ALTERNATIVES TO CONVENTIONAL CHEMICAL INSECTICIDES FOR CONTROLOF GLASSY-WINGED SHARPSHOOTER

Principal Investigator:
Gary J. Puterka
USDA-ARS, Appalachian Fruit Research Station
Kearneysville, WV 25430

Cooperators:
Don Luvisi
UC Cooperative Extension Service
Bakersfield, CA

Ed Civerolo and Kayimbi Tubajika
USDA-ARS, PWA
SJV Agric. Sciences Center
Exotic Invasive Dis. Pests Research
Parlier, CA

Matt Ciomperlik, David Bartels and Lloyd Wendel
USDA-APHIS-PPQ
Mission Plant Protection Center
Mission, TX

Reporting Period: The results reported here are from work conducted from March 2001 through August 2002.

INTRODUCTION

ARS and industry partners have developed two new insecticidal chemistries that offer significant insect control properties with improved safety to human health and the environment. Particle film technology (Surround WP, Engelhard Corp, Iselin, NJ) is based on the inert mineral, kaolin, that forms a film that protects plants from insects and some diseases. Surround WP is exempt from tolerance, can be applied up to the day of harvest, has a 4 hour re-entry period, has virtually no mammalian toxicity, and is listed as an approved organic production material. Surround WP is unique among insecticides in that it has the ability to repel insects from plants and prevents insect oviposition and feeding which could prevent transmission of Pierce's disease. It has proven to be as effective as imidacloprid in controlling GWSS in citrus in recent small block tests in California. Sucrose octanoate received EPA registration in 2002, is made of food grade materials, is exempt from tolerance, and has also shown levels of control of GWSS that is as good as other conventional insecticides. The objectives of this research were to determine how effective these materials were in controlling GWSS in lab and field experiments.

OBJECTIVES

1. Evaluation of particle film, Surround WP, effects on GWSS biology.
2. Efficacy of sugar esters a quick knock-down agents for GWSS control.
3. Prevention of GWSS infestations with season-long and timed spray applications of Surround WP.

RESULTS AND CONCLUSIONS

Effect of surround WP applications on nymphal behavior:

A series of studies were conducted on GWSS nymphs in free-choice and no-choice environments where they were offered Surround WP treated and untreated lemon foliage. The objectives of these studies were to determine if Surround treatments affected feeding preference and survival of GWSS nymphs. In a free-choice study, twenty GWSS nymphs were release at the base of a lemon seedling with one limb treated with Surround WP and one limb left untreated. Nymphs per limb were recorded 1 and 2 days after treatment. This experiment was replicated 6 times in field cages during July, 2001. In a no-choice study, 20 GWSS nymphs were released at the base of a lemon seedling that was treated with Surround or left untreated. Numbers of nymphs per seedling were recorded daily for 4 days after initiation of the study. This experiment was replicated 6 times in field cages during July, 2001.

GWSS nymphs and adults refused to settle on Surround treated foliage when given a choice (Figure 1). When given a no choice, all adults and most nymphs refused to stay on Surround treated plants and cling to the cages until they died. These studies show that Surround is highly repellent to both GWSS nymphs and adults.

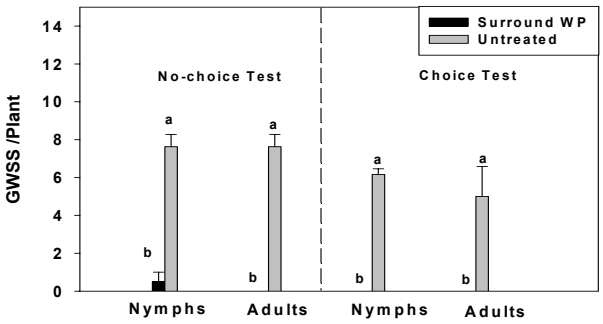

Figure 1. Number of glassy-winged sharpshooter nymphs (n=20) and adults (n=50) after being released in cages containing either a lemon tree treated with Surround WP or left untreated in a no-choice test (right) or given a choice between one limb treated with Surround WP and the other left untreated (left).

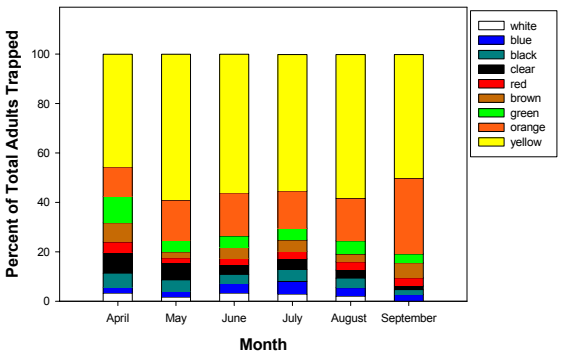

Figure 2. Mean response of glassy-winged sharpshooter adults to 25.4 cm plastic discs painted a spectrum of colors, coated with Tangle Foot™ (Grand Rapids, MI), and placed at a height of 2.0 m in two citrus groves bordering grape, Kern Co., CA.

Surround WP or left untreated in a no-choice test (right) or given a choice between one limb treated with Surround WP and the other left untreated (left).

Response of GWSS adults to different colored traps:

A study was conducted to determine the response of GWSS adults to different colored sticky traps. Although it is known that GWSS adults are attracted to yellow, it is not known what other colors attract GWSS adults or if this attraction is temporal. Directly related to our Surround studies was the need to determine how GWSS adults respond to the color white because Surround turns plant foliage white. Round plastic colored targets 10 inches in diameter and coated with Tangle Foot sticky polymer were attached to bamboo poles 6 ft. above the ground. The colored traps were then placed within citrus groves at 3 sites beginning in April, 2001 and were sampled year-around. There were 9 colors with 4 replications per site.

Results during the 2001 season showed that yellow was the most preferred color followed by orange and that white was among the least preferred colors we examined (Figure 2). There was also evidence that GWSS adults responded more to brown in the spring and orange in September while their response to yellow was consistent over the sample period.

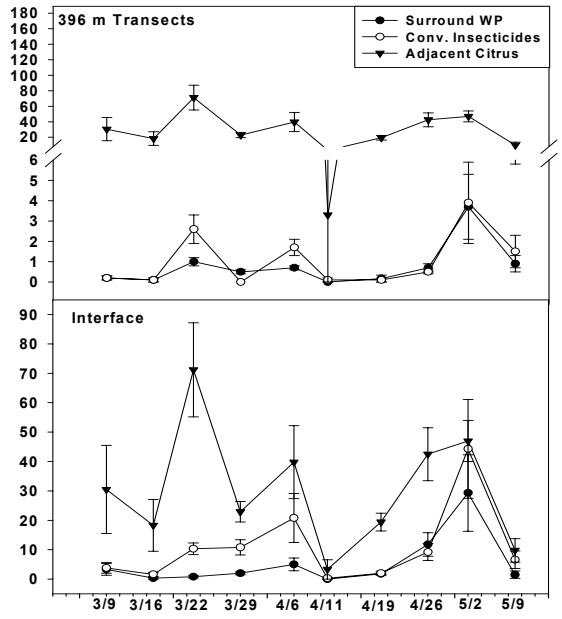

Figure 3. Mean number of glassy-winged sharpshooter adults caught per yellow sticky trap (Trece, Salinas, CA) placed 1.0 m high in the first grape vines in a vineyard bordering citrus (Interface) and placed every 30.5 m in two 365.7 m transects extending into each treatment block (Transect) in Site 1, Kern Co., CA.

Early season applications of Surround as a barrier to GWSS movement from citrus into grape:

In March of 2001, research was initiated at 3 vineyard sites bordering citrus near Bakersfield, CA, but only Site 1 produced enough GWSS numbers for study. In this study, we examined the effect of a 247.5 m Surround WP barrier treatment on grape to prevent GWSS adult movement from citrus into grape. Site 1 had treatment blocks 164.6 m wide by 365.7 m long (6.5 ha) replicated 3 times in a mixed block of table and wine grape. Surround treatments only extended 247.5 m into each block with the remaining 152.4 m left untreated while conventional chemical treatments extended the entire 365.7 m distance of the block in order to determine the effect of a 247.5 m treatment barrier. Yellow sticky traps were place in 2 transects per block and spaced every 100 feet that began where grape interfaced citrus and extended 396 m into the treatment blocks that went approximately 500 ft beyond the treated areas. In addition, the trap transects were extended into adjacent citrus groves for 100 ft. Effects of the treatments on oviposition was examined on May 4 by visually sampling 25 leaves/vine every 30.5 m along the trap transects. Three bi-weekly treatments of Surround WP were compared to six conventional chemical control program that applied various contact insecticides weekly. Surround treatments of 50 lb Surround WP/100 gal was applied at 50 to 70 gpa on March 13, March 30 and April 14.

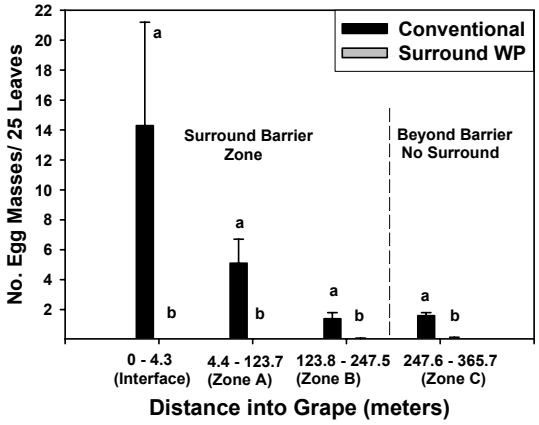

Figure 4. Mean number of glassy-winged sharpshooter eggs on 25 leaves/vine in the first grape vines in a vineyard bordering citrus (Interface) and from samples taken every 30.5 m into each treatment zone in Site 1, Kern Co., CA.

Surround treatments significantly reduced average GWSS trap numbers in the 396 m transects in comparison to conventional insecticides on 22 March and 6 April (Figure. 3). At the grape-citrus interface, Surround treatments reduced GWSS number significantly more than the conventional treatments from 22 March to 6 April (Figure 3.). Surround WP treatments also significantly reduced GWSS to nearly zero in comparison to the conventional treatment almost 3 weeks after the last Surround application (Figure 4). The strong repellency of Surround WP treated plant foliage minimizes the chance of GWSS to vector Pierce's disease in grape. In 2001, ARS plant pathologists (Ed Civerolo and K. Tubajika, USDA, Parlier, CA) found Surround treated blocks had 60% less Pierce's disease than the conventional blocks. Based on these studies Surround WP offers better protection against GWSS infestations than conventional insecticides.

Sugar esters for control of GWSS adults:

Two sugar ester materials that are produced by AVA Chemical Ventures (Portsmouth, MA) were evaluated for efficacy against GWSS adults in a field trial in Ventura Co., CA. A range of concentrations were examined in comparison to another soft insecticide, M-Pede insecticidal soap. Applications were made in late-July, 2002 to 2.0 m citrus trees heavily infested with GWSS. Trees were caged in early morning and treatments were applied using a hand-gun sprayer. Sucrose octantoate was more effective than sorbitol octanoate and M-Pede at lower doses (Table 1). Sorbitol octanoate and M-Pede performed similarly. There was recovery of GWSS adults over time in the sorbitol octanoate treatment which was not as evident for the sucrose octanoate and M-Pede materials making sorbitol octanoate less than desirable for GWSS control. However, further evaluations of sucrose octanoate would be worthwhile. Sucrose octanoate recently became registered as an insecticide with the U.S. EPA as Sucrose Octanoate Esters and which is a new class of insecticide that is safe to humans and the environment.

Table 1. Comparison of glassywinged sharpshooter adult mortalities after treatment with different of sugar esters and insecticidal soap applied to orange trees, Ventura County, CA, July, 2002.

		Mortality over Time (± std err.)		
Treatment	Conc.	5 min.	30 min.	60 min.
Sucrose Octanoate	0.8%	93.0 ± 4.0a	79.0 ± 6.4bcd	69.0 ± 7.4cd
Sucrose Octanoate	1.0%	89.0 ± 4.0a	86.0 ± 4.8abc	77.0 ± 6.6bc
Sucrose Octanoate	1.2%	98.0 ± 1.2a	96.0 ± 1.8a	97.0 ± 1.2a
Sucrose Octanoate	1.5%	98.0 ± 1.2a	98.0 ± 1.2a	97.0 ± 1.2a
Sorbitol Octanoate	0.8%	38.0 ± 7.8c	25.0 ± 7.5g	17.0 ± 4.6g
Sorbitol Octanoate	1.0%	76.0 ± 2.9b	55 .0± 7.9ef	37.0 ± 5.1f
Sorbitol Octanoate	1.2%	95.0 ± 1.5a	74 .0± 7.6cd	59.0 ± 9.2de
Sorbitol Octanoate	1.5%	91.0 ± 4.5a	91.0 ± 4.5ab	88.0 ± 5.8ab
M-Pede	0.6%	42.0 ± 9.7c	50.0 ± 10.3f	49.0 ± 9.9ef
M-Pede	0.8%	64.0 ± 5.1b	69.0 ± 2.9de	65.0 ± 5.4cd
M-Pede	1.0%	74.0 ± 4.0b	76.0 ± 7.6bcd	77.0 ± 6.0bc
M-Pede	1.2%	99.0 ± 1.0a	97.0 ± 97.0a	96.0 ± 1.8a
Water	100%	0.0 ± 0d	0.0 ± 0.0h	0.0 ± 0.0h

Means followed by the same letter within a column are not significant, REGWQ, $P = 0.05$

FUNDING AGENCIES

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