MALATHION ULV RATE STUDIES UNDER BOLL WEEVIL ERADICATION PROGRAM FIELD CONDITIONS

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Abstract

Malathion ulv (ultra low volume) is the main insecticide and ultra low volume is the application technology used by the Boll Weevil Eradication Programs on cotton in the United States. This study compares 12 oz. to 16 oz. per acre of Fyfanon ULV (95% a.i. malathion) under actual Program conditions in Hidalgo County Texas. Five pairs of fields (38 acres/field) were selected on a large cotton farm. One of each pair was sprayed by aerial application with 12 oz./acre and the other with 16 oz./acre. Leaf samples were collected from each field and boll weevils were held on these leaves in petri dishes for 48 hours. The first two applications were seven days apart starting shortly after the first square stage of cotton. These leaf samples were collected and tested with boll weevils every other day including 8 and 11 days after the 2nd application. Five, later, applications had leaf samples collected only on the application day. Cotton plants were individually examined for the whole growing season in both treatments. Fruiting records and insect counts were made. No significant difference was found in field infestations between the two rates of malathion ulv or in boll weevil control.

Introduction

Malathion ULV (ultra low volume) has been used for effective boll weevil control and as an eradication tool. Work on rate tests have been conducted for mid to late season diapause programs (Burgess, 1965), but not with Fyfanon ULV (95% a.i.). There have been no early season studies of lower rates for boll weevil control under eradication conditions. Reducing the rate from 16 oz. to 12 oz. of malathion ulv per acre is simply that. There will be one quarter fewer spray droplets per acre. The droplets in both rates will be of the same size and concentration of active ingredient.

The hypothesis to be tested is that 12 oz. of malathion ulv is as effective as 16 oz. per acre to control the boll weevil under actual Boll Weevil Eradication Program operations for the full season. The ultra low volume aerial application technology is designed to cover the whole field, with overlapping of spray swaths for good droplet coverage. Therefore, the test procedure to sample this should cover multiple application swaths or a major cross section of the treated field.

Methods and Materials

Five pairs of fields (38 acres/field) were selected near each other with same soil types, planting dates, cotton variety and production practices. One field in each pair was treated with the 12 oz. rate and the other with the standard 16 oz. rate. The applications of both treatments were made the same day and immediately after the other. The first 2 applications of both treatments were made on May 4 and May 11. The sequence of the 2 treatment applications was alternated between the first and second spray dates. Dry windy conditions were similar for both application days with wind gusts increasing in velocity and frequency towards mid-day. Each field or replicate was sprayed uniformly using a satellite guidance system in the Cessna AGTRUCK spray plane. Both field ends were sprayed perpendicular to these swaths to complete the spray coverage. This same procedure was used for the other five applications of both treatments. These application dates were determined by the numbers of boll weevil adults caught in the Eradication Program's boll weevil pheromone traps on the farm.

Immediately after application (day 0) 30 plants were sampled in each field or treatment replicate. Plants selected to sample were on a line perpendicular to the flight of the aircraft and near the field centers. The sampled plants were selected at 5 row intervals totaling 486 feet across the field or 6.5 of the 75 foot aircraft spray swaths. Three leaves from each plant were hand picked and placed in a plastic petri dish. These dishes (1.5 x 90 cm) were numbered for infield location to determine coverage. In the laboratory, ten adult boll weevils were placed in each petri dish and observed for mortality after 24 and 48 hours. This bioassay used adult boll weevils from the Gast Rearing Facility at Mississippi State University. The sample was reduced to 15 plants and 5 boll weevils per dish at 2, 4, and 6 days after both the lst and 2nd applications from all fields. After the second application the 8 and 11 day samples were further reduced to 10 plants with 5 boll weevils per dish. This smallest bioassay was conducted for the remaining 5 applications only on day 0. Controls were used with greenhouse grown cotton and untreated experiment station research plot cotton leaves in petri dishes with adult boll weevils from the same source as treated weevils. The results of 5 separate controls were combined. These were used to adjust for mortality not associated with the insecticide by deriving Abbott's Formula (1925). Mortality was observed at 24 and 48 hours for all reduced bioassays and controls.

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Plant sampling was conducted the same in each field in both treatments. It varied from one to two times a week from May 1 through July 31. Either 6 or 12 plants were randomly selected across each field. Each plant sample or examinations included fruit counts and presence of boll weevils both adult and immature stages. Field examinations of 100 squares were also conducted. Boll weevil survey traps baited with Grandlure, 10 mg in Hercon strips, were located on field edges throughout the farm. These traps were serviced by Eradication Program personnel on a periodic basis (Table 2).

The experimental design for this test was a paired comparison for statistical analyses with the t-test (Wilkinson et al, 1992). The nature of the aggregation pheromone in the boll weevil traps (Lloyd et al, 1983) disallowed use in comparison of adjoining fields. This data was, therefore, averaged by trap by date for all fields in the test area.

Results and Discussion

With all bioassays of leaves there were no significant differences between the two rates of malathion ulv as tested and compared by t-test (Tables 1). The 24 hour counts showed 100% mortality for all samples collected immediately after application (day 0) in all replicates for both treatments for the first 2 applications. All day 2 samples had 98% mortality at 24 hours and 100% mortality at 48 hours. The weather conditions were similar on both application days (May 4 and 11, 1995). The cotton plants were dry during the May 4th to 22nd study period with no dew formation. Wind was a factor during both (1st and 2nd) application days, increasing in speed (10 mph maximum) from early morning to noon. The 12 oz. rate was applied first on the morning of May 4 and second on May 11. The leaf samples taken and compared only for day 0 for the other 5 applications (Table 1) showed no significant difference between treatments.

Boll weevil mortality on day 0 of the first 2 applications (Table1) indicates that insecticide coverage on cotton plants is not significantly different between treatments. This mortality from samples across 6.5 separate spray swaths of the airplane indicates good whole field coverage. The growth of the plant during this period (Table 2) and sampling technique indicate full plant coverage. The results are in agreement with the work conducted by Burgess (1965) in the lower Rio Grande Valley.

Rain and dew formation and its effect on malathion ulv application and spray residual was not a factor during this study as indicated by Nemec et al, 1969. The residual efficacy of both rates showed no significant difference through Day 11 of the study (Table 1). The fields were watered using gravity feed furrow irrigation during the month of May.

Damaged squares and boll weevil presence were not significantly different (Table 2) between the 2 rates. Adult boll weevils were not found in any of the fields until July when open bolls were present. This population started building during the late season (Table 2). The boll weevil trap catches likewise started increasing at the same time. The seasonal trap catch was similar seasonally to that found by Wolfenbarger et al, 1976 to occur in this valley. None of the numbers of boll weevils found in the field or in the traps were extreme. The scarcity of boll weevils in the plant and square samples during May and June does not support or disprove the effectiveness of malathion ulv for suppression of boll weevil populations on cotton plants during the bloom period.

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Table 1. Mortality of boll weevils after 48 hours on cotton leaves collected immediately (0 day) and other days after aerial spray application of malathion ulv at 12 and 16 oz. rates per acre under Boll Weevil Eradication Program conditions in Hidalgo County, Texas during 1995.

Dates and Day Leaves Collected After Application	Applications	16 oz./acre rate		12 oz./acre rate
May 4 (0 Day)	1st	100.0% 1		100.0% 1
May 6 (2 Day)		100.0%		100.0%
May 8 (4 Day		89.2%	90.2%	
May 10 (6 Day)		80.8%	72.4%	
May 11 (0 Day)	2nd	100.0%		100.0%
May 13 (2 Day)		100.0%		100.0%
May 15 (4 Day)		89.0%	90.0%	
May 17 (6 Day)		63.9%	65.7%	
May 19 (8 Day)		34.8%	45.2%	
May 22 (11 Day)		24.2%	35.0%	
May 26 (0 Day)	3rd	100.0%		100.0%
June 14 (0 Day)	4th	100.0%		100.0%
July 6 (0 Day)	5th	99.2%	99.2%	
July 20 (0 Day)	6th	97.0%	97.0%	
July 28 (0 Day)	7th	100.0%		100.0%

1. Adjusted percent mortality.

Table 2. Seasonal patterns of boll weevils in trap catches, in field samples and cotton plant development.

		Numbers Of Boll Weevils In Samples Per 100 Squares					
	Avg./	16 oz. Fields		12 oz. Fields		ULV	Plant
Date	Trap	Adults	Egg	Adult	Egg	Spray	Condition
4/12	1.6						
4/17	0.5						
4/24	0.3						
5/1		0	0	0	0		1st Square
5/4	0.1					X	
5/8		0	0	0	0		
5/11						X	
5/15		0	0	0	0		Bloom
5/17	0.2						
5/22		0	0	0	0		
5/26	.06	0	0	0	0	X	
5/30		0	0	0	0		
6/3	0.1						
6/5		0	1	0	0		Lrg. bolls
6/12	0.06	0	1	0	0		
6/14						X	
6/19		0	0	0	0		
6/26	0.13	0	0	0	0		
7/3		1	0	0	0		Open bolls
7/6	0.74	0	0	0	0	X	
7/10		2	0	1	0		
7/17	1.9	7	0	6	0		
7/20		4	0	8	0	X	
7/24	3.2	2	3	4	5		
7/28		12	1	9	3	X	Defoliated
7/31	6.4	7	3	4	6		
8/7	11.0						
8/17	3.5						