# Promoting Adoption of Precision Nitrogen Management Technologies through On-Farm Research


Laura Thompson[1], Laila Puntel[2], Taylor Lexow[1], Taro Mieno[4], Joe Luck[3] , Seth Norquest[1]

[1]Nebraska Extension, University of Nebraska-Lincoln [2]Department of Agronomy & Horticulture, University of Nebraska-Lincoln [3]Department of Biological Systems Engineering, University of Nebraska-Lincoln, [4]Department of Agricultural Economics, University of Nebraska-Lincoln


## BACKGROUND

- The Nebraska On-Farm Research Network helps farmers evaluate products and practices that impact the productivity, profitability, and sustainability of their operations.
- There are many technologies that have potential to increase nitrogen use efficiency (NUE) on corn and winter wheat but typically these technologies have low adoption.
- Farmers have technologies such as GPS, yield monitors and variable-rate application equipment on their farms that enables them to easily conduct on-farm research to evaluate new technologies and products.

## OBJECTIVES

1. Evaluate commercially available nitrogen (N) management technologies across Nebraska and their impact on yield, profit, and NUE.
2. Enable farmer's hands on experience with technologies that are relevant for their operation and promote technology adoption.
3. Provide financial compensation for farmers to negate risk of trying a new technology in their fields.
4. Collect field data to validate and improve the technology tested.

## METHODS

Participating growers selected a "Next Level" N technology to test in their fields (Fig.1). A randomized strip trial experimental design was used to compare treatments of growers N management practice and the "Next Level" technology selected by the grower. Small N plots with incremental N rates were located at contrasting zones of the field (Fig. 2). Treatments were established with variable-rate fertilizer equipment. An automated process was developed for data analysis and reporting (Fig. 3). The small N plots are used to analyze the yield response to N within the field, estimate economic optimal N rate (EONR), and compare the performance of the tools. Intensive data collection was performed for the small N plots during the growing season to measure leaf area index, soil nitrate, biomass and multispectral images.

## RESULTS

- **98%** of the experiments were successfully established in 2021 with a total of 36 trials for wheat and corn. 42% selected sensor-based technology, 33% crop model-based tools, and 25% inhibitor products. 90% of the trials were analyzed using the automatic process (Fig 3). The reminder trials were analyzed manually due to issues in data quality.
- Due to this project, industry collaborations were established between academia and the growers. This facilitated technology transfer with expert input. Graduate students were supported due to industry collaboration.
- Results were share with 200+ individuals in the on-farm research meetings and 12 presentations.
- We expect to complete 120 trials by 2023 .
- Grower impact was documented:

"I've had crop canopy sensors for years but didn't feel confident using them. Now that I've seen the results, I will use them farm wide."

"I'm shocked that our NUE is 1.1. I want to push the efficiency below 1. I was planning on purchasing some more fertilizer for the upcoming year, but now that I see these results, I think what I have is enough."


Figure 1: Growers select the "next-level" N management options that fits their operation

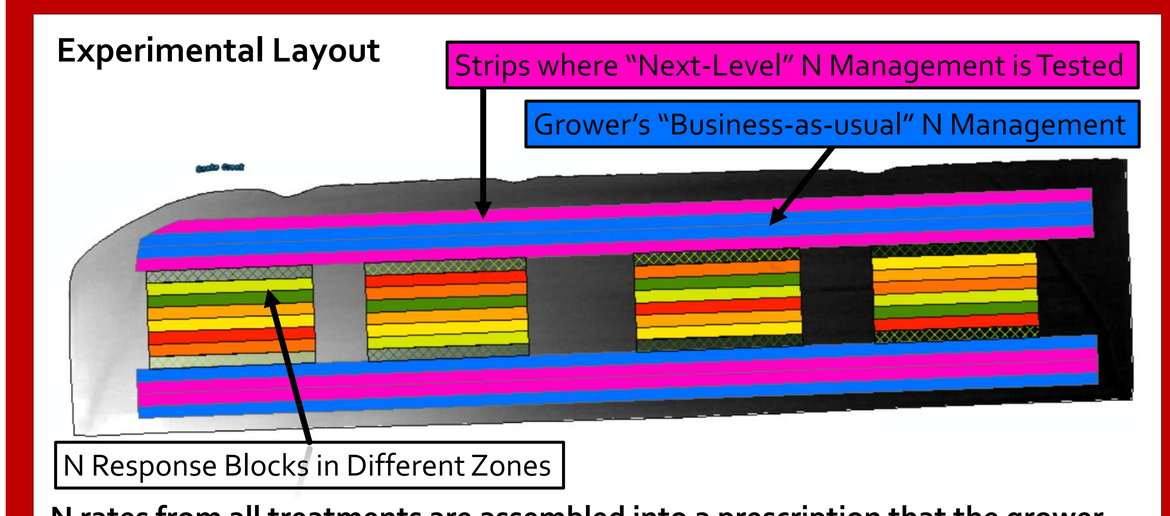


Figure 2: Example layout comparing "next-level" N management with grower's traditional N management and N rate blocks in contrasting field zones

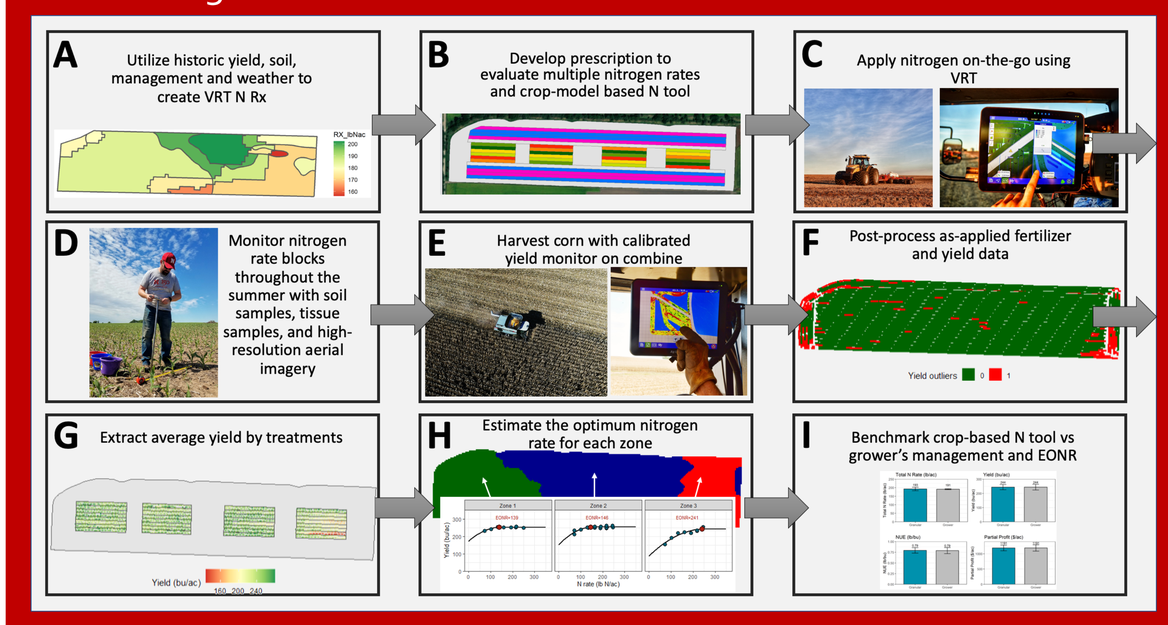


Figure 3: Precision nitrogen trial implementation workflow diagram: A) variable nitrogen rate prescriptions are created with the selected technology, B) trial layout is combined with the output of the technology and the nitrogen ramps , C) trials are applied on the go while the producers applies fertilizer, D) in-season data collection, E) end of season data collection, F) automatic data processing in R software, G) data summaries, H) analysis by zone, and I) data sharing.

## SPONSORS


Thank you to the funding agencies, industry supporters, cooperating farmers, extension educators, graduate students, technologists, and interns involved with this project.

United States Department of Agriculture NRCS Natural Resources Conservation Service · CIG Conservation Innovation Grant · adapt-N · Granular Insights · Corteva agriscience · Koch Fertilizer · Ninja AG · Nebraska Extension On-Farm Research · Nebraska Extension Digital Agriculture