INSECTICIDE TERMINATION REGIMES IN SOUTHEAST ARKANSAS

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Abstract

Insecticide termination rules for Southeast Arkansas were validated during the 2000 growing season on a producer's cotton field in Desha County, AR. Two insecticide termination systems were compared: NAWF = 5 + 350 heat units (early system advocated by COTMAN), and NAWF = 5 + 598 heat units (standard system recommended by consultants). In comparing the two systems, we looked at such variables as boll count and retention rate, lint per boll, lint yield, and net return. No statistical differences were found for any of the aforementioned variables between the two insecticide termination systems. Plots in the standard termination system yielded numerically about 63.6 lb/acre more lint than those in the early (COTMAN) termination system. Net return was also statistically similar between the two insecticide termination systems. A numerical difference of about $13.13 in net return was in favor of the standard termination system. No economic benefits were gained by making two extra insecticide applications in excess of the crop protection regime recommended by COTMAN.

Introduction

Insecticides are needed for the economical production of cotton in Southeast Arkansas. However, they are an expensive input and add to the cost of producing the crop. Farmers are thus faced every year with making the critical decision of when to terminate sprays for insect pests. If farmers terminate insect control sprays too early, crop is rendered vulnerable to damage by insects which destroy cotton fruit that would have contributed to higher yields and greater profitability. Conversely, if they spray too long they will be protecting cotton fruit that will not contribute to higher yields. Such additional sprays are thus unnecessary, create environmental concerns, increase production costs and reduce profitability, and increase selection pressure on insects leading to the development of resistance to insecticides. Until recently, there has not been a reliable system to help farmers terminate insecticide use as early as possible without sacrificing yield. Researchers have worked for year to define the "right" time in the cotton growing season at which insecticidal sprays can be terminated for optimum returns. The COTMAN, COTton MANagement Model, provides an uncomplicated system to assist growers, county agents, and consultants in making insecticide termination decisions. The system provides a technique for monitoring cotton growth and fruit development during the season and assisting with end-of-season management decisions (Oosterhuis et al. 1996).

COTMAN uses Nodes Above White Flower (NAWF) as the basis to determine crop maturity. Research has shown NAWF is closely related with variations in canopy photosynthesis (Oosterhuis et al. 1992) and that fruiting forms produced on main-stem nodes above the NAWF 5 stage did not contribute significantly to total yield (Bourland et al. 1992, Lammers 1996). The date that a crop attains NAWF of 5 is the flowering date of the last effective boll population (Oosterhuis et al. 1996). Beyond that point, the number of heat units accumulated forms the basis on which to predict the date on which the last effective boll population will be safe from insect injury and insecticide applications can be safely terminated. Research has shown that cotton bolls which have accumulated 350 heat units (DD 60's) or more since bloom are safe from significant loss by bollworm/budworm or boll weevil damage. Therefore, COTMAN recommends insecticide termination at NAWF=5 + 350 heat units, unless beet armyworm or fall armyworm infestations are present. However, farmers, in fear of late season damage to bolls, often continue insecticide applications beyond the COTMAN termination date. The available research indicates that there is no economic advantage to using insecticides after the COTMAN termination date, but few studies have been conducted in South Arkansas. This study was conducted to examine the effect of insecticide termination date on yield and economic returns.

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Materials and Methods

The insecticide termination test was conducted in 2000 on Stevens Farms in Desha County, AR. The field consisted of 37 acres of irrigated Stoneville BXN 47 planted on April 20, 2000 and maintained using standard production practices. The test was conducted using a Randomized Complete Block Design with four replications. Plots were four rows wide and ran across the field (average length = 1321 ft.). A twenty-four row border area separated adjacent plots. Two insecticide termination regimes were compared: NAWF=5 + 350 heat units (early termination) and NAWF=5 + 598 heat units (the standard termination regime recommended by the consultant). The field in which the test was conducted received treatments of Temik 15G (3.5 lb/ac) at planting on 4-20-2000, then foliar applications of Bidrin (3.20 oz/ac) on 5-15 and 5-26-2000, Larvin (21.33 oz/ac) on 6-16-2000, Karate Z (1.83 oz/ac) + Tracer (1.28 oz/ac) on 7-18-2000, Curacron (16 oz/ac) on 7-22-2000, Baythroid (2.13 oz/ac) + Orthene (8 oz/ac) on 8-4-2000. NAWF=5 occurred on 7-25 and NAWF=5 + 350 heat units occurred on 8-10-2000. After 8-10, standard termination plots were treated by air with Tracer (1.83 oz/ac) on 8-15 and 8-22-2000. Complete plant mapping was done on 9-29-2000 by thoroughly examining10 plants in each plot and recording fruit presence/absence on each fruiting site. Height of 10 plants per plot (measured from the cotyledon leaves to the tip of plant) was also taken at the time of mapping. Lint yield was determined by machine harvesting all four rows of the plots on 10-12-2000. Data collected were analyzed using ANOVA and LSD Test. Variables analyzed were amount of lint per boll, lint per fruiting node, percent turn out, boll count and retention rate, lint yield, and net return. For economic comparisons, $0.60 per pound was applied to the lint yields.

Results and Discussion

Boll Weight, Count, and Retention Rate

All fruiting sites analyzed produced statistically similar amounts of lint per boll in both the early and standard insecticide termination systems (Table 1). Turn out rates for those same fruiting sites were also similar between the two termination systems (Table 1). Even when data were analyzed across all fruiting sites per node, no significant differences were found between the two insecticide termination systems in terms of lint produced per node for nodes 5 through 24 (Table 2). Fruit count per node was also statistically similar between the two insecticide termination systems for nodes 5 through 24 (Table 2). There was, however, a slight numerical increase in fruit count under the standard termination system. Boll retention rates were also similar between the early and standard termination systems for all nodes (Table 2) including the uppermost nodes which are the main target of the extra insecticide sprays made in the standard termination system. However, there was a tendency for retention rates on the six uppermost nodes to be numerically higher under the standard than the early termination system.

Lint Yield

Plots in the standard insecticide termination regime produced similar lint yield to those under the early termination system recommended by

COTMAN (Table 3). There was a numerical increase in yield of about 63.6 lb/acre under the standard termination system in comparison with the early termination system. The fact that boll weight and boll retention rates in the two insecticide termination regimes were similar well explains the insignificant differences found in lint yields. Although there was a noticeable numerical increase in the amount of lint collected per boll for node/fruiting site 20-1 (Table 1), fruit on such nodes high on the main stem do not contribute much to crop yield.

Economic Assessments

The economic returns after treatment costs were similar between the two insecticide termination systems (Table 3). Prolonging crop protection time under the standard termination regime did not translate into higher yields or more profits compared with the early termination regime recommended by COTMAN. Such results are particularly interesting having been obtained from southeast Arkansas, an area currently under boll weevil eradication. Heavy worm infestations occurred late in the 2000 growing season which, in our test, required that two insecticide applications be made to plots in the standard termination system to keep worm counts below the economic threshold. That added an additional expense of about $25.00 per acre in production costs incurred by our cooperator. Yet, there was no economic benefits, statistically, for extending the period of crop protection beyond COTMAN recommendations.

Summary

Insecticide termination rules recommended by COTMAN have been validated in this study. There were no economic advantages for extending protection period of crop from insect damage any further than that recommended by COTMAN. Plots in which insecticide applications were terminated early (at NAWF=5 + 350 heat units) were similar in boll counts and retention rates, lint yields, and economic returns to plots in which insecticides were terminated at a later time (NAWF=5 + 598 heat units).

References

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Table 1. The effect of early insecticide termination system (COTMAN) vs. standard system on amount of lint collected per boll and percent turn out[1]. Desha County, Arkansas. 2000.

Node /	Lint (g) / Boll		Percent Turn Out	
Fruiting Site[2]	Early[3]	Standard[4]	Early[3]	Standard[4]
6-1	1.40 a	1.25 a	37.3 a	36.0 a
7-1	1.47 a	1.69 a	39.0 a	38.3 a
7-2	1.56 a	1.25 a	36.8 a	37.8 a
8-1	1.85 a	1.71 a	39.0 a	38.3 a
8-2	1.62 a	1.68 a	38.0 a	38.3 a
8-4	1.63 a	1.39 a	40.0 a	38.3 a
9-1	1.81 a	1.88 a	39.8 a	40.8 a
9-2	1.66 a	1.81 a	39.0 a	39.3 a
9-4	1.41 a	1.30 a	39.8 a	39.3 a
10-1	1.95 a	1.91 a	39.5 a	40.8 a
10-2	1.80 a	1.76 a	39.0 a	38.8 a
10-3	1.48 a	1.71 a	40.8 a	42.3 a
11-1	1.94 a	1.98 a	41.0 a	40.8 a
11-2	1.59 a	1.74 a	40.3 a	39.0 a
11-3	1.52 a	1.62 a	41.8 a	41.0 a
12-1	1.99 a	2.08 a	40.5 a	41.3 a
12-2	1.42 a	1.75 a	41.3 a	40.5 a
12-3	1.69 a	1.72 a	41.0 a	42.0 a
13-1	1.90 a	1.97 a	40.5 a	40.0 a
13-2	1.83 a	1.81 a	43.3 a	42.0 a
13-3	1.54 a	1.40 a	41.8 a	42.0 a
14-1	1.88 a	1.90 a	42.5 a	41.5 a
14-2	1.53 a	1.92 a	42.8 a	43.0 a
15-1	1.72 a	1.74 a	42.8 a	44.3 a
15-2	1.53 a	1.47 a	41.3 a	41.8 a
16-1	1.82 a	1.91 a	42.3 a	43.0 a
16-2	1.42 a	1.66 a	40.8 a	42.7 a
17-1	1.69 a	1.85 a	42.8 a	42.8 a
17-2	1.43 a	1.38 a	40.3 a	40.8 a
18-1	1.60 a	1.60 a	41.5 a	41.0 a
19-1	1.46 a	1.51 a	40.5 a	41.7 a
20-1	1.08 a	1.94 a	44.8 a	43.0 a

[1]Means within rows followed by the same letter are not significantly different (LSD, $P = 0.05$).
[2]From bottom of plant.
[3]NAWF=5 + 350 DD60 heat units.
[4]NAWF=5 + 598 DD60 heat units.

Table 2. The effect of early insecticide termination system (COTMAN) vs. standard system on the amount of lint collected per node, number of bolls per node, and percent boll retention[1]. Desha County, Arkansas. 2000.

Node	Lint (g) Collected[3]		Number of bolls[3]		% Boll Retention[4]	
Number[2]	Early[5]	Standard[6]	Early[5]	Standard[6]	Early[5]	Standard[6]
5	0.06 a	0.04 a	0.05 a	0.03 a	2.5 a	1.3 a
6	0.36 a	0.17 a	0.25 a	0.15 a	11.3 a	5.0 a
7	1.44 a	1.70 a	0.95 a	1.20 a	42.5 a	55.3 a
8	2.40 a	2.05 a	1.40 a	1.30 a	56.3 a	55.6 a
9	2.28 a	2.12 a	1.35 a	1.23 a	48.8 a	54.3 a
10	2.77 a	2.77 a	1.55 a	1.60 a	57.5 a	57.9 a
11	2.66 a	2.88 a	1.55 a	1.65 a	51.3 a	59.2 a
12	2.33 a	2.65 a	1.35 a	1.45 a	53.8 a	50.4 a
13	2.27 a	2.41 a	1.25 a	1.43 a	50.0 a	55.3 a
14	1.84 a	1.73 a	1.08 a	1.00 a	46.3 a	46.4 a
15	1.70 a	1.78 a	1.03 a	1.13 a	48.8 a	51.4 a
16	1.25 a	1.51 a	0.75 a	0.87 a	35.0 a	42.2 a
17	1.03 a	1.41 a	0.65 a	0.88 a	30.0 a	40.2 a
18	0.80 a	0.92 a	0.48 a	0.40 a	22.5 a	31.3 a
19	0.38 a	0.57 a	0.25 a	0.39 a	11.3 a	17.0 a
20	0.30 a	0.29 a	0.25 a	0.19 a	12.5 a	9.5 a
21	0.07 a	0.13 a	0.05 a	0.10 a	2.5 a	5.2 a
22	0.16 a	0.21 a	0.13 a	0.15 a	5.0 a	7.7 a
23	0.08 a	0.05 a	0.05 a	0.03 a	2.5 a	1.3 a
24	0.00 a	0.04 a	0.00 a	0.03 a	0.0 a	1.4 a
Veg. Branch	1.49 a	1.02 a	1.03 a	0.71 a	-	-

[1]Means within rows followed by the same letter are not significantly different (LSD, $P = 0.05$).
[2]From bottom of plant.
[3]Total per node/10 (plants/sample), across all fruiting positions.
[4]Total boll count per node/10 (plants/sample) x 100, first and second fruiting positions only.
[5]NAWF=5 + 350 DD60 heat units.
[6]NAWF=5 + 598 DD60 heat units.

Table 3. Effect of insecticide termination system on lint yield and net return in Southeast Arkansas[1]. Desha County, Arkansas. 2000.

Insecticide Termination System	Lint Yield (lb./ac)	Gross Revenue[2] ($/ac)	Cost of Extra Protection ($/ac)	Net Return ($/ac)
Early Termination[3]	1011.8 a	607.10 a	-	607.10 a
Standard Termination[4]	1075.4 a	645.23 a	25.00	620.23 a

[1]Means within columns followed by the same letter are not significantly different (LSD, $P = 0.05$).
[2]$0.60 per pound applied to lint yield.
[3]NAWF=5 + 350 DD60 heat units.
[4]NAWF=5 + 598 DD60 heat units.