

CONTROL OF HEMIPTERA IN COTTON WITH DIAMOND 0.83EC – 2003 FIELD TRIAL RESULTS

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Abstract

Diamond™ (novaluron), an insect growth regulator, was evaluated for control of tarnished plant bugs (TPB) *Lygus lineolaris* and stink bugs (Pentatomidae) along with other cotton pests at a number of locations in the Mid-South states of Arkansas, Louisiana, and Mississippi in 2003. Rates of application for Diamond™ ranged from 0.039 to 0.078 lbs. a.i./A and the product was applied alone or in combination with Karate Z (lambda-cyhalothrin). Insecticides such as Bidrin (dicotophos), Centric (thiamethoxam), and Baythroid (cyfluthrin) were used alone or in combinations as standards. Single or multiple insecticide applications were made depending on timing of TPB infestations and population pressure. Diamond™ provided TPB and stink bug control equal to or greater than the standards and other insecticide treatments depending on location.

Introduction

The tarnished plant bug (TPB), *Lygus lineolaris* (Palisot de Beauvois), has become a major insect problem of cotton in the Mid-South region of the United States in recent years and typically ranks among the three most damaging pests (Williams, 2003). Additionally, plant feeding stink bugs (Pentatomidae) such as the green stinkbug, *Acrosternum hilare* (Say), southern green stink bug, *Nezara viridula* (L.) and brown stink bug, *Euschistus servus* (Say), have become economically important pests in cotton. Both tarnished plant bugs and the stink bug complex have benefited greatly from a successful boll weevil eradication program and the introduction and widespread utilization of transgenic Bt cotton. Both factors have resulted in a significant reduction in the total number of foliar insecticide treatments required to control weevils and caterpillar pests in cotton and thus reduced coincidental control of Hemipteran insects (Layton, et. al., 2003).

Tarnished plant bug has developed resistance particularly to synthetic pyrethroids and to a lesser extent certain organophosphate, carbamates and cyclodiene insecticides (Snodgrass, 1994 and 2000). Brown stink bug is resistant to the pyrethroids and control is obtained mainly from the organophosphates (OP's) such as acephate and dicotophos. Acceptable control of TPB and stink bugs using OP's is obtained in many cases by increased application rates due to insect tolerance. TPB resistance to many commonly used cotton insecticides and significant mid to late season TPB infestations have added a sense of urgency to the discovery of new insecticidal compounds with TPB and stink bug efficacy.

Diamond™ (novaluron), a benzoylphenyl urea type of insect growth regulator (IGR), has shown activity against insect species of Hemiptera and other orders such as Lepidoptera, Coleoptera and Diptera in earlier small plot replicated trials conducted registration in cotton and other crops (Weiland, 2003). Diamond™ was granted Organophosphate Replacement status in 2002 by U.S. E.P.A. on cotton and full registration for use on cotton is anticipated in 2004.

The mode-of-action of Diamond™ is that of a chitin biosynthesis inhibitor resulting in interference with cuticle formation (Ishaaya et al., 1996). Diamond works primarily by ingestion, however, contact activity and ovicidal activities have been observed. The product is primarily active against immature stages of the target insect, i.e., larvae or nymphs, depending on the species.

In the spring of 2003, a field-testing program was initiated in cotton in the Mid-South to determine the level of efficacy of several rates of Diamond™ against a number of cotton pests including TPB, stink bugs, Heliothine spp. and other Lepidopteran species and whiteflies. This paper presents tarnished plant bug and stink bug control results from several locations.

Materials and Methods

Lonoke, AR

A test was set up in Lonoke County at the Brantley Farms by Dr. G. Lorenz, Ext. Ent., Univ. of AR to evaluate TPB control with two rates of Diamond 0.83EC, Steward (indoxacarb) plus Crop Oil, KN-128 + Crop Oil, Vydate (oxamyl) mixed with Asana XL (esfenvalerate), Vydate plus Crop Oil, Bidrin, Curacron (profenofos), Karate Z, Intruder (acetamiprid) plus Crop Oil, Centric plus surfactant, and two untreated checks. Plot size was 12.67 ft. by 25 ft arranged in a randomized complete block design with four replications. Insecticide treatments were applied on 10 September with a one-man boom using a spray volume of 9 gal/A.

Tarnished plant bug density was determined by counting adults and nymphs from two randomly selected locations in each plot using a beat sheet on 12 September (3 DAT) and 16 September (7 DAT). Yields were not available from this location due to heavy TPB damage.

Proctor, AR

The study was conducted by Dr. D. Harlan, Mid-Sough Ag. Research Inc. in Crittenden County, Arkansas, approximately one-mile South of West Memphis near Proctor. The field was planted with DP451BGRR cottonseed on April 30. Plots were four 36" rows wide by 100 feet long arranged in a randomized design with four replications. Treatments were applied with a tractor-mounted CO₂ pressurized 4-row boom sprayer. Tarnished plant bugs were the predominant pest present during the trial. Applications were made on 27 June, and 8 July. A drop cloth was used to determine the plant bug numbers from four areas of each plot. Evaluations were made pre-treatment and 3, 5 and 10 days after treatment. The plots were harvested and the yield determined from the 2 center rows on 24 September.

Rohwer, AR (Test I)

A replicated trial was established by Dr. J. Greene, Univ. of AR, Monticello at the Southeast Branch Experiment Station near Rohwer, AR to evaluate 0.058 and 0.078 lbs. a.i./A of Diamond 0.83EC, Baythroid at 0.04 lbs. a.i./A and a mixture of Baythroid and Bidrin at 0.025 plus 0.33 lbs. a.i./A for TPB and stinkbug control. The cotton variety Paymaster 1218 B/R was planted on 13 May. Plot size was 76 ft. by 90 ft arranged in a randomized complete block design with four replications. Insecticide applications were made on 1 July and 24 July using a John Deere 6500 spray rig set up to treat an 8-row swath. Adult and nymph TPB and brown stinkbug counts per 15 feet of row were made on 27 June (Pre-treatment), 7 July, 14 July, 28 July and 5 August. Plots were harvested for yield on 23 October and lint yields converted to 35% turnout.

Rohwer, AR (Test II)

A tarnished plant bug control trial was established by Dr. J. Greene, Univ. of AR, Monticello to measure efficacy during the mid to late season period of cotton development at the Southeast Branch Experiment Station near Rohwer, AR. Diamond 0.83EC was tank mixed with Karate Z and compared to tank mixes of Trimax (imidacloprid) and Bidrin, Trimax and Baythroid, Centric and Karate Z and standalone treatments of Malathion, Dimethoate, Vydate, Lorsban (chlorpyrifos) and experimental product CS-AV-44-JO. The cotton variety was Stoneville 4892 B/R and was planted on 28 May. Plot size was 25 ft. by 40 ft. arranged in a randomized complete block design with four replications. Insecticide applications were made on 4 August, 11 August and 25 August using a John Deere 6500 spray rig set up to treat an 8-row swath. Adult and nymph TPB counts per 15 row feet were made on 6 August, 8 August, 14 August and 27 August. Plots were harvested for yield on 5 November and lint yields converted to 35% turnout.

Senatobia, MS

The study was conducted by Dr. T. Blythe, S-L Agri-Development Co., in Tate County, near Senatobia. The field was planted with Stoneville 5303RR cottonseed on 29 May. The crop was maintained as needed until test was begun. Treatments were arranged in a randomized complete block design with four replications. Treatments were applied with a HiBoy spray rig using TX9 nozzles delivering 10GPA. Treatment applications were made on 8 August. A drop cloth and sweep net evaluations were used to determine pest numbers per treated area at 6, 13 and 20 DAT.

Stoneville, MS

Dr. G. Andrews, and Dr. J. Robbins, Delta Research and Extension Center DREC, Stoneville, Mississippi. The test area was planted with DPL5415 cottonseed. The objective was to evaluate Diamond for season long tarnished plant bug control in cotton. Treatments were arranged in blocks. This test was initiated with the first treatment application at node 8, 11 June. The second treatment application occurred on 24 June. Pest pressure was relatively light up to 22 July. The pest pressure increased and the third and fourth treatment applications were applied on 24 July and 30 July.

Tillar, AR

Diamond 0.83EC was evaluated for efficacy against TPB and Lepidoptera in a replicated trial at the farm of G & H Associates, Inc. west of Tillar, by Dr. C. Guy. The cotton variety was SureGrow 521 RR and was planted on 15 May. Plot size was 12.67 ft. by 50 ft. and replicated four times. Diamond was evaluated alone at 0.058 and 0.078 lbs. a.i./A, 0.058 lbs. a.i./A mixed with Penetrator Plus adjuvant at 1% v/v, 0.039 and 0.058 lbs. a.i./A tank mixed with 0.03 lbs. a.i./A of Karate Z each and all were compared to an untreated check and a Tracer standard at 0.047 lbs. a.i./A. A total of five applications were made with the first on 15 July primarily for worms using a high clearance spray rig calibrated to deliver 10 gal/A at 45 psi. Further treatments were made on 24 July, 28 July, 12 August and 21 August. Tarnished plant bug numbers were reported as total counts per 10 plants on 28 July and 1 August. On 25 August, TPB numbers were reported as number of adults and nymphs per 10 plants. Plots were harvested for yield on 28 October.

Winnsboro, LA

A replicated large plot trial was established at the Macon Ridge Branch of the LSU Northeast Research Station south of Winnsboro to measure the effect of several Diamond 0.83EC treatments on TPB and stink bugs in Bt and non-Bt cotton varieties. Dia-

mond rates of 0.058, 0.078 and 0.089 lbs. a.i./A as standalone treatments and a rate of 0.039 lbs. a.i./A tank mixed with Karate Z at 0.018 lbs. a.i./A were compared to a Bidrin plus Denim tank mix standard at 0.4 + 0.01 lbs. a.i./A and an untreated check. Stoneville 4563 and Stoneville 5222 BGII were planted on 20 June and represented a non-Bt and Bt type of cotton, respectively. The late planting date was intentional to encourage adequate TPB and stink bug populations for evaluation. Plots were 213 ft. by 200 ft. replicated four times and were non-randomized. A total of three applications were made to each variety on 13 August, 20 August, and 28 August using a high clearance spray rig calibrated to deliver 6 gal/A at 48 psi. Adult and nymph TPB counts and southern green and brown stink bug counts were reported as number per 12 row ft. Target insect counts were made on 19 August, 22 August, 28 August, and 5 September. Yield data was not taken due to the lack of maturity of the crop.

Results

Lonoke, AR

Tarnished plant bug pressure was extremely heavy at this location with total TPB numbers exceeding 90 per 10 row feet in the untreated check when measured 7 DAT (Table 1). Best treatment in the test was Diamond at 9 fl. oz./A (0.058 lbs. a.i./A) with 7.3 nymphs per 10 row feet or 90% control. Diamond at 6 fl. oz./A (0.039 lb a.i./A) was the second best treatment in the test based on nymph counts with 11.3 per 10 row feet and was statistically similar to Bidrin, Centric, Steward, Vydate and Vydate + Asana. Adult TPB numbers were uniform and statistically non-significant among all treatments (data not shown).

Proctor, AR

Table 2 shows that 3 days after the first application, TPB nymph numbers were significantly lower with Diamond @ 0.058 lb a.i./a and Centric @ 0.05 lb a.i./a than in the untreated check. By 5 DAT-1, the 0.058 and 0.078 lbs. a.i./A Diamond rates and Centric at 0.05 lbs. a.i./A had significantly lower numbers of TPB nymphs than the check. At 3, 6, and 10 days after the second application, the number of TPB nymphs was significantly lower in all treatments compared to the untreated check. Adult TPB numbers were similar among all treatments. Cotton yields were not significantly different among treatments.

Rohwer, AR (Test I)

Results of a large plot trial are shown in Table 3. Total numbers of adults and nymphs are reported for this location since adult numbers were low and statistically similar among treatments while nymphs comprised a significant portion of counts. By 13 DAT1, Diamond at 0.058 lbs. a.i./A had significantly fewer TPB adults and nymphs per 15 row feet (2.8) than the untreated check (13.5) and performance was similar to the Baythroid + Bidrin standard with 4.8 TPB per 15 row feet. Total TPB numbers increased in the untreated check through the last rating date on 5 August (12 DAT2), at which time Diamond at 0.058 lbs. a.i./A had fewest TPB at 11.3 per 15 row feet and was significantly less than the untreated check and numerically less than Baythroid + Bidrin at 20.0 per 15 row feet. Cotton lint yields were significantly different among treatments. Diamond at 0.058 and 0.078 lbs. a.i./A and the Baythroid + Bidrin standard yielded 1300 lbs./A or more and were significantly greater than the untreated check or Baythroid alone.

Rohwer, AR (Test II)

A number of products were evaluated for mid to late-season TPB control in a second test at Rohwer (Table 4). Diamond at 0.039 lbs. a.i./A (6 fl. oz.) was tank mixed with Karate Z at rate of 0.025 lbs. a.i./A. At 4 DAT1, all treatments had reduced TPB numbers (adults + nymphs) compared to the untreated check. By 3 DAT2, Diamond + Karate Z had the fewest TPB per 15 row feet with 9.3 compared to 63 in the untreated check. All insecticide treatments were statistically similar at this time, however. By 2 DAT3, Diamond + Karate Z still maintained the fewest TPB of all treatments at 9.3 per 15 row feet. The Diamond + Karate Z tank mix produced the greatest lint yield at 1005 lbs./A which was statistically similar to Bidrin + Trimax, Baythroid + Trimax, Centric + Karate Z, Dimethoate and experimental CS-AV-44-JO yields.

Tillar, AR

Tarnished plant bug control data is presented in Table 5. The test was originally set up to monitor lepidopteran pests primarily cotton bollworm (*Helicoverpa zea*) and as such included the worm control product of Tracer (spinosad) as the standard. It is known that Tracer has little activity against TPB and so this should be kept in mind when evaluating the results from this location. A significant TPB infestation occurred mid-to late season. Adult TPB numbers were similar across all treatments and damage relates mostly to a high population of nymphs. Diamond applied alone at two rates, a low rate with adjuvant and two rates tank mixed with a single Karate Z rate resulted in significantly reduced TPB nymphs per 10 row feet compared to the untreated check and Tracer (spinosad) standard when counts were taken 4 DAT4. All Diamond treatments resulted in significantly greater seed cotton yields than the untreated check and numerically greater yields than the Tracer (spinosad) standard even though the Tracer standard was more effective at controlling bollworm (data not shown). It is thought that the level of TPB control late season influenced the yields more so than the amount of worm control.

Winnsboro, LA

Cumulative numbers of TPB adults, nymphs and all stages of stinkbugs are presented in Table 6. Tarnished plant bug and stink bug counts were summarized from both Bt and non-Bt cotton varieties and reported as one value per treatment. Num-

bers of adult TPB were numerically less in all insecticide treatments compared to the untreated check but were not statistically different. Bidrin + Denim had the fewest TPB nymphs at 1.0 per 12 row feet. Diamond at three rates was statistically similar to Bidrin + Denim and the 0.078 lbs. a.i./A Diamond rate most effective with 1.8 nymphs per 12 row feet. The tank mix of Diamond + Karate Z was less effective than either the Diamond rates alone or the Bidrin + Denim standard. It is thought that the rates of Diamond and Karate Z were too low for adequate TPB control in this test. Numbers of stink bugs were significantly reduced by all insecticide treatments compared to the untreated check and all Diamond treatments were equal to the Bidrin + Denim standard.

Senatobia, MS

Table 7 indicates that all treatments had significantly lower TPB nymphs than the untreated 6 DAT. Diamond @ 0.078 lbs. a.i./A (12 fl. oz./A) was numerically the best followed by the 0.058 lbs. a.i./A rate (9 fl. oz./A). This same trend was evident at the 13 DAT evaluation with TPB nymphs significantly lower with both Diamond rates versus Fury and UTC. By 20 DAT, TPB populations had declined in the untreated check and there was no statistical difference among treatments. Cotton lint yields from the 9 oz and 12 oz rates of Diamond were numerically the highest of all treatments (1439 and 1544 lbs./A, respectively) and statistically similar to each other and Fury.

Stoneville, MS 2003

Fifty terminals and squares per treatment were sampled for presence of TPB and the results are shown in Figure 1. At 2 DAT3 (26 July) Bidrin at 4 fl. oz./A had the lowest percentage of TPB infested terminals and squares followed by Diamond @ 0.065 lbs. a.i./A (10 fl. oz./A). Further evaluations at 2, 6 and 14 DAT4 indicated Diamond @ 10 fl. oz./A was effective at controlling TPB with the lowest percentage of TPB infested terminals and squares. The 0.078 lbs. a.i./A rate of Diamond (12 fl. oz.) was active against TPB, but the level of control was less than with the 10 fl. oz. rate.

Summary

Diamond 0.83EC was shown to be an effective tool for controlling tarnished plant bug nymphs when applied alone or in combination with a pyrethroid such as Karate Z based on results from a number of trials conducted in the Mid-South in 2003. Diamond treatments as applied in these trials for TPB and stinkbugs were equal to or more effective than standard control products such as Bidrin, Centric, Intruder, Steward and Vydate. The 0.058 lbs. a.i./A rate (9 fl. oz./A) was as effective as the 0.078 lbs. a.i./A rate (12 fl. oz./A) when applied alone. Cotton yields were influenced by level of TPB control at several locations and Diamond treatments at those locations increased yields relative to the untreated checks and other insecticide treatments.

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Table 1. Mean number of *Lygus lineolaris* nymphs per 10 feet of row 7 days after application (Lonoke, AR 2003).

Treatment	Rate	Mean number
	Lbs. ai. /A	per 10 feet 7 DAA
Untreated		93.3 a
Diamond 0.83EC	0.039	11.3 ef
Diamond 0.83EC	0.058	7.3 f
Bidrin 8E	0.33	13.8 ef
Centric 40WG	0.031	71.3 abc
Centric 40WG	0.05	22.0 def
Curacron 8E	0.25	40.8 cdef
Intruder 70WP	0.05	49.3 bcde
Karate Z	0.03	73.0 abc
Steward SC	0.09	13.5 ef
Steward SC	0.104	19.8 def
Vydate C-LV	0.25	43.0 cdef
Vydate C-LV +	0.25 +	
Asana XL	0.036	23.0 def

Means followed by the same letter do not significantly differ (P=0.05, Duncan's New MRT).

Table 2. Mean number of *Lygus lineolaris* nymphs per 12 feet of row (Proctor, AR 2003).

Treatment	Rate	Nymphs	Nymphs	Nymphs	Nymphs	Nymphs	Nymphs
	Lbs. ai. /A	3DAT1	5DAT1	10DAT1	3DAT2	6DAT2	10DAT2
Untreated		7.0 a	6.5 a	15.5 a	21.5 a	27.3 a	20.5 a
Diamond 0.83EC	0.058	4.8 b	2.3 b	7.8 b	3.0 b	3.0 b	3.0 b
Diamond 0.83EC	0.078	6.3 ab	2.0 b	5.0 b	1.0 b	0.8 b	2.3 b
Centric 40WG	0.05	1.8 c	0.8 b	6.3 b	3.8 b	3.0 b	2.8 b

Means followed by same letter do not significantly differ (P=0.5, Duncan's New MRT).

Table 3. Mean number of *Lygus lineolaris* adults + nymphs per 15 feet of row at various days after each of two applications (Rohwer, AR 2003).

Treatment	Rate	7/7/03	7/14/03	7/28/03	08/05/03	Yield
	Lbs. ai. /A	6DAT1	13DAT1	4DAT2	12DAT2	35% lint
Untreated		4.8 a	13.5 a	13.8 a	24.5 ab	1012.6 c
Diamond 0.83EC	0.058	3.5 a	2.8 b	3.3 b	11.3 b	1300.3 a
Diamond 0.83EC	0.078	2.0 a	8.3 ab	1.8 b	15.8 ab	1310.3 a
Baythroid 2EC	0.04	6.5 a	12.3 a	8.0 ab	29.8 a	1131.6 b
Baythroid 2EC +	0.025 +					
Bidrin 8E	0.33	2.8 a	4.8 b	8.3 ab	20.0 ab	1347.2 a

Means within a column followed by the same letter do not significantly differ (P=0.05, Student-Newman-Keuls).

Table 4. Mean number of *Lygus lineolaris* adults + nymphs per 15 feet of row at various days after each of three applications (Rohwer, AR 2003).

Treatment	Rate	8/8/03	8/14/03	8/27/03	Yield
	Lbs. ai. /A	4DAT1	3DAT2	2DAT3	35% lint
Untreated		38.0 a	63.0 a	30.0 abc	437.8 d
Diamond 0.83EC +	0.039 +				
Karate Z	0.025	19.5 ab	9.3 b	9.3 c	1005.0 a
Trimax 4 +	0.031 +				
Bidrin 8E	0.025	22.8 ab	11.8 b	14.3 bc	889.2 ab
Trimax 4 +	0.031 +				
Baythroid 2EC	0.025	27.3 ab	30.8 b	38.0 a	890.7 ab
Centric 40WG +	0.031 +				
Karate Z	0.025	18.3 b	16.5 b	13.3 bc	958.4 a
Malathion	0.5	28.0 ab	27.5 b	29.8 abc	472.4 cd
Dimethoate	0.5	20.8 ab	20.5 b	19.5 abc	809.4 ab
Vydate	0.25	21.3 ab	21.0 b	14.5 bc	746.3 b
Lorsban 4E	0.5	21.8 ab	25.5 b	32.0 ab	607.8 c

Means within a column followed by the same letter do not significantly differ (P=0.05, Student-Newman-Keuls).

Trial 5. Tillar, AR, 2003. Mean number of *Lygus lineolaris* per 10 feet of row at 4 days after fourth application.

Treatment	Rate Lbs. ai. /A	Avg. No. TPB per 10 ft.		Seed Cotton Yield Lbs/A
		Adults	Nymphs	
Untreated		2.5 a	5.8 a	1727.3 c
Diamond 0.83EC	0.058	1.3 a	1.0 b	3372.0 ab
Diamond 0.83EC +	0.058 +			
Penetrator Plus	1.0% v/v	0.5 a	0.5 b	3430.4 ab
Diamond 0.83EC	0.078	0.8 a	1.0 b	3344.4 ab
Diamond 0.83EC +	0.039 +			
Karate Z	0.03	0.5 a	0.3 b	3375.4 ab
Diamond 0.83EC +	0.058 +			
Karate Z	0.03	0.5 a	0.8 b	3588.7 a
Tracer 4SC	0.047	1.8 a	7.5 a	2656.3 b

Means within a column followed by the same letter do not significantly differ (P=0.05, Student-Newman-Keuls).

Trial 6. Winnsboro, LA, 2003. Mean number of *Lygus lineolaris* and stink bugs per 12 feet of row after three applications.

Treatment	Rate Lbs. ai. /A	Avg. No. TPB per 12 ft.		
		Adults	Nymphs	All Stinkbugs
Untreated		10.00 a	7.5 a	5.25 a
Diamond 0.83EC	0.058	6.50 a	2.5 bc	1.25 b
Diamond 0.83EC	0.078	6.25 a	1.8 c	1.25 b
Diamond 0.83EC	0.089	7.50 a	2.0 bc	1.50 b
Diamond 0.83EC +	0.039 +			
Karate Z	0.018	6.00 a	6.0 ab	1.00 b
Bidrin 8E +	0.4 +			
Denim	0.01	5.00 a	1.0 c	0.00 b

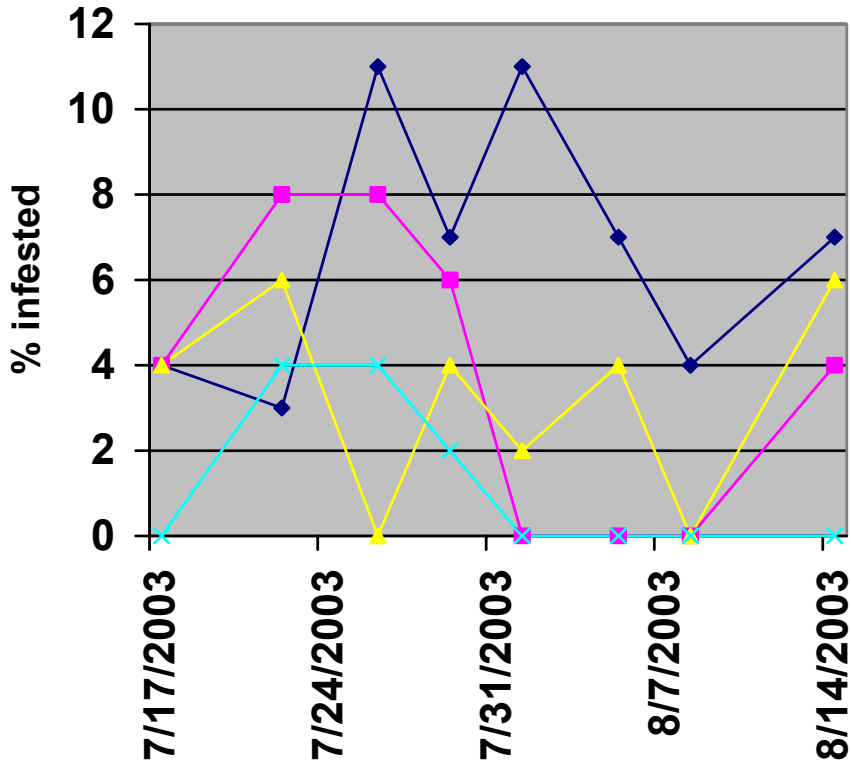
Means within a column followed by the same letter do not significantly differ (P=0.05, Duncan's New MRT).

Trial 7. Senatobia, MS, 2003. Mean number of *Lygus lineolaris* nymphs per 6 feet of row.

Treatment	Rate Lbs. ai. /A	NYPHHS/	NYPHHS/	NYPHHS/	YIELD Lint Lbs/A
		6-row ft. 6 DAT	6-row ft. 13 DAT	6-row ft. 20 DAT	
Untreated		4.0 a	3.3 a	2.8 a	1088 b
Diamond 0.83EC	0.058	0.3 b	0.5 b	1.8 a	1439 a
Diamond 0.83EC	0.078	0.0 b	0.3 b	1.0 a	1544 a
Fury 1.5EC	0.025	0.8 b	2.5 a	0.8 a	1306 ab

Means within a column followed by the same letter do not significantly differ (P=0.05, Student-Newman-Keuls).

◆ UTC ■ Diamond @ 12 fl.oz/a ▲ Bidrin @ 4 fl. oz/a ✕ Diamond @ 10 fl. oz/a



(Treatment application dates 7-24 and 7-30)

Figure 1. Diamond Plant Bug Test DREC Stoneville, MS. (2003). Percent infested of 50 terminals and squares sampled for plant bug nymphs in Cotton trial, Stoneville, MS. (2003).



Figure 2. Cotton Plants from Diamond Trial in Crittenden County, Arkansas (2003). The plant on the left is the untreated with 9 Bolls on 8-14-03. The plant to the right is Diamond @ 9 fl.oz/a (2-applications) with 14 bolls on 8-14-03.