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. Most 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 and 2019 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 both years 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 and 18 in 2018 and 2019, respectively. 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, in the 2019, below average rainfall occurred throughout the growing season. No differences in plant height or total nodes at first bloom or first cracked boll were observed in 2018. Lint yield ranged between 843 and 1134 kg-lint ha^{-1} but no significant differences due to irrigation were observed in 2018. However, in 2019, lint yield ranged from 607 to 1129 kg-lint ha^{-1} and significant differences were observed between thresholds. A season-long threshold of -15 kPa provided the greatest lint yield compared to both the -30 and -60 kPa thresholds as well as the non-irrigated treatment in 2019. Furthermore, both the -30 and -60 kPa thresholds provided greater lint yield than the non-irrigated treatment. When data was averaged across 2018 and 2019, irrigation that was triggered using a -15 kPa threshold provided the lowest irrigation water use efficiency (IWUE) value when compared to the -30 and -60 kPa thresholds where, IWUE was reduced by 56 and 50% 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. Though lint yield was greater at a threshold of -15 kPa in 2019 when compared to the -30 kPa threshold, these data suggest that over irrigation and thus reducing IWUE can lead to reductions in overall profit observed by the grower.