GROWTH ENVIRONMENT AND GENETICS IN COTTON FIBER QUALITY

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Abstract

When four Upland cotton genotypes, Deltapine 20, 50, 90, and 5690, were grown in two years of a South Carolina planting date study, the 'offsets' in heat unit accumulation resulting from the staggered planting dates allowed analysis of the modulation of fiber-quality genetic potential by the growth environment. The first year of the study was the hotter, drier, shorter season. Genotype was the most important determinant of fiber length and diameter, but interactions between genotype and environment were detected in fiber length and short fiber content. Both genotype and environment contributed significantly to fiber maturity properties and interacted to determine fiber circularity, immature fiber content, micronAFIS, and perimeter. Cross-sectional area was not affected by the genotype-environment interaction. Genotypic differences were found in rate of wall-thickening and micronaire increase, and the genotypes responded differently to increasing heat unit accumulation in the two study years. Environment alone was significant in determining fiber color and dye-uptake success. Subsequent studies suggest environmental factors other than temperature modulate intrinsic fiber quality. Elevated ozone levels increase fiber length while decreasing fiber diameter. Weather and edaphic spatial variability alter the ranges and averages of fiber 'shape' properties and fiber maturity and strength as well. Strategies for improving cotton fiber quality clearly must incorporate the effects of growth environment on the genetic traits being introduced if intrinsic fiber quality is to be improved rationally.

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