

Sensor-based Nitrogen Fertigation

Study ID: 0568003201901

County: Antelope

Soil Type: Loretto sandy loam 0-3% slope; Valentine fine sand 9-24 percent rolling slopes; Thurman loamy fine sand 2-6% slopes; Thurman-Valentine complex undulating; Boelus loamy fine sand 0-2% slope; Boelus loamy fine sand 2-6% slopes

Planting Date: 5/4/19

Harvest Date: 11/2/19

Seeding Rate: 30,000 to 33,000

Row Spacing (in): 30

Variety: Channel® 213-19 STXRIB & VT2PRIB

Reps: 3

Previous Crop: Corn

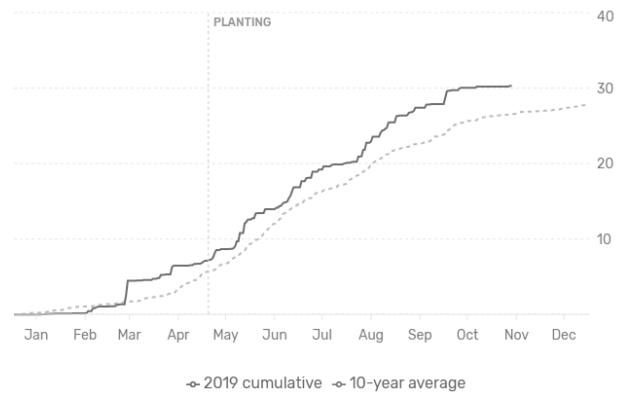
Tillage: Disk, Harrow

Herbicides: *Pre:* 32 oz/ac atrazine 4L, 24 oz/ac Durango®, and 12 oz/ac Verdict® with 1.1 lb/ac AMS and 0.13 gal/ac MSO on 5/4/19 *Post:* 24 oz/ac Durango®, 3 oz/ac Explorer™, and 1.5 qt/ac atrazine 4L with 9 oz/ac crop oil on 6/5/19

Foliar Insecticides and Fungicides: None

Irrigation: Pivot, Total: 8"

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:

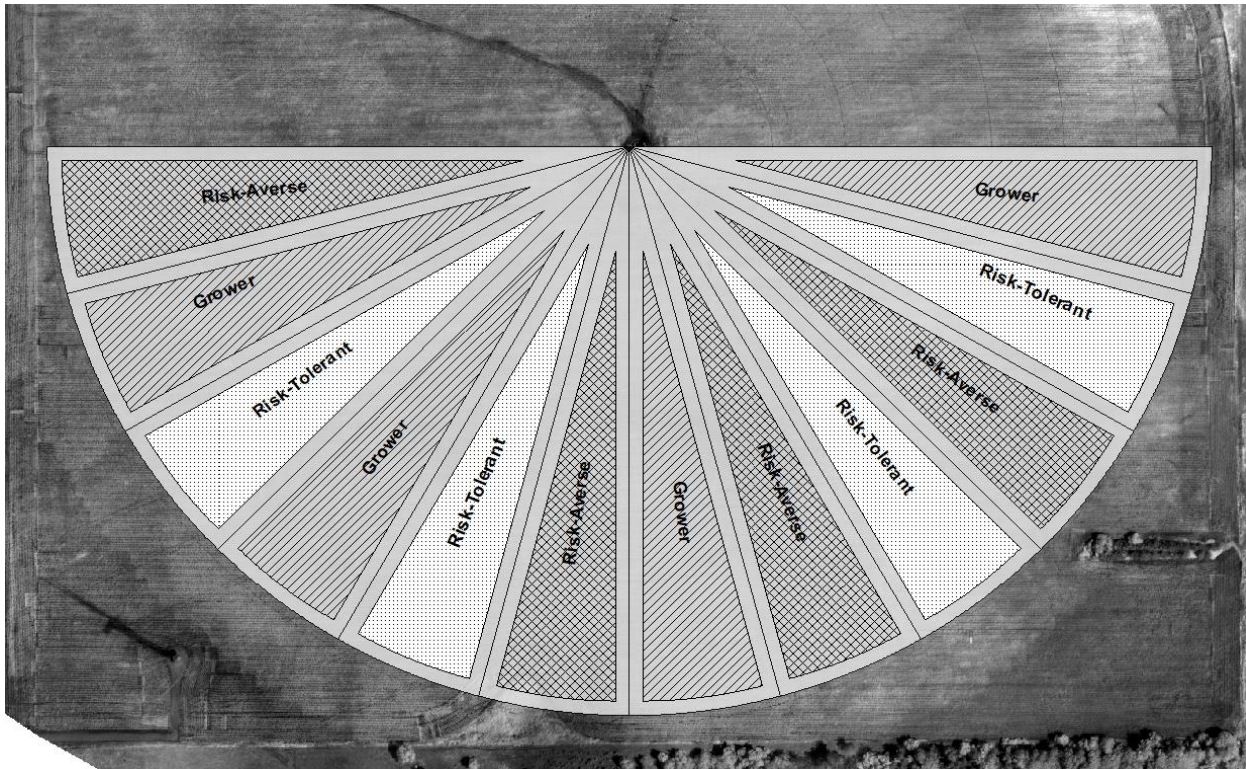


Figure 1. Experiment layout showing four replications of three treatments arranged in sectors. Due to an error, only three replications are considered in this analysis.

Grower Management: 40 lb N/ac was applied on May 4 at planting, 30 lb N/ac was applied as 32-0-0-5 on June 12, and 120 lb N/ac was applied as 32-0-0-5 on June 13. The June 13 application was used to establish indicator blocks. UAN (32-0-0-5) was applied through fertigation on two dates: 30 lb N/ac on July 11 and 30 lb N/ac on July 31. The total N applied was 250 lb N/ac. This total N rate exceeded the total N target rate of 230 lb N/ac, which was determined prior to the season.

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 170 lb N/ac, which was established with 40 lb N/ac on May 4 at planting, 30 lb N/ac applied as 32-0-0-5 on June 12, and 100 lb N/ac applied as sidedress with 28-0-0-5 on June 13. Sensor-based fertigation management began after the June 13 application since this brought the applied N rate to 170 lb N/ac, 60 lb N/ac less than the 230 lb N/ac target total N rate. Sensor-based fertigation with 32-0-0-5 was triggered on three dates: 30 lb N/ac was applied July 11 to all three replications, 30 lb N/ac was applied July 26 to two of three replications, and 30 lb N/ac was applied on August 6 to one of three replications. Total sensor-based fertigation was 60 lb N/ac and the total applied during the growing season was 230 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 170 lb N/ac, which was established with 40 lb N/ac on May 4 at planting, 30 lb N/ac applied as 32-0-0-5 on June 12, and 100 lb N/ac applied as sidedress with 28-0-0-5 on June 13. Sensor-based fertigation management began after the June 13 application since this brought the applied N rate to 170 lb N/ac, 60 lb N/ac less than the 230 lb N/ac target total N rate. Sensor-based fertigation with 32-0-0-5 was triggered on two dates: 30 lb N/ac was applied on July 22 to one of three replications and 30 lb N/ac was applied on July 31 to one of three replications. The total applied through sensor-based fertigation was 20 lb N/ac, and the total applied over the growing season was 190 lb N/ac.

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	250 A*	18.0 A	245 A	55 A	1.02 A	837.55 A
Risk-Averse Fertigation	230 AB	18.7 A	242 A	60 A	0.96 A	833.06 A
Risk-Tolerant Fertigation	190 B	18.0 A	228 A	68 A	0.84 A	797.10 A
P-Value	0.044	0.243	0.327	0.23	0.208	0.613

*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 20 lb/ac less N than the grower's N management, while the risk tolerant fertigation approach applied 60 lb/ac less N than the grower's N management.
- There was no yield, N efficiency, or marginal net return difference between the sensor-based fertigation approaches and the grower's N management.

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