Project SENSE (Sensor-based In-season N Management)

Study ID: 619159201701
County: Seward
Soil Type: Butler silt loam 0-1% slope; Hobbs silt loam frequently flooded; Crete silt loam 1-3% slope
Planting Date: 05/09/17
Harvest Date: 10/24/17
**Population:** 35,000
Hybrid: CRM (days) 113
Reps: 5
Previous Crop: Soybean
Tillage: No-Till

Note: 5 lb N/ac from irrigation
Irrigation: Pivot
**Rainfall (in):**
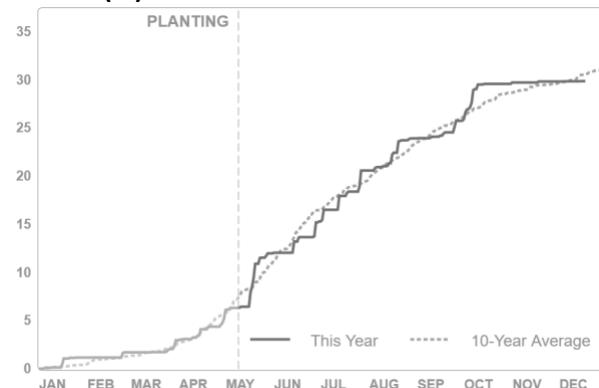
Introduction: This study compares sensor based in-season N application with the grower's standard N management. For the Project SENSE nitrogen treatments, a high clearance applicator was equipped with Ag Leader® OptRx sensors. UAN fertilizer was applied with drop nozzles as the crop canopy was sensed. At this site, a third treatment was added – the drone based sensor N management. For the drone based treatment, a SenseFly eBee drone was equipped with a Parrot® Sequoia™ multispectral sensor. The drone and sensor was flown over the field to create NDRE (normalized difference red edge) index maps. These data were then used to develop an in-season N fertilizing prescription which was applied using the same high clearance applicator and drop nozzles.

Grower Nitrogen Treatment: The initial grower N rate was 100 lb N/acre applied on March 18, 2017. An additional 30 lb N/acre was applied on May 10, 2017, and an additional 60 lb N/acre was applied on July 6, 2017. The total N rate was 190 lb N/acre.

Project SENSE Nitrogen Treatment: For the SENSE treatment strips, 100 lb N/acre was applied on March 18, 2017, and an additional 30 lb N/acre was applied on May 10, 2017. Crop canopy sensing and application occurred on July 6, 2017, at the V13 growth stage. The normalized difference red edge (NDRE) index values captured using the crop canopy sensors are shown in *Figure 1*. Across all Project SENSE treatments, the average N rate applied in-season was 54 lb N/acre. Nitrogen application for the Project SENSE treatment strips is shown in *Figure 3*. The total N rate was 184 lb N/acre.

Drone Based Sensor N Treatment: For the drone based sensor treatment, 100 lb N/acre applied on March 18, 2017, and an additional 30 lb N/acre was applied on May 10, 2017. The drone was flown over the field on July 5, 2017, and the NDRE imagery was used to develop a N prescription map. The normalized difference red edge (NDRE) index values captured using the drone are shown in *Figure 2*. The average N rate applied in-season was 48 lb N/acre. These N rates were applied on July 6, 2017, at the V13 growth stage. Nitrogen application for the drone based treatment strips is shown in *Figure 3*. The total N rate was 178 lb N/acre.

Data were analyzed using the GLIMMIX procedure in SAS 9.4 (SAS Institute Inc., Cary, NC). Mean separation was performed with Fisher's LSD.
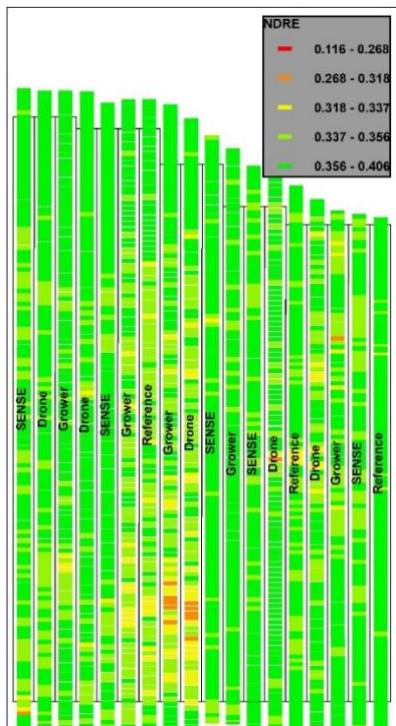
Figure 1. NDRE (normalized difference red edge) index obtained using crop canopy sensors mounted on a high clearance applicator for the plot area on July 6, 2017.
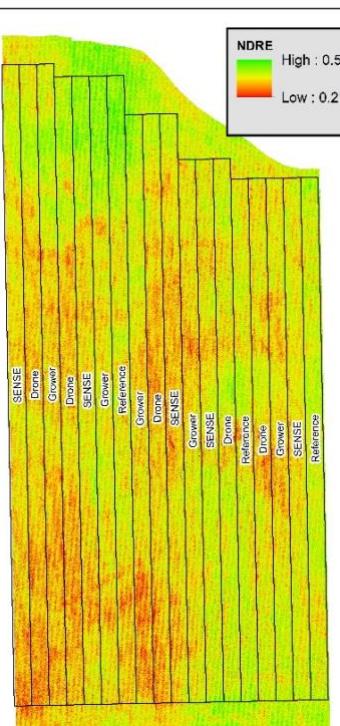
Figure 2. NDRE (normalized difference red edge) index obtained using a drone based sensor on July 5, 2017.
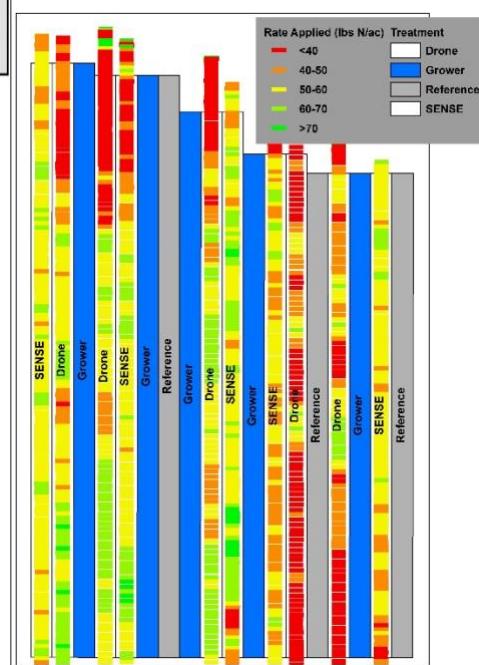
Figure 3. Nitrogen rate applied to Project SENSE N Management and Drone Based Sensor Management treatments based on NDRE values in *Figure 1* and *Figure 2*.

Results:

	Total N rate (lb/ac)	Yield (bu/acre)†	Partial Factor Productivity of N (lb grain/lb N)	lb N/ bu grain	Marginal Net Return‡ ($/ac)
Drone Based Sensor N Management	178	244 A*	77 A	0.73 C	694.02 A
Grower N Management	190	245 A	72 C	0.78 A	692.60 A
Project SENSE N Management	184	245 A	74 B	0.75 B	696.12 A
P-Value	N/A	0.764	0.002	0.001	0.833

*Values with the same letter are not significantly different at a 95% confidence level.

†Yield values are from cleaned yield monitor data. Bushels per acre corrected to 15.5% moisture.

‡Marginal net return based on $3.15/bu corn and $0.41/lb nitrogen fertilizer

Summary:

- Both the Project SENSE N management and drone based sensor management had a lower total N rate than the grower, and did not have a reduced yield compared with the grower. This indicates that both approaches appropriately reduced the N rate, leading to higher nitrogen use efficiency.
- The drone based treatment had lower N recommendations than the Project SENSE treatment, resulting in greater N efficiencies.
- There was no difference in marginal net return between the three treatments.

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