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COMBINING ABILITY FOR NEAR EXTRA LONG FIBERS IN UPLAND COTTON

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Abstract

Cotton breeders must be concerned with fiber quality as well as yield if American cotton is to maintain a strong, competitive edge in today's world market. Fiber quality is important to the textile industry because it directly relates to processing performance, productivity, and yarn quality. Improvement in fiber length is important to the textile industry in utilizing high-speed yarn spinning technology and in expanding the array of yarn products. The objective of this study was to investigate general combining ability (GCA) and specific combining ability (SCA) for enhanced fiber length. Genotypes chosen on the basis of their HVI upper-half mean (UHM) length of fibers and genotypic origins were TAM 94L-25, TTU 202, TTU 271, Acala 1517-99, FiberMax 832, and Tamcot CAMD-E. Potential parental plants were screened for UHM length prior to the initiation of crossing. For TAM 94L-25, TTU 202, TTU 271, FiberMax 832, and Acala 1517-99, plants having an UHM fiber length 1.5 mm shorter than that of the parent plant with the longest UHM within each genotype were discarded. Tamcot CAMD-E plants having an UHM fiber length greater than 1.5 mm than that of the shortest plant were discarded. Fiber evaluation of selfed progeny of each parent plant confirmed homozygosity. Parent plants from the six upland cultivars were hybridized in a half diallel. Parents and F_1s were grown at the Texas A&M University Research Farm located near College Station in a randomized complete block design using a split plot arrangement of treatments with families as main plots and generations as sub plots. Each family consisted of an F_1 and both parents. Five plants of each generation per family were individually harvested and ginned on a laboratory saw gin. Fiber quality parameters were determined by HVI at the Texas Tech University International Textile Center. Model I, Method IV of Griffing (1956), with genotypes treated as fixed effects, was used for combining ability analysis of F_1 data. Diallel Analysis and Simulation Software by Burow and Coors (1993) was used in this study. The model in this software assumes that epistasis and genotype x environment interaction are not significant. Analysis of variance indicated significance for parents, F_1s, GCA, and SCA. FiberMax 832 and TAM 94L-25 had the longest fibers at 31.0 mm and 30.8 mm, respectfully. Next was Acala 1517-99 with an UHM fiber length of 29.8 mm, followed by TTU 202 and 271. Tamcot CAMD-E had the shortest UHM fiber length of 26.5 mm. The F_1 of FiberMax 832 / TAM 94L-25 had the longest UHM fiber length among all F_1s and parents at 31.7 mm. Acala 1517-99 and TTU 202 combined well with TAM 94L-25 or FiberMax 832 to produce enhanced fiber length, while TTU 271 and Tamcot CAMD-E combined only with TAM 94L-25 for extra fiber length. Highly significant GCA effects were detected for UHM signifying important additive gene action for fiber length among these six cultivars. With a standard error of 0.10 between any two genotypes, TAM 94L-25 had the largest positive effect on GCA with an estimate of 0.86. FiberMax 832 followed with GCA estimates of 0.57. Acala 1517-99 with a GCA estimate 0.13 was significantly less than 832 but not different from 202. GCA effects of TTU 271 and Tamcot CAMD-E were significantly different from each other with negative estimates of – 0.2 and – 1.37, respectfully. For specific combining ability, TAM94L-25/Tamcot CAMD-E numerically had the highest effect of 0.37 mm followed by Acala 1517-99/Tamcot CAMD-E with an estimate of 0.21 mm. TAM94L-25/Acala 1517-99 numerically had the lowest specific combining estimate of – 0.43 mm followed by FiberMax 832/Tamcot CAMD-E with an estimate of – 0.28 mm. While these data specifically apply only to the six genotypes evaluated, they suggest that TAM 94L-25 would be the most useful parent in breeding for improved UHM fiber length followed by FiberMax 832.

References

Burow, M.D., and J.G. Coors. 1993. Diallel analysis and simulation. User's guide. Dep. of Agron., Univ. of Wisconsin, Madison.

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