Sensor-based Nitrogen Fertigation

Study ID: 0207121201901
County: Merrick
Soil Type: O'Neill loam 0-2% slope; Lockton loam rarely flooded; Brocksburg loam 0-2% slope; O'Neill sandy loam 0-2% slope
Planting Date: 4/20/19
Harvest Date: 9/27/19
Seeding Rate: 29,400
Row Spacing (in): 30
Variety: Pioneer® P1828Q™ and P1366Q™
Reps: 4
Previous Crop: Soybean
Tillage: No-Till
Herbicides: *Post:* 1 pt/ac Atrazine, 2.5 qt/ac Acuron® and 32 oz/ac glyphosate with 1 pt/ac MSO and 1.875 lb/ac AMS on 5/4/19
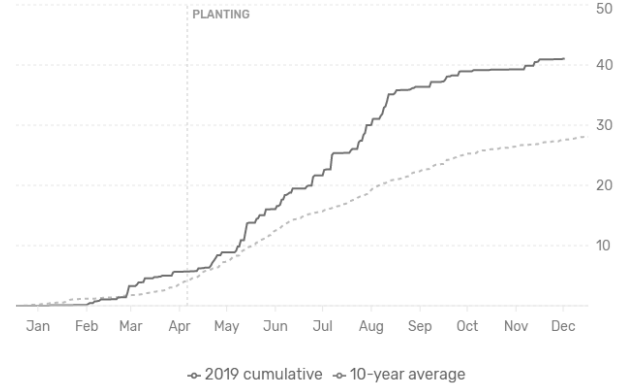**Seed Treatment:** None

Foliar Insecticides: 4 oz/ac Mustang® Maxx with 0.5 pt/ac LIBERATE® surfactant on 7/18/19, 5 oz/ac Hero® on 8/4/19
Foliar Fungicides: 5 oz/ac Absolute® Maxx with 0.5 pt/ac LIBERATE® on 7/18/19
Irrigation: Pivot, Total: 2.8"
Rainfall (in):

2019 cumulative   10-year average

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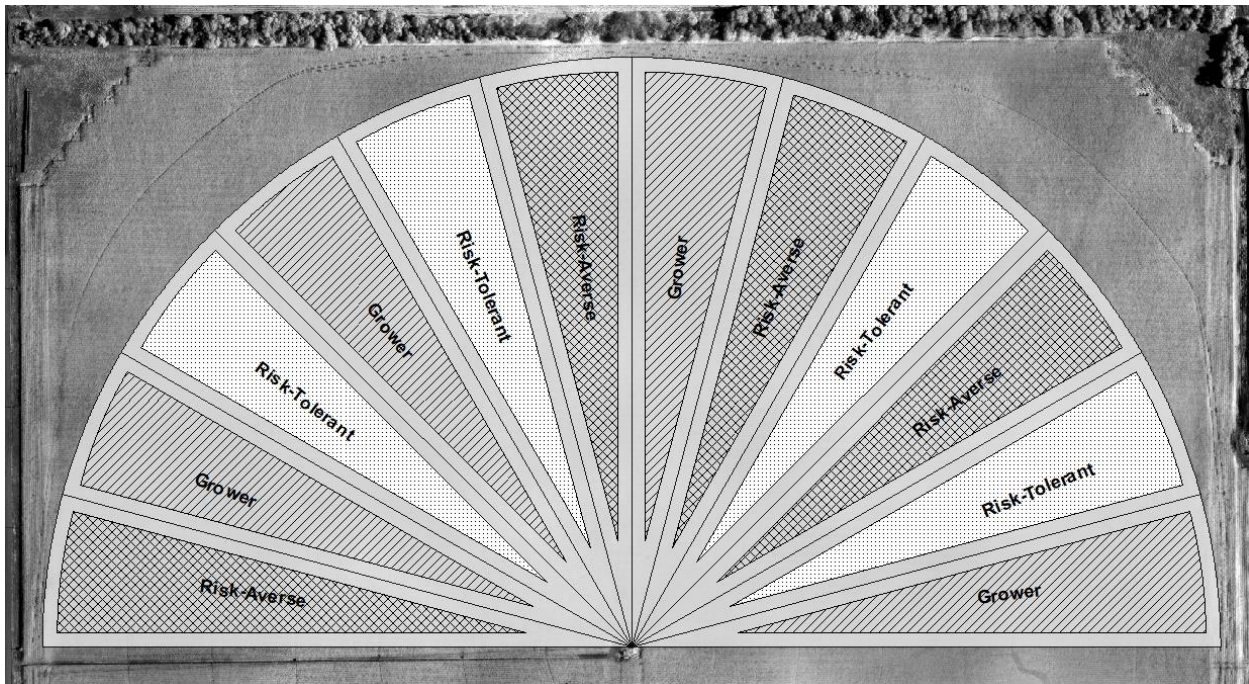
Figure 1. Experiment layout showing four replications of three treatments arranged in sectors.

Grower Management: The grower's standard N management plan involved applying 40 lb N/ac as starter at planting and 90 lb N/ac as 28-0-0-5 on June 5. The total N applied was 130 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 70 lb N/ac (40 lb N/ac as starter at planting and 30 lb N/ac as 28-0-0-5 on June 5). Sensor-based fertigation management began after the June 5 application. Sensor-based fertigation with 28-0-0-5 was triggered on two dates: 30 lb N/ac on July 3 and 30 lb N/ac on July 19 with all four replications receiving applications on both dates. Total sensor-based fertigation was 60 lb N/ac and the total applied during the growing season was 130 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 70 lb N/ac (40 lb N/ac as starter at planting and 30 lb N/ac as 28-0-0-5 on June 5). Sensor-based fertigation management began after the June 5 application. Sensor-based fertigation with 28-0-0-5 was triggered on three dates: 30 lb N/ac on July 3 to one of four replications, 30 lb N/ac on July 19 to three of four replications, and 30 lb N/ac on July 27 to one of four replications. Total sensor-based fertigation was 37.5 lb N/ac and the total applied during the growing season was 108 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	130 A	18.5 A	211 A	91 A	0.62 A	757.79 A
Risk-Averse Fertigation	130 A	19.4 A	201 A	87 A	0.70 A	716.68 A
Risk-Tolerant Fertigation	108 B	19.2 A	199 A	105 A	0.55 A	717.80 A
P-Value	0.012	0.819	0.87	0.374	0.469	0.896

*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 the same amount of N as the grower's N management, while the risk tolerant fertigation approach applied 22 lb/ac less N than the grower's N management.
- There was no yield, N efficiency, or net return difference between the sensor-based fertigation approaches and the grower's N management.