Breeding for Bacterial Blight Resistance in Cotton

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Resistance to bacterial blight, caused *Xanthomonas axonopodis* pv. *malvacearum,* is perhaps the best understood host plant resistance relationship in cotton. Intentional incorporation of bacterial blight resistance into cultivars was abandoned by most U.S. cotton breeders (until recently), but remained an important breeding objective for cotton breeders in some other countries, particularly Australia and Brazil. Inheritance of resistance to bacterial blight in cotton was first demonstrated by Knight and Clouston (1939) in the Sudan. They screened wild and cultivated cottons and identified the "B" series of genes that conferred resistance. Work in the U.S. on bacterial blight resistance was primarily led by Dr. L.A. Brinkeroff at Oklahoma State University and Dr. L.S. Bird at Texas A&M University (1950's through early 1980's). They were able to establish a set of host differentials, which were used to identify 18 races of the bacteria. Effective immunity to bacterial blight was developed by combining several single-gene resistance factors into a polygenic resistance background.

My experience with breeding for resistance to bacterial blight is grounded in Dr. Bird's TAM-MAR program. In his program, he would inoculate with a mixture of four races, which usually included races 1, 2, 12, and 18, with race 18 always included. Seedlings selected for resistance to seed deterioration and for germination at a cool time (13.3C) were scratch-inoculated with the mixture. Seedlings showing any susceptible reaction were discarded. The resistant seedlings were transplanted to greenhouse pots, and grown to maturity during the winter. Seed from the individual plants were planted in progeny rows the next summer, and superior progeny rows were selected and evaluated as strains in replicated tests. All progeny rows and subsequent seed increases were inoculated with the mixture of races (without surfactant at that time) using a tractor mounted, high-pressure sprayer. Spray tips were pointed up toward abaxial leaf surfaces, and plants were inoculated early in the mornings when stomates were open. Progeny displaying any susceptible plants were assumed to be segregating, and were discarded. The occasional susceptible plant in seed increases was rogued.

For the past 45 years, I have used the basic procedures developed by Dr. Bird in my cotton breeding program at Mississippi State University and the University of Arkansas. Since the early 1990's, we have used a silicon surfactant mixed the inoculum - which has greatly improved inoculation success. With improved inoculation efficiency, we are able to confidently spray-inoculate early generation populations in the field rather than scratch-inoculate plants in the greenhouse. Annually, we inoculate all plants in our F_2 though F_4 populations. Individual plants are selected from the F_4 populations. Seed from the individual plants are evaluated as progeny in the F_5 and F_6 generations. Selected progenies are promoted to strains and evaluated in replicated strain test for up to four years. Annually, all progeny rows and all seed increases of strains are inoculated and evaluated for bacterial blight resistance. A total of 86 germplasm lines and cultivars have been released from my program, and all but four of these are resistant to bacterial blight.

Access to cultures of multiple, virulent races of *X. axonopodis* is essential for establishing resistance to bacterial blight. If a plant is resistant to race 18, it will be resistant to all races. However, the inclusion of other

races insures satisfactory inoculation even when race 18 cultures change and/or become less virulent. A breeding program that relies upon using naturally infected leaves for inoculum cannot be sure of the specific race(s) being used and cannot be assured of an ample supply of inoculum each year.

Selected literature

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