Leaf gas exchange and photochemistry of sugarcane under water stress and low night temperature

Machado, D.F.S.P.[(1)]; Machado, R.S.[(1)]; Marchiori, P.E.R.[(1)]; Lagôa, A.M.M.A.[(1)] Machado, E.C.[(1*)]; Ribeiro, R.V.[(1)]

[(1)]Laboratório de Fisiologia Vegetal "Coaracy M. Franco", Instituto Agronômico (IAC), Brazil.

In this study we evaluated the effects of water stress and cold night temperature on gas exchange and photochemical reactions of photosynthesis in the sugarcane genotype IACSP 94-2094. Diurnal courses of leaf gas exchange and chlorophyll fluorescence were evaluated in young plants after five days in the following treatments (water/night temperature): well-hydrated and 20 ºC (control); water-stressed and 20 ºC (WD); well-hydrated and 12 ºC (LT); and water-stressed and 12 ºC (WD+LT). Leaf CO_2 assimilation was reduced in all treatments, with the lowest values being found in WD and WD+LT plants. Decreases in CO_2 assimilation were caused by decreases in stomatal conductance and in apparent carboxylation efficiency. The potential quantum efficiency of PSII was unaffected, whereas the effective quantum efficiency of PSII and photochemical quenching of the chlorophyll fluorescence were reduced. Non-photochemical quenching and alternative electron sinks were stimulated under stressful conditions after five days of treatment. As photoinhibition was not noticed, we suggest that photochemical changes were effective in reducing excessive energy pressure on PSII and protecting the photochemistry. Considering the apparent electron transport rate, the photochemical activity was sufficient to support photosynthetic rates in all treatments. As conclusion, low night temperature and water stress affect photosynthesis of IACSP 94-2094 through increases in both stomatal and biochemical limitations.

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