COMBINING ABILITY FOR NEAR EXTRA LONG FIBERS IN UPLAND COTTON, 2001 - 2002 Chris Braden, C. W. Smith, and Peggy Thaxton Texas A&M University College Station, TX Eric Hequet International Textile Center Lubbock, TX

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 relates directly 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 objectives of this study were: 1. to investigate general combining ability (GCA) and specific combining ability (SCA) for fiber length in four genotypes having long upper-half mean (UHM) lengths and one genotype exhibiting short UHM length and 2. to evaluate the potential of TAM 94L-25 as a parental source for superior fiber length.

Genotypes chosen on the basis of their HVI UHM length of fibers and programmatic origins were TAM 94L-25, TTU 202, Acala 1517-99, FiberMax 832, and Tamcot CAMD-E. Potential parental plants were screened for UHM length prior to the initiation of the crossing scheme. Fiber evaluation of selfed progeny of each parent plant confirmed homozygosity except for TTU 202. To ensure long fiber phenotypes, TAM 94L-25, TTU 202, 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 in each genotype were discarded. To ensure that all Tamcot CAMD-E plants were short fiber phenotypes, plants having an UHM fiber length greater than 1.5 mm than that of the shortest plant were discarded. Parent plants from the five upland genotypes were hybridized in a half diallel. Parents and F,s 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, and both parents. Five plants of each generation per family were harvested individually and ginned on a laboratory saw gin. Fiber quality parameters were determined by HVI at the Texas Tech University International Textile Center. Analysis of variance for combining ability was conducted for UHM fiber length using individual plot data for each year separately and then combined across years. Years were considered random and genotypes considered fixed effects in the ANOVA. Estimates of combining ability among crosses, and general and specific effects for each parent and their crosses were calculated. Model I, Method IV of Griffing (1956) was used for combining ability analysis of F, data. Only main effects and partitions of the main effects were tested against their respective interaction with environment while the interaction with environment terms were tested against the pooled error term.

Analysis of variance indicated significance for years, genotypes, parents, F_1 s, GCA, genotypes*year, parents*year, and parents vs. F_1 *year. FiberMax 832 had the longest fibers at 31.0 mm in 2001 and 32.3 mm in 2002, respectfully followed by TAM 94L-25 with an UHM fiber length of 30.7 mm in 2001 and 31.7 mm in 2002. Tamcot CAMD-E had the shortest UHM fiber length of 26.5 mm in 2001 and 27.3 mm in 2002. The F_1 of FiberMax 832 / TAM 94L-25 had the longest (p=0.05) UHM fiber length among all F_1 s and parents at 32.2 mm. Acala 1517-99 and TTU 202 combined well with TAM 94L-25 or FiberMax 832 to produce enhanced fiber length, while TTU 202 and Tamcot CAMD-E combined only with TAM 94L-25 for extra fiber length. Highly significant GCA effects were detected for UHM suggesting important additive gene action for fiber length among these five cultivars. With a standard error of 0.29 between any two genotypes and a critical difference of 0.80 at the 5% level, TAM 94L-25 and FiberMax 832 had the largest positive effect on GCA with estimates of 0.92 and 0.56, respectfully. Tamcot CAMD-E had a negative effect on GCA with an estimate of -1.44. The preponderance of GCA effects implies that progeny performance relative to UHM fiber length can be predicted from GCA alone. While these data specifically apply only to the five genotypes evaluated, they suggest that TAM 94L-25 and FiberMax 832 would be useful parents in breeding for improved UHM fiber length.

References

Griffing, B. 1956. Concept of general and specific combining ability in relation to diallel crossing systems. Aust. J. Biol. Sci. 9:463-493.