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SITE-SPECIFIC TEMPORAL PATTERNS OF MULTISPECTRAL REFLECTANCE, LEAF AREA INDEX, AND PLANT DEVELOPMENT IN DRYLAND COTTON

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Abstract

Remote sensed data is a potential source of information for site-specific crop management, providing both spatial and temporal information. Our objectives were to (1) derive vegetation indices using remotely sensed multispectral imagery and hyperspectral reflectance data as a means of assessing cotton canopy variation, (2) use crop simulation model GOSSYM to predict the potential yield and other crop growth variables and (3) use kriging techniques to assess the spatial structure of soil physical properties in dryland cotton. Multispectral imagery from 2000 was used to derive NDVI map of the previous crop (soybean) for establishing a number of site-specific crop mapping and soil sampling zones for characterizing soil variables that may influence yield variability. A biweekly plant mapping protocol was carried out including measurement of leaf area index, site-specific hyperspectral reflectance, and imagery data with 2-m spatial resolution using a multispectral three-band [green, red, and near-infrared reflectance] digital camera system. Imagery was imported into a digital image analysis software (ERDAS Imagine v. 8.5), and then georegistered. A 6×6 pixels (36×36 m) area of interest (AOI) was established on top of each field plot site and digital numbers (DN) were extracted from each band for derivation of NDVI map for each of four sampling dates. Lint yield from each plot was collected by hand, and a cotton picker equipped with differential global positioning system collected lint yield for the whole field. Our results showed that NDVI maps and NIR bands values derived from images and / or hyperspectral data acquired during peak bloom in mid July were closely correlated with plant height, leaf area index, and lint yield. A temporal pattern in the NDVI maps and the difference in NDVI between 17 and 5 July showed that an increase in the site-specific yield is associated with higher DN values or NDVI numbers. These results suggest that NDVI and NIR bands could be used to produce estimated field maps of plant height, leaf area index and yield, which offer a potentially attractive management tool for site specific farming especially in dryland cotton.