INFLUENCE OF IRRIGATION ON COTTON YIELD AND FRUIT PARTITIONING

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Introduction

Responses from 885 cotton growers in the 2011 Producer Priority Survey conducted by Cotton Incorporated indicated that water was the number one 'top-of-mind' concern producers had about cotton production. Comments ranged from needing more drought resistant varieties to how water effects yield stability from year to year. Additionally, cotton tolerance to heat and drought was ranked as the number four 'Key Issue' that should be addressed by research funding. Previous research by Main et al. (2012) indicates that cotton variety response to water is highly variable in humid, rain-fed growing areas. As variety offerings change on almost an annual basis with changes in technological traits, growers are often unsure of how a new variety may respond to irrigation. During vegetative growth, root growth out paces shoot growth leading to very little potential for water stress. However, high yield potential requires stress avoidance during pre-bloom construction of vegetative framework. Stress during the pre-bloom period is most detrimental due to a reduction in the number of fruiting sites and less photosynthetic surface to retain mature bolls (Hake and Grimes, 2010). In addition, moisture stress during peak bloom can reduce yield (Grimes et al., 1970). Research from Logenecker and Erie (1968) suggests that seed index (seed size) is more sensitive to moisture stress than staple and micronaire, although, micronaire can be reduced if drought stress occurs during secondary cell wall thickening (Hake and Grimes, 2010). Furthermore, droughty periods reduce fiber length and adequate water increases fiber length (Jordan, 1986). The objective of this research was to evaluate experimental and commercial cotton varieties for lint yield and fiber quality response to irrigation.

Materials and Methods

Sixteen commercial and twelve experimental cotton varieties were planted in a split-block design (blocked on irrigation) with four replications in 2011 and 2012, respectively. Plots were established at Marianna, Arkansas on a Commerce Silt Loam, at Starkville, Mississippi on a Marietta Fine Sandy Loam, at Jackson, Tennessee on a Collins Silt Loam, and at Florence, South Carolina on a Norfolk Loamy Sand. Variety subplots consisted of either two or four rows, and were 30 to 40 feet in length depending on experimental location. Irrigation main plots consisted of either dryland (no supplemental irrigation) or irrigated based on current University recommendations. Furrow-irrigation was used in Arkansas and Mississippi and watered based on a 2 inch deficit throughout the year (12 to 14 in/season in Arkansas; 8 to 10 in/season in Mississippi). Surface drip irrigation was used in Tennessee with one-inch of water applied each week during the bloom period (5 to 6 in/season). Overhead Lateral irrigation was used in South Carolina with one-inch of water applied every two weeks during the bloom period (3 to 4 in/season). All pest management and agronomic practices were uniform across the entire test and were in accordance with Extension recommendations. Data collection parameters consisted of plant stand, plant height, total node counts, NAWF counts, and an end-of-season plant map. Plots were harvested with spindle type cotton pickers modified for small plot research. A seed cotton grab sample was collected from each plot, air dried, weighted and ginned. A subsample of lint was collected for HVI fiber quality analysis and 100 fuzzy seed were counted and weighted for seed index determination. Prior to harvest, Box Mapping was performed in 2012 to determine yield distribution.

Summary

Location of the trial had a significant impact on the results of this study. As expected, irrigation increased plant height, number of nodes, height:node ratio and NAWF at all locations in both years. In both years, cotton variety

response to irrigation in Arkansas was highly significant, with irrigation increasing lint yield over 100%. However, a significant decline in lint yield occurred with irrigation in Mississippi in 2011 and no response to irrigation was found in Mississippi in 2012. Lint yields response to irrigation was fairly consistent in South Carolina, with increases of 14 and 12% in 2011 and 2012, respectively. Lint yield response to irrigation in Tennessee was variable, with only a 4% increase in 2011 and a 34% increase in 2012. Varieties responded differently to irrigation at some locations, but overall yield differences were hard to discern over years. End-of-season box mapping revealed irrigation increased boll development at more distal locations on the main stem and on sympodial branches at most locations. There were some minor gin turnout differences, however; most irrigation responses occurred with fiber quality parameters. Micronaire was significantly decreased and fiber strength increased in Arkansas and South Carolina in both years with irrigation. Fiber length (staple) and uniformity increased with irrigation at all locations and both years.