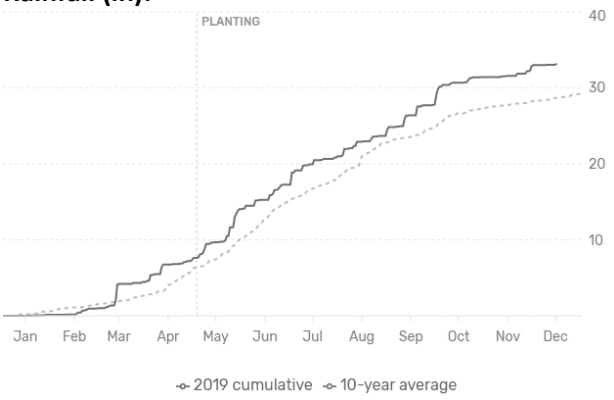
Sensor-based Nitrogen Fertigation

Study ID: 0036139201901
County: Pierce
Soil Type: Elsmere fine sand; Boelus-Loretto complex 0-2% slope; Thurman loamy fine sand 2-6% slopes; Thurman loamy fine sand 0-2% slope; Thurman-Valentine complex
Planting Date: 5/3/19
Harvest Date: 10/18/19
Seeding Rate: 33,000
Row Spacing (in): 30
Variety: Pioneer® P1379AM™
Reps: 4
Previous Crop: Soybean
Tillage: No-Till
Herbicides: ***Pre:*** 1.5 qt/ac Cinch® ATZ Lite, 0.75 oz/ac Sharpen®, and 45 oz/ac Abundit™ Extra with 2 lb/ac AMS and 20 oz/ac crop oil concentrate on 5/14/19 ***Post:*** 4 oz/ac Realm® Q, 8 oz/ac atrazine, and 22 oz/ac Abundit™ Extra with 4 oz/ac CHS Unlocked™ and 2 lb/ac AMS, on 6/14/19
Seed Treatment: VOTiVO® and NUTRIO™ UNLOCK®
Foliar Insecticides: None
Foliar Fungicides: None
Irrigation: Pivot, Total: 14.4"
Rainfall (in):



Introduction: Corn nitrogen management may be improved by using sensors or imagery to detect and respond to corn nitrogen need during the growing season. This study used weekly aerial imagery to monitor indicator plots with lower N rates. Sensor-based fertigation management began once the cumulative N applied was 60 lb/ac less than the grower's total target N for the season. If indicator plots demonstrated nitrogen deficiency, a fertigation application of 30 lb/ac was triggered. This study compared the grower's standard N management with two reactive, sensor-based fertigation approaches as follows:

Grower Nitrogen Treatment: 43 lb N/ac was applied at planting on May 3, 2019 from 10 gal/ac 8-20-5-5-0.5, 4 gal/ac 3-18-18, 8 gal/ac 32-0-0, and 2 gal/ac 12-0-0-26. An additional 40 lb N/ac (as 32% UAN) was applied on June 17, 2019 with a high clearance applicator. Applications of N were made through fertigation with 32% UAN as follows: 30 lb N/ac on June 7, 30 lb N/ac on July 10, 17 lb N/ac on July 12, 23 lb N/ac on July 18, 21 lb N/ac on July 24, and 30 lb N/ac on August 2 for a total of 151 lb N/ac through fertigation. The total N applied to the grower N managment was 234 lb N/ac.

Risk-Averse Fertigation Treatment: This approach triggered N fertigation when one indicator block showed N deficiency and therefore may better protect yield by applying N more frequently. The base rate of N was 113 lb N/ac, which was established with 43 lb N/ac (from 10 gal/ac 8-20-5-5-0.5, 4 gal/ac 3-18-18, 8 gal/ac 32-0-0, and 2 gal/ac 12-0-0-26) applied at planting on May 3, 2019, 30 lb N/ac (applied as 32% UAN via fertigation) on June 7, and 40 lb N/ac (applied as 32% UAN on June 17). Fertigation events with 32% UAN were completed on four dates: 30 lb N/ac on July 10, 17 lb N/ac on July 12, 23 lb N/ac on July 18, and 21 lb N/ac on July 24, each to all four replications. Sensor-based fertigation management began after the July 24 application. A sensor-based fertigation application with 32% UAN was triggered on August 2 at 30 lb N/ac to two of the four replications. The total applied as sensor-based fertigation was 15 lb N/ac and the total applied over the growing season was 219 lb N/ac.

Risk-Tolerant Fertigation Treatment: This approach triggered N fertigation when three indicator blocks showed N deficiency and may better guard against excess N applications by only applying N when several indicator blocks agree that N is needed. The base rate of N was 113 lb N/ac, which was established with 43 lb N/ac (from 10 gal/ac 8-20-5-5-0.5, 4 gal/ac 3-18-18, 8 gal/ac 32-0-0, and 2 gal/ac 12-0-0-26) applied at planting on May 3, 2019, 30 lb N/ac (applied as 32% UAN via fertigation) on June 7, and 40 lb N/ac (applied as 32% UAN on June 17). Fertigation events with 32% UAN were applied on four dates: 30 lb N/ac on July 10, 17 lb N/ac on July 12, 23 lb N/ac on July 18, and 21 lb N/ac on July 24, each to all four replications. Sensor-based fertigation management began after the July 24 application. Aerial imagery indicated that a fertigation application was not necessary for any of the four replications on August 2. The total applied as sensor-based fertigation was 0 lb N/ac through fertigation and the total applied over the growing season was 204 lb N/ac.

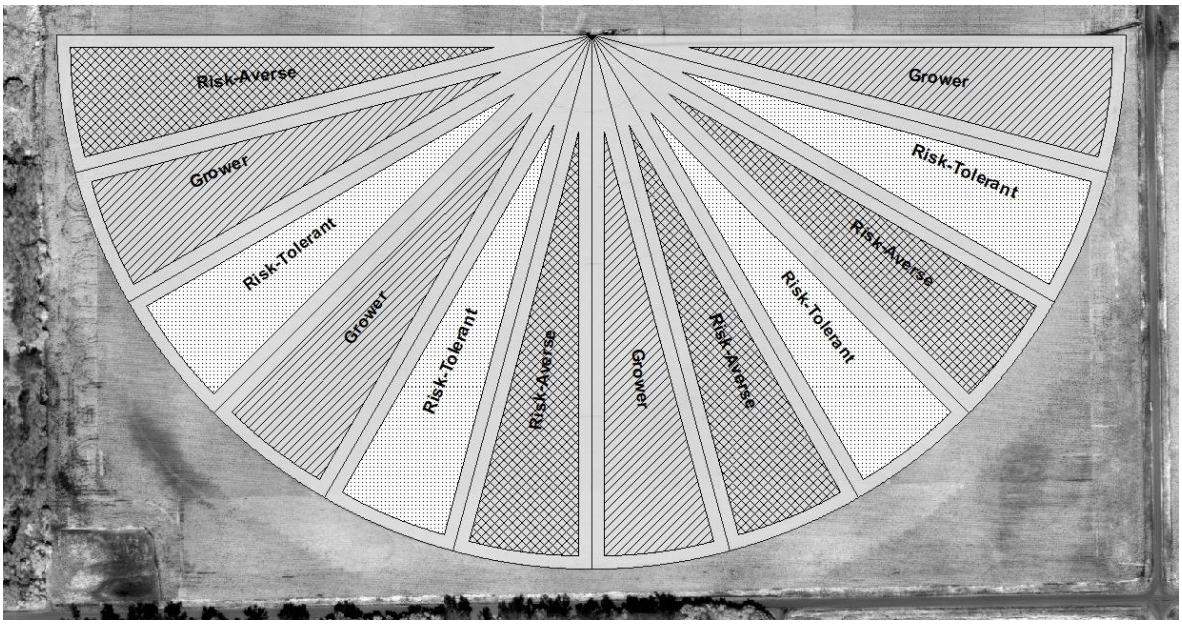


Figure 1. Experiment layout showing four replications of three treatments arranged in sectors.

Results:

N Management Strategy	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	234 A*	19.3 A	257 A	62 B	0.91 A	890.67 A
Risk-Averse Fertigation	219 AB	19.4 A	257 A	66 AB	0.85 AB	898.19 A
Risk-Tolerant Fertigation	204 B	19.1 A	255 A	70 A	0.80 B	893.64 A
P-Value	0.01	0.746	0.918	0.101	0.093	0.966

*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 adjusted to 15.5% moisture.
‡Marginal net return based on $3.83/bu corn and $0.40/lb N.

Summary:

- At this site, the risk adverse fertigation approach applied 15 lb/ac less N than the grower's N management, whereas the risk tolerant fertigation approach applied 30 lb/ac less N than the grower's N management.
- There was no yield difference between the sensor-based fertigation approaches and the grower's N management.
- The risk tolerant sensor-based fertigation approach had greater N efficiency compared to the grower's N management.
- There was no difference in profitability between the grower's N management and the two sensor-based fertigation approaches.

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