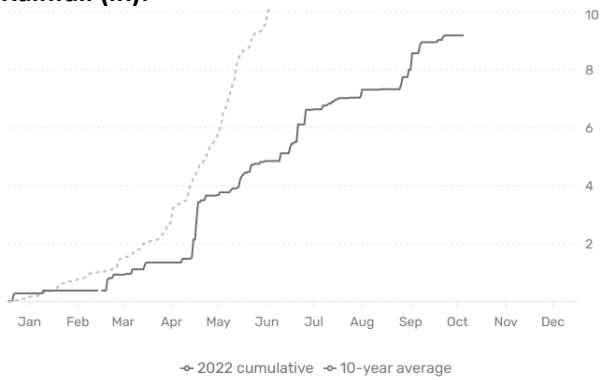
Sensor-Based Nitrogen Management on Winter Wheat

Study ID: 0736111202201
County: Lincoln
Soil Type: Keith silt loam 1-3% slope; Keith silt loam 3-6% slopes, eroded; Kuma silt loam 0-1% slope; Ulysses-Sulco silt loam 6-9% slopes, eroded
Planting Date: 10/19/21
Harvest Date: 7/14/22
Row Spacing (in): 7.5
Hybrid: AgriPro® AP Bigfoot and ApriPro® SY Wolverine
Reps: 4
Previous Crop: Soybean
Tillage: Unknown

Irrigation: Pivot
Rainfall (in):



Baseline Soil Samples, 0-6" (4/13/2022):

								-------Melich lll-------							
	pH	BpH	OM LOI %	Melich-lll P ppm	Nitrate – N ppm	Bray P1 ppm	Sulfate-S ppm	K	Ca	Mg	Na	CEC me/100g	Sand (%)	Silt (%)	Clay (%)
North	6.1	6.7	3.3	62	11.1	47	10	516	1594	246	29	13.4	45	39	16
South	7.1	6.9	2.2	19	6.1	14	9	350	1378	213	33	9.7	59	31	10

Introduction: This study evaluated a sensor-based N management strategy for winter wheat compared to the grower's traditional N management. The experiment was arranged in a randomized complete block design with four replications of two treatments, with each treatment segment being 45 degrees (Figure 1, left). The field had two varieties, one on the north half of the pivot and one on the south half. The entire field received 97 lb N/ac through the following applications:

- 8 gal/ac 10-34-0 (9 lb N/ac) on October 19, 2021, with drilling
- 18 gal/ac 30-0-0-3 (58.5 lb N/ac) on March 18, 2022, stream applied
- 9 gal/ac 30-0-0 (29 lb N/ac) on May 24, 2022, through fertigation with 1 gal/ac chloride

Treatments: The sensor-based N management strategy was compared to the grower's N management in the final fertigation.

- *Grower's N management:* Fertigation of 30 lb N/ac on June 8, 2022.
- *Sensor-based N management:* At Feekes growth stage 3, two small high N rate blocks were established in the field by hand-applying a high rate of fertilizer, one in each variety. Following N rate block establishment, Planet® SkySat (50 cm resolution) satellite imagery (Figure 1, right) and multispectral drone imagery were collected, and the normalized difference vegetation index (NDVI) was calculated. In-field measurements were taken with a handheld Trimble® GreenSeeker® in the high-N plots, and selected locations in the bulk of the field to calibrate the imagery. The imagery and Trimble® GreenSeeker® measurements were processed in the Ninja Ag platform using the Oklahoma State University algorithm and Kansas State University algorithm. On average, these algorithms recommended 15 lb N/ac. On June 8, 2022, 15 lb N/ac was applied through fertigation.

Results:

	Total N rate (lb/ac)	Yield (bu/ac)†	Nitrogen Efficiency (lb N/bu grain)	Partial Profit‡ ($/ac)
Grower N Management	127	73 A*	1.74 A	630 A
Sensor-based N Management	112	72 A	1.57 A	629 A
P-Value	-	0.849	0.179	0.992

*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 corrected to 13.5% moisture.
‡Marginal net return based on $9.58/bu wheat and $0.56/lb N fertilizer.

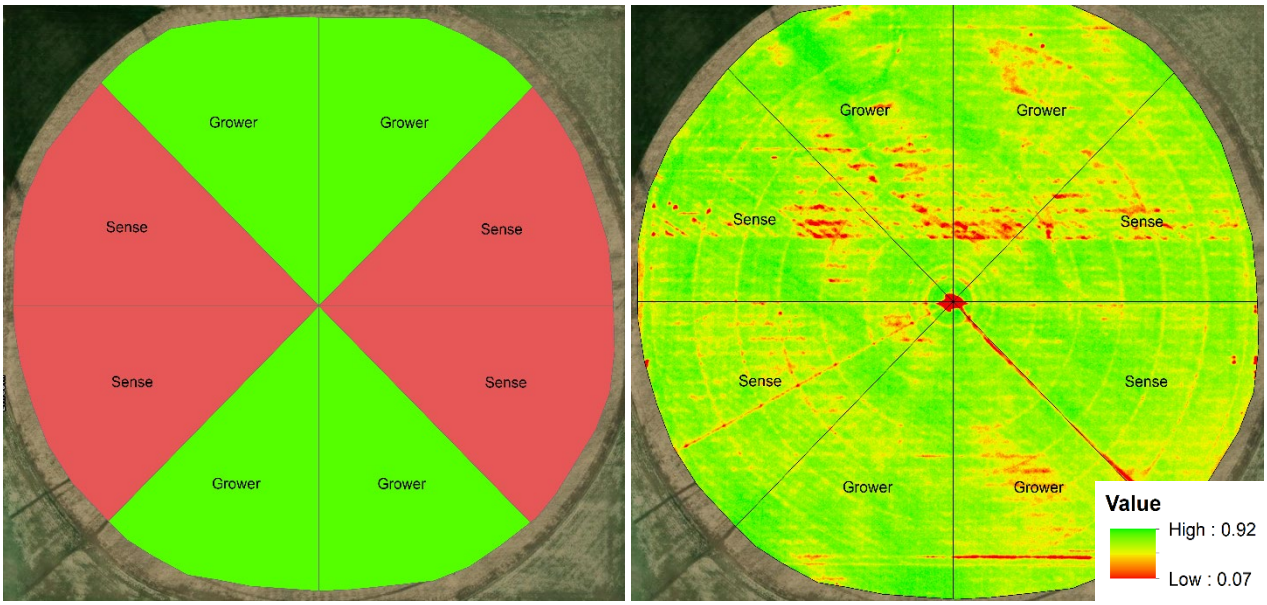


Figure 1. Treatment layout comparing grower's N management (Grower) to sensor-based N management (SENSE) in 45-degree segments (left). Normalized difference vegetation index (NDVI) from Planet® SkySat satellite imagery on May 27, 2022 (right).

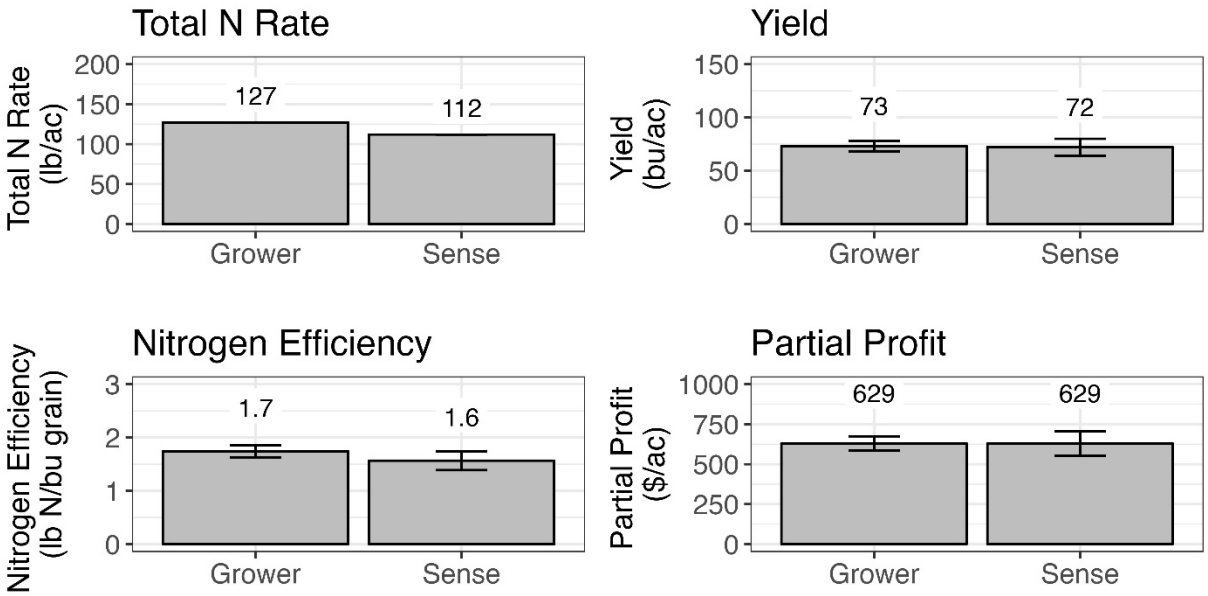


Figure 2. Total N rate, yield, nitrogen efficiency, and partial profit for the grower's N management and sensor-based N management. Vertical bars represent the standard deviation of the mean. Averages reported are means of all observations and will not be identical to results in table on previous page, which are summarized first by replication.

Summary:

- The sensor-based approach resulted in a reduction in N fertilizer (15 lb N/ac) with no yield loss.
- Nitrogen use efficiency and partial profit were not significantly different between the two treatments.
- Utilizing the sensor-based management earlier in the season could result in greater N fertilizer savings.

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