MSU AGRICULTURE INNOVATION DAY

FOCUS ON PRECISION

TECHNOLOGY THAT PAYS

Feeding Crops with Sensor-Based Variable Rate Nitrogen Technology

Integrating crop-sensing technology in your nutrient management program can be an effective way to feed your corn crop on the go.

Figure 1 Normalized Difference Red Edge (NDRE) values at sidedress. Green areas indicate above-average biomass.

Situation:

The unpredictable weather patterns and economic pressures of farming have caused Michigan crop growers to consider new ways to manage field variability and increase yield and profitability. While nitrogen (N) management is essential, in-field N needs can be highly variable due to interactions between the soils, weather, plants, and other management decisions needed to determine full yield potential.

Interest in crop sensing technologies designed to feed the corn crop the right amount of N, when needed, has gained the confidence of many growers. Sensors have simplified N management by estimating crop N needs and driving VRA applicators on the go based on crop chlorophyll content. Advantages of sensor technology are less labor needed compared to the pre-sidedress nitrogen test (PSNT) and elimination of the lag time between measurement and application. Reducing this lag gap reduces the risk of the yield- and profit-robbing nitrogen loss from leaching and N loss to the atmosphere.

Using N sensor technology

The sensors are positioned on the applicator above the crop canopy and measure chlorophyll content and thereby N needs by light reflected by the crop canopy. The best results come with sidedress applications made at or after growth stage V6. The sensors have a built-in light source, so they work as well in low light as in full sunlight. Information from the sensors adjusts the N application rate on the go.

Typically, one-third to one-half of the anticipated seasonal N is applied at planting. The remainder is applied at growth stage V6 or later. The best practice is to create a well-fertilized N reference strip in each field at planting time as a benchmark or calibration strip to ‘train’ the sensor to respond to crop growth variability in that field.

Example: Sensor-enabled 28% N VRA application

Figure 1 shows the Normalized Difference Red Edge (NDRE) sensor values at sidedress (July 7) for the 2015 corn crop in a 90-acre field in Lenawee Co. The soils are predominately loam (Blount/Morey/Glynwood) with a few clay pockets (Pewamo, 16 ac). The green areas indicate above-average crop canopy reflectance and increased biomass (indicating chlorophyll/N status). The yellow areas indicate below-average biomass and the need for additional N.

College of Agriculture and Natural Resources
MICHIGAN STATE UNIVERSITY

MSU AGRICULTURE INNOVATION DAY

FOCUS ON PRECISION

TECHNOLOGY THAT PAYS

The field received 50 lbs-N/ac at planting and an average sidedress rate of about 75 lb-N/ac. However, the as-applied rate varied up to 70% with less than 30 lb/ac applied to the green, high biomass areas, and up to 128 lb/ac in the yellow, lower biomass areas. In this case, a single, full-field blanket N rate would have over-applied N in some regions and under-applied in others. Sensor-based technologies seek to apply the right amount, in the right place, at the right time.

Figure 3 shows the corn grain yield (bu/ac) map. Green areas are above average in yield, and yellow areas are below average. Compare Figures 1-3 and notice that the highest yielding areas also had the highest NDRE values indicating adequate N and thus the lowest N sidedress rates. The expected yield for this field is 150 bu/ac.

The total N applied using the crop sensing technology (11,020 lbs) reduced the amount of N applied by almost 9% ($622) when compared to the Maximum Return to Nitrogen (MTRN) rate of 136 lb N/acre.

Key Points:

- On the go, nitrogen-sensing VRA can be an essential part of an effective nutrient management program.
- N applications based on sensor technology require less labor compared to the pre-sidedress nitrogen test (PSNT) and eliminates the lag time between measurement and application.
- Closing the lag time gap between N assessment and application reduces the risk of the yield- and profit-robbing nitrogen loss from leaching and N loss to the atmosphere.
- Applications of a flat rate based on expected yields may be correct on average, but over-apply in low-yielding areas and may under-apply in others.
- The greatest benefit will be in fields with high yield variability.
- In this 90 acre Lenawee Co. field, N sensing reduced N use and cost by almost 9% compared to the standard N recommendation.
- VRA-N applications based on in-field variability make efficient use of crop nutrients, save time and labor, and minimize nutrient loss to the environment.

For manufacturer information about N sensing technologies:

- *CropSpec* is a trademark of TOPCON Agriculture
- *GreenSeeker* is a trademark of Trimble Navigation Limited
- *OptRx* is a trademark of Ag Leader Technology, Inc.

Figure 2. VRA application of 28% N based on on-the-go NDRE sensor values. Green areas indicate N rates above field average

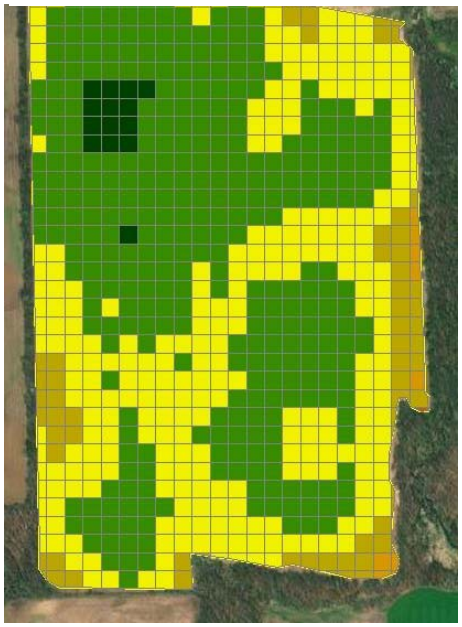

Figure 3. Corn grain yield, bu/ac. Green areas indicate grain yields above field average, and yellow areas are below average.

College of Agriculture and Natural Resources
MICHIGAN STATE UNIVERSITY

The authors are: Dr. Tim Harrigan, Biosystems and Agricultural Engineering, and Ricardo Costa, MSU Extension Field Crops Educator. Acknowledgements: the authors would like to thank Blaine Baker and Tim Stuzman, Lenewee County farmers; Tom van Wagner, Technician, Lenawee Conservation District; and Bill Copeland, Precision Ag Services Inc. Wauseon, OH for their help in assembling and presenting this information.