IMPACT OF BAYTHROID, GUTHION AND LEGEND ON PEST AND BENEFICIAL ARTHROPODS IN COTTON

Alton N. Sparks, Jr. and John W. Norman, Jr.
Texas Agricultural Research and Extension Center
Weslaco, TX

Abstract

A replicated large plot field trial was conducted to examine the effects of selected insecticides on pest and beneficial arthropods in cotton. Insecticides targeted for boll weevil control were aerially applied to plots of approximately 10 acres each on a 5 day schedule for 5 applications. Guthion, Baythroid and Legend (Baythroid plus Provado) were evaluated. Pest densities were low and all three products provided good control of boll weevils. Guthion (in oil) and Legend provided good control of cotton fleahoppers. Although whitefly and aphid densities were low, Legend appeared to reduce the potential for flaring these pests as compared to the pyrethroid alone. Baythroid was less detrimental to the beneficial arthropods present than Guthion. Addition of Provado with Baythroid (Legend) was also more detrimental to some species of beneficial arthropods than Baythroid alone.

Introduction

Since the introduction of the Silverleaf Whitefly (SLWF) in the early 1990's, the Beat Armyworm outbreak of 1995, and recent reoccurring problems with aphids, much more interest has been expressed in the effects of insecticides on non-target arthropods, including both pest and beneficial species, within the cotton ecosystem of the Lower Rio Grande Valley (LRGV). The boll weevil is the key pest of cotton in this region and typically requires the greatest use of insecticide for control. Insecticides for boll weevils are generally broad spectrum and can greatly reduce beneficial arthropod populations. In recent years, research efforts have been placed on evaluating the effects of insecticides targeted for boll weevil control on pest and beneficial arthropods in LRGV cotton. This test was conducted to examine the effects of Guthion, Baythroid, and Legend (Baythroid plus Provado). Guthion is considered a 'standard' organophosphate insecticide for boll weevil control. Baythroid is one of the newer pyrethroid insecticides that are being used more commonly for boll weevil control. Legend contains Baythroid for weevil control in combination with Provado to hopefully alleviate potential flaring of secondary pests such as aphids and whiteflies.

Materials and Methods

The experiment was conducted in three commercial cotton fields, of approximately 35 acres each, near Monte Alto, Texas. Each field was divided into three plots and each plot was randomly assigned to an insecticide treatment. Thus, the experimental design was a RCBD with three replications. Plots were established as 5 or 6 swath widths (24 row swaths) wide and the length of each field to accommodate aerial application of the insecticide treatments.

Treatments evaluated in this study were: Guthion 2L at 0.25 lb AI/ac applied in cottonseed oil (1.5 qt/ac); Baythroid 2EC at 0.033 lb AI/ac applied in water; and Legend applied in water. Legend is a tank mix of Baythroid 2EC and Provado 1.6F. The first application of Legend was made with rates of Baythroid and Provado at 0.033 and 0.0234 lb AI/ac, respectively. The other four applications were made with the Provado rate increased to 0.0468 lb AI/ac. All applications were applied by a commercial aerial applicator. Five applications were made on a 5 day schedule. Application dates were June 10, 15, 20, 25, and 30.

Arthropods were sampled after each treatment. Sample dates are indicated in the data tables as days after each treatment (ie. 3 DAT1 is 3 days after the 1st application). Arthropods were sampled with a modified leaf blower/mulcher (blower/vac samples)(Sparks and Norman 1998) along 100 feet-of-row at three sites within each plot on each sample date (3 blower/vac samples per plot). Silverleaf whitefly (SLWF) populations were monitored by counting the adults on the 3rd leaf from the terminal and nymphs on the 5th leaf from the terminal on 5 plants at three sites in each plot (15 leaves for adults and 15 leaves for nymphs in each plot). Four cotton squares were examined for weevil or caterpillar damage at 5 spots within three sites within each plot (15 squares per site * 3 sites per plot = 45 squares per plot).

In addition to the periodic numeric sampling, a SLWF adult relative density rating was assigned to the blower/vac samples on most dates (this was initiated in response to low SLWF adult counts on leaves but relatively high capture in 100-foot blower/vac samples). Finally, aphids began to appear in low numbers at the end of the test, and they were counted on the last two sample dates in a manner identical to SLWF adults.

All data were analyzed with the PROC GLM procedure of PC-SAS. Where significant (P=0.05) differences were indicated, means were separated with Duncans Multiple Range Test (P= 0.05) (SAS Institute 1992).

Reprinted from the *Proceedings of the Beltwide Cotton Conference*
Volume 2:1181-1184 (1999)
National Cotton Council, Memphis TN

Results and Discussion

Arthropod Pests

Boll weevils were controlled equally well by all treatments, with no significant differences among treatments in the percent of squares damaged by weevils (Tables 1 and 2). Similar results were seen for caterpillar damaged squares (Tables 1 and 2).

SLWF adults and nymphs were at low densities throughout the test; however, significant differences among treatments were occasional detected in both SLWF numbers (Tables 1 and 2) and relative ratings (Table 3). The trends indicate that SLWF densities were generally greatest in the Baythroid treatment. This likely resulted from slight 'flaring' of SLWF populations in the Baythroid treatment, a lack of effects from Guthion (organophosphate insecticides are generally recognized as having little or no effect on SLWF when applied alone), and a prevention of 'flaring' with the addition of Provado (which is registered for SLWF suppression) in the Legend treatment. Aphid counts taken at the end of the study show the same trends as SLWF counts (Table 4). This would support the conclusions from the SLWF data, as the pyrethroids are fairly well known to 'flair' aphid populations.

Cotton fleahoppers were abundant in the blower/vac samples through the early part of this test (Table 5). Both adult and nymph densities were most rapidly reduced by Guthion (1 DAT1). By 3 DAT1 and afterwards, Legend also showed significant efficacy against this pest (despite Provado being applied at ½ rate for the first application)(Tables 5 and 6). It is interesting to note that Guthion (in oil) showed good efficacy against cotton fleahopper; whereas, Guthion (in water) in similar tests has not been effective against this pest (authors, unpublished data).

Beneficial Arthropods

Beneficial arthropod sample data are presented in Tables 5 and 6. Total beneficial arthropod densities were significantly different among treatments on several sample dates, particularly after the first two applications. Guthion appeared to be more harsh on beneficial arthropods than Baythroid, and the addition of Provado (Legend) significantly reduced beneficial arthropod densities as compared to Baythroid alone.

The more abundant beneficial insects present in this test were green lacewings, big-eyed bugs, pirate bugs, and 'parasitic' wasps (wasps were not identified beyond order). General trends for green lacewings, big-eyed bugs and pirate bugs were similar to the total beneficial populations, with Guthion and Legend frequently having lower populations than the Baythroid treatment. Wasp densities were less consistent with short lived differences.

Overall, the beneficial data indicated that Baythroid was less detrimental to the beneficial arthropods present in this test as compared to Guthion. In addition, these data suggest that Provado may have adverse effects on some beneficial arthropods, which was unexpected given the selectivity of this product. Whether this occurs with Provado alone, or is an effect of the specific insecticide combination will require additional testing.

Acknowledgments

This study was funded in part through grants from Cotton Incorporated and Bayer. We thank David Hoelscher for his cooperation and use of his fields and Roland Dusters for application of the treatments. We also thank Cesar Medeles, Mat Bauer and Jodie Miller for their hard, dirty work in conducting this experiment.

References

SAS Institute. 1992. SAS/STAT User's Guide, Release 6.08. SAS Institute, Cary, NC.

Sparks, A.N. Jr. and J.W. Norman, Jr. 1998. Modification of a leaf blower/vac for sampling of arthropods. Proc. Beltwide Cotton Conferences. 1302-1304.

Table 1. Effects of selected in-season insecticide applications on silverleaf whitefly densities and cotton square damage, Monte Alto, Texas, 1998, insecticide applications 1 and 2.

	Number per leaf or percent damaged squares				
Treatment	Pre-trt	1 DAT1	3 DAT1	2 DAT2	4 DAT2
Silverleaf whitefly adults					
Guthion	0.4	0.6	0.4	0.3 ab	0.5 b
Baythroid	0.3	0.5	0.6	0.6 a	0.9 a
Legend	0.3	0.5	0.3	0.2 b	0.6 ab
Silverleaf whitefly nymphs					
Guthion	0.4	0.3	0.8 ab	0.2 ab	0.5
Baythroid	0.2	0.3	1.2 a	0.5 a	0.9
Legend	0.4	0.3	0.2 b	0.1 b	0.2
Weevil damaged squares					
Guthion	2.5 b	6.1	3.3	1.7	2.8
Baythroid	9.2 a	2.8	9.4	3.9	3.3
Legend	2.5 b	5.6	4.4	2.8	1.7
Caterpillar damaged squares					
Guthion	4.2	5.0	2.8	3.3	2.8
Baythroid	4.2	5.0	1.7	1.7	0.6
Legend	4.2	2.8	3.9	1.1	1.1

Numbers within columns and category without letters or followed by the same letter are not significantly different (DMRT; P=0.05).

Table 2. Effects of selected in-season insecticide applications on silverleaf whitefly densities and cotton square damage, Monte Alto, Texas, 1998, insecticide application 3 through 5.

	Number per leaf or percent damaged squares				
Treatment	2 DAT3	4 DAT3	4 DAT4	2 DAT5	7 DAT5
Silverleaf whitefly adults					
Guthion	0.7	1.3 b	1.7	3.9	3.9
Baythroid	0.8	2.0 a	2.1	4.8	6.2
Legend	0.3	0.9 b	1.1	3.6	3.6
Silverleaf whitefly nymphs					
Guthion	0.3	0.6	0.2 b	0.6	0.4 b
Baythroid	0.3	0.5	0.8 a	0.8	1.6 a
Legend	0.1	0.2	0.2 b	0.6	0.2 b
Weevil damaged squares					
Guthion	3.3	2.5	4.2	1.1	6.7
Baythroid	3.3	0.8	4.2	4.4	5.0
Legend	2.5	3.3	5.0	2.8	3.3
Caterpillar damaged squares					
Guthion	0.0	0.8	0.0	0.6	3.9
Baythroid	0.8	0.0	0.0	0.0	0.6
Legend	0.0	1.7	0.0	0.0	1.1

Numbers within columns and category without letters or followed by the same letter are not significantly different (DMRT; P=0.05).

Table 3. Effects of selected in-season insecticide applications on relative whitefly ratings, Monte Alto, Texas, 1998.

	Whitefly adult RATING (from blower/vac samples)							
Trt	No. of days after treatment /no. of applications							
	1/1	2/2	4/2	2/3	4/3	4/4	2/5	7/5
G	1.0 b	1.7 b	1.2	2.7 a	2.3 b	3.0	2.6	3.2
B	2.1 a	3.0 a	1.9	2.7 a	4.0 a	3.7	2.8	3.4
L	2.1 a	1.2 b	1.2	1.0 b	2.0 b	2.7	2.6	2.6

Whitefly ratings: 1-low; 3-moderate; 5-high.
First column indicates treatment: G=Guthion, B=Baythroid, L=Legend
Numbers within columns and category without letters or followed by the same letter are not significantly different (DMRT; P=0.05).

Table 4. Effects of selected in-season insecticide applications on aphid densities, Monte Alto, Texas, 1998.

	Aphids per leaf	
Treatment	2 DAT5	7 DAT5
Guthion	0.0 b	0.2 b
Baythroid	4.9 a	8.6 a
Legend	0.0 b	0.1 b

Numbers within columns and category without letters or followed by the same letter are not significantly different (DMRT; P=0.05).

Table 5. Effects of selected in-season insecticide applications on cotton pest and beneficial arthropods, vacuum samples, Monte Alto, TX, insecticide applications 1 and 2.

Treatment	Number per 100-foot blower/vac sample				
	Pre-trt	1 DAT1	3 DAT1	2 DAT2	4 DAT2
Boll weevil					
Guthion	0	0.0	0	0	0.0
Baythroid	0	0.1	0	0	0.1
Legend	0	0.0	0	0	0.1
Fleahopper adults					
Guthion	36.7 b	4.9 b	5.7 b	2.3 b	6.0 b
Baythroid	36.5 b	18.2 a	15.4 a	22.4 a	21.9 a
Legend	52.5 a	21.8 a	8.7 b	7.1 b	6.1 b
Fleahopper nymphs					
Guthion	9.7	4.4 b	1.4 b	1.3 b	3.0 b
Baythroid	13.0	25.9 a	14.4 a	15.6 a	11.1 a
Legend	9.0	19.0 a	4.6 b	4.0 b	0.4 b
Total beneficials					
Guthion	24.0	9.4 b	16.1 b	13.3 b	12.6 b
Baythroid	24.2	22.4 a	25.9 a	27.4 a	19.6 a
Legend	25.7	23.0 a	13.1 b	15.7 b	9.2 b
Lady beetle adults					
Guthion	0.5	0.0	0.1 b	0.0	0
Baythroid	1.0	0.4	0.7 a	0.1	0
Legend	1.3	0.3	0.0 b	0.0	0
Lady beetle larvae					
Guthion	0.0	0	0	0	0
Baythroid	0.2	0	0	0	0
Legend	0.0	0	0	0	0
Green lacewing adults					
Guthion	4.0	0.4 b	1.8	0.8 b	2.1
Baythroid	6.2	2.8 a	2.4	4.3 a	3.4
Legend	3.2	1.9 ab	1.1	1.6 b	0.9
Green lacewing larvae					
Guthion	1.3	2.1	4.0 ab	4.0	3.7
Baythroid	0.3	2.8	5.4 a	6.4	4.0
Legend	0.7	3.4	2.0 b	4.6	2.8
Big-eyed bug adults					
Guthion	1.7	0.2	0.3 b	0.3	0.1
Baythroid	2.8	1.0	1.2 a	0.4	0.7
Legend	3.3	1.4	0.1 b	0.2	0.6
Big-eyed bug nymphs					
Guthion	1.0 ab	0.3	0.3 b	0.0	0.0
Baythroid	1.8 a	1.8	2.2 a	1.1	2.0
Legend	0.2 b	1.9	0.4 b	0.8	0.0
Pirate bug adults					
Guthion	4.8	3.8 b	4.1	3.4	2.8
Baythroid	4.2	8.4 a	7.0	9.4	4.3
Legend	4.0	8.1 a	5.3	3.7	2.1
Pirate bug nymphs					
Guthion	0.0	0.0	0.1	0.1	0.0
Baythroid	0.0	0.4	0.1	0.3	0.1
Legend	0.3	0.4	0.2	0.4	0.0
Damsel bugs					
Guthion	0.2	0.0	0	0	0
Baythroid	0.2	0.2	0	0	0
Legend	0.7	0.0	0	0	0
Assassin bugs					
Guthion	0	0.2	0.2	0.1	0.0
Baythroid	0	0.0	0.3	0.1	0.2
Legend	0	0.3	0.0	0.1	0.0
Spiders					
Guthion	0.8	0.0 b	0.1	0.0 b	0.1
Baythroid	0.2	0.3 b	0.6	0.3 ab	0.3
Legend	0.3	0.9 a	0.4	0.6 a	0.2
'Parasitic' wasps					
Guthion	9.7	2.3 b	5.0 ab	4.6	3.8
Baythroid	7.3	4.2 a	5.9 a	4.8	3.4
Legend	11.7	4.2 a	3.4 b	3.8	2.7

Numbers within columns and category without letters or followed by the same letter are not significantly different (DMRT; P=0.05).

Table 6. Effects of selected in-season insecticide applications on cotton pest and beneficial arthropods, vacuum samples, Monte Alto, TX, insecticide applications 3 through 5.

Treatment	Number per 100-foot blower/vac sample				
	2 DAT3	4 DAT3	4 DAT4	2 DAT5	7 DAT5
Boll weevil					
Guthion	0.0	0.0	0.0	0	0.1
Baythroid	0.2	0.2	0.2	0	0.1
Legend	0.2	0.0	0.0	0	0.0
Fleahopper adults					
Guthion	2.8 b	3.2 b	2.5	0.3	2.2
Baythroid	12.2 a	9.0 a	1.0	0.4	0.4
Legend	2.7 b	5.2 b	0.7	0.8	1.6
Fleahopper nymphs					
Guthion	1.7 b	0.5 b	0.5	0.1	0.3
Baythroid	8.8 a	3.7 a	0.3	0.0	0.3
Legend	0.3 b	0.3 b	0.0	0.0	0.2
Total beneficials					
Guthion	11.7	10.8	16.8 a	10.1	36.8 a
Baythroid	22.2	11.3	18.5 a	10.6	27.7 a
Legend	3.8	10.5	5.0 b	9.2	14.1 b
Lady beetle adults					
Guthion	0.0	0	0	0.0	0
Baythroid	0.2	0	0	0.0	0
Legend	0.0	0	0	0.1	0
Lady beetle larvae					
Guthion	0	0	0	0	0
Baythroid	0	0	0	0	0
Legend	0	0	0	0	0
Green lacewing adults					
Guthion	2.5 a	4.2	9.8	1.6	12.7 ab
Baythroid	1.8 a	1.7	10.8	3.4	18.4 a
Legend	0.3 b	2.2	2.0	2.1	5.0 b
Green lacewing larvae					
Guthion	4.7	2.2	2.5 ab	1.9	5.2
Baythroid	3.2	2.3	4.8 a	2.8	5.0
Legend	1.0	2.7	1.3 b	1.0	4.2
Big-eyed bug adults					
Guthion	0.7	0.2	0	0.6	0.2
Baythroid	0.7	0.0	0	0.2	0.0
Legend	0.2	0.0	0	0.2	0.1
Big-eyed bug nymphs					
Guthion	0.0	0.0	0.0	0	0
Baythroid	4.7	0.5	0.2	0	0
Legend	0.0	0.8	0.2	0	0
Pirate bug adults					
Guthion	2.0 b	1.2 b	2.0 a	1.4	14.2 a
Baythroid	7.2 a	3.7 a	0.3 b	0.7	1.0 b
Legend	1.0 b	1.0 b	0.3 b	1.0	1.4 b
Pirate bug nymphs					
Guthion	0.0 b	0.2	0.2	0.1	0
Baythroid	0.5 a	0.2	0.0	0.1	0
Legend	0.0 b	0.0	0.0	0.0	0
Damsel bugs					
Guthion	0	0	0	0.0	0
Baythroid	0	0	0	0.1	0
Legend	0	0	0	0.0	0
Assassin bugs					
Guthion	0.0	0.2	0.0	0.1	0.1
Baythroid	0.2	0.2	0.2	0.0	0.1
Legend	0.0	0.0	0.0	0.0	0.0
Spiders					
Guthion	0.2	0.0	0.0 b	0.1	0.2
Baythroid	0.5	0.3	0.0 b	0.3	0.1
Legend	0.2	0.2	0.5 a	0.8	0.1
'Parasitic' wasps					
Guthion	1.7	2.8	2.3	4.3	4.1
Baythroid	3.3	2.5	2.2	2.9	3.0
Legend	1.2	3.7	0.7	4.0	3.2

Numbers within columns and category without letters or followed by the same letter are not significantly different (DMRT; P=0.05).