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GAS EXCHANGE IN UPLAND COTTON CULTIVARS UNDER WATER DEFICIT STRATEGIES

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RESUMO

Upland cotton crop in Brazilian semiarid zones has a favorable factor, the duration of the mean solar day. On the other hand, cotton is frequently subjected to soil water deficit. Several physiological indexes are related to the use of water by plants. Among them, photosynthesis and stomatal conductance stand out, as osmotic adjustment, such as stomatal closure, allows plants to escape dehydration and loss of turgor through the maintenance of the water content in the cells. Therefore, the efficiency of water use for irrigated production systems need to be optimized, especially in the cotton crop, as it is a species of great economic and social importance. Aiming to evaluate the gas exchange of upland cotton cultivars cultivated in the Brazilian semiarid, subject to water deficit periods on the phenological stages, an experiment was carried out at the Campina Grande Federal University, Pombal county campus, Paraíba, between June and December 2015. Treatments were formed from a split-plot arrangement, in which the plots were 6 water deficit periods (P) (P1 = No deficit, P2 = Deficit in the initial growth stage, P3 = Deficit in the flower bud stage, P4 = Deficit in the flower stage, P5 = Deficit in the boll stage and P6 = Deficit in the open boll stage) and the subplots, 2 upland cotton cultivars (C) (C1 = Brazil Seeds 286 and C2 = BRS 336), in randomized block design, with 4 replicates. Irrigations were carried out daily, always in the morning, based on the availability of soil water (AWS) to plants. The replacement water volume was calculated considering the water lost by the crop evapotranspiration (ETc), which is represented as the difference between the soil water content (SWC) in the field capacity (FC) and the current mean SWC measured in the depths of 0.10, 0.20, 0.30 and 0.40 m, which were measured before irrigations. The current SWC was determined by the time-domain reflectometry (TDR) method, using a Delta-T-PR2 probe introduced through access pipes installed in each treatment. Each period of water deficit consisted of 14 days without irrigation in the predetermined phenological stage. After this period, the plants had normal irrigation until the end of the cycle. The gas exchanges evaluations were performed at 29, 40, 54, 62 and 100 days after germination (DAG) from measuring stomatal conductance (gs) (mol H2O m-2 s-1), transpiration (E) (mmol H2O m-2 s-1), net photosynthesis (A) (µmol CO2 m-2 s-1) and internal CO2 concentration (Ci) (µmol CO2 mol-1). With these data, the instantaneous water-use efficiency (iWUE) (A/E) [(µmol CO2 m-2 s-1) / (mmol H2O m-2 s-1)-1] and the instantaneous carboxylation efficiency (iCE) (A/Ci) [(µmol CO2 m-2 s-1) / (µmol CO2 mol-1)-1] were estimated. These evaluations were performed with a plant gas exchange (model LCpro – SD, ADC Bioscientific, UK), containing an infrared gas analyzer (IRGA). The readings were performed on the third fully expanded leaf, conducted under natural conditions of air temperature, CO2 concentration and using an artificial radiation source of 1200 µmol m-2 s-1. The cotton plant underwent physiological changes in all deficit periods. The plants can recover after its suspension and the return of irrigation. The decrease in the photosynthetic activity may be due to its stomatal closure efficiency to reduce cotton gas exchange and transpiration. Water deficits reduced the gas exchange of the upland cotton plants, mainly stomatal conductance, transpiration and photosynthesis. The cotton cultivars BRS 286 and BRS 336 presented similar behavior in the different water deficits applied on different phenological stages. Cotton was less tolerant to water deficits in the boll formation stage and more tolerant in the initial growth and flower bud stages.

Keywords: Gossypium hirsutum L. r. latifolium H., water stress, physiology.

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