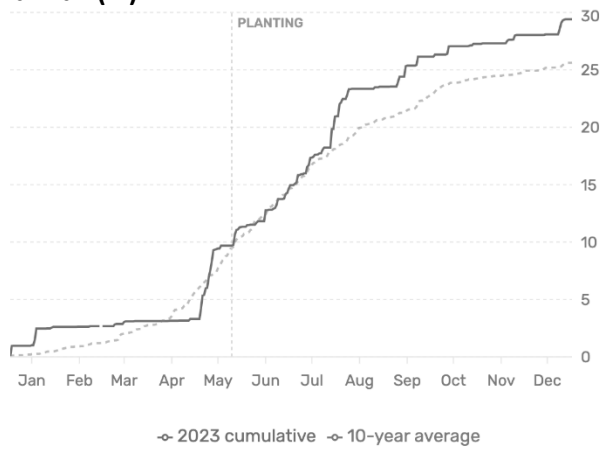
Imagery- and Model-Based Nitrogen Fertilization with Sentinel Fertigation N-Time® and Adapt-N

Study ID: 1231111202301
County: Lincoln
Soil Type: Hord silt loam 0-1% slope
Planting Date: 5/24/23
Harvest Date: 10/25/23, 10/31/23, 11/2/23
Seeding Rate: 32,000 seeds/acre
Row Spacing (in): 30
Hybrid: Pioneer® P0075
Reps: 5
Previous Crop: Soybean
Tillage: Strip-till
Herbicides: ***Pre:*** 16 oz/ac Armezon Pro®, 0.5 oz/ac Armezon®, and 32 oz/ac Atra-V™ 4L on 5/24/23
Post: 3 oz/ac Laudis®, 64 oz/ac Warrant®, and 6 oz/ac dicamba on 6/20/23
Foliar Insecticides: None
Foliar Fungicides: None
Irrigation: Pivot
Rainfall (in):

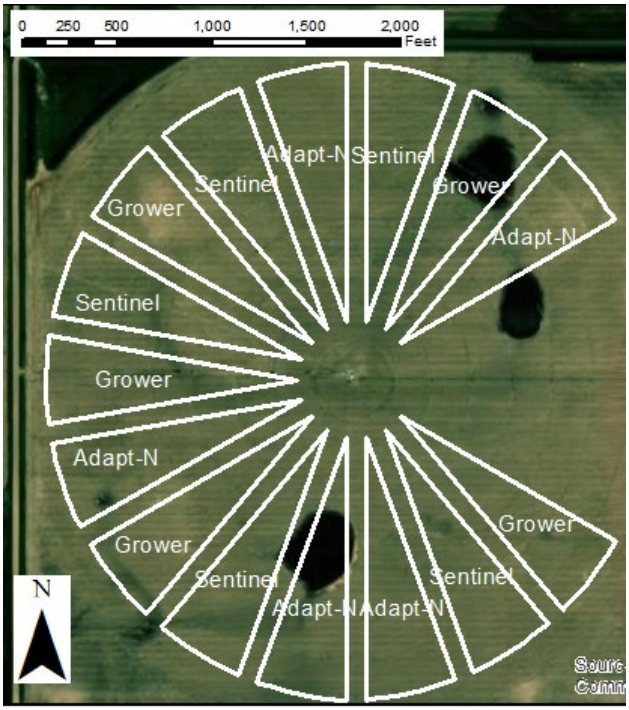


Baseline Soil Samples 0-6" (May 2023):

pH	OM LOI %	Nitrate–N ppm N	M3–P ppm P	Sulfate–S ppm S	K ppm	Ca ppm	Mg ppm	Na ppm	CEC me/100g
7.1	2.6	0.9	15	14.6	399	1739	175	26	11.3
7.5	2.8	0.1	30	16.5	449	1634	132	19	10.5
6.9	3.6	7.8	46	11.6	509	1879	141	19	12

Introduction: Corn nitrogen (N) management may be improved by using dynamic tools such as sensors, imagery, and crop models to respond to corn N needs during the growing season. These tools can account for field variability to improve nitrogen use efficiency and farmers' profits.

- Adapt-N is a dynamic crop modeling software that simulates crop growth and N requirements. Previously, Adapt-N has been evaluated for a single N application. In this study, Adapt-N was instead evaluated as a tool to monitor N throughout the season and direct N application(s) through fertigation.
- Sentinel Fertigation's N-Time® application analyzes multispectral images to deliver fertigation scheduling recommendations. Indicator blocks (small blocks established during the base N applications) with higher (+60 lb N/ac) and lower (-30 lb N/ac) nitrogen rates were applied in the field on May 26, 2023 to monitor and determine when fertigation was needed. If an N application was recommended by N-Time® the N (lb N/ac) applied via fertigation (typically 30 or 60 lb N/ac) was noted in the application table below. Note that different Sentinel sectors of the pivot may receive different recommendations throughout the growing season.



Comparing Adapt-N and Sentinel Fertigation's N-Time® with the grower's current fertigation management allows for evaluation of the potential benefits of dynamic crop model N management and imagery-based management. Different sectors of the pivot may receive different recommendations. Five replicate sectors (each about 7 acres shown above) were included in the study for each of the three treatments (grower, Adapt-N and Sentinel). Note that one replicate block on the east side of the field was removed due to issues with a missed application in the Adapt-N sector.

Application Table: Nitrogen applied throughout the 2023 growing season is included in the table below. N applications (in lb N/ac) are noted by date, along with products applied at those instances. Sentinel N-Time® or Adapt-N began monitoring and directing N fertigation applications following the June 21, 2023 N application; further N-Time® or Adapt-N directed N applications are shaded in gray to the right of the double vertical lines in the table below. Applied values were averaged across all reps; therefore, if only two out of five replications triggered an application of 40 lb N/ac, a value of 16 lb-N/ac is reported as the average treatment N application across replications.

	4/21	6/9	6/21	7/24	8/12	**Total N rate (lb/ac)**
Treatment	----------*lb N/ac applied*---------					
Grower N Management	25[a]	43.5[b]	50[c]	37.5[b]	-	156
Sentinel Fertigation N-Time®	25[a]	43.5[b]	50[c]	-	-	119
Adapt-N	25[a]	43.5[b]	50[c]	16[b]	9[b]	144

[a] Product used was 31-0-0-1 S via stream

[b] Product used was 50-0-0-5 S +Mol

[c] Product used was 50-0-0-5 S +Mol via Indicator block Rx

Results:

	Total N rate (lb/ac)	**Moisture (%)**	**Yield (bu/ac)†**	**Partial Factor Productivity of N (lb grain/lb N)**	**lbs N/bu grain**	**Marginal Net Return‡ ($/ac)**
Grower N Management	156 A*	16.5 A	232 A	83 C	0.67 A	1,064 A
Sentinel Fertigation N-Time®	119 C	16.5 A	226 B	106 A	0.52 C	1,056 A
Adapt-N	144 B	16.5 A	231 AB	91 B	0.62 B	1,065 A
P-Value	0.0002	0.876	0.058	0.0001	0.0003	0.681

*Values with the same letter are not significantly different at a 90% confidence level.
†Yield values are from cleaned yield monitor data. Bushels per acre corrected to 15.5% moisture.
‡Marginal net return based on $5/bu corn and $0.63/lb N.

Summary:

- Compared to the grower's traditional management, the Adapt-N management resulted in a 12 lb N/ac reduction with no yield decrease. Meanwhile, the Sentinel Fertigation N-Time® management resulted in a 37 lb N/ac reduction and a 6 bu/ac yield decrease.
- Compared to the grower's traditional management, nitrogen efficiency was 10% greater when using the Adapt-N management and 28% greater when using the Sentinel Fertigation N-Time® management.
- There was no significant difference in marginal net return.

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