A SOIL MOISTURE SENSOR APPROACH TO SCHEDULING COTTON IRRIGATION

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Abstract

Approximately 40% of cotton planted in Mississippi irrigated and as such, substantial amounts of water are used to produce a crop each year. A majority of the cotton in Mississippi is grown in the Delta region where furrow irrigation is used and water is supplied from wells drilled into the Mississippi River Valley Aquifer. Due to environmental regulations, aquifer depletion, and high water usage, restrictions and monitoring on irrigation wells have become an issue for growers. In order to maximize water use efficiency in cotton proper scheduling is a key factor.

An experiment was conducted in 2015, 2016, and 2017 at the R.R. Foil Plant Science Research Center in Starkville, MS to determine proper furrow irrigation scheduling in cotton with the use of soil moisture sensors. Stoneville 4946GLB2 was planted on May 8, 2015, May 7, 2016, and May 7, 2017 in 4-row plots 3.9 m wide x 12.2 m long. Polypipe 38 cm in diameter was used to irrigate the center three furrows of each 4 row plot. Cotton was irrigated full season and by 3 different growth stages. Cotton growth stages used were emergence to first bloom, first bloom to peak bloom, and peak bloom to first cracked boll. Irrigation was initiated using readings from WATERMARK™ soil moisture sensors placed at 15, 30, 60, and 90 cm deep. Full season plots were irrigated at three different irrigation levels including 50, 90, and 130 kPa. During each growth stage, irrigation at 90 and 130 kPa was implemented while blanket irrigation applications at 75 kPa were used outside of each growth stages. Both full season irrigation and each growth stage contained non-irrigated plots for comparison purposes. Cotton was harvested Oct. 4, 2015, Oct. 10, 2016, and Oct. 25, 2017. Data were pooled across years (2015 and 2016) and were subjected to analysis of variance using the PROC Glimmix procedure in SAS 9.4 and multiple pairwise T-tests were used to separate means at $p = 0.10$.

The number of irrigation events each treatment was subjected to throughout the growing season was dependent upon the soil moisture sensor reading for each treatment. Sensors only triggered one time in 2017 therefore data were analyzed across 2015 and 2016 years. Lint yield ranged between 1,791 and 2,127 kg ha^{-1} but significant differences due to irrigation were present when irrigation was managed full season. When irrigation was triggered using a 90 kPa trigger throughout the growing season lint yield was 16% higher than either non-irrigated or 50 kPa plots. Plots that were watered at a trigger of 130 kPa had no difference in yield between the non-irrigated, 50, or 90 kPa triggers. Lint yield was not significantly different between any trigger when irrigation was managed by growth stage which may suggest that current irrigation initiation recommendations hold true that irrigation is not needed in cotton until 1st bloom.