GROWTH STAGE SPECIFIC IRRIGATION SCHEDULING AND YIELD RESPONSE IN THE OKLAHOMA PANHANDLE

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Abstract

The Great Plains region is a relatively new cotton production area that over the past five years has accounted for 12% of the total U.S. upland cotton production (USDA, NASS, 2017-21). This area consists of south central and southwestern Kansas, the Oklahoma panhandle, and the High Plains region of Texas. Oklahoma falls in the center of this great plains region, making research findings here applicable to the Kansas and Texas regions. Typical conditions in the Great Plains region consist of low seasonal rainfall (Texas Almanac, 2020, Oklahoma Mesonet, 2018-19, Kansas State University, 2020) and reduced seasonal heat units (Howell et al. 2004). Because of the low rainfall, producers are forced to use supplemental irrigation practices that source from the declining Ogallala Aquifer (Colaizzi, et al., 2004; McGuire, 2017). While overhead irrigation is the most common, subsurface drip irrigation has become popular since it can be the most efficient in season water application (Bordovsky, et al., 2008). Cotton producers in short season environments must capitalize on a short window of heat units to ensure a profitable crop. In arid environments such as the Oklahoma panhandle, avoiding water stress is key to mitigating environmental factors of this region that may result in delayed maturity and yield loss. Variety selection and irrigation management are critical to overcoming these challenges. The objective of this study for 2020 and 2021 is to evaluate subsurface drip irrigation strategies for early maturity cotton in a short season environment and quantify the plant growth and yield response to growth stage specific drip irrigation based on percentage evapotranspiration (ET) replacement values. An additional objective was to determine a viable drip irrigation schedule utilizing ET values for producers in this region, attaining values from the Mesonet irrigation planner (Oklahoma Mesonet Irrigation Planner, 2021).

This experiment was located at the Oklahoma Panhandle Research and Extension Center in Goodwell, Oklahoma. The treatments included irrigation zones of 24 rows spaced 76 cm apart, with the center 16 rows separated into four four-row subplots consisting of four different varieties. The outer four rows on either side of each zone were utilized as borders between irrigation treatments. There were four irrigation treatments evaluated in 2020, all receiving 10.7 cm of pre-plant irrigation: 90% of ET replacement (90% ET), 36% of ET replacement (36% ET). 90% during squaring, 63% during bloom ET replacement (90/63% ET), and 63% of ET replacement (63% ET). In 2021, there was 3.6 cm of preplant irrigation applied, using the same four irrigation treatments with the additional fifth treatment of 63% of ET replacement, no pre water (63% ET NP). The varieties included NexGen® 3930 B3XF (NG 3930), Stoneville® 4480 B3XF (ST 4480), Dyna-Grow® 3385 B2XF (DG 3385), and Deltapine® 2012 B3XF (DP 2012). Plots were 101 m in length by 3.04 m, with three replications. The data collected consisted of taking plant heights at eight leaf (8 lf), first bloom (FB), 2-, and 4-weeks after FB, while the number of nodes above the uppermost first position white flower (NAWF) was quantified at FB, 2-, and 4-weeks FB. Data for both measurements was collected on seven random and representative plants per plot. The whole plots were harvested with a 6 row John Deere 7460 Stripper, and lint yield

was determined after ginning on a 20 saw Eagle Gin in Stillwater, OK. A 100g lint sample was sent for grading and HVI quality testing at the Texas Tech University Fiber and Biopolymer Research Institute in Lubbock, TX. Experimental design was in a split-plot. Our data was analyzed by SAS subjected to analysis of variance (ANOVA) using Proc Mixed in SAS V.9.4. Means separated using Fisher s Protected LSD at ± = 0.05.

Excessive rainfall during the reproductive period in 2020 resulted in weekly water received values exceeding targeted amounts throughout the squaring and bloom stages. While variety did influence plant growth characteristics, there was no impact from the irrigation treatments. Irrigation also had no effect on lint yield, although there was a variety effect with DG 3385 and NG 3930 resulting in greater yields than DP 2012 and ST 4480 across all irrigation treatments. In 2021, despite lower rainfall during reproductive growth, relative to 2020, there was minimal impact on plant growth and yield as a result of the irrigation treatments. The impact of variety on plant growth and yield was similar to 2020. Varieties that exhibited earlier maturing characteristics, DG 3385 and NG 3930, were the highest yielding varieties. In conclusion, over both years irrigation treatments had no effect on cotton performance in either year, while variety differences did impact plant growth and yield. Variety selection in an irrigated short season environment is critical, even among varieties within the same advertised maturity category there can be significant variation in performance. Additional years of this study will be required to further identify optimal irrigation strategies in response to varying seasonal conditions and irrigation delivery methods.

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