

UPDATE ON COTTON RACE-STOCK SCREENING AND PHENOTYPIC CHARACTERIZATION

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Abstract

Construction of a greenhouse complex primarily intended to exploit the world *Gossypium* collection for useful traits was initiated at the Texas AgriLife Research and Extension Center, Lubbock in 1994. Justification for the screening initiative included narrowing of the genetic base in cotton due to domestication leading to limited progress in classical breeding for important objectives, availability of rich genetic resources from world cotton collections and a need for focused germplasm improvement efforts to complement plant-based biotechnology solutions. Resources in cotton collections are available in very limited seed quantities; to date, 686 accessions from the primary germplasm pool, 73 from the secondary germplasm pool, 20 from the tertiary germplasm pool and one representative from the *Gossypoides* species have been increased, digitally characterized, fiber-analyzed and seed made available for screening experiments. Twenty-five species are represented in the experiment-ready accessions. Screening methodologies have been developed and experiments conducted for seedling diseases, root-knot and reniform nematode resistance, and fiber traits have been characterized following hand-, saw- and roller-ginning treatment. Updates reported in 2011 include screening results for drought tolerance, thrips resistance, Lygus bug screening, salt tolerance and phenotypic characterization of all increased accessions. More than 400 accessions have been examined in seedling growth studies to document physiological phenotypic characteristics contributing to drought tolerance. Wide range in values for taproot length; root, shoot and plant total dry weight; and ratio of shoot to root dry weight have been observed. Data have been used to identify contrasting phenotypes for molecular tool development and rapid seedling growth and development in some lines compared to FM 989 make them good candidates for breeding cultivars for marginal environments. Thrips are a major insect culprit in early season cotton production on the High Plains, causing yield loss up to 350 pounds per acre in heavy-pressure years (Vandiver, et al., 2009). Primary control practices include in-furrow aldicarb treatment at planting, an option that will be obsolete by 2018. More than 350 accessions have been screened for thrips tolerance, revealing large differences in susceptibility to thrips injury. *Gossypium barbadense* species overall shows better tolerance than *G. hirsutum*, but some *G. hirsutum* lines with excellent breeding potential have been identified with improved tolerance to thrips feeding. Populations have been created for the purpose of cultivar or breeding line development with F₄ progeny rows selected for field evaluation in 2011. Previous studies of susceptibility of cotton to *Lygus* species show specific morphological traits related to host-plant resistance (Maxwell, 1982). Optimization of the screening process to improve the number of lines that can be screened efficiently and to focus on potential genetic resistance is ongoing. A hydroponic screening method is used to characterize physiological growth characteristics under different levels of salinity. One undomesticated *G. hirsutum* accession has been identified with a differential phenotype under salinity levels approaching sea water. Population development with 'DN-1' began in 2008 and F₄ progeny rows selected under saline soils in a nursery at Pecos, TX will be available for field evaluation in 2011. Characterization to classify DN-1 as salt tolerant, or a "salt-avoider" is ongoing. Identifying phenotypes that exhibit salt avoidance can be important in determining the best genetic background for potential biotechnology solutions to salt tolerance. Increasing genetic diversity through use of the ancestral cotton collection requires some basic information on the phenotypic characteristics of accessions in the collection as well as their potential trait contributions. More than 800 accessions have been documented using digital photography and strategies are under development to incorporate these data into the GRIN-Global database.

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