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Better Crops, Better Environment...through Science

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SENSOR-BASED NITROGEN FERTILIZATION FOR COTTON

Managing nitrogen (N) for cotton in the southern U.S. is challenging due to spatial and temporal variability in plant available N. This variability results in many areas of the field being over-fertilized, while others are under-fertilized, when using a single N rate for the entire field. Crop sensors are effective N management tools that can help growers adjust for spatial and temporal variability when making N fertilizer decisions for cotton.

Crop sensors measure reflected light at wavelengths that correspond to crop greenness and biomass. Various wavelengths are combined mathematically to create vegetation indices (VI's) that have greater utility in determining N fertilizer requirements than single wavelengths. The normalized difference vegetation index (NDVI) is one of the most common and has been used successfully to determine N fertilizer requirements for wheat and corn in several states.

Sensor-based N application strategies in cotton have not been developed as rapidly as in other crops. Part of the problem has been the failure of NDVI and other commonly used VI's to strongly correlate with crop N status and final lint yield to accurately determine a fertilizer N rate. However, researchers at Mississippi State University have recently identified a combined VI that exhibits a good relationship with leaf N and sensor measurements at critical cotton growth stages.

The MSU research team, led by Dr. Jac Varco, conducted a study between 2012 and 2014 where they evaluated a simplified canopy chlorophyll content index (SCCCI) for determining in-season N fertilization needs in cotton. The measured SCCCI was calibrated to historical crop growth and greenness and expressed as a fertilizer N equivalence. Fertilizer N requirements at pinhead to early square were then adjusted using the estimated fertilizer N equivalence. Detailed information on the calculation of SCCCI is reported in *Raper and Varco. 2015. Prec. Agric. 16:62-76*.

Benefits from the sensor-based applications were also observed as early as peak bloom, when leaf N contents in the VR-fertilized treatments were greater than in those receiving the highest constant N rate. Sensor-based, variable-rate N applications based on the SCCCI also resulted in higher lint yield per unit of applied N compared with standard grower or fixed-rate applications. This increase in N-use efficiency when utilizing sensor-based N management could be an important performance indicator as part of a 4R Nutrient Stewardship program.

Sensor-based, VRN fertilization of cotton can reduce over- and under-application; thus, improving fertilizer N use efficiency. Utilization of crop sensors and the combined VI, SCCCI, near early cotton squaring provides a viable indicator of crop N needs. However, more work is needed to develop properly calibrated algorithms that take into account cotton growth response to soil N availability and intuitive grower input to adjust minimum, maximum, and perceived optimum average field rates. To learn more about on-the-go cotton sensing and other topics in precision agriculture, make plans now to attend InfoAg 2015 scheduled for July 28-30, in St. Louis, MO. **<**www.infoag.org**>**

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