THE ASSOCIATION OF FIBER QUALITY PARAMETERS AND LINT YIELD COMPONENTS IN F_3 DERIVED F_4 PROGENY OF TWO UPLAND COTTON POPULATIONS

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Abstract

New cotton, *Gossypium hirsutum* L., cultivars must be developed to meet the demands of new spinning technology as well as the cotton producers. In the last 50 years, dramatic changes have been made in the speed of processing fibers in the textile industry. Ring spinning has been used in the textile industry to spin cotton fibers into yarns since the 1800's. New spinning technology (rotor spinning) that evolved in the 1960's required higher quality cotton, with higher fiber strength. Known as rotor spinning, this machinery produced yarn that was 10-40 % weaker than yarn produced from equivalent fibers spun on a ring spinning frame. Spinners began to demand that producers provide them with stronger fibers to offset this inherent weakness in rotor spun yarn. In addition to this pressure to improve fiber quality of cultivars produced in the U.S., spinning and weaving mills saw advancements in the speeds of machinery that also required better fiber quality, especially strength. These events, plus newer spinning and weaving technology that will soon become commercially available, mandate that plant breeders and geneticists develop cultivars of upland cotton having improved fiber quality parameters without sacrificing yield potential. However, efforts to improve both fiber quality parameters and lint yield components has been limited due to the negative correlation between lint yield components and fiber quality parameters. To meet the continued demands of the textile industry, cotton breeders redirected their objectives toward producing stronger and more uniform fibers. Information about the relationship between fiber quality parameters and lint yield components within the boll has a great importance for cotton breeders dealing with simultaneous improvement of fiber quality and lint yield per unit land area. The purpose of this study was to determine the association of fiber quality parameters and lint yield components within two diverse populations of $F_{3:4}$ lines. Fiber quality parameters, determined by high volume instrument, were: micronaire, upper half mean fiber length (UHM), uniformity index (UI), fiber strength, and elongation. Within-boll yield components, determined by direct measurements or through calculations included: seed surface area (SA/S), lint percentage (LP), seeds per boll (S/B), lint weight per seed (L/S), fibers per seed (F/S), lint weight per unit seed surface area (L/SA), and fibers per unit seed surface area (F/SA). In population 1: micronaire was positively correlated with fiber uniformity index, strength, LP, S/B, L/S, and L/SA, and negatively associated with length, F/S and F/SA. Fiber length was positively associated with fiber uniformity index, strength, SA/S, L/S, and negatively associated with LP, F/S, L/SA, and F/SA. Fiber uniformity index was positively correlated with strength, SA/S, L/S. Fiber strength was positively associated with SA/S, S/B, L/S, and L/SA, and negatively associated with F/S and F/SA. In population 2: micronaire was positively associated with fiber uniformity index, LP, S/B, and L/SA, and negatively correlated with F/S and F/SA. Fiber length was positively correlated with strength, SA/S, and L/S, and negatively correlated with LP, S/B, and F/SA. Fiber uniformity index was positively associated with strength, and S/B, and negatively correlated with F/S and F/SA. Strength was positively associated with SA/S, S/B, and L/S, and negatively correlated with LP, F/S, and F/SA. These results indicated that fiber strength was negatively correlated with F/SA, which is the most basic within-boll lint yield component, for both populations. However, in population 1, insignificant correlations of fiber strength with LP and positive associations of strength and lint weight components suggest that cotton breeders could select for increased fiber strength and higher within-boll lint yield simultaneously. However, this positive conclusion in tempered by the fact that in this population, i.e., population 1, fiber strength was negatively associated with F/S and F/SA just as in population 2. This association of strength and lint weight components may suggest that the negative correlation between fiber quality parameters and lint yield components could be broken by hybridization of high and low strength parents. No $F_{3:4}$ line in either of the two populations studied were identified as having broken the negative associations of F/SA and fiber strength without sacrificing levels other desirable yield components such as S/B.

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