VALIDATION OF COTMAN RULES IN THE TEXAS HIGH PLAINS

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Abstract

COTMAN is a cotton expert system that among other things calculates heat units from cutout which aids in timing insecticide and crop termination. This study evaluated COTMAN rules for both seasonal and physiological cutout fields in scheduling crop termination in the Texas High Plains. COTMAN predicted crop termination satisfactorily for both physiological and seasonal cutout fields in the central and southern areas of the High Plains. The dates set for seasonal cutout in the northern area based on a 30-year weather database were not realistic and would have significantly reduced yield compared to terminating the crop at NACB (nodes above cracked boll) = 4. The seasonal cutout dates typically allow for only two weeks of blooming and would not allow for the irrigated lint yields typically observed for the northern area. Based on tests conducted in 2000, COTMAN rules for insecticide termination for late-season boll weevil management do not adequately address situations where boll weevil infestations are severe. Grower control programs are typically insufficient to minimize infestations prior to the nominal termination point of 350 heat units past cutout.

Introduction

The COTMAN Expert System of Cotton Plant Management was developed by the University of Arkansas and is designed to provide continuous in-season crop monitoring to assist producers with earliness management of their crop. The program provides information on early detection of plant stress, forecasts cutout dates for individual fields, and provides end-of-season management decisions based on cutout date. These decisions include when to discontinue the use of insecticides for boll weevils and fruit-feeding caterpillars, and when to initiate the use of harvest aid materials. The program consists of two software components, SQUAREMAN and BOLLMAN. SQUAREMAN monitors the crop from first square to first flower and tracks square retention and growth rate. The BOLLMAN component monitors the crop from first flower until cutout and calculates heat units from cutout which assists growers in timing of insecticide termination and defoliation. The BOLLMAN component was used in this study. BOLLMAN utilizes two risk levels of 15% and 50%. The risk levels can be defined as when blooms have either an 85% or 50% chance of obtaining enough heat units for boll maturation. Cutout is defined as the last effective boll population relative to the latest possible cutout date and is set at nodes above uppermost first position white flower equal to five (NAWF=5) (Cochran et al., 1998). Cutout for a specific field can be defined on a physiological or seasonal basis. Physiological cutout is when a field reaches NAWF=5 on or before the seasonal cutout date for the risk level being utilized. Seasonal cutout is when a field does not reach NAWF=5 before the date for the specific risk level. Insecticide termination for small fruit-feeding caterpillars and boll weevils is advised when 350 heat units have accumulated past cutout and crop termination is advised at 850 heat units past cutout.

Reprinted from the *Proceedings of the Beltwide Cotton Conference*
Volume 1:481-485 (2001)
National Cotton Council, Memphis TN

The objective of this study was to validate the BOLLMAN component of the COTMAN computer model in determining when to terminate insecticide applications and schedule harvest aid treatments in three separate cotton growing areas of the Texas High Plains.

Materials and Methods

Crop Termination

Three specific areas, northern, central and southern within the Texas High Plains were used to validate the COTMAN rules for defoliation. The northern area was represented by two Castro County sites (elevation 3,883 feet). The central area was represented by two Lubbock County sites (elevation 3,281 feet) and the southern area was represented by one Lynn and one Dawson County site (elevation 2,998 feet). All fields were center-pivot irrigated and utilized the seasonal cutout date for 50% probability of maturing a boll (Table 1). Once each field started to bloom, the data collection for COTMAN was initiated. Plant monitoring was discontinued when NAWF = 5 (or 4 depending upon site) was reached. Daily maximum and minimum temperatures were recorded and all information was entered into the COTMAN program. Temperature data for each location were obtained from the Lubbock National Weather Service Web-site. Prior to treatment, percent open bolls and NACB were determined for each plot. The middle two rows of each plot were hand harvested and the number of bolls from the harvested area and the total row feet harvested were recorded. Cotton samples were ginned at the Texas Agricultural Research and Extension Center at Lubbock. High volume instrument analyses were determined at the International Textile Center at Texas Tech University.

Castro County data included two separate locations in 2000. The experimental design was a randomized complete block with three replications at both sites. The plot size was four 30-inch rows by 100 ft in length. Treatments consisted of crop termination at 650 and 750 heat units past NAWF=4 and nodes above uppermost first position cracked boll equal to four (NACB=4). Plots were terminated with a tank mix of 21 oz./acre of Prep (6 lb/gal ethephon) plus 4 oz. /acre Ginstar (thidiazuron and diuron) applied with a CO_2 backpack sprayer at 40 psi and 12 gpa total volume. Hand harvest was conducted on 1/1000 acre 21 days following applications. In addition, the bottom four fruiting nodes (bottom crop) were harvested separately from the remaining top bolls (top crop).

Lubbock County data included one project location in 1999 and one in 2000. Experimental design for the 1999 test consisted of a randomized complete block design with four replications. Plot size was four 40-inch rows by 50 ft in length. Crop termination treatments were initiated at 650, 750, and 850 heat units after the field reached NAWF = 5. The harvest aid treatment consisted of 21 oz/acre of Prep with 4 oz/acre of Ginstar applied using a CO_2 backpack sprayer calibrated at 35 psi and 18gpa total volume. Hand harvests were conducted on 1/1000 acre areas 14 days following crop termination. An additional 100 bolls per plot were obtained by whole plant sampling to determine average lint weight per boll. Experimental design for the 2000 test was the same as 1999 except for the following. Plot size was four 40-inch rows by 1000 ft in length. Applications were made with a self-propelled ground rig applicator calibrated at 15 gpa, and used CO_2 as the propellant. Plots were harvested 21 days after application and the 100 boll harvest was not included.

The Lynn and Dawson County projects were conducted in 1999 and 2000, respectively. In 1999, crop termination treatments were scheduled at 650, 750, 850, and 950 heat units past cutout (NAWF=5). The 950 heat unit treatment was never obtained due to lack of heat unit accumulation. A randomized complete block design with four replications of treatments was used. Each plot was four 40-inch rows by 50 ft in length. SuperBoll (6 lb/gal ethephon) at a rate of 21 oz./acre with 4 oz./acre of Ginstar were tank-mixed and applied using a CO_2 backpack sprayer adjusted to 40 psi and 15 gpa total volume. Each plot was harvested 14 days after crop termination. The 2000 project was a randomized complete block design with four replications. Cotton was planted on three different dates including May 2, May 15, and May 30. Cutout for this test was defined as NAWF=4. Plot size was four 40-inch rows by 250 ft in length. Crop termination treatments were targeted at 650, 750, 850 and 950 heat units past cutout. SuperBoll at 21 oz./acre and 4 oz./acre of Ginstar were tank-mixed. Applications were made using a self-propelled ground rig adjusted to 40 psi and 15 gpa total volume. Hand harvest of 1/1000 acre areas was initiated 21 days following crop termination.

Insecticide Termination

Insecticide termination projects were conducted at two furrow-irrigated locations in Lubbock County in 2000. Experimental design for both locations was a randomized complete block design with three replications. Plot size was eight 40-inch rows by 1000 ft in length. Treatments consisted of termination of insecticide applications at 350 heat units past NAWF=5 and a grower standard. The grower standard treatment was defined as when the producer elected to discontinue insecticide applications. The grower standard treatment received two additional applications of methyl parathion at 5-day intervals. Once the grower standard insecticide applications were terminated, forty plants per plot for each treatment were checked for damaged fruit. Each damaged boll was evaluated for penetration of the carpel wall. The plots were terminated with harvest aids at 850 heat units past NAWF=5. Hand harvests were conducted on 1/1000 acre plots 21 days following the application.

Results and Discussion

Seasonal Cutout - North

Based on the protocol for these tests, the fields did not reach NAWF=4 on or before July 24, and therefore seasonal cutout rules were implemented. The actual heat units accumulated for crop termination treatments in the first test were 713, 813, and 1004, respectively, for 750, 850, and NACB=4 targets (Table 2). Neither first position cracked bolls nor open bolls were not present until 1004 heat units were accumulated past July 24. Lint yield from the top crop, average weight per boll and percent turnout were significantly different across all treatments (Table 3) with the NACB=4 being the highest. The NACB=4 treatment had the highest micronaire and was significantly different from the 750 and 850 heat unit treatments but all treatments resulted in micronaire values in the discount range. The NACB =4 treatment and the 850 heat unit treatment had the highest bottom crop yield and percent lint turnout with 1054 and 925 pounds and 28.0% and 25.6% , respectively, but were not significantly different from each other (Table 4). However, these two treatments were significantly different from the 750 heat unit treatment which yielded 498 pounds and a turnout of 17.9%. Average weight per boll was significantly different across all crop termination treatments. Total yield was significantly different across all treatments with NACB=4 yielding the most with 1,298 pounds per acre (Table5). In addition, NACB=4 had the highest micronaire and the highest percent of top crop yield.

Heat unit accumulation at the second northern location also started on July 24, and the actual heat unit accumulations were the same as for the first test. First position cracked bolls were not present until 1004 heat units were accumulated (Table 6). The NACB=4 and 850 heat unit treatments had the highest lint yield for the top crop with 156 and 136 pounds, respectively, and were significantly different from the 750 heat unit treatment with 84 pounds of lint (Table 7). Micronaire for all treatments was significantly different with the NACB=4 treatment falling within base. Average weight per boll and percent lint turnout was significantly different across all treatments with NACB=4 being the highest. The NACB=4 treatment had the highest bottom crop yield with 617 pounds and was significantly different from the 850 and 750 heat unit treatments with 475 and 364 pounds, respectively (Table 8). As with the top crop, micronaire for all treatments was significantly different with the NACB=4 treatment falling within base. Average boll weight was significantly different across all treatments with NACB=4 being the highest. Pounds of lint per acre for total yield was significantly different across all treatments with NACB=4 yielding the most with 773 pounds per acre (Table 9). The NACB=4 treatment had the highest micronaire but was in the discount range. There were no differences due to treatment in percent of total yield from the top crop.

Seasonal Cutout - South

The 1999 Lynn County site did not reach NAWF=5 until August 26 (Table 10). Therefore, the seasonal cutout protocol was utilized. First position cracked bolls were not present until 851 heat units were accumulated. Micronaire and strength were the only fiber quality measurements where treatment differences were noted (Table 11). Micronaire increased as heat units increased with the 850 heat unit treatment being different from the 650 and 750 heat unit treatments. The 650 and the 750 heat unit treatments did not differ from each other. Micronaire for both the 650 and 750 heat unit treatments were categorized as "discount" while the 850 heat unit treatment was categorized as "premium". There was a difference between the 850 heat unit treatment and the 650 and 750 heat unit treatments for fiber strength, however, the value for all three treatments fell in the "very strong" category. Lint weight per boll and lint yield increased with increasing heat units accumulation (Table 12). The 650 and 750 heat unit treatments did not differ from each other but did differ from the 850 heat unit treatment for both lint weight per boll and lint yield.

Physiological Cutout - Central

The 1999 Lubbock County location reached physiological cutout (NAWF=5) on August 4. Seasonal cutout for this location for this location was August 8. The actual heat unit accumulations were 655, 758 and 859 from physiological cutout. The 859 heat unit treatment yielded more lint per acre than the 655 heat unit treatment with 805 and 534 lb/acre , respectively (Table 13). However, no significant differences were found in average lint weight per boll. The NACB declined as heat unit accumulations increased and all three treatments were significantly different with 6.0, 4.9 and 1.8 NACB, respectively. The 859 heat unit treatment had 70.3 percent open bolls which was different from the 758 and 655 heat unit treatments with 18.3 and 17.8, respectively. No significant differences in micronaire, length, and strength were found among treatments (Table 14). The 2000 test field reached NAWF=5 on August 3. The actual heat unit accumulations were 665, 748, and 843 past NAWF=5. At 843 heat units, this field had NACB=1.8 and 74% open bolls (Table 15). The 850 heat unit treatment had the highest lint yield per acre, but was not significantly different from the 750 heat unit treatment. All treatments had low micronaire with no significant differences noted (Table 16).

Physiological Cutout - South

All three planting dates in this test reached physiological cutout (NAWF=4) before the August 12 seasonal cutout date. Physiological cutout was reached with the May 2 planting on July 18; the May 15 planting on July 25; and the May 30 planting on August 3 (Tables 17-19). No statistical differences in lint yield and average boll weight occurred among treatments across all planting dates, however, as a trend the 950 heat unit treatments had higher yields and mean boll weights (Tables 20-22). Within each planting date, a trend was noted for higher lint yield, boll weight, lint turnout and micronaire as heat unit accumulation increased. The May 15 planting date optimized lint yield and quality at this location.

Insecticide Termination

The boll weevil was the primary late-season pest at both test locations. The Texas Tech University farm location had a lower boll weevil population compared to the Idalou site. The actual heat unit accumulations that occurred when insecticide applications were terminated (NAWF=5) were 338 and 468 at the Texas Tech University location and 355 and 476 at the Idalou site (Tables 23and 24). There were no differences between treatments for the total number of bolls counted per 40 plants inspected at either location. No differences in the percent boll weevil punctures that did or did not penetrate the boll carpal wall were observed at either site. At the Texas Tech University farm, no differences in yield between treatments were noted. However, the grower standard treatment the Idalou location netted an additional 250 lb lint/acre compared to the 350 heat unit treatment.

Summary

The 1999 and 2000 crop termination test results validated the COTMAN rules for both physiological and seasonal cutout fields in the central and southern areas of the Texas High Plains. For fields reaching physiological cutout in the central and southern areas, there was no yield advantage for accumulating heat units beyond 750. In addition, the seasonal cutout dates appeared to be reasonable for these two areas. The seasonal cutout dates established for COTMAN for the northern area of the Texas High Plains appear to be set 10-14 days too early. Fields in this area typically do not begin blooming until at least July 10, resulting in an effective bloom period of only 2 weeks. This window of blooming is insufficient to produce the irrigated yields typically observed in this area. Based on this area's seasonal cutout dates, fields planted during the optimal period would never achieve physiological cutout. Heat unit accumulation over the last five years has been considerably greater than that predicted from the long-term weather data sets submitted for the COTMAN model. This suggests that a different weighting of weather data may need to be evaluated for producers to avoid underutilizing available heat units in this area.

COTMAN rules for termination of insecticides do not take into account different levels of pest pressure. The lower boll weevil infestation level at the Texas Tech University location resulted in no differences in yield between treatments. The Idalou location with a 250 lb lint yield difference between treatments was the result of controlling an acute boll weevil infestation with two additional applications past NAWF=5 plus 350 heat units. COTMAN assumes that economically damaging boll weevil infestations are not present at the time of insecticide termination. This typically cannot be done economically in areas experiencing severe late-season boll weevil problems.

Acknowledgments

Appreciation is expressed to the University of Arkansas COTMAN group for providing technical assistance and to Cotton Incorporated for funding this project.

References

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Table 1. COTMAN seasonal cutout dates for producing a fully mature boll, based on 850 heat units past cutout. Texas High Plains.

Location	50% probability of maturing a boll	85% probability of maturing a boll	Elevation (feet)
Hereford	7-28	7-23	3783
Dimmitt	7-24	7-15	3883
Plainview	8-5	8-1	3374
Lubbock	8-8	8-1	3281
Lamesa	8-12	8-6	2998

Table 2. Actual heat unit accumulation, NACB, and percent open bolls in seasonal cutout test. Coby Gilbreath, Castro County, Texas 2000.

Termination date	Harvest date	Target HU	Actual HU	NACB	% open boll
9-1	9-25	750	713	--	0
9-7	10-4	850	813	--	0
9-19	10-13	NACB	1004	4.8	7.9

Table 3. Yield, micronaire, boll weight, and percent turnout for top crop in seasonal cutout test. Coby Gilbreath, Castro County, Texas 2000

Treatment	Yield (lb/ac)	Micronaire	Boll wt (g)	% lint turnout
750 HU	66 c[1/]	2.1 b	0.43 c	11.8 c
850 HU	148 b	2.1 b	0.74 b	18.2 b
NACB 4	244 a	2.5 a	1.16 a	24.0 a

1/ Means in a column followed by the same letter are not significantly different by ANOVA (P = 0.05; LSD).

Table 4. Yield, micronaire, boll weight, and percent turnout for bottom crop in seasonal cutout test. Coby Gilbreath, Castro County, Texas 2000.

Treatment	Yield (lb/ac)	Micronaire	Boll wt (g)	% lint turnout
750 HU	498 b[1/]	2.5 b	0.89 c	17.9 b
850 HU	925 a	2.6 b	1.41 b	25.6 a
NACB 4	1054 a	3.3 a	1.68 a	28.0 a

1/ Means in a column followed by the same letter are not significantly different by ANOVA (P = 0.05; LSD).

Table 5. Yield, micronaire, boll weight, and percent turnout for total crop in seasonal cutout test. Coby Gilbreath, Castro County, Texas 2000.

Treatment	Yield (lb/ac)	Micronaire	Yield as % of top
750 HU	565 c[1/]	2.5 b	12.0 c
850 HU	1073 b	2.5 b	13.9 bc
NACB 4	1298 a	3.2 a	18.8 a

1/ Means in a column followed by the same letter are not significantly different by ANOVA (P = 0.05; LSD).

Table 6. Actual heat unit accumulation, NACB, and percent open bolls in seasonal cutout test. Paul Fry, Castro County, Texas 2000.

Termination date	Harvest date	Target HU	Actual HU	NACB	% open boll
9-1	9-25	750	713	--	0
9-7	10-4	850	813	--	0
9-19	10-13	NACB	1004	3.2	10.1

Table 7. Yield, micronaire, boll weight, and percent turnout for top crop in seasonal cutout test. Paul Fry, Castro County, Texas 2000.

Treatment	Yield (lb/ac)	Micronaire	Boll wt (g)	% lint turnout
750 HU	84 b[1/]	2.1 c	0.72 c	15.4 c
850 HU	136 a	2.5 b	0.90 b	17.9 b
NACB 4	156 a	3.4 a	1.94 a	19.9 a

1/ Means in a column followed by the same letter are not significantly different by ANOVA (P = 0.05; LSD).

Table 8. Yield, micronaire, boll weight, and percent turnout for bottom crop in seasonal cutout test. Paul Fry, Castro County, Texas 2000.

Treatment	Yield (lb/ac)	Micronaire	Boll wt (g)	% lint turnout
750 HU	364 b[1/]	2.4 c	0.97 a	19.3 b
850 HU	475 b	2.9 b	1.21 b	22.2 ab
NACB 4	617 a	3.6 a	1.56 c	24.7 a

1/ Means in a column followed by the same letter are not significantly different by ANOVA (P = 0.05; LSD).

Table 9. Yield, micronaire, boll weight, and percent turnout for total crop in seasonal cutout test. Paul Fry, Castro County, Texas 2000.

Treatment	Yield (lb/ac)	Micronaire	Yield as % of top
750 HU	448 c[1/]	2.3 c	18.8 a
850 HU	612 b	2.8 b	22.5 a
NACB 4	773 a	3.6 a	20.0 a

1/ Means in a column followed by the same letter are not significantly different by ANOVA (P = 0.05; LSD).

Table 10. Heat unit accumulations, NAWF, percent open boll and NACB in seasonal cutout field. Lynn County, Texas,1999.

	Termination HU				
Date	Target	Actual	NAWF	% open boll	NACB
8-11	--	--	8	0	--
8-19	--	--	5.5	0	--
8-26	--	--	4.6	0	--
9-30	--	--	4.1	0	--
9-13	650	689	2.5	0	--
9-20	750	762	--	0	--
10- 6	850	851	--	2.3	6.5

Table11. Impact of defoliation timing based on seasonal cutout at different heat unit accumulations on lint quality measurements. Lynn County, Texas, 1999.

	Lint quality measurements		
Actual HU	Mic	Length	Strength
689	2.8 a[1/]	1.13 a	35.0 a
762	2.9 a	1.14 a	35.0 a
851	3.8 b	1.11 a	32.0 b

1/ Means in the same column followed by different letters are significantly different at P=0.005 level (DMRT).

Table12. Impact of defoliation timing based on seasonal cutout at different heat unit accumulations on lint yield and boll weight. Lynn County, Texas, 1999.

Actual HU	Yield (lb/ac)	boll wt (g)
689	39 a[1/]	0.8 a
762	126 a	0.9 a
851	331 b	1.4 b

1/ Means in the same column followed by different letters are significantly different at P=0.005 level (DMRT).

Table 13. Impact of defoliation timing based on physiological cutout at different heat unit accumulations on lint yield and boll weight. August Patsche Farm, Lubbock County, Texas 1999.

Actual HU	Yield (lb/ac)	boll wt (g)	NACB	% open boll
655	534 b[1/]	1.47 a	6.0 a	17.8 b
758	686 ab	1.66 a	4.9 b	18.3 b
859	805 a	1.64 a	1.8 c	70.3 a

1/ Means in a column followed by the same letter are not significantly different by ANOVA (P = 0.10; LSD).

Table14. Impact of defoliation timing based on physiological cutout at different heat unit accumulations on lint quality measurements. August Patsche Farm, Lubbock County, Texas 1999.

Actual HU	Micronaire	Length	Strength
665	4.8 a[1/]	1.00 a	31.0 a
758	4.7 a	1.01 a	30.2 a
859	5.0 a	1.02 a	29.7 a

1/ Means in a column followed by the same letter are not significantly different by ANOVA (P = 0.10; LSD).

Table 15. Impact of defoliation timing based on physiological cutout at different heat unit accumulations on crop maturity. Rex Isom Farm, Lubbock County, Texas 2000.

Actual HU	Termination date	% open boll	NACB
665	8/30	6.0	5.6
748	9/5	32.3	4.4
843	9/10	74.0	1.8

Table 16. Impact of defoliation timing based on physiological cutout at different heat unit accumulations on lint yield, micronaire, and lint turnout. Rex Isom Farm, Lubbock County, Texas 2000.

Actual HU	Yield (lb/ac)	Micronaire	% lint turnout
665	608 b[1/]	2.6 a	24.7 a
748	679 ab	2.7 a	19.7 ab
843	748 a	2.8 a	17.3 b

1/ Means in a column followed by the same letter are not significantly different by ANOVA (P = 0.1; LSD).

Table 17. Impact of defoliation timing based on physiological cutout at different heat unit accumulations on crop maturity, May 2 planting date. AGCARES Farm, Dawson County, Texas 2000.

Actual HU	Termination date	% open boll	NACB
665	8-20	19.0	5.3
758	8-24	47.3	2.8
864	8-30	51.0	2.9
968	9-4	67.8	1.5

Table 18. Impact of defoliation timing based on physiological cutout at different heat unit accumulations on crop maturity, May 15 planting date. AGCARES Farm, Dawson County, Texas 2000.

Actual HU	Termination date	% open boll	NACB
660	8-27	15.8	3.5
761	9-1	33.0	3.0
871	9-6	57.3	2.1
952	9-10	60.5	1.3

Table 19. Impact of defoliation timing based on physiological cutout at different heat unit accumulations on crop maturity, May 30 planting date. AGCARES Farm, Dawson County, Texas 2000.

Actual HU	Termination date	% open boll	NACB
662	9-5	24.5	3.1
749	9-9	34.3	2.4
854	9-15	48.8	2.3
970	9-23	71.3	0.7

Table 20. Impact of defoliation timing based on physiological cutout at different heat unit accumulations on lint yield, micronaire, boll weight, and lint turnout, May 2 planting date. AGCARES Farm, Dawson County, Texas 2000.

Actual HU	Yield (lb/ac)	Micronaire	Boll wt (g)	% lint turnout
665	465 a[1/]	4.0 c	1.33 a	26.3 a
758	388 a	4.8 a	1.33 a	26.0 a
864	534 a	4.3 bc	1.40 a	26.9 a
968	542 a	4.6 ab	1.45 a	26.5 a

1/ Means in a column followed by the same letter are not significantly different by ANOVA (P = 0.1; LSD).

Table 21. Impact of defoliation timing based on physiological cutout at different heat unit accumulations on lint yield, micronaire, boll weight, and lint turnout, May 15 planting date. AGCARES Farm, Dawson County, Texas 2000.

Actual HU	Yield (lb/ac)	Micronaire	Boll wt (g)	% lint turnout
660	454 a[1/]	3.8 a	1.25 a	25.0 a
761	523 a	4.0 a	1.27 a	24.4 a
871	517 a	4.0 a	1.28 a	25.2 a
952	654 a	4.2 a	1.45 a	28.4 a

1/ Means in a column followed by the same letter are not significantly different by ANOVA (P = 0.1; LSD).

Table 22. Impact of defoliation timing based on physiological cutout at different heat unit accumulations on lint yield, micronaire, boll weight, and lint turnout, May 30 planting date. AGCARES Farm, Dawson County, Texas 2000.

Actual HU	Yield (lb/ac)	Micronaire	Boll wt (g)	% lint turnout
662	424 a[1/]	3.9 c	1.15 a	24.6 a
749	419 a	4.0 bc	1.30 a	26.5 a
854	500 a	4.1 b	1.25 a	24.1 a
970	483 a	4.4 a	1.25 a	24.7 a

1/ Means in a column followed by the same letter are not significantly different by ANOVA (P = 0.1; LSD).

Table 23. Impact of insecticide termination timing on boll weevil damage and lint yield. Texas Tech University Farm, Lubbock County, Texas 2000.

Actual HU	Total bolls /40 plants	% punctured bolls: no penetration	% punctured bolls: penetration	Yield (lb/ac)
338 [1/]	100.3 a [3/]	14.9 a	10.4 a	504 a
468 [2/]	94.3 a	8.4 a	5.4 a	523 a

1/ Heat units past NAWF=5, insecticide treatments terminated.

2/ Grower standard, heat units past NAWF=5, insecticide treatments terminated.

3/ Means in a column followed by the same letter are not significantly different by ANOVA (P = 0.1; LSD).

Table 24. Impact of insecticide termination timing on boll weevil damage and lint yield. Rex Isom Farm, Idalou Texas 2000.

Actual HU	Total bolls /40 plants	% punctured bolls: no penetration	% punctured bolls: penetration	Yield (lb/ac)
355 [1/]	122.0 a [3/]	11.5 a	15.0 a	588 a
476 [2/]	134.3 a	24.8 a	21.0 a	838 b

1/ Heat units past NAWF=5, insecticide treatments terminated.

2/ Grower standard, heat units past NAWF=5, insecticide treatments terminated.

3/ Means in a column followed by the same letter are not significantly different by ANOVA (P = 0.1; LSD).