

**COTTON SUBSURFACE DRIP AND OVERHEAD IRRIGATION EFFICIENCY, MATURITY, YIELD,
AND QUALITY****Jared R. Whitaker****University of Georgia****Statesboro, GA****Guy D. Collins****University of Georgia****Tifton, GA****Glen L. Ritchie****Texas Tech University****Lubbock, TX****Calvin D. Meeks****University of Georgia****Tifton, GA****Abstract**

Water is one of the most limiting factors in cotton production and it has been documented that cotton requires 18 inches of water per acre to maximize yields. Average rainfall in Georgia exceeds that amount during the growing season; however, due to low water holding capacity of Coastal Plain soils and unevenly distributed rainfall it is not uncommon for episodic drought to occur. Overhead, sprinkler irrigation is a tool many growers have used to alleviate stress during these events and adoption of these systems is widespread. Although these systems are extremely valuable, several economic and agronomic issues have made exploring alternative irrigation systems a reality. Economic issues are based on the increasing input costs and volatility of dryland cotton production, and the need to increase irrigated acreage paired with the feasibility of center pivot irrigation in small or irregularly shaped fields. Other issues associated with overhead irrigation, such as lower efficiency due to water losses associated with evaporation and runoff as well as the potential adverse effects from water on cotton pollen, make subsurface drip (SSD) irrigation an attractive alternative to typical overhead irrigation in the Southeast. Research in 2004, 2005, and 2011 was conducted to investigate the potential of SSD to adequately irrigate cotton in Georgia while evaluating irrigation scheduling methods with both SSD and overhead irrigation and their effect on water use efficiency, cotton maturity, fiber quality, and lint yield. In these experiments, SSD irrigation systems consisted of drip tape buried 10 to 12 inches deep in alternate middles (72 inches apart) and overhead irrigation was applied with either a lateral or center pivot irrigation system. The systems were integrated to allow implementation of randomized complete block designed experiments. Irrigations were applied when conditions were met according to specific irrigation treatments in one inch increments with the overhead system and at various amounts (0.2 to 0.5 inches) with the SSD system. Irrigation treatments that were designed to maintain a certain level of soil moisture were scheduled using Watermark® sensors buried at various depths in the cotton row. Research conducted during 2004 and 2005 in Tifton and Camilla, GA evaluated cotton irrigated with an overhead system and SSD system compared to a non-irrigated check. Both the SSD and the overhead systems were used to apply water to maintain soil moisture below 40 cb. In 2011, experiments were conducted in Midville and Camilla, GA. At both locations, the performance of two cotton varieties (DP 1050 B2RF and FM 1740 B2RF) were assessed in four SSD irrigation treatments and a non-irrigated check. The SSD treatments consisted of: irrigations applied to maintain Watermark® readings below 40 cb (40cb), irrigation scheduled to maintain Watermark® readings below 70 cb (70cb), irrigation applied according to The University of Georgia's cotton irrigation recommendations, using a checkbook method with rainfall adjustments (UGA 100%), and irrigation applied at 65% of UGA's irrigation recommendations (UGA 65%). The University of Georgia cotton irrigation recommendations state that cotton should receive one inch of water per week of growth through the 1st week of bloom, 1.5 inches during the 2nd week, two inches during the 3rd and 4th week, 1.5 inches during the 5th and 6th week, and one inch per week afterwards until irrigation termination. In Camilla, two additional treatments consisting of overhead irrigation were also implemented, with irrigations triggered at 40 cb and 70 cb. In 2004 and 2005, SSD was more efficient than overhead in maintaining similar soil moisture (37% less water used with SSD). Lint yields from cotton irrigated with SSD were equal to or greater than overhead irrigated cotton and water use efficiency (yield per acre per inch of total water) was higher in SSD irrigated cotton. Cotton irrigated with the SSD system also matured faster, and produced more cotton lower in the plant canopy than cotton irrigated with overhead irrigation. At Camilla in 2011, both SSD and overhead irrigation increased cotton yields over the non-irrigated check (271 to 519 lbs/A). Similar yield advantages were also obtained with both systems when irrigations were triggered at 40 cb compared to 70 cb. (152 lbs/A, averaged over systems and varieties). To maintain soil

moisture at similar levels, the SSD system required 19% less water than the overhead system. With regards to variety, similar yields were noted between irrigation levels, however FM 1740 B2RF had a larger increase in yield compared to the non-irrigated check in the overhead system than in the SSD system (552 vs. 412 lbs/A). In both 2011 locations, SSD irrigation increased yields over the non-irrigated check (743 lbs/A averaged across varieties and treatments). Increased cotton yields were also obtained when SSD irrigation was scheduled with the 40 cb treatment compared to the 70 cb treatment (148 lbs/A averaged across locations and varieties) and with the UGA 100% treatment compared to the UGA 65% treatment (139 lbs/A averaged across locations and varieties). There was a difference in variety performance between irrigation treatments, where both varieties produced similar yields when non-irrigated and irrigated with the UGA 65% treatment, but FM 1740 B2RF produced higher yields than DP 1050 B2RF when irrigated with the UGA 100%, 40 cb, and 70 cb irrigation treatments (138 lbs/A averaged across locations). This work demonstrates that SSD can adequately provide water to meet cotton demands throughout the growing season in Georgia. Subsurface drip irrigation was also more efficient than overhead irrigation, thus slightly reducing overall water needs for cotton irrigation. Yields from cotton grown with SSD irrigation were found to be equal or better than overhead irrigation, without significant differences in fiber quality, while increasing rate of maturity. This data also demonstrated the utility of using soil moisture sensors to schedule irrigation and benefits of maintaining more adequate soil moisture. It also provided evidence that the recommendations used in Georgia to irrigate cotton were sufficient and there is a need to further investigate the response of cotton varieties to irrigation since differences were observed in this study. Therefore, from an agronomic standpoint, SSD is a viable option for cotton irrigation in Georgia.