University of Arkansas Cotton Breeding Program – 2011 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 to 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 (2011) provided the most recent update of the current program. The breeding program has primarily focused on conventional genotypes. The recent advent of glyphosate-resistant pigweed has renewed some interest in conventional cotton cultivars, but no highly adapted conventional cultivars have been available.

RESEARCH DESCRIPTION

Breeding lines and strains are annually evaluated 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

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multiple Arkansas locations to determine yield, 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.

RESULTS

Breeding Lines

The primary objectives of the 2006 through 2011 crosses (F1 through F6 generations) have included development of enhanced nectariless lines (with goal of improving resistance to tarnished plant bug), improvement of yield components (how lines achieve yield), and improvement of fiber quality (with specific use of Q-score). Breeding line development is almost entirely focused on conventional cotton lines.

Each of the 24 sets of crosses made in 2011 was between conventional cotton lines. The primary focus of these crosses was to combine lines having specific morphological traits, enhanced yield components and improved fiber characteristics. The 2011 breeding line effort also included evaluation of 30 F2 populations, 24 F3 populations, 23 F4 populations, 661 1st year progeny, and 192 advanced progeny. Bolls were harvested from superior plants in F2 and F3 populations and bulked by population. Individual plants (1810) were selected from the F4 populations. After discarding individual plants for fiber traits, 962 progeny from the individual plant selections will be evaluated in 2012. Also, 132 superior F5 progeny were advanced, and 72 F6 advanced progeny were promoted to strain status.

Strain Evaluation

In 2011, 108 conventional and 8 transgenic strains (preliminary, new and advanced) were evaluated at multiple locations. Screening for host-plant resistance included evaluation for resistance to seed deterioration, bacterial blight, verticillium wilt, tarnished plant bug, and root knot nematode (in greenhouse). Work to improve yield stability by focusing on yield components and to improve fiber quality by reducing bract trichomes continued.

Two approaches for improving cotton yield stability are being used. The first approach focuses on yield components. Increased lint index and fiber density are being used as selection criteria to improve yield stability (Groves and Bourland, 2010). The second approach focuses on host-plant resistance, with specific emphasis on improving heat tolerance and resistance to tarnished plant bug. A method for evaluating heat tolerance is still being refined. Response of all entries in the Arkansas Cotton Variety Test, two Regional Strain Tests, and two Arkansas Strain Tests to tarnished plant bug was evaluated. Consistent response over years has been found. Lines resistant to tarnished plant bug, as determined in these small plot tests, have been found to reach treatment threshold at a slower rate and require less insecticides than more susceptible lines.
Germplasm Releases

Germplasm releases are a major function of public breeding programs. The Arkansas Agricultural Experiment Station released three cotton germplasm lines in 2011. These lines included Arkot 0111, Arkot 0113 and Arkot 0114. Variation with respect to yield, adaptation, yield components, fiber properties, and specific morphological and host-plant resistance traits are represented in these lines. The lines provide new genetic material to public and private cotton breeders with documented adaptation to the Mid-south cotton region. In addition, two conventional varieties, ‘UA103’ and ‘UA222’ were released in 2011.

PRACTICAL APPLICATION

Genotypes that possess enhanced 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. Released germplasm lines 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


