CONSIDERATIONS FOR DEVELOPMENT OF OPTICAL SENSOR BASED NITROGEN RECOMMENDATION ALGORITHMS FOR CORN

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Abstract

Optical sensor technology in Kansas has been used on winter wheat and grain sorghum with great success for predicting N fertilizer needs early in the growing season. However with both crops, there is a required minimum period of growth required before optical sensors can accurately detect N deficiencies. In both cases the target crop needs to have entered a period of vegetative growth where N uptake and utilization is increasing. In the case of wheat that generally corresponds to the Feekes 4 to 5 growth stages, while in sorghum that occurs approximately 30 days after emergence, when the plant has produced approximately 6 to 7 leaves. Prior to these times, modest levels of soil N can provide adequate N to the plant to support growth, and little difference in sensor readings are observed, with or without N fertilizer applied. However the higher demand placed on N supply once the crop becomes established and begins rapid vegetative growth, creates a clear differential in sensor readings between plants growing in soils with adequate and deficient N supplies.

Efforts to use this technology in corn have met similar challenges. Since the rates of biomass production and N utilization are relatively low in the first month after planting, corn may not display N deficiency needed to make a sensor based system adequately differentiate N needs in early growth stages (V-4, V-6), when producers would like to apply N. Especially where even modest rates of N have been applied as starter fertilizer or in some other preplant or planting time application. These conditions result in a relatively short "window" at the early stages of rapid vegetative growth, V-8 to V-10, where N can be sidedressed with traditional equipment using sensor rate guidance. As the corn increases in height, a switch to high clearance sprayers or similar high clearance application equipment becomes necessary to avoid crop injury. Although N uptake/demand greatly increases in corn after V-10, allowing for more N need to be observed, increased plant biomass reduces the ability of many optical sensors to discern these N deficiencies due to "signal saturation", especially when the sensor is targeting the top of the canopy from directly over the row.

Current research at K-State has focused on addressing these challenges and creating algorithms designed to overcome them. Optical sensors such as the Crop Circle, Greenseeker, and Spad Meter were utilized at multiple growth stages across a series of N application times and rates. Current findings suggest that due to the variable N dynamics of corn, it may be necessary to vary sensor position and wavelengths utilized, in order to optimize the quality of data for algorithm inputs and development.

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