DOES THERMOTOLERANCE PLASTICITY INFLUENCE YIELD STABILITY?

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Abstract

In cotton, Photosystem II heat tolerance acclimates to conditions of high temperature and drought such that the photosynthetic efficiency of PSII (the F_v/F_m ratio measured using chlorophyll *a* fluorescence) for field grown cotton does not decline appreciably until leaf temperatures are artificially raised to temperatures well-above those experienced in the field. Both innate heat tolerance (maintaining high levels of PSII thermotolerance without prior exposure to abiotic stress conditions) and acclimation (increasing PSII heat tolerance) have been proposed as possible mechanisms for improving plant performance under heat and drought conditions; however, the relationship between thermotolerance plasticity and yield stability has not been elucidated for field grown cotton. To address this, the temperature response of maximum quantum yield of photosystem II (F_v/F_m) were evaluated for two cotton cultivars, at three sample times during the 2014 growing season, under five different irrigation regimes. The temperature at which each parameter declined 15% from the optimum (T_{15}) served as the high temperature threshold for all parameters. Linear regression of T_{15} for each cultivar on an environmental index provided a measure of thermotolerance plasticity for each cultivar; a similar approach was used to assess yield stability. It was observed that the two cultivars utilized in the present study differed significantly in stability of every parameter evaluated. Specifically, the most thermotolerance-stable cultivar was also the most photosynthetically stable and yield stable, suggesting that greater thermotolerance plasticity of PSII does not necessarily promote yield stability when variability in yield is water-induced.