INTEGRATION OF BOLL WEEVIL ATTRACT AND CONTROL TUBES IN COTTON IPM PROGRAMS: PRELIMINARY FINDINGS IN TENNESSEE

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Abstract

Field tests conducted in the fall of 1995 demonstrated the importance of proper placement and maintenance of Boll Weevil Attract and Control Tube (BWACT) installations. BWACTs in weed-free areas attracted numerically greater boll weevils compared with BWACTs in areas where excessive vegetation was present. Placement of BWACTs under tree limbs attracted significantly fewer boll weevils compared with BWACT placements in open areas. Significantly more boll weevils were captured on the bottom half of BWACTs compared with the top half. And placement of BWACTs in fences attracted significantly fewer boll weevils compared with recommended placement on the ground.

Field demonstrations evaluated the efficacy of BWACTs in boll weevil management programs. Numerous oversprays for control of tobacco budworm confounded boll weevil damaged square count data and only one replication was able to be interpreted.

Introduction

Attract-and-kill devices (bait sticks) that incorporated grandlure, feeding stimulants, and a toxicant applied to upright wooden stakes were developed and tested for boll weevil, *Anthonomus grandis* Boheman, suppression by McKibbon et al. in 1990. Attract-and-kill technology for boll weevil control has recently been commercially developed by Plato Industries and is marketed as the Boll Weevil Attract and Control Tube (BWACT). BWACTs consist of a 3 ft. long yellow paper cylinder which is coated with malathion and a feeding stimulant. A grandlure pheromone dispenser is fitted into the top end of the tube and it is mounted on a wooden dowel.

The BWACT may offer an alternative to standard insecticide applications for suppressing early season boll weevils. BWACTs appear to be compatible with integrated pest management (IPM) programs due to their selectivity for boll weevils. Insecticide sprays which target boll weevils are broad spectrum and disrupt the beneficial populations in cotton fields which may flare secondary pests. Research conducted over the past five years has led to much debate concerning the effectiveness of BWACTs for boll weevil management. Most successful field tests with the BWACT have involved area-wide trials or tests conducted in isolated areas (Smith et al. 1992, McKibbon et al. 1994). Additionally, the BWACT is thought to work best when low boll weevil populations exists. In 1992, Fuchs and Minzenmayer found that bait sticks were unable to give acceptable control of boll weevils in Texas. Disagree-ment continues to exist among entomologists as to the effectiveness and potential use of boll weevil attract-and-kill technologies.

Entomologists have recognized the importance of placement of pheromone traps when monitoring insect populations for many years. Visual cues associated with color as well as pheromone play important roles in the efficiency of boll weevil pheromone traps. It stands to reason that placement as well as maintenance of surrounding vegetation would also influence the efficiency of BWACT attractability to boll weevils.

The objective of tests reported herein were to demonstrate the importance of proper placement and maintenance of BWACT installations and to evaluate the BWACT for effectiveness in suppression of boll weevil damage in cotton.

Placement and Maintenance
Materials and Methods

Weed Interference

BWACTs which had been coated with Stickem (a glue-like gel) were placed along the perimeter of cotton fields at 100 ft. intervals on three dates in the fall of 1995. BWACTs were alternately placed in weedy or weed-free surroundings. On August 25 the weedy environment consisted of native vegetation which ranged in height from 24-36 inches and the weed-free environment consisted of a 6-8 ft. circle where existing vegetation had been clipped to a height of less than 3 inches (the BWACTs were installed in the center of the weed-free area). On September 20 the weedy environment consisted of native vegetation which had been bush-hogged at a height of 24 inches and varied in height from 12-24 inches. The weedy environment on September 26 was bush-hogged at a height of 12 inches and varied in height from 6-12 inches. On both September 20 and 26 the weed-free area had been bush-hogged so that existing vegetation was less than 3 inches in height. The number of boll weevils captured by the Stickem were counted on the top and bottom halves of the BWACTs 3, 36, and 24 hours after installation on August 25 and September 20 and 26 respectively.

Placement Under Trees

BWACTs were coated with Stickem and alternately placed at 100 ft. intervals under tree drip lines and in open areas

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or preferred placement. Vegetation in the immediate vicinity (6-8 ft. diameter circle) of BWACTs had been clipped with a weed-eater and were similar for all installations. Boll weevil captures were recorded for the top and bottom halves of the BWACTs 3 and 24 hours after installation on September 20 and 26 respectively.

Placement in Fences

BWACTs were coated with Stickem and alternately placed in fences or on the ground at 100 ft. intervals. Placement in the fence was such that the base of the BWACTs were approximately 30 inches above the soil surface. The number of boll weevils captured were recorded 24 hours after placement on the top and bottom halves of the BWACTs.

Results and Discussion

Maintenance of vegetation around the base of BWACT installations appears to influence the efficiency of BWACT attractability (Table 1). Although not significantly different, the total number of boll weevils captured on BWACTs in weed-free environments were numerically greater than BWACTs in weedy environments. Numerical differences were greatest when weeds were 24-36 inches in height. Significantly more boll weevils were captured on the bottom halves of BWACTs placed in weed-free environments in all three tests. As weed height decreased in weedy environments, the relative differ-ences (ratio) between boll weevil captures on the bottom halves of BWACTs in weed-free and weedy installations also decreased. Captures on the top halves of BWACTs were numerically greater when weed height was 24-36 inches and significantly greater when weed heights were 12-24 and 6-12 inches compared to weed-free installations. From these tests it appears that boll weevils are most attracted to the area on BWACTs one to two feet above surrounding vegetation. Further study and increased replications are needed concerning influence of vegetation maintenance and weed interference.

Significantly more boll weevils were captured on BWACTs placed outside of tree drip lines compared with installations under tree limbs (Table 2). BWACT installations tended to be least efficient when low lying limbs (<10 ft.) were directly above BWACTs.

Significantly more boll weevils were captured on the bottom half of recom-mended BWACT installations when summarizing eight different tests (Table 3). Seventy-four percent of the boll weevils captured on recommended BWACT installations were on the bottom half of the BWACT. Such observation prompted us to question the efficiency of placement of BWACTs in fences. Placement in fences can be time saving and would appear to be very attractive to boll weevils. However, significantly more weevils were captured when BWACTs were placed on the ground compared to placement in a fence (Table 4).

Based on preliminary findings in 1995, placement and maintenance appears to be critical when utilizing the BWACT technology. Placing BWACTs on the ground in open areas away from trees and maintaining an area in the immediate vicinity free of vegetation will increase efficiency of BWACTs.

BWACT Field Demonstrations
Materials and Methods

Field demonstrations comparing the efficacy of BWACT installations with standard boll weevil management programs were conducted in Crockett County and at the Milan Experiment Station and Ames Plantation during 1995. Treatment units included fields ranging in size from 5 to 40 acres and are listed in Tables 5, 6, and 7. Initial BWACT installations were made prior to cotton emergence and replaced approximately 50 days later. All locations received two BWACT deployments and Milan received a third installation. BWACT installation dates included May 2 & June 26 in Crockett County, May 1, June 22, & July 26 at Milan, and May 5 & June 20 at Ames. Roundup was periodically applied around the base of BWACTs to prevent interference of attracting boll weevils by surrounding vegetation.

Pinhead square sprays were initiated on selected fields to control overwintered boll weevils at the matchhead square stage. Boll weevil square damage counts were made on a weekly basis in each field by examining 100 one-third grown squares. Insecticide applications for boll weevils and other pests were made based on economic thresholds. Ten percent square damage was used as the boll weevil economic threshold.

Pheromone traps were monitored at several locations in West Tennessee on fields which were planted in cotton in 1994 but not in 1995 to determine overwintered boll weevil emergence curves. Efficacy of early season boll weevil management programs such as pinhead square insecticide sprays are highly influenced by emergence patterns which vary from year to year.

Results and Discussion

Crockett County

Percent boll weevil damaged squares at the Crockett County site from July 13 thru Aug 7 may be found in Table 5. The 10 percent boll weevil damaged square threshold was exceeded on July 25 in the untreated field. The BWACT and BWACT plus one and two pinhead sprays exceeded threshold on August 1. Due to additional pyrethroid oversprays for tobacco budworm control, boll weevil sampling procedures were discontinued after August 7. Treatments which received pinhead square sprays only had not exceeded the boll weevil threshold on August 7. Figure 1 illustrates a boll weevil emergence curve generated in Crockett County. An early emergence occurred in 1995 and a large percentage of overwintering boll weevils had emerged and infested cotton fields prior to the time pinhead sprays were made. Although very high pheromone trap counts were observed for this area, the early emergence partially explains the lack of heavy boll weevil pressure. Emergence curves at other locations in Tennessee were similar.

Milan Experiment Station

Insecticide use and percent boll weevil punctures at the Milan Experiment Station are listed in Table 6. In four of the ten treatment fields an early application of Karate was made for tobacco budworm control and make data interpretation difficult. On August 1 both untreated fields and one BWACT treatment exceeded the 10 percent boll weevil threshold. The following week, August 7, five of the seven remaining fields exceeded threshold for boll weevil. After August 7 numerous pyrethroid sprays were applied for boll weevil and tobacco budworm control.

Ames Plantation

Boll weevil damaged square counts for treatments at Ames Plantation are listed in Table 7. Nine to ten insecticide sprays were made for tobacco budworm and boll weevil control on all fields between July 7 and August 30. Most sprays targeted tobacco budworm and in many cases included a pyrethroid which has good control activity on boll weevils. Thus, data is confounded and no conclusions can be drawn.

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Table 1. Mean Boll Weevil Captures on weedy and weed-free BWACT installations.

		Boll Weevils Captured per BWACT		
Date	Treatments	Total	Bottom 1/2	Top 1/2
Aug. 25	Weedy (24-36")	86	19	67
(n=5)	Weed-Free	148	97	51
	Trt. Prob(F)	0.18	0.01	0.57
Sept. 20	Weedy (12-24")	131	46	85
(n=9)	Weed-Free	165	141	24
	Trt. Prob(F)	0.55	0.03	0.02
Sept. 26	Weedy (6-12")	154	51	104
(n=6)	Weed-Free	196	127	69
	Trt. Prob(F)	0.15	0.002	0.02

Table 2. Mean Boll Weevil Captures on preferred BWACT installations and placement under tree driplines.

		Boll Weevils Captured per BWACT		
Date	Treatments	Total	Bottom 1/2	Top 1/2
Sept. 20	Preferred	255	220	35
(n=5)	Dripline	78	48	29
	Trt. Prob(F)	0.0001	0.0001	0.64
Sept. 26	Preferred	173	111	62
(n=5)	Dripline	73	38	35
	Trt. Prob(F)	0.03	0.005	0.26

Table 3. Mean Boll Weevil Captures on preferred BWACT installations on the bottom verse top halves of the tube (mean of eight tests).

	Boll Weevils Captured per BWACT	
	Bottom 1/2	Top 1/2
Trt Prob(F) = 0.0002	149 (74%)	53 (26%)

Table 4. Mean Boll Weevil Captures on preferred BWACT installations and placement in a fence 30 inches above the soil surface.

		Boll Weevils Captured per BWACT		
Date	Treatments	Total	Bottom 1/2	Top 1/2
Sept. 26	Preferred	284	196	88
(n=6)	Fence	128	102	26
	Trt. Prob(F)	0.002	0.03	0.004

Table 5. Percent boll weevil damaged squares and insecticide use by week, Crockett Co., TN 1995.

	Percent Boll Weevil Damaged Squares				
Treatment	Jul 13	Jul 20	Jul 25	Aug 1	Aug 7
Untreated	1	4	16	22[3]	13[4]
BWACT	0	5	6	16[3]	8
BWACT + One[1] Pinhead Spray	0	0	2	14[3]	6
BWACT + Two[1,2] Pinhead Spray	0	0	1	11[3]	6
One Pinhead Spray[1]	0	0	8	6	8
Two Pinhead Sprays[1,2]	0	1	4	6	4

[1]Guthion (12 ozs.) + dimethoate (4 ozs.) applied on June 20.
[2]Guthion (1 pt.) applied on June 26.
[3]Karate (4 ozs.) applied on August 1.
[4]Karate (4 ozs.) applied on August 7.

Table 6. Percent boll weevil damaged squares by week and boll weevil and tobacco budworm insecticide use, Milan Experiment Station 1995.

	Percent Boll Weevil Damaged Squares			
Treatment	Jul 18	Jul 25	Aug 1	Aug 7
Untreated	0[1]	3	-[2]	14[3]
Untreated	1	6	34	42
BWACT + One[4] Pinhead	0	0	4	25
BWACT + One[4] Pinhead	0	0	0	7
BWACT + One[4] Pinhead	0	5	14	20[3]
BWACT + Two[5,4] Pinhead	1	1	6	6
BWACT + Two[6,7] Pinhead	0[8]	2	4	12[3]
BWACT + Two[4,9] Pinhead	-	0	3	13
Two Pinhead[5,7] Sprays	1[1]	0	4	12
Two Pinhead[5,7] Sprays	0[1]	0	5	14

[1] Karate (4.2 ozs.) applied on July 11.
[2] Guthion (1 pt.) applied on July 31.
[3] Guthion (1 pt.) applied on August 3.
[4] Vydate (8 ozs.) applied on June 27.
[5] Vydate (6 ozs.) applied on June 16.
[6] Vydate (6 ozs.) applied on June 15.
[7] Vydate (8 ozs.) applied on June 28.
[8] Karate (4.2 ozs.) applied on July 1.
[9] Vydate (8 ozs.) applied on July 10.

Table 7. Percent boll weevil damaged squares by week and insecticide use, Ames Plantation 1995.

	Percent Boll Weevil Damaged Squares[2]					
Treatment	7/20	7/27	7/31	8/10	8/14	8/17
Untreated(n=1)	8	16	6	3	4	9
BWACT + Pinhead[1]	5	14	22	5	10	18
Pinhead[1] Spray	4	10	9	2	3	7

[1]Methyl parathion (1/2 pt.) applied on June 30.
[2]Eight-ten pyrethroid applications were made between July 7 and August 30.