

RESEARCH REPORT

Title: Breeding Cotton for Yield and Quality in Alabama

Project Number: 02-172-AL

Principle Investigator: David B. Weaver

There are four major aspects to this project: Development of cotton germplasm or cultivars with improved yield and fiber properties; evaluation and development of cotton germplasm for resistance to reniform nematode; evaluation and development of cotton germplasm for resistance to abiotic stresses, particularly heat and drought, and evaluation of the effect of exotic germplasm introgression on cotton yield and fiber properties. For the first objective, experimental breeding lines from several different cotton populations were developed using bulk and pedigree methods. In 2008, we evaluated 80 experimental lines for yield and fiber properties at two locations, Tallassee and Prattville. Plots were two rows, 6.1 m in length, with a spacing of 1 m between rows, replicated 3 times. Data were collected by sampling 50 bolls from each plot for determining lint percentage, boll size, lint weight per seed, and fiber quality. Fiber quality was analyzed by HVI at Cotton, Inc., Cary, NC. The entire plot area was spindle-harvested to determine seed and lint yield. Good data were collected at both locations, and yield and fiber data analysis is in progress. Complete yield and fiber quality data are now available from the 2007 Regional Breeders Testing Network at 10 locations across the cotton belt. Auburn experimental lines ranked 4th, 5th, and 14th in the 32-entry test (29 experimental lines plus 3 checks). We have cooperated in this test for the past seven growing seasons. Five advanced lines were evaluated in the Regional Breeders Testing Network at 12 locations across the cotton belt in 2008. Data collection for is still in progress. Further work is being done to develop new populations for generating experimental cotton lines for future testing. New crosses were made in the field in 2008, and F₂ and F₃ generations from crosses made in previous years were grown. Single plants were harvested from F₃ populations and will be used to generate lines for testing in future years.

We have made significant progress developing advanced populations from crosses between four adapted lines (FM966, SG747, PM1218, and Delta Pearl) and two germplasm lines (TX245 and TX1419) identified as having a moderate level of resistance to reniform nematode. Three types of populations have been developed: Adapted × resistant accession (F_{2:4} lines); (adapted × resistant accession) × adapted (BC_{1:3} lines); and (adapted × resistant accession) × resistant accession (BC_{1:3} lines). We grew a total of 1200 lines representing 25, 50 and 75% adapted germplasm, and increased these in the field in 2008. We have begun the evaluation for these lines for nematode resistance in greenhouse tests and evaluation will continue into 2009. Because of extreme variation we have altered our evaluation procedures to include 10 plants per line, so we are able to evaluate about 20 lines every two weeks. It will take some time to evaluate all these materials. Evaluation and incorporation of genes for resistance into adapted types will be a long-term process.

We are continuing along the same path in development of similar type populations using genotypes identified as heat tolerant. We have identified seven accessions as having significantly greater vegetative heat tolerance than Deltapine 90, and have demonstrated a relationship between chlorophyll fluorescence following heat stress and vegetative heat tolerance

among these selected accessions. Development of these populations is progressing more slowly, due to the difficulty of crossing with these materials. These lines are photoperiodic, with long juvenile periods and can take over a year between planting and flowering. We were able to make crosses in the greenhouse in spring of 2007, and grew the F₁ plants during summer and early winter of 2008. We have begun to harvest F₂ seeds from these plants from at least 3 of the populations, and more have produced bolls that will be harvestable in late winter and spring of 2009. These F₂ populations, along with the parental lines, will be used to determine heritability of the chlorophyll fluorescence trait, and further establish the relationship between chlorophyll fluorescence and vegetative heat tolerance. During the upcoming year, we will continue to work with these lines to determine the level of expression of this trait and hope to identify genes that are responsible.

For our fourth aspect, using materials described above in the reniform nematode work, we have developed a series of 120 advanced lines [8 populations, each with 15 lines (5 lines each at 25, 50 and 75% adapted germplasm)] to study the effect of exotic (unadapted) germplasm on yield and fiber quality of upland cotton. Lack of genetic progress in cotton has been at least partially ascribed to a very narrow genetic base, and the purpose of this research is to assess the impact that exotic germplasm has on cotton yield and fiber properties, and determine if genetic variation can be improved by introgression of exotic lines. We plan to evaluate these materials in the field at two locations in 2009.