Abstract/Introduction

Important steps for producers after establishing a good plant stand are to promote healthy root development and canopy growth. A type of irrigation management strategy called Primed Acclimation aims to limit water availability early in the growing season to promote root development, which potentially helps prepare plants for episodic drought in years with limited water. Recent advances in continuous and remote soil moisture monitoring will allow for a more definitive assessment of 1) the utility of the primed acclimation strategy and 2) the thresholds needed to achieve the maximum benefit from this strategy. Consequently, the UGA Smart Sensor Array (SSA) was used to trigger irrigation events at predetermined soil water potential readings prior to all irrigation events triggered at -35 cb following the first week of bloom. Field physiological data such as plant height and total nodes was collected biweekly, while remote sensing data were collected weekly and included Normalized Difference Vegetation Index (NDVI), and aerial RGB photography.

Objectives/Materials and Methods

We sought to demonstrate the potential usage of the UGA SSA to apply the Primed Acclimation irrigation strategy and to evaluate multiple irrigation thresholds pre-bloom to maximize Water Use Efficiency (WUE).

Field experiments were conducted in Camilla, GA during 2014 and 2015. The experiment was conducted using a Split Plot Design with 4 replications. Treatments: 1 Cotton Cultivar: FiberMax 1944GLB2 35 cb pre-bloom, FiberMax 1944GLB3 70 cb pre-bloom, FiberMax 1944GLB4 9.9 cb pre-bloom, 4 prebloom irrigation triggers: T1 - (0 cb pre bloom), T2 - (40 cb pre bloom), T3 - (70 cb pre bloom), and T4 - (100 cb pre bloom) 1 trigger at first bloom - (35 cb)

Remote sensing measurements and Agronomic Measurements were collected throughout the season Treatment effects evaluated via 2-way ANOVA with a random blocking factor. Post-hoc analysis was done using Fisher’s LSD (p<0.05).

Results

Cotton yields were not significantly different among treatments receiving irrigation. (Figure 1, A-2014, B-2015) However environmental conditions varied across the two years (Figure 5, A-C-2014, B-D-2015). Increased irrigation thresholds decreased water usage while maintaining yields. (Figure 6) Plant growth patterns were influenced by irrigation. However, irrigation treatments did influence boll distribution patterns. Dryland treatments were heavily negatively affected in 2014. (Figure 8, A-T1, B-T2, C-T3, D-T4, E-T5) Boll distribution was distributed among the most nodes and positions utilizing the highest prebloom threshold in 2014. (Figure 8, A-T1, B-T2, C-T3, D-T4, E-T5)

Dryland treatments were also negatively affected in 2015 (Figure 9, A-T1, B-T2, C-T3, D-T4, E-T5). Boll distribution was similar regardless of applied prebloom irrigation in 2015. (Figure 9, A-T1, B-T2, C-T3, D-T4, E-T5).

Conclusions

- T4 and T3 irrigation treatments resulted in similar application amounts with a %17 reduction in applied irrigation compared to T1 when fully irrigated.
- Sensor-based primed acclimation irrigation strategies exhibited water savings without a yield penalty.
- NDVI as well as RGB imagery parameters demonstrated no significant differences between irrigated treatments (Figure 3, 4, 10, 11).
- Irrigation events triggered prebloom were four fold greater for T1 than the higher Primed Acclimation thresholds.
- Irrigation amounts and events were not significantly different even with the reduced prebloom irrigation for Primed Acclimation treatments (Figure 6).
- Crop yields were not significantly different among treatments receiving irrigation.
- Irrigation events triggered prebloom were four fold greater for T1 than the higher Primed Acclimation thresholds.
- Irrigation amounts and events were not significantly different even with the reduced prebloom irrigation for Primed Acclimation treatments (Figure 6).
- Plant growth patterns were influenced by irrigation. However, irrigation treatments did influence boll distribution patterns. Dryland treatments were negatively affected in 2014. (Figure 8, A-T1, B-T2, C-T3, D-T4, E-T5)
- Boll distribution was distributed among the most nodes and positions utilizing the highest prebloom threshold in 2014. (Figure 8, A-T1, B-T2, C-T3, D-T4, E-T5)
- Dryland treatments were also negatively affected in 2015 (Figure 9, A-T1, B-T2, C-T3, D-T4, E-T5).
- Boll distribution was similar regardless of applied prebloom irrigation in 2015. (Figure 9, A-T1, B-T2, C-T3, D-T4, E-T5).

Future research should be under taken to determine if Primed Acclimation irrigation strategies could utilize higher trigger points than the -100 cb trigger for higher water savings. Experiments should also be repeated under a more severe environment to observe if this irrigation strategy can be implemented whilst the cotton crop is blooming (i.e., if the strategy could be implemented during the first week of bloom with no yield loss).

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References