

Wenninger NOPP Report

Dodge County

Data Collection Began: 2023
Data Collection Ended: 2023
Site Years: 1

Other Collaborators:
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Takeaways

- **Economic optimum nitrogen rate was 148 lb-N/ac.**
 - **Pre-sidedress nitrate test indicated soil had enough nitrogen to provide an additional "credit" to the crop.**
- **Post-harvest soil nitrate increased as nitrogen rate increased in the 2nd foot, indicating more unused nitrogen at higher 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.

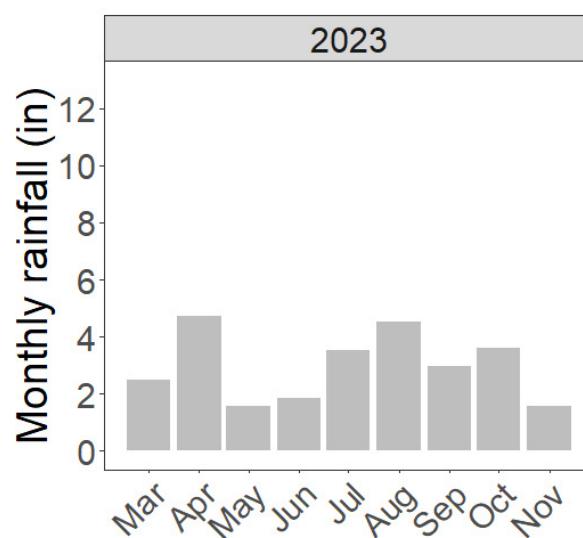


Figure 1. Monthly rainfall during the growing season in 2023 with data from Hartford, WI. Data gathered from NOAA's National Centers for Environmental Information.

Table 1. Field history for 2023.

Wenninger	2023 Home South, East
Soil series	Miami
Soil texture	Silt loam
Soil drainage class	Well drained
Years of previous 10 receiving manure	0
Years of previous 10 with cover crop	5
Years no-till	30+
Irrigation	No
Drainage tile	No
Previous crop	Soybean

Methods

Nitrogen fertilizer was applied at sidedress to achieve final treatments of 0, 40, 80, 120, 160, and 200 lb-N/ac as 28% UAN. This was a one year trial that took place in 2023 only.

Table 2. Trial management information for 2023.

Weninger	2023 Home South, East
Cover crop	None
Manure	None
Corn planting date	5/6/2023
N application date	7/7/23
N application method	Y-drop

Data Collection

- Routine soil 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. Soil test interpretation categories for corn based on UW-Extension pub A2809.

Weninger	pH	OM	P	K	Ca	Mg
		%	----- ppm -----			
2023	6.9	2.2	63	178	1739	515
Interpretation category			Excessively high	Very high	High	High

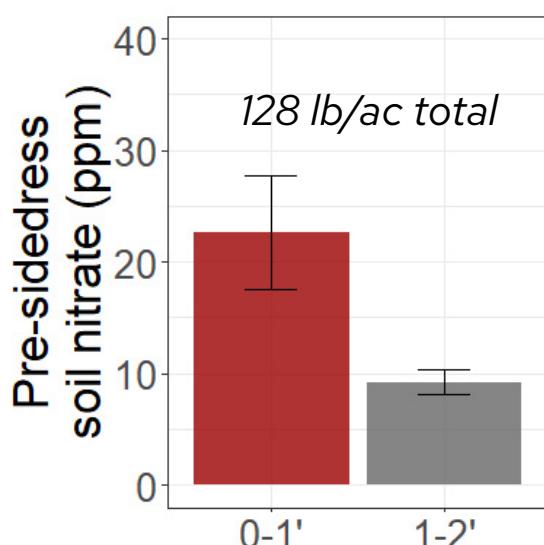


Figure 2. Pre-sidedress soil nitrate sampled prior to any nitrogen application in 2023.

- Large amount of nitrate in soil profile at pre-sidedress timing, indicating some additional N may be available to crop.

Yield results

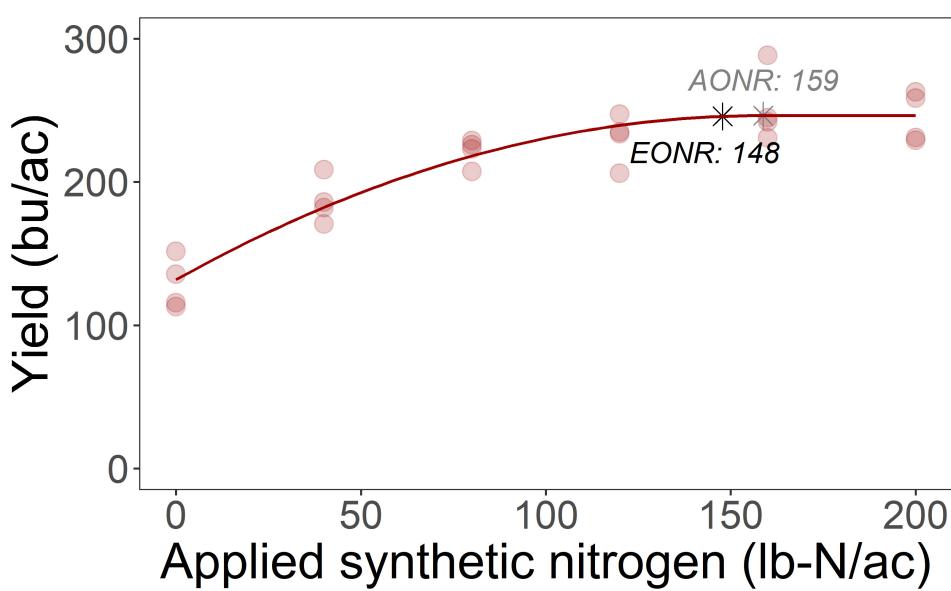


Figure 3. Corn yield (adjusted to 15.5% moisture) by applied synthetic nitrogen rate. Agronomic optimum nitrogen rate (AONR) is defined as the nitrogen rate that results in maximum yield, and economic optimum nitrogen rate (EONR) is the nitrogen rate that results in the maximum financial profit based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

- EONR on the field was 148 with yield of 245 bu/ac and AONR was 159 with yield of 246 bu/ac.

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

- **Significant difference** in yield across nitrogen rates.

Weninger	Applied synthetic nitrogen	Yield (bu/ac)	Marginal net return* (\$/ac)
	(lb-N/ac)		
2023	0	129 d	644
	40	187 c	914
	80	221 b	1067
	120	231 ab	1093
	160	251 a	1177
	200	245 a	1127

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

Post-harvest soil results

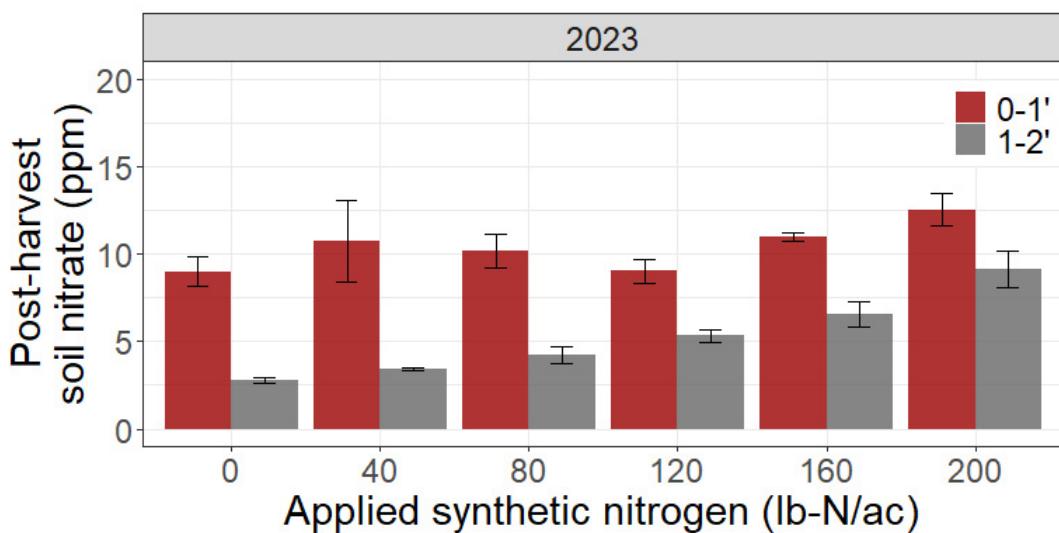


Figure 4. Post-harvest soil nitrate in ppm sampled at each nitrogen rate. In both years soil was sampled to a depth of 0-1' (red) and 1-2' (grey). Post-harvest soil was not sampled in 2024. Table 5 shows the same data but presented in lb/ac.

Synthetic nitrogen (lb-N/ac)	2023 post-harvest soil nitrate (lb-N/ac)	
	0-1'	1-2'
0	36 b	11 d
40	43 ab	14 d
80	41 ab	17 cd
120	36 b	21 bc
160	44 ab	26 b
200	50 a	37 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.

- Significant difference** in post-harvest between the lowest and highest N rate at 0-1', and nitrate increases as N rate increased at 1-2'.

Conclusions

- Corn yield increased as nitrogen rate increased until it reached plateau at 159 lb-N/ac (AONR). Based on the curve of the yield response and a nitrogen:corn ratio of 0.1, EONR was 11 lb less at 148 lb-N/ac.
- Post-harvest soil sampling indicated a difference in soil nitrate in both feet of the soil profile, with greater soil N at the highest N rate. In the 2nd foot of the soil profile, residual soil nitrate increases as N rate increases, indicating more remaining nitrogen where more fertilizer was put out.
- Yields above 5 year county average of 194 bu/ac.



Dodge County HSHW NOPP participants.