RESPONSES OF OKRA-LEAF COTTON TO COMPETITIVE POPULATIONS

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Abstract

Okra-leaf (OL) cotton (*Gossypium hirsutum* L.) offers cotton producers advantages that include pest resistance, increased pesticide penetration into the canopy, and early maturity. Although OL cotton comprises 50% of Australian cotton production, it is not commonly planted in the United States. Perhaps the greatest limitation to OL cotton involves the decreased productivity associated with the lower leaf area. The lower leaf area of OL cotton suggests that more plants per unit area are required to achieve the same leaf area index (LAI) as normal-leaf (NL) cotton. The higher populations achieved by planting in narrow rows may alleviate the yield problems of OL cotton by increasing the amount of leaf tissue per unit area available for light interception. Although higher populations are required in OL cotton to achieve the optimum LAI (LAI=5.0), excessively high populations, which exceed the optimum LAI, are negatively correlated with yield. An LAI above 5.0 results in shading of lower leaves and a subsequent shortage of available carbohydrates for the fruit. Thus, the ultimate challenge to OL cotton production involves determining the population necessary for efficient light interception to maximize yields.

A field experiment was conducted during the 1999 growing season at the Texas Agricultural Experiment Station near College Station, Texas to document differences in yield, growth, boll distribution, and biomass partitioning for OL cotton planted under various populations. FiberMax 819 was planted at 92,000, 173,000, and 352,000 plants A^{-1} in 30, 15, and 7.5" rows, respectively. Data collection consisted of five in-season mappings, yield, and an end-of-season box mapping. Five plants per plot were selected to document differences in growth, boll distribution, and boll size in all plant mappings. Biomass partitioning was calculated by dividing the fruit dry weight by the total dry weight on a per plant basis. LAI was calculated by multiplying the leaf area per plant estimated by a LiCor 3000 Area Meter by the plant population. A 13 x 21-ft^2 area was machine-harvested, and a subsample of the harvested cotton was analyzed for fiber quality by the International Textile Center in Lubbock, Texas.

Increasing the population of OL cotton tended to reduce lint yields. The reduction in yield paralleled a decrease in the total number of bolls per plant in the high population treatment. On the other hand, OL cotton planted at the low population possessed a significantly greater number of bolls at the first and second fruiting positions. In addition, OL cotton at the low population also possessed a greater percentage of fruit on the lower branches. To the contrary, OL cotton planted at the higher population exhibited a greater percentage of fruit higher in the canopy. OL cotton planted in the low population also allocated a significantly greater amount of carbon into the fruit than did OL cotton planted at the high population.

Boll counts on an area basis were highest for the high population treatment, which should have translated into higher yields for the high population treatment. Barren plants were not mapped, and the high population treatment contained a substantial number of barren plants. Thus, boll numbers per unit area for the high population treatment were not indicative of the plots and do not describe the yield reduction observed in the high population.

The differences in lint yield and boll distribution paralleled the differences in LAI among the three populations. OL cotton planted at the high population exhibited LAIs above the optimum. The yield reduction detected in the high population treatment is probably attributed to the shading of the lower leaves. Under conditions of shading, the lower leaves may have reduced carbohydrate supplies in the lower portion of the canopy, which could have reduced the amount of fruit produced on the lower branches.

Thus, the key to OL cotton production involves determining the population required to maximize light interception. One strategy to overcome the decreased yields due to reduced leaf area would be to plant OL cotton in narrower rows and under higher populations than NL cotton. However, caution must be exercised when planting OL cotton in narrow rows to avoid the yield reductions associated with excessive plant populations.

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