PREDAWN RESPIRATION PREDICTS LINT YIELD IN COTTON WHEN YIELD VARIABILITY IS WATER-INDUCED

John L Snider
University of Georgia
Tifton, GA
Daryl R Chastain
Mississippi State University
Stoneville, MS
Calvin Meeks
University of Georgia
Tifton, GA
Guy D Collins
North Carolina State University
Rocky Mount, NC
Ronald Sorensen
USDA-ARS
Dawson, GA
Calvin D Perry
University of Georgia
Camilla, GA

Abstract

Respiratory carbon evolution by leaves under abiotic stress is implicated as a major limitation to crop productivity; however, respiration rates of fully expanded leaves are positively associated with plant growth rates. Given the substantial sensitivity of plant growth to drought, it was hypothesized that predawn respiration rates (R_{PD}) would be 1) more sensitive to drought than photosynthetic processes and 2) highly predictive of water-induced yield variability in *Gossypium hirsutum*. Two studies (at Tifton and Camilla Georgia) addressed these hypotheses. At Tifton, drought was imposed beginning at the onset of flowering (first flower) and continuing for three weeks (peak bloom) followed by a recovery period, and predawn water potential (Ψ_{PD}), R_{PD}, net photosynthesis (A_N) and maximum quantum yield of photosystem II (F_v/F_m) were measured throughout the study period. At Camilla, plants were exposed to five different irrigation regimes throughout the growing season, and average Ψ_{PD} and R_{PD} were determined between first flower and peak bloom for all treatments. For both sites, fiber yield was assessed at crop maturity. The relationships between Ψ_{PD}, R_{PD} and yield were assessed via non-linear regression, and the interactive effects of Ψ_{PD} and R_{PD} on fiber yield was assessed using response-surface analysis. It was concluded for field-grown *G. hirsutum* that 1) R_{PD} is exceptionally sensitive to progressive drought (more so than A_N or F_v/F_m), 2) average R_{PD} from first flower to peak bloom is highly predictive of water-induced yield variability, and 3) average Ψ_{PD} during flowering alters yield response to R_{PD}.