LATE SEASON INSECTICIDE TERMINATION STUDIES IN NORTHEAST LOUISIANA DURING 1997

K. Torrey, H. Fife, B. R. Leonard,
R. D. Bagwell, E. Burris and D. Cook
Louisiana State University Agricultural Center
Louisiana Agricultural Experiment Station
Baton Rouge, LA

Abstract

Field tests were conducted in North Louisiana during 1997 to evaluate the effects of terminating insect control strategies at selected intervals on seedcotton yields. Termination intervals based on cotton plant development used plant mainstem nodes above white flower (NAWF) and heat unit (HU) accumulation. The treatment termination intervals based on crop development rules included NAWF = 5, NAWF = 5 + 200 HU, NAWF = 5 + 350 HU, NAWF = 5 + 500 HU, and NAWF = 5 + 650 HU. The termination intervals based on weather oriented rules used 17 Aug as a final cutout date in Louisiana. Insecticide treatments were terminated at 350, 450, 550, and 650 HU beyond 17 Aug. There was no significant increase in yield from terminating insecticide treatments beyond NAWF = 5 + 350 HU using the crop development rules. Seedcotton yields in the weather-oriented rules test were inconsistent. Also, two tests were conducted to examine the effects of insect-simulated defoliation on seedcotton yield. As defoliation levels increased from 0 to 99% at the NAWF = 5 + 350 HU stage of development, yields consistently declined. Significant yield losses occurred at 99% defoliation levels in the two tests.

Introduction

Insecticide treatment termination at the end of the production season is one of the most important decisions that cotton growers have to consider. Protection of the harvestable crop is a goal that must be balanced with high insect control costs and possible insecticide resistance problems. Managing for early maturity has been recommended for years as a means of avoiding losses caused by late-season insect injury (Isely 1957). However, until recently there was no recommended procedure for determining when the harvestable crop was safe from insect injury (Bourland et al. 1997).

Crop growth status during mid-late season can be measured by using the node above white flower (NAWF) method (Bourland et al. 1992). The nodal position of the highest white flower on the main axis relative to the plant apex has been a reliable description of the relationship between fruit set and rate of plant terminal growth. By using the NAWF + accumulated heat units (HU) method, decisions can be made to terminate insecticide treatments when the last effective boll population accumulates sufficient HU to become tolerant to specific insect pests (Cochran et al. 1997). Arkansas researchers have reported that the harvestable portion of the cotton crop is generally safe from bollworm, *Helicoverpa zea* (Boddie), and boll weevil, *Anthonomus grandis grandis* Boheman, at NAWF = 5 + 350 HU (Bernhardt el al. 1986, Bagwell and Tugwell 1992). In addition, defining the last calendar date on which harvestable bolls may be produced and then accumulating 350 HU from that date also can be used to terminate insecticide applications (Bourland et al. 1997). However, studies on boll tolerance to other insect pests are lacking and considerable testing remains to be done to validate insecticide treatment termination rules within various production systems and crop environments.

This report summarizes the results of studies in 1997 to evaluate crop development and weather oriented rules for terminating late-season insecticide applications in Louisiana. In addition, the effects of insect simulated defoliation levels at the NAWF = 5 + 350 HU crop stage on seedcotton yield are included.

Materials and Methods

Crop Development Rules

The treatment termination intervals based on crop development rules included NAWF = 5, NAWF = 5 + 200 HU, NAWF = 5 + 350 HU, NAWF = 5 + 500 HU, and NAWF = 5 + 650 HU. The MRS971 test was planted with Stoneville LA 887 cotton seed on 7 May at the Macon Ridge Research Station (MRS) near Winnsboro, LA. The NRS97 test was planted with Stoneville LA 887 seed on 15 May at the Northeast Research Station (NRS) near St. Joseph, LA. For each test, the treatments were arranged in a randomized complete block design (RCBD) and replicated 4 times. The plots consisted of 4 rows (40-inch centers) x 50 ft. The test at the MRS received sprinkler irrigation "as needed" to maintain adequate moisture during the season. The test conducted at the NRS was non-irrigated.

Weather-Oriented Rules

The final cutout date used in this series of trials was 17 Aug. Insecticide treatments were terminated on 17 Aug and at 350, 450, 550, and 650 HU beyond 17 Aug. Three tests (MRS972, MRS973, and MRS974) were planted with Paymaster 1220 Roundup Ready Bollgard, Deltapine NuCOTN 33^{B} and Deltapine NuCOTN 33^{B}, respectively, on 4, 16, and 19 Jun, respectively, at the Macon Ridge Research Station. The treatments were arranged in a RCBD and replicated 4 times. The plots consisted of 4 rows (40-inch centers) x 50 ft. Tests MRS972 and MRS974 were furrow-irrigated "as needed", and test MRS973 was non-irrigated.

Reprinted from the *Proceedings of the Beltwide Cotton Conference*
Volume 2:1323-1326 (1998)
National Cotton Council, Memphis TN

Sampling and Insecticide Application

Ten plants/plot (100/replication) were sampled 1-2 times weekly to determine the flowering pattern based on the NAWF in all tests. NAWF was recorded from first bloom until NAWF £ 5. The HU were recorded daily from NAWF = 5 until defoliation treatments were applied. Insecticide treatments were applied with a high clearance sprayer calibrated to deliver 6 gal total spray/acre through Teejet TX-8 hollow cone nozzles (2/row) at 44 psi. Insecticide treatments consisted of specific tank-mixtures to address the pest complex in the test plots. At least one application was applied between each of the termination intervals. The two center rows were mechanically harvested to determine seedcotton yields. Cumulative HU, termination dates, treatment application timing, and harvest intervals are presented in Tables 1 and 2. Data were analyzed with ANOVA, and means were separated according to DMRT.

Simulated Defoliation (Leaf Removal) Tests

Deltapine NuCOTN 33^{B} cotton seed was planted in Test 1 on 10 May and Stoneville LA 887 cotton seed was planted in Test 2 on 7 May at the Macon Ridge Research Station. Cotton plants were monitored for NAWF across the test area, and daily HU were recorded from NAWF £ 5 until NAWF = 5 + 350 HU. At this stage of crop maturity the mean height of plants in the plots was used to divide the plants into 3 equal levels (bottom, middle, and top). Treatments consisted of 33, 66, and 99% defoliation levels which corresponded to leaf removal in the bottom level, bottom + middle levels, and bottom + middle + top levels, respectively. Plots consisted of two rows (40-inch centers) x 10 ft. Treatments were arranged in a RCBD and were replicated 4 times. The treatments were applied to Deltapine NuCOTN 33^{B} on 12 Aug and to Stoneville LA 887 on 8 Aug. Seedcotton yields were determined by hand-harvesting the entire plots of Deltapine NuCOTN 33^{B} on 18 Sep and Stoneville LA 887 on 25 Sep.

Results and Discussion

Insecticide Termination Rules

Pest populations were generally low during 1997 in these tests. Applications were applied in all tests, regardless of insect pest density, and probably reduced insect injury levels in some plots not designated to receive treatments due to the small plot size. There were no statistical differences in seedcotton yields among termination intervals in the MRS971 test. In the NRS97 test seedcotton yields were significantly higher in plots terminated at 500, and 650 HU compared to the plots terminated at NAWF = 5 (Table 3). For the weather-oriented tests, there were no significant differences among treatments in seedcotton yields except in MRS973 (Table 4). Seedcotton yields in plots which had insecticide treatments terminated at 450 and 550 HU beyond cutout were significantly higher than that in plots that had treatments terminated earlier. These studies will be continued for several years to refine the proper interval for terminating late-season insecticide applications.

Simulated Defoliation (Leaf Removal) Tests

Seedcotton yields for Deltapine NuCOTN 33^{B} and Stoneville LA 887 were significantly lower in the plots receiving 99% defoliation levels compared to that in all other plots (Table 5). In the analysis across varieties, the plots receiving ³ 66% defoliation levels had significantly lower yields compared to the control plots. These data are similar to that reported for 1996 (Burris et al. 1997).

References

Bagwell, R. D. and N. P. Tugwell. 1992. Defining the period of boll susceptibility to insect damage in heat units from flower, pp. 767-768. IN Proc. Beltwide Cotton Conf., National Cotton Council, Memphis, TN.

Bernhardt, J. L., J. R. Phillips, and N. P. Tugwell. 1986. Position of the uppermost white bloom defined by node counts as an indicator for termination of insecticide treatments in cotton. J. Econ. Entomol. 79:1430-1438.

Bourland, F. M., D. M. Oosterhuis, and N. P. Tugwell. 1992. Conceptual model for modeling plant growth and development using main-stem node counts. J. Prod. Agric. 5: 532-538.

Bourland, F. M., D. M. Oosterhuis, N. P. Tugwell, M. J. Cochran, and D. M. Danforth. 1997. Interpretation of crop growth patterns generated by COTMAN. Univ. of Ark., Ark. Agric. Exp. Stn., Special Rep. 181.

Burris, E., S. Micinski, B. R. Leonard, J. B. Graves, and R. D. Bagwell. 1997. Cotton insect pest management studies in Louisiana, 1996. Louisiana Agric. Exp. Stn. Mimeo Series No. 121.

Cochran, M. J., D. Danforth, F. M. Bourland, N. P. Tugwell, and D. M. Oosterhuis. 1997. The COTMAN expert system of cotton plant monitoring: 1997 update, p. 474. IN Proc. Beltwide Cotton Conf., National Cotton Council, Memphis, TN.

Isely, D. 1957. Methods of Insect Control. Braun Brumfield, Inc., Ann Arbor, Michigan. 208 pp.

Table 1. Development of patterns of cotton plants and treatment application timing for tests evaluating crop development termination rules.

Application Timing	Date	Days From Planting	Actual HU	Dates of Insecticide Application
MRS971				
Planting	7 May	------	------	------
#5 NAWF	23 Jul	77	------	23Jul
+ 200 HU	31 Jul	85	204.0	23,29Jul
+ 350 HU	8 Aug	93	356.5	23,29Jul, 8Aug
+ 500 HU	14 Aug	99	498.0	23,29Jul, 8,14Aug
+ 650 HU	20 Aug	105	654.0	23,29Jul,8,14,20Aug
Defoliation	16 Sep	132	1169.5	------
Harvest 1	26 Sep	142	1350.5	------
Harvest 2	7 Oct	153	1502.0	------
NRS97				
Planting	14 May	------	------	------
#5 NAWF	26 Jul	73	------	26Jul
+ 200 HU	4 Aug	82	260.0	26Jul , 7Aug
+ 350 HU	12 Aug	90	443.0	26Jul , 7,15Aug
+ 500 HU	17 Aug	95	573.5	26Jul , 7,15,20Aug
+ 650 HU	25 Aug	103	722.0	26Jul,7,15,20,28Aug
Defoliation	8 Sep	117	957.5	------
Harvest 1	29 Sep	160	1314.5	------
Harvest 2	9 Oct	170	1463.0	------

Table 2. Development of cotton plants and treatment application timing for tests evaluating weather-oriented rules.

Application Timing	Date	Days From Planting	Actual HU	Dates of Insecticide Application
MRS972				
Planting	4 Jun	------	------	------
Cutout	17 Aug	74	------	------
+ 350 HU	2 Sep	87	199.5	27Aug
+ 550 HU	14 Sep	99	591.5	27Aug,9,16Sep
Defoliation	20 Oct	125	1033.5	------
Harvest	29 Oct	134	1064.5	------
MRS973				
Planting	16 Jun	------	------	------
Cutout	17 Aug[1]	62	------	17Aug
+ 350 HU	2 Sep	78	154.5	17,25Aug
+ 450 HU	7 Sep	83	479.0	17,25Aug,9Sep
+ 550 HU	14 Sep	90	591.5	17,25Aug,9,16Sep
Defoliation	29 Oct	134	1064.5	------
Harvest	6 Nov	142	1076.5	------
MRS974				
Planting	19 Jun	------	------	------
Cutout	17 Aug[1]	59	------	17Aug
+ 350 HU	2 Sep	72	154.5	17,25Aug
+ 450 HU	7 Sep	87	479.0	17,25Aug, 9Sep
+ 550 HU	14 Sep	94	591.5	17,25Aug, 9,16Sep
+ 650 HU	19 Sep	99	591.5	17,25Aug,9,16 Sep
Defoliation	29 Oct	139	1064.5	------
Harvest	18 Nov	159	1076.5	------

[1]NAWF = 5 on 20 and 25 Aug for MRS973 and MRS974, respectively.

Table 3. Seedcotton yields in tests MRS971 and NRS97.

	Yield (lb seedcotton/acre)	
Application Timing	MRS971	NRS97
#5 NAWF	2047.2a	3189.3b
+ 200 HU	2155.1a	3370.8ab
+ 350 HU	2380.8a	3470.6a
+ 500 HU	2174.7a	3403.4a
+ 650 HU	2115.9a	3476.1a
(P>F)	0.32	0.05

Means within a column followed by a common letter are not significantly different (P = 0.05;DMRT).

Table 4. Seedcotton yields in tests MRS972, MRS973 and MRS974.

	Yield (lb seedcotton/acre)		
Application Timing	MRS972	MRS973	MRS974
Cutout	------	1347.3b	546.2a
+ 350 HU	1911.3a	1356.4b	654.0a
+ 450 HU	------	1569.8a	497.1a
+ 550 HU	1815.5a[1]	1651.5a	693.3a
+ 650 HU	------	------	684.6a
(P>F)	0.32	<0.01	0.30

Means within a column followed by a common letter are not significantly different (P = 0.05;DMRT).
[1]Actual HU = 479.0.

Table 5. Effect of insect simulated defoliation on yield and crop maturity.

	Yield (lb seedcotton/acre)		
Application Timing	NuCOTN 33[B]	LA 887	Mean
Control	4913.6a	2137.4a	3525.5a
33% Defoliation	4586.9a	1956.2a	3271.6ab
66% Defoliation	4116.5a	1994.6a	3055.5b
99% Defoliation	1875.3b	1123.5b	1499.4c
(P > F)	<0.01	<0.01	<0.01

Means within a column followed by a common letter are not significantly different (P = 0.05;DMRT).