

LEAF STOMATAL CONDUCTANCE, TRANSPIRATION AND LEAF AREA GROWTH PATTERNS OF FOUR COTTON VARIETIES UNDER DIFFERENT IRRIGATION REGIMES IN SOUTHERN TEXAS**Xuejun Dong****Angela Jones****Bethany Speer****Daniel Leskovar****Texas A&M AgriLife Research and Extension Center at Uvalde****Uvalde, TX****J. Tom Cothren****Texas A&M University****College Station, TX****Abstract**

Increasing water use efficiency in agricultural crop production is an important aspect in alleviating the severe competition for water between agriculture and urban use. We compared water use characteristics of four cotton varieties under irrigated conditions in southwest Texas. The objective was to characterize ecophysiological traits related to cotton water use and yield. Four varieties of cotton, namely, 'PHY499 WRF', 'DP1044 B2RF', 'FM1944 GLB2' and 'DP0935 B2RF', were planted in a center pivot field under three different levels of irrigation (100%, 75% and 50% of crop evapotranspiration) in a split plot design. Both variety and irrigation level were replicated twice. Planting date was April 18, 2014 and harvest date was September 18, 2014. Total irrigation applied during the growing season (100% ET_c) was 9.27 in. and total rainfall was 11.75 in. Predawn leaf water potentials were measured to indicate water stress experienced by the plants. Severe water stress developed (especially under 50% irrigation) starting July 31 (first boll open at August 2). Two heavy rains caused flooding to one of the plots at 75% irrigation. As a result data analysis was done only to the plots with 100% and 50% irrigation. Results show a significant effect of irrigation on cotton yield ($p=0.001$), while variety effect was not significant ($p=0.3$). At 50% and 100% irrigation levels, the yield of seed cotton increased in the following order: FM1944 (2149 and 2750 lbs/acre, respectively), PHY499 (2242 and 2817 lbs/acre), DP0935 (2268 and 2878 lbs/acre) and DP1044 (2533 and 2966 lbs/acre). Leaf gas exchange rate, leaf area index and sap flow rate were measured during the experiment. At 2nd square stage (June 16), all four varieties had similar and high stomatal conductance ($0.8 \text{ mol H}_2\text{O m}^{-2} \text{ s}^{-1}$). However, at peak flower (July 17) the values diverged among varieties under both irrigation levels, with the highest conductance measured in DP1044 and lowest in PHY499. However, stem sap flow measurements during August indicated a lower water use in DP1044 than PHY499. For example, from August 4 to 10, the average sap daily flow rate under 50% irrigation was 2.1 and 1.27 kg/day/m² (leaf area), respectively, for PHY499 and DP1044. Following a heavy rain in August 19, 2014 (1.5 in.), the corresponding sap flow rate for the period of August 19 to 25 increased to 4.3 and 2.7 kg/day/m², respectively. Leaf area index reached highest values for all varieties a week following the peak flower, with DP1044 maintaining a low leaf area index from mid- to late growing season. A more comprehensive measurement of both leaf level and whole plant level water use is needed for a complete comparison among the four varieties in water use patterns. Preliminary data from this study suggest that, of the four varieties tested, DP1044 and PHY499 have a greater potential for saving water while maintaining yield.