EFFECT OF NITROGEN RATE AND PLANT POPULATION ON COTTON GROWTH, DEVELOPMENT, AND YIELD

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Abstract

Efficient nitrogen nutrition is critical for successful production of cotton. Nitrogen has been shown to have the greatest impact on lint yield, earliness, and lint quality when compared to other applied nutrients. Increased nitrogen rates have been shown to increase lint yield. However, increased nitrogen application rates have also been shown to delay crop maturity. Reduced nitrogen application rates have been shown to reduce the number of mainstem nodes, as well as the percentage of bolls located on upper nodes. Excessive nitrogen rates can result in rank growth, poor fruit retention, and an overall increase in vegetative growth. Seed premiums, technology fees associated with transgenic technology and the use of seed treatments have greatly increased at – planting costs. This has caused a renewed interest in reduced plant populations. The establishment of an acceptable population in cotton is critical to maximize yield and profitability. Higher plant populations tend to result in taller plants as well as a reduction in mainstem nodes. Lower populations have been shown to delay maturity. Numerous studies have been conducted on the effect of nitrogen rate and plant population as separate effects on cotton growth and yield. However, data is lacking on the interactive effects of nitrogen rate and plant population. Therefore, the objective of this study was to determine the effect of nitrogen application rate and plant population on cotton growth, development, and yield.

Experiments were conducted in 2012 at Starkville, MS on a leeper silty clay loam (irrigated), and Brooksville, MS on Brooksville silty clay (dryland). Deltapine 0912 B2RF was planted on May 17, 2012 in Starkville and May 18, 2012 in Brooksville. Nitrogen (32% UAN) was applied to six- to eight-leaf cotton at the following rates (kg/ha): 0, 44, 90, 134, and 179. Plant populations (plants/ha) included: 16,800; 33,600; 50,400; and 67,200. Cotton was seeded at rates in excess of the desired plant population and hand thinned to the desired population three to four weeks after planting. Experiments were conducted using a factorial arrangement of treatments within a randomized complete block design. Data was subjected to analysis of variance using the PROC MIXED procedure with each location analyzed separately. Means were separated using Fisher's Protected LSD at $\alpha = 0.05$.

Plant population $\geq$ 50,400 resulted in significantly shorter plants at first bloom at the Brooksville location. Conversely, a plant population of 16,800 resulted in significantly more nodes when compared to 50,400 and 67,200 plants/acre at first bloom at both locations. There were no significant differences with respect to nodes above white flower observed at the Starkville location. However, at Brooksville, plant populations $\geq$ 50,400 resulted in a significant reduction in nodes above white flower compared to a plant population of 16,800 plants/ha. As plant population increased, end of season plant height decreased regardless of nitrogen application rate at the Brooksville location. End of season plant height was similar at all plant populations within each nitrogen application rate at Starkville. Total nodes increased as nitrogen rate increased. As plant population increased, the number of total nodes decreased at the Brooksville location. Nodes above cracked boll increased as nitrogen rate increased at both locations. Nitrogen application rates of 90, 134, and 179 kilograms per hectare resulted in significantly more nodes above cracked boll when compared to other nitrogen application rates at the Starkville location. As nitrogen rate increased, seedcotton yield significantly increased at both locations. Seedcotton yield was maximized (>4600 kg/ha) following nitrogen application rates greater than 90 kg/ha at Starkville and nitrogen application rates greater than of 134 kg/ha and greater at Brooksville (>2700 kg/ha).