1999 FIELD TRIAL RESULTS WITH PYMETROZINE (FULFILL®) AND THIAMETHOXAM (CENTRIC™/ACTARA™) FOR CONTROL OF COTTON APHID (*APHIS GOSSYPII*)

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Abstract

Pymetrozine and thiamethoxam are new insecticides being developed by Novartis Crop Protection for management of cotton pests. Pymetrozine is a highly selective insecticide that has excellent activity against a wide range of aphid species, including the cotton aphid. Thiamethoxam is a second-generation neonicotinoid insecticide that has excellent activity against a number of sucking pests in cotton, including aphids, whiteflies, thrips, tarnished plant bugs and fleahoppers.

This manuscript presents results from field trials conducted in 1999 to evaluate the efficacy of both pymetrozine and thiamethoxam for the cotton aphid. Both pymetrozine (0.086 lbs ai/A) and thiamethoxam (0.023-0.047 lbs ai/A) provided significant control of cotton aphid populations in five field trials conducted by Novartis research personnel.

Introduction

Pymetrozine is a highly selective insecticide with excellent activity against a wide range of aphid species, including the cotton aphid, *Aphis gossypii*. Pymetrozine belongs to the pyridine azomethine chemical class and exhibits a unique mode of action that is characterized as neural inhibition of feeding behavior. It does not have a general toxic or paralyzing effect on aphids, but selectively interferes with normal feeding activities by affecting the neural regulation of fluid intake (Harrewijn and Kayser, 1997). Affected aphids stop feeding shortly after exposure, which consequently results in mortality due to starvation after several days.

Pymetrozine is formulated as Fulfill 50WG and is applied as a foliar spray at a rate of 2.75 oz/A (0.086 lbs ai/A) in response to threshold levels of aphids in cotton. It is recommended that a penetrating type adjuvant be used with all applications of Fulfill in order to provide good coverage of plant surfaces and to facilitate penetration of the active ingredient into leaf tissue. Fulfill typically exhibits residual activity for a period of about 2 weeks.

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Pymetrozine is a highly selective insecticide, and has been shown to be safe to many cotton predators and parasitoids including green lacewings, seven-spotted lady beetles, carabid beetles, *Orius spp., Geocoris spp*., syrphid flies, predatory mites and *Encarsia spp.* (Sechser, 1996).

Thiamethoxam has excellent activity against a wide spectrum of sucking pests in cotton, including aphids, whiteflies, thrips, tarnished plant bugs and fleahoppers. This new active ingredient is a thianicotinyl insecticide in the neonicotinoid class. The mode of action of thiamethoxam is presently under investigation; preliminary data indicate that thiamethoxam acts by interfering with the nicotinic acetylcholine receptor of the insect's nervous system. Thiamethoxam acts through contact and ingestion and typically results in the death of target insects within 24 –48 hours of exposure.

Thiamethoxam is a highly systemic insecticide, and can be applied using a variety of application methods, including seed treatment, soil application, or foliar application. In cotton, thiamethoxam will be developed as a seed treatment under the trade name Adage™. Thiamethoxam is also being developed as a foliar spray in cotton at rates of 0.023-0.062 lbs ai/A under the trade names Centric and Actara. Centric is formulated specifically for use in mid-South cotton while Actara is formulated for use in western cotton. There are currently no plans to develop thiamethoxam for soil applications in cotton.

Thiamethoxam is classified as slightly harmful to beneficial insects and harmless to predatory mites. However, when applied as a foliar spray thiamethoxam has minimal impact on beneficial arthropods. This is due primarily to two factors: 1) thiamethoxam moves quickly across the leaf surface and into plant tissue, and 2) any remaining surface residues are quickly dissipated by a variety of environmental factors.

Objective

Field trial results for both pymetrozine and thiamethoxam have been presented at previous Beltwide Cotton Conference meetings (Minton, et. al., 1994; Ngo et al, 1995; Allemann et al., 1997; Koenig, et al., 1998; Ferguson, et al., 1999; Lawson, et al, 1999). The objective of this manuscript is to present results from 1999 field trials conducted to evaluate control of the cotton aphid.

Materials and Methods

1. Field efficacy trials were conducted by Novartis research personnel in the states of Mississippi, Arkansas, Texas, California and Florida during the 1999 season.
2. In three trials, single foliar applications of pymetrozine, thiamethoxam, and a standard (carbofuran (Furadan) or naled (Dibrom), were directed against populations of

cotton aphids. In two trials, two applications of all treatments were made.

3. Pymetrozine was applied at a rate of 0.086 lbs ai/A; thiamethoxam was applied at rates of 0.023- 0.047 lbs ai/A; carbofuran was applied at a rate of 0.0.25 lbs ai/A; naled was applied at a rate of 0.40 lbs ai/A. All treatments were applied using standard ground equipment. All pymetrozine applications included a spray adjuvant at the manufacturer's recommended rate.
4. All treatments were replicated four times and arranged in a randomized complete block design, except for the Mississippi location, which was replicated only three times.
5. Efficacy evaluations of all compounds were made at appropriate intervals after application by counting cotton aphids on 10-25 leaves per replicated plot.

Results

In the Mississippi trial (Figure 1), all treatments provided significant reduction of cotton aphid populations compared to the check at 3 days after application. Pymetrozine provided aphid control that was comparable and not significantly different than carbofuran or thiamethoxam. Thiamethoxam provided the best aphid control in this trial and was significantly better than carbofuran at the three-day evaluation. A second application of all treatments was made 8 days after the first application in response to rebuilding aphid populations. All treatments resulted in significant reduction of aphid populations by 3 days after the second application.

In the Texas trial (Figure 2), all treatments provided significant reduction of cotton aphid populations compared to the check at 5, 8, and 15 days after application. Although there were no significant differences among treatments at any evaluation date, thiamethoxam and carbofuran provided numerically greater reductions of aphid populations than pymetrozine.

In the Arkansas trial (Figure 3), all treatments provided significant reduction of cotton aphid populations compared to the check at 4 days after application. Although there were no significant differences among treatments at the single evaluation date, thiamethoxam and carbofuran provided numerically greater reductions of aphid populations than pymetrozine. Additional evaluations were not recorded because aphid populations crashed at 10 days after application.

In the Florida trial (Figure 4), all treatments provided significant reduction of cotton aphid populations compared to the check at 5 and 9 days after the first application. Although there were no significant differences among treatments at either evaluation date, thiamethoxam and carbofuran provided numerically greater reductions of aphid populations than pymetrozine. A second application of all treatments was made 12 days after the first application in response to rebuilding aphid populations. All treatments resulted in significant reduction of aphid populations at 4 and 11 days after the second application.

In the California trial (Figure 5), all treatments except naled provided significant reduction of cotton aphid populations compared to the check at 7 and 14 days after application. Although there were no significant differences among treatments at both evaluation dates, thiamethoxam and carbofuran provided numerically greater reductions of aphid populations than pymetrozine. Between 21 and 28 days after application, aphid populations had declined in all plots, and there were no significant differences among any of the treatments. At 35 days after application, aphid populations in the check had increased slightly. At this time, thiamethoxam and pymetrozine provided significant reduction of aphid populations compared to the check, while naled did not.

Summary

1. Both pymetrozine (0.086 lbs ai/A) and thiamethoxam (0.023-0.047 lbs ai/A) provided significant control of cotton aphid populations in five field trials conducted by Novartis research personnel in the 1999 season.
2. In general, thiamethoxam provided the best aphid control in all trials, but the level of control was rarely significantly different (p=.05) than either pymetrozine or the standard, carbofuran. In one trial, both thiamethoxam and pymetrozine provided superior control compared to Dibrom.
3. Both rates of thiamethoxam (0.023 and 0.047 lbs ai/A) provided excellent control of the cotton aphid. There were no siginificant differences between these two treatments at any of the trial sites.
4. Residual control obtained from pymetrozine and thiamethoxam was variable, and ranged approximately from 7-14 days.

Conclusion

Based on the results of field trials conducted during the 1999 season, both pymetrozine and thiamethoxam will have utility for managing the cotton aphid. These new insecticides will provide an alternative to broad spectrum insecticides currently being used to manage this pest in cotton.

Pymetrozine is expected to be registered under the trade name Fulfill in the second quarter of 2000. Thiamethoxam will be registered under the trade name Centric for use in mid-south cotton and under the trade name Actara for use in western cotton. Registrations for thiamethoxam are expected in 2000 and 2001.

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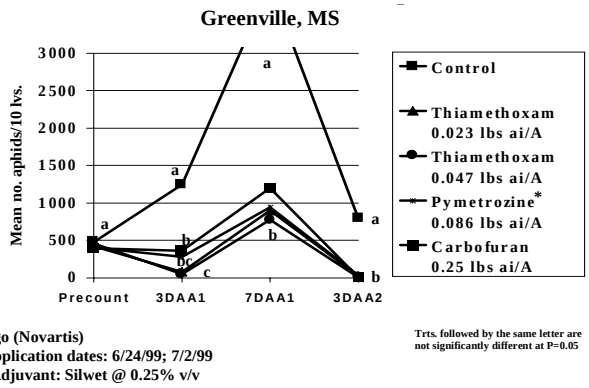

Figure 1. Efficacy of Pymetrozine and Thiamethoxam on Cotton Aphid.

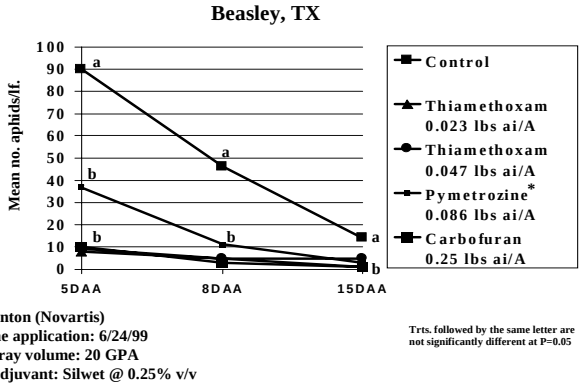

Figure 2. Efficacy of Pymetrozine and Thiamethoxam on Cotton Aphid.

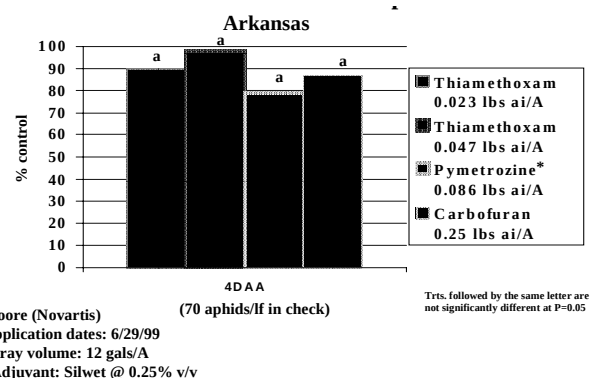

Figure 3. Efficacy of Pymetrozine and Thiamethoxam on Cotton Aphid.

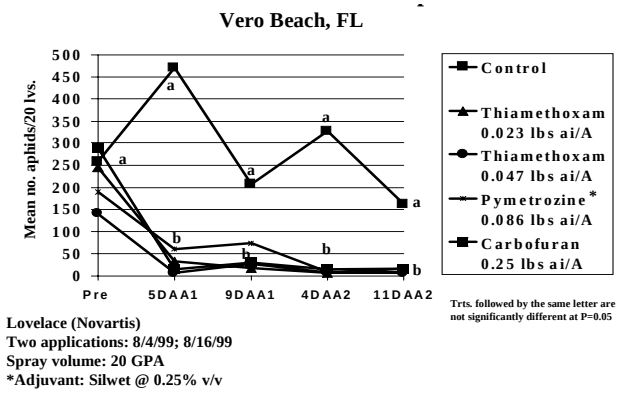

Figure 4. Efficacy of Pymetroxine and Thiamethoxam on Cotton Aphid.