MANAGEMENT OF COTTON USING SUBSURFACE DRIP IRRIGATION

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Introduction

Subsurface drip irrigation (SSDI) can be used to achieve excellent yields in cotton in cases where water is a limiting factor. The technology is already used in vegetable production in Georgia, and a few producers are testing the efficacy of using SSDI as an alternative to center pivots in oddly shaped fields that would be not suitable for center pivot irrigation. Irrigation water is commonly applied using overhead sprinkler irrigation systems, which are currently used on approximately half of Georgia cotton acreage. However, negative impacts on fruit retention and changes in fruit distribution have been observed due to overhead irrigation. Jared Whitaker showed in his Master's degree research at the Stripling Irrigation Research Park that the more compact fruiting due to subsurface drip irrigation (SSDI) management can produce high yield and high quality cotton. However, his research focused on one cultivar, DP488BR, which is no longer on the market. The study was also limited to one irrigation rate for overhead irrigation.
In 2010, the University of Georgia began a partnership with the USDA National Peanut Laboratory in Dawson, Georgia, to expand the testing of subsurface drip irrigation in cotton. The bulk of the startup money for this project came through earmark money, most of which was used to pay for installation of the drip irrigation systems that were installed in Camilla, Georgia and in Midville, Georgia.

The initial measurements in 2010, while based on late planted cotton that received irrigation late in the season, suggested both a variety interaction and an increased yield for the drip irrigation methods. The project was quite large, with almost 200 plots established in Camilla. In 2011 the project was expanded, with plots in Midville operational and the plots in Camilla ongoing. The 2011 project narrowed the focus to two varieties subjected to multiple irrigation strategies. The results of the 2011 project revealed useful information for irrigation management in both SSDI and Overhead systems.

Calvin Meeks, a current graduate student under the direction of Dr. Collins, is using this project as his primary thesis research, and has presented the 2011 results at the 2012 Beltwide Cotton Conferences.

Materials and Methods

Research conducted in 2011 utilized SSDI at two depths (2 inch and 12 inch), two rates (65% and 100% of the UGA weekly chart recommendations), two irrigation trigger points (-40 cb and -70cb) for both OVHD and SSDI systems, and with two cultivars (the full-season DP1050 B2RF, and shorter-season FM1740 B2F). This research has two objectives:

1. Identify the growth, yield, and fiber characteristics of cotton subjected multiple subsurface drip and overhead irrigation strategies.
2. Comparing growth, maturity characteristics, yield distribution, and quality under subsurface drip irrigation in multiple environments.
3.

Plant heights and nodes above white bloom data were collected every other week as a measure of plant growth and maturity. Mapping of boll distribution was collected prior to harvest. Lint yield and HVI fiber quality were collected after ginning was conducted at the UGA Microgin.

Results

All irrigation systems and treatments improved yields when compared to dryland (Figure 1). Higher yielding treatments, ranging from the Shallow SSDI irrigated according to 100% of the UGA checkbook down to Shallow SSDI irrigated according to 65% of the UGA checkbook, yielded statistically similar, when pooled across varieties. In general, the -70cb trigger allowed for significant stress resulting in yield loss, when pooled across the two varieties (Figure 1). Yields were generally similar in overhead and SSDI systems. When pooled over the Camilla and Midville locations, data suggests that FM 1740 B2F may have a yield advantage over DP 1050 B2RF when irrigated with most SSDI treatments (Figure 2). Data also suggest that similar yields between the two varieties were only achieved when DP 1050 B2RF was irrigated when triggered at -40cb and FM 1740 B2F was irrigated when triggered at -70cb (Figure 2). In general, the -40cb trigger point minimized water stress for both varieties compared to the -70cb trigger which allowed for more stress to be encountered between irrigations (Figure 2). At both locations, data suggests that DP 1050 B2RF may be more tolerant to water stress, as indicated by similar yields for this variety between the 65 % and 100 % UGA checkbook methods, whereas there was a positive yield response for FM 1740 B2F associated with increased irrigation amounts (Figure 2). In some situations, FM 1740 B2F, obviously less tolerant to water stress, may respond better to shallow versus deep SSDI (Figure 3). This research shows that SSDI is a viable irrigation system for Georgia and that SSDI could increase yields if installed in fields where OVHD is impractical such as oddly shaped small fields, despite significant rainfall. Additionally, this research demonstrated that the current UGA weekly irrigation recommendations resulted in the highest yields in the Camilla trial (Figure 1). Data suggests that deficit irrigation may be feasible for some varieties, however this will need to be confirmed through subsequent research when significant water stress is encountered during the bloom period.

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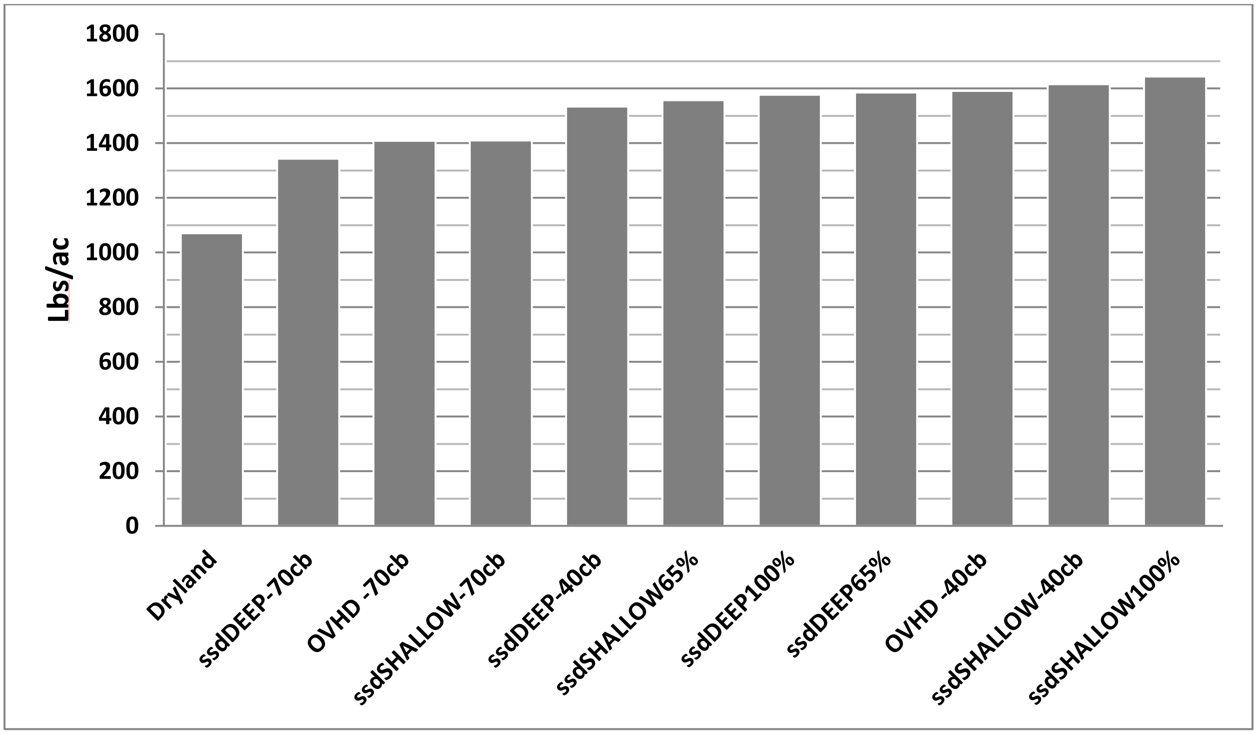

Figure 1. Lint Yield Response to SSDI and OVHD irrigation treatments in Camilla 2011.

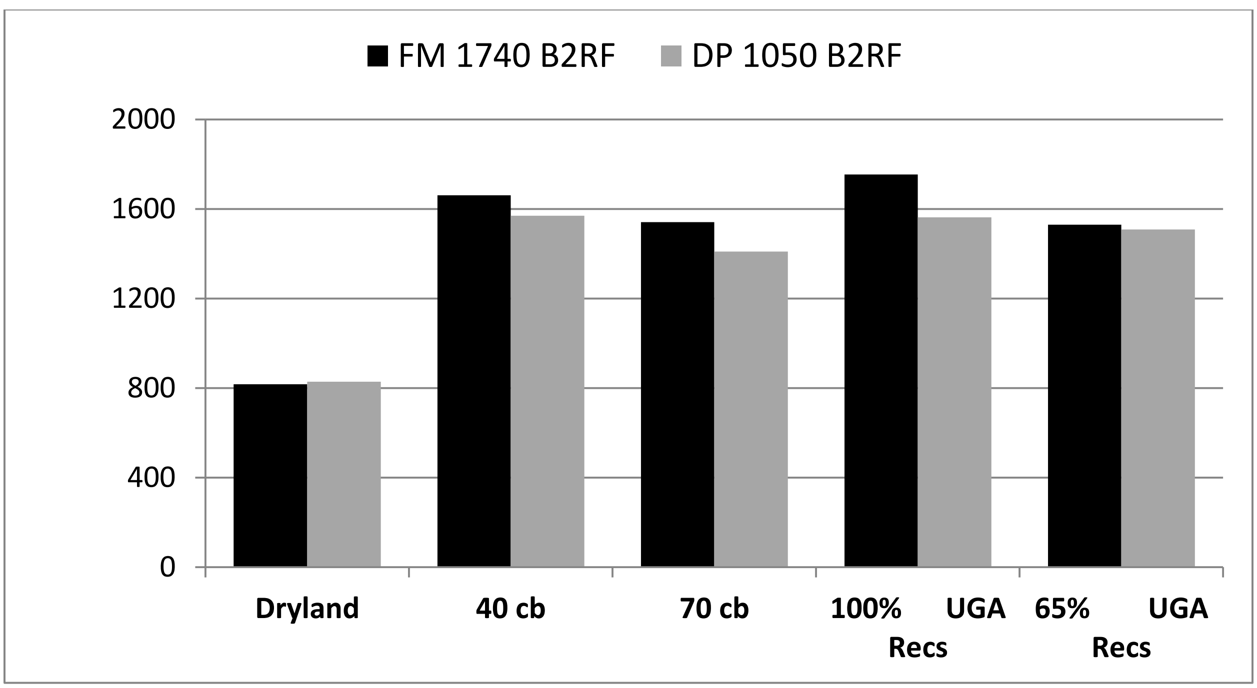

Figure 2. Lint Yield response of SSDI trigger points and irrigation checkbook in 2011 (data pooled over Camilla and Midville)

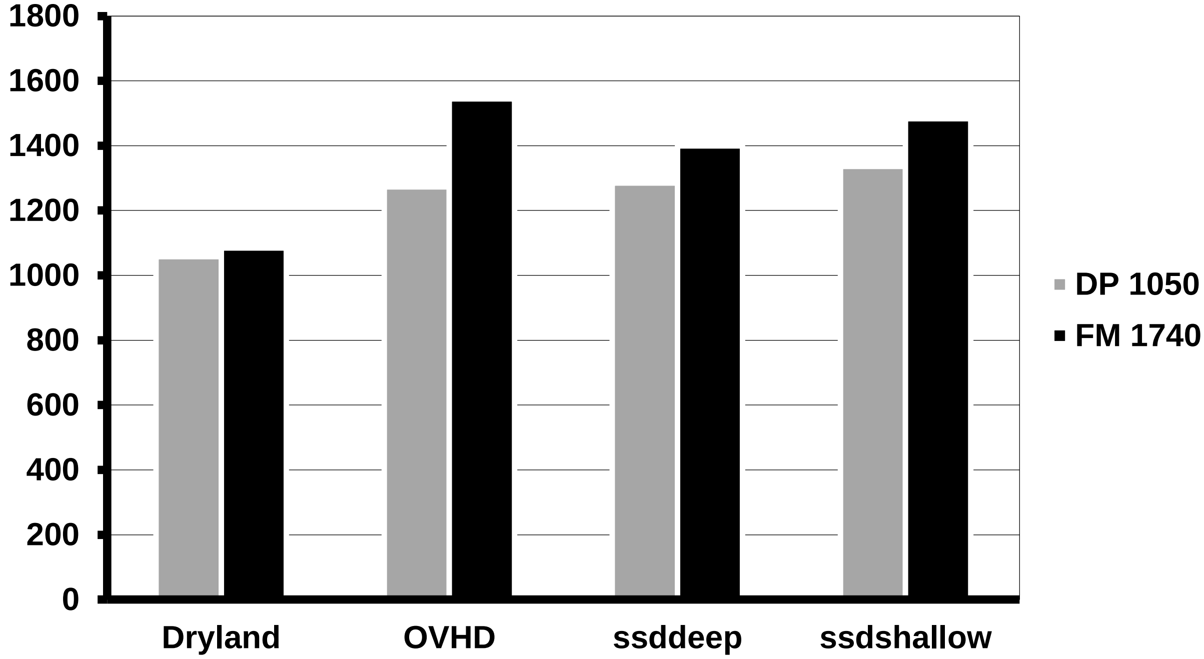

Figure 3. Variety lint yield response to depth of SSDI in 2011 (Camilla).