Detecting Drought And Nutrient Stresses

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Research hypothesis: Simultaneously testing for drought and nutrient stresses will lead to improved real-time fertility recommendations as well as provide a check on irrigation management. Better fertility recommendations will improve profitability and reduce the environmental risks associated with excessive fertilizer application.

Applying nitrogen (N) in excess of crop needs results in unused soil N and increased potential for N loss. Unused N can move to groundwater, to surface waters, or denitrify from the soil into atmospheric greenhouse gases. Other plant nutrients in agricultural runoff have also been linked to water-quality problems such as eutrophication of lakes.

Research is currently being conducted in Missouri and other states to develop recommendations for cotton sidedress N based on real-time reflectance sensor measurements. A typical system, adapted from successful systems for wheat and corn, has one or more reflectance sensors (e.g., GreenSeeker; mention of trade names or commercial products is solely for the purpose of providing specific information and does not imply recommendation or endorsement by the U.S. Department of Agriculture) above the row. The observed reflectance is compared to reflectance from plants with sufficient N to estimate the additional N needed. However, there is general agreement among researchers from several states that additional information is needed to refine the current recommendations.

Drought stress has been observed to affect the utility of the reflectance measurements for N, and even with irrigated crops irrigation is often delayed to allow time for pesticide and/or fertilizer applications. The ability to determine what part of the observed response is due to drought stress should lead to more reliable N recommendations. Furthermore, even though measurements won't generally occur often enough to serve as the primary method for scheduling irrigation, they could function as a check on whatever method is used.

Temperature of the crop canopy is strongly affected by drought stress and in arid regions it can be the basis for irrigation scheduling. The Crop Water Stress Index (CWSI), derived from canopy temperature and other climatic measurements, has not been as reliable in the Mid-South, where cloud interference is more common. However, canopy temperature and climatic data could indicate areas of drought stress, even without a dependable CWSI. Therefore, additional sensors were added to measure spatially referenced canopy temperature as well as the temperature and relative humidity of the air above the cotton crop.

Although nitrogen is not generally applied to legume crops like soybean, other nutrient deficiencies can impact growth and yield. Therefore, the study also includes soybeans grown in a potassium-deficient field. Based on the observations from this study, future plans include looking at other crop stressors such as diseases and nematodes to further identify the causes of any observed stresses and allow for more effective treatment. Δ

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