REEVALUATION OF REPLANTING RECOMMENDATIONS FOR NC COTTON

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Abstract

When poor seedling emergence occurs, growers must decide if replanting is justified. Many factors influence these decisions including the costs of replanting, time left within the optimal planting window, prevailing temperatures and soil moisture, and the likelihood of improved success by replanting. Replanting is generally justified when 50% or more of the planted area is occupied by 3-foot skips between adjacent plants within a row (Jost, 2006). Previously, seed for replanting was provided by seed companies at no charge. Currently, most seed companies are charging 25% of suggested retail price per bag of replanting seed, increasing the total cost of replanting to approximately $35/A at a seeding rate of 43,560 sd/A. This, along with improvements in yield potential could influence the threshold at which replanting decisions are made. New advances in precision agriculture, such as the implementation of unmanned aerial vehicles (UAV) and their ability to generate high-resolution imagery are being used for a variety of applications (Ehsani, 2013). The objectives of this research were to utilize UAV imagery to accurately assess size and frequency of skips between cotton plants to facilitate replanting decisions, and to redefine thresholds for replanting cotton based on modern yield potential and replanting costs.

Research trials were conducted at three sites (Rocky Mount, Lewiston, and Plymouth NC) in eastern North Carolina during 2019. Each site included both an early and late planted trial, which were subjected to a randomized complete block design: four-row plots and four replications per site, each including various ratios or mixtures of DP 1646 and DP 493: 100%, 75%, 50%, 25%, and a 100% simulated replanting treatment, at 43,560 sd/A. Within the early planted trial at each location, planting of all treatments excluding the simulated replanting treatment were targeted at May 1st, with the simulated replanting treatment targeted for May 25th. Within the late planted trial at each location, planting of all treatments excluding the simulated replanting treatment were targeted at May 25th, with the simulated replanting treatment targeted for June 5th. Immediately following emergence, glyphosate (32 oz/A) and glufosinate (42 oz/A) were applied once in each of three consecutive weeks following emergence, to terminate all conventional seedlings, leaving natural, random skips that varied in size and frequency. The percent of planted area occupied by skips of various size and frequency were detected using a DJI Matrice 600 Pro drone and counted with Precision Hawk Ag Analytics. Using the data obtained through imagery, an algorithm was developed in R to measure distances between plants. Similarly, subsamples of 200 ft. of row were measured in each plot, for comparison. Data were subjected to ANOVA and regression analyses. Means were separated using Fishers Protected LSD at $p < 0.1$.

The replanted treatment in the early planted trial at Plymouth yielded significantly higher than the 25% stand treatment but was equal to all other treatments. At all other sites, the replanted yield was not statistically higher than the lowest yielding treatment with skippy stands. This is atypical for most years in NC, as later planted cotton often results in yields greater than or equal to that of early planted cotton, due to summer rainfall patterns and tropical weather during the early fall. Regression analysis was conducted comparing the percentage of planted area occupied by skips through manual measurement of a 200 ft. of row subsample versus UAV aerial imagery measurement of skips in the entire planted area. Although both methods are relatively equal in their ability to predict yield loss resulting from skips (similar R^2 values), the slopes of each regressions noticeably different which could likely influence the threshold at which replanting is justified. This suggests that precise manual measurements of a subsample area in fields may not effectively evaluate the entire planted area, therefore could result in inaccurate replanting decisions. Additionally, at prices of $0.70/lb of lint, and an average replanting cost of $35/A for replanting 43,560 sd/A, a yield loss of 50 lbs/A or greater economically necessitates replanting. Considering these economics, replanting was justified at Plymouth when 7% of the planted area was occupied by 3.5-ft. skips or greater, but was not justified at any other location, due to low yields of replanted treatments. The atypical lower replanted yields were likely the result of severe drought stress during mid summer and the absence of tropical weather in the fall that generally and adversely affects yields of

earlier planted cotton. Some data however suggested that for modern yields and replanting costs, and measurement of skips in the entire planted area using UAV imagery, replanting may be triggered at a lower threshold than has been previously used

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