DIGITAL CAMERA ANALYSIS OF DEFOLIATION AND LIGHT INTERCEPTION

A. M. Stewart, K. L. Edmisten and R. Wells
Dept. of Crop Science, North Carolina State University
Raleigh, NC

Abstract

Measurements of defoliation in cotton are currently based on a visual rating. While this method appears to work well, it is a subjective measurement. Researchers could benefit from a more objective method of measuring cotton defoliation. Leaf area measurements in plant sciences are typically made by harvesting plant material and analyzing with a leaf area meter. While these measurements are reliable, they are also time consuming and destructive. The objectives of this study are to 1) examine alternative methods of measuring defoliation that are objective, and 2) evaluate a non destructive measure of leaf area using digital imaging and analysis techniques. Three different methods were used to take pictures measuring defoliation. The pictures were taken perpendicular into the center of two rows from 7 feet, hand held at eye level looking down four rows of a plot, and 1.5 feet off of the ground looking down the center two rows of a four row plot. A color separation was achieved using image processing software that selected for leaf colors, turning them black, while turning all other pixels in the picture white. Image processing software then counted the number of black pixels in a picture, reflecting the average leaf cover. Pictures for leaf area were taken with the camera mounted to shoot perpendicular to a row from a height of 7 feet. Five pictures per plot were taken and a color separation and analysis was achieved the same as with the defoliation pictures using Adobe Photoshop software. Actual leaf area determinations were made in the same plots. Results indicate that although numerical differences can be observed for a defoliation measurements, the variation in the sample is too great with all methods to achieve a mean separation. Less sample variation was observed in the leaf area determination plots, partially due to the fact of five pictures per plot being taken. Percent leaf cover with the digital imaging method predicted leaf area with an $r^2 = 0.856$. The relationship of the leaf cover to leaf area appears to resemble the relationship for light interception using a line quantum sensor to leaf area. Future investigations in this methodology need to refine the methods of sampling and color separation for defoliation measurements. Future work also needs to correlate the digital camera leaf cover method with light interception using a line quantum sensor.

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