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EFFECT OF IRRIGATION APPLICATION DEVICES ON BOLL SET, COTTON YIELD AND FIBER QUALITY

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Abstract

Previous research concluded that water sprayed above the canopy on open flowers interrupted pollination causing flower drop and subsequent reduction in boll set and lint yield. The effect of water delivered through three different irrigation applicators (spray above canopy, spray below canopy and LEPA or drag socks) on boll set, lint yield and fiber quality of irrigated cotton was evaluated. Lint yield and the average number of bolls per plant were not affected by the type of applicator used ($P<0.05$, LSD). However, lint yield was 9.9% less in the spray above canopy applicator treatment than the spray below canopy and LEPA treatments. The type of applicator used did not affect fiber quality.

Introduction

Two million acres of irrigated cotton are grown on the High Plains of Texas. Most of this cotton is watered by center pivots with above canopy spray nozzles. It has been documented that a reduction in flower retention occurs when open flowers are wetted by overhead irrigation (Pennington and Pringle, 1987 and Burke et al., 2001). It was also found that the time of day that watering occurred had an impact on flower retention. Burke, et al. (2001) reported an 80% flower loss with flower wetting from 10 a.m. to 4 p.m. while Pennington and Pringle (1987) found a 35% loss when cotton was irrigated in the morning. As a result of reduced flower retention, yield reductions of 2% (Pennington and Pringle, 1987) to 36% (Burke, et al., 2001) were reported. The purpose of this experiment was to note the effect of three commonly available irrigation applicators on boll set, lint yield and fiber quality on fully irrigated cotton.

Materials and Methods

This experiment was performed during the growing season of 2001 at the Texas Agricultural Experiment Station in Halfway, Texas. Cotton was irrigated by a center pivot with drag socks at an irrigation level of 100% reference ET according to the irrigation protocol developed by Bordovsky and Lyle (1996). Applicator treatments consisted of applying 0.3 inches of water per pass with 1) spray applicators located 38 inches above the bottom of the furrow (spray-above canopy), 2) spray applicators located 12 inches above the bottom of the furrow (spray-below canopy), and 3) drag sock type applicators (LEPA). These treatments were compared to a control treatment consisting of irrigated cotton with no additional applications of water. A randomized complete block design with four replicates was used. Blocks were divided into treatment plots measuring 6 rows by fifty feet. Water in each applicator treatment was applied three times per week for a total of fourteen applications per plot from initial bloom (July 17) through flowering (August 17, 2001). All applicator treatments were applied from 9 a.m. to 3:30 p.m. using a pivot simulator (Figure 1). Senninger 360 Super Spray nozzles with convex grooved pads were used for the spray applicator treatments. Fertilizer applications were based on soil analysis results of samples taken before planting. Paymaster 2200RR was planted at 13.5 pounds per acre on May 16, 2001. Before harvest, representative plants from each replicate of each treatment were collected and mapped (Landivar and Hickey, 1997). Cotton samples were hand-harvested from a 0.002-acre section in the middle of each treatment plot and ginned to determine lint yield. Yield estimates were calculated from these results.

Results

Table 1 summarizes the times and the amount of water applied to the treatment plots through applicator treatments, irrigations, and rainfall which may have affected the cotton boll set during the growing season. An attempt was made to fully irrigate all treatments using 14.4 inches of water in a growing season where only 3.3 inches of rainfall occurred. The irrigation applicator treatments resulted in an additional 4.2 inches of water being applied.

No significant differences were found in either lint yield or the average number of bolls per plant due to the applicator treatments ($P<0.05$, LSD, Table 2). All water applicator treatments resulted in higher lint yields than the control. This increase may have been due to the extra 4.2 inches of water applied during the flowering period through the applicator devices used for the treatments. Lint yield in the spray-above canopy treatment was 9.9% less than the spray-below canopy and the LEPA applicator treatments. The micronaire readings were not significantly different between treatments and fell into the premium range of 37–42 with the exception of the control which fell into the lower base range category of 43-49 (Reed,

2002). No differences (P<0.05, LSD) were found between treatments in the length or strength measurements. Boll distribution among the fruiting branches was similar for all treatments (Figure 2). The majority of bolls were produced on the third through ninth fruiting branches.

Conclusion

The results from the first year of this study indicate that irrigations applied using above canopy spray applicators during flowering did not significantly reduce yield in fully irrigated cotton. There was, however, a 9.9% numerical reduction in yield. The type of applicator used did not affect fiber quality.

References

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Table 1. Water quantities (inches) applied to treatment plots through rainfall, irrigation and irrigation application devices during the 2001growing season.

Date	Time of application	Treatment	Rainfall	Irrigation
May 19 thru Jul 16			1.4	4.4
17-Jul	9:30am-2:00pm	0.3		0.4
18-Jul	9:00am-3:45pm	0.3		0.4
19-Jul				0.8
20-Jul	9:30am-2:00pm	0.3		
21-Jul				0.8
23-Jul	9:15am-12:45pm	0.3		
24-Jul				0.4
25-Jul	9:15am-12:45pm	0.3		
26-Jul				0.4
27-Jul	9:30am-12:45pm	0.3		
29-Jul				0.8
30-Jul	9:15am-12:15pm	0.3		
31-Jul				0.4
1-Aug	9:15am-11:45am	0.3		
2-Aug				0.8
3-Aug	11:00am-2:45pm	0.3		
4-Aug				0.8
5-Aug				0.4
6-Aug	10:30am-2:30pm	0.3		
7-Aug				0.4
8-Aug	9:30am-12:45pm	0.3		
9-Aug	9:15am-3:30pm	0.3		0.4
10-Aug			0.4	0.8
11-Aug				0.4
13-Aug			0.3	
15-Aug	9:30am-12:45pm	0.3		
17-Aug	9:30am-12:45pm	0.3		
Aug 18 thru Sept 4			1.2	1.6
	Total	4.2	3.3	14.4

Table 2. The effect of irrigation applicators on lint yield, average number of bolls per plant, micronaire, strength and length of cotton fiber.

Treatment	Yield (lb./acre)	Average Number of Bolls Per Plant	Micronaire	Strength (grams per tex)	Length (inches)
Control	1132.7 a	6.1 a	43 a	30.6 a	1.1 a
Spray- above canopy	1197.8 a	7.2 a	38 a	30.4 a	1.1 a
Spray – below canopy	1329.7 a	7.5 a	37 a	30.4 a	1.1 a
LEPA	1329.2 a	7.2 a	37 a	31.2 a	1.1 a

Means within a column followed by the same letter are not statistically different (P<0.05, LSD).

Figure 1. The pivot simulator used to administer treatments of water through three irrigation applicators.

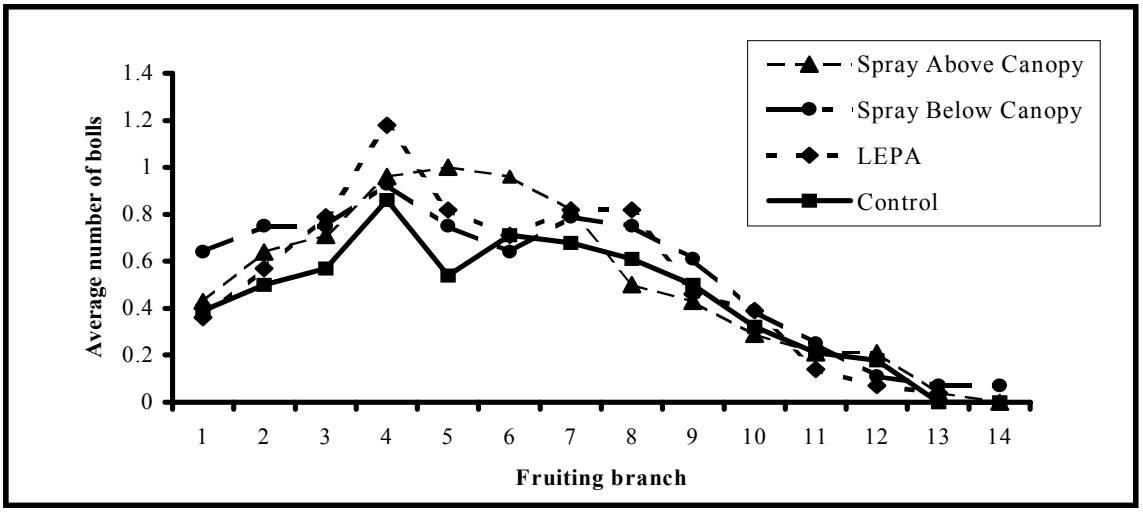

Figure 2. The effect of three different irrigation applicator devices on the average number of bolls per fruiting branch.