DIFLUBENZURON AND MALATHION ULTRA LOW VOLUME FOR BOLL WEEVIL AND BEET ARMYWORM CONTROL UNDER BOLL WEEVIL ERADICATION PROGRAM CONDITIONS

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Abstract

Three treatments of diflubenzuron with either cottonseed oil or malathion ultra low volume were tested under Boll Weevil Eradication Program conditions in the Concho River Valley of Texas. All treatments were aerially applied as ultra low volume (ULV) at either 14 or 16 ounces per acre. These applications were compared for effect on boll weevil, beet armyworm, cabbage looper and beneficial arthropod populations. Treatments were also compared to a large acreage of cotton that had no insecticide treatments. The addition of di-flubenzuron protected cotton bolls as compared to those on the untreated.

Introduction

Diflubenzuron (Dimilin) is an insect growth regulator that is registered for both the boll weevil and beet armyworm in cotton. As a chitin inhibitor it prevents egg hatch in the boll weevil (Rummel, 1980) and disrupt molt and development of the beet armyworm larval stages (Chandler, 1994). Past work has shown an enhanced effect on the efficacy of boll weevil control when diflubenzuron was added to malathion ULV (ultra low volume) (Haynes, 1992). The addition of diflubenzuron to the Boll Weevil Eradication Program's Malathion ULV applications to prevent exacerbating beet armyworm populations has been discussed but never tested. In the test work, (Jones et al. 1995 and 1993) used tank mixes of Dimilin 2F and malathion ULV. Dimilin 2F as a ULV application spray material has been tested in the southeast seasonally (Jones et al. 1995) since 1989 with promising results on boll weevil but no beet armyworm populations were present in test areas.

Treatment

1. Dimilin 2F at 4 ounces (1 ounce active ingredient) and cottonseed oil at 10 ounces per acre. 2. Dimilin 2F at 4 ounces and Malathion ULV at 12 ounces (95 percent active ingredient) per acre. 3. Dimilin 2F at 2 ounces and Malathion ULV at 12 ounces per acre. 4. No insecticides applied.

Applications of the first three treatments were made on each of equal thirds of five large fields with about 50 acres per treatment replication. Applications were made by an aircraft contracted to the Boll Weevil Eradication Program for their standard ultra low volume control applications. Three of these fields were northeast of San Angelo and the other two were southeast of Wall, Tom Green County, Texas. All fields had reached the Boll Weevil Eradication pheromone trap threshold for boll weevil control and the growers were preparing to control for beet armyworm with Dimilin 2F. Both locations were treated by growers after our prespray samples and before the first test treatment applications for both aphids and bollworms, but not beet armyworm. The test treatments were made as three weekly applications. This was done on August 9 - 10, August 16 and August 23, 1995. The untreated control or treatment 4 were four fields of cotton composing an 800 acre block of cotton between San Angelo and Wall which remained untreated by either the grower or the Eradication Program prior to and during this trial.

Sampling

A plot was 50 foot of row with five plots across each treatment replicate or field. The first and fifth plots were on opposite sides of the field with the other three being equal distance between. Different rows were selected for each sample date. The sample specimens were collected by a tractor mounted blower and vacuum. The tractor was operated at its lowest speed and the blower at a force of 90 miles per hour. The blower side blew the collected materials, plant and arthropod, into the vacuum side. A row or cotton plant was straddled and the whole plant sampled. The plot samples were immediately transferred from the mesh collection bag into a large ziplock brand plastic bag. These samples were placed in a cooler behind the tractor seat until transfer to a freezer. The samples remained frozen until analysis which included water flotation and sieves to separate the plant and arthropod materials. The major arthropods were identified, counted and recorded.

Plant and boll counts began on September 12 and ended on September 19 with rain delays. Plot size and spacing was as previously described. Bolls were counted and distinguished by size and maturity. The diameter of a USA twenty-five cent coin was the determining factor with large boll diameters being larger. Mature bolls were open or hard to the touch and immature bolls were soft.

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Results and Conclusions

There were no adult boll weevils or signs of boll weevils found in any of the treatment samples. The Boll Weevil Eradication Program traps caught adult boll weevils in numbers to trigger spray applications in treated fields in both early August and September. Bollworms were not prevalent enough to justify comparison.

The beet armyworm and cabbage looper counts are presented in Table 1. The insect growth regulator, diflubenzuron does not give an immediate effect and the sampling did not distinguish between healthy and affected insects. The samples show the pest pressure over time. The untreated cotton was not as attractive to the second generation of moths in the study as the more protected or treated cotton. These differences were not statistically significant. This is shown also in the boll counts in Table 2. The untreated cotton had only immature small bolls present by mid-September with most if not all of the middle and lower part of the plant stripped of leaves and fruit prior to August 28. A definitive impact of the pest populations, predominately the beet armyworm and cabbage looper was not possible to ascertain. This study was done in dry land cotton and periods of drought complicated the situation especially in late August and early September. The small mature bolls in the treated cotton are a product of this. These fields experienced pressure from two separate generations of the beet armyworm with egg laying occurring for over two weeks both times. The samples indicated a building population on August 7 (after the fields had dried from the five day rain from tropical storm Dean stalling over the Concho River Valley). Only last instar larvae were present on August 21. August 28 samples had early instar larvae indicating the buildup of a new generation. The cabbage looper population showed similar trends. Their highest numbers were found in the untreated cotton.

Beneficial arthropod numbers (Table 1) were consistent in all treatments and all dates for the lack of species diversity. The predominant predator was the ladybird beetle composing 90 to 98 percent of the sample numbers. The green lacewing was the next most common predator composing up to 7 percent of some samples. Bigeyed bugs, damsel bugs, crab spiders (no other types of spiders), and spined soldier stinkbugs were collected sporadically in low numbers. No hymenopterans were found in the samples. Green stinkbug and Conchuela stinkbug populations were expected to move into the cotton from the grain sorghum but only sporadic and low numbers of adults were encountered. Control of stinkbugs and headworm populations in the grain sorghum may explain the lack of beneficial numbers and diversity. No minute piratebugs were collected or observed during the study in the cotton fields.

All of the treatments with Dimilin had mature bolls. This shows that the ultra low volume applications of Dimilin 2F in either oil or with malathion ULV gave a statistically significant level of protection in terms of large bolls between the treated and untreated cotton.

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Table 1. Means of 50 foot row samples for beet armyworm, cabbage looper and beneficial arthropods in Dimilin and Dimilin + Malathion ULV treatments versus untreated fields, 1995.

	Trtmt	7 Aug	14 Aug	21 Aug	28 Aug	6 Sept
Beet Armyworm	1	19.40 A	40.56 A	4.56 A	11.52 A	163.68 A
	2	15.70 A	80.40 AB	5.44 A	12.28 A	142.20 A
	3	13.90 A	110.76 B	5.00 A	11.12 A	87.52 A
	4	15.25 A	66.25 AB	7.70 A	0.70 A	33.70 A
	LSD	14.21	50.73	5.95	12.52	149.42
Cabbage Looper	1	15.75 A	14.36 A	15.04 A	8.60 A	45.68 A
	2	17.10 A	17.96 A	10.44 A	8.48 A	44.44 A
	3	18.75 A	23.52 AB	20.48 A	8.28 A	23.48 A
	4	5.25 A	110.60 B	40.75 A	4.20 A	6.65 A
	LSD	15.61	87.61	30.45	14.45	39.81
Beneficial Arthropods	1	10.45 A	8.44 A	3.56 A	5.60 A	26.84 A
	2	11.50 A	5.04 A	1.48 A	6.88 A	14.88 A
	3	12.70 A	7.24 A	0.84 A	0.80 A	12.20 A
	4	34.90 B	198.00 B	228.60 B	68.75 B	24.40 A
	LSD	13.95	127.24	51.17	17.73	37.64

Means followed by same letter are not significantly different LSD test 5% confidence level.

1. Dimilin 2F at 4 ounces and cottonseed oil 10 ounces per acre.
2. Dimilin 2F at 4 ounces and Malathion ULV at 12 ounces per acre.
3. Dimilin 2F at 2 ounces and Malathion ULV at 12 ounces per acre
4. No insecticides applied.

Table 2. Mean number of large bolls, small bolls and plants per 50 foot row in Dimilin, Dimilin + Malathion ULV and untreated cotton fields.

Treatment	Large Bolls	Small Bolls	Plants
Dimilin	88.64 A1	33.20 A	129.36 A
Dimilin 4oz. + Malathion	86.68 A	36.24 A	143.20 A
Dimilin 2 oz. + Malathion	96.72 A	39.16 A	133.92 A
Untreated	1.00 B	27.95 A2	150.50 A
LSD .005	72.00	47.64	49.96

1. Same letter indicates no significant difference at LSD + .05 level of probability.
2. Small bolls in untreated were immature while other treatments were mature.