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 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 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 the 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 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 growth stages. Both full season irrigation and each growth stage contained non-irrigated plots for comparison purposes. Cotton was harvested Oct. 4, 2015. In addition to yield data, node above cracked boll, and defoliation data consisting of % defoliation, % desiccation, % greenleaf, and % open boll was also collected. Data 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 $p = 0.05$.

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; the full season 130 kPa trigger was never irrigated. Lint yield ranged between 1,914 and 2,209 kg ha^{-1} but significant differences due to irrigation were present. Significant differences between number of nodes above cracked boll between cotton in which irrigation was triggered at 90 kPa and non-irrigated as well as differences between full season triggers at 90 kPa and 130 kPa were observed. Where cotton was irrigated differently from emergence to first bloom, differences in node above cracked boll between 90 kPa and both non-irrigated and 130 kPa were observed. Full season non-irrigated plots had a 34% defoliation rating 10 days after harvest aid applications were made compared to plots watered at 90 kPa. Desiccation when present ranged between 19 and 34% across treatments with no significant differences occurring. Higher percentages of greenleaf occurred when plots were irrigated at 90 kPa (53%) than non-irrigated (23%), 50 (30%), or 130 kPa (30%) full season, as well as 90 kPa (51%) had higher percentage than non-irrigated (25%) or 130 kPa (33%) during the growth stage peak bloom to first cracked boll. Full season non-irrigated plots had 15% more open bolls than plots irrigated at 90 kPa.