University of Arkansas Cotton Breeding Program: 2004 Progress Report
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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 1920s (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 (2004a) 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. 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 individual plants. Once 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 and evaluated in replicated strain tests at multiple Arkansas locations to determine yield, quality,

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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 (2004b) described the selection criteria presently being used.

**RESULTS AND DISCUSSION**

Except for some relatively cool conditions in mid-August and excessive rainfall during harvest, growing conditions for cotton in most of Arkansas were near optimal throughout the 2004 season. Temperatures during the summer were mild and rainfall was generally ample (Bourland et al., 2005). Lint yields in the 2005 Arkansas Cotton Variety Test were very high, ranging from 1017 lb/acre in the Marianna non-irrigated test to 1455 in the Marianna irrigated test. Average yield in the Keiser non-irrigated was within 10% of the average yield of the Keiser irrigated test. Southern Arkansas conditions were not as favorable as northern Arkansas conditions. The Rohwer (southeast Arkansas) location typically provides the highest yields of all locations in the Arkansas Cotton Variety Test. Although average lint yield at Rohwer was high (1312 lb/acre), the Rohwer location yield was fifth among six 2004 locations.

**Breeding Lines**

A primary focus of breeding-line crosses in 2004 was to combine nectariless lines with lines having enhanced yield components and fiber characteristics. In 2004, 16 new crosses, 28 F2 populations 36 F3 populations, 14 F4 populations, 1117 (including 337 selected for resistance to root knot nematode) 1st-year progeny, and 256 advanced progeny were evaluated. Bolls were harvested from superior plants in F2 and F3 populations and bulked by population. A total of 738 plants was selected from F4 populations, 286 superior F5 progeny were advanced, and 54 F6 advanced progeny were promoted to strain status.

**Strain Evaluation**

In 2004, 103 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 2005 New and Advanced Strain Tests. Superior strains exhibited a wide range of lint percentages, leaf pubescence, maturity, and fiber quality. The 2004 New and Advanced Strains were tested for host-plant resistance [thrips, tarnished plant bug, bacterial blight, fusarium wilt, seedling disease (*Rhizoctonia solani* Kuehn), and resistance to seed deterioration] and were evaluated in regional strain tests and the 2004 Arkansas Cotton Variety Test. Four germplasm lines were released in 2004, and additional releases are planned for 2005.
**Root Knot Nematode (RKN) Resistance**

Work to improve resistance to RKN was increased in 2004. Large greenhouse beds (12 x 12 x 2.5 ft) were built and filled with sandy soil from near Leachville, Ark. (area known for heavy RKN infestations). The soil was inoculated with roots of heavily RKN-infected tomato plants prior to planting. Segregating populations with at least one RKN-resistant parent were planted and grown for ca. 6 weeks. Individual plants were removed from the beds, evaluated for visible egg masses, and plants having none or relatively few egg masses were transplanted to the fields. The 337 progeny that had been selected for RKN resistance in a 2003 field planting were then evaluated for RKN resistance in two greenhouse runs. RKN resistance of progeny that appeared to have the highest level of resistance from the two runs was confirmed by evaluation in an additional run. These progeny were also evaluated for morphological traits, bacterial blight resistance, and yield in a field planting at Keiser. A total of 18 progeny were selected for displaying good RKN resistance, good field performance, and acceptable fiber properties. These 18 progeny will be evaluated as a replicated strain test in 2005.

**Marginal Bract Trichome Studies**

Work is continuing to characterize bract traits and to determine their relation to trash in lint and to yield components. Marginal bract-trichome density and bract length and circumference were determined on entries in the 2004 Arkansas Cotton Variety Test (Bourland et al., 2005) and for all preliminary, new, and advanced strains. Significant variation among entries was found for each trait. It appears to be possible to reduce bract-trichome density in both hairy and smooth leaf type cottons. A 2004 study was initiated to study the relation of bract trichomes to the number of fibers per seed and fiber properties. Bolls of cotton genotypes having contrasting leaf pubescence were tagged and one bract sampled (after physiological cutout) at four locations (Keiser and Marianna, Ark.; Tifton, Ga.; and Stoneville, Miss.). Sampled bracts were measured (length and circumference) and marginal trichomes were counted. After defoliation, the tagged bolls were harvested, ginned, and yield components were weighed and seed were counted. Fiber samples were collected and evaluated with AFIS. These data will be used to evaluate the relation of bract traits to yield component and fiber quality traits.

**PRACTICAL APPLICATION**

Genotypes with improved host-plant resistance, improved yield and yield stability, and possessing 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.

