TEMPERATURE GRADIENT IN THE CANOPY AND EFFECTS ON COTTON BOLLS

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Abstract

Higher than optimal temperature, especially during reproductive growth, affects cotton development and yields. The excepted scenario of increasing global temperatures is considered a threat for crop productivity and emphasizes the need for understanding cotton responses to high temperature. One of the principal problems about research in this area is that ambient temperatures are used to evaluate effects on yields, while actual temperatures in the canopy where bolls develop may be different. This study seeks to evaluate temperature gradients within the canopy and its influence on boll growth. It is hypothesized that leaf, boll, and air temperatures within the canopy are better correlated with boll growth and yield than ambient air temperature. The objective of this study was to compare ambient temperatures to temperatures inside the canopy for their effects on boll growth and development under field conditions. A field experiment was conducted in Arkansas Agriculture Experiment Station, Fayetteville, AR. Cotton (*Gossypium hirsutum* L.) cultivar DP0912 B2RF was used under furrow Irrigation. The study consisted on two planting dates, 20th May and 4th June 2014. Measurements were taken weekly at midday, starting one week after first flower with thermocouple probes. The temperature measurement sites included: air temperature above the canopy, upper and lower canopy including internal boll temperature, air next to the boll, and subtending leaf temperature. Additionally, environmental conditions from an adjacent weather station were recorded. Subtending leaf photosynthesis was measured with a handheld photosynthesis system (CI-340, CID Bioscience) and boll (first sympodial fruiting position) dry matter, size, and carbohydrates content were analyzed. The season was characterized by lower than optimal temperatures and the absence of significant heat stress during reproductive development. For the observed temperature range, ambient temperature was consistently lower than temperature inside the canopy, while internal boll temperature was higher than all the other measurement sites throughout the growing season. Relatively higher photosynthetic rates were measured under cool conditions (lower than optimal temperatures) and relatively low photosynthetically active radiation, which may indicate plant adaptation to less than optimal environmental conditions. Complex interactions between solar radiation, temperature, and microclimate affect the dynamics of the temperature gradient and boll growth throughout the canopy.