TESTING COTTON SEED COAT QUALITY

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Abstract

Cotton (Gossypium spp.) seed coat quality was tested using an Instron Instrument in a double shear test. Five cotton genotypes were examined with five seed parameters significantly different among genotypes. These parameters were energy to breakpoint, displacement, load, weight, and minimum diameter. Step wise regressions failed to identify seed parameters that contribute to seed coat quality. Physical seed parameters examined were longest length and largest diameter, shortest length and minimum diameter, longitudinal cross-section, and mass. Eleven percent of the variability could be accounted by mass and length when load was the dependent variable; no other parameters contributed significantly to load. Brittle seed coat requires a shorter displacement before breaking and less force to break the seed coat. In a ginning experiment a correlation was found between number of seed coat fragments and seed shear strength.

Introduction

Cotton seed coat fragments are an obvious problem in the textile industry. Cotton genotypes that have a potential for large numbers of seed coat fragments are undesirable. In addition, cotton genotypes with brittle seed coats are undesirable from the growers' standpoint due to poor emergence and seed deterioration. In attempting to increase lint yield, cotton breeders have noticed that genotypes with high lint percent generally have deleterious seed coat quality characterized by small seed with brittle seed coats. This study was initiated primarily to determine whether three high percent germplasm lines also had a seed coat problem. From this initial study a comparison of seed coat quality with ginning quality with seed coat fragment measures was conducted by C. F. Abrams, N. C. State University and G. J. Mangilardi, Jr., U. S. Cotton Ginning Laboratory, Stoneville, MS. (Abrams et al. 1994).

Materials and Methods

Three cotton genotypes with high lint percent and unknown seed coat quality, along with Deltapine 50 which have average lint percent and excellent seed coat quality and Deltapine 41 which has high lint percent and brittle seed coats were examined in this study. Seeds were measured for the physical traits length, maximum diameter, minimum diameter and weight. An Instron instrument was used to crush the individual seed and measure displacement (distance seed were compressed), load (peak force at break point), energy to break point, and shear (peak force to nominal area ratio). Details for the shearing-testing apparatus procedures are described by Abrams et al. (1993). Additional details are found in the 1994 paper by Abrams et al. In the ginning study six genotypes were selected from plantings grown at the Delta Research and Extension Center, Mississippi Agriculture and Forestry Experiment Station, Stoneville, MS in 1993. Seedcotton were standardized for relative humidity and ginned. Seeds were taken from the lots from each replicate where they were then acid-delinted, dried, and kept in laboratory storage until testing. Seed coat fragment measures were taken before lint cleaning.

Reprinted from the *Proceedings of the Beltwide Cotton Conference*
Volume 1:623-624 (1996)
National Cotton Council, Memphis TN

Results and Discussion

In the first study significant genotypic differences were detected in energy to break point, displacement, load, weight, and minimum diameter. Corre-lations between the various measurements were either low or nonsignificant. Step wise regressions did not reveal any physical seed trait measurements that would contribute to seed coat quality as measured by the Instron instrument. Deltapine 41 which has a brittle seed coat has a shorter displacement before breaking and required less force or shear to break the seed coat compared with Deltapine 50 which does not have a brittle seed coat. In the ginning study, the genotype with the lowest seed coat shear strength also had the highest seed coat fragments while the genotypes with the higher seed coat strength had lower seed coat fragments in the ginned lint.

Given the importance of seed coat quality and genotypic differences for seed coat strength, testing for this trait should be routine in a cotton breeder's program. However, the testing of seed coat strength using an Instron instrument is very slow and expensive. All breeders cannot afford an Instron. A simple hand-held device is desirable so that many lines could be screened for seed coat strength in a relatively short period of time. During these studies as few as four seed were tested at varying deformation rates with no change in values, indicating the need for limited number of seed per line to be tested and the inconsequential affect of different people using a hand-held device to measure seed coat strength since individuals would use the instrument differently. The next challenge is for the engineers to devise a relatively cheap hand-held device to measure seed coat strength. It must be noted that all seed for these studies were equilibrated for moisture a minimum of 48 hours before testing since it is suspected that varying moisture levels would influence displacement before breaking and possible shear force.

References

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