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 that 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 1920’s (Bourland and Waddle, 1988). Throughout this time, the primary emphases of the programs have been to identify and develop lines that are highly adapted to Arkansas environments and possess good host-plant resistance traits. Bourland (2003) provided the most recent update of the current program.

RESEARCH DESCRIPTION

Each year, breeding lines and strains are tested at multiple locations 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 performance capabilities. Selected progeny are carried forward and evaluated in replicated strain tests at multiple Arkansas locations to determine their yield, fiber quality, host-plant resistance, and adaptation 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. Bourland (2004) described the selection criteria presently being used.

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RESULTS AND DISCUSSION

Early-season conditions in 2003 were characterized by cooler and wetter than normal. Consequently, many tests required either re-planting or delayed planting. Variation in stands and early-season growth restricted confidence in the results of many tests. Except for relatively cool conditions during defoliation (September), growing conditions throughout the rest of the season were excellent.

Breeding Lines

The primary focus of breeding line crosses in the last three years has been to enhance yield components or improve resistance to root knot nematode. In 2003, 28 new crosses, 36°F₂ populations, 14°F₃ populations, 192°F₄ 1ˢᵗ cycle progeny from 28 progeny, 790 F₅ 2ⁿᵈ cycle progeny selected from 88 1ˢᵗ cycle progeny, and 74 advanced progeny from 54 2ⁿᵈ cycle progeny were evaluated. Bolls were harvested from superior plants in the F₄ and F₅ populations and bulked by population. A total of 780 plants were selected from superior F₄ progeny, and 257 superior F₅ progeny were advanced, and 54°F₆ advanced progeny were promoted to strain status.

In addition, 237 individual plants were selected from 30 populations, which have at least one root knot-resistant parent. Progeny from these plants will be evaluated for root knot resistance in the greenhouse and will be planted in field plots in 2004. Progeny with good resistance and field performance will be advanced.

Strain Evaluation

In 2003, 108 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 2004 strain tests. The superior strains exhibited a wide range of lint percentages, leaf pubescence, maturity, and fiber quality. Advanced strains were tested for host-plant resistance (thrips, tarnished plant bug, bacterial blight, fusarium wilt) and were evaluated in regional strain tests and the Arkansas Cotton Variety Test.

Marginal bract trichome studies

Two thesis projects are evaluating marginal bract trichomes in cotton. The first project is determining sampling procedures, variation among cultivars and relationship to other plant trichomes. Marginal trichomes have been found to decline as bract ages (from top to bottom of plant and with sampling date), but the
rate of decline is consistent over cultivars with contrasting numbers of trichomes. Within years, significant cultivar-by-location effects were only found when a highly stressed location was included. These results indicate that marginal bract trichomes of cultivars can be characterized by sampling at a constant plant position on one date at one non-stress location. Smooth-leaf cultivars have fewer marginal bract trichomes than hairy-leaf cultivars, but number of marginal bract trichomes vary significantly within both smooth-leaf and hairy-leaf cultivars. A second thesis project is investigating the inheritance of marginal bract trichomes.

**Yield component studies**

Two most basic yield components (number of seed per acre and weight of lint per seed) were evaluated in a study of 10 contrasting cultivars in four plant densities at two locations in 2002 and 2003.

Yield, yield components, and fiber data have been collected for whole plots and for individual tagged bolls. The tagged bolls were produced from three flowering dates and represent different areas of the plant. In addition, a study of the inheritance of these yield components is underway. Results from these studies should help to better understand relationships of yield and fiber traits and to develop breeding strategies to improve yield, yield stability, and fiber quality.

**PRACTICAL APPLICATION**

Genotypes with improved host-plant resistance, improved yield and yield stability, and good fiber quality are being developed. Improved host-plant resistance should decrease production costs and risks. Selection based on yield components 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.

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