ELEVATED NIGHT TEMPERATURES EFFECTS ON COTTON RESPIRATION, ATP LEVELS AND CARBOHYDRATES

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Abstract

High temperatures are considered to be one of the main environmental factors contributing to variable yields in cotton. This has been attributed to a negative effect on respiration and carbohydrate accumulation, but the evidence for this is lacking. Yield comparisons between locations with the same day temperatures and different night temperatures have shown that locations with higher night temperatures have lower yields. We hypothesized that high night temperatures have a negative effect on cotton respiration and adenosine 5'-triphosphate (ATP) content that results in a significant loss of carbohydrates. Three sets of growth chamber studies were conducted in 2007 at the University of Arkansas to study the physiological effects of long-term and short-term, both increasing and decreasing, high night temperatures. Cotton (*Gossypium hirsutum* L.) cultivar DP444BR was planted in 1L pots in growth chambers set for 12h photoperiods, 60% relative humidity, and normal day/night temperatures of 30/20ºC imposed until the pinhead square stage. In the long-term study, high night temperatures treatments consisted of normal day/night temperatures (30/20ºC) and high night temperatures (30/28ºC) for four weeks after the pinhead square stage. In the short-term study, increasing high night temperatures treatments of 24, 27 and 30ºC were imposed on the plants for one night with 2h intervals between each incremental temperature regime. For the short-term decreasing high night temperature study, plants were left to acclimate at 34/28ºC (day/night) for one week prior to treatment imposition in which temperatures of 24 and 20ºC were imposed for one night with 2h intervals between each incremental temperature regime. Measurements of respiration, ATP and carbohydrates were conducted at the end of each treatment. The results showed an increase in respiration with elevated temperatures which led to a decrease in leaf ATP and a depletion of leaf carbohydrates.