2005 RESEARCH SUMMARY

PROJECT TITLE: Screening Cotton Germplasm for Heat and Osmotic Stress Tolerance (Agreement No. 03-320-AL)

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Techniques relying on changes in chlorophyll fluorescence during episodes of heat and drought stress have been developed, and utilized to screen approximately 1700 accessions of the cotton (*Gossypium hirsutum*) germplasm collection. Twenty-two of these accessions demonstrated F_v/F_{max} chlorophyll fluorescence values (a measure of photosynthetic effeciency) after 60 min at 55° C (131° F) that were significantly greater than the mean of all accessions tested and the mean of the commercial variety DPL90. This data verified that photosynthesis is dramatically more stable during heat stress in these 22 elite accessions. Of the 22 elite accessions, three plants had final fluorescence values greater than two times the standard deviation of the mean in both rounds of screening. Because we were supplied limited quantities of seed, it was necessary to grow all 22 elite accessions for seed increase, and a secondary evaluation of the elite accessions was then conducted by growing plants of the 22 elite accessions for approximately four weeks in the greenhouse, and then transferring them to a growth chamber where a heat stress of 45° C (113° F) was continuously applied to the plants. The overall growth and appearance of the accessions under these conditions was compared with DPL90, a variety considered to be among the most heat and drought tolerant available. While all 22 of the accessions performed better than DPL90, 7 of the elite 22 were clearly superior in performance during heat stress to DPL 90 and the other plants. We are making the initial crosses of the 7 selected accessions with DPL90 and additional germplasm. In order to efficiently breed for a complex trait like heat tolerance a set of molecular markers that can be utilized to facilitate and expedite the breeding program are being developed. Approximately, 300 sequences that are differentially expressed during heat stress have been obtained and are being verified. The expression of these sequences in DPL90 and the 7 elite accessions will subsequently be used to devise a set of sequences that are useful as molecular markers in the breeding project.