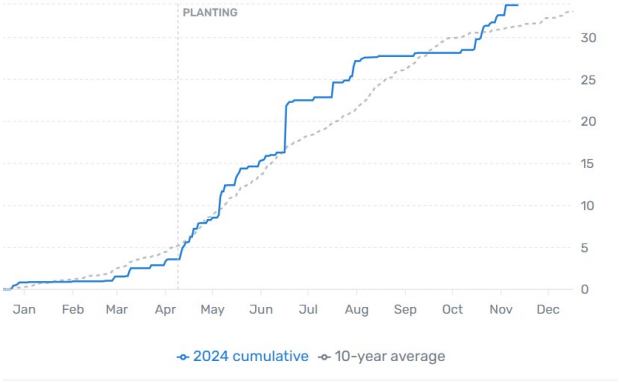
Pre-Plant vs Split-Applied Coulter vs Split-Applied Surface Nitrogen Application Study

Study ID: 0928155202402
County: Saunders
Soil Type: Yutan silty clay loam, Filbert silt loam, Tomek silt loam
Planting Date: 4/25/24
Harvest Date: 10/3/24
Population: 28,000
Row Spacing (in): 30
Hybrid: DEKALB® DKC63-91
Reps: 5
Previous Crop: Soybeans
Tillage: No-till
Herbicides: ***Pre:*** 3.19 oz/ac Laudis® + 8.5 oz/ac DiFlexx® + 23.4 oz/ac Roundup PowerMAX 3® on 5/8
Post: 2.9 oz/ac Laudis® + 30.9 oz/ac Atrazine 4L + 21.2 oz/ac Roundup PowerMAX 3® on 5/30/24

Seed Treatment: Company standard
Foliar Insecticides: None
Foliar Fungicides: None
Irrigation: None
Rainfall (in):



Introduction: This study evaluated three application methods for applying nitrogen, with spring pre-plant applied anhydrous, split-applied nitrogen with a spring anhydrous base rate and sidedress coulter injected UAN, and split-applied nitrogen with a spring anhydrous base rate and sidedress surface-applied UAN. In addition, different N rates were evaluated with the pre-plant anhydrous receiving 0, 80, 120, 160, and 200 lbs per acre and the split applications receiving an 80 lbs base rate and 40, 80 or 120 lbs sidedress for a total of 120, 160, and 200 lbs N per acre.

Soil samples taken in March of 2024 showed residual soil nitrate values of 8.7 to 19.0 ppm for the 0-8 inch samples and 8.5 to 22.1 ppm for the 8-24 inch samples. These values are considerably higher than the default value of 3.6 ppm that the UNL calculator uses when no soil tests are available. Using these values in the UNL nitrogen calculator results in a nitrate nitrogen credit ranging from 45 to 97 lbs per acre. The UNL nitrogen calculator was used to determine an N rate with a yield goal of 230 bushels, which ranged from 72 to 124 lbs N per acre before adjustments for corn to nitrogen price ratio.

Sidedress applications were made with a Hagie high clearance machine, with the coulter plots using a nitrogen toolbar to inject the UAN, while UAN was sprayed on the soil surface of the remaining sidedress plots. Sidedress applications occurred on June 26 and the site received 5.52 inches of rain on July 2-3. The application width was 40 feet wide.

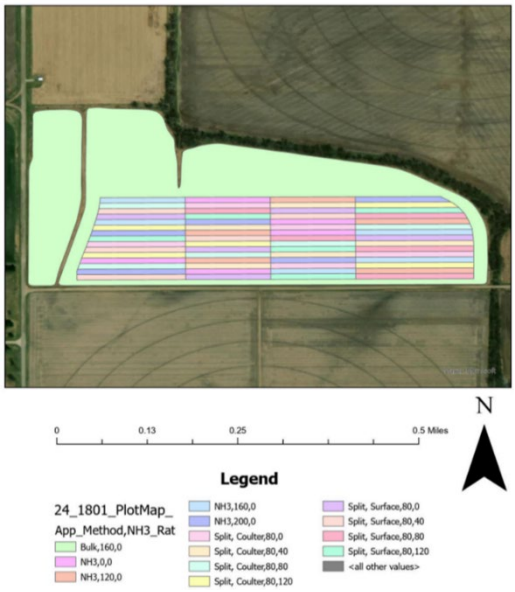


Figure 1: Treatment Design and Layout

Baseline Soil Sample 0-8" (March 2024):

pH	OM LOI %	Nitrate–N ppm N (0-8")	Nitrate – N ppm N (8-24")	M-3 P ppm P	Sulfate-S ppm S	K ppm	Ca ppm	CEC me/100g
5.5	3.8	8.7	8.5	49	10.7	390	2178	19.7
7.0	3.8	19.0	22.1	34	12.3	372	2385	16.8

Results:

Application Method (lb N as NH3_lb N as 32%UAN)	Yield (bu/ac)†	Moisture (%)	Total N (lb/ac)	Partial Factor Productivity of N (lb grain/lb N)	lb N/bu grain	Marginal Net Return ($/ac)‡
NH3 0 lbs N	209 B*	12.7 A	0 E	0 E	0 E	910 AB
NH3 80 lbs N	229 A	12.5 A	79.7 D	160.9 A	0.35 D	985 A
NH3 120 lbs N	230 A	12.3 A	120.6 C	106.8 B	0.53 C	954 AB
NH3 160 lbs N	225 AB	12.3 A	158.0 B	79.6 C	0.70 B	917 AB
NH3 200 lbs N	228 AB	12.3 A	194.2 A	65.8 D	0.85 A	918 AB
Split, Coulter 80 lbs + 40 lbs N	233 A	12.4 A	122.4 C	106.5 B	0.53 C	961 AB
Split, Coulter 80 lbs + 80 lbs N	226 AB	12.3 A	158.4 B	80.1 C	0.70 B	915 AB
Split, Coulter 80 lbs + 120 lbs N	229 A	12.2 A	196.8 A	65.1 D	0.86 A	905 AB
Split, Surface 80 lbs + 40 lbs N	231 A	12.3 A	121.4 C	106.2 B	0.53 C	950 AB
Split, Surface 80 lbs + 80 lbs N	234 A	12.3 A	158.9 B	82.5 C	0.68 B	948 AB
Split, Surface 80 lbs + 120 lbs N	227 AB	11.9 A	195.9 A	65.0 D	0.87 A	900 B
P-Value:	0.02	0.2	<0.001	<0.001	<0.001	0.03

*Values with the same letter are not significantly different at a 90% confidence level.

†Bushels per acre corrected to 15.5% moisture.

‡Marginal net return based on $4.35/bu corn, $0.38 NH3, and $0.50 32% UAN.

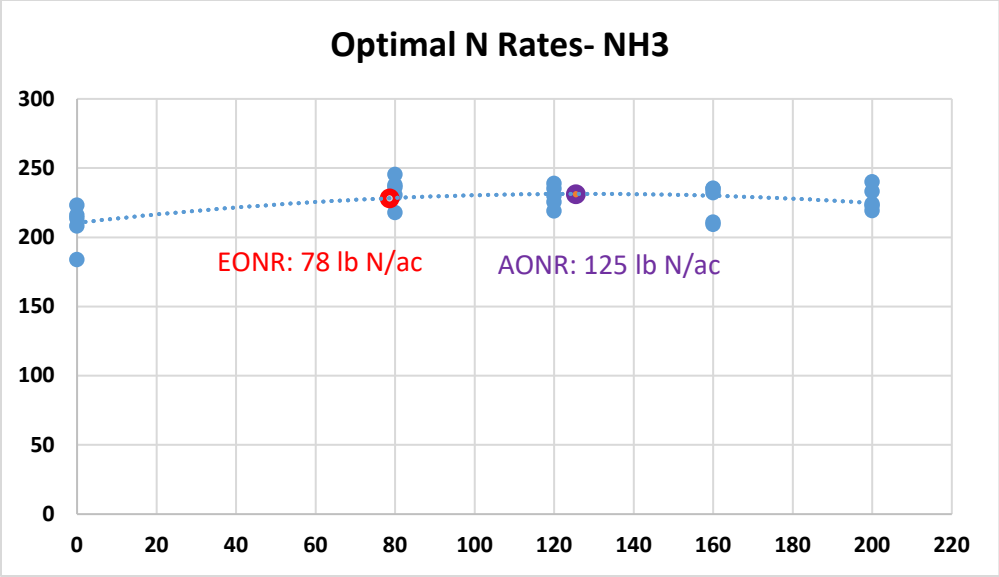


Figure 2: Optimal N Rates in NH3 treatments.

Summary:

- There were significant differences in yield, total N, partial factor productivity, and lbs N/bu of grain.
- There was a significant difference in marginal net return between NH3 80 lb N/ac ($986/ac) and split, surface 200 lb N/ac ($900/ac).
- In NH3 treatments, the EONR was 78 lb N/ac, and the AONR was 125 lb N/ac.
- 80 lbs of NH3 resulted in the lowest NUE (lb N/ bu grain) among N applications with a value of 0.35. The high residual nitrate levels likely contributed to the high yield for the check (209 bu/ac) and the lack of N response to higher rates.
- This study shows that soil sampling for residual soil nitrate can be a valuable tool and that high soil test nitrate values should be credited when determining N rates.