Project No: CPES-163-08/09

FINAL REPORT TO: Georgia Agricultural Commodity Commission for Peanuts

TITLE: USING VEGETATION INDICES TO DETERMINE PEANUT MATURITY

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OBJECTIVE: Using vegetation indices to determine peanut maturity

Digging too early or too late can greatly reduce both the quality and yield of a peanut crop. Harvesting mature peanuts is critical to financial success. The best tasting and best paying peanut is a mature one. Maturity affects flavor, grade, milling quality and shelf life. Mature peanuts have quality characteristics consumers want and are, therefore, worth more to the producer. Determining when to harvest peanuts is always a difficult decision for peanut producers because there are always maturity differences in any peanut field. Although the hull-scrape method allows us to objectively determine maturity, many samples are required to properly represent the maturity of the entire field. It is cumbersome and time consuming to collect samples from many locations in a field and to do that repeatedly. Consequently, most producers may not be harvesting their peanuts at the optimal time. Harvesting decisions could be greatly improved if maturity maps of the field were available. Our hypothesis was that vegetation indices can be used to create peanut maturity maps.

During the 2008 growing season, we received $5000 from the Peanut Commission to test our hypothesis. We monitored a 62 ac field planted to *Georgia-02C* peanuts which is a high-yielding, high-oleic, runner-type variety. We created two types of vegetation index maps (RVI and NDVI) of the field using the Crop Circle® sensor on 09 Sep, 30 Sep, 14 Oct, 23 Oct, and 10 Nov. In the past, we have shown that vegetation indices, or VIs, derived from remotely sensed data may be used to measure plant vigor, biomass, canopy stress and plant maturity. VIs are mathematical ratios of reflectance at specific wavelengths. Reflectance is a measure of the percentage of sunlight reflected by plants at those wavelengths. Reflectance is measured with sensors like the Crop Circle® . Figure 1 shows the response of two VIs, NDVI and RVI, during a grain sorghum growing season. Note the decline in RVI values as the crop approaches senescence.

The sequence of maps in Figure 2 show the response of RVI in our study field as the peanuts matured. All three maps use the same scale. As you can see, the maps show a steady decline in RVI over a period of 3 weeks and match the response predicted in Figure 1.

In our project we also collected 9 plants from 10 different locations in the field (see Figure 2) on each of

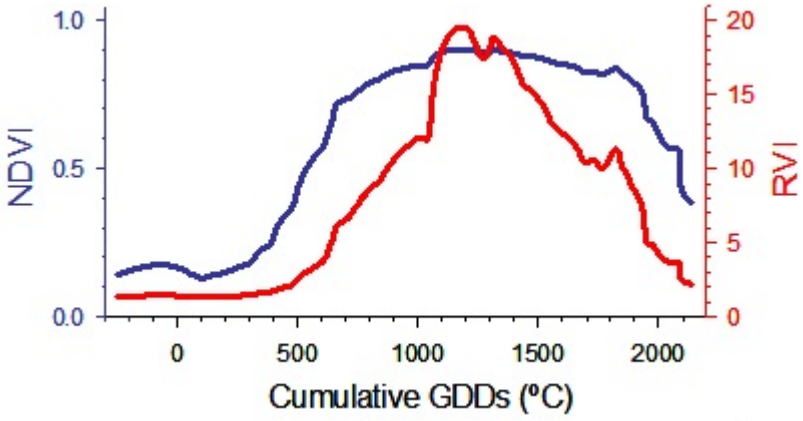

Figure 1. NDVI and RVI response of grain sorghum over the entire growing season. Zero growing degree days (GDDs) indicates planting and 2100 GDDs indicates harvest.

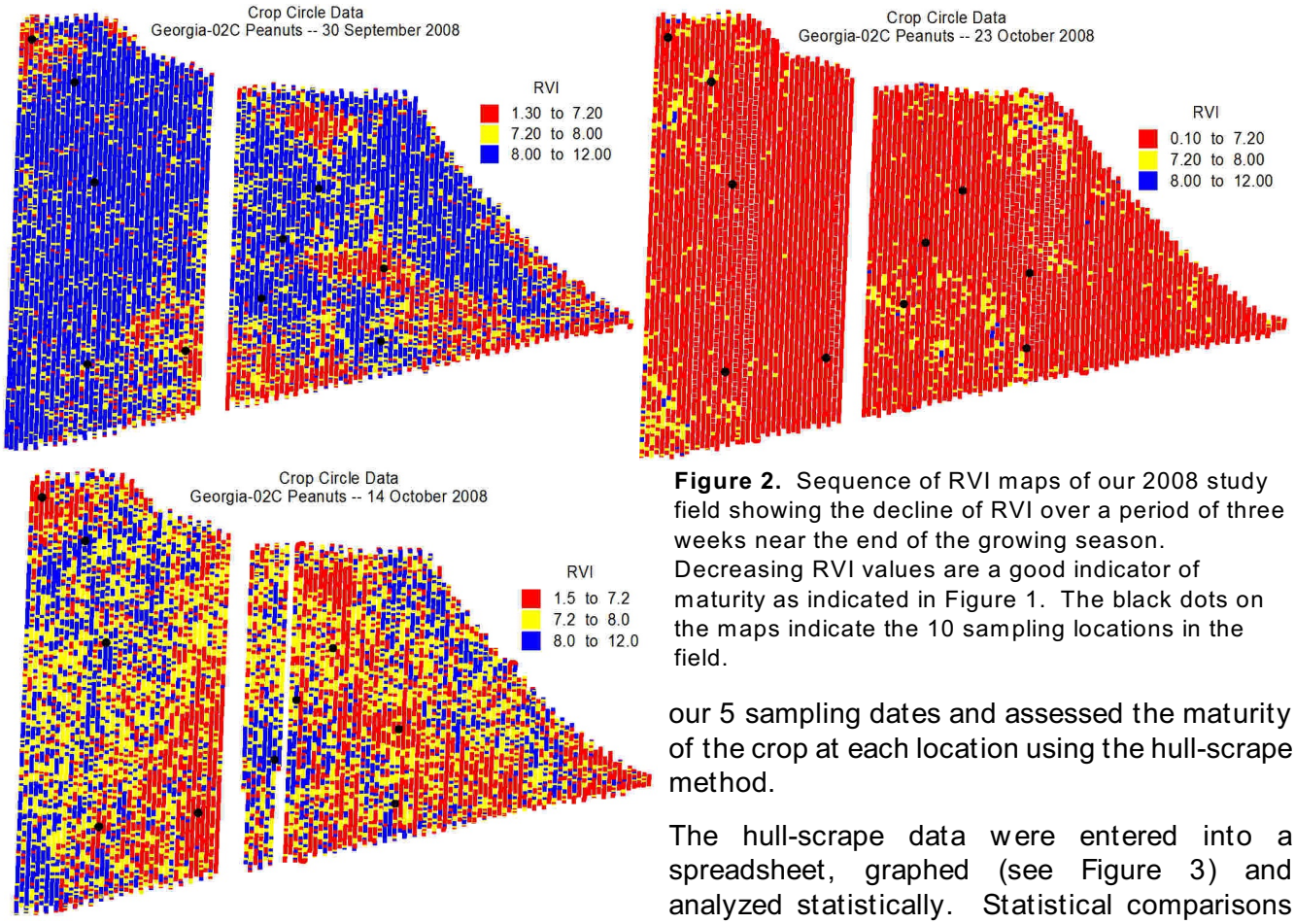

Figure 2. Sequence of RVI maps of our 2008 study field showing the decline of RVI over a period of three weeks near the end of the growing season. Decreasing RVI values are a good indicator of maturity as indicated in Figure 1. The black dots on the maps indicate the 10 sampling locations in the field.

our 5 sampling dates and assessed the maturity of the crop at each location using the hull-scrape method.

The hull-scrape data were entered into a spreadsheet, graphed (see Figure 3) and analyzed statistically. Statistical comparisons between the RVI and NDVI data and the hull-scrape data indicate a relationship between RVI and maturity on 30 September. However, the results from subsequent dates are complicated by the fact that the peanuts in this field set two (or more) crops of nuts as indicated in Figure 3. Because the field was infrequently irrigated during July and early August, this phenomenon was attributed to additional water availability following the rains brought by tropical storm Fay in August.

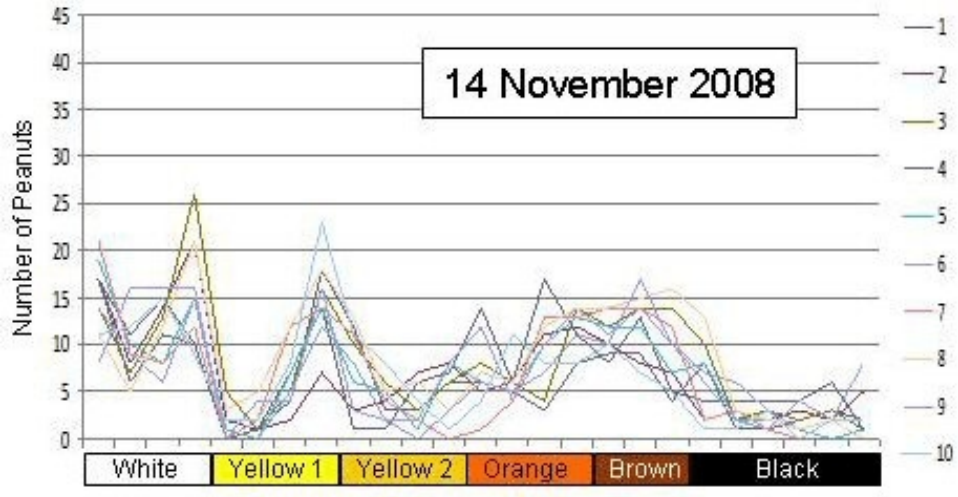

Figure 3. Maturity distribution at each one of the 10 sampling locations prior to harvest on 10 November 2008.

The two crops of nuts resulted in large numbers of immature peanuts on the vines even as late as November 10, our final sampling date. These immature nuts so late in the season confound the statistical analyses. Nevertheless, we feel comfortable in saying that RVI appears to be excellent predictor of maturity.