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The Impact of Different Irrigation Scheduling Regimes on Cotton Growth and Development

The main goal of irrigation scheduling is to obtain high and stable yields and to use water efficiently. Most of the irrigation studies have been conducted under rainfed conditions, where supplemental water was provided through irrigation if needed. There is insufficient information about the response of cotton when all water applications are completely controlled throughout the growing season. The main goal of this study was to determine the impact of different irrigation scheduling regimes under dry conditions on cotton growth and development. Two experiments were conducted at the rainout shelters of the Griffin Campus of the University of Georgia. The four rainout shelters corresponded to four different irrigation threshold (IT) treatments, including 30%, 40%, 60%, and 90% and variable irrigation management depths according to the development of the crop. The irrigation event was triggered when the soil water content in the irrigation management depth dropped below the specified IT. The CSM-CROPGRO-Cotton model was used to define the IT treatments by estimating the timing of irrigation and the amount of water to apply. The model requires daily weather data, including maximum and minimum temperature, solar radiation and precipitation as input. Thus, actual weather data were used until the current date and the daily weather data of past 10 years were used to project until the end of the growing season. The cotton cultivar DP 555 BG/RR was planted on May 19th in 2004 and on May 17th in 2005. Growth analysis, including leaf area index (LAI), plant height and dry matter accumulation was conducted every 18 days approximately. Yield and yield components were obtained at final harvest. For the experiment conducted in 2004, yield (seeds plus lint) ranged from 1,981 kg ha⁻¹ for the IT of 40% to 2,963 kg ha⁻¹ for the IT of 60%. The maximum LAI and the highest dry matter at harvest were observed for the treatment with the IT of 60% which corresponded to a total of 450 mm of water applied during the growing season. For the 2005 experiment, low values for LAI were found for the IT of 30 and 40%, while the highest values were found for treatments of 60 and 90% IT. The study showed that the dynamic crop growth model CSM-CROPGRO-Cotton can be a promising tool for irrigation scheduling. However a variable irrigation management depth should be used and a correct characterization of the soil properties is needed.

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