TARGETED DEFICIT IRRIGATION TO PROMOTE EFFICIENT USE OF SOIL MOISTURE AND HIGH YIELD IN COTTON

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Abstract

Texas is the largest producer of cotton in the U.S. and water for irrigation is increasingly limited. Producers need irrigation strategies that efficiently leverage precipitation and stored soil moisture with irrigation water inputs. We hypothesized that elimination of early-season (0 – 4 weeks after planting) and mid-season (8 – 12 weeks) irrigation would promote efficient use of precipitation and stored soil moisture through enhancements in root growth, giving yields similar to continuously irrigated cotton. Our treatments included a continuously irrigated control, a dryland control, and a treatment following the deficit irrigation strategy just outlined. In the first year of the study, lint yield of the well-watered crop was 1.33 Mg ha^{-1} and dryland yield was 0.884 Mg ha^{-1}, meaning that irrigation increased yield by 51%. At 1.27 Mg ha^{-1}, the cotton crop that was watered according to the deficit irrigation strategy produced just 5% less cotton lint than the well-watered crop, but with 50% as much irrigation input. We are unable to confirm if the results were associated with differences in root growth or function, as root quantification on soil samples extracted from the field was unsuccessful. Data collected on soil moisture suggested that more moisture was extracted in the mid-season by the crop given irrigation deficit relative to the controls, including the dryland control. The preliminary results indicated that lint yields similar to continuously watered cotton could be achieved by elimination of early-season and mid-season irrigation and suggested that this was related to greater efficiency in soil moisture extraction with targeted deficit irrigation.