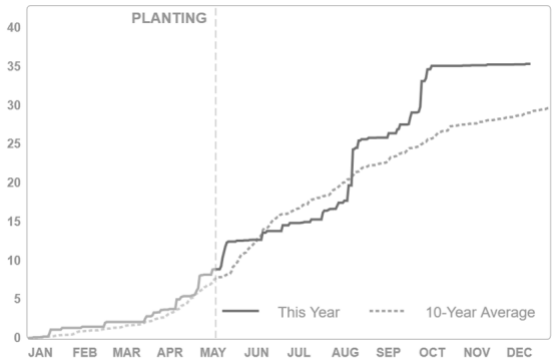
Project SENSE (Sensor-based In-season N Management)

Study ID: 714125201701
County: Nance
Soil Type: Ortello fine sandy loam 1-3% slope
Planting Date: 5/12/17
Harvest Date: 10/29/17
Population: 29,600
Hybrid: CRM (days) 115
Reps: 4
Previous Crop: Corn
Tillage: No-Till
Note: 34 lb N/ac from irrigation
Irrigation: Pivot

Rainfall (in):



Soil Sample Results: Soil samples were taken in three locations within the research study area and do not correspond to specific treatments or replications.

ID	Soil pH 1:1	WDRF Buffer pH	Soluble Salts 1:1 mmho/cm	Excess Lime Rating	Organic Matter LOI %	Nitrate – N ppm N	Nitrate lb N/A	Mehlich P-III ppm P	Sulfate-S ppm S	Zn (ppm)	Ammonium Acetate (ppm)				CEC me/100g	% Base Saturation				
											K	Ca	Mg	Na		H	K	Ca	Mg	Na
3	6.9	7.2	0.07	NONE	1.3	2.2	5	15	9	3.82	218	1138	113	6	7.2	0	8	79	13	0
10	6.3	6.8	0.2	NONE	2.2	3.4	8	20	10	6.24	290	1345	144	12	10.2	15	7	65	12	1
20	6.2	6.8	0.07	NONE	1.2	1.9	4	48	9	3.52	281	804	82	4	6.9	22	10	58	10	0

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 25 lb N/acre applied on May 12, 2017. An additional 50 lb N/acre was applied on June 20, 2017, and an additional 103 lb N/acre was applied on July 10, 2017. The total N rate was 178 lb N/acre.

Project SENSE Nitrogen Treatment: For the SENSE treatment strips, 25 lb N/acre was applied on May 12, 2017, and an additional 50 lb N/acre was applied on June 20, 2017. Crop canopy sensing and application occurred on July 10, 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 60 lb N/acre. Nitrogen application for the Project SENSE treatment strips is shown in *Figure 3*. The total N rate was 135 lb N/acre.

Drone Based Sensor N Treatment: For the drone based sensor treatment, 25 lb N/acre was applied on May 12, 2017, and an additional 50 lb N/acre was applied on June 20, 2017. The drone was flown over the field on July 7, 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 100 lb N/acre. These N rates were applied on July 10, 2017, at the V13 growth stage. Nitrogen application for the drone based treatment strips are shown in *Figure 3*. The total N rate was 175 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.

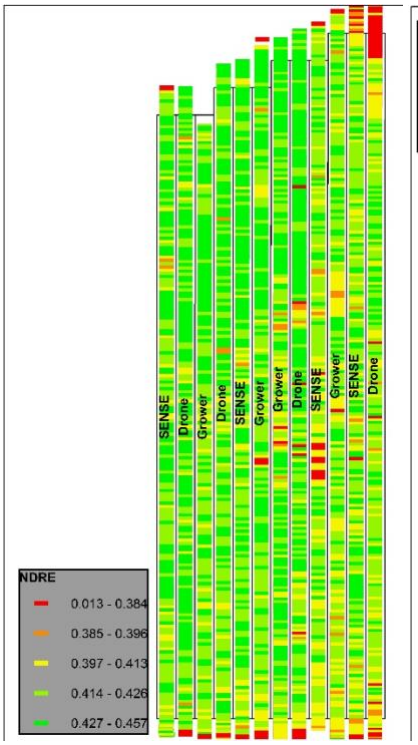


Figure 1. NDRE (normalized difference red edge) index obtained using crop canopy sensors mounted on a high clearance applicator for the plot area on July 10, 2017.

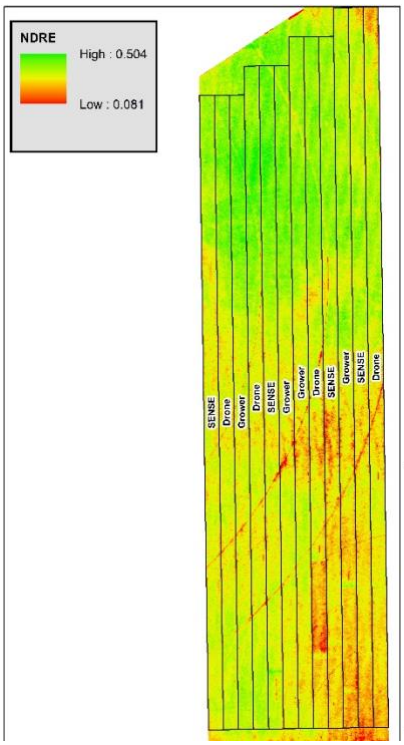


Figure 2. NDRE (normalized difference red edge) index obtained using a drone based sensor on July 7, 2017.

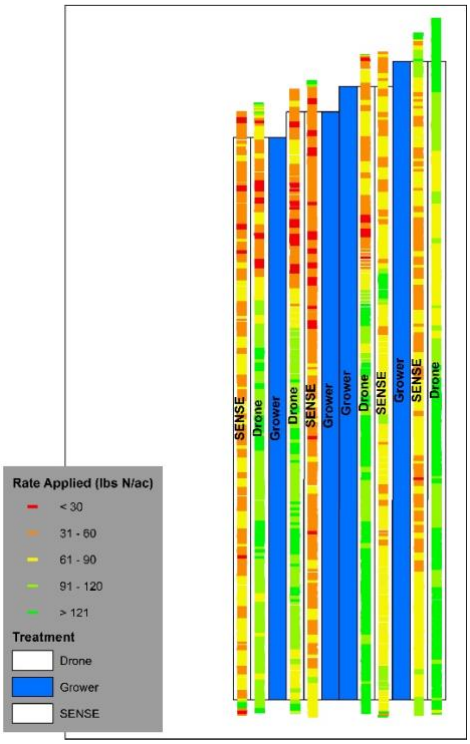


Figure 3. Nitrogen rate applied to Project SENSE N Management and Drone Based Sensor Management treatments based on NDRE values in *Figure 1* and *Figure 2*.

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	175	232 A*	75 B	0.75 A	660.11 A
Grower N Management	178	238 A	75 B	0.75 A	675.11 A
Project SENSE N Management	135	229 B	96 A	0.59 B	666.46 A
P-Value	N/A	0.012	0.002	0.001	0.165

*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:

- At this site, the Project SENSE N management used 43 less lb N/acre than the grower and had a lower yield.
- The drone based management and grower management resulted in similar total N rates and no difference in yield.
- It is not clear why the drone based sensor and high clearance applicator sensor resulted in such different N recommendations.

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