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CONTROL OF TARNISHED PLANT BUGS AND STINK BUGS WITH CENTRIC®

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Abstract

Thiamethoxam (Actara®, Centric®, Cruiser® and Platinum®) is a second generation neonicotinoid insecticide which is effective against sucking and chewing pests when applied at very low rates on a wide range of crops. In cotton, foliar applications of thiamethoxam (THX) provide excellent control of aphids, fleahoppers, tarnished plant bugs, thrips and whiteflies. THX is highly systemic and has unique chemical properties that allow it to penetrate plant tissues rapidly providing a reservoir of active ingredient against insect pests. THX is a selective insecticide and is ideally suited for use in integrated management programs. Results from field trials conducted during 2001 confirmed the activity of THX against tarnished plant bugs, and indicated that THX was efficacious against stink bugs.

Introduction

Thiamethoxam, discovered by Ciba in 1991, prevents nerve impulses in insects by blocking the nicotinic acetylcholine receptors of the nerve cells. Feeding usually stops within a few hours of exposure, and death occurs within 24-48 hours. THX controls target insects by contact and stomach activity. THX has an excellent mammalian and environmental safety profile. In extensive testing for cross resistance, no cross resistance has been documented to the major classes of insecticides.

THX has low molecular weight, relatively high water solubility and low partition coefficient which result in rapid plant uptake. When applied in the soil, THX is taken up by the roots and transported acropetally in the xylem throughout the plant. When applied to foliage, THX also rapidly penetrates into leaf tissues. Once inside the leaf, THX is locally systemic and quickly moves throughout the leaf to form a reservoir of active ingredient where it is protected from environmental degradation. (Syngenta calls this unique action trans-systemic movement.) THX is slowly metabolized by the plant and residues remaining on the leaf surface are degraded by environmental conditions. THX, therefore, remains active against insect pests for an extended length of time. The number of application required for control can drastically be reduced with THX, and the impact on beneficial arthropods is minimal.

The fast uptake and distribution within the plant makes THX a very versatile product to apply. It can be applied by air and by ground, in chemigation, in the seed furrow, in transplant drench water, through drip irrigation, as lay-by shanked-in, or as a transplant tray treatment. THX can also be used as a seed treatment.

The favorable safety of THX and its environmental compatibility have made registration possible in all major markets, including Australia, Brazil, Europe, Japan and the U.S. As of October 2001, sixty-six registrations have been granted to THX in more than 70 countries for control of more than 160 pests in 115 crops. Four different formulations of THX have been registered in the U.S.; registrations were granted to Cruiser 5FS seed treatment in December 2000, and to Actara, Centric and Platinum in May 2001.

Actara 25WG is registered for foliar applications in potatoes, tobacco, fruits, vegetables and cotton (in CA and AZ) for control of major sucking pests as well as some chewing pests such as Colorado potato beetles, Japanese beetles and plum curculio.

Platinum 2SC can be used in soil application for control of aphids, whiteflies, flea beetles, Colorado potato beetles, potato psyllids, leafhoppers, Japanese beetles, thrips and wireworms in potatoes, tobacco and vegetables.

Centric 25WG is registered for use in the eastern cotton belt for control of aphids, thrips, whiteflies, fleahoppers and tarnished plant bugs in cotton. Centric 25WG can be applied by air or by ground at 3 oz/acre. Two applications can be made per season at 14-day interval. Centric may be applied up to 21 days prior to harvest.

The performance of Centric against cotton insects was reported at the Beltwide Cotton Conferences in 1999, 2000 and 2001 (Koenig et al. 2000, Lawson et al. 1999, Lawson et al. 2000, Lorenz III et al. 2000, Parker 1999, Robbins et al. 1999, Scott et al. 1999, Scott et al. 2000, Teague et al. 2000, Teague et al. 2001 and White et al. 2000).

Objectives

The objective of this paper is to report on the performance of Centric against tarnished plant bugs (TPB), *Lygus lineolaris* (Palisot de Beauvois) and stink bugs, summarizing field trials conducted in Arkansas, Louisiana, Mississippi and Texas during 2001.

Materials and Methods

Tarnished Plant Bug Control

1. Mississippi Trials. Two trials were conducted in Quitman Co., MS. Plot sizes varied from 8 to 12 rows by 50 ft with treatments replicated 4 times in a randomized complete block (RCB) design. Plots were sprayed with either a motorized small plot sprayer or a backpack sprayer, calibrated to deliver 7.5 gpa at 40 psi (motorized small plot sprayer) or 10 gpa at 40 psi (backpack sprayer). Trial 1 was sprayed on Aug 1, and trial 2 was sprayed on Aug 8 and 15. Treatments were evaluated by randomly selecting 20 plants per plot and counting the number of adults and nymphs present in the terminal, inside the bracts of large squares and bolls, or in blooms. Counts were expressed as number of TPB per 20 plants. Data were analyzed using AOV with the means separated by Fisher's Protected Least Significant Difference test.

2. Arkansas Trials. Two trials were conducted in Arkansas in 2001, one was a field cage study near Manila, AR, and one was a field trial in Mississippi Co., AR. Plot sizes for the cage study were 4 rows by 40 ft. The plots were arranged in a RCB design with 3 replications. In the center 2 rows of each plot, 6 organdy sleeve cages were secured to randomly selected individual plants. The application was made on Jul 24 with a high-clearance sprayer calibrated to deliver 13.4 gpa at 28 psi. Immediately following the application (0 HAA), 5 TPB adults (< 5 days old) were placed in each of 3 cages. Four hours later (4 HAA), 5 TPB adults were released into each of the remaining 3 cages in each plot. Mortality was determined at 72 hours after placement of TPB adults in the cages. Mortality data were analyzed using AOV, and means were separated using LSD.

Plot sizes of the field trial in Mississippi Co., AR were 8 rows by 50 ft replicated 4 times in a RCB design. The plots were sprayed on Jul 26 with a backpack sprayer calibrated to deliver 12 gpa at 35 psi. Evaluations were made at 4 and 7 days after treatment. Insect counts were expressed as number of TPB per 24 row feet. Data were analyzed using AOV, and means were separated using Duncan's New MRT.

Stink Bug Control

1. Louisiana Trial. One trial was conducted in Franklin Parish, LA for control of brown stink bug, *Euschisus servus* (Say). Plot sizes were 4 rows by 50 ft with 4 replications. The treatments were arranged in a RCB design. The plots were sprayed on Aug 17 with a tractor plot sprayer calibrated to deliver 10 gpa at 74 psi. Insect counts were reported as number of brown stink bug per 25 sweeps. Prior to statistical analysis, data were transformed using log(X+1) transformation and means were separated using Duncan's New MRT.

2. Texas Trial. One trial was conducted in Fort Bend Co., TX for control of green stink bug, *Acrosternum hilare* (Say). Plot sizes were 4 rows by 50 ft with 4 replications. The treatments were arranged in a RCB design. The plots were sprayed on Aug 18 with a tractor plot sprayer calibrated to deliver 20 gpa at 58 psi. Insect counts were expressed as number of green stink bug per 20 sweeps. Data were analyzed using AOV, and means were separated using Duncan's New MRT.

Results and Discussion

Tarnished Plant Bug Control

1. Mississippi Trials. Tables 1 and 2 show the results of trial 1 in Quitman Co., MS. All insecticide treatments significantly reduced the number of TPB nymphs per 20 plants below the untreated check at 5 and 7 days after treatment (Table 1). At 5 days after treatment, Centric (0.047 lb ai/Acre), Orthene (0.5 & 1.0 lb ai/Acre) and Bidrin (0.5 lb ai/Acre) were significantly better than Steward (0.11 lb ai/Acre), Vydate (0.33 lb ai/Acre) and Karate-Z (0.04 lb ai/Acre). At 7 days after treatment, Centric (0.047 lb ai/Acre) and Bidrin (0.5 lb ai/Acre) were significantly better than Steward (0.11 lb ai/Acre).

At 5 days after treatment, all insecticide treatments, except Steward (0.11 lb ai/Acre) and Vydate (0.33 lb ai/Acre), significantly reduced the number of TPB adults per 20 plants below the untreated check (Table 2). At 7 days after treatment, none of the insecticide treatments significantly reduced the number of TPB adults per 20 plants below the untreated check. Because of their high mobility, it is difficult to evaluate the efficacy of foliar insecticides against TPB adults in small plot trials.

Tables 3 and 4 show the results of trial 2 in Quitman Co., MS. At 5 days after the first application, all insecticide treatments, except Denim (0.01 lb ai/Acre) and Asana (0. 05 lb ai/Acre), significantly reduced the number of TPB nymphs per 20 plants below the untreated check. No significant differences were observed among Centric (0.031, 0.047 & 0.062 lb ai/Acre), Steward (0.11 lb ai/Acre), Orthene (0.5 lb ai/Acre) and Capture (0.05 lb ai/Acre). At 5 days after the second application, all insecticide treatments, except Asana (0.05 lb ai/Acre), significantly reduced the number of TPB nymphs per 20 plants below the untreated check. Centric (0.031, & 0.047 lb ai/Acre) was not significantly different from Steward (0.11 lb ai/Acre), Denim (0.01 lb ai/Acre), Orthene (0.5 lb ai/Acre) and Capture (0.05 lb ai/Acre) (Table 3).

At 5 days after the first application, none of the insecticide treatments significantly reduced the number of TPB adults per 20 plants below the untreated check (Table 4). At 5 days after the second application, all insecticide treatments, except Steward (0.11 lb ai/Acre) and Asana (0.05 lb ai/Acre), significantly reduced the number of TPB adults below the untreated check. Centric (0.031 & 0.047 lb ai/Acre) was not significantly different from Denim (0.01 lb ai/Acre), Orthene (0.5 lb ai/Acre) and Capture (0.05 lb ai/Acre).

2. Arkansas Trials. Table 5 shows the results of the field cage study near Manila, AR. All insecticide treatments had significantly higher TPB mortality than the untreated check at both exposure times. Mortality was significantly higher in Centric (0.0346 lb ai/Acre) than in Steward (0.104 lb ai/Acre) at 0 and 4 HAA exposure times. Centric (0.0625 lb ai/Acre) was significantly better than Steward (0.104 lb ai/Acre) at 0 HAA exposure time. Centric (0.0346 & 0.0625 lb ai/Acre) was significantly better than Leverage (0.0634 lb ai/Acre) at 4 HAA exposure time.

Table 6 shows the results of the field trial in Mississippi Co., AR. All insecticide treatments had significantly lower number of TPB nymphs per 24 row feet than the untreated check at 4 days after treatment. No significant differences were observed among the insecticide treatments. TPB nymph populations were reduced significantly by 7 days after treatment and no significant differences were observed among the insecticide treatments and the untreated check.

Stink Bug Control

1. Louisiana Trial. Tables 7 and 8 show the results of the trial in Franklin Parish, LA. At 7 days after treatment, Centric (0.047 lb ai/Acre), Karate-Z (0.035 lb ai/Acre), Orthene (0.8 lb ai/Acre) and Leverage (0.078 lb ai/Acre) significantly reduced the number of nymphs per 25 sweeps below the untreated check. At 11 days after treatment, Centric (0.047 lb ai/Acre), Karate-Z (0.035 lb ai/Acre), Assail (0.075 lbai/Acre) and Leverage (0.078 lb ai/Acre) significantly reduced the number of brown stink bug nymphs per 25 sweeps below the untreated check. Centric (0.047 lb ai/Acre) was not significantly different from Karate-Z (0.035 lb ai/Acre), Assail (0.075 lb ai/Acre) and Leverage (0.078 lb ai/Acre).

All insecticide treatments, except Centric (0.062 lb ai/Acre) and Assail (0.075 lb ai/Acre), significantly reduced the number of brown stink bug adults per 25 sweeps below the untreated check at 7 days after treatment (Table 8). At 11 days after treatment, none of the insecticide treatments significantly reduced the number of brown stink bug adults below the untreated check.

2. Texas trial. Table 9 shows the results of the trial in Fort Bend Co., TX for green stink bug control at 7 days after treatment. All insecticide treatments significantly reduced the number of nymphs per 20 sweeps below the untreated check. Nymph populations, however, were low. All insecticide treatments, except Steward (0.089 lb ai/Acre), significantly reduced the number of adults per 20 sweeps below the untreated check. Centric (0.047 & 0.062 lb ai/Acre) was significantly better than Karate-Z (0.035 lb ai/Acre), Assail (0.075 lb ai/Acre) and Steward (0.089 lb ai/Acre).

Conclusions

Results of studies conducted during 2001 indicated that Centric provided excellent control of TPB and stink bugs. The performance of Centric was comparable, if not superior, to all of the commonly used insecticides. In 2002, Syngenta will introduce Centric 40 WG, which will have the same single rate structure as Centric 25 WG. In addition, the aerial label will be revised to allow a minimum of 3 gpa application rate.

As the result of the reduced use of broad spectrum insecticides, the availability of lepidopterous specific insecticides, and the success of the boll weevil eradication and Bt cotton, secondary pests such as TPB and stink bugs have become increasingly

important in cotton. Because of the possibility of widespread TPB resistance to cyclodiene, organophosphate and pyrethroid insecticides in the Delta of Arkansas, Louisiana and Mississippi (Scott et al. 1999), and the dependence on insecticides for control of TPB, new insecticides are needed for the control and management of this pest.

Centric is an excellent substitute for commonly used insecticides for control of TPB as well as other sucking pests in cotton because it offers the following advantages: a/ new chemistry, b/ new mode of action, c/ lack of cross resistance, d/ low use rates, e/ high selectivity and f/ minimal impact on the environment.

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Table 1. Mean Number of Tarnished Plant Bug Nymphs per 20 Plants in Quitman Co., MS - Trial 1 (Layton, MSU, 2001).

		Mean No. TPB Nymphs/20 plants	
Treatment	**Rate (lb ai/Acre)**	**5 DAT**	**7 DAT**
Untreated Check		25.0 a	25.8 a
Centric 25WG	0.047	4.5 c	5.3 c
Orthene 97S	0.500	3.5 c	5.8 bc
Orthene 97S	1.000	2.8 c	7.8 bc
Steward 1.25SC	0.110	9.0 b	10.8 b
Vydate C-LV 3.77	0.330	9.3 b	8.3 bc
Karate-Z 2.08CS	0.040	9.0 b	7.5 bc
Bidrin 8E	0.500	1.3 c	3.3 c

Means within a column that are not followed by a common letter differ significantly (Fisher's Protected LSD, *P*=0.1).

Table 2. Mean Number of Tarnished Plant Bug Adults per 20 Plants in Quitman Co., MS - Trial 1 (Layton, MSU, 2001).

		Mean No. TPB Adults/20 plants	
Treatment	**Rate (lb ai/Acre)**	**5 DAT**	**7 DAT**
Untreated Check		5.5 a	3.3 a
Centric 25WG	0.047	2.8 bc	3.0 a
Orthene 97S	0.500	2.0 c	2.0 a
Orthene 97S	1.000	2.0 c	2.5 a
Steward 1.25SC	0.110	4.0 ab	3.8 a
Vydate C-LV 3.77	0.330	3.8 abc	1.0 a
Karate-Z 2.08CS	0.040	2.0 c	2.3 a
Bidrin 8E	0.500	2.3 bc	2.0 a

Means within a column that are not followed by a common letter differ significantly (Fisher's Protected LSD, *P*=0.1).

Table 3. Mean Number of Tarnished Plant Bug Nymphs per 20 Plants in Quitman Co., MS - Trial 2 (Layton, MSU, 2001).

		Mean No. TPB Nymphs/20 plants	
Treatment	**Rate (lb ai/Acre)**	**5 DAT1***	**5 DAT2**
Untreated Check	0.031	18.3 a	13.0 a
Centric 25WG	0.047	9.8 bc	2.3 bcd
Centric 25WG	0.062	8.0 bc	2.7 bcd
Centric 25WG	0.110	6.0 c	1.0 d
Steward 1.25SC	0.010	10.3 bc	4.7 bc
Denim 0.16EC	0.050	13.5 ab	4.7 bc
Asana 0.66EC	0.500	19.0 a	12.3 a
Orthene 97S	0.050	11.0 bc	1.7 cd
Capture 2 EC		10.6 bc	5.3 b

Means within a column that are not followed by a common letter differ significantly (Fisher's Protected LSD, *P*=0.1) * 5 DAT1 = 5 days after first application; 5 DAT2 = 5 days after second application.

Table 4. Mean Number of Tarnished Plant Bug Adults per 20 Plants in Quitman Co., MS - Trial 2 (Layton, MSU, 2001).

		Mean No. TPB Adults/20 plants	
Treatment	**Rate (lb ai/Acre)**	**5 DAT1***	**5 DAT2**
Untreated Check	0.031	10.0 a	11.0 ab
Centric 25WG	0.047	6.5 a	6.0 c
Centric 25WG	0.062	6.8 a	6.0 c
Centric 25WG	0.110	7.5 a	1.7 d
Steward 1.25SC	0.010	8.0 a	7.0 bc
Denim 0.16EC	0.050	11.8 a	5.7 cd
Asana 0.66EC	0.500	9.8 a	12.3 a
Orthene 97S	0.050	9.5 a	3.0 cd
Capture 2EC		5.8 a	4.3 cd

Means within a column that are not followed by a common letter differ significantly (Fisher's Protected LSD, *P*=0.1).

* 5 DAT1 = 5 days after first application; 5 DAT2 = 5 days after second application.

Table 5. Mean % Mortality of Tarnished Plant Bug Adults Observed 72 Hours after Release near Manila, AR (Teague, Univ. of Arkansas, 2001).

		% Mortality 72 hrs	
Treatment	**Rate (lb ai/Acre)**	**Released 0 HAA**	**Released 4 HAA**
Untreated Check	0.0346	4.3 c	22.2 d
Centric 25WG	0.062	90.1 a	84.4 a
Centric 25WG	0.104	95.7 a	82.2 ab
Steward 1.25SC	0.0634	73.7 b	62.2 bc
Leverage 2.7EC		85.0 ab	56.1 c
P>F (AOV)		0.001	0.001
LSD (.05)		12.0	20.52

Table 6. Mean Number of Tarnished Plant Bug Nymphs per 24 Row Feet in Mississippi Co., AR (Hopkins, Univ. of Arkansas, 2001).

		Mean No. TPB Nymphs/24 rwft	
Treatment	**Rate (lb ai/Acre)**	**4 DAT**	**7 DAT**
Untreated Check	0.047	13.0 a	3.5 a
Centric 25WG	0.062	1.0 b	0.3 a
Centric 25WG	0.034	1.3 b	0.3 a
Karate-Z 2.08CS	0.800	2.0 b	0.8 a
Orthene 97S	0.075	0.8 b	0.0 a
Assail 70WP	0.089	0.3 b	0.3 a
Steward 1.25SC	0.078	0.3 b	0.3 a
Leverage 2.7EC		0.5 b	0.8 a

Means followed by the same letter do not significantly differ (P=.05, Duncan's New MRT).

Table 7. Mean Number of Brown Stink Bug Nymphs per 25 Sweeps in Franklin Parish, LA (Martin, Syngenta, 2001).

		Mean No. Nymphs/25 sweeps**	
Treatment	**Rate (lb ai/Acre)**	**7 DAT**	**11 DAT**
Untreated Check	0.047	6.44 a	10.40 a
Centric 25WG	0.062	0.32 b	1.30 bc
Centric 25WG	0.035	2.81 ab	4.51 ab
Karate-Z 2.08CS	0.800	0.41 b	0.41 c
Orthene 97S	0.075	0.57 b	3.68 ab
Assail 70WP	0.089	1.78 ab	2.41 bc
Steward 1.25SC	0.078	1.63 ab	4.05 ab
Leverage 2.7EC		0.41 b	0.57 c

** Prior to statistical analysis, data were transformed using log(X+1) transformation.
Means followed by the same letter do not significantly differ (P=.05, Duncan's New MRT).
T= Means descriptions are reported in transformed data units, and are not de-transformed.

Table 8. Mean Number of Brown Stink Bug Adults per 25 Sweeps in Franklin Parish, LA (Martin, Syngenta, 2001).

		Mean No. Adults/25 sweeps**	
Treatment	**Rate (lb ai/Acre)**	**7 DAT**	**11 DAT**
Untreated Check	0.047	4.98 a	1.45 a
Centric 25WG	0.062	0.68 b	1.21 a
Centric 25WG	0.035	1.63 ab	1.21 a
Karate-Z 2.08CS	0.800	0.86 b	0.68 a
Orthene 97S	0.075	0.73 b	1.21 a
Assail 70WP	0.089	1.51 ab	1.38 a
Steward 1.25SC	0.078	0.73 b	1.63 a
Leverage 2.7EC		0.86 b	1.71 a

** Prior to statistical analysis, data were transformed using log(X+1) transformation.
Means followed by the same letter do not significantly differ (P=.05, Duncan's New MRT).
T= Means descriptions are reported in transformed data units, and are not de-transformed.

Table 9. Mean Number of Green Stink Bugs per 20 Sweeps at 7 DAT in Fort Bend Co., TX (Minton, Syngenta, 2001).

		Mean No. Green Stink Bugs/20 sweeps	
Treatment	**Rate (lb ai/Acre)**	**Nymphs**	**Adults**
Untreated Check	0.047	3.00 a	13.75 a
Centric 25WG	0.062	0.75 c	0.50 c
Centric 25WG	0.035	1.00 c	0.75 c
Karate-Z 2.08CS	0.800	0.00 c	5.00 b
Orthene 97S	0.075	0.00 c	1.50 bc
Assail 70WP	0.089	0.75 c	4.50 b
Steward 1.25SC	0.400	2.00 b	11.75 a
Bidrin 8E		0.25 c	2.00 bc

Means followed by the same letter do not significantly differ (P=.05, Duncan's New MRT).