RELATIONSHIP OF NDVI TO CROP MATURITY DIFFERENCES DUE TO K FERTILITY

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Abstract

Cotton producers are increasingly interested in remote sensing methods of crop monitoring. A method under development uses the Normalized Difference Vegetative Index (NDVI) to detect crop condition remotely. Earlier research showed that changes in spectral reflectance from the cotton canopy tracked the progress towards crop maturity governed by nitrogen fertility. Objectives of this research were to determine if crop responses to potassium (K) fertility can be detected by NDVI sensing, and to evaluate the suitability of using NDVI to monitor cotton crop maturity as affected by K fertility. We planted 'DP 555 BG/RR' cotton on 3 May 2006 and 2 May 2007 in a no-tilled Loring-Calloway silt loam at Jackson TN. Long-term treatments of 0, 60, 120 and 180 lb K_2O ac^{-1} were applied to replicated plots as KCl prior to planting each year. Canopy NDVI data were collected weekly (in 2006) or biweekly (in 2007), after mid-bloom, using a hand-held GreenSeeker Red/NIR sensor suspended 28 to 32 inches above the canopy and aligned with the rows. Data for calculating degree-day (base 60°F) accumulation after planting (DDAP) were recorded at a nearby weather station. Earliness of maturity was measured as the percent of total yield picked at the first of two mechanical harvests. In 2006, potassium deficiency (zero K) induced earlier maturity than the 120 or 180 lb K_2O rates, as shown in percent first harvest. Differences in NDVI due to K fertility appeared by ~1700 DDAP, as canopy NDVI declined more rapidly with zero K than with higher K rates. With 180 lb K_2O ac^{-1}, canopy NDVI at ~2000 DDAP remained similar to values obtained at ~1250 DDAP, and it was higher than NDVI of cotton fertilized with less K. In 2007, maturity differences due to K fertility were not detected in percent first harvest, due to relatively rapid boll opening associated with high temperatures in September 2007. Values of NDVI did not differ between treatments at 1250 or 1580 DDAP, but NDVI differences appeared by 1960 DDAP. Potassium deficient cotton (zero K) had lower NDVI than cotton at higher K rates, and NDVI declined more rapidly with zero K than at higher K rates. With 180 lb K_2O ac^{-1}, NDVI at 1960 DDAP remained similar to that at 1250 DDAP, and it was higher than NDVI of cotton fertilized with zero or 60 lb K_2O ac^{-1}. Although cotton responses to K fertility were detected by NDVI sensing after cutout in both years, more research is needed to determine the suitability of using NDVI to monitor crop maturity when earliness is governed primarily by K nutrition.

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