GROWTH AND BIOMASS PARTITIONING IN OBSOLETE AND MODERN PIMA COTTON CULTIVARS

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Abstract

Yield potentials of extra-long staple Pima cotton (*Gossypium barbadense* L.) have increased in the past 50 years due, in part, to breeding and selection efforts for high lint production and heat tolerance. However, little is known about changes in vegetative, reproductive, and growth characteristics that have occurred concurrent with yield increases. The objective of this study was to characterize changes in vegetative, reproductive, and growth characteristics in a successive series of Pima cultivars. Pima 32, PS-3, PS-4, and PS-7 (released in 1948, 1966, 1966, and 1991, respectively) were grown in replicated tests at Maricopa, AZ (low desert, 358 m elev.) and Safford, AZ (884 m elev.) in 1996 and 1997. Biomass partitioning and plant mapping were performed three times during the growing season and at cutout. Plants were mapped and partitioned from 0.6 m of row on the first two sampling dates, and from 0.3 m of row on the last two dates. Leaf, stem and petiole, square, immature boll, and mature boll weights were determined, as well as square, immature boll, and mature boll numbers. Plant height, first fruiting branch, mainstem node number, and fruit retention were obtained from mapping. Newly opened blooms were counted in a single row of the six row plots on a weekly basis. Cultivars differed in bloom numbers at peak bloom at both locations in both years. PS-4 produced the highest bloom count, followed by PS-7, PS-3, and Pima 32, respectively. At cutout, cultivars differed for vegetative biomass and its components across locations and years, but not for reproductive biomass or its components. There was a trend toward lower leaf and stem weights in the four successive cultivars of the Pima series, accompanied by increases in the reproductive to vegetative ratio. Plant heights, first fruiting branch, and mainstem nodes also were observed to have decreased from the obsolete Pima 32 cultivar to PS-7. Although reproductive biomass did not vary between cultivars when measured across locations and years, significant cultivar x location and cultivar x location x year interactions occurred for mature boll weight, mature boll number, and fruit retention rates. PS-7 produced a higher number of mature bolls and had a heavier mature boll weight than did the obsolete Pima 32 cultivar at Maricopa in1996 (460 g/m^2 vs. 239 g/m^2) and 1997 (449 g/m^2 vs. 230 g/m^2). PS-7 also produced a higher number of mature bolls with a heavier weight than did PS-3 at Maricopa in 1996 (460 g/m^2 vs. 182 g/m^2), but not in 1997. PS-7 had a higher fruit retention rate than PS-3 in 1996 (42% vs. 28%) or Pima 32 in 1997 (52% vs. 36%). In the absence of heat stress conditions at Safford in either year, no cultivar differences for mature boll weight or number, or for fruit retention were observed. In conclusion, significant reductions in vegetative and growth parameters have accompanied increases in yield potential of Pima cultivars. Interactions of cultivars with locations or years for reproductive parameters support the hypothesis that increased heat tolerance has had a major role in realized yield gains in Pima cotton.

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