MULTI-LOCATION ASSESSMENT OF HEAT TOLERANCE IN SIX COMMERCIALLY-AVAILABLE COTTON CULTIVARS

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Abstract

Chlorophyll fluorescence provides a rapid measure of photosystem II efficiency. Leaf samples can be collected in the field and chlorophyll fluorescence assessed under a range of temperatures to define heat tolerance for a given variety or environment. Heat tolerance assessments at statewide variety testing sites should provide a robust indication of cultivar differences in heat tolerance plasticity to environment. In the current study we assessed heat tolerance for six cultivars (CG 3787 B2RF, DP 1555 B2RF, PHY 333 WRF, PHY 499 WRF, ST 6182 GLT, ST 6448 GLB2) at multiple variety trial locations in Georgia and Mississippi, under different irrigation regimes, on two sample dates per season (first flower and peak bloom in most locations), and over two growing seasons (2015 and 2016). The temperature at which photosystem II maximum quantum yield (F_v/F_m) declined 15% from the optimum temperature served as a standardized measure of heat tolerance. Photosystem II heat tolerance was exceptionally responsive to environment, where T_{15} values ranged from 41°C to 44.9°C across the 21 heat tolerance environments evaluated in the current study. Cultivar differences in heat tolerance were not observed in this study. Previous work has indicated that heat tolerance may be influenced by plant water status and/or ambient temperature conditions. Increases in heat tolerance were most closely associated with declines in predawn water potential. *In situ* F_v/F_m, measured at each study site was stable across all environments. We speculate that increases in PSII heat tolerance in response to drought may be an acclimation mechanism to prevent damage to PSII under the high leaf temperatures that commonly occur under water deficit conditions.