COTTON PHENOTYPING AND PHYSIOLOGY MONITORING WITH A PROXIMAL REMOTE SENSING SYSTEM

Curtis Adams
Texas A&M AgriLife Research
Vernon, TX
Glen Ritchie
Texas Tech University
Lubbock, TX
Nithya Rajan
Texas A&M University
College Station, TX

Abstract

Substantial progress has been made to develop sensor-based proximal phenotyping systems for cotton, but continued development is needed to improve in-season prediction of lint yield and to improve accuracy in monitoring crop water stress or managing irrigation using such a system. Here we report on results of a two-year field study in which a proximal sensing system [measuring canopy height, spectral indices (NDVI), and canopy temperature] was deployed bi-weekly over plots of eight cotton varieties at three rates of ET replacement (0, 45, and 90%). As expected, NDVI was an excellent predictor of canopy and biomass traits, including canopy height and leaf area index. The strength of the correlations between in-season sensor measurements [NDVI and the canopy-to-air-temperature difference (Tc – Ta)] and lint yield ranged from poor to fair in assessments of cotton germplasm grown in the same conditions, with NDVI being a better and more consistent predictor of yield than Tc – Ta, though multiple linear regression improved results by up to 9%. Combining the Tc – Ta data with on-site atmospheric weather station data allowed calculation of empirical crop water stress index (CWSI) values. Using the CWSI metric, relative differences in crop water stress were clear among ET replacement levels once the canopy width reached the threshold for focusing the infrared temperature sensor on the canopy (40 cm, for this system), indicating that cotton water stress/irrigation monitoring can be successfully done using a relatively simple proximal phenotyping system.