

ECONOMIC WATER USE EFFICIENCY IN COTTON (*Gossypium hirsutum* L.)**Russell C. Nuti****Marshall C. Lamb****Ronald B. Sorensen****USDA-ARS, National Peanut Research Laboratory****Dawson, GA****Abstract**

Cotton (*Gossypium hirsutum* L.) production is often limited by periodic drought. Irrigation may or may not improve economic yield of cotton in the Southeast U.S. depending on current energy costs and yield potential; however nearly 50% of cotton produced in Georgia has irrigation in place to achieve the goal of producing economically sustainable yields regardless of rainfall. Rainfall often interferes with the efficiency of irrigation, adding to the challenge of optimal irrigation scheduling. In 2001 to 2008, four irrigation rates were evaluated at the USDA-ARS Multicrop Irrigation Farm near Shellman, Georgia. Cotton was produced under conventional tillage with best management practices. Cultivar 'DP 458' was used in 2001 and 2002 and 'DP 555BG/RR' in 2003-2008. Irrigator Pro for Cotton was used to schedule irrigation timing. A three tower linear overhead irrigation system was used that had separate nozzle packages on each tower to achieve different irrigation rates. The four rates applied were 100, 66, 33, and 0% of the full rate recommended by Irrigator Pro for Cotton. Treatments were replicated three times. Irrigation timing was in accordance with the needs for full yield potential in the 100% treatment. The objectives were to determine the value of irrigation and the water use efficiency of irrigation among irrigation rates and over years. In-season rainfall ranged from 10.6 to 30.0 inches and irrigation volume ranged from 4.3 to 17.9 inches. Total water applied (rainfall + irrigation) ranged between 22.0 and 34.3 inches over the eight years. The non-irrigated yield was subtracted from the irrigated yields in each respective replication. The value of the cotton produced by each irrigation level over non-irrigated was converted to the value of lint per inch of water applied. Interactions were significant for treatment effects over years mainly due to variable rainfall and growing conditions. Rainfall was above average in 2003 and 2005. In all but 2003, irrigation improved yield by 220-575 lb lint/A. Years with average or below average rainfall had incrementally higher yields as irrigation rate increased except for 2007. Water use efficiency for irrigation was highest for the 33% rate in 2001 and 2002 and higher in 2004 and 2006 for the 66% rate. Drought was most severe in 2004 and 2007, so the 33% rate did not sufficiently relieve drought stress compared to the 66% rate. Irrigation provided profit in 7 of 8 years of the study. Reduced irrigation rates have the highest return per unit of water applied, but simply decreasing irrigation level does not maximize efficiency; yield limiting stress must be avoided. Although 100% irrigation is not the most efficient irrigation level, it often provides the most economic return, and the upper limit of economic potential was not reached in 5 of 8 years of this study.