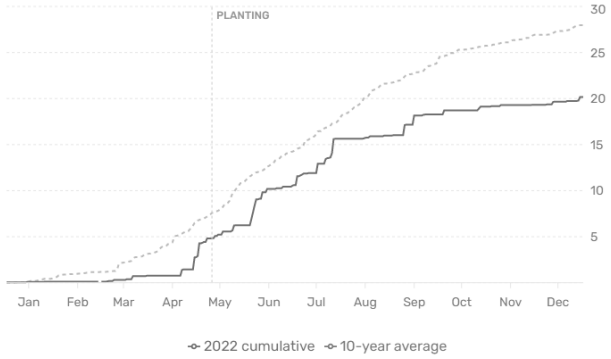
Sensor-Based Nitrogen Fertigation Management

Study ID: 0205079202201
County: Hall
Soil Type: Hord silt loam 0-1% slope; Hord silt loam 1-3% slope; Hall silt loam 0-1% slope
Planting Date: 5/10/22
Harvest Date: 10/11/22
Seeding Rate: 27,000
Row Spacing (in): 30
Hybrid: Pioneer® P1185AM®
Reps: 7
Previous Crop: Seed corn
Tillage: Strip-till
Herbicides: ***Pre:*** 1.5 qt/ac Degree Xtra®, 32 oz/ac Roundup PowerMAX®, and 4 oz/ac DiFlexx® ***Post:*** 32 oz/ac Roundup PowerMAX®, 5 oz/ac Status®, and 3 pt/ac Warrant®
Seed Treatment: None

Foliar Insecticides: 6.4 oz/ac Brigade® 2EC, and 4 oz/ac Mustang® Maxx
Foliar Fungicides: 13.7 oz.ac Trivapro®
Note: Hail damage on 6/5 at the V5 growth stage
Irrigation: Pivot, Total: 9.35", 8.4 ppm N in irrigation water
Rainfall (in):



Introduction: Corn nitrogen management may be improved by using sensors or imagery to detect and respond to corn nitrogen needs during the growing season. This study used weekly aerial imagery obtained with a multispectral sensor on a fixed-wing drone to monitor indicator plots that had lower N rates. If indicator plots demonstrated nitrogen deficiency, a fertigation application of 30 lb/ac or 60 lb/ac was triggered. This study compared the grower's standard management with two reactive, sensor-based fertigation approaches as follows:

Grower Management: Cooperating grower made the fertigation management decisions for this treatment throughout the growing season.

Risk-Averse Post-Establishment (RAP): Fertigation application decisions were made based on decision logic and analytics applied to aerial imagery from the V6 growth stage to the R3 growth stage.

Risk-Averse Post-Establishment Increased-Rate (RAP-IR): Fertigation application decisions were made based on decision logic and analytics applied to aerial imagery from the V6 growth stage to the R3 growth stage with application rate increased from 30 lb N/ac to 60 lb N/ac for any fertigation applications recommended between V9 and V14.

Application Table: Unless otherwise noted, N was applied using 32% UAN. Gray shaded area to the right of the striped line indicates where sensor-based management dictated N rates.

	5/1	5/23	7/8	7/13	Total N Applied
Treatment	----------*lb N/ac applied*----------				
Grower	3.5[a]	121[b]	35.5	35.5	**196**
RAP	3.5[a]	91[b]	-	-	**95**
RAP-IR	3.5[a]	91[b]	-	-	**95**

[a] Product used is 10-34-0 with planter

[b] Product used is 32-0-0 with coulter rig

Results:

	Total N rate (lb/ac)	Moisture (%)	Yield (bu/ac)†	Partial Factor Productivity of N (lb grain/lb N)	lb N/ bu grain	Marginal Net Return‡ ($/ac)
Grower	196 A*	19.9 A	277 A	79 B	0.71 A	1,663 B
RAP	95 B	19.6 A	271 B	161 A	0.35 B	1,707 A
RAP-IR	95 B	19.8 A	274 AB	161 A	0.35 B	1,725 A
P-Value	<0.0001	0.142	0.087	<0.0001	<0.0001	0.004

*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 $6.80/bu corn and $0.80/lb N.

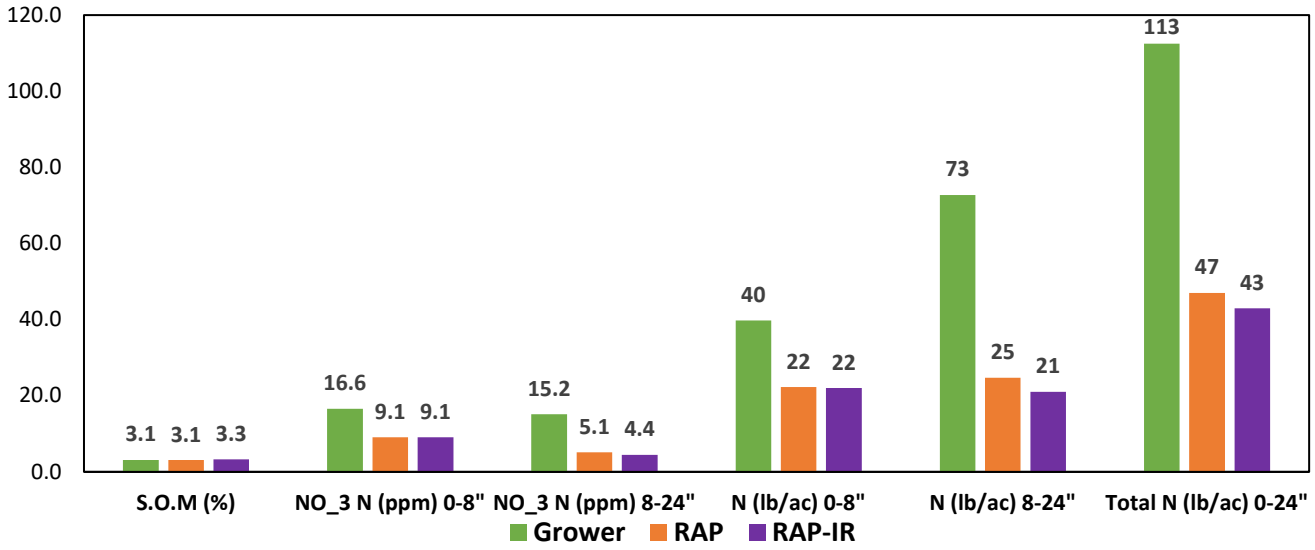


Figure 1. Post-harvest soil samples were taken in 12 treatment sectors (one sample per sector) for grower, risk-averse post-establishment (RAP), and risk-averse post-establishment increased-rate (RAP-IR) treatments. Soil organic matter (S.O.M.) in percent, nitrate nitrogen in ppm (NO_3 N), and nitrogen (N) in lb/ac are reported for two depths, 0-8" and 8-24".

Summary:

- Both RAP and RAP-IR approaches resulted in a significant N fertilizer savings (100 lb N/ac) compared to the grower's traditional method. The N rate was identical for the sensor-based approaches as no fertigation events were triggered based on the imagery analysis.
- The RAP treatment resulted in a 6 bu/ac reduction in yield compared to the grower's management; however, the RAP-IR was not significantly different in yield compared to the grower's management or the RAP approach.
- The similar yields and large reduction in N fertilizer resulted in the RAP approaches being $44/ac more profitable than the grower's traditional management and RAP-IR being $62/ac more profitable than the grower's traditional management.
- Nitrogen efficiency was greatly increased with the sensor-based approaches.
- Neither sensor-based approaches triggered an application throughout the season.
- Both-sensor-based fertigation approaches resulted in significantly lower residual nitrate values compared to the grower's management (Figure 1).

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