



VARIABLE RATE NITROGEN APPLICATION

VR-N WORKS WITH THE CONDITIONS IN YOUR FIELD, applying more nitrogen where the crop can use it and less where additional N won't increase yield. Aligning nitrogen needs with fertilizer applications within the field may increase profitability and reduce losses to the environment.

WHAT TO EXPECT

Improved nitrogen use efficiency- By matching your fertilizer applications to your crop needs, you'll apply nitrogen where your crop can use it. You may find that you don't apply less nitrogen overall- increased efficiency can come from lower inputs or higher yields.

A whole-system approach- In order to achieve the greatest benefits, look at all 4 Rs- right nutrient source, rate, time & placement. If you plan to vary your sidedress N application rate, for example, you'll have to limit your early-season applications or you won't have much N left in your nutrient management recommendation to work with later in the season. In addition, nitrogen is just one source of in-field variability. Drainage issues, pH and insect pressure are others. Consider your field conditions to make sure that VR-N will benefit your operation.

A need for technical support- Managing data, compatibility issues and developing field-specific variable rate nitrogen (VR-N) recommendations are tasks that technical service providers or crop providers can assist with to match your goals.

SENSOR-BASED OR MAP-BASED?

Nitrogen dynamics in the soil are complex. Seasonal variability- including weather and other factors- have a significant impact on the "right rate" in any given season. Research shows that VR-N offers potential to increase nitrogen use efficiency and profitability, if both spatial variability in the soil and in-season conditions are considered in the development of nitrogen recommendations.

Map-based VR-N recommendations from historic yield or soil types don't reflect in-season conditions that affect yield potential (like rainfall), and haven't shown a consistent advantage over flat-rate nitrogen application strategies.

The greatest potential seems to be in sensor-based technologies to develop nitrogen recommendations. These tools have seen some implementation challenges on Delmarva due to increased management complexity and compatibility issues, but the investment may be worth it. **On Virginia's Eastern Shore, VR-N in wheat saved Virginia farmers an average of 4 lbs of N per acre, which is 7% of the spring nitrogen application. In addition, side-dress N application for corn could be reduced by 21 lbs per acre while maintaining similar yields.** (Thomason, et al 2011)

4RS IN THE FIELD

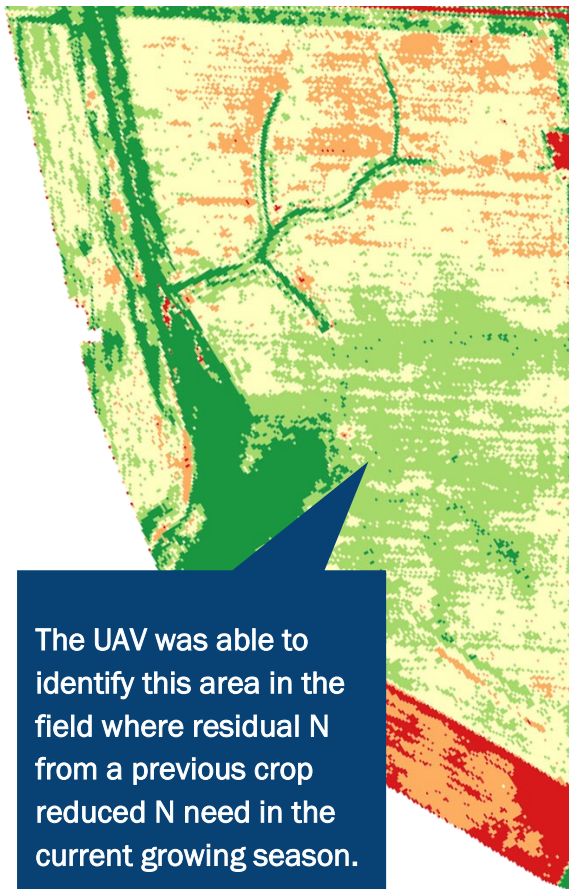
In 2017, the Delaware-Maryland 4R Alliance worked with two farmers and Hooper, Inc. to evaluate the benefits of sensor-based VR-N application.

In this project, an Unmanned Aerial Vehicle (UAV, or drone) collected NDVI data prior to corn sidedress nitrogen application in the spring to develop variable-rate side-dress application rates in the field. (NDVI, or “normalized difference vegetation index” is a metric to evaluate crop vigor.) Areas with higher NDVI were assumed to have a lower need for additional nitrogen compared to areas with lower NDVI.

The demonstration project in two separate fields indicated that variable-rate nitrogen application was more profitable than a flat nitrogen rate and has the potential to increase nitrogen use efficiency.



Hooper's Precision Ag Specialist, Dave Wharry, demonstrates a UAV at DM4RA's 2017 Field Day



The UAV was able to identify this area in the field where residual N from a previous crop reduced N need in the current growing season.

NDVI appears to be a good indicator of yield potential throughout the field, and can assess conditions related to the current growing season.

On one of the demonstration fields where spinach had been grown the previous year, the UAV detected areas of the field with residual soil nitrogen from the previous crop. This residual N could not have been accounted for if other methods were used to delineate areas for variable-rate nitrogen application, such as yield history or soil type.

NRCS PRACTICES

ENVIRONMENTAL QUALITY INCENTIVE PROGRAM (EQIP) PRACTICES:

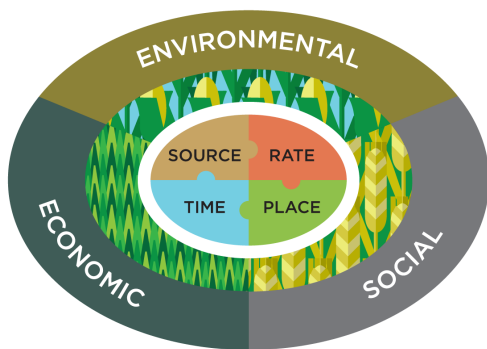
- Nutrient Management (590)

CONSERVATION STEWARDSHIP PROGRAM (CSP) ENHANCEMENTS:

- E590118X - Reduce risks of nutrient losses to surface water by utilizing precision agriculture technologies to plan and apply nutrients
- E590119Z- Improving nutrient uptake efficiency and reducing risk of nutrient losses to groundwater
- E590118Z- Improving nutrient uptake efficiency and reducing risk of nutrient losses to surface water

FURTHER READING

- **SENSOR-BASED, VARIABLE-RATE NITROGEN APPLICATIONS IN VIRGINIA-** Virginia Cooperative Extension Publication CSES-90P by Reiter, M, Mason, J, Thomason, W. 2014, Available at pubs.ext.vt.edu/
- **PRECISION FARMING TOOLS: VARIABLE-RATE APPLICATION-** Virginia Cooperative Extension Publication 442-505 by Grisso, R, Allery, M, Thomason, W, Holshouser, D, Roberson, G. 2011. Available at pubs.ext.vt.edu/
- **VARIABLE-RATE NITROGEN MANAGEMENT FOR CORN PRODUCTION – SUCCESS PROVES ELUSIVE-** International Plant Nutrition Institute (IPNI) Site Specific Management Guidelines, Publication SSMG-36 by Doerge, T.A., Available at ipni.net/ssmg



THE DELAWARE MARYLAND 4R ALLIANCE (DM4RA) is a collaboration between agribusinesses, government agencies, conservation groups and scientists working together to ensure that every nutrient application on Delmarva is consistent with the 4Rs– the Right Nutrient Source, applied at the Right Rate, at the Right Time, in the Right Place.

Founded by The Nature Conservancy and the Delaware-Maryland Agribusiness Association, we support the increased implementation of 4R practices, to benefit the economic, environmental and social well-being of our region and our farmers.

CONTACT: Keiller Kyle, Agricultural Specialist
(315) 730-7454, keiller.kyle@tnc.org

WWW.4RMIDATLANTIC.COM