Final Irrigation Timing 2005 – Using COTMAN to Make Crop Termination Decisions

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RESEARCH PROBLEM

Earlier termination of irrigation could help conserve water resources and benefit producers by reducing irrigation costs. Eliminating unnecessary late irrigation could reduce lush fall crop growth that makes defoliation more difficult and costly and delays harvest operations. In the first year of research at the new Judd Hill Foundation Cooperative University Research Center, our focus was to address the following question: Does the timing for the final furrow irrigation occur at a similar crop stage as that for insecticide termination—Cutout + 350 DD60s—or will prolonged irrigation produce higher yields?

BACKGROUND INFORMATION

Cotton growers across the Cotton Belt have adopted COTMAN crop termination guidelines to aid in end-of-season crop management. Research-based recommendations are used for termination of insecticides and application of defoliants based on physiological cutout. A recommendation that relates the timing of the final irrigation to physiological cutout should better fit the needs of the crop and fit the approach taken with other management recommendations.

RESEARCH DESCRIPTION

The experiment was carried out on the Judd Hill Plantation near Trumann, Ark. The latest possible cutout dates for this production area—that date with a 50% or 85% probability of attaining 850 DD60s from cutout—are 9 August and 31 July, respectively (Danforth and O’Leary, 1996). The five irrigation termination treatments are listed in Table 1. The experiment was arranged in randomized complete block with 5 treatments and 3 replications. Plots were 500- to 620-ft long and 6 rows wide. There were 4 rows separating plots. Plots were furrow-irrigated on 1, 8, 17, 23 June; 1, 21, 28 July; and 4, 11, and 18 August.

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Cotton (*Gossypium hirsutum* L.) cultivar Stoneville 5242 RBG was planted on 4 May at a seeding rate of 3 to 4 Cruiser-treated seeds/ft in rows spaced 38 inches apart. Plants were monitored in each plot from the early squaring period through cutout using the COTMAN™ crop monitoring system (Danforth and O’Leary, 1998). Two sets of five consecutive plants in the center rows were monitored weekly. Sampling included measurement of plant height, number of sympodia, and presence or absence of first-position squares and bolls. Applications of Bidrin 8 were made on 26 May (3.2 oz/acre for thrips) and 26 July (6 oz/acre for tarnished plant bugs). A single application of Baythroid 2 (2.5 oz/acre) was made 4 August for fall armyworm. Harvest-aid chemicals for defoliation and boll opening were applied 6 Sept (Finish 6, 1 qt/acre) and 16 Sept (Ginstar, 4 oz/acre). Defoliants were applied at 1024 DD60s after cutout. Rows 3 and 4 of each plot were machine-harvested using a 2-row picker on 20 Sept. Fifty boll samples taken from consecutive plants were collected at harvest and submitted to the International Textile Center at Texas Tech University for HVI fiber-quality determinations. All crop, insect monitoring, and yield data were analyzed using AOV with means separation using LSD.

**RESULTS AND DISCUSSION**

COTMAN growth curves show that first squares appeared for all treatments just prior to the target of 35 days after planting (Fig. 1). Sympodial development was comparable to the COTMAN standard curve through the season; plant structure at the time of first flower was lower than the standard curve, ranging from 7.4 to 8.3 main-stem sympodia compared to the standard curve value of 10.25. Plants in all treatments reached physiological cutout (mean NAWF=5) on 22 July, 80 days after planting. Irrigation timing did not affect days to cutout (Table 1). Lowest mean lint yield was observed when irrigation was terminated on 21 July, the week of physiological cutout (Fig. 2). Mean yields were 66 to 173 lb greater when additional irrigations were made after cutout (P=0.08). No significant differences were observed among treatments for fiber quality from 50 boll samples taken at the time of harvest (Table 2). There was no further increase if irrigation was extended to 600 DD60s after cutout.

For the past 5 years, Cotton Incorporated has funded research in the mid-South focused on crop monitoring with COTMAN to time the final irrigation (Vories and Glover, 2000; Vories et al., 2001, 2002, 2003, 2004; Teague et al., 2005). In 2001, only two of the eight studies in 3 states (Mo., Ark., La.) had yield response to late irrigation. In the two cases where yield differences were significant, the differences for southeast Arkansas were observed later in the growing season (after 20 days or 470 DD60 after NAWF=5) than for northeast Arkansas (where no differences were observed with irrigation later than 11 days or 220 DD60 after NAWF=5). Eleven irrigation studies were conducted in five states (Mo., Ark., La., Texas) during the 2002 growing season to investigate the response to late-season irrigation. In the mid-South, only five of the ten studies could be completed due to rain interference, and only one of the five showed significant differences in cotton yield with later irrigation. The rest showed no yield or quality response to irrigation after cutout. In a trial conducted at Marianna, Ark., in 2002, a significant benefit was observed if irrigation was extended from NAWF=5+
250 to include an irrigation at NAWF=5 + 350, but no benefit was observed with final irrigation at NAWF=5 + 500 DD60s. When the test was repeated in 2003 and 2004, there were no differences in yield among irrigation-termination treatments (Teague, unpublished). In a different replicated test at Marianna in 2004, there were yield penalties for suspending irrigation before NAWF=5+350 DD60s, but no benefit to extending irrigation out to NAWF=5+600 DD60s (Teague et al., 2005).

In the 2005 season at Judd Hill, there was a distinct dry period in August followed by rainfall in late season after irrigation-termination treatments were applied (Fig. 3). There was no yield penalty observed with terminating irrigation at 272 DD60s after cutout compared to 430 and 600 DD60s.

**PRACTICAL APPLICATION**

The current COTMAN recommendation in Arkansas for terminating insecticides is to control insect pests such as bollworms and tarnished plant bugs until the last effective boll population has accumulated 350 DD60s; new infestations that occur after that time can be ignored. Results from this study and others from northeast Arkansas indicate that similar timing—cutout +350 DD60s—may be appropriate for the final irrigation. This research will be repeated in 2006 at Judd Hill as part of an ongoing mid-South effort to produce a regionally acceptable recommendation for irrigation termination.

**ACKNOWLEDGMENTS**

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**LITERATURE CITED**


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<th>Date of final irrigation</th>
<th>Days after planting</th>
<th>Crop maturity status at final irrigation</th>
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<tr>
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<td>78</td>
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<tr>
<td>28 July</td>
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<td>04 August</td>
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<td>11 August</td>
<td>99</td>
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<tr>
<td>18 August</td>
<td>106</td>
<td>NAWF = 5 + 600DD60s</td>
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\(^{\circ}\) Furrow irrigation dates: 1, 8, 17, 23 June, 1, 21, 28 July, and 4, 11, and 18 August.

\(^{\circ}\) Mean date when plants reached mean NAWF = 5 was 22 July.
Fig. 1. COTMAN standard curve and crop growth curves of plants with different final dates of irrigation. The mean date of physiological cutout was 22 July, 80 days after planting.
Fig. 2. Mean lint yields (±SE) from furrow-irrigation termination trial at the Judd Hill Plantation University Farm, 2005 (P>F=0.08 – AOV).

Date of Final Irrigation

Heat Units after Physiological Cutout (NAWF=5)

Fig. 2. Mean lint yields (±SE) from furrow-irrigation termination trial at the Judd Hill Plantation University Farm, 2005 (P>F=0.08 – AOV).