

Roche NOPP Report

Dodge County

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

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Takeaways

- **Economic optimum nitrogen rate (EONR) was 187 lb-N/ac in 2023.**
- **Post-harvest soil nitrate increased as nitrogen fertilizer rate increased in both years.**



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.

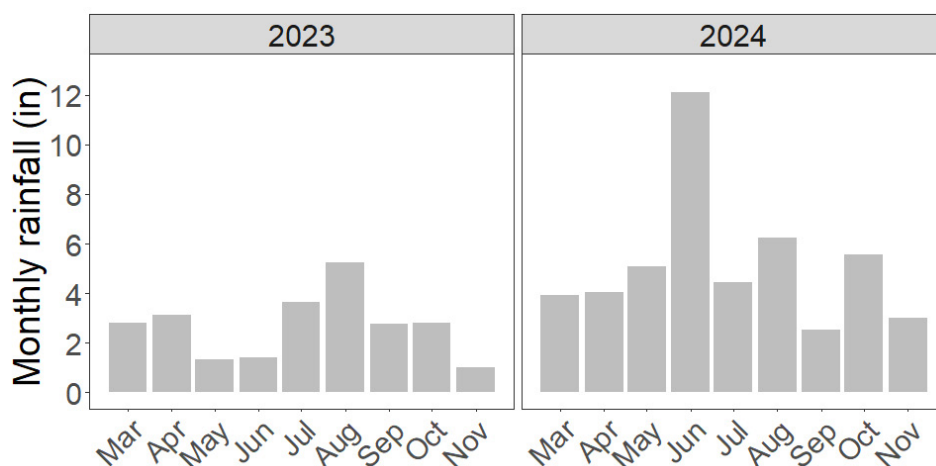


Figure 1. Monthly rainfall during the growing season in 2023 and 2024 with data from Beaver Dam, WI. Data gathered from NOAA's National Centers for Environmental Information.

Table 1. Field history for 2023 and 2024.

Roche	2023 SM 70	2024 SM 62
Soil series	Pella	McHenry
Soil texture	Silt loam	Silt loam
Soil drainage class	Moderately well drained	Somewhat poorly drained
Years of previous 10 receiving manure	3	3
Years of previous 10 with cover crop	6	6
Years no-till	4	0
Irrigation	No	No
Drainage tile	Yes	Yes
Previous crop	Soybean	Wheat

Methods

Corn was planted green into a rye cover crop in 2023. A small amount of nitrogen (3 lbs) was applied as starter to the entire field in both years. The remainder of nitrogen fertilizer was applied at sidedress to achieve final treatments of 0, 40, 80, 120, 160, and 200 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 samples (0-6")
- Pre-plant 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 data

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.

Roche	pH	OM	P	K	Ca	Mg
		%	----- ppm -----			
2023 - SM 70	6.1	2.4	30	91	1449	324
Interpretation category			Optimum	Low	High	Optimum

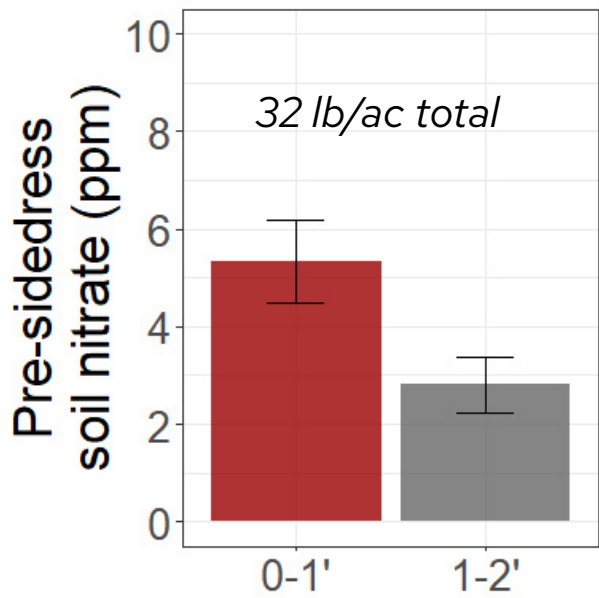


Figure 2. Pre-sidedress soil nitrate sampled prior to any nitrogen application in 2023. Spring soil nitrate not sampled in 2024.

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

Table 2. Field management for 2023 and 2024. The trial took place on a different field in 2023 and 2024.

Roche	2023 SM 70	2024 SM 62
Cover crop (CC)	Cereal rye	Oat & pea
CC term. date	5/18/23	Winterkill
Manure	None	None
Corn variety	Brevant B01Z88	Unknown
Corn planting date	5/17/23	5/13/24
N application date	6/27/23	6/11/24
N application method	Y-Drop	Y-drop

Yield results

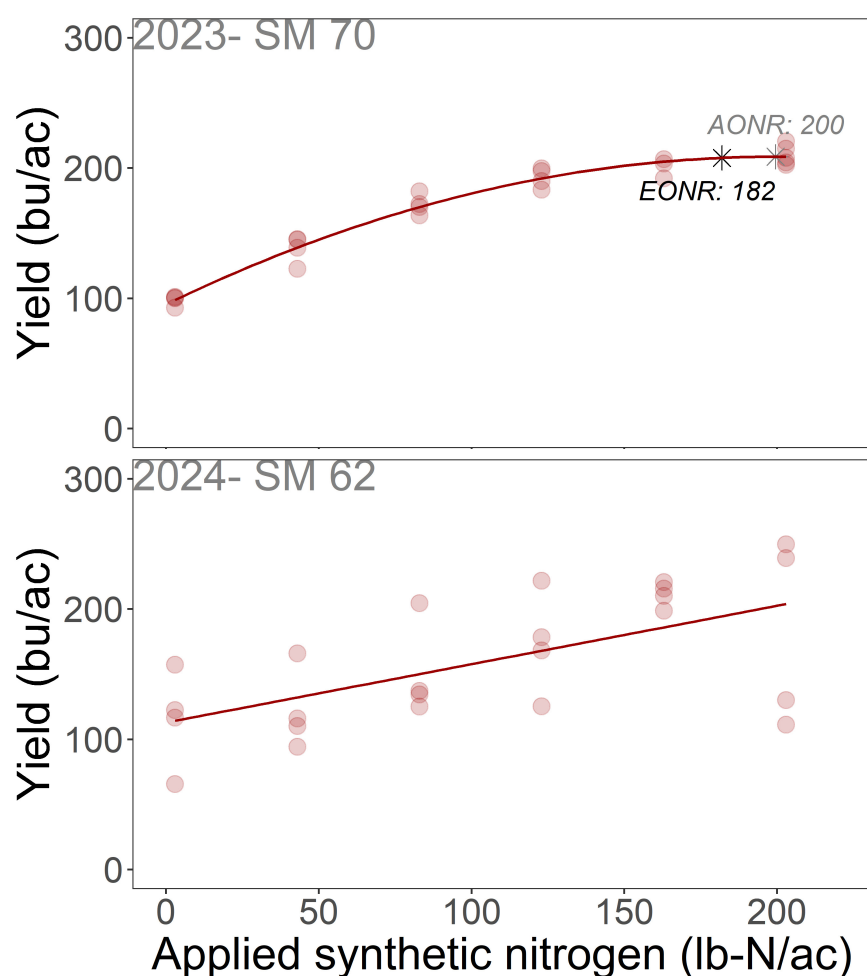


Figure 3. Corn yield (adjusted to 15.5% moisture) by applied synthetic nitrogen and field. Agronomic optimum nitrogen rate (AONR) is defined as the nitrogen rate that results in maximum yield, and economic optimum nitrogen rate (EONR) is the nitrogen rate that results in the maximum financial profit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

- In 2023 EONR for the field was 182 lb-N/ac with yield of 208 bu/ac and AONR was 200 lb-N/ac with yield of 209 bu/ac.
- In 2024 corn yield increased as nitrogen rate increased without reaching a plateau. Max yield was 182 bu/ac.
 - High amount of variability across field due to wet spots in field from above average rainfall.

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.

Roche	Applied synthetic nitrogen	Yield	Marginal net return*
	(lb-N/ac)	(bu/ac)	(\$/ac)
2023	3	99 e	491
	43	138 d	668
	83	172 c	818
	123	193 b	902
	163	201 b	922
	203	210 a	948

2024	3	115 c	575
	53	121 c	586
	83	150 bc	710
	123	173 ab	805
	163	211 a	974
	203	182 ab	811

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

Post-harvest soil results

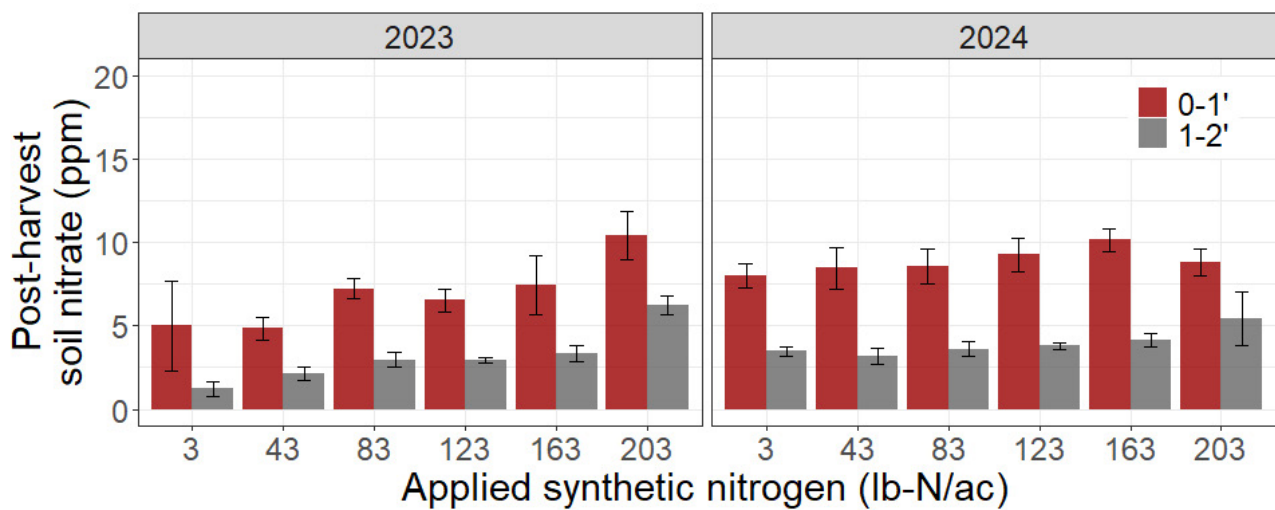


Figure 4. Post-harvest soil nitrate in ppm sampled at each nitrogen rate. In both years soil was sampled to a depth of 0-1' (red) and 1-2' (grey).

Post-harvest soil nitrate (lb-N/ac)				
Synthetic nitrogen (lb-N/ac)	2023		2024	
	0-1'	1-2'	0-1'	1-2'
3	20 b	5 c	32 b	14 b
43	19 b	9 bc	34 ab	13 b
83	29 ab	12 b	34 ab	14 b
123	26 ab	12 b	37 ab	15 ab
163	33 ab	15 b	41 a	17 ab
203	37 a	21 a	35 ab	22 a

Table 5. Post-harvest soil nitrate in lb-N/ac by year and depth. Values within column with the same letter are not significantly different according to Fisher's LSD test at alpha = 0.1.

- PHNT differed across N rates in both years at both depths.

Conclusion

- In 2023, corn yield increased as nitrogen rate increased until it reached plateau at 200 lb-N/ac (AONR). Based on the curve of the yield response and a nitrogen:corn ratio of 0.1, EONR was 18 lb less at 182 lb-N/ac.
- In 2024, the yield was variable and did not follow a curve, so EONR and AONR could not be calculated. High variability in yield data due to wet spots in field from above average rainfall.
- Post-harvest soil nitrate increased as nitrogen fertilizer rate increased in both depths across both years. This indicates more unused fertilizer nitrogen at higher N rates, and this is reflected through the soil profile.
- Yields above 5 year county average of 194 bu/ac.



Dodge County HSHW NOPP participants.