# CHARACTERIZING PHYSIOLOGICAL RESPONSES TO PLANT WATER STATUS DURING PROGRESSIVE DROUGHT AS A MEANS TO IDENTIFY DROUGHT TOLERANCE IN COMMERCIALLY-AVAILABLE COTTON CULTIVARS

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## Abstract

Characterizing plant water status along with gas exchange and fluorescence measurements for different cotton cultivars during progressive drought should allow for water potential-based physiological thresholds to be determined for any given parameter of interest and any given cultivar, and these thresholds could be validated using cultivar differences in yield response to drought. To this end, three cotton cultivars were grown under well watered conditions until first flower, at which time irrigation ceased and a rainout shelter was utilized to prevent rainfall interception by the crop. A three week drying period was used to assess, predawn water potential, maximum quantum yield of photosystem II, dark respiration, net photosynthesis, photosynthetic electron transport rate, non-photochemical quenching, and end of season lint yield with the goal of identifying cultivar differences in drought tolerance. Predawn water potential declined substantially during the drought period; net photosynthesis, and respiration declined concomitant with an increase in the duration of the drought period. Furthermore, respiration was linearly ($r^2 = 0.935$) and net photosynthesis non-linearly (r2 = 0.843) related to predawn water potential during soil drying, indicating these parameters were highly sensitive to drought stress. In contrast, PSII photochemical efficiency was insensitive to progressive drought. No significant cultivar effects were observed for physiological parameters and yield data agreed with physiological data in that no significant cultivar effect was observed for lint yield. Future work may need to evaluate a broader range of cotton germplasm to detect genotypic difference with the physiological methods used.