UNIVERSITY OF ARKANSAS COTTON BREEDING PROGRAM - 2002 PROGRESS REPORT

Fred M. Bourland

RESEARCH PROBLEM

The University of Arkansas Cotton Breeding Program attempts to develop cotton genotypes that are improved with respect to yield, host plant resistance, fiber quality, and adaptation to Arkansas environments. Such genotypes would be expected to provide higher, more consistent yields with fewer inputs. To maintain a strong breeding program, continued research is needed to develop techniques which will identify genotypes with favorable genes, combine those genes into adapted lines, then select and test derived lines.

BACKGROUND INFORMATION

Cotton breeding programs have existed at the University of Arkansas since the 1920s (Bourland and Waddle, 1988). Throughout this time, the primary emphases of the programs have been to identify and develop lines which are highly adapted to Arkansas environments and possess good host plant resistance traits. Bourland (2002) provided the most recent update of the current program.

RESEARCH DESCRIPTION

Each year, breeding lines and strains are tested in the University of Arkansas Cotton Breeding Program. The breeding lines are developed and evaluated in non-replicated tests, which include initial crossing of parents, individual plant selections from segregating populations, and evaluation of the progeny grown from seed of the individual plants. Once the segregating populations are established, each sequential test provides screening of genotypes to identify ones with specific host plant resistance and agronomic performance capabilities. Selected progeny are carried forward.

1 Director and plant breeder, University of Arkansas, Northeast Research and Extension Center, Keiser.
and evaluated in replicated strain tests at multiple Arkansas locations to determine their yield, quality, host plant resistance, and adaptative properties. Superior strains are subsequently evaluated over multiple years and in regional tests. Improved strains are used as parents in the breeding program and/or released as germplasm or cultivars.

RESULTS AND DISCUSSION

Breeding Lines

The primary focus of the 2002 breeding line crosses was to enhance yield components and improve resistance to root knot nematode. The F₁ seed are being advanced to F₂ generation in a winter nursery. In 2002, all F₂ populations (from crosses made in 2001) were hot water (65°C) treated to provide selection for resistance to seed deterioration. Unfortunately, bacterial blight inoculation was not successful in 2002. Instead of individual plant selection, mass selection was conducted within each population. Individual plant selections will be made from subsequent F₃ populations in 2003. In addition, population advances of 30 populations, which have at least one root knot-resistant parent, were made by harvesting one boll from each plant then bulking by population. These advanced populations will be screened for field resistance to root knot nematode in 2003.

Based on harvested yields at Clarkedale and Keiser, Verticillium wilt incidence, and morphological traits, 195 of 584 first-cycle progeny rows were selected in 2002. In 2003, individual plant selections will be made from the best (based on yields at Rohwer and Keiser) of these progeny. Also in 2002, 805 plants were selected from 89 advanced progeny. These will be tested as second-cycle progeny rows in 2002. From 970 second-cycle progeny in 2002, 72 were selected and will be evaluated in replicated preliminary strain tests in 2003. An additional 162, will be evaluated for yield at Keiser and Rohwer in 2003 before being advanced to strains.

Strain Evaluation

In 2002, 98 strains were evaluated in replicated strain tests at multiple locations. Within each test, strains were compared to standard cultivars (PSC 355 and SG 105). Based on their performance, 36 of the strains were selected and entered into 2003 strain tests. The superior strains exhibited a wide range of lint percentages, leaf pubescence, maturity, and fiber quality. Also, six advanced strains were evaluated in the 2002 Arkansas Cotton Variety Test (Bourland et al., 2003).

Selection Criteria

In 2002, work continued to establish selection criteria in four specific areas: Root-knot nematode resistance, thrips resistance, yield components, and bract trichomes.
**Root-Knot Nematode (RKN) Resistance**

Greenhouse evaluation of resistance to root-knot nematode was not successful. Apparently, we were unable to maintain the greenhouse warm enough when unseasonable cool temperatures occurred in May. No root symptoms were found on known susceptible lines. Populations having root-knot resistant parentage were planted at Keiser and advanced to the next generation. Mass selection was not conducted to ensure that root-knot resistant plants were preserved in the population. Previous work has indicated that root-knot resistance can be lost if selection is done for superior agronomic appearance in the absence of the pest. These populations will be screened in a root-knot nematode infested field in 2003.

**Thrips Resistance**

New and advanced strains were evaluated for yield in adjacent plots having thrips control (in-furrow insecticide) and no thrips control in 2002. Thrips infestations were relatively high, and infested plots yielded ca. 65% as much as control plots. However, the strain by treatment interaction was not significant in either test. Therefore, no difference in resistance to thrips could be detected.

**Yield Components**

Strains were evaluated with regard to relative influence of basic yield components of seed per acre and lint index (weight lint per 100 seed). An additional index trait, LS ratio, was determined by dividing lint index by seed index. This index should standardize lint per seed for different sizes of seed. A genetic evaluation of yield component study was initiated by crossing parents which varied greatly in relative contributions of lint per seed and seed per acre required for yield. Results of this study should assist breeding of lines that produce yield more efficiently. In addition, a yield component study was initiated to evaluate relative yield components of 10 cotton lines at four plant densities. Yield components on a whole plot and selected individual boll basis are being evaluated.

**Bract Trichomes**

Trichomes on the teeth of bracts may influence the cleanability of cotton lint. Bract trichomes were found to be correlated with trichomes on leaves and stems, but independent assortment should be possible. Visually rating of bract trichomes was improved in 2001 and 2002 by using a magnifying glass and a dark background. Environment does not appear to greatly influence the bract trichome trait. Over four years, a cultivar by location interaction was only found one year when a severely stressed environment was included. In a two-year study, bract trichomes from three positions of three cultivars were counted over three dates. Trichomes declined with lower position (older bracts) on the plant, later sampling date, and as leaves of the cultivar had less trichomes. None of the 2-way or 3-way interactions were significant. These results
suggest that bract trichomes of genotypes can be characterized by sampling one location (avoid highly stressed environment) on one sampling date at one plant position. Variation in bract trichomes of breeding lines is being evaluated. Multiple generations including backcross populations are being developed to determine the inheritance of bract trichomes.

Release of Material

Data are being summarized for germplasm and/or cultivar releases in 2003.

PRACTICAL APPLICATION

Genotypes with improved host plant resistance that are adaptable to Arkansas environments and possess good fiber quality are being developed. Improved host plant resistance should decrease production costs and reduce production risks. Selection based on a higher reliance on lint per seed rather than seed per acre to produce yield may help to identify and develop lines having improved and more stable yield. Lines with fewer bract trichomes may reduce the amount of lint cleaning required to attain acceptable trash grades. These genotypes should be valuable as breeding material to commercial breeders or released as cultivars. In either case, Arkansas cotton producers should benefit from having cultivars that are specifically adapted to their growing conditions.

LITERATURE CITED

