EVALUATING VARIOUS SOIL MOISTURE SENSOR THRESHOLDS IN COTTON IN SOUTH CAROLINA

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Abstract

Approximately 10% of cotton planted in South Carolina is irrigated and as such, substantial amounts of water are used to produce a crop each year. A majority of the cotton in South Carolina is grown in the coastal plain region where irrigation is used and water is supplied from wells drilled into underground aquifers. 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 2018 at the Edisto Research and Education Center in Blackville, SC to evaluate three season-long soil moisture sensor threshold values in a loamy sand soil. Deltapine 1538 B2XF was planted on May 10, 2018 in 32-row plots 31 m wide x 60 m long and each treatment was replicated four times. A lateral-move irrigation system supplying overhead sprinkler irrigation was used to irrigate each 32 row plot. Cotton was irrigated by each sensor threshold for the entire growing season. Irrigation was initiated using readings from WATERMARK™ 200SS soil moisture sensors placed at depths of 15, 30, and 60 cm within the planted row. Plots were irrigated when the weighted average threshold value exceeded levels of -15, -30, and -60 kPa. Non-irrigated plots were also included for comparison purposes. Cotton was harvested Oct. 4, 2018. Root cores were obtained at 5-leaf and full bloom to quantify surface area and root length by irrigation treatment. 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. In the 2018 growing season, average and above average rainfall each month was observed, however, irrigation was triggered four, two, and two times for each threshold -15, -30, and -60 kPa, respectively. No differences in plant height or total nodes at first bloom or first cracked boll were observed. Lint yield ranged between 843 and 1134 kg ha^{-1} but no significant differences due to irrigation were observed. When irrigation was triggered using a -15 kPa trigger throughout the growing season irrigation water use efficiency (IWUE) was reduced by 65 and 54% when compared to -30 and -60 kPa, respectively. Plots that were watered at a threshold value of -30 kPa had the greatest net return above irrigation cost in addition to the greatest IWUE. No differences in root length or root surface area were observed by irrigation treatment. Both root length and root surface area were similar from 0-30 cm in depth within the rooting zone. Root length and root surface area were both reduced at depths ranging from 30 to 45 cm and again at 45-75 cm depths when compared to the 0-30 cm depth. These data suggest that in 2018, the majority of cotton roots are in the top 30 cm of the rooting zone. Lint yield was not significantly different between any threshold value, however, these data suggest that over irrigation and reducing IWUE can lead to reductions in overall profit observed by the grower.