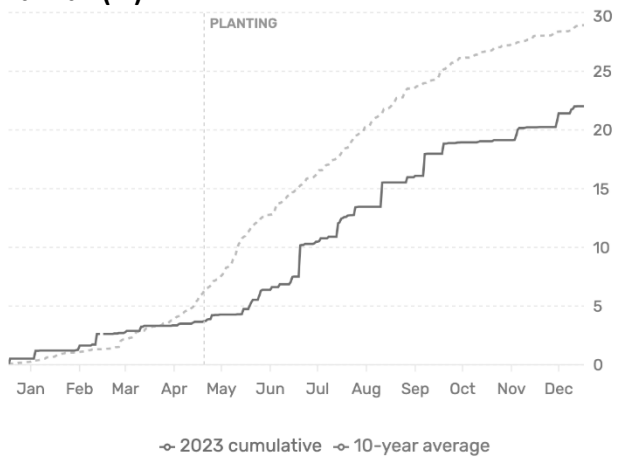
Imagery-Based Nitrogen Fertilization with Sentinel Fertigation N-Time®

Study ID: 0686035202303
County: Clay
Soil Type: Hastings silt loam
Planting Date: 5/3/23
Harvest Date: 9/29/23
Seeding Rate: Fontanelle® 11DT590 at 33,000 and Pioneer® P1185 at 34,000
Row Spacing (in): 30
Hybrid: Fontanelle® 11DT591 and Pioneer® P1185
Reps: 4
Previous Crop: Corn
Tillage: Strip-till
Herbicides: ***Pre:*** 9.6 oz/ac MSO Extra, 0.9 lb/ac Spray-Start®, 40 oz/ac SureStart®, 3 oz/ac Cavallo® 4SC, and 32 oz/ac Glypex™ 5 Extra on 5/5/23 ***Post:*** 0.9 lb/ac Spray-Start®, 80 oz/ac Helmet® Maxx, and 32 oz/ac Glypex™ 5 Extra on 5/31/23
Seed Treatment: Standard treatments

Foliar Insecticides: 6.4 oz/ac Lambda CY and 3.8 oz/ac Batallion® chemigated on 7/18/23
Foliar Fungicides: 14 oz/ac Aquila® chemigated on 7/18/23
Irrigation: Pivot, Total: 12"
Rainfall (in):

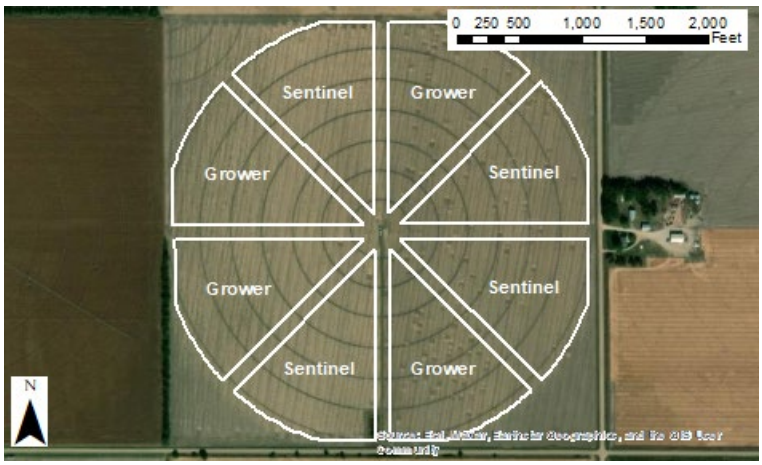


Baseline Soil Samples 0-6" (May 2023):

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
6	3.8	10.8	17	15.3	387	2173	267	43	16.9
6.2	3.5	28.2	20	13.4	379	2462	302	42	17.9
5.6	3.4	39.6	23	16.7	491	1883	230	41	16.1

Introduction: Corn nitrogen (N) management may be improved by using sensors or imagery to detect and respond to corn N needs during the growing season. 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) rates were applied in the field on April 6, 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) is noted in the application table below. Note that different Sentinel sectors of the pivot may receive different recommendations throughout the growing season. This study compared the grower's standard N management to the Sentinel Fertigation N-Time® N management, with four paired sectors of each treatment (each sector was about 22 acres, buffered 60 feet internally to reduce sprinkler package overlap between sectors); the field trial layout is shown below.



NOTE: Two different hybrids were planted on the east and west sides of the field, which affected both treatments equally; therefore, the analysis did not separate out the influence of the hybrids (allowing for statistical analysis of the four paired sectors).

Application Table: Nitrogen applied throughout the 2023 growing season (or in fall of 2022, as noted) 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® began monitoring and directing N fertigation applications following the May 3, 2023 N application. Applications directed by N-Time® are shaded in gray to the right of the double vertical lines in the table below. The applied values were averaged across all reps; therefore, if only one out of four replications triggered an application of 32 lb N/ac, a value of 8 lb N/ac is reported as the average treatment N application across replications.

	Oct. 2022	4/6	5/3	6/17	6/26	6/27	Total N rate (lb/ac)
Treatment	*lb N/ac applied*						
Grower N Management	16.8[a]	118[b]	2.3[c]	82.9[d]	36[d]		**256**
Sentinel Fertigation N-Time®	16.8[a]	118[b]	2.3[c]	-	-	8[d]	**145**

[a] Product used was MESZ

[b] Product used was 28-0-0-5 (111.8 lb-N/ac) and AMS (6.3 lb-N/ac)

[c] Product was 10-34-0 starter at planting

[d] Product was 28-0-0-5

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	256 A	16.4 A	285 A	62 B	0.90 A	1,264 B
Sentinel Fertigation N-Time®	145 B	15.9 B	276 B	107 A	0.53 B	1,289 A
P-Value	0.001	0.033	0.006	0.003	0.002	0.040

*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: The Sentinel Fertigation N-Time® management recommended one 32 lb N/ac application in one sector (out of four) during the growing season. The grower N management program applied 111 lb N/ac more compared to the sensor-based approach, which resulted in a 9 bu/ac yield increase. N-Time management increased N use efficiency by 73%. Despite the lower yield for the Sentinel Fertigation N-Time® management, the nitrogen savings resulted in a $25/ac increase in marginal net return.

After harvest, soil samples (24" depth) were collected in early December 2023. Three grower and Sentinel sectors were randomly selected and two composite samples were taken from each sector. Results indicated significantly less residual nitrate in the Sentinel sectors (average 5.1 ppm) compared to the grower sectors (average 13.0 ppm).

This research was partly supported by an award from the USDA-NRCS Conservation Innovation Grants, On-Farm Conservation Innovation Trials, award number NR203A750013G014.