INVESTIGATION OF CROP VARIETIES AT DIFFERENT GROWTH STAGES USING OPTICAL SENSOR DATA

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ABSTRACT

Cotton, soybean and sorghum are economically important crops in Texas. Knowing the growing status of crops at different stages of growth is crucial to apply site-specific management and increase crop yield for farmers. Field experiments were initiated to measure cotton, soybean and sorghum plants growth status and spatial variability through the whole growing cycle. A ground-based active optical sensor was used to collect the Normalized Difference Vegetation Index (NDVI) data cross a crop field. The mean and variance values computed from NDVI data was used to characterize crop development at different stages.

Keywords. NDVI cotton, soybean, sorghum

INTRODUCTION

Successful information acquisition relies on the ability of sensors and instrumentation in detecting these crop canopy variables, which are indicative of crop growth (Goel et al. 2003). The Normalized Difference Vegetative Index (NDVI) is a commonly used measurement of crop health in agricultural applications. NDVI is calculated as: NDVI= (NIR reflected – Red reflected) / (NIR reflected +Red reflected), where Red and NIR stand for the spectral reflectance measurements acquired in the red and near-infrared regions, respectively. Healthier crop canopy will absorb more red and reflect more near infrared light, and consequently has a higher NDVI value.

OBJECTIVE

The objective of this study is to investigate the potential of using optical sensor NDVI value to characterize different crop varieties at various growth stages.

MATERIAL AND METHODS

Study site

The study site was located at the Texas A&M AgriLife Research Farm (30°31'19"N, 96°23'52"W) in Burleson County, Texas. Three agricultural crops, cotton, soybean, and grain sorghum were planted and managed in a 1.62-hectare during 2009 using conventional production practices for the area (Table 1). There were six rows of each crop with a row spacing of 1 m and rows oriented in the east-west direction.

Table 1. Crop varieties with respective planting dates in 2009, Texas A&M AgriLife Research Farm, Burleson Co., TX.

Crop	Variety	Planting date
Cotton	Deltapine DP174RF	April 16
Sorghum	DynaGro DG771B	April 15
Soybean	Asgrow O361380	March 24

Data collection

NDVI were collected at different growth stages. The distinctive growth stages are summarized in Table 2.

Table 2. Measurement dates and respective stages of plant development, 2009.

Crop	May 7	May 27	June 11	July 16
Cotton	Early vegetative (EV)	Early squaring	Squaring (SQ)	Bolls & Blooming (Boll/BM)
Soybean	Early vegetative (EV/V)	Pod developing (POD)	Pod 3/16 inch at one of four upper nodes (PF)	Seeding/full seed (SD)
Sorghum	Early vegetative (EV)	Vegetative (V)	Boot (head surrounded by flag leaf) (BT)	Black layer/mature (BL)

RESULTS

Figure 1 and 2 shows the changes of mean and variance of NDVI during the whole growing season. The mean NDVI of cotton increased from 0.215 at early vegetative stage to 0.793 at blooming stage, which was the maximum during the growing season. The mean NDVI of soybean reached the maximum at pod developing stage and then dropped off. The mean NDVI of sorghum reached the

maximum value between the vegetative and boot stages, then decreased. The mean NDVI of soybean and sorghum plants were very similar at their late stages. The variance of cotton NDVI was very large compared to the other two crops. The reason needs to be investigated in the future study.

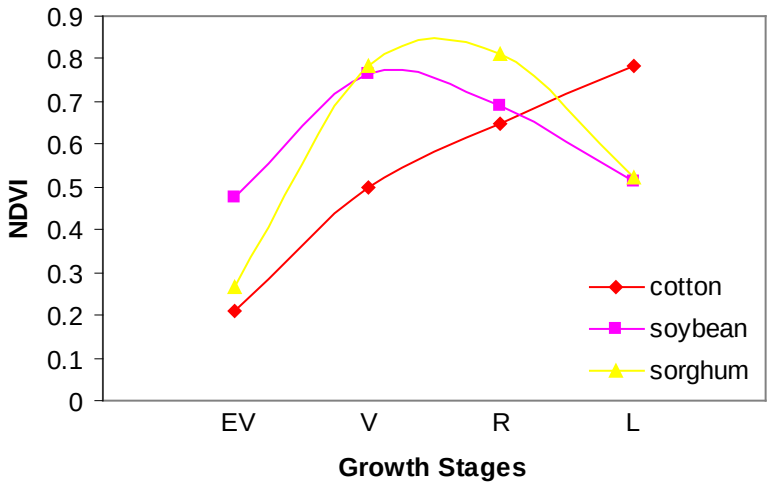

Figure 1. NDVI changes at different growth stages.

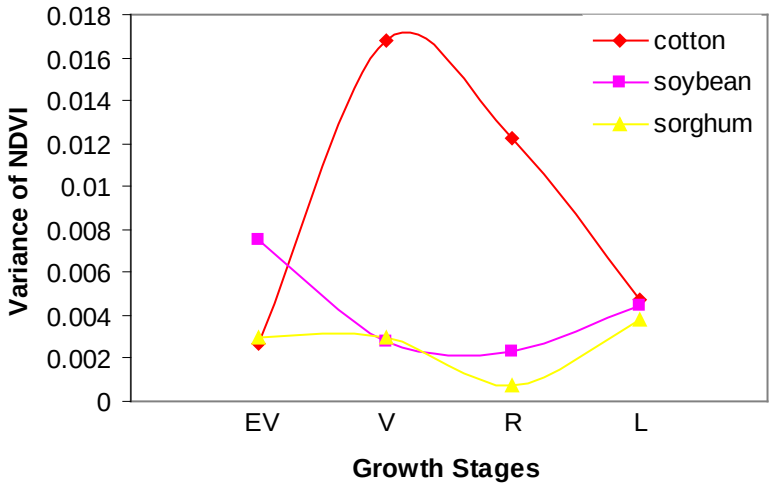

Figure 2. Variance of NDVI changes at different growth stages.