IRRIGATION SCHEDULING AND FERTILITY REQUIREMENTS FOR NORTH ALABAMA COTTON

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Abstract

A field study was initiated in 1997 to evaluate the response of cotton (*Gossypium hirsutum)* to varying rates of irrigation and fertility. The test was conducted on a Decatur silt loam (Rhodic Paleudult) in North Alabama. Irrigation scheduling was based on the MOISTCOT (Moisture Management and Irrigation Scheduling for Cotton). Four irrigation regime capabilities consisted of: no irrigation, irrigation on demand, 1-inch water wk^{-1}, and 2 inches water wk^{-1}. Fertility treatments included preplant and sidedress applications of N. Two foliar treatments (4.4 lbs K ac^{-1} plus 5 lbs N ac^{-1} or 4.4 lbs K ac^{-1}) were applied four times, beginning one week after first white bloom. In 1997, irrigation and the interaction between irrigation and fertility treatments affected seed cotton yields. In 1998, significant differences arose from irrigation treatments, fertility treatments, and the interaction between irrigation and fertility treatments. In the standard nitrogen fertility treatments, applying 1-inch water wk^{-1} increased seed cotton yields by an average of 1546 lbs ac^{-1} as compared to the non-irrigated treatment. Irrigation on demand resulted in a slight reduction in seed cotton yield.

Introduction

In 1997 and 1998, 535,000 and 460,000 acres (respectively) of cotton were planted in Alabama. Irrigation in Alabama is typically provided through a center pivot system. Research has been conducted across the Cotton Belt to evaluate the response of irrigated cotton to varying levels of nitrogen and water, as these are the two major inputs of a cotton crop. This type of research has not been conducted in Alabama and is the basis for this particular experiment. The test is located in North Alabama where more than 50% of the state's cotton production occurs. In recent years, an increased number of cotton producers in North Alabama have expressed an interest in irrigation. With this increased interest in irrigation and new developments and technology, including genetically altered cotton and global positioning systems that allow for precise nutrient application systems, it is essential that irrigated cotton fertility requirements be studied in this area of Alabama. The primary objective of this study was to evaluate the response of cotton to varying rates of irrigation on a Limestone Valley soil. A second objective was to evaluate nitrogen and potassium requirements for cotton grown on a Limestone Valley soil under irrigated conditions.

Materials and Methods

A field study was conducted at the Tennessee Valley Substation (Belle Mina, AL) on a Decatur silt loam. Treatments consisted of four irrigation regime capabilities, which were applied in combination with six fertility treatments. The four irrigation regime capabilities consisted of 1) no irrigation, 2) irrigation on demand, 3) 1-inch water wk^{-1}, and 4) 2 inch water wk^{-1}. All irrigation scheduling was based on the MOISTCOT computer program, which utilizes Watermark (granular matrix sensors) sensors to obtain soil moisture data. Fertility treatments included the standard N recommendations for non-irrigated and irrigated cotton in North Alabama, a high rate of N applied preplant, supplemental N applied as a sidedress, and treatments receiving foliar applications of K with and without N. Sidedress applications of nitrogen were applied at first square. Foliar treatments (4.4 lbs K ac^{-1} + 5 lbs N ac^{-1} or 4.4 lbs K ac^{-1}) were applied beginning one week after first bloom. The foliar treatments were applied every 10-14 days for a total of four applications. The effectiveness of the foliar treatments was evaluated by analyzing petiole tissues for NO_3^- and K^+ and leaf tissue for K^+ (potassium data is not presented). The four center rows of each plot were picked with a spindle picker for the determination of seed cotton, lint yields and lint quality.

Results

Petiole nitrate concentrations were significantly affected by the irrigation treatments in 1997 and 1998 (data not shown). Fertility treatments, however, did not have a consistent effect on petiole nitrate levels. In 1997, irrigation treatments and the interaction between irrigation and fertility treatments significantly affected yield with the bulk of the differences arising from the second harvest (Table 1). In 1998, significant differences in yield occurred due to irrigation treatments, fertility treatments, and the interaction between irrigation and fertility treatments (Table 2). In both years, the greatest response to the fertility variables was observed in the non-irrigated treatments. Without irrigation, applying foliar K or a higher rate of N increased yields. Only minor differences were observed among fertility variables for the irrigation treatments. Preliminary results suggest that optimum seed cotton yields were obtained when the standard nitrogen recommendation of the Auburn University Soil Testing Laboratory for irrigated cotton was applied in combination with an irrigation rate of 1-inch or 2-inch water wk^{-1}.

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Table 1. Interaction of irrigation X fertility variables on seed cotton yields, 1997.

	No Irrigation	Water on Demand	1 inch water wk^{-1}	2 inch water wk^{-1}
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Check	2271	3673	3717	3884
Foliar K	2257	3795	3901	3855
Foliar N + K	2579	3622	3889	3787
High N Rate	3130	3762	3632	3612
Sidedress N	2865	3530	3831	3924

$LSD_{(0.10)}$ =376 lbs ac^{-1}

Table 2. Interaction of irrigation X fertility treatments on seed cotton yields, 1998.

	No Irrigation	Water on Demand	1 in water wk^{-1}	2 in water wk^{-1}
	----------------------------	----------------------------	lbs ac^{-1}	------------------------
Check	2195	3720	3917	3724
Foliar K	2592	3948	4086	3776
Foliar N + K	2497	3853	3446	3602
Pix	2781	3789	3687	3082
High N Rate	3022	3773	3996	3561
Sidedress N	2621	3749	3901	3609

$LSD_{(0.10)}$ =335 lbs ac^{-1}