## METABOLIC AND REPRODUCTIVE FITNESS OF HEAT-STRESSED COTTON John J. Burke USDA-ARS Plant Stress and Germplasm Development Unit Lubbock, TX

## **Abstract**

Cotton geneticists are currently working to develop broadly adapted and elite upland germplasm that can be used for fiber quality and heat tolerance improvement for the Southeast and Midsouth. Germplasm evaluation in the field is sometimes hampered by seasonal variability in weather patterns that fail to provide stress levels at desire developmental stages needed to identify genotypic differences. This study evaluated greenhouse-grown cotton and laboratory techniques that might aid cotton geneticists in selection of germplasm with improved heat tolerance. Seeds of parental lines selected as putative heat tolerant lines (SG248, DP565, and Stoneville 474) or high fiber-quality lines (Phy72, Acala Maxxa, and NM 67) were provided by Richard Percy (USDA-ARS, Maricopa, AZ). A set of four plants per cultivar were grown under an automated drip irrigation system in a greenhouse set to obtain a 40C day/ 27C night regime. Air temperature rose from 27C to 35C between 8 am and 10 am. A second increase in air temperature to 40C occurred between 10 am and 2 pm. Heat tolerance of the leaves of the cotton cultivars was evaluated in plants when they reached the 7<sup>th</sup> mainstem leaf stage. Similar "Metabolic Fitness Indices" were obtained for all cultivars immediately upon removal of the leaf tissue from the greenhouse. This finding suggests that each cultivar made metabolic adjustments to cope with the elevated air temperatures. Distinct differences in tissue "Metabolic Fitness Indices" were observed after a 7h dark incubation at 39C. SG248 exhibited the lowest MFI, followed by DP565 and Stoneville 474. Acala Maxxa and Phy72 had the next highest MFI, and NM67 always showed the highest MFI of the six varieties evaluated under this thermal regime. It is interesting to note that the three lines selected for high fiber quality were the three lines exhibiting the highest Metabolic Fitness values. Flower fertility was evaluated on three dates by harvesting one flower at random per plant and recording the percent dehiscence of the anthers. NM67 and SG248 showed the greatest fertility, followed by Phy72 and Stoneville 474, and then Acala Maxxa and DP565. It is interesting to note that NM 67 and SG248 had the greatest fertility, yet NM 67 and SG248 were at opposite ends of the scale in the Metabolic Fitness determination of vegetative heat tolerance. The results showed genetic diversity in heat tolerance among the six greenhousegrown cotton cultivars. Based upon these results, vegetative tissue Metabolic Fitness Indices and reproductive heat tolerance should be determined for each cultivar to obtain a more meaningful measure of cotton heat tolerance.