OVICIDAL ACTIVITY OF ACETAMIPRID (ASSAIL™ BRAND 70WP INSECTICIDE) ON ECONOMIC PESTS OF COTTON

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Abstract

Laboratory bioassays indicate that acetamiprid, formulated as Assail™ brand 70WP Insecticide is an effective ovicide for tobacco budworm, bollworm, southern armyworm, fall armyworm, cabbage looper, European corn borer, diamondback moth, Colorado potato beetle, Mexican bean beetle and green stink bug. Efficacy is achieved at dose rates well below that required for adult or immature control when applied by direct spray or by contact with residue on treated foliage. For tobacco budworm and bollworm, a substantial drop in efficacy is observed between 0.0125 and 0.00625 lb ai/A. Acetamiprid is effective as an ovicide against eggs of susceptible and pyrethroid-resistant tobacco budworm and Colorado potato beetle. Acetamiprid appears to be more active than other commercially available chloronicotynils tested against tobacco budworm and bollworm.

Introduction

The active ingredient in Assail™ brand 70WP Insecticide is acetamiprid, a new insecticide belonging to the family of chemistry known as chloronicotinyls. This compound is being developed by Aventis CropScience in North America, Europe, and many other parts of the world as a foliar insecticide. Acetamiprid (NI-25) was originally discovered by Nippon Soda in Japan and is already being sold in countries outside of the US and Canada as Mospilan® and Rescate®.

Preliminary laboratory investigations and field observations suggested that acetamiprid has ovicidal activity and that this activity occurred across many different insect species. The research reported here was conducted to evaluate acetamiprid as an ovicide under laboratory conditions. Objectives include: 1) Determine the spectrum of ovicidal activity. 2) Determine the optimal exposure route. 3) Determine the susceptibility of pyrethroid-resistant insect strains. 4) Compare ovicidal activity of commercially available chloronicotinyls.

Methods and Materials

Bioassays were conducted to assess the ovicidal activity of acetamiprid, against eggs of pyrethroid-resistant and susceptible Tobacco budworm, *Heliothis virescens,* Bollworm, *Heliocoverpa zea,* Southern armyworm, *Spodoptera eridania,* Fall armyworm, *Spodoptera frugiperda,* Cabbage looper, *Trichoplusia ni,* European corn borer, *Ostrinia nubilalis,* Diamondback moth, *Plutella xylostella,* multi-resistant and susceptible Colorado potato beetle, *Leptinotarsa decemlineata,* Mexican bean beetle, *Epilachna varivestis,* and Green stink bug, *Acrosternum hilare*.

For direct spray tests, 40-100 eggs were placed on top of filter paper inside a Gelman petri dish and replicated 3 times for each treatment. A hand sprayer (calibrated to spray 20 gallons/acre) was used to apply the treatments with the appropriate concentrations. Treated eggs were covered and kept inside the Gelman petri dishes.

In treated leaf tests, 1.5 inch diameter cotton leaf disks were sprayed with insecticide solutions then left to dry on paper towel. Treated disks were placed individually in Gelman petri dishes on top of eggs.

All dishes were held at 80 ± 5ºF and 50 ± 5 percent relative humidity and examined daily until the eggs in the untreated check hatch. Untreated controls consist of eggs and leaves sprayed only with water. Egg hatch in untreated controls ranged from 90 to 98 percent.

In one test, where the susceptibility of pyrethroid resistant tobacco budworm eggs were used, the insecticide application was made using an Allen track sprayer which was calibrated to deliver 20 gallons/Acre. Immediately after spray application, eggs, still wet, were placed in an 8 oz solo plastic cup. The cup was covered with a plastic lid. Cups were held for two days in a room at 80 ± 5ºF and 50 ± 5 percent relative humidity, then for another day at 72ºF and ambient relative humidity. Mortality data were recorded after three days.

Results

Spectrum of Activity

All species tested are susceptible to ovicidal activity by acetamiprid at rates of 0.05 to 0.0125 lb ai/A (Table 1). Efficacy against eggs of tobacco budworm, bollworm and fall armyworm sharply declined at 0.00625 lb ai/A. Mortality resulting from acetamiprid is a true ovicidal effect in that eggs fail to hatch. Observation of the treated tobacco budworm eggs indicate that development of the neonate larvae may have been interrupted.

Exposure Route

Efficacy of exposure route varied by species (Table 2). For green stink bug, bollworm, southern armyworm and fall armyworm, egg mortality was similar for contact by direct spray and residual on the leaf surface. For tobacco budworm and European corn borer, contact by direct spray provided greater mortality than residual on the leaf surface.

Activity on Pyrethroid-Resistant Insect Strains

Acetamiprid appears to be equally effective on pyrethroid-resistant and susceptible strains of Colorado potato beetle and tobacco budworm (Table 3). The laboratory-reared, pyrethroid-resistant strain of tobacco budworm appeared to be slightly more susceptible to acetamiprid than the wild, pyrethroid-susceptible strain indicating a possible loss of vigor in that strain.

Acitivity of Commercial Chloronicotinyls

Efficacy against bollworm eggs was similar for the 3 chloronicotynils acetamiprid, imidacloprid, and thiamethoxam (Table 4). However, mortality of tobacco budworm eggs greatly differed with acetamiprid being superior to the other two. Imidacloprid demonstrated very little activity against tobacco budworm eggs below the 0.05 lb ai/A dose.

Discussion and Conclusion

Acetamiprid, formulated as Assail™ brand 70WP Insecticide provides ovicidal activity on a wide spectrum of economic pests in cotton. It is effective as a direct spray or as a residual on the leaf surface. Acetamiprid is effective against eggs of pyrethroid-resistant and multi-resistant insect strains and it is more active that other commercially available chloronicotinyls on eggs of bollworm and tobacco budworm.

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Table 1. Mortality of insect eggs resulting from application of acetamiprid.

	% Mortality			
	Acetamiprid Application Rate (lb ai/A)			
	0.045	0.022	0.011	0.00625
Species	-0.05	-0.025	-0.0125	
Tobacco budworm	100	95	100	82
Bollworm	97	95	99	88
Southern armyworm	100	100	100	99.5
Fall armyworm	89	95	95	35
Cabbage looper	100	100	100	
European corn borer	93	95	98	96
Diamondback moth	100	100	100	
Colorado potato beetle	96	100	100	
Mexican bean beetle	78	83	90	
Green stink bug	98	100	100	100

Table 2. Mortality of insect eggs resulting from a direct spray application of acetamiprid (Direct) compared to mortality from contact with acetamiprid residue on a leaf surface (Residue).

	Thiodicarb	Acetamiprid			
Application Rate (lb ai/A)	0.125	0.05	0.025	0.0125	0.00625
Target	Method	% Mortality			
Green stink bug	Direct	85	98	100	100
	Residue	100	100	100	98
Bollworm	Direct	70	97	95	99
	Residue	80	85	98	92
Tobacco budworm	Direct	98	100	95	100
	Residue	100	99	83	92
Southern armyworm	Direct	88	100	100	100
	Residue	81	97	98	96
Fall armyworm	Direct	88	89	95	95
	Residue	0	94	98	67
European corn borer	Direct	97	93	95	98
	Residue	76	82	50	55

Table 3. Mortality of eggs from pyrethroid-resistant insect strains and susceptible strains.

	Chlordimeform	Acetamiprid		
Application Rate (lb ai/A)	0.167	0.042	0.021	0.011
Target Strain	% Mortality			
Colorado potato beetle				
Susceptible	8	96	100	100
Resistant	0	100	100	82
Tobacco budworm				
Susceptible	68	83	59	80
Resistant	81	94	86	82

Table 4. Mortality of bollworm and tobacco budworm eggs treated with three chloronicotinyls.

	Rate in lb ai/A			
	0.05	0.025	0.0125	0.00625
Species Test Compound	% Mortality			
Bollworm				
Acetamiprid	97	95	99	88
Imidacloprid	89	90	94	40
Thiamethoxam	80	85	99	90
Tobacco budworm				
Acetamiprid	100	95	100	82
Imidacloprid	82	5	0	0
Thiamethoxam	79	82	70	65