INSECTICIDES FOR EARLY-SEASON TARNISHED PLANT BUG CONTROL

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RESEARCH PROBLEM

The tarnished plant bug is a key pest of cotton in Arkansas, and its management is of a considerable importance to farmers. Since we rely to a great extent on insecticides to control plant bugs, the risk of developing resistance exists. However, the introduction of new chemistries against plant bugs allows farmers to control their damage and helps to slow down the development of resistance. Farmers need updated information on efficacy of insecticides, both traditional and new, along with their effects on beneficials, in order to make wise decisions related to plant bug management.

BACKGROUND INFORMATION

The tarnished plant bug, *Lygus lineolaris* (Palisot de Beauvois), is a major concern of Arkansas and other mid-South cotton growers. The feeding activities of *L. lineolaris* cause square shed, aborted plant terminals, and damaged anthers and bolls, which results in delayed crop maturity and reduced yield (Johnson *et al.*, 1996). Cotton farmers in Arkansas lost over 21,000 bales in 1998 due to *Lygus* damage (Williams, 1999). Chemical sprays are the primary method used to control plant bugs. However, population resistance to the major classes of insecticides in the mid-South has been reported (Snodgrass and Elzen, 1995). In addition, insecticides used to control plant bugs cause varied degrees of damage to beneficial arthropods in cotton fields. Thus, information on the effects of insecticides on plant bugs and on beneficials is needed so that a resistance/beneficial insect management program can be developed. We initiated this study to examine the efficacy of selected chemicals on pre-bloom plant bug populations. We also examined the side effects of such treatments on the natural enemies complex and the influence of treatments on lint yield.

RESEARCH DESCRIPTION

Three separate field trials were conducted in 1998 and 1999 at the Southeast Branch Experiment Station near Rohwer. In the1998 test, the cultivar Paymaster 1220 BGxRR was planted on 22 May 1998. Two tests were carried out in 1999 (hereafter referred to as Test I and Test II) in which DPL NuCotn 33B was planted on 13 May

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1999. Plots were four rows wide and 40 ft long in all three tests and arranged in a randomized complete-block design with four replications. We used a planting pattern of 4 x 2 skip row in 1998 so that each plot was bordered on each side by a two-row fallow strip. Mustard was planted between plots in 1999 to ensure strong plant bug populations in the cotton plots. Standard production practices were used to produce the crop in both years. Insecticides were applied in all three tests using a John Deere high clearance sprayer in 10 gal of total spray solution/acre. Treatments were made on 6 July 1998. In 1999, treatments in Test I were made on 18 June, 27 June, 6 July, and 12 July, while treatments in Test II were made on 21 June, 28 June, 5 July, and 13 July. Post-treatment arthropod counts were taken 3 days after treatment in both years by using a 3-ft beat sheet (6 row ft/plot). Lint yield was determined by machine-harvesting the middle two rows of each plot. Data were processed using the Pesticide Research Manager 5 (PRM) / Agriculture Research Manager (ARM) (Gylling Data Management) and CoStat (CoStat Statistical Software). Analysis of variance was run and least significant difference was used to separate the means.

RESULTS AND DISCUSSION

Insecticide Efficacy

All treatments in 1998 significantly reduced plant bug numbers compared to the untreated check (Table 1). Although all chemicals provided similar degrees of control, a strong trend was seen for Strategy, Steward, and Provado to be especially effective against plant bugs, while Orthene and Bidrin seemed to be less effective. In Test I (1999), all treatments provided significant reduction in plant bug counts compared with the untreated check (Table 2). Actara, Leverage, Regent, and Provado gave strong control of plant bugs. Steward was not as effective as it was in our previous tests (Kharboutli *et al.*, 1999), while Vydate and YCR 2894 tended to be weaker treatments. In Test II (1999), only Karate Z, Leverage, and Decis significantly reduced plant bug counts compared with the untreated control. However, Provado, Bidrin, and Baythroid tended to provide good control. Orthene and Vydate were numerically less effective treatments.

Effect of Insecticides on Beneficial Arthropods

Beneficial counts were similar among all treatments in 1998 (Table 1). However, Strategy, Steward, and Provado tended to be somewhat gentler on beneficials than Orthene or Bidrin. In Test I (1999), all insecticides except Denim significantly reduced beneficial arthropod counts compared to the check (Table 2). Actara and Leverage were numerically harsher on beneficials than other products. Regent, Provado, and Steward showed a tendency toward intermediate toxicity against beneficial arthropods. In an earlier study (Kharboutli *et al.*, 1998), we found Regent to be particularly harsh on beneficials. In Test II (1999), beneficial counts in all treatments were similar to those in the untreated check (Table 3). However, beneficial arthropods tended to be more abundant in plots treated with Karate and Vydate than in plots treated with Leverage, Bidrin, or Baythroid.

Lint Yield

All treatments in 1998 produced similar lint yields to that of the untreated check (Table 1). Strategy produced significantly more lint than Orthene. Plots treated with Orthene produced numerically 126 lb less lint than the check plots. Steward's performance in this test was relatively modest, which may have been partly due to the low plant bug pressure. Increased lint yield was obtained with Steward in our earlier tests (Kharboutli *et al.*, 1999). In Test I (1999), Actara (0.0623 lb ai/acre) and Provado (0.047 lb ai/acre) were the only treatments to significantly increase lint yield compared with the check (Table 2). Each of the two compounds produced about 300 lb more cotton lint than the check. Plots treated with Steward (0.11 lb ai/acre) or Regent (0.05 lb ai/acre) produced numerically about 200 lb more cotton lint than the check plots. In Test II (1999), all treatments including the untreated check produced statistically similar lint yields (Table 3). However, Bidrin (0.50 lb ai/acre) and Orthene (0.4 lb ai/acre) increased lint yield numerically by 274 and 264 lb, respectively, compared with the check.

PRACTICAL APPLICATION

Provado and Decis effectively controlled plant bugs as did new insecticides such as Actara, Regent, Steward, Provado, and Leverage; new chemistries with novel modes of action and could be vital for management of resistance in plant bugs. Bidrin, Denim, Vydate, and Orthene tended to be less effective. Steward, Strategy, and Vydate were soft on beneficials while Regent, Actara, and Orthene were harsher. Bidrin and Provado showed a tendency toward intermediate toxicity against beneficial arthropods. Farmers need to take this into consideration, since preservation and augmentation of natural enemies is an important element in pest control programs. Increased lint yield compared to the check was obtained with Actara, Strategy, and Provado. Although higher yields were not always tightly associated with lower plant bug counts, there was a general trend toward higher yields in treatments with fewer plant bugs. Chemical control of the bug is attainable; however, judicious use of the available insecticides to control the tarnished plant bug is needed in order to slow down the development of resistance and preserve the natural enemy complex.

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LITERATURE CITED

Johnson, D.R., C.D. Klein, H.B. Myers, and L.D. Page. 1996. Pre-bloom square loss, causes and diagnosis. Proc. Beltwide Cotton Conf., National Cotton Council, Memphis, TN. pp. 103-105.

Kharboutli, M.S., C.T. Allen, C. Capps, and L. Earnest. 1998. Insecticides for tarnished plant bug control in Southeast Arkansas. Proc. Beltwide Cotton Conf., National Cotton Council, Memphis, TN. pp. 1194-1197.

Kharboutli, M.S., C.T. Allen, C. Capps, and L. Earnest. 1999. Outlook for Steward insecticide in Southeast Arkansas. Proc. Beltwide Cotton Conf., National Cotton Council, Memphis, TN. pp. 1092-1095.

Snodgrass, G.L. and G.W. Elzen. 1995. Insecticide resistance in a tarnished plant bug population in cotton in the Mississippi Delta. Proc. Beltwide Cotton Conf., National Cotton Council, Memphis, TN. pp. 975-977.

Williams, M.R. 1999. Cotton insect losses 1998. Proc. Beltwide Cotton Conf., National Cotton Council, Memphis, TN. pp. 785-809.

Table 1. Plant bug control, beneficial arthropods counts, and lint yield following a single insecticide application against plant bugs. Rohwer, AR, 1998.

Treatment	Rate	Plant Bugs[z]	Beneficials[z]	Lint Yield
	lb ai/acre	---------- No./6 row ft[2] ----------		lb/acre
Untreated control	-	2.3 a[y]	6.0 a	511 ab
Orthene 90S	0.5	1.0 b	1.8 a	385 b
Orthene 90S + Provado 1.6F	0.5 + 0.0375	1.0 b	2.3 a	517 ab
Bidrin 8 + Provado 1.6F	0.25 + 0.125	0.8 b	2.0 a	494 ab
Provado 1.6F	0.0375	0.5 b	5.0 a	436 ab
Steward 1.25SC	0.09	0.5 b	6.5 a	514 ab
Steward 1.25SC	0.11	0.5 b	6.0 a	503 ab
Strategy 0.16EC	0.01	0 b	6.3 a	558 a

[z] Beat sheet samples were taken on 9 July 1998; 3 days after treatment.

[y] Means in columns followed by the same letter(s) are not significantly different (P=0.05).

Table 2. Plant bug control, beneficial arthropods counts, and lint yield following repeated insecticide applications against plant bugs. Rohwer, AR, 1999 (Test I).

Treatment	Rate	Plant Bugs[z]	Beneficials[z]	Lint Yield
	lb ai/acre	---------- No./6 row ft[2] ----------		lb/acre
Untreated control	-	2.9 a[y]	12.7 a	1252 b
YCR 2894 4SC	0.047	1.3 b	6.0 bc	1440 ab
Vydate C-LV 3.77	0.33	1.1 b	6.9 bc	1359 ab
Steward 1.25SC + Dyne-amic	0.09 + 64[x]	1.1 b	4.7 bc	1311 ab
Denim 0.16EC + Kinetic HV	0.01 + 32[x]	0.9 b	9.6 ab	1411 ab
Steward 1.25SC + Dyne-amic	0.11 + 64[x]	0.7 b	5.4 bc	1428 ab
Provado 1.6F	0.047	0.6 b	6.2 bc	1541 a
Regent 2.5EC	0.038	0.4 b	7.3 bc	1381 ab
Regent 2.5EC	0.05	0.4 b	7.8 bc	1457 ab
Actara 25WG	0.0623	0.4 b	4.2 bc	1556 a
Leverage 2.7SC	0.079	0.3 b	2.8 c	1423 ab
Actara 25WG	0.047	0.2 b	3.4 c	1520 ab

[z] Beat sheet samples taken on 21 June, 1 July, 9 July, and 15 July 1999; 3 days after treatment.

[y] Means in columns followed by the same letter(s) are not significantly different (P=0.05).

[x] Dyne-amic and Kinetic HV rates are in fluid ounces per 100 gal.

Table 3. Plant bug control, beneficial arthropods counts, and lint yield following repeated insecticide applications against plant bugs. Rohwer, AR, 1999 (Test II).

Treatment	Rate	Plant Bugs[z]	Beneficials[z]	Lint Yield
	lb ai/acre	---------- No./6 row ft² ----------		lb/acre
Untreated control	-	1.94 a[y]	7.94 ab	1125 a
Orthene 90S	0.4	1.44 ab	7.50 ab	1389 a
Vydate C-LV 3.77	0.25	0.63 ab	10.38 a	1237 a
Vydate C-LV 3.77 + Provado 1.6F	0.25 + 0.025	0.63 ab	6.38 ab	1241 a
Baythroid 2EC	0.032	0.56 ab	4.50 b	1270 a
Bidrin 8	0.5	0.50 ab	4.75 b	1399 a
Provado 1.6F	0.047	0.44 ab	5.44 ab	1289 a
Decis 1.5EC	0.022	0.38 b	5.38 ab	1283 a
Leverage 2.7SC	0.079	0.31 b	2.44 b	1339 a
Karate Z 2EC	0.028	0.13 b	10.44 a	1277 a

[z] Beat sheet samples taken on 24 June, 1 July, 8 July, and 16 July 1999; 3 days after treatment.

[y] Means in columns followed by the same letter(s) are not significantly different (P=0.05).