Project SENSE
Final Project Report

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Joe Luck, Laura Thompson, Richard Ferguson, John Parrish, Joel Crowther, Brian Krienke, Troy Ingram, Dean Krull, Keith Glewen, Nathan Mueller, Taro Mieno

Project Details

This report documents project activities, results, and outputs generated from Project SENSE from 2015 to 2018. The overall goal of Project SENSE was to demonstrate the opportunity to increase fertilizer nitrogen (N) use efficiency (NUE), and reduce nitrate loss to groundwater, by demonstrating crop canopy sensors as a means of reactive management for in-season N fertilization. During the 2015 to 2017 growing seasons, 52 site studies were conducted within the five partnering NRDs. It should be noted that four sites were removed from the final analysis summary; each was impacted by weather which delayed sensor-based applications well beyond (2 to 4 weeks) the target V8 to V14 crop stages (this was largely due to the geographic distribution of project sites).

Final Summary of Results

Across the 48 sites, ***the sensor-based approach used 29 lb-N/ac less*** than the cooperating growers' approaches; the result was an ***average of 1.5 bu/ac less corn produced using the sensor-based method***. In terms of productivity and NUE, the sensor based-approach produced an additional 16 lb-grain/lb-N compared to the cooperator approaches.

The sensor-based approach resulted in an average increase in profit compared to the grower approaches. At the higher N and corn prices ($0.65/lb-N and $3.65/bu) noted during the study (typically in 2015), ***the sensor-based approach was $13.23/ac more profitable***; and at lower N and corn prices ($0.41/lb-N and $3.05/bu) experienced in 2016 and 2017, ***the sensors were $7.24/ac more profitable compared to the grower approaches***. Input costs and crop revenues are important consideration regarding decisions about technology adoption; however the sensors were a viable option for improving economic returns based on this study.

Project Support

The project was made possible with support from the Nebraska Corn Board, as well as the Central Platte, Little Blue, Lower Loup, Lower Platte North, and Upper Big Blue NRDs. In addition, funding from the USDA National Institute of Food and Agriculture was also leveraged for supplemental research associated with the project. The entire project team would like to thank our sponsors!

Summary of Results (all NRD sites)

Three Year Average	SENSE	Grower
Total N rate* (lb-N/ac)	161.1	189.8
Yield* (bu/ac)	218.5	219.9
Partial Factor of Productivity* (lb grain/lb-N)	83	68
Nitrogen Use Efficiency* (lb-N/bu grain)	0.76	0.92
Partial Profitability* ($/ac) [@3.65/bu and $0.65/lb-N]	$692.82	$679.59
Partial Profitability* ($/ac) [@3.05/bu and $0.41/lb-N]	$600.39	$593.15

*values are statistically different at a 95% confidence level.

Additional project information can be found at: cropwatch.unl.edu/projectsense

Yearly Differences for Production Metrics (Values represent GROWER – SENSE):

	2015	2016	2017
Total N rate (lb-N/ac)	45*	33*	15*
Yield (bu/ac)	4.2*	-2.3*	3.5*
Partial Factor of Productivity (lb grain/lb-N)	-23*	-15*	-11*
Nitrogen Use Efficiency (lb-N/bu grain)	0.20*	0.24*	0.06*
Partial Profitability ($/ac)†	-$13.91*	-$21.86*	$5.05*

†at yearly corn and N prices: $3.65/bu & $0.65/lb-N in 2015; $3.05/bu & $0.45/lb-N in 2016; $3.15/bu & $0.41/lb-N in 2017
*values are statistically different at a 95% confidence level.

Differences (Grower – SENSE) in project metrics are summarized in the table above (4 sites overall were removed from the total analysis). For 2015 and 2016, the sensor-based method resulted in significant reductions in N required and also improved profitability. In 2016, average yields increased using the sensors; in 2015 a loss of 4.2 bu/ac was noticed. In 2017, a few factors may have contributed to reduced performance using the sensors (high economic optimum N rates, for example in some SENSE plots); however N required was still less using the sensors. As expected, yearly variability was noted using this technology.

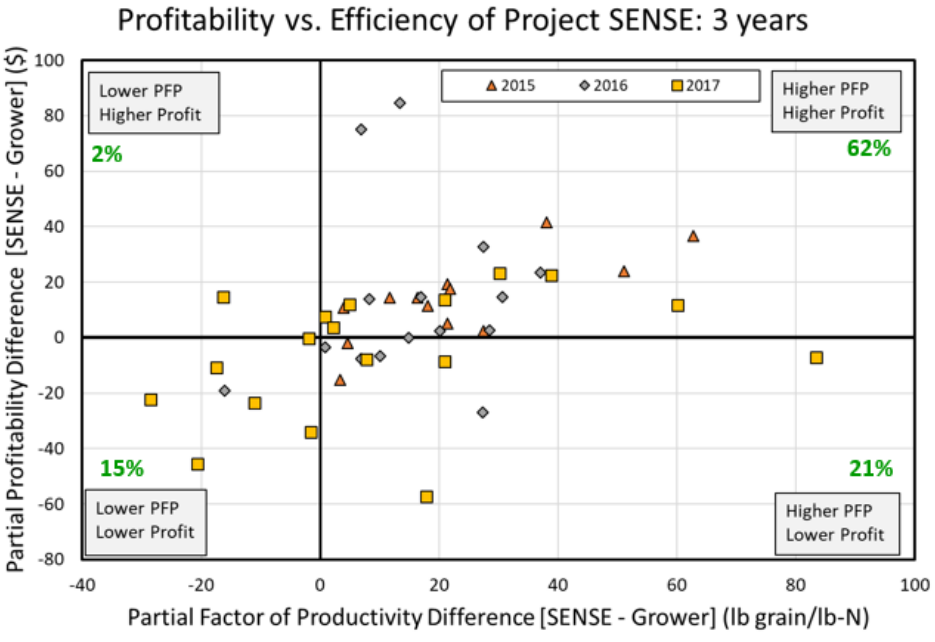
The chart below shows the distribution of producer-sites (of 48 total) where profitability and productivity were improved (62% of sites) along with an additional 21%, productivity was improved while profitability suffered. In 15% of the sites, productivity and profitability were both negatively impacted by using the sensors. When considering productivity alone, 83% of sites saw an improvement using sensors for N management.

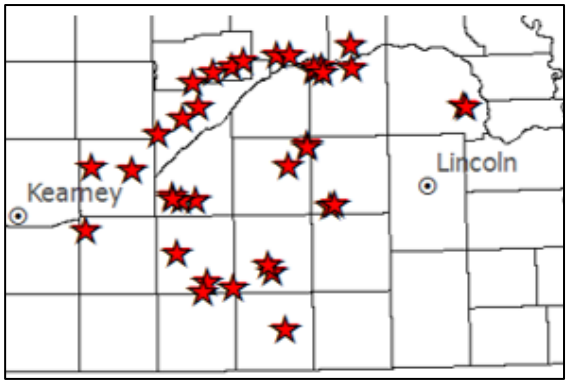
Project Reporting and Feedback

Project SENSE Field Days: Fifteen field days were conducted from 2015 to 2017, one within each participating NRD each year. Over 350 attended these informational sessions, the majority indicating significant knowledge gained regarding sensor-based management.

Project SENSE Grower Meetings: Three winter meetings were held from 2016 to 2018 to communicate project results directly to cooperating growers. At the final meeting, 50% of respondents indicated that they had reduced N rates or moved to split N application as a result of interacting with Project SENSE.

NE On Farm Research Meetings: Results were discussed at the Nebraska On-Farm Research Network annual meetings from 2016 to 2018 with just under 600 total attendees; 76% of survey respondents indicated moderate-to-significant knowledge gained from information presented while 55% indicated they would make changes to their N management plans based on what they'd learned.





The geographic distribution of Project SENSE sites is pictured above which comprised the 2015, 2016 and 2017 growing seasons. Some sites were repeated up to three years during the project; however most individual field sites were not repeated during the project.