WHOLE-FARM EVALUATION OF THE BOLLMAN COMPONENT OF COTMAN

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RESEARCH PROBLEM

Unstable cotton prices and inconsistent yields have required cotton producers to better manage production costs. The BOLLMAN component of COTMAN, a computer-aided cotton management program, utilizes Nodes-Above-White-Flower (NAWF) data to reduce production costs to improve end-of-season management. Based on crop development and heat units accumulated after cutout, COTMAN identifies when the crop has reached an insect-safe level from fruit feeders (ISL_{ff}). COTMAN, therefore, has the potential to save producers unnecessary late-season insect control costs. The objective of this study was to conduct a whole-farm evaluation of the BOLLMAN component of COTMAN, and demonstrate the potential economic benefits of utilizing the system.

BACKGROUND INFORMATION

COTMAN is a computer-aided COTton MANagement system consisting of two expert systems: SQUAREMAN, which is used to monitor pre-flower plant development, and BOLLMAN, which uses NAWF data to monitor post-flower plant development. By monitoring plant responses to environment, COTMAN allows producers to adjust management practices to better address crop needs (Bourland *et al*., 1994).

The BOLLMAN component of the COTMAN system allows producers to monitor the crop from first flower to cutout by utilizing NAWF data. COTMAN defines cutout as the flowering date of the last effective boll population (Bourland *et al*., 1992). The research of Bourland and colleagues (1992) indicated that first-position white flowers five nodes down from the plant terminal (NAWF = 5) represents the last flower population that significantly contributes to yield, and is the basis for defining cutout.

Research has further suggested that heat unit accumulation after cutout can be used to determine when a boll is no longer susceptible to insect feeding (Bagwell and Tugwell, 1992). The work of Bagwell and Tugwell (1992) showed a decline in bollworm and boll weevil damage to bolls 350 heat units after anthesis of the last effective

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flower (NAWF=5) and suggested that insecticide applications could be terminated based on heat unit accumulation past cutout. Preliminary testing has shown that upper-canopy square removal at cutout (NAWF=5) + 350 heat units results in increased boll weights lower in the canopy (Kim and Oosterhuis, 1998). That study demonstrated that plants can compensate for late-season square loss by partitioning more carbohydrates to the most economically important bolls. The use of the BOLLMAN component of COTMAN to determine when to terminate insecticide applications has shown potential for increasing farm profitability (Cochran *et al*., 1994). Therefore, the objective of this study was to demonstrate profitability of utilizing COTMAN rules on a whole farm.

RESEARCH DESCRIPTION

COTMAN demonstrations were established in 1998 on a Southeast Arkansas farm located in Lincoln County. The farm consisted of 743 acres divided into 13 fields. Field acreage, cultivar, and date of planting varied across the farm (Table 1). Beginning at approximately first flower, NAWF measurements were made as described by Bourland *et al*. (1992). NAWF data were collected from each field once per week and entered into the COTMAN computer program until cutout (NAWF=5). Once a field reached cutout, heat unit accumulation was tracked using the following equation: [(daily high temp) + (daily low temp)/2] – 60, where 60° is the threshold temperature. COTMAN determined the date that fields reached an ISL_{ff} (350 heat units had been accumulated past cutout) (Table 2). Data on insecticide treatment dates and rates were collected on each of the fields for the remainder of the production season. Costs for insecticide treatments beyond ISL_{ff} were formulated for each field (Table 2).

Two fields were selected for yield studies. Within both fields, treatments were established once an ISL_{ff} was reached. The treatments included untreated plots (plots receiving no insecticide applications after ISL_{ff}) and treated plots (plots receiving insecticide applications after ISL_{ff}). Insect control in the treated plots was initiated based on producer and consultant thresholds and was continued as long as the producer deemed necessary. Plots in both fields were replicated four times and arranged in a randomized complete-block design. All other production practices, including timing of defoliation and harvest initiation, were consistent across plots and determined by the producer. Plots were machine-harvested using producer equipment, and seedcotton weights were recorded. Yield and fiber data were analyzed for each field using analysis of variance statistical procedures. Mean yields, micronaire, fiber length, and fiber strength of treated and untreated plots were compared and separated using Fisher's Protected Least Significant Difference Test at the 0.05 level of probability.

RESULTS

No statistical (P=0.05) yield (Table 3) or fiber differences (data not shown) were noted between treated and untreated plots in the two COTMAN yield study fields; however, an average numerical increase of 56 lb lint/acre was observed from the COTMAN terminated plots. Across the farm, a total of 32 insecticide applications were made on 10 fields after COTMAN recommended that insecticide applications be terminated. These treatments increased production costs by $33.31 per acre and reduced farm profitability by $24,746.

PRACTICAL APPLICATION

By utilizing the BOLLMAN component of the COTMAN system, potential savings of $33.31 per acre could have been realized with no significant yield or fiber differences. This study further validates the COTMAN insecticide termination rules.

LITERATURE CITED

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Table 1. Field data on Mizell Brother's farm, Gould, Arkansas, 1998.

Field No.	Acres	Variety	Planting Date	Cutout[z] Date	ISL_{ff}[y] Date
1	33	DP 33B	5/05/98	7/23	8/05
2	165	DP 33B	5/05/98	7/19	7/31
3	138	DP 33B	5/06/98	7/23	8/05
4	33	SG 501	5/07/98	8/15	8/28
5	25	DP 50	5/07/98	7/16	7/29
6	17	ST 132	5/08/98	7/11	7/24
7	42	ST 132	5/08/98	7/17	7/29
8	31	DP 50	5/08/98	7/15	7/28
9	105	DP 33B	5/08/98	7/21	8/02
10	66	ST 474	5/09/98	7/22	8/03
11	51	ST 474	5/09/98	7/21	8/02
12	17	SG 501	5/11/98	8/16	8/29
13	20	SG 501	5/11/98	7/24	8/06
Total	743				

[z] Date of NAWF = 5.

[y] Date of NAWF = 5 + 350 heat units.

Table 2. Whole farm expense of insecticide applications made after field reached ISL_{ff}[z].

Field No.	Applications after ISL_{ff}	Total cost per acre	Total cost per field
1	3	28.12	927.96
2	3	28.12	4,639.80
3	3	31.21	4,305.60
4	1	25.15	829.95
5	3	38.28	957.00
6	0	00.00	00.00
7	0	00.00	00.00
8	4	59.41	1,841.71
9	4	42.41	4,505.55
10	3	35.19	2,322.54
11	4	55.78	2,844.78
12	0	00.00	00.00
13	4	55.78	1,115.60
Average	2.5	33.31	1,903.55
Total			$24,746.19

[z]Insect-safe level from fruit feeders.

Table 3. Yield results of Mizell field demonstrations, Gould, AR, 1998.

Field No.	Replication No.	COTMAN Termination[z]	Producer Termination[y]	Difference	LSD
		lb lint/acre	lb lint/acre		
1	4	1,028	904	124	ns[x]
11	4	735	747	-11	ns
Average		868	821	56	

[z] Yield of Plots where insecticide applications were terminated based on COTMAN rules.
[y] Yield of plots where insecticide applications were terminated based on producer standards.
[x] Not statistically different.