INITIAL AND RESIDUAL TOXICITY OF BOLL WEEVIL ATTRACT AND CONTROL TUBE IN THE LOWER RIO GRANDE VALLEY AND BRAZOS VALLEY OF TEXAS - SPRING AND FALL, 1998

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Abstract

All weevils that contacted un-aged double-coated BWACTs (0 weeks of age) and were collected died within 48 h. BWACTs aged 4 weeks killed 31% of the weevils in the spring upon contact and 75% and 78% of the weevils in the fall after 48 h. BWACTs aged 6 weeks killed 25% to 100% of the weevils in 48 h. Sixty milligrams of the pheromone grandlure were present in each BWACT and placebo. The range of times that weevils landed and contacted the BWACT formed a continuum and were extremely variable. In the spring, at both locations, range of times weevils collected from the placebo (the same formulation without malathion) was longer than the time determined on the BWACT. In the fall, times were variable at both locations. More boll weevils were found in buckets at the base of un-aged BWACTs than in buckets at the base of the 4 and 6 week BWACTs. More boll weevils were found in buckets at the base of the triple-coated aged BWACTs for the same times than at the base of the double-coated aged BWACTs. Number of weevils landing on BWACT were greater than number collected because some flew away before they were captured. Zero to 15 % of the total number of weevils observed approaching the BWACTs and placebos were fly-bys.

Introduction

The objectives of these tests were to determine initial toxicity with un-aged Boll Weevil Attract and Control Tubes (BWACTs) and residual toxicity with aged BWACTs to boll weevils. Placebos with grandlure, but no malathion, were used as checks. In addition to the results on the toxicity we also observed the response and behavior patterns of boll weevil to grandlure pheromone released from a dispenser placed in the BWACT and placebo.

In a previous test the BWACT was not toxic to the boll weevil (Spurgeon et al 1998). No explanation was offered for the loss of toxicity.

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Materials and Methods

Double-coated, un-aged BWACTs used in all but one of these tests had 35 g of malathion on 3,716 cm2 or 576 in2 in both coats on each polyvinyl alcohol glue (PVA) coated cardboard tube. The PVA provides waterproofing for the tubes. Double-coated BWACTs have 32 mg/in2 cottonseed oil and 41 mg/in2 of a natural wax. Clay, green pigment and ethanol are added for mixing and bonding all the ingredients. The PVA-coated cardboard tube is dipped in the insecticide solution, allowed to dry 24 hr and then re-dipped in the same solution. In the fall Brazos Valley test each tube was triple-dipped and contained 52.5 g malathion. With the exception of malathion placebos contained the same ingredients as the BWACTs. Cottonseed oil was used to replace the malathion in the coating of the placebo.

The coatings on the BWACTs used in both spring tests were formulated with solvent-extracted cottonseed oil. They had 65 g of coating on top of the PVA and were from the same lot [#007298]. Double or triple coated BWACTs used in the fall tests were formulated with crude or crushed cottonseed oil. The triple coated BWACTs had 90-95 g of coating and were made at the same time, thus they were from the same lot (#019798). All the placebos were made in 1998 just prior to the spring tests. All un-aged BWACTs and placebos were maintained in individual plastic sleeves. BWACTs were maintained in plastic sleeves until placed outdoors. Sixty mg of grandlure pheromone in a 3" x 3" plastic dispenser was placed in each BWACT or placebo when each test was established.

The spring test in the LRGV was conducted with un-aged and aged BWACTs and placebos on March 17-18, April 14-15, and April 28-29. The spring test, in Brazos Valley with un-aged and aged BWACTs and placebos, was conducted on May 4 - 5, June 1 - 2 and June 15 - 16. In the spring BWACTs were aged for 4 and 6 weeks in the field at the site of the tests before observation. The fall test in the LRGV was conducted September 2 - 3. The fall test in Brazos Valley was conducted September 30 - October l. Aged BWACTs were held outdoors at each location 4 and 6 weeks prior to the test in the spring and near Houston in the fall. The major difference in the spring and fall tests was the aging of BWACTs 4 and 6 weeks prior to the start of the fall tests; this allowed us to determine toxicity of the un-aged and aged BWACTs at the same time.

Each BWACT and placebo was placed on a stake driven through a rectangular 9.45 liter white or yellow plastic bucket which made observation of dead and dispersing boll weevils from BWACT or placebo easier to determine. Each bucket was 100 to 200 m apart in all the tests. Fresh 60 mg grandlure pheromone dispensers (Lot # 007198) were used with each BWACT and placebo in the tests.

Location of spring test was near Brown and Dockberry Roads southeast of Brownsville in the LRGV along brush-

lines and drainage ditches around fallow fields and soybean fields when cotton was not fruiting. Location of fall test was along brush lines surrounding shredded and plowed cotton fields near FM510 and McCullough and old Rio Hondo road, near San Benito in the LRGV.

Spring test in Brazos Valley was located in Robertson County in river bottom near non-fruiting cotton. Cotton ranged in size from 3 to 6 inches in the field utilized in the test. Fall test in Brazos Valley was conducted at intersection of County Road 227 and FM 50 along wooded areas adjacent to cotton awaiting harvest.

In the LRGV BWACTs and placebos were placed upwind or downwind along fields of cotton or along brush lines adjacent to cultivated fields. The LRGV has prevailing southeast winds. BWACTs and placebos were downwind to prevailing southerly winds in fall and spring in fields in Brazos Valley. However, winds were variable at all observation sites in both the spring and fall.

Method of evaluating each test was the same both seasons at both locations. Four two hour observation periods in the mornings and afternoons for 0 week and 4 and 6 weeks BWACTs and placebo were conducted. One person observed each BWACT in each test. The time of contact by the boll weevil was recorded. The length of time they walked, rested or poised with proboscis up to the time of elytra opening and flight was recorded. The weevil was allowed to move about the stick until it fell from the surface of the BWACT or was captured just prior to or in flight by hand or sweep net. Each captured weevil was placed in a quart zip-lock bag with a cotton ball saturated with 5-10 % sugar water. Bags were placed in shade for return to air-conditioned room to determine mortalities after 24 and 48 h. Only the 48 h mortality is shown. Mortality was determined when weevils did not respond upon probing.

Time weevils were observed on bucket, plants, soil, and observers within the 2 m2 area was determined. Boll weevils which flew by the area, but did not land, were also counted.

Twenty-four, 48, 72 and 96 h after the observation period the bucket of each BWACT or placebo was examined for dead and live weevils. At the same time the BWACT or placebo was also examined for weevils.

Results

Mortality Of Boll Weevils Which Contacted The BWACT Or Placebo

In all four tests all un-aged BWACTs killed 100% of weevils within 48 h after they were collected (Table 1). On unaged 0 week BWACT 34 mgs malathion is present at the site where a weevil makes contact. This quantity will kill all boll weevils, but 48 h is needed to assure that all adults which contact the BWACT will die.

In the spring BWACTs aged 4 weeks killed 31% of the weevils which were collected in the Brazos Valley. In the fall 78% and 75% of the weevils collected in the LRGV and Brazos Valley, respectively, were killed. No weevils were observed on aged BWACTs in the spring in LRGV. BWACTs aged 6 weeks killed 100% of the boll weevils in the spring in the Brazos Valley and 25% to 75% in the fall at the two locations. In the spring in the LRGV no weevils contacted the aged BWACTs. None of the boll weevils which contacted the placebo in the spring were killed. In the fall 5 to 16% died in the bucket of the placebo. We conclude that these weevils were either aged or were exposed to insecticides prior to contacting the placebo.

Time Boll Weevils Were In Contact With BWACT And Placebo

In the spring in the LRGV the greatest time a weevil was observed was 4,140 seconds on a placebo and the least time was 0.1 seconds on a BWACT (Table 2). Seconds that boll weevils walked, rested or poised in alert position were variable with no trend indicated.

Boll Weevil Landings And Fly-Bys

Fly-by of weevils for BWACT was greater than for placebo in spring and fall in LRGV (Table 3). Fly-by of weevils for placebo was greater than for BWACT in spring and fall in the Brazos Valley.

Boll weevils landing near but not contacting the BWACT were greater than near the placebo during both seasons in the Brazos Valley and fall in the LRGV. The spring season in the LRGV followed the opposite trend.

Toxicity Of Boll Weevils Post-Observations

More weevils were killed 24 to 96 h post-observation in un-aged 0 week BWACT than BWACTs aged 4 or 6 weeks (Table 4). Decreasing numbers to 96 h were shown in the spring and fall in the LRGV. Variable numbers were shown in the Brazos Valley in un-aged and aged BWACTs in the spring and fall. More total weevils were found in buckets of un-aged and aged BWACTs in the Brazos Valley than in the LRGV.

Percentage of boll weevils which contacted the placebo compared to the BWACT was greater in 75% of the tests. Weevils contacted a greater percentage of BWACTs in the spring in the LRGV than the placebo. Constant efforts are being made to improve the field residual toxicity of the BWACT and to evaluate alternate toxicants for use in the BWACT.

Discussion

These tests were conducted to determine the initial and residual toxicity of malathion in the BWACTs and the behavior of the boll weevil as it relates to grandlure in the attract and kill device in a year-round area-wide suppression program. The BWACT is one of three factors that should

be used to suppress the boll weevil to the point where it will no longer be an economic pest of cotton, Wolfenbarger and Wolfenbarger (1998). The factors should be used in sequence and in parallel, i.e. planting and plow-up dates and applications of malathion.

Activity of the boll weevil in these tests was consistently inconsistent. For example, the results in the spring in Brazos Valley suggested that the BWACTs repelled the boll weevil. This was not indicated in the spring test in the LRGV. It appeared that the weevils present in the spring were considerably weaker and were killed almost instantly upon contact with the BWACT. The weevils in the fall, including young or red weevils, were able to walk around and be in contact with the BWACT for longer periods of time.

The reasons for the inconsistencies can be attributed to a number of variables. There are also differences in these variables between the LRGV and the Brazos Valley. Some of these variables are boll weevil populations and dispersions, weather conditions, time of the season, placement and/or observation site of BWACTs, and boll weevil habits in different areas.

These results suggest that the BWACT needs to be used as long as possible in an area for maximum effectiveness. In the LRGV boll weevils are moving at all times of the year except during inclement weather. Because of the inconsistent behavior patterns of the boll weevil, the BWACTs need to be in place to interact with the changes in these behavior patterns. The BWACTs need to be replaced at specified intervals. In the LRGV or Brazos Valley they need to be replaced 3 to 4 times following stalk destruction. They should be removed following planting in the spring.

References

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Table 1. Boll weevil mortalities after 48 h, LRGV and Brazos Valley, TX. 1998.

Age	SPRING		FALL	
BWACT	Number insects	Dead [%]	Number insects	Dead [%]
	Lower Rio Grande Valley			
0 wk.	34	100	19	100
4 wks	0		63	78
6 wks	0		18	75
Placebo	44	0	49	16
	Brazos Valley			
0 wk.	59	100	16	100
4 wks	16	31	16	75
6 wks	4	100	21	25
Placebo	62	0	15	6

Table 2. Time of boll weevil on BWACT and placebo prior to collection or death. 1998.

Age	Number insects	Seconds	
BWACT		Mean	Range
	SPRING		
	Lower Rio Grande Valley		
0 wk	19	37	0.1 - 300
4 wks	0		
6 wks	0		
Placebo	40	400	2 - 4140
	Brazos Valley		
0 wk	33	21	3 - 201
4 wks	2	120	30 - 210
6 wks	3	135	5 - 122
Placebo	36	174	7 - 600
	FALL		
	Lower Rio Grande Valley		
0 wk	7	214	66 - 380
4 wks	18	105	10 - 590
6 wks	4	620	240 - 1220
Placebo	43	136	4 - 801
	Brazos Valley		
0 wk	19	293	1 - 1862
4 wks	26	168	1 - 984
6 wks	38	86	5 - 300
Placebo	35	192	2 - 740

Table 3. Number of boll weevils on or near un-aged BWACTs and placebos. 1998.

		Percentage of Total Insects		
	Total insects	Landed on BWACT/ placebo	Landed nearby	Fly-bys
		Lower Rio Grande Valley		
			SPRING	
BWACT	34	79	6	15
Placebo	44	68	25	5
			FALL	
BWACT	19	36	58	5
Placebo	49	82	18	0
		Brazos Valley		
			SPRING	
BWACT	61	54	43	3
Placebo	66	94	0	6
			FALL	
BWACT	59	39	58	3
Placebo	43	49	44	7

Table 4. Boll weevil mortalities in buckets. 1998.

	Un-aged and aged BWACTs in weeks					
Hr. post	0	4	6	0	4	6
observation	SPRING			FALL		
	Lower Rio Grande Valley					
24	25	0	0	21	2	1
48	11	0	2	11	2	0
72	2	0	0	7		0
96	4	0	0		8	
	Brazos Valley					
24	24	2	0	9	5	8
48	51	3	0	4	2	7
72	5	2	3	15	7	2
96	29	4	3	7	4	2