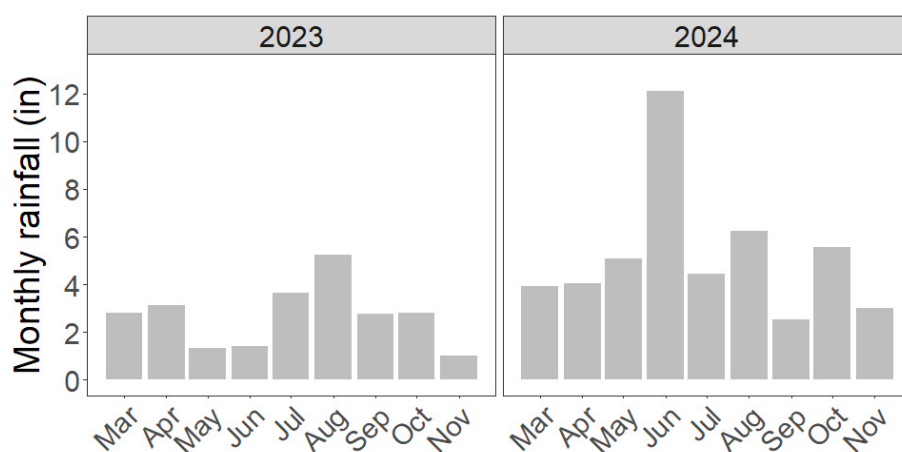


Figure 1. Monthly rainfall during the growing season in 2023 and 2024 with data from Beaver Dam, WI. Data gathered from NOAA's National Centers for Environmental Information.

Table 1. Field history for site in 2023 and 2024.

Gaska	2023 HF12	2024 JG114
Soil series	Miami	Miami, Elburn
Soil texture	Silt loam	Silt loam
Soil drainage class	Well drained	Well drained
Years of previous 10 receiving manure	0	1*
Years of previous 10 with cover crop	5	3
Years no-till	20	20
Irrigation	No	No
Drainage tile	Yes	No
Previous crop	Winter wheat	Winter wheat

*Beef cattle were winter grazed on the covers during January 2024.

Methods

In 2023, corn was planted green into a multi-species cover crop mix and the cover crop was chemically terminated 14 days later. In 2024, the cover crop was terminated prior to corn planting.

Prior to trial implementation in 2024, the field was bale grazed by 35 cows from January–February. Cows had access to the whole 17 ac field, but bales were not placed in the trial area and we do not expect to see any manure credit in trial area.

In both years, 3 lb-N/ac was applied with starter to the whole field, with 40 lb-N/ac also applied at plant to all plots except the ON treatment. The remainder of nitrogen fertilizer was applied at sidedress to achieve final treatments of 3, 43, 83, 123, 163, and 203 lb N/ac. Trial was a randomized complete block design with four replicates. Each year of the trial took place on a different field.

Data Collection

- Routine soil fertility samples (0–6")
- Pre-sidedress soil nitrate samples (0–1' and 1–2')
- Post-harvest soil nitrate samples (0–1' and 1–2')
- Yield collected via yield monitor

Spring soil results

Table 3. Routine soil analysis sampled at a depth of 0–6" prior to any nitrogen application. Routine soil sample not collected in 2024. Soil test interpretation categories for corn based on UW-Extension pub A2809.

Gaska	pH	OM	P	K	Ca	Mg
		%	----- ppm -----			
2023- HF12	5.9	2.9	35	137	1526	452
Interpretation category			Excessively high	High	High	Optimum

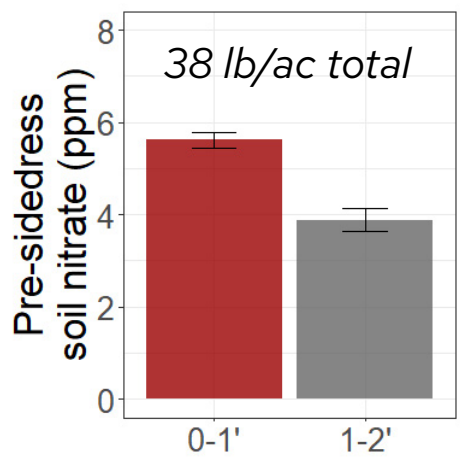


Figure 2. Pre-sidedress soil nitrate sampled prior to any nitrogen application in 2023. Spring soil nitrate not sampled in 2024.

- Soil test values indicate no additional N "credit" supplied to crop from soil N.

Table 2. Trial management information for 2023 and 2024.

Gaska	2023 HF12	2024 JG114
Cover crop (CC)	Cereal rye, spring barley, hairy vetch, oats, radish, peas	Oats, barley, tillage radish, hairy vetch, red clover
CC seeding rate	65 lb/ac drilled	47 lb/ac drilled
Spring CC height	8", great stand	6", fair stand
CC termination date	5/26/23	4/22/24
Manure	None	Winter grazed
Corn variety	Brevant B02V81AM	Pioneer 96760Q
Corn planting date	5/12/23	5/6/24
N application date	6/23/23	6/26/24
N application method	Y-drop	Y-drop

Yield results

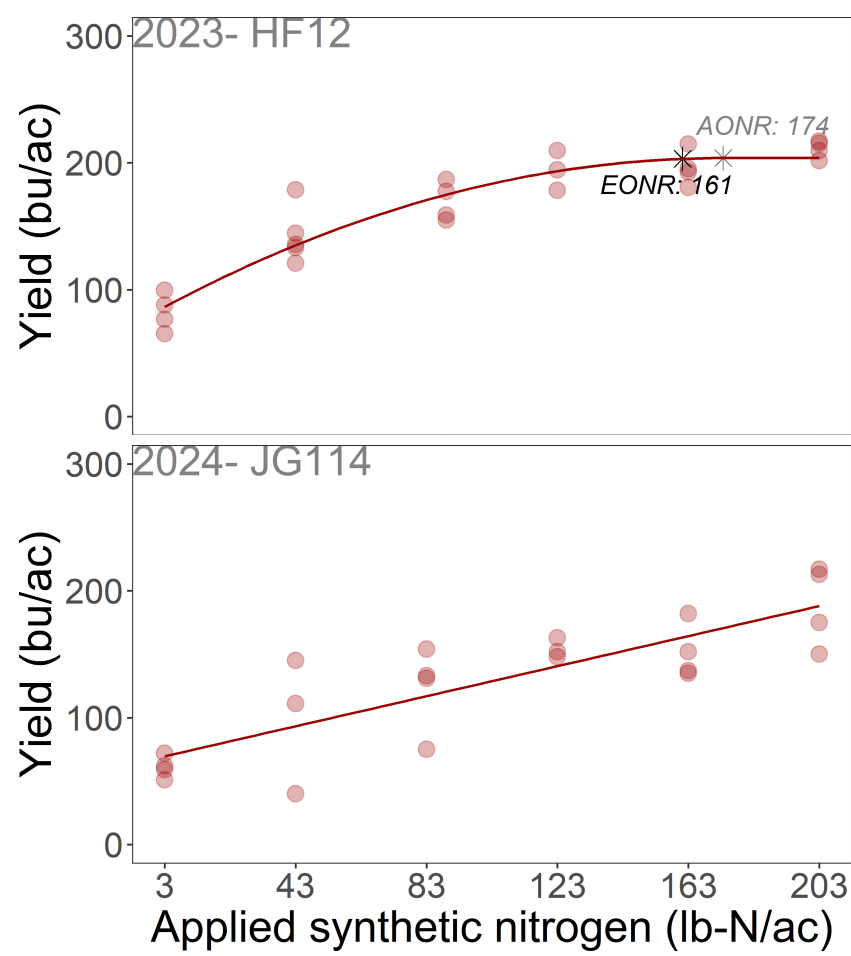


Figure 3. Corn yield (adjusted to 15.5% moisture) by applied synthetic nitrogen and field. Agronomic optimum nitrogen rate (AONR) is defined as the nitrogen rate that results in maximum yield, and economic optimum nitrogen rate (EONR) is the nitrogen rate that results in the maximum financial profit based on shape of yield response curve and nitrogen:corn price ratio of 0.1 (\$0.50/lb-N, \$5/bu corn).

- In 2023 EONR for the field was 161 lb-N/ac and AONR was 174 lb-N/ac.
- In 2024 corn yield increased as nitrogen rate increased without reaching a plateau.
 - High amount of variability across field in 2024 due to 300-400' wet spots across the field.

Table 4. Yield and marginal net return by site and applied nitrogen. Values within column and year with the same letter are not significantly different according to Fisher's LSD test at alpha = 0.1 (90% confidence).

- Significant difference in yield across nitrogen rates in 2023 & 2024.



Figure 4. Aerial image of site in 2023. Visible spotiness in field due to wildlife damage.

- Yield data was trimmed to avoid areas of major damage.

Gaska	Applied synthetic nitrogen	Yield	Marginal net return*
	(lb-N/ac)	(bu/ac)	(\$/ac)
2023	3	82 d	409
	43	143 c	690
	83	169 b	801
	123	194 a	907
	163	196 a	896
	203	211 a	951
2024	3	61 d	302
	43	99 c	470
	83	123 c	573
	123	154 b	708
	163	152 b	674
	203	189 a	840

*Marginal net return calculation based on nitrogen:corn price ratio of 0.1 (\$0.50/lb-N, \$5/bu corn).

Post-harvest soil results

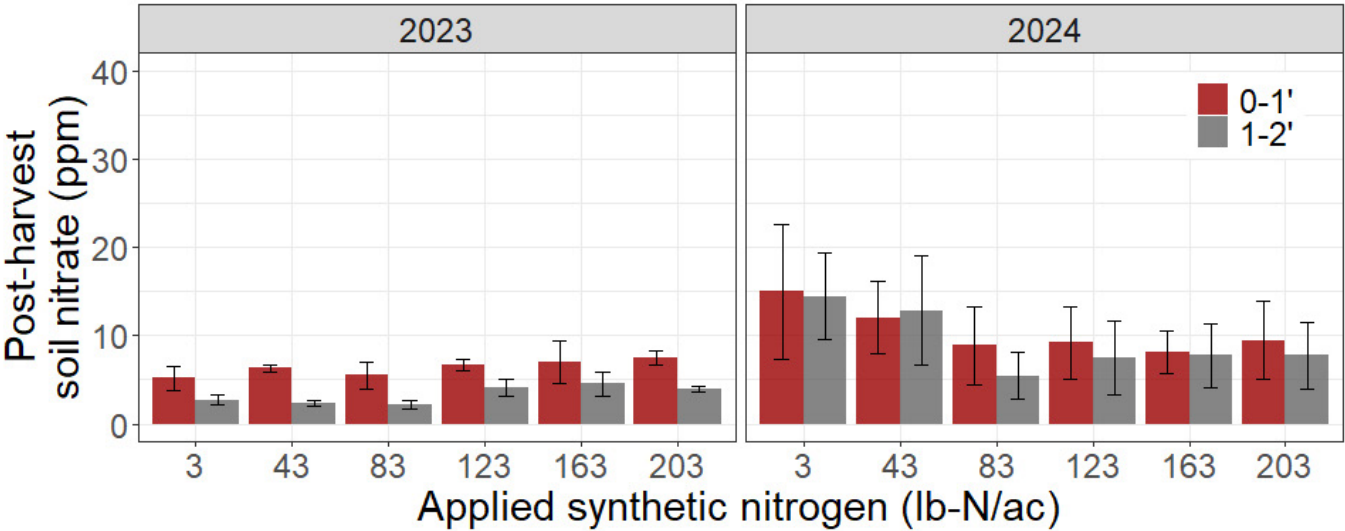


Figure 5. Post-harvest soil nitrate in ppm sampled at each nitrogen rate. In both years soil was sampled to a depth of 0-1' (red) and 1-2' (grey).

Synthetic nitrogen (lb-N/ac)	Post-harvest soil nitrate (lb-N/ac)			
	2023		2024	
	0-1'	1-2'	0-1'	1-2'
3	21	11	60	58
43	25	9	48	52
83	22	9	36	22
123	27	17	37	30
163	28	18	32	31
203	30	16	38	31

Table 6. Post-harvest soil nitrate in lb-N/ac by year and depth.

- No difference in PHNT across N rates within year and depth.

Conclusions

- In 2023, corn yield increased as nitrogen rate increased until it reached plateau at 174 lb-N/ac (AONR). Based on the curve of the yield response and a nitrogen:corn price ratio of 0.1, EONR was 13 lb less at 161 lb-N/ac.
 - EONR similar to what producer would normally apply to the field under the season's growing conditions.
- In 2024, corn yield increased as nitrogen rate increased and did not reach a plateau.
 - High amount of in-field variability in 2024 due to wet spring and wet spots in the field.
- In both years, post-harvest soil nitrate did not differ at either depth across all N rates.
 - 2024 PHNT values indicated unused N, despite the crop yield response which demonstrated that the crop needed more N that applied.
- Greater max yield in 2023 (211 bu/ac) than 2024 (189 bu/ac).
- Yields comparable to 5 year county average of 194 bu/ac.



Dodge County HSHW NOPP participants.