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IR-4 Ornamental Horticulture Program

Hachi-Hachi 15EC (tolfenpyrad) Crop Safety and Efficacy

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Abstract

Hachi-Hachi 15EC (tolfenpyrad) was registered July 28, 2010 for the control of aphids, leafhoppers, scales, thrips, whiteflies, and early instar lepidopteran larvae on ornamental horticulture crops grown in greenhouses. An expansion of this label for outdoor uses is planned. Since 2006, IR-4 tested Hachi-Hachi for efficacy on coleopteran insects and thrips. Efficacy for beetles and borers was variable, but good to excellent efficacy was observed for thrips populations. In general crop safety did not appear to be an issue in the efficacy testing with the exception of gladiolus and impatiens. Preliminary results for crop safety screening, however, indicate additional testing is warranted to clarify which crop species may be sensitive. With the limited results so far, impatiens is definitely sensitive to Hachi-Hachi applications.

Introduction

Hachi-Hachi 15EC (tolfenpyrad) was registered July 28, 2010 for the control of aphids, leafhoppers, scales, thrips, whiteflies, and early instar lepidopteran larvae on ornamental horticulture crops grown in greenhouses. An expansion of this label for outdoor uses is planned. Since 2006, IR-4 tested Hachi-Hachi for efficacy on coleopteran insects and thrips. Both of these projects were critical in identifying new potential tools for growers to manage these pest groups. Hachi-Hachi was included in both projects as an A level product because it had not yet been registered. During 2010, IR-4 also conducted crop safety tests on Hachi-Hachi and other recently registered products to manage thrips populations.

Materials & Methods

This summary covers crop safety and efficacy research on Hachi-Hachi 15EC (tolfenpyrad) and Tolfenpyrad SC. The efficacy research has been summarized previously within the 2009 Thrips Efficacy Summary and the 2010 Borer, Beetle, and White Grub Summary. Details on the efficacy protocols and methodology can be found in these reports posted at http://ir4.rutgers.edu/Ornamental/ornamentalSummaryReports.cfm. This summary also covers preliminary reports on crop safety.

Hachi-Hachi 15EC and Tolfenpyrad SC were provided to researchers by Nichino USA.

Efficacy Results

Hachi-Hachi did not exhibit any mortality to black vine weevil adults after exposure to treated leaves, but it did work well as a pre-plant soil incorporation treatment for the control of black vine weevil larvae in pots, bit this was a single experiment and needs to be verified.

Hachi-Hachi may impact Japanese beetle adults but it may take several weeks after initial exposure for mortality to be evident. In two experiments with data collections points less than 3 weeks after treatment, virtually no impact was observed. However, in an experiment with data collect 21 days after treatment, excellent control was achieved.

Good to excellent reduction of defoliation as a result of Viburnum leaf beetle damage occurred with foliar applications of Hachi-Hachi.

There appeared to be no impact on Ambrosia beetle larvae, but none of the other treatments provided control either. There may be a reduction in banded Ash clearwing borer, but additional experiments are needed. There seemed to be no efficacy with foliar applications to manage peach tree borer.

Hachi-Hachi provided good to excellent control of chili thrips as a foliar spray, gladiolus thrips as a bulb dip, good control of privet thrips consistent with Conserve, and good to excellent control of western flower thrips.

Black Vine Weevil (Otiorhynchus sulcatus)

Black vine weevil (*Otiorhynchus sulcatus*) is a serious pest of ornamental nursery crops (field and container-grown), vineyards, strawberries and hops. Even though, it is suspected the black vine weevil (BVW) originated in northern Europe, it was first identified in North America in 1835 and became a notable pest in Missouri by 1871. It is found predominantly in the northern portions of the United States, but its range extends into Virginia and out to the pacific northwest.

In 2007, Nielsen tested six products for their residual efficacy in controlling black vine weevil adults on foliage. Five products were applied to yew and one was applied to rhododendron. Foliage of Rhododendron or yew was sprayed August 13, 2007, and then adults were caged with treated leaves at 1, 3, 7, and 13 DAT. After exposure for 72 hours, the number of dead weevils was counted and any moribund adult was moved to untreated foliage and reevaluated 3-days later.

Only the standard Talstar and BAS 320i treatments provided any mortality of adult black vine weevils. Data were similar for all evaluation dates. (Table 1). Hachi-Hachi did not exhibit any mortality to black vine weevil adults after exposure to treated leaves.

No phytotoxicity was observed.

Table 1. Efficacy of several insecticides for black vine weevil adults (*Otiorhynchus sulcatus*) on Yew (*Taxus sp.*) or Rhododendron (*Rhododendron sp.*), Nielsen, 2007.

Treatment [z]	Rate (per 100 gal)	Plant Host	Percent Mortality after 3 day exposure [y]
Acelepryn (DPX-E2Y45; chlorantraniliprole)	10 oz	Yew	0
BAS 320i (metaflumizone)	16 oz	Rhododendron	100
Hachi-Hachi 15EC (tolfenpyrad)	21 oz	Yew	0
Metarhizium anisopliae	29 oz	Yew	0
Safari 20SG (dinotefuran)	8 oz	Yew	0
Talstar F (bifenthrin)	40 fl oz	Yew	100
Untreated		Yew	0

[z] Treatments were applied August 13, 2007 and evaluated through 13 DAT. Four plants per treatment were used.
[y] Exposed 5 weevils/replicate in plastic cups with treated foliage.

In 2008, Cowles conducted an experiment with potted strawberries to continue investigating dose-response of Acelepryn and BAS 320i, to compare neonicotinoids (Safari vs. Arena), and to compare preventive preplant incorporation into potting media with curative drenches.

Black vine weevil eggs were repeatedly infested to potted strawberries on June 5, 12 and 19, for a total of 123 eggs per pot. Eggs were placed 1 – 2 cm deep in the soil, close to the crown of the plant. Larvae were counted on September 4, 5 and 8 by sifting through the potting media shaken from the strawberry root system. Root systems were rated on a zero to four scale, where 0 indicated total destruction, always involving crown feeding and imminent plant death; 1 was poor roots, in which the living roots were found within a 50 ml volume of medium; 2 was fair, with most of the soil falling away from the roots; 3 was good, with most of the soil being held together by the root system; 4 was excellent, with roots encircling the bottom of the pot and great difficulty in removing soil from the extensive root system.

Recovery of BVW larvae was unusually low, with the untreated Check having one of the lowest numbers and the most extensive root system (Table 2). Two factors other than insecticide treatment probably contributed to poor recovery of larvae: ant predation (maximized by running the trial during the summer) and over-exploitation of food resources by BVW larvae in some treatments. Therefore, the results from this experiment have to be interpreted from the combination of the number of larvae and the root ratings. Based on these data, BAS 320i, applied as preventive preplant incorporation into potting media or curative drenches, should be considered an outstanding material to target control of BVW. Acelepryn looked ineffective at the lower rates used this year compared to those in the 2007 study. Arena was effective applied as a preplant incorporation; in 2007, it was ineffective when applied as a curative drench. Safari 20SG was effective in this year's trial with preplant incorporation while Safari 2G was

ineffective. The poorer control from the Safari 2G granules suggests that the product distribution within the mix was inadequate.

BotaniGard ES and WP formulations require further testing before concluding that they have poor potential for control of BVW. It is possible that the dosage applied was inadequate. *Metarhizium*- and Hachi-Hachi 15EC (tolfenpyrad)-treated pots had uniformly healthy plants and few larvae, however the low counts in the untreated check preclude being able to determine whether these treatments provided significant benefits.

Japanese Beetle (Popillia japonica)

The Japanese beetle (*Popillia japonica*) is a widespread and destructive exotic pest of turf, landscape, and ornamental plants in the United States. Outside of its native Japan, it is also found in China, Russia, Portugal, and Canada. Since the first detection in the US in a nursery near Riverton, New Jersey in 1916, it has spread to many states east of the Mississippi River, as well as parts of Wisconsin, Minnesota, Iowa, Missouri, Nebraska, Kansas, Arkansas and Oklahoma. Despite regulatory efforts, by 2002 it has become established in at least 30 states. Occasional introductions are made into western states such as California and Oregon when the adult beetles or larvae are shipped in commerce.

The Japanese beetle has a total host range of more than 400 plant species, including turf, ornamentals, fruits, and vegetables.

In 2008, Braman compared eight treatments for efficacy on Japanese beetle adults on rose. In this experiment, 5 adult beetles were caged on treated foliage using BugDorm insect rearing sleeves. At 7 and 19 days after treatment and caging (7 and 19 DAT), the number of surviving beetles were counted, and at Day 19 total damage was recorded using a rating scale from 0 to 10, with 0= no damage and 10= 100% defoliation. Data were subjected to analysis of variance using the GLM procedure of SAS and means were separated using LSD.

Acelepryn, Aloft, BAS 320i, Onyx and Talstar provided excellent control of Japanese beetle adults, based on number of survival at 7 and 19 DAT (Table 3). This resulted in virtually no defoliation on roses treated with these products. Safari provided significant but less effective control. Hachi-Hachi 15EC (tolfenpyrad) showed essentially similar beetle survival as the untreated but significantly reduced leaf feeding damage. Tick-Ex was non-effective, showing beetle survival and feeding damage similar to the untreated check.

Table 2. Efficacy of several insecticides for Black Vine Weevil on Strawberry (*Fragraria sp.)*, Cowles, 2008.

Treatment	Application Method	Application Date	Rate	Active Ingredient (mg/pot)	Number of Larvae 11 weeks after last infestation [z, y] (% control)	Root Rating[z,x] 11 WAT
Acelepryn (DPX-E2Y45; chlorantraniliprole)	Curative drench	Jul 15	0.8 fl oz/100 gal	0.44	4.5 bc (0)	2.8 ab
Acelepryn (DPX-E2Y45; chlorantraniliprole)	Pre-plant incorporation	Apr 24	1 ppm	0.22	3.8 bcd (0)	2.7 bc
			2 ppm	0.43	10.8 a (0)	1.0 d
			4 ppm	0.86	0.67 e (20)	4.0 a
Arena 50WDG (clothianidin)	Pre-plant incorporation	Apr 24	49 mg/pot	24.7	0 e (100)	4.0 a
BAS 320i SC (metaflumizone)	Curative drench	Jul 15, 29, Aug 13, 28	16 fl oz/100 gal	240	0 e (100)	4.0 a
BAS 320i EC (metaflumizone)	Pre-plant incorporation	Apr 24	1 ppm	0.22	0.50 e (40)	4.0 a
			2 ppm	0.43	0.33 e (60)	4.0 a
			4 ppm	0.86	0 e (100)	4.0 a
BotaniGard ES (*Beauveria bassiana*)	Curative drench	Jul 15, 29, Aug 13, 28	39 µL/pot		4.2 bc (0)	1.3 d
BotaniGard WP (*Beauveria bassiana*)	Curative drench	Jul 15, 29, Aug 13, 28	18.7 mg/pot		1.2 de (0)	0.5 d
BotaniGard ES (*Beauveria bassiana*)	Pre-plant incorporation	Apr 24	39 µL/pot		2.0 cde (0)	1.3 d
BotaniGard WP (*Beauveria bassiana*)	Pre-plant incorporation	Apr 24	18.7 mg/pot		5.8 b (0)	1.5 d
Hachi-Hachi 15EC (tolfenpyrad)	Pre-plant incorporation	Apr 24	10 ppm	2.2	0.83 e (0)	3.8 ab
Metarhizium anisopliae	Curative drench	Jul 15	2.9 g/pot		0.67 e (20)	4.0 a
Metarhizium anisopliae	Pre-plant incorporation	Apr 24	2.9 g/pot		0.33 e (60)	4.0 a
Safari 2G (dinotefuran)	Pre-plant incorporation	Apr 24	1.23 g/pot	24.7	1.7 cde (0)	2.7 bc
Safari 20SG (dinotefuran)	Pre-plant incorporation	Apr 24	24 oz/100 gal	24.7	0 e (100)	4.0 a
Untreated					0.83 e (0)	4.0 a

[z] Pots were infested repeatedly from Jun 5, 12 and 19 until there were 123 eggs added per pot.
[y] Means followed by the same letter do not significantly differ (Fisher's protected LSD test, $P < 0.05$).
[x] Root rating 0-4, where 0 = all roots destroyed, 4 = extensive root system.

Table 3. Efficacy of several insecticides for *Popillia japonica* adults feeding on rose (*Rosa sp.*) 'Blushing', Braman, 2008.

Product	Rate per 100 gal	No. feeding beetles 7 DAT	No. living beetles 19 DAT	Leaf Damage Rating[a] 19 DAT
Acelepryn (DPX-E2Y45; chlorantraniliprole)	10 fl oz	0.4 c	0 b	0.1 c
Aloft (clothianidin+bifenthrin)	8 fl oz	0 c	0 b	0 c
BAS 320i (metaflumizone)	16 fl oz	0 c	0 b	0 c
Hachi-Hachi 15EC (tolfenpyrad)	21 fl oz	1.4 ab	2.4 a	3.6 b
Onyx (bifenthrin)	12.8 fl oz	0.2 c	0 b	0 c
Safari 20SG (dinotefuran)	8 oz	0.8 bc	0.8 b	1.0 c
Talstar One (bifenthrin)	21.7 fl oz	0 c	0 b	0 c
Tick-Ex (*Metarrizium anisophliae*)	29 oz	1.4 ab	2.0 a	4.8 a
	Untreated	2.0 a	2.2 a	5.0 a

[z] Means followed by the same letter are not significantly different, P> 0.05
[a] Rating: 1 = 10 % defoliation, 10 = 100 % defoliation.

In 2009, Davis initiated an outdoor assessment of products on the feeding of Japanese beetle adults. Container roses were positioned next to a planting of Linden where JB adults were present in previous years. At no time were there any differences between any of the treatments or the untreated check on any of the sample days while the plants were in the field. This is primarily due to the low numbers of JB adults in the area and the number of other suitable hosts nearby.

To enable usable data to be generated, treated leaves were placed into arenas and the amount of leaf tissue consumed by adult JB was measured. At 3 days after the arenas were set-up, the Acelepryn, Safari drench, Safari and Hachi-Hachi 15EC (tolfenpyrad) treatments were not significantly different from the untreated check. The number of adults left alive in the arenas was significantly different from the untreated check in the BAS 320i, Flagship drench and Scimitar treatments. The arenas were evaluated again the next day. Mortality had increased in all of the treatments. All of the treatments except for Safari and Hachi-Hachi 15EC (tolfenpyrad) were significantly different from the untreated check treatment. The 3 applications of BAS 320i, 3 applications of Scimitar and single drench application of Flagship were the superior treatments. Four days after the arenas were set-up, the untreated check had 35% of the foliage in the arena consumed. All of the treatments were significantly different from the untreated check with regards to amount of foliage consumed. The Flagship and Scimitar treatments protected the foliage the best.

Table 4. Efficacy of several insecticides on Japanese beetle adults feeding on rose, Davis, 2009.

Treatment	Rate	Application Type	Lab assay 5 JB initial, after 3 days	% Skeletonized after 3 days	Lab assay 5 JB initial, after 4 days	% Skeletonized after 4 days
Acelepryn 1.67SC (DPX-E2Y45; chloranitriprole)	10 fl oz/100 gal	foliar	2.86 b	9.29 b	1.57 ab	9.29 b
BAS 320i (metaflumizone)	16 fl oz/100 gal	foliar	1.72 a	9.29 b	1.00 ab	9.29 b
Flagship 25WG (thiamethoxam)	24 oz/100 gal - 43 oz soln/gal/media	drench	1.57 a	3.71 a	1.00 ab	2.86 a
Hachi-Hachi 15EC (tolfenpyrad) & adjuvant	21 fl oz/100 gal & 0.25% v/v	foliar	4.00 b	17.86 c	3.71 d	19.29 c
Safari 20SG (dinotefuran)	24 oz/100 gal - 4 oz soln/gal/media	drench	2.86 b	6.43 a	2.00 bc	7.86 b
Safari 2G (dinotefuran)	2.2 g/gal/media	top of potting soil	3.72 b	5.00 ab	3.00 cd	5.71 ab
Scimitar CS (lambda-cyhalothrin)	5 fl oz/100 gal	foliar	1.72 a	5.00 ab	0.86 a	5.00 ab
Untreated Check			4.00 b	26.43 c	3.86 d	35.00 d

In an experiment conducted in 2007, Schultz examined Acelepryn, BAS 320i, Celero, Hachi-Hachi, *Metarhizium*, Onyx, and Safari SG for their ability to control Japanese beetle adults on rose. Applications were made either June 25th or 28th as foliar sprays or drenches (Table 5). After foliage had dried (and one week after the Safari drench), 10 Japanese beetle adults were introduced into a mesh cage on a single branch. Mortality was assessed weekly (7, 14, and 21 DAT). After the 21 DAT counts, dead and remaining live beetles were removed, mesh bags were relocated on the plant, and new adults introduced. Mortality of the newly introduced beetles was taken for 7 and 14 days after introduction (28 and 35 DAT).

At 7 DAT all treatments, except Safari applied as a drench and Tick Ex, had significantly higher adult mortality for caged beetles than the untreated plants. At 7 DAT, Acelepryn and BAS 320i had 100% mortality 7 DAT. By 14 DAT, Bifenthrin and Celero also exhibited 100% mortality. At 21 DAT, Safari and Hachi-Hachi 15EC (tolfenpyrad) reached 100% mortality.

There was a high background population of beetles, and observations were taken on their feeding. Throughout the experiment roses treated with Acelepryn, BAS 320i, Celero, Onyx, and Safari SG sustained no damage to the foliage regardless of adult beetle mortality. Foliage in the other treatments (*Metarhizium*, Hachi-Hachi 15EC, and untreated check) did exhibit foliar damage.

Table 5. Efficacy of several insecticides for *Popillia japonica* on 'Julia Child ™ Butter Gold' Rose, Schultz, 2007.

Treatments	Rate per 100 gal	Mean Number Dead Beetles per Cage (Corrected Percent Control)					
		First Challenge (after foliar applications had dried)				Second Challenge	
		0 DAT	7 DAT	14 DAT	21 DAT	28 DAT	35 DAT
Acelepryn (DPX-E2Y45; chlorantraniliprole)	Foliar – 10 fl oz	3.6 b (34%)	10.0 a (100%)	10.0 a (100%)	10.0 a (100%)	8.3 b (81%)	10.0 a (100%)
BAS 320i (metaflumizone)	Foliar – 16 oz	1.1 c (8%)	10.0 a (100%)	10.0 a (100%)	10.0 a (100%)	1.5 c (6%)	10.0 a (100%)
Celero 16WSG (clothianidin)	Foliar – 4 oz	5.8 a (57%)	9.8 a (98%)	10.0 a (100%)	10.0 a (100%)	10.0 a (100%)	10.0 a (100%)
Hachi-Hachi 15EC (tolfenpyrad)	Foliar – 14 oz	2.1 bc (19%)	7.4 b (73%)	9.6 a (95%)	10.0 a (100%)	9.0 ab (89%)	9.6 a (95%)
Onyx (bifenthrin)	Foliar – **	5.6 a (55%)	6.9 b (68%)	10.0 a (100%)	10.0 a (100%)	10.0 a (100%)	10.0 a (100%)
Safari 20SG (dinotefuran)	Drench – 24 oz	--	1.3 c (10%)	9.5 a (94%)	10.0 a (100%)	10.0 a (100%)	10.0 a (100%)
Tick Ex EC (Metarhizium anisopliae)	Foliar – 29 oz	0.4 c (1%)	0.5 c (2%)	2.5 b (10%)	9.1 a (74%)	9.9 a (99%)	9.9 a (99%)
Untreated		0.3 c (0%)	0.3 c (0%)	1.7 c (0%)	6.6 b (0%)	1.0 c (0%)	1.4 b (0%)

** no rate provided in report so the high label rate of 12.8 fl oz per 100 gal was assumed.

Viburnum Leaf Beetle (Pyrrhalta viburni)

Viburnum leaf beetle is native to Europe and Asia and was first detected in North America in 1947 in Ontario, Canada. Since 1978 when breeding populations were discovered in the Ottawa/Hull region of Canada, viburnum leaf beetle has slowly spread south and was found in Maine in 1994 and in New York in 1996. Currently, it has been found as far south as Pennsylvania and Ohio. Viburnum leaf beetle feeds exclusively on viburnum species. The most susceptible include arrowwood viburnum (*V. dentatum*), European cranberry bush viburnum (*Viburnum opulus*), Rafinesque viburnum (*V. rafinesquianum*), and Sargent viburnum (*V. sargentii*).

In 2007, Costa examined 8 products for efficacy of Viburnum leaf beetle larvae. All products except Safari 2G were applied as foliar sprays. Safari 2G was broadcast by hand around the plant base.

By 7 DAT, Viburnum plants treated with Acelepryn, BAS 320i, Celero, Permethrin, Safari, and Hachi-Hachi 15EC (tolfenpyrad) exhibited significantly less feeding damage than the untreated plants (Table 6). Throughout this experiment Met 52 was equivalent to the untreated. Safari 2G did reduce feeding damage at 14 DAT. While most products reduced severity of feeding, the extent of defoliation was only reduced by BAS 320i and Safari through 14 DAT (Table 7). By 28 DAT, these two products plus Celero, Permethrin and Hachi-Hachi 15EC (tolfenpyrad) reduced defoliation as compared to the untreated plants.

Table 6. Efficacy of several insecticides for Viburnum Leaf Beetle (*Pyrrhalta viburni*) larval management on Arrowwood viburnum (*Viburnum dentatum*) – Defoliation Severity, Costa, 2007.

		Defoliation Severity Rating (±SE) Relative Area [z]			
Product	Rate per 100 gal	Pre-Trt [y]	Week 1 [x]	Week 2	Week 4
Acelepryn (DPX-E2Y45; chlorantraniliprole)	10 fl oz	5.2 (0.2)	4.6 (0.2)*	4.6 (0.2)*	4.4 (0.2)*
BAS 320i (metaflumizone)	16 oz	3.6 (0.4)	4.2 (0.5)*	4.4 (0.2)*	4.2 (0.2)*
Celero 16WSG (clothianidin)	4 oz	4.2 (0.4)	4.2 (0.2)*	4.4 (0.2)*	4.4 (0.2)*
Hachi-Hachi 15EC (tolfenpyrad)	21 fl oz	3.5 (0.3)	4.0 (0.0)*	4.3 (0.3)*	4.5 (0.5)
Metarhizium anisopliae (Strain F52)	29 oz	4.6 (0.2)	6.6 (0.5)	6.4 (0.5)	5.8 (0.4)
Permethrin 2.5EC	128 fl oz	4.0 (0.5)	4.2 (0.2)*	4.4 (0.2)*	4.0 (0.3)*
Safari 2G (dinotefuran)	2.2 g/gal potting media	4.8 (0.6)	5.5 (0.9)	5.0 (0.4)*	5.0 (0.6)
Safari 20SG (dinotefuran)	8 oz	4.0 (0.0)	4.5 (0.3)*	4.5 (0.3)*	4.3 (0.5)*
Untreated		4.8 (0.6)	6.2 (0.0)	6.4 (0.5)	5.8 (0.5)

[z] The severity of larval feeding post treatment as determined by qualitative rating of relative area affected on damaged leaves. Scale 1-10 is for 0 to 100% (1=0, 2=1-5, 3=6-15, 4=16-30, 5=31-50, 6=51-70, 7=71-85, 8=86-95, 9=96-99, 10=100% affected).

[y] Pre-treatment (Pre-Trt) ratings were taken the day applications were made.

[x] An '*' indicates a significant difference between insecticide treatments and the water treated control (alpha = 0.05; one sided Dunnett's after GLM). There were no significant differences among insecticide treatments (P>0.05, GLM-ANOVA).

Table 7. Efficacy of several insecticides for Viburnum Leaf Beetle (*Pyrrhalta viburni*) larval management on Arrowwood viburnum (*Viburnum dentatum*) – Defoliation Extent, Costa, 2007.

Product	Rate per 100 gal	Defoliation Extent Rating (±SE) [z]			
		Pre-Trt [y]	Week 1 [x]	Week 2	Week 4
Acelepryn (DPX-E2Y45; chlorantraniliprole)	10 fl oz	5.8 (0.2)	7.0 (0.6)	6.6 (0.6)	5.8 (0.6)
BAS 320i (metaflumizone)	16 oz	5.0 (0.6)	4.8 (0.7)*	4.8 (0.4)*	4.2 (0.4)*
Celero 16WSG (clothianidin)	4 oz	5.0 (0.5)	5.4 (0.7)	6.0 (0.7)	4.8 (0.6)*
Hachi-Hachi 15EC (tolfenpyrad)	21 fl oz	4.5 (0.3)	4.5 (0.7)	5.3 (0.9)	4.5 (0.7)*
Metarhizium anisopliae (Strain F52)	29 oz	5.4 (0.2)	7.2 (0.6)	7.4 (0.2)	7.2 (0.4)
Permethrin	128 fl oz	5.4 (0.5)	5.2 (0.7)	5.6 (0.7)	4.6 (0.4)*
Safari 2G (dinotefuran)	2.2 g/gal potting media	5.5 (0.7)	6.3 (1.4)	6.0 (0.9)	5.8 (0.8)
Safari 20SG (dinotefuran)	8 oz	4.8 (0.5)	5.0 (0.7)*	4.8 (0.9)*	4.3 (0.8)*
Untreated		6.0 (0.6)	7.4 (1.1)	7.6 (0.8)	7.0 (0.8)

[z] The extent of larval feeding post treatment as determined by qualitative rating of percentage of affected leaves. Scale 1-10 is for 0 to 100% (1=0, 2=1-5, 3=6-15, 4=16-30, 5=31-50, 6=51-70, 7=71-85, 8=86-95, 9=96-99, 10=100% affected).
[y] Pre-treatment (Pre-Trt) ratings were taken the day applications were made.
[x] An '*' indicates a significant difference between insecticide treatments and the water treated control (alpha = 0.05; one sided Dunnett's after GLM). There were no significant differences among insecticide treatments (P>0.05, GLM-ANOVA).

In this experiment, Weston tested seven products for their efficacy on viburnum leaf beetle infesting established arrowwood viburnum (*Viburnum dentatum*) in field plots at the Bluegrass Lane Turf and Ornamentals Research Farm in Ithaca, NY. The shrubs, which had been growing under field conditions for 7 years, were approximately 6' tall and were naturally infested by viburnum leaf beetle in previous years. Products were applied as foliar sprays on May 22, 2007 when viburnum leaf beetle was in its first larval instar (egg hatch had begun on May 9). Five plants (replicates) were used for each treatment, and larval feeding damage was assessed 1 and 2 weeks after treatment. Data were analyzed with randomized complete block ANOVA, and treatments were compared with LSD.

The range of feeding damage was dramatic, ranging from 55% on the untreated control to near zero for the most effective treatments (Table 8). *Metarhizium anisopliae*, a fungus effective against many immature insects, had no effect on larvae (defoliation was virtually identical to that of the untreated control). The remaining products provided good to excellent control. Most effective were Celero and Safari, which were slightly more efficacious than Acelypryn, BAS 320i, Merit and Hachi-Hachi 15EC (tolfenpyrad) through 14 DAT.

[NOTE: Earlier field trials by Weston have shown that soil drenches with Merit 75 WP have resulted in nearly complete protection from viburnum leaf beetle for several years. In the current trial, Merit was applied as a foliar spray, like all of the other test products.]

Table 8. Efficacy of several insecticides for Viburnum Leaf Beetle (*Pyrrhalta viburni*) management on Arrowwood viburnum (*Viburnum dentatum*), Weston, 2007.

Product (active ingredient)	Rate per 100 gal	Defoliation	
		1 WAT	2 WAT
Acelepryn (DPX-E2Y45; chlorantraniliprole)	10 fl oz	3.3 ab	4.3 b
BAS 320i (metaflumizone)	16 oz	2.5 b	2.2 bc
Celero (clothianidin)	4 oz	0.7 b	0.7 d
Hachi-Hachi 15EC (tolfenpyrad) EC	21 oz	4.4 ab	3.9 b
Merit (imidacloprid)	10 tsp	3.6 ab	3.6 b
Metarhizium anisopliae (Strain F52)	29 oz	22.2 ab	50.2 a
Safari 20SG (dinotefuran)	8 oz	2.7 b	1.7 cd
Untreated	--	24.4 a	55.4 a

Asian Ambrosia Beetle (Xylosandrus crassiusculus)

In 2009, Schultz tested six products as either trunk sprays or soil drenches to determine whether any could prevent AAB infestation on magnolia. Applications were made on April 7, 2009 for Flagship 25WP and Safari 20SG as drenches. The remaining products were applied as trunk sprays on April 13, 2009 (Acelepryn, DPX-HGW86, Onyx, and Hachi-Hachi 15EC). Each magnolia with the exception of the planned untreated without ethanol was injected with an ethanol solution on April 14 to more uniformly attract adult beetle attacks. Every 2 days over a 4 day period in late April, the number of holes created by adult beetles were counted.

On the first day of assessment, there were very few attacks; on the second assessment two days later all treatments including the ETOH control had increased number of attacks over the water control. The concentration of ETOH applied overwhelmingly attracted AAB such that no treatment exhibited a reduction in attack holes.

Table 9. Efficacy Efficacy of several insecticides for Asian ambrosia beetle (*Xylosandrus crassiusculus*) on Magnolia, Schultz, 2009.

Treatment (Active Ingredient)	Rate	Average Number of Attack Holes (cumulative with previous date)		
		4/24/2009	4/26/2009	4/28/2009
Acelepryn (DPX-E2Y45; chlorantraniliprole)	32 fl oz trunk spray	1.0 a	4.5 a	5.6 a
DPX-HGW86 (cyantraniliprole)	32 fl oz trunk spray	0.0 a	1.4 bc	2.8 abc
Flagship 25WG (thiamethoxam)	8 oz drench	1.75 a	3.4 ab	1.5 bc
Hachi-Hachi 15EC (tolfenpyrad)	21 fl oz trunk spray	0.75 a	2.6 abc	4.3 ab
Onyx (bifenthrin)	32 fl oz trunk spray	0.0 a	1.0 bc	1.5 bc
Safari 20SG (dinotefuran)	24 oz drench	0.75 a	2.0 abc	2.1 bc
ETOH Control		0.0 a	1.1 bc	3.5 ab
Water Control		0.0 a	0.1 c	0.0c

Ambrosia Beetle (Xylosandrus germanus)

In 2009, Reding evaluated five insecticides applied as trunk sprays or soil drenches for control of the ambrosia beetle (*Xylosandrus germanus*) on magnolia, a known favorite host of *X. germanus*. The plants were purchased in 3 gallon pots from a nursery in Lake County, Ohio on March 17. Soil drenches were applied April 28 one week

before ethanol injection and trunk sprays were applied May 4 one day before injection. Two sets of control plants were used, one injected with ethanol but untreated with insecticide and the other un-injected and untreated. On May 5 all magnolia trees, except the un-injected control plants, were injected with ethanol to attract ambrosia beetles and then placed along the wooded border of a field. Trees were watered as needed until the study was terminated on May 27, 2009. Beetle attacks (entrance holes in stems) were counted 2, 7, 14, and 23 days after treatment and exposure to beetles. All stems with attack holes were cut from the trees, labeled and brought back to the laboratory to determine survivability and ambrosia beetle species causing damage.

Attacks occurred on all treatments except for the un-injected controls (Table 10). Efficacy results showed a difference in treatments for the first few days but no statistical difference between treatments 5 days after exposure to ambrosia beetles. Flagship applied as drench and Hachi-Hachi 15EC (tolfenpyrad) trunk spray provided control that was almost comparable to the standard Onyx. Acelepryn, Safari and Scimitar were ineffective.

Table 10. Efficacy of several insecticides for Ambrosia Beetle (*Xylosandrus germanus*) on Magnolia (*Magnolia virginiana*), Reding, 2009.

Treatment	Rate per 100 gal	Application Method	Mean Attacks[z]	
			May 6 – 11	May 12 - 27
Acelepryn (DPX-E2Y45; chlorantraniliprole)	32 fl oz	Trunk Spray	2.7 a	13.9
Flagship 25WG (thiamethoxam)	8 oz	Drench	0.9 bc	17.9
Hachi-Hachi 15EC (tolfenpyrad) 15EC	21 fl oz	Trunk Spray	0.8 bc	11.0
Onyx (bifenthrin)	32 fl oz	Trunk Spray	0.4 c	13.9
Safari 20SG (dinotefuran)	24 oz	Drench	1.7 abc	10.0
Safari 20SG (dinotefuran)	24 oz	Trunk Spray	3.2 a	12.5
Scimitar GC (lambda-cyhalothrin)	5 fl oz	Trunk Spray	2.4 ab	17.3
Untreated Control		-	2.6 a	13.9
Un-injected Control		-	0.0 c	0.0

[z] Means within columns followed by the same letter are not significantly different ANOVA ($P = 0.05$), means separated by LSD ($\alpha = 0.05$).

Banded Ash Clearwing Borer (Podosesia aureocincta)

In 2008, Nielsen evaluated five products for controlling banded ash clearwing borer (Table 11). The green ash trees chosen for this project were heavily infested when treatments were applied on 8 August 2008. Presence or absence of new frass was recorded on July 13 as evidence of borer infestation; by this time the borer population had crashed. Frass indexing showed little frass production, even from untreated Check trees. No frass production was noted from any of the trees treated with Acelepryn, Aloft, or Hachi-Hachi 15EC (tolfenpyrad). Onyx reduced frass production. Tristar + Capsil, applied to bark from the soil to a height of 8', was ineffective.

No phytotoxicity was observed.

Table 11. Efficacy of several insecticides for Banded Ash Clearwing Borer (*Podosesia aureocincta*) on Green Ash (*Fraxinus pennsylvanica*); Nielsen, 2008.

Treatment [z]	Rate	Application Method	Frass Index[y]
Acelepryn (DPX-E2Y45; chlorantraniliprole)	10 fl oz/100 gal	Trunk spray to just above first scaffold limbs	0
Aloft (clothianidin+bifenthrin)	32 fl oz/100 gal	Sprayed trunk and soil at base of tree	0
Hachi-Hachi 15EC (tolfenpyrad)	24 fl oz/100 gal	Trunk spray to just above first scaffold limbs	0
NEI-25925 (acetamiprid)	6 ml/inch DBH + Capsil	Applied 1 quart of mix/tree up to height of 8'	0.6
Onyx 2EC (bifenthrin)	12.8 fl oz/100 gal	Trunk spray to just above first scaffold limbs	0.2
Untreated			0.6

[z] Treatments were applied 8 August 2008 and evaluated 13 July, 2009 . Five plants per treatment were used.
[y] Frass index 0-3 where 0 = no frass, 3 = heavy frass

Peachtree Borer (Synanthedon exitiosa)

In 2009, Nielsen tested six products for their residual efficacy in controlling peachtree borer. An experimental block of purple-leaf sand cherry used in this trial supported a moderately high level infestation of peachtree borer larvae. Treatments were applied on June 25 when Catalpa was in full bloom. Presence or absence of new orange frass and gummosis near base of plants were recorded on September 13 as evidence of borer infestation. Drench application of Acelepryn, Discus, DPX-HGW86 and Safari, and spray application of Onyx, Scimitar and Tristar provided excellent control (Table 12). The top-dress treatment with Flagship 25WG was somewhat effective, but inadequate for nursery production. Hachi-Hachi 15EC (tolfenpyrad) spray was ineffective.

No phytotoxicity was observed.

Table 12. Efficacy of several insecticides for Peachtree Borer (*Synanthedon exitiosa*) on Sand Cherry (*Prunus cistina*), Nielsen, 2009.

Treatment [z]	Rate	Application Method	Percent Plants Infested 11 WAT
Acelepryn (DPX-E2Y45; chlorantraniliprole)	100 fl oz per 100 gal	Drench	0
Discus (imidacloprid+cyfluthrin)	44 ml/inch DBH	Drench	0
DPX-HGW86 (cyantraniliprole)	0.25 fl oz/quart	Drench	0
Hachi-Hachi 15EC (tolfenpyrad)	21 fl oz/100 gal	Trunk spray to run-off	25
Flagship 25WG (thiamethoxam)	0.09 g/linear foot	Top-dress	15
Onyx 2EC (bifenthrin)	102 fl oz/100 gal.	Trunk spray to run-off	0
Safari 20SG (dinotefuran)	6 g/ft shrub height	Drench	0
Scimitar (lambda-cyhalothrin)	5 fl oz/100 gal + Capsil	Trunk spray to run-off	0
Tristar 30SG (acetamiprid)	4 oz/inch DBH + Capsil	Trunk spray to run-off	0
Untreated		-	65

[z] Treatments were applied June 25 2009 and evaluated September, 13 2009 . Twenty plants per treatment were used.

Results: Thrips

IR-4 has sponsored research on several thrips species – chilli thrips (*Scirtothrips dorsalis*), gladiolus thrips (*Thrips simplex*), privet thrips (*Dendothrips ornatus*), weeping fig thrips (*Gynaikothrips uzeli*), and western flower thrips (*Frankliniella occidentalis*). The following discussions are organized by thrips species. Within each species the experiments are presented in groups based on crop and then by researcher.

Chili Thrips (Scirtothrips dorsalis)

Chilli thrips (*Scirtothrips dorsalis*) is a newly invasive species to the United States. Since its introduction in 2006, chilli thrips has been moved throughout the southern U.S. on nursery stock. It has been found in commercial retail nurseries as well as established in landscapes. Chilli thrips is known to infest over 250 ornamental horticulture plant species and also can cause significant damage to food crops such as pepper and blueberry.

During 2007, Ludwig tested contact materials with either two or three consecutive weekly applications (Table 13). Both adult and immature thrips were counted on meristems and, when possible, flowers. Because Kelthane was applied on the second application date in addition to the weekly treatment applications, all thrips populations were suppressed on the 13 DAT reading date. Because the adult thrips are quite mobile, for the purposes of this discussion, control assessments refer to immature thrips. Conserve SC provided excellent control at 6 and 20 DAT on meristems, while Avid, Overture, Pylon, and the low rate of Hachi-Hachi 15EC (tolfenpyrad) all provided good to excellent control at 20 DAT. On flowers at 7 DAT, Avid, Conserve and Pylon exhibited good levels of control (Table 14).

During 2008, an additional experiment was conducted containing Hachi-Hachi (Table 15). By 13 DAT, Avid, Conserve, MOI 201, NNI 0101, Pylon, and Hachi-Hachi 15EC (tolfenpyrad) provided good to excellent control; Avid, MOI 201, NNI0101, and Pylon continued to provide good control through 20 DAT (Table 16).

Table 13. Efficacy of several insecticides for *Scirtothrips dorsalis* on 'Knockout' Rose – Experiment 1 – Application Rates and Dates, Ludwig, 2007a.

Treatment (Active Ingredient)	Application Method – Rate per 100 gal	Application Dates		
		6/13 0 DAT	6/20 7 DAT	6/27 14 DAT
Avid (abamectin)	Foliar – 8 fl oz	X	X	
Conserve SC (spinosad)	Foliar – 6 fl oz	X	X	
Hachi-Hachi 15EC (tolfenpyrad)	Foliar – 14 fl oz	X	X	
Hachi-Hachi 15EC (tolfenpyrad)	Foliar – 21 fl oz	X	X	
Overture 35WP (pyridalyl)	Foliar – 8 fl oz	X	X	
Pylon (chlorfenapyr)	Foliar – 5 fl oz	X	X	
QRD400	Foliar – 130 fl oz	X	X	X
Unsprayed Control				
Kelthane	Foliar on all treatments		X	

Table 14. Efficacy of several insecticides for *Scirtothrips dorsalis* on 'Knockout' Rose – Experiment 1, Ludwig, 2007a.

Treatment (Active Ingredient)	Population Counts [z], Means Separations [y], and Percent Control [x]					
	-1 DAT Meristems	6 DAT Meristems	13 DAT Meristems	20 DAT Meristems	-1 DAT Flowers	7 DAT Flowers
Adults						
Avid (8 fl oz)	51.5 a	17.2 a (0)	3.5 bc (76)	0.3 d (96)	24.7 ab	5.6 ab (61)
Conserve (6 fl oz)	31.0 a	9.8 a (5)	3.7 bc (58)	1.0 bcd (78)	26.7 ab	5.7 ab (63)
Hachi-Hachi 15EC (tolfenpyrad) (14 fl oz)	35.5 a	21.7 a (0)	5.7 abc (44)	2.7 abc (49)	29.2 ab	3.8 b (77)
Hachi-Hachi 15EC (tolfenpyrad) (21 fl oz)	34.2 a	16.5 a (0)	17.8 a (0)	4.5 a (10)	32.4 a	4.7 ab (75)
Overture (8 fl oz)	103.5 a	14.3 a (58)	3.8 abc (87)	0.8 cd (95)	22.6 ab	7.4 ab (44)
Pylon (5 fl oz)	47.5 a	15.8 a (0)	1.8 c (86)	0.2 d (98)	46.8 a	5.9 ab (78)
QRD400 (130 fl oz)	33.8 a	10.8 a (4)	5.3 abc (45)	0.8 cd (83)	26.1 ab	12.1 a (21)
Untreated	37.5 a	12.5 a (0)	10.7 ab (0)	5.5 ab (0)	14.5 b	8.5 ab (0)
Nymphs						
Avid (8 fl oz)	200.8 a	27.7 ab (80)	2.2 a (18)	5.3 bc (92)	24.9 a	4.1 c (90)
Conserve (6 fl oz)	140.3 a	5.2 b (95)	1.0 a (46)	0.8 c (98)	20.5 a	3.9 c (88)
Hachi-Hachi 15EC (tolfenpyrad) (14 fl oz)	231.5 a	18.8 ab (88)	2.0 a (34)	12.7 abc (83)	23.8 a	6.9 bc (82)
Hachi-Hachi 15EC (tolfenpyrad) (21 fl oz)	146.7 a	49.3 a (50)	1.5 a (22)	26.5 a (45)	47.2 a	12.9 abc (83)
Overture (8 fl oz)	128.8 a	43.3 ab (50)	1.0 a (41)	7.2 bc (83)	14.1 b	16.1 ab (29)
Pylon (5 fl oz)	157.8 a	28.2 ab (74)	0.3 a (84)	0.7 c (99)	42.1 a	8.7 abc (87)
QRD400 (130 fl oz)	166.0 a	54.7 ab (51)	0.8 a (62)	17.7 ab (68)	38.2 a	25.1 a (59)
Untreated	126.5 a	85.3 a (0)	1.7 a (0)	41.5 a (0)	15.4 a	25.0 a (0)
Total Population						
Avid (8 fl oz)	252.3	44.8 (70)	5.7 (70)	5.7 (92)	49.6	9.7 (82)
Conserve (6 fl oz)	171.3	15.0 (85)	4.7 (64)	1.8 (96)	47.2	9.7 (82)
Hachi-Hachi 15EC (tolfenpyrad) (14 fl oz)	267.0	40.5 (75)	7.7 (62)	15.3 (80)	53.0	10.7 (82)
Hachi-Hachi 15EC (tolfenpyrad) (21 fl oz)	180.8	65.8 (39)	19.3 (0)	31.0 (40)	79.6	17.7 (80)
Overture (8 fl oz)	232.3	57.7 (58)	4.8 (72)	8.0 (88)	36.6	23.5 (43)
Pylon (5 fl oz)	205.3	44.0 (64)	2.2 (86)	0.8 (99)	88.9	14.6 (85)
QRD400 (130 fl oz)	199.8	65.5 (45)	6.2 (59)	18.5 (68)	64.3	37.2 (48)
Untreated	164.0	97.8 (0)	12.3 (0)	47.0 (0)	29.9	33.4 (0)

[z] Mean number of thrips were counted from alcohol extraction of 5 meristems or 5 flowers.
[y] Means within column followed by the same letter are not significantly different (P>0.05, Tukeys HSD).
[x] Henderson's percent control was calculated on the meristem and flower counts.

Table 15. Efficacy of several insecticides for *Scirtothrips dorsalis* on 'Knockout' Rose – Experiment 3 – Application Rates and Dates, Ludwig, 2008a.

Treatment (Active Ingredient)	Application Method – Rate per 100 gal	Application Dates		
		6/10 0 DAT	6/17 7 DAT	6/24 14 DAT
Avid (abamectin)	Foliar – 8 fl oz	X	X	
Conserve SC (spinosad)	Foliar – 6 fl oz	X	X	
Hachi-Hachi 15EC (tolfenpyrad)	Foliar – 21 fl oz	X	X	
MOI 201	Foliar – 0.8 quarts	X	X	
NNI 0101	Foliar – 6.38 fl oz	X	X	
NNI 0101	Foliar – 3.19 fl oz	X	X	
Overture 35WP (pyridalyl)	Foliar – 8 fl oz	X	X	
Pylon (chlorfenapyr)	Foliar – 5 fl oz	X	X	
QRD400	Foliar – 130 fl oz	X	X	X
Scimitar	Foliar – 5 fl oz	X	X	
Talstar	Foliar – 21.5 fl oz	X	X	
Unsprayed Control				

Comparative Efficacy on Gladiolus Bulb Thrips (Thrips simplex)

Gladiolus thrips (*Thrips simplex*) which overwinter in bulbs are problematic for the production of bulbs used for landscape and indoor pot plantings as well as bulbs grown for sale to produce cut flowers. One method of treatment can be to dip gladiolus bulbs in the application materials, similar to the methods used to treat bulbs for diseases. However, no thrips insecticides are currently registered for this use. This research was undertaken to provide some answers for a Michigan bulb grower to initiate 24c label registration(s) of suitable products.

In a single experiment conducted in 2005, 24 products with potential for controlling Gladiolus thrips were tested as bulb dip applications (Table 17). Adult and immature thrips were counted on bulbs before treatment and at 1, 2, 4, and 8 weeks after treatment. Phytotoxicity due to the treatments was also assessed. In general, most products provided outstanding control of *Thrips simplex* adults and immature: Allectus, Avid, BYI 8330, Celero, Conserve, Diazinon, Discus, Flagship, NAI-2302, Orthene, Pedestal, Safari, Tristar 70WSP. Merit 75W, Pylon, and Talstar F, provided good efficacy initially, but they started to taper off by 8 WAT. Those that did not give acceptable control included Aria, NNI-0101 and Tricon. While Azatin and Carzol did not provide acceptable control of adults until 8 WAT, Azatin appeared to have little initial impact on immatures even though Carzol did.

Table 16. Efficacy of several insecticides for *Scirtothrips dorsalis* on 'Knockout' Rose – Experiment 3, Ludwig, 2008a.

Treatment (Active Ingredient)	Population Counts [z], Means Separations [y], and Percent Control [x]				
	-1 DAT Meristems	6 DAT Meristems	13 DAT Meristems	20 DAT Meristems	27 DAT Flowers
Adults					
Avid (8 fl oz)	7.7 cde	0.3 d (91)	0.0 f (100)	0.5 de (78)	0.2 d (65)
Conserve (6 fl oz)	4.2 e	3.0 cd (0)	0.7 cdef (55)	0.2 e (84)	0.5 cd (0)
Hachi-Hachi 15EC (tolfenpyrad) (21 fl oz)	11.5 bcd	6.2 ab (0)	0.5 cdef (88)	0.5 de (85)	0.8 cd (5)
MOI201 (0.8 quarts)	9.2 bcd	3.2 abcd (21)	1.0 cde (70)	0.8 cde (70)	0.2 d (70)
NNI 0101 (6.38 fl oz)	7.0 de	0.7 cd (0)	0.3 def (0)	1.3 cde (0)	2.3 bc (0)
NNI 0101 (3.19 fl oz)	9.2 bcd	1.8 cd (0)	0.3 ef (0)	0.2 e (0)	0.2 d (0)
Overture (8 fl oz)	7.7 cde	8.8 a (0)	2.0 abcd (0)	2.7 bc (0)	1.0 cd (0)
Pylon (5 fl oz)	9.7 bcd	3.2 abc (0)	1.5 bcde (0)	0.8 de (0)	0.2 d (0)
QRD400 (130 fl oz)	17.8 ab	2.0 bcd (75)	0.7 cdef (89)	1.5 cde (71)	3.5 ab (0)
Scimitar (5 fl oz)	13.0 abc	2.2 bcd (62)	3.2 a (33)	5.2 b (0)	7.0 a (0)
Talstar (21.5 fl oz)	24.7 a	4.5 abc (59)	3.0 ab (67)	8.0 a (0)	9.3 a (0)
Untreated	6.8 de	3.0 abc (0)	2.5 abc (0)	2.0 bcd (0)	0.5 cd (0)
Nymphs					
Avid (8 fl oz)	18.8 abc	2.7 ef (78)	0.0 f (100)	0.0 e (100)	0.2 e (91)
Conserve (6 fl oz)	13.5 cd	2.0 f (78)	0.7 ed (95)	1.3 cde (85)	0.3 e (82)
Hachi-Hachi 15EC (tolfenpyrad) (21 fl oz)	21.3 abc	13.3 bcd (6)	2.0 cde (91)	3.3 bc (76)	2.5 cd (4)
MOI201 (0.8 quarts)	14.5 bcd	5.0 ef (48)	1.3 def (91)	0.3 de (97)	3.5 cd (0)
NNI 0101 (6.38 fl oz)	17.5 abc	3.0 ef (74)	1.8 def (90)	1.3 bcde (89)	5.3 cd (0)
NNI 0101 (3.19 fl oz)	17.0 abcd	5.5 def (51)	0.3 ef (98)	0.0 e (100)	0.0 e (100)
Overture (8 fl oz)	10.0 d	20.3 bc (0)	4.0 bcd (60)	15.0 a (0)	11.8 b (0)
Pylon (5 fl oz)	14.7 bcd	6.3 def (36)	0.0 f (100)	0.2 de (98)	0.7 de (61)
QRD400 (130 fl oz)	23.3 ab	15.8 bcd (0)	3.7 bcd (84)	4.0 bcd (74)	4.5 c (0)
Scimitar (5 fl oz)	27.5 a	27.3 ab (0)	9.0 ab (67)	11.5 a (36)	19.2 ab (0)
Talstar (21.5 fl oz)	30.2 a	42.2 a (0)	5.7 abc (81)	12.0 a (39)	30.0 a (0)
Untreated	12.3 bcd	8.2 cde (0)	12.2 a (0)	8.0 b (0)	1.5 cde (0)
Total Population					
Avid (8 fl oz)	26.5	3.0 (81)	0.0 (100)	0.5 (96)	0.4 (86)
Conserve (6 fl oz)	17.7	5.0 (52)	1.4 (90)	1.5 (84)	0.8 (57)
Hachi-Hachi 15EC (tolfenpyrad) (21 fl oz)	32.8	19.5 (0)	2.5 (90)	3.8 (78)	3.3 (4)
MOI201 (0.8 quarts)	23.7	8.2 (41)	2.3 (87)	1.1 (91)	3.7 (0)
NNI 0101 (6.38 fl oz)	24.5	3.7 (74)	2.1 (89)	2.6 (80)	7.6 (0)
NNI 0101 (3.19 fl oz)	26.2	7.3 (52)	0.6 (97)	0.2 (99)	0.2 (93)
Overture (8 fl oz)	17.7	29.1 (0)	6.0 (56)	17.7 (0)	12.8 (0)
Pylon (5 fl oz)	24.4	9.5 (34)	1.5 (92)	1.0 (92)	0.9 (65)
QRD400 (130 fl oz)	41.1	17.8 (26)	4.4 (86)	5.5 (74)	8.0 (0)
Scimitar (5 fl oz)	40.5	29.5 (0)	12.2 (61)	16.7 (21)	26.2 (0)
Talstar (21.5 fl oz)	54.9	46.7 (0)	8.7 (79)	20.0 (30)	39.3 (0)
Untreated	19.1	11.2 (0)	14.7 (0)	10.0 (0)	2.0 (0)

[z] Mean number of thrips were counted from alcohol extraction of 5 meristems or 5 flowers.
[y] Means within column followed by the same letter are not significantly different (P>0.05, Tukeys HSD).

[x] Henderson's percent control was calculated on the meristem and flower counts.

Table 17. Efficacy of Gladiolus Bulb Dip Applications on Gladiolus Thrips (*Thrips simplex*), Smitley & Davis, MI, 2006.

Treatment	Rate / 100 gal	Pretreatment	1 WAT	2 WAT	4 WAT	8 WAT
Adults						
Allectus SC	21.3 oz	20.2 ghij	0.0 a (100)	0.0 a (100)	0.0 a (100)	0.0 a (100)
Aria	100 oz	15.0 cdefghi	4.0 ef (47)	4.4 de (0)	5.8 bc (0)	1.0 cd (0)
Avid	8 oz	28.8 j	0.2 a (99)	0.0 a (100)	0.0 a (100)	0.0 a (100)
Azatin	16 oz	9.6 abcdef	2.0 cde (58)	1.6 bc (37)	0.2 a (86)	0.0 a (100)
Carzol	1 lb	6.6 abc	3.0 def (9)	2.4 bc (0)	0.4 a (60)	0.0 a (100)
Celero 16 WSG	4 oz	12.6 bcdefgh	0.8 abc (87)	0.2 a (94)	0.0 a (100)	0.2 ab (66)
Conserve	11 oz	18.2 ghij	0.0 a (100)	0.0 a (100)	0.0 a (100)	0.0 a (100)
Diazinon 4E	3 pts	13.2 cdefghij	0.0 a (100)	0.0 a (100)	0.0 a (100)	0.0 a (100)
Discus	25 oz	26.2 ij	0.0 a (100)	0.0 a (100)	0.0 a (100)	0.0 a (100)
Flagship 25WG	2 oz	12.6 bcdefg	0.2 a (97)	0.0 a (100)	0.0 a (100)	0.0 a (100)
Flagship 25WG	8 oz	3.4 a	0.4 ab (76)	0.2 a (78)	0.0 a (100)	0.0 a (100)
Hachi-Hachi 15EC (tolfenpyrad)	10.5 oz	11.0 bcdefgh	0.2 a (96)	0.0 a (100)	0.2 a (88)	0.0 a (100)
Kontos (BYI-8330)	1.7 fl oz	6.2 abc	0.2 a (94)	0.0 a (100)	0.0 a (100)	0.0 a (100)
Merit 75	16 gr	17.4 fghij	1.2 abc (86)	0.0 a (100)	0.0 a (100)	0.4 abc (51)
Mesurol 75W	1 lb	9.4 abcd	0.2 a (96)	0.0 a (100)	0.0 a (100)	0.0 a (100)
NNI-0101	9.5 oz	13.0 cdefghij	5.6 fg (14)	2.6 cd (24)	7.2 bc (0)	0.4 ab (35)
Orthene 97	8 oz	17.8 fghij	0.0 a (100)	0.0 a (100)	0.2 a (93)	0.0 a (100)
Overture	8 oz	20.8 hij	0.6 ab (94)	0.0 a (100)	0.0 a (100)	0.0 a (100)
Pedestal	8 oz	12.2 cdefghi	1.2 bcd (80)	0.2 a (94)	0.0 a (100)	0.0 a (100)
Pylon	10 oz	14.6 bcdefgh	1.0 ab (86)	0.2 a (95)	0.0 a (100)	0.0 a (100)
Safari	24 oz	12.4 cdefghij	0.4 ab (94)	0.4 a (88)	0.2 a (89)	0.0 a (100)
Talstar F	21.7 oz	17.0 efghij	0.4 ab (95)	0.0 a (100)	0.0 a (100)	0.0 a (100)
Tricon (BW 420)	100 oz	15.8 defghij	0.6 ab (92)	0.4 a (90)	6.2 c (0)	0.6 bc (19)
TriStar 70WSP	64 g	12.2 bcdefgh	0.4 ab (93)	0.4 a (88)	0.2 a (89)	0.0 a (100)
TriStar 70WSP + Capsil	64 g + 6 oz	5.4 ab	0.2 a (93)	0.0 a (100)	0.4 a (51)	0.0 a (100)
Clearys 3336 WP	24 oz	8.2 abcde	5.0 ef (0)	2.4 b (0)	5.0 bc (0)	1.2 d (0)
Water Control		21.2 efghij	10.6 g (0)	5.6 e (0)	3.2 b (0)	1.0 cd (0)
Immatures						
Allectus SC	21.3 oz	22.4 fgh	0.8 abcd (97)	0.4 a (97)	0.0 a (100)	0.0 a (100)
Aria	100 oz	13.0 bcdefgh	9.2 f (47)	17.2 d (0)	4.4 e (0)	0.8 bc (0)
Avid	8 oz	19.6 defgh	0.6 abc (98)	0.0 a (100)	0.2 ab (85)	0.2 ab (83)
Azatin	16 oz	7.2 abc	3.0 cde (69)	3.2 b (15)	1.2 bc (0)	0.0 a (100)
Carzol	1 lb	11.6 bcdefgh	1.8 bcde (88)	1.2 a (80)	0.0 a (100)	0.4 abc (41)
Celero 16 WSG	4 oz	9.8 abc	1.2 abcde (91)	0.2 a (96)	0.0 a (100)	0.0 a (100)
Conserve	11 oz	9.4 abcdefgh	1.2 abcd (90)	0.0 a (100)	0.0 a (100)	0.6 abc (0)
Diazinon 4E	3 pts	9.6 bcdefgh	0.6 abc (95)	0.6 a (88)	0.0 a (100)	0.0 a (100)
Discus	25 oz	18.4 gh	0.6 abc (98)	0.2 a (98)	0.2 ab (84)	0.0 a (100)
Flagship 25WG	2 oz	6.6 ab	1.0 abcd (89)	0.0 a (100)	0.0 a (100)	0.0 a (100)
Flagship 25WG	8 oz	12.6 bcdefgh	0.4 ab (98)	0.2 a (97)	0.0 a (100)	0.0 a (100)
Hachi-Hachi 15EC (tolfenpyrad)	10.5 oz	7.2 abcde	0.8 abcd (92)	0.6 a (84)	1.0 abc (0)	0.2 ab (53)
Kontos (BYI-8330)	1.7 fl oz	8.2 abcde	0.2 a (98)	0.4 a (91)	1.2 ab (0)	0.0 a (100)
Merit 75	16 gr	16.6 efgh	0.4 abc (98)	0.2 a (98)	0.2 ab (82)	0.0 a (100)
Mesurol 75W	1 lb	5.4 a	0.4 abc (94)	0.6 a (79)	0.0 a (100)	0.2 ab (37)
NNI-0101	9.5 oz	9.4 abcdefgh	16.6 fg (0)	9.0 c (0)	4.2 de (0)	0.2 ab (64)

Treatment	Rate / 100 gal	Pretreatment	1 WAT	2 WAT	4 WAT	8 WAT
Othene 97	8 oz	11.8 bcdefgh	1.0 abcd (94)	0.4 a (93)	0.0 a (100)	0.0 a (100)
Overture	8 oz	6.2 abc	2.8 e (66)	0.8 a (75)	0.4 ab (4)	0.2 ab (45)
Pedestal	8 oz	7.8 abcd	2.6 de (75)	0.6 a (85)	0.0 a (100)	0.0 a (100)
Pylon	10 oz	8.0 abcdef	0.2 a (98)	0.4 a (90)	0.0 a (100)	0.8 bc (0)
Safari	24 oz	6.2 abc	0.4 abc (95)	0.4 a (88)	0.0 a (100)	0.0 a (100)
Talstar F	21.7 oz	9.4 abcdefg	1.0 abcde (92)	0.0 a (100)	0.0 a (100)	0.2 ab (64)
TriCon (BW 420)	100 oz	18.8 defgh	2.6 (90)	9.6 cd (2)	7.8 e (0)	2.6 d (0)
TriStar 70WSP	64 g	15.0 cdefgh	0.2 a (99)	0.0 a (100)	0.2 ab (80)	0.0 a (100)
TriStar 70WSP & Capsil	64 g + 6 oz	8.2 abcdefg	0.2 a (98)	0.4 a (91)	0.2 ab (64)	0.0 a (100)
Clearys 3336 WP	24 oz	12.2 bcdefgh	11.6 f (28)	14.0 cd (0)	6.0 e (0)	1.2 cd (0)
Water Control		23.8 h	31.6 g (0)	12.4 cd (0)	1.6 cd (0)	1.4 cd (0)
Total Population						
Allectus SC	21.3 oz	42.6 hij	0.8 a (98)	0.4 a (98)	0.0 a (100)	0.0 a (100)
Aria	100 oz	28.0 bcdefghi	13.2 e (50)	21.6 d (0)	10.2 cd (0)	1.8 bc (0)
Avid	8 oz	48.4 j	0.8 a (98)	0.0 a (100)	0.2 ab (96)	0.2 a (92)
Azatin	16 oz	16.8 abcd	5.0 cd (68)	4.8 b (29)	1.4 b (22)	0.0 a (100)
Carzol	1 lb	18.2 abcdefg	4.8 d (72)	3.6 b (51)	0.4 ab (79)	0.4 a (59)
Celero 16 WSG	4 oz	22.4 bcdefgh	2.0 abcd (90)	0.4 a (96)	0.0 a (100)	0.2 a (83)
Conserve	11 oz	27.6 defghij	1.2 ab (95)	0.0 a (100)	0.0 a (100)	0.6 ab (59)
Diazinon 4E	3 pts	22.8 bcdefgh	0.6 a (97)	0.6 a (93)	0.0 a (100)	0.0 a (100)
Discus	25 oz	44.6 ij	0.6 a (99)	0.2 a (99)	0.2 ab (96)	0.0 a (100)
Flagship 25WG	2 oz	19.2 bcdefg	1.2 ab (93)	0.0 a (100)	0.0 a (100)	0.0 a (100)
Flagship 25WG	8 oz	16.0 abcde	0.8 ab (95)	0.4 a (94)	0.0 a (100)	0.0 a (100)
Hachi-Hachi 15EC (tolfenpyrad)	10.5 oz	18.2 abcdefg	1.0 ab (94)	0.6 a (92)	1.2 ab (38)	0.2 a (79)
Kontos (BYI-8330)	1.7 fl oz	14.4 abc	0.4 a (97)	0.4 a (93)	1.2 ab (22)	0.0 a (100)
Merit 75	16 gr	34.0 ghij	1.6 abc (95)	0.2 a (99)	0.2 ab (94)	0.4 a (78)
Mesurol 75W	1 lb	14.8 a	0.6 a (96)	0.6 a (90)	0.0 a (100)	0.2 a (75)
NNI-0101	9.5 oz	22.4 bcdefghi	22.2 ef (0)	11.6 c (0)	11.4 cd (0)	0.6 a (50)
Othene 97	8 oz	29.6 efghij	1.0 ab (96)	0.4 a (97)	0.2 ab (94)	0.0 a (100)
Overture	8 oz	27.0 cdefghij	3.4 cd (87)	0.8 a (93)	0.4 ab (86)	0.2 a (86)
Pedestal	8 oz	20.0 bcdefgh	3.8 cd (80)	0.8 a (90)	0.0 a (100)	0.0 a (100)
Pylon	10 oz	22.6 bcdefgh	1.2 a (94)	0.6 a (93)	0.0 a (100)	0.8 ab (34)
Safari	24 oz	18.6 abcdefg	0.8 ab (95)	0.8 a (89)	0.2 ab (90)	0.0 a (100)
Talstar F	21.7 oz	26.4 bcdefghij	1.4 abc (94)	0.0 a (100)	0.0 a (100)	0.2 a (86)
TriCon (BW 420)	100 oz	34.6 fghij	3.2 bcd (90)	10.0 c (28)	14.0 d (0)	3.2 c (0)
TriStar 70WSP	64 g	27.2 bcdefghij	0.6 a (98)	0.4 a (96)	0.4 ab (86)	0.0 a (100)
TriStar 70WSP & Capsil	64 g + 6 oz	13.6 ab	0.4 a (97)	0.4 a (93)	0.6 ab (59)	0.0 a (100)
Clearys 3336 WP	24 oz	20.4 abcdefg	16.6 e (13)	16.4 cd (0)	11.0 c (0)	2.4 c (0)
Water Control		45.0 efghij	42.2 f (0)	18.0 cd (0)	4.8 c (0)	2.4 c (0)

Comparative Efficacy on Privet Thrips (Dendothrips ornatus)

Privet thrips (*Dendrothrips ornatus*) is known to attack privet, lilac and possibly ash, causing the leaves to become grey and even fall. In a single experiment conducted by a researcher in 2008, 9 products were tested as foliar treatments on 3-year old privet trees (Table 16). Adult and immature thrips were collected from leaflets at 3, 7 and 13 days after treament. Scimitar, the standard, provided good to excellent control. In general, BYI -8330, Conserve, Flagship, Tick-EX and Hachi-Hachi 15EC (tolfenpyrad) provided fair to good efficacy. Ecotrol, MOI 201 and NNI-0101 showed poor efficacy.

Table 18. Privet Thrips Control on New Mexican Privet (*Foresteria neomexicana*), Cranshaw, CO 2008.

Treatment (Active Ingredient)	Rate / 100 gal	Population Counts [x], Means Separations [y], and Percent Control		
		3 DAT	7 DAT	13 DAT
Conserve	11 fl oz	5.3 c (77)	4.8 a (66)	5.8 b (74)
Ecotrol	4 pt	16.3 b (31)	28.3 a (0)	14.5 ab (35)
Flagship 25WG	8 oz	4.5 c (81)	17.0 a (0)	10.3 b (54)
Hachi-Hachi 15EC (tolfenpyrad) EC	21 fl oz	5.0 c (79)	12.8 a (9)	6.0 b (73)
Kontos (BYI-8330)	1.7 fl oz	4.3 c (82)	19.3 a (0)	10.3 b (54)
MOI 201	1:500	12.8 bc (46)	23.5 a (0)	16.5 ab (26)
NNI-0101SC	6.38 fl oz	10.0 bc (57)	13.0 a (7)	7.3 b (67)
Scimitar SC	5 fl oz	3.0 c (87)	3.5 a(75)	1.0 b (96)
Tick-EX EC	29 fl oz	6.5 c (72)	8.8 a (37)	7.5 b (66)
Untreated		23.5 a (0)	14.0 a (0)	22.3 a (0)

[x] Mean number of live thrips per 20 leaflets from plant and extracted with alcohol.
[y] Means followed by the same letter are not significantly different at p=0.05 (SNK).

Comparative Efficacy on Western Flower Thrips (Frankliniella occidentalis)

Western flower thrips (*Frankliniella occidentalis*) remains the major pest threat for ornamental horticulture growers in the United States. The following is an extract from the 2009 IR-4 Thrips Efficacy Summary focusing on the experiments conducted with Hachi-Hachi as one or more of the treatments. For more details, please refer to that summary.

Cosmos. In 2008, Cranshaw examined the efficacy of various products to control western flower thrips on cosmos (Table 19). Unfortunately under the conditions of this trial, which involved field plantings subject to continuous reinvasion by migrant thrips, none of the treatments provided acceptable control. Even so, Hachi-Hachi was one of the better performing products.

Gerbera. In 2006, two researchers studied western flower thrips on gerbera (*Gerbera jamesonii*), comparing Hachi-Hachi with other thrips management tools. Each researcher used a different method to collect efficacy information. In one set of data, live adult and immature thrips were counted on leaves, on intact flowers with CO_2 exhalation and at select dates from alcohol extractions of single cut flowers (Table 20 -

Table 23). In another set of data, whole plants were placed into brown paper bags, stored for 4 weeks with yellow sticky cards, and adult thrips on the sticky cards were counted (Table 24, Table 25).

In both experiments, Hachi-Hachi exhibited similar levels of thrips efficacy as other products such as Conserve, Mesurol and Pylon.

Table 19. Western Flower Thrips Control on Cosmos (*Cosmos bipinnatus*) 'Picotee', Cranshaw, 2008a.

Treatment	Rate Per 100 gal	Population Counts [x], Means Separations [y], and Percent Control					
		8/4/08	8/7/08	8/18/08	8/22/08	8/26/08	9/5/08
Conserve	11 fl oz	33.5 bc (31)	59.0 ab (0)	35.5 a (32)	16.0 b (77)	47.5 a (15)	36.3 a (0)
Ecotrol	4 pts	48.3 ab (0)	60.8 ab (0)	46.3 a (12)	62.3 ab (10)	42.0 a (25)	48.0 a (0)
Flagship 25WG	8 oz	58.3 a (0)	75.8 a (0)	40.0 a (24)	50.3 ab (27)	63.5 a (0)	36.3 a (0)
Hachi-Hachi 15EC (tolfenpyrad) EC	21 fl oz	41.5 ab (14)	42.8 ab (0)	36.5 a (30)	42.5 ab (39)	50.8 a (9)	39.0 a (0)
Kontos (BYI-8330)	1.7 fl oz	43.0 ab (11)	54.0 ab (0)	38.0 a (28)	47.0 ab (32)	41.0 a (27)	34.5 a (0)
MOI 201	25.6 fl oz (1:500)	57.5 ab (0)	36.5 ab (0)	30.8 a (41)	62.0 ab (11)	56.0 a (0)	40.0 a (0)
NNI-0101SC	6.38 fl oz	53.8 ab (0)	33.0 ab (0)	38.3 a (27)	59.0 ab (15)	56.8 a (0)	33.8 a (0)
Scimitar SC	5 fl oz	22.0 c (55)	28.3 b (11)	44.8 a (15)	26.5a ab (62)	31.8 a (43)	30.8 a (0)
Tick-EX EC	29 fl oz	46.8 ab (4)	45.8 a (0)	45.3 a (14)	79.5 a (0)	56.0 a (0)	47.0 a (0)
Untreated Check		48.5 ab (0)	31.8 ab (0)	52.5 a (0)	69.3 ab (0)	56.0 a (0)	26.5 a (0)
Nymphs							
Conserve	11 fl oz	1.8 a (60)	5.3 a (0)	2.0 a (29)	0.3 c (92)	0.8 a (73)	1.8 a (0)
Ecotrol	4 pt	4.5 a (0)	3.3 a (31)	3.8 a (0)	2.5 ab (34)	3.3 a (0)	1.8 a (0)
Flagship 25WG	8 oz	7.0 a (0)	8.3 a (0)	2.8 a (0)	0.8 bc (79)	1.5 a (50)	1.8 a (0)
Hachi-Hachi 15EC (tolfenpyrad) EC	21 fl oz	4.3 a (4)	1.3 a (73)	1.3 a (54)	0.5 bc (87)	1.0 a (67)	2.0 a (0)
Kontos (BYI-8330)	1.7 fl oz	3.3 a (27)	2.0 a (58)	4.3 a (0)	4.8 a (0)	2.8 a (7)	1.8 a (0)
MOI 201	25.6 fl oz (1:500)	4.3 a (4)	5.0 a (0)	0.3 a (89)	4.0 ab (0)	2.8 a (7)	2.5 a (0)
NNI-0101SC	6.38 fl oz	3.8 a (16)	1.5 a (69)	2.3 a (18)	4.0 ab (0)	3.3 a (0)	1.5 a (0)
Scimitar SC	5 fl oz	3.3 a (27)	3.3 a (31)	2.3 a (18)	0.0 c (100)	1.8 a (40)	1.3 a (13)
Tick-EX EC	29 fl oz	5.3 a (0)	0.5 a (90)	2.8 a (0)	3.2 ab (16)	3.3 a (0)	1.5 a (0)
Untreated Check		4.5 a (0)	4.8 a (0)	2.8 a (0)	3.8 bc (0)	3.0 a (0)	1.5 a (0)

[x] Mean number of live thrips per 25 blossoms cut from plant and extracted with alcohol.

[y] Means followed by the same letter are not significantly different at p=0.05 (SNK).

Treatments applied on 8/1/08; a second application of Kontos (BYI-8330), Ecotrol and Tick-EX made on 8/7/08.

Table 20. Western Flower Thrips Control on Gerbera (*Gerbera jamesonii*) 'Festival Dark Eye Golden Yellow' – Application Rates & Intervals, Canas, OH, 2006.

Treatment (Active Ingredient)	Application Method – Rate per 100 gal	Application Dates		
		6/12/2006 0 DAT	6/19/2006 7 DAT	6/26/2006 14 DAT
Acelepryn (DPX-E2Y45)	Foliar – 20 fl oz	X		X
Aria 50SG (flonicamid)	Foliar – 3.7 oz (105 g)	X		X
BAS 320i	Foliar – 16 fl oz	X		X
Celero (clothianadin)	Drench – 4 oz	X		
Conserve SC (spinosad)	Foliar – 8 fl oz	X		X
Hachi-Hachi 15EC (tolfenpyrad)	Foliar – 21 fl oz	X		X
Kontos (BYI-8330) (spirotetramat)	Drench – 1.7 fl oz	X		
Overture (pyridalyl)	Foliar – 8 oz	X		X
Pylon (chlorfenapyr)	Foliar – 10 fl oz	X	X	
S1812 (pyridalyl)	Foliar – 8 oz	X		X
S1812 (pyridalyl)	Foliar – 12 oz	X		X
Untreated				

Table 21. Western Flower Thrips Control on Gerbera (*Gerbera jamesonii*) 'Festival Dark Eye Golden Yellow' – Leaves, Canas, OH, 2006.

Treatment [z]	Population Counts [y], Means Separations [x], and Henderson's Percent Control								
	0 DAT	7 DAT	14 DAT	21 DAT	28 DAT	35 DAT	42 DAT	49 DAT	56 DAT
Adults									
Acelepryn	7.8	0.7 (0)	1.2 (0)	1.8 (65)	1.5 (0)	3.5 (0)	4.8 (17)	2.3 (0)	1.8 (0)
Aria	6.7	0.3 (41)	2.2 (0)	2.8 (36)	1.7 (0)	2.7 (10)	4.3 (13)	7.0 (0)	1.7 (0)
BAS 320i	6.2	0.7 (0)	0.7 (0)	1.0 (75)	1.7 (0)	3.8 (0)	8.3 (0)	4.8 (0)	2.0 (0)
Celero	5.7	0.2 (65)	0.6 (0)	1.8 (51)	0.8 (14)	1.7 (34)	3.5 (17)	2.3 (0)	1.2 (0)
Conserve	5.2	0.5 (0)	0.2 (62)	1.2 (66)	0.3 (62)	2.3 (0)	5.7 (0)	2.3 (0)	1.2 (0)
Hachi-Hachi 15EC	4.3	0.2 (55)	0.3 (10)	0.7 (77)	1.2 (0)	2.2 (0)	4.8 (0)	0.7 (44)	0.5 (32)
Kontos	6.0	0.8 (0)	1.2 (0)	1.5 (62)	2.8 (0)	2.2 (19)	1.8 (59)	1.7 (0)	1.7 (0)
Overture	6.0	0.7 (0)	0.7 (0)	2.0 (49)	0.8 (18)	3.2 (0)	3.8 (14)	3.5 (0)	0.7 (35)
Pylon	6.0	0.3 (35)	0.5 (2)	0.5 (87)	0.2 (84)	2.5 (7)	11.8 (0)	1.8 (0)	2.2 (0)
S1812 35WP 8 oz	4.8	0.2 (59)	0.7 (0)	1.7 (48)	1.2 (0)	2.5 (0)	5.8 (0)	1.3 (0)	0.5 (39)
S1812 35WP 12 oz	5.5	0.0 (100)	0.0 (100)	0.8 (77)	0.8 (11)	3.2 (0)	6.3 (0)	2.3 (0)	2.8 (0)
Untreated	7.8	0.7 (0)	0.7 (0)	5.2 (0)	1.3 (0)	3.5 (0)	5.8 (0)	2.2 (0)	1.3 (0)
Nymphs									
Acelepryn	17.0 a	18.8 ab (0)	3.3 abc (44)	4.0 bc (62)	2.3 a (63)	4.2 a (33)	5.0 a (0)	0.7 abcd (56)	0.0 a
Aria	18.8 a	15.3 ab (19)	3.2 abc (52)	1.5 bcd (87)	2.2 a (69)	6.8 a (1)	1.2 a (78)	1.5 cde (11)	0.0 a
BAS320i	13.5 a	17.2 ab (0)	6.5 abc (0)	6.2 ab (26)	2.5 a (50)	8.5 a (0)	2.5 a (35)	2.3 abcde (0)	0.7 a
Celero	15.7 a	6.2 cd (61)	3.2 bc (42)	2.8 bc (71)	3.2 a (46)	3.5 a (39)	5.5 a (0)	1.0 ab (29)	0.3 a
Conserve	24.0 a	1.8 ef (92)	0.0 d (100)	0.2 d (99)	0.3 a (96)	1.8 a (79)	1.3 a (80)	1.0 cde (53)	0.0 a
Hachi-Hachi 15EC	13.3 a	3.7 de (73)	0.8 cd (82)	2.0 bcd (76)	2.7 a (47)	14.0 a (0)	7.5 a (0)	0.7 a (44)	0.2 a
Kontos	28.5 a	9.7 bc (66)	3.0 abc (70)	4.3 ab (75)	6.5 a (39)	3.8 a (63)	0.3 a (96)	0.7 e (74)	0.3 a
Overture	21.0 a	10.8 bc (49)	2.2 abc (70)	3.8 ab (70)	3.3 a (58)	4.2 a (46)	1.8 a (69)	0.7 bcde (65)	0.2 a
Pylon	22.5 a	0.3 f (99)	1.0 cd (87)	0.8 cd (94)	2.7 a (68)	6.0 a (27)	4.2 a (35)	2.5 abcd (0)	0.3 a
S1812 35WP 8 oz	15.5 a	10.5 bc (33)	2.5 bc (54)	2.5 bcd (74)	2.7 a (54)	7.7 a (0)	1.0 a (77)	1.5 de (0)	0.0 a
S1812 35WP 12 oz	15.5 a	9.5 bc (39)	1.2 cd (78)	1.8 bcd (81)	1.3 a (77)	3.5 a (38)	4.8 a (0)	0.5 abc (64)	0.0 a
Untreated	20.5 a	20.7 a (0)	7.2 a (0)	12.7 a (0)	7.7 a (0)	7.5 a (0)	5.8 a (0)	1.8 abcd (0)	0.0 a

Treatment [z]	Population Counts [y], Means Separations [x], and Henderson's Percent Control								
	0 DAT	7 DAT	14 DAT	21 DAT	28 DAT	35 DAT	42 DAT	49 DAT	56 DAT
Total Population									
Acelepryn	24.8 a	19.5 abc (0)	4.5 abc (34)	5.8 abc (63)	3.8 a (51)	7.7 a (20)	9.8 a (4)	3.0 a (14)	1.8 a (0)
Aria	25.5 a	15.7 abc (18)	5.3 abc (24)	4.3 bcd (73)	3.8 a (53)	9.5 a (4)	5.5 ab (48)	8.5 a (0)	1.7 a (0)
BAS 320i	19.7 a	17.8 ab (0)	7.2 ab (0)	7.2 abc (42)	4.2 a (33)	12.3 a (0)	10.8 a (0)	7.2 a (0)	2.7 a (0)
Celero	21.3 a	6.3 de (61)	3.8 cd (36)	4.7 bcd (65)	4.0 a (41)	5.2 a (38)	9.0 a (0)	3.3 a (0)	1.5 a (0)
Conserve	29.2 a	2.3 f (89)	0.2 e (98)	1.3 cd (93)	0.7 a (93)	4.2 a (63)	7.0 ab (42)	3.3 a (19)	1.2 a (15)
Hachi-Hachi 15EC	17.7 a	3.8 ef (71)	1.2 de (76)	2.7 bcd (76)	3.8 a (32)	16.2 a (0)	12.3 a (0)	1.3 a (47)	0.7 a (20)
Kontos	34.5 a	10.5 bcd (60)	4.2 abc (56)	5.8 bcd (73)	9.3 a (15)	6.0 a (55)	2.2 b (85)	2.3 a (52)	2.0 a (0)
Overture	27.0 a	11.5 cde (43)	2.8 abcd (62)	5.8 ab (66)	4.2 a (51)	7.3 a (30)	5.7 ab (49)	4.2 a (0)	0.8 a (34)
Pylon	28.5 a	0.7 g (97)	1.5 de (81)	1.3 d (93)	2.8 a (69)	8.5 a (23)	16.0 a (0)	4.3 a (0)	2.5 a (0)
S1812 35WP 8 oz	20.3 a	10.7 bcd (30)	3.2 bcd (44)	4.2 bcd (67)	3.8 a (41)	10.2 a (0)	6.8 ab (18)	2.8 a (1)	0.5 a (48)
S1812 35WP 12 oz	21.0 a	9.5 abcd (40)	1.2 de (80)	2.7 bcd (80)	2.2 a (68)	6.7 a (18)	11.2 a (0)	2.8 a (4)	2.8 a (0)
Untreated	28.3 a	21.3 a (0)	7.8 a (0)	17.8 a (0)	9.0 a (0)	11.0 a (0)	11.7 a (0)	4.0 a (0)	1.3 a (0)

[z] See Table 16 for details on application rates and intervals.

[y] Mean number of thrips counted on 5 leaves.

[x] For the statistical analysis data were transformed using the function ln (x + 1). Original data are presented here. Means within a column followed by the same letter are not significantly different by the Duncan-Waller's test ($P = 0.05$).

Table 22. Western Flower Thrips Control on Gerbera 'Festival Dark Eye Golden Yellow' – Flowers, Canas, OH, 2006.

Treatment [z]	Population Counts [y], Means Separations [x], and Henderson's Percent Control								
	0 DAT	7 DAT	14 DAT	21 DAT	28 DAT	35 DAT	42 DAT	49 DAT	56 DAT
Adults									
Acelepryn (DPX-E2Y45)	1.8 a	3.8 a (0)	4.8 a (43)	5.3 a (0)	11.2 a (0)	6.7 a (51)	2.7 a (74)	8.3 a (0)	4.2 a
Aria	4.3 a	2.7 a (66)	13.7 a (32)	6.2 a (40)	9.5 a (11)	3.8 a (88)	6.7 a (73)	9.2 a (20)	2.3 a
BAS 320i	4.0 a	3.8 a (47)	6.7 a (64)	5.5 a (42)	6.7 a (32)	7.2 a (76)	7.0 a (69)	13.0 a (0)	2.2 a
Celero	2.8 a	5.0 a (3)	11.0 a (16)	3.8 a (43)	7.8 a (0)	4.3 a (79)	0.0 a (100)	7.7 a (0)	2.0 a
Conserve	1.8 a	0.7 a (80)	6.5 a (24)	2.3 a (46)	6.7 a (0)	8.3 a (39)	8.3 a (19)	7.2 a (0)	4.2 a
Hachi-Hachi 15EC (tolfenpyrad)	2.8 a	1.2 a (77)	3.8 a (71)	5.0 a (25)	4.3 a (38)	10.8 a (49)	4.2 a (74)	2.2 a (71)	0.0 a
Kontos (BYI-8330)	2.8 a	3.8 a (26)	5.7 a (57)	8.0 a (0)	11.2 a (0)	1.0 a (95)	0.0 a (100)	0.7 a (91)	2.3 a
Overture	3.5 a	0.7 a (90)	17.5 a (0)	5.5 a (34)	7.2 a (17)	0.2 a (99)	0.0 a (100)	6.0 a (35)	1.0 a
Pylon	3.7 a	0.3 a (95)	5.3 a (69)	6.2 a (29)	11.8 a (0)	23.2 a (15)	11.2 a (46)	8.7 a (10)	6.7 a
S1812 35WP 8 oz	2.2 a	1.2 a (70)	5.7 a (44)	6.8 a (0)	11.2 a (0)	5.0 a (69)	15.5 a (0)	5.7 a (1)	1.5 a
S1812 35WP 12 oz	2.2 a	1.2 a (70)	4.5 a (55)	3.0 a (41)	3.0 a (44)	1.8 a (89)	6.0 a (51)	1.2 a (80)	8.3 a
Untreated	1.8 a	3.3 a (0)	8.5 a (0)	4.3 a (0)	4.5 a (0)	13.7 a (0)	10.3 a (0)	4.8 a (0)	0.0 a

Treatment [z]	Population Counts [y], Means Separations [x], and Henderson's Percent Control								
	0 DAT	7 DAT	14 DAT	21 DAT	28 DAT	35 DAT	42 DAT	49 DAT	56 DAT
Nymphs									
Acelepryn (DPX-E2Y45)	0.0 b	0.0 a	0.2 a	2.0 a	0.8 a	0.0 b	0.0 a	0.2 a	0.0 a
Aria	0.7 a	0.0 a	0.0 a	1.0 a	0.3 a	0.3 b	0.0 a	0.0 a	0.0 a
BAS 320i	0.0 b	0.0 a	0.2 a	1.5 a	0.3 a	1.8 a	0.3 a	0.2 a	0.0 a
Celero	0.0 b	0.0 a	0.4 a	2.2 a	2.8 a	0.0 b	0.0 a	0.2 a	0.0 a
Conserve	0.2 ab	0.0 a	0.0 a	0.3 a	0.2 a	0.0 b	0.0 a	0.2 a	0.0 a
Hachi-Hachi 15EC (tolfenpyrad)	0.0 b	0.0 a	0.0 a	0.2 a	0.5 a	0.0 b	0.5 a	0.0 a	0.0 a
Kontos (BYI-8330)	0.0 b	0.0 a	0.2 a	2.7 a	1.5 a	0.0 b	0.0 a	0.2 a	0.0 a
Overture	0.0 b	0.0 a	0.0 a	0.3 a	0.0 a	0.0 b	0.0 a	0.0 a	0.0 a
Pylon	0.0 b	0.0 a	0.3 a	3.2 a	0.5 a	0.7 ab	0.2 a	0.2 a	0.3 a
S1812 35WP 8 oz	0.0 b	0.0 a	0.5 a	1.2 a	0.5 a	0.3 b	0.7 a	0.3 a	0.5 a
S1812 35WP 12 oz	0.0 b	0.0 a	0.0 a	0.2 a	0.0 a	1.2 ab	0.2 a	0.0 a	0.0 a
Untreated	0.0 b	0.0 a	0.5 a	0.3 a	0.0 a	0.2 b	0.0 a	0.0 a	0.2 a
Total Population									
Acelepryn (DPX-E2Y45)	1.8 a	3.8 abc (0)	5.0 a (44)	7.3 a (0)	12.0 a (0)	6.7 b (52)	2.7 a (74)	8.5 a (0)	4.2 abc (0)
Aria	5.0 a	2.7 abc (71)	13.7 a (44)	7.2 a (44)	9.8 a (20)	4.2 ab (89)	6.7 a (76)	9.2 a (30)	2.3 abc (0)
BAS 320i	4.0 a	3.8 ab (47)	6.8 a (65)	7.0 a (31)	7.0 a (29)	9.0 ab (70)	7.3 a (67)	13.2 a (0)	2.2 abc (0)
Celero	2.8 a	5.0 a (3)	11.4 a (18)	6.0 a (17)	10.7 a (0)	4.3 b (80)	0.0 a (100)	7.8 a (0)	2.0 bc (0)
Conserve	2.0 a	0.7 cd (82)	6.5 a (34)	2.7 a (48)	6.8 a (0)	8.3 b (45)	8.3 a (26)	7.3 a (0)	4.2 abc (0)
Hachi-Hachi 15EC (tolfenpyrad)	2.8 a	1.2 abcd (77)	3.8 a (72)	5.2 a (28)	4.8 a (31)	10.8 ab (49)	4.7 a (71)	2.2 a (71)	0.0 c (100)
Kontos (BYI-8330)	2.8 a	3.8 abcd (26)	5.8 a (58)	10.7 a (0)	12.7 a (0)	1.0 b (95)	0.0 a (100)	0.8 a (89)	2.3 bc (0)
Overture	3.5 a	0.7 cd (90)	17.5 a (0)	5.8 a (35)	7.2 a (17)	0.2 b (99)	0.0 a (100)	6.0 a (35)	1.0 bc (0)
Pylon	3.7 a	0.3 d (95)	5.7 a (69)	9.3 a (0)	12.3 a (0)	23.8 a (14)	11.3 a (45)	8.8 a (9)	7.0 ab (0)
S1812 35WP 8 oz	2.2 a	1.2 abcd (70)	6.2 a (42)	8.0 a (0)	11.7 a (0)	5.3 ab (67)	16.2 a (0)	6.0 a (0)	2.0 abc (0)
S1812 35WP 12 oz	2.2 a	1.2 bcd (70)	4.5 a (58)	3.2 a (43)	3.0 a (44)	3.0 b (82)	6.2 a (50)	1.2 a (80)	8.3 a (0)
Untreated	1.8 a	3.3 abc (0)	9.0 a (0)	4.7 a (0)	4.5 a (0)	13.8 ab (0)	10.3 a (0)	4.8 a (0)	0.2 c (0)

[z] See Table 21 for details on application rates and intervals.

[y] Mean number of thrips

[x] For the statistical analysis data were transformed using the function ln (x + 1). Original data are presented here. Means within a column followed by the same letter are not significantly different by the Duncan-Waller's test ($P = 0.05$).

Table 23. Western Flower Thrips Control on Gerbera (*Gerbera jamesonii*) 'Festival Dark Eye Golden Yellow' – Cut Flowers, Canas, OH, 2006.

Treatment [z]	Population Counts [y], Means Separations [x], and Percent Control	
	16 DAT	23 DAT
Adults		
Acelepryn (DPX-E2Y45)	15.7 (9)	14.5 (0)
Aria	9.2 (47)	16.0 (0)
BAS320i	9.7 (44)	19.8 (0)
Celero	20.5 (0)	20.3 (0)
Conserve	5.2 (70)	2.7 (81)
Hachi-Hachi 15EC (tolfenpyrad)	8.8 (49)	8.5 (39)
Kontos (BYI-8330)	12.2 (29)	17.8 (0)
Overture	20.5 (0)	34.5 (0)
Pylon	13.0 (24)	20.5 (0)
S1812 35WP 8 oz	17.7 (0)	12.2 (13)
S1812 35WP 12 oz	16.7 (3)	14.3 (0)
Untreated	17.2 (0)	14.0 (0)
Nymphs		
Acelepryn (DPX-E2Y45)	23.2 abc (63)	4.5 bcde (29)
Aria	18.7 abcd (70)	21.7 abc (0)
BAS320i	28.3 abc (55)	56.5 a (0)
Celero	41.5 abc (34)	13.3 bcde (0)
Conserve	1.8 e (97)	0.8 e (87)
Hachi-Hachi 15EC (tolfenpyrad)	22.8 abc (64)	2.8 de (56)
Kontos (BYI-8330)	62.5 a (0)	7.7 cde (0)
Overture	40.7 abc (35)	34.3 ab (0)
Pylon	6.3 de (90)	17.8 abcd (0)
S1812 35WP 8 oz	18.8 bcd (70)	7.3 abcd (0)
S1812 35WP 12 oz	17.2 cde (73)	3.2 de (49)
Untreated	62.8 ab (0)	6.3 cde (0)
Total Population		
Acelepryn (DPX-E2Y45)	38.8 a (52)	19.0 abc (6)
Aria	27.8 a (65)	37.7 ab (0)
BAS320i	38.0 a (53)	76.3 a (0)
Celero	62.0 a (23)	33.7 ab (0)
Conserve	7.0 b (91)	3.5 c (83)
Hachi-Hachi 15EC (tolfenpyrad)	31.7 a (60)	11.3 bc (44)
Kontos (BYI-8330)	74.7 a (7)	25.5 abc (0)
Overture	61.2 a (24)	68.8 a (0)
Pylon	19.3 ab (76)	38.3 ab (0)
S1812 35WP 8 oz	36.5 ab (54)	19.5 ab (4)
S1812 35WP 12 oz	33.8 ab (58)	17.5 bc (14)
Untreated	80.0 a (0)	20.3 bc (0)

[z] See Table 16 for details on application rates and intervals.

[y] Mean number of thrips collected from single flower cut from plant and extracted with alcohol.

[x] For the statistical analysis data were transformed using the function ln (x + 1). Original data are presented here. Means within a column followed by the same letter are not significantly different by the Duncan-Waller's test ($P = 0.05$).

Table 24. Efficacy of several insecticides for *Frankliniella occidentalis* on *Gerbera jamesonii* 'Royal' series with mixed colors – Application Rates and Dates, Parrella, 2006b.

Treatment (Active Ingredient) [z]	Application Method – Rate / 100 gal	Application Dates			
		3/12 0 DAT	3/19 7 DAT	3/21 9 DAT	3/26 14 DAT
Allectus (bifenthrin + imidacloprid)	Foliar – 21.3 oz	X			X
Aria 50SG (flonicamid)	Foliar – 120 g	X			X
Conserve (spinosad)	Foliar – 11 oz	X			X
Flagship 25WG (thiamethoxam)	Foliar – 4 oz	X			X
Hachi-Hachi 15EC (tolfenpyrad)	Foliar – 14 oz	X			X
Hachi-Hachi 15EC (tolfenpyrad)	Foliar – 21 oz	X			X
Mesurol (methiocarb)	Foliar – 16 oz	X		X	
Pylon (chlorfenapyr)	Foliar – 5 oz	X	X		
Pylon (chlorfenapyr)	Foliar – 10 oz	X	X		
Tricon	Foliar – 80 oz	X			X
TriStar (acetamiprid)	Foliar – 8 oz (227 g)	X			X
Untreated					

Table 25. Efficacy of several insecticides for *Frankliniella occidentalis* on *Gerbera jamesonii* 'Royal' series with mixed colors, Parrella, 2006b.

Treatment	Population Counts [z], Means Separations [y], and Henderson's % Control					
	PreCount	4 DAT	11 DAT	25 DAT	46 DAT	59 DAT
Allectus	1.0 a	5.9 b (0)	10.2 de (0)	27.3 d (0)	12.4 d (0)	10.5 ab (0)
Aria	0.8 a	2.8 ab (0)	4.5 abcd (0)	15.8 bc (0)	11.1 cd (0)	6.4 ab (0)
Conserve	1.5 a	1.0 a (72)	--	9.7 ab (29)	5.4 abc (28)	6.1 a (16)
Flagship	0.9 a	2.4 ab (0)	13.9 e (0)	20.5 cd (0)	5.4 abc (0)	8.9 ab (0)
Hachi-Hachi 15EC (tolfenpyrad) 14 oz	1.5 a	3.0 ab (20)	1.4 ab (75)	0.9 a (94)	4.5 ab (43)	10.8 ab (0)
Hachi-Hachi 15EC (tolfenpyrad) 21 oz	1.4 a	4.5 ab (0)	0.3 a (94)	0.5 a (96)	2.3 a (67)	10.9 ab (0)
Mesurol	1.2 a	3.5 ab (0)	2.2 abc (50)	2.3 a (80)	9.2 bcd (0)	4.5 a (27)
Pylon 5 oz	1.2 a	3.2 ab (0)	3.8 abcd (9)	0.9 a (91)	4.5 ab (23)	7.4 ab (0)
Pylon 10 oz	1.2 a	3.0 ab (0)	1.5 ab (67)	0.4 a (97)	2.1 a (67)	5.2 a (15)
Tricon	1.8 a	3.6 ab (19)	9.9 cde (0)	6.8 ab (60)	6.0 abcd (36)	16.8 b (0)
Tristar	1.9 a	2.5 ab (46)	7.0 abcde (0)	12.6 bc (29)	7.7 abcd (22)	9.7 ab (0)
Untreated	2.3 a	5.6 b	8.3 bcde	21.5 cd	11.8 cd	11.5 ab

[z] Populations of all adults found on yellow sticky cards with 13 plants in brown paper bags after 4 weeks.
[y] All letters following numbers within a column, that are different, are significantly different at the <0.05 level according to Tukey-Kramer HSD.

Impatiens. Several experiments were conducted in 2006 and 2007 (Table 26 - Table 27) using either combination of thrips knocked off plants, emasculation of flowers and plants, and alcohol extraction of meristems or alcohol extraction of leaves and flowers. The level of thrips populations varied among these experiments from very low to medium infestations. In the experiment conducted by Chen (Table 26) with 'Super Elfin Cherry', Celero and Pylon provided excellent control equivalent to or better than Conserve 10 DAT, but by 15 DAT BAS 320i provided excellent control and the level of efficacy dropped for the other products. Hachi-Hachi 15EC (tolfenpyrad), in the experiment, did not perform well. In the experiment conducted by Redding and Anderson (Table 27), alcohol extractions of impatiens leaves and flowers were used to assess populations. Since western

flower thrips feeds on pollen, the management on flowers is a good indicator of success. In this experiment, Avid exhibited the best control on flowers and on leaves. On flowers 28 DAT, foliar applications of Flagship performed better than drench applications, while both provided equivalent control on leaves. Safari drench applications provided better control than foliar applications on flowers, while both were similar on leaves. Hachi-Hachi 15EC (tolfenpyrad) provided equivalent immature control on thrips as Avid.

Table 26. Western Flower Thrips Control on Impatiens (*Impatiens wallerana*) 'Super Elfin Cherry' – Experiment 4, Chen, LA 2006d.

Treatment (Active Ingredient) Rate per 100 gal [z]	Population Counts [y], Means Separations [x], and % Control	
	10 DAT	15 DAT
Adults		
BAS320i 8 fl oz	0.5 d (80)	0.0 b (100)
BAS320i 16 fl oz	0.3 d (88)	0.5 b (17)
Celero 2 oz	0.3 d (88)	0.2 b (67)
Celero 4 oz	0.0 d (100)	0.2 b (67)
Hachi-Hachi 15EC (tolfenpyrad) 14 fl oz	2.7 b (0)	1.3 b (0)
Hachi-Hachi 15EC (tolfenpyrad) 21 fl oz	4.8 a (0)	3.3 a (0)
Pylon 5 fl oz	2.0 bcd (20)	0.3 b (50)
Pylon 10 fl oz	0.2 d (92)	0.2 b (67)
Std. (Conserve 6 oz)	0.8 cd (68)	0.0 b (100)
Untreated	2.5 bc (0)	0.6 b (0)
Nymphs		
BAS320i 8 fl oz	4.0 b (61)	0.0 b (100)
BAS320i 16 fl oz	4.7 b (54)	1.3 b (24)
Celero 2 oz	0.2 c (98)	0.5 b (71)
Celero 4 oz	1.5 bc (85)	0.7 b (59)
Hachi-Hachi 15EC (tolfenpyrad) 14 fl oz	1.7 bc (83)	4.3 b (0)
Hachi-Hachi 15EC (tolfenpyrad) 21 fl oz	11.8 a (0)	16.0 (0)
Pylon 5 fl oz	0.8 c (92)	0.5 b (71)
Pylon 10 fl oz	0.7 c (93)	0.2 b (88)
Std. (Conserve 6 oz)	0.7 c (93)	1.3 b (24)
Untreated	10.2 a (0)	1.7 b (0)
Total Population		
BAS320i 8 fl oz	4.5 (65)	0.0 (100)
BAS320i 16 fl oz	5.0 (61)	1.8 (22)
Celero 2 oz	0.5 (96)	0.7 (70)
Celero 4 oz	1.5 (88)	0.9 (61)
Hachi-Hachi 15EC (tolfenpyrad) 14 fl oz	4.4 (65)	5.6 (0)
Hachi-Hachi 15EC (tolfenpyrad) 21 fl oz	16.6 (0)	19.3 (0)
Pylon 5 fl oz	2.8 (78)	0.8 (65)
Pylon 10 fl oz	0.9 (93)	0.4 (83)
Std. (Conserve 6 oz)	1.5 (88)	1.3 (43)
Untreated	12.7 (0)	2.3 (0)

[z] All treatments were foliar sprays applied on June 18, 2007.

[y] Mean number of thrips were counted three ways: 1) the number shaken from plant samples 2) destructively harvesting flowers and buds, and 3) alcohol extraction of meristems.

Table 27. Western Flower Thrips Control on *Impatiens balsamina,* Reding and Anderson, OH 2007.

Treatment (Active Ingredient) Rate per 100 gal	Population Counts [z], Means Separations [y], and Henderson's Percent Control							
	0 DAT Leaves	7 DAT Leaves	14 DAT Leaves	28 DAT Leaves	0 DAT Flowers	7 DAT Flowers	14 DAT Flowers	28 DAT Flowers
Adults								
Avid (8 fl oz)	0.9	1.3 (59)	0.9 (90)	2.7 (85)	0.9	2.0 (0)	0.7 (61)	2.5 (70)
Flagship (D) 25WG (8 oz)	0.3	0.9 (14)	0.4 (87)	4.0 (33)	0.2	2.1 (0)	1.5 (0)	5.2 (0)
Flagship (F) 25WG (8 oz)	0.1	0.5 (0)	1.7 (0)	3.3 (0)	0.6	1.6 (0)	2.0 (0)	4.1 (26)
Hachi-Hachi 15EC (tolfenpyrad) (14 oz)	0.2	0.2 (71)	0.6 (70)	3.5 (13)	0.2	0.4 (0)	1.1 (0)	4.0 (0)
Hachi-Hachi 15EC (tolfenpyrad) (21 oz)	0.1	0.2 (43)	0.3 (70)	3.4 (0)	0.3	0.8 (0)	0.8 (0)	2.4 (13)
Safari (D) 20SG (24 oz)	0.1	0.2 (43)	0.2 (80)	1.3 (35)	0.9	1.3 (16)	1.1 (39)	3.0 (64)
Safari (F) 20SG (8 oz)	0.2	0.7 (0)	0.9 (55)	4.6 (0)	0.3	0.6 (0)	1.4 (0)	5.5 (0)
Untreated	0.2	0.7 (0)	2.0 (0)	4.0 (0)	1.1	1.9 (0)	2.2 (0)	10.1 (0)
Nymphs								
Avid (8 fl oz)	10.8	1.1 (83)	2.6 (90)	2.0 (95)	11.4	2.1 (29)	3.5 (69)	1.0 (96)
Flagship (D) 25WG (8 oz)	16.6	0.8 (92)	6.1 (84)	17.3 (71)	14.2	1.6 (56)	3.3 (76)	11.6 (61)
Flagship (F) 25WG (8 oz)	6.4	1.0 (74)	7.6 (49)	4.6 (80)	14.2	1.8 (51)	4.8 (66)	2.7 (91)
Hachi-Hachi 15EC (tolfenpyrad) (14 oz)	6.4	2.2 (42)	1.3 (91)	14.8 (35)	9.2	1.8 (24)	2.3 (75)	11.6 (40)
Hachi-Hachi 15EC (tolfenpyrad) (21 oz)	8.8	1.0 (81)	2.4 (88)	8.1 (74)	7.7	2.0 (0)	4.5 (41)	3.3 (79)
Safari (D) 20SG (24 oz)	5.8	0.4 (88)	1.7 (87)	4.2 (80)	6.6	1.7 (0)	1.8 (72)	3.3 (76)
Safari (F) 20SG (8 oz)	11.4	0.8 (88)	3.5 (87)	9.1 (78)	6.9	1.6 (10)	3.6 (47)	9.9 (31)
Untreated	7.2	4.3 (0)	16.8 (0)	25.6 (0)	12.8	3.3 (0)	12.6 (0)	26.7 (0)
Total Population								
Avid (8 fl oz)	11.7 a	2.4 a (70)	3.5 a (88)	4.7 a (90)	12.3 a	4.1 a (11)	4.2 a (68)	3.5 a (89)
Flagship (D) 25WG (8 oz)	16.9 a	1.7 a (85)	6.5 a (85)	21.3 cd (68)	14.4 a	3.7 a (31)	4.8 a (69)	16.8 c (56)
Flagship (F) 25WG (8 oz)	6.5 a	1.5 a (66)	9.3 a (44)	7.9 ab (70)	14.8 a	3.4 a (39)	6.8 a (57)	6.8 bc (83)
Hachi-Hachi 15EC (tolfenpyrad) (14 oz)	6.6 a	2.4 a (46)	1.9 a (89)	18.3 bcd (31)	9.4 a	2.2 a (37)	3.4 a (66)	15.6 c (37)
Hachi-Hachi 15EC (tolfenpyrad) (21 oz)	8.9 a	1.2 a (80)	2.7 a (88)	11.5 abc (68)	8.0 a	2.8 a (6)	5.3 a (38)	5.7 bc (73)
Safari (D) 20SG (24 oz)	5.9 a	0.6 a (85)	1.9 a (87)	5.5 a (77)	7.5 a	3.0 a (0)	2.9 a (64)	6.3 bc (68)
Safari (F) 20SG (8 oz)	11.6 a	1.5 a (81)	4.4 a (85)	13.7 abc (70)	7.2 a	2.2 a (18)	5.0 a (35)	15.4 c (19)
Untreated	7.4 a	5.0 b (0)	18.8 b (0)	29.6 d (0)	13.9 a	5.2 a (0)	14.8 b (0)	36.8 d (0)

Mean number of thrips were counted from alcohol extraction of 3 leaves or 3 flowers.

Means within columns followed by the same letter are not significantly different ANOVA ($P = 0.05$), means separated by LSD ($\alpha = 0.05$).

Marigold. Three experiments were conducted between 2005 and 2008 on marigold 'Yellow Boy' (Tables 43 – 47). In these experiments, flower buds were removed throughout and all thrips were counted on either five or six leaves after alcohol extraction. In the first experiment, by 12 days after the first application all treatments (Avid, Conserve, Mesurol, and TriStar) provided good to excellent control. In the second experiment, Conserve did not provide adequate control levels, while Mesurol performed similarly as in the first experiment. In the third experiment, Conserve, Mesurol and MOI 201 provided adequate control only at 3 days after treatment. Of the other treatments, BAS 350i and Hachi-Hachi 15EC (tolfenpyrad) at the 21 oz rate provided good to excellent control. Safari 20SG provided good control, while Kontos (BYI-8330), Botanigard, Acelepryn (DPX-E2Y45), NNI-0101, QRD 416, TickEx and TriCon BW exhibited little impact on thrips populations.

In 2008, two researchers also conducted trials on marigold (Tables 48-50). In one experiment, leaves were tapped over a white board and all stages of live thrips counted. The most effective treatments were Conserve, NAI-2302 and TriStar. In a second experiment, two flowers were tapped five times over a styrifoam bowl 15 cm diam X 5 cm deep, adults and immatures that were moving in the box were counted and then dumped back on the plant. Adult counts were not of much use to determine efficacy because of the movement of adults among treatments (Table 50). The immature counts and overall damage rating were the best estimate of thrips control. Generally, Conserve was the most effective treatment followed by NAI 2302 and BYI 8330. Other treatments were less effective.

Table 28. Western Flower Thrips Control on Marigold (*Tagetes patula*) 'Yellow Boy' – Application Rates and Dates, Davis, MI 2007.

Treatment (Active Ingredient) [z]	Application Method – Rate / 100 gal	Application Dates			
		6/27 0 DAT	7/5 8 DAT	7/13 16 DAT	7/23 26 DAT
Acelepryn (DPX-E2Y45)	Foliar – 20 oz/100 gal	X		X	
BAS350i	Foliar – 1.2 oz	X	X	X	
Conserve SC (spinosad)	Foliar – 6 oz/100 gal	X	X	X	
Kontos foliar (spirotetramat)	Foliar – 1.7 oz	X	X	X	
Kontos drench (spirotetramat)	Drench – 1.7 oz (200 mL per 6" pot)	X			
Mesurol 75WP (methiocarb)	Foliar – 0.5-1.0lb/100 gal	X	X	X	
Safari 20SG (dinotefuran)	Foliar – 8 oz	X		X	
Tick-EX (Metarhizium anisopliae Strain 52)	Foliar – 15 oz/100 gal	X	X	X	X
Tick-EX (Metarhizium anisopliae Strain 52)	Foliar – 29 oz/100gal	X	X	X	X
Hachi-Hachi 15EC (tolfenpyrad)	Foliar – 14 oz/100 gal	X		X	
Hachi-Hachi 15EC (tolfenpyrad)	Foliar – 21 oz/100 gal	X		X	
Untreated					

Table 29. Western Flower Thrips Control on Marigold (*Tagetes patula*) 'Yellow Boy', Davis, MI 2007.

Treatment	Population Counts [z], Means Separations [y], and Henderson's Percent Control						
	0 DAT	6 DAT	15 DAT	22 DAT	29 DAT	37 DAT	41 DAT
Total Population							
Acelepryn (DPX-E2Y45)	12.8 a	7.3 c (0)	13.7 f (0)	5.6 d (0)	3.2 cde (0)	3.9 a (0)	3.9 bcd (0)
BAS350i	25.2 a	0.6 a (96)	0.3 a (99)	0.0 a (100)	0.2 a (96)	2.0 a (72)	1.2 d (80)
Conserve	16.0 a	2.9 b (68)	6.5 de (56)	5.0 d (7)	5.5 e (0)	6.4 a (0)	4.8 bcd (0)
Kontos foliar	12.8 a	15.0 c (0)	2.5 bc (79)	5.0 cd (0)	0.6 ab (79)	7.8 a (0)	4.0 bcd (0)
Kontos drench	12.0 a	12.3 c (0)	2.8 cd (75)	1.9 bc (53)	2.4 ab (9)	5.8 a (0)	6.1 cd (0)
Mesurol	14.1 a	1.1 ab (86)	0.1 a (99)	0.7 ab (85)	0.6 ab (81)	5.4 a (0)	6.3 cd (0)
Safari 20SG	12.8 a	3.0 b (58)	5.5 cd (54)	0.7 ab (84)	1.5 bc (47)	5.9 a (0)	7.0 bcd (0)
Tick-EX 15 oz	12.9 a	8.9 c (0)	8.8 ef (26)	6.0 cd (0)	5.3 cde (0)	4.4 a (0)	3.4 b (0)
Tick-EX 29 oz	15.1 a	7.4 c (12)	5.8 de (58)	4.6 cd (10)	3.3 cde (1)	3.2 a (26)	3.2 bc (13)
Hachi-Hachi 15EC (tolfenpyrad) 14 oz	12.3 a	3.0 b (56)	1.2 ab (89)	0.9 ab (78)	0.7 ab (74)	9.3 a (0)	8.4 cd (0)
Hachi-Hachi 15EC (tolfenpyrad) 21 oz	11.3 a	2.7 b (57)	0.7 a (93)	0.1 a (97)	0.3 a (88)	4.2 a (0)	9.3 d (0)
Untreated	17.2 a	9.6 c (0)	15.9 f (0)	5.8 d (0)	3.8 de (0)	4.9 a (0)	4.2 bcd (0)

[z] Flowers were removed prior to opening throughout the experiment. Mean number of thrips were counted from alcohol extraction of 5 leaves.

[y] Means followed by the same letter are not significantly different Fisher's LSD ($p < 0.05$). Data transformed prior to ANOVA log (x+1). Untransformed means presented in table.

Table 30. Western Flower Thrips Control on Marigold (*Tagetes patula*) 'Yellow Boy' – Application Rates and Dates, Davis, MI 2008.

Treatment (Active Ingredient)	Rate / 100 gal	Application Dates		
		6/17 0 DAT	6/24 7 DAT	7/1 14 DAT
Botanigard 22 % WP (*Beauvaria bassiana*)	2 lb	X	X	X
Botanigard 22 % WP (*Beauvaria bassiana*) + BW130 (unknown)	2 lb /100 gal + 325 ml/100 liters	X	X	X
Conserve SC (spinosad)	11fl oz	X	X	X
Kontos 240SC (spirotetramat)	1.7 fl oz	X		X
Mesurol 75WP (methiocarb)	0.5 lb	X		X
MOI 201 (unknown)	0.8 qt	X	X	X
NNI-0101 SC (pyrifluquinazon)	9.6 fl oz	X		X
QRD 416 (unknown)	128 fl oz	X	X	X
Tick-EX (Metarhizium anisopliae Strain 52)	29 fl oz/100gal	X	X	X
Tolfenpyralid EC (Hachi-Hachi 15EC (tolfenpyrad))	21 fl oz/100 gal	X		X
TriCon (Sodium Tetraborohydrate Decahydrate)	50 fl oz	X	X	X
Untreated				

Table 31. Western Flower Thrips Control on Marigold (*Tagetes patula*) 'Yellow Boy', Davis, MI 2008.

Treatment	Population Counts [z], Means Separations [y], and Henderson's Percent Control						
	Precount	3 DAT	7 DAT	14 DAT	21 DAT	28 DAT	35 DAT
Total Population							
Botanigard 22 % WP	6.3 a	5.3 ef (36)	6.8 de (0)	2.1 cde (51)	1.0 bcd (0)	1.6 c (0)	0.5 bc (44)
Botanigard 22 % WP + BW130	6.1 a	2.6 bcd (68)	2.3 bc (9)	1.2 abc (18)	0.5 abc (0)	0.4 ab (0)	0.4 bc (0)
Conserve SC	6.4 a	1.8 ab (79)	1.6 ab (9)	0.9 ab (11)	0.5 abc (0)	0.8 abc (0)	0.4 bc (10)
Kontos 240SC	6.0 a	5.8 ef (26)	6.2 de (0)	1.3 bc (67)	0.7 a-d (0)	0.4 a (11)	0.3 ab (0)
Mesurol 75WP	6.3 a	0.9 a (89)	0.5 a (43)	0.3 a (5)	0.2 a (0)	0.4 a (0)	0.5 bc (0)
MOI 201	6.3 a	1.0 a (88)	1.4 ab (0)	1.4 bcd (0)	0.6 a-d (0)	0.8 abc (0)	0.6 bc (0)
NNI-0101 SC	6.4 a	5.4 ef (36)	4.5 cd (15)	3.4 def (0)	1.1 cde (0)	0.4 ab (53)	0.6 bc (0)
QRD 416	6.1 a	5.6 de (30)	6.8 de (0)	6.5 g (0)	1.2 b-e (31)	1.2 bc (0)	0.1 a (85)
Tick-EX	6.3 a	5.4 de (35)	6.1 de (0)	4.9 efg (0)	2.0 ef (0)	1.1 abc (14)	0.7 c (0)
Tolfenpyralid EC	6.3 a	2.4 bc (71)	1.3 ab(45)	1.1 abc (0)	0.3 ab (0)	0.3 a (0)	0.2 a (0)
TriCon	6.9 a	4.0 cde (56)	6.8 de (0)	5.8 fg (0)	3.0 f (0)	1.4 c (27)	0.6 bc (23)
Untreated	6.4 a	8.4 f (0)	8.2 e (0)	5.2 fg (0)	1.4 de (0)	0.9 abc (0)	0.5 bc (0)

[z] Flowers were removed prior to opening throughout the experiment. Mean number of thrips were counted from alcohol extraction of 5 leaves.

[y] Means followed by the same letter are not significantly different Fisher's LSD ($p < 0.05$). Data transformed prior to ANOVA log (x+1). Untransformed means presented in table.

Table 32. Western Flower Thrips Control on Marigold (*Tagetes patula*) 'Jaguar', Gilrein, NY 2008.

Treatment	Rate Per 100 gals	Population Counts [z], Means Separations [y], and Henderson's Percent Control				Immatures % Control
		9/5/08 (precount)	9/15/08	9/23/08*	9/26/08*	10/6/08*
Acelepryn 1.67SC	20 fl oz	4.0 a	3.8 bcd (33)	5.1 bc (0)	6.5 abc (3)	2.9 cd (15)
Conserve 1SC	6 fl oz	4.4 a	2.1 ab (66)	1.6 a (42)	3.5 a (0)	0.5 ab (85)
Kontos (BYI-8330) 2SC (240SC)	1.7 fl oz	4.6 a	6.1 cd (6)	8.3 cd (0)	10.9 c (0)	1.5 bc (56)
NNI-0101 20SC	8 fl oz	3.6 a	4.6 cd (10)	5.0 b (18)	6.1 ab (7)	2.5 cd (26)
Hachi-Hachi 15EC (tolfenpyrad) 15EC	27 fl oz	3.5 a	1.9 a (62)	2.6 a (0)	3.1 a (9)	0.0 a (100)
Tristar 30SG	8 oz	3.5 a	3.6 abc (27)	6.0 bcd (0)	8.4 bc (0)	0.4 ab (88)
Untreated		4.6 a	6.5 d (0)	8.6 d (0)	11.3 c (0)	3.4 d (0)

[z] Mean number of live thrips per 8 plants.

[y] Means followed by the same letter are not significantly different at p=0.05 (Fisher's LSD).

*Data were transformed prior to analysis using ln (y+1)

Treatments applied on 9/8/08, 9/19 and 10/3.

Table 33. Western Flower Thrips Control on Marigold 'Hero Mix' – Application Rates and Dates, Oetting, GA 2008.

Treatment (Active Ingredient)	Rate / 100 gal	Application Dates		
		0 DAT	7 DAT	14 DAT
Acelepryn (DPX-E2Y45) (chlorantraniliprole)	20 fl oz	X		X
Conserve (spinosad)	8 fl oz	X		X
Flagship (thiamethoxam)	8 oz	X		X
Kontos (BYI-8330) (spirotetramat)	1.7 fl oz	X		X
MOI 201	1:500	X	X	X
MOI 201	1:800	X	X	X
NNI-0101 (pyrifluquinazon)	6.3 fl oz	X		X
Tick-EX (Metarhizium anisophiae)	29 fl oz	X	X	X
Hachi-Hachi 15EC (tolfenpyrad)	21 fl oz	X		X
Untreated				

Treatments applied on Apr 24, May 1, and May 8, 2008.

Table 34. Western Flower Thrips Control and Flower Damage Rating on Marigold 'Hero Mix', Oetting, GA 2008.

Treatment	Population Counts [x], Means Separations [y], and Percent Control					Damage Rating (0-100) 34 DAT
	7 DAT	14 DAT	21 DAT	28 DAT[z]	34 DAT[z]	
	Adults					
Acelepryn (DPX-E2Y45)	2.9 a (22)	4.1 a (0)	1.7 b (0)	2.2 a	7.2 ab	52.6 b
Conserve	1.4 a (62)	6.0 a (0)	3.7 ab (0)	2.6 a	16.3 a	23.3 c
Flagship	2.8 a (24)	6.4 a (0)	6.0 a (0)	5.0 a	17.2 a	52.4 b
Kontos (BYI-8330)	1.6 a (57)	3.0 a (25)	3.6 ab (0)	3.6 a	15.1 a	31.4 bc
MOI 201	2.9 a(22)	4.9 a (0)	3.6 ab (0)	3.6 a	14.6 a	37.6 bc
MOI 201	2.7 a (27)	5.6 a (0)	1.7 b (0)	3.6 a	15.4 a	55.1 b
NNI-0101	4.6 a (0)	7.0 a (0)	1.4 b (0)	4.1 a	11.6 ab	53.0 b
Tick-EX	3.0 a (19)	2.7 a (33)	1.6 b (0)	2.0 a	9.2 ab	38.3 bc
Hachi-Hachi 15EC	2.3 a (38)	4.7 a (0)	2.7 b (0)	3.3 a	9.3 ab	28.9 bc
Untreated	3.7 a (0)	4.0 a (0)	1.1 b (0)	2.4 a	4.0 b	98.0 a
	Immatures					
Acelepryn (DPX-E2Y45)	4.6 ab (8)	8.1bcd (29)	4.3 bc (41)	3.2 a	11.0 a	
Conserve	1.3 c (74)	6.1 cd (46)	3.3 bcd (55)	1.9 a	9.1 a	
Flagship	4.0 ab (20)	9.0 a-d (21)	4.6 bc (37)	3.0a	11.2 a	
Kontos (BYI-8330)	3.3 bc (34)	11.6ab (0)	5.1 ab (30)	3.0 a	8.7 a	
MOI 201	3.9 b (22)	8.7 a-d (24)	3.6 bcd (51)	3.3 a	8.7 a	
MOI 201	3.4 bc (32)	11.3abc (1)	4.7 bc (36)	2.1 a	10.2 a	
NNI-0101	4.7 ab (6)	5.3 d (54)	3.4 bcd (53)	2.9 a	9.2 a	
Tick-EX	6.3 a (0)	13.7a (0)	1.6 d (78)	1.4 a	14.7 a	
Hachi-Hachi 15EC	3.7 b (26)	6.0d (47)	2.7 cd (63)	5.1 a	10.3 a	
Untreated	5.0 ab (0)	11.4 ab (0)	7.3 a (0)	1.1 a	1.5 b	

[x] Mean number of immature thrips per 2 flowers knocked five times over a styrifoam bowl 15 cm diam x 5 cm deep .
[y] Means followed by the same letter are not significantly different at p=0.05 (ANOVA and mean separation test).
[z] Check flowers at 28 and 34 DAT were dead or of poor quality.

Petunia. In 2006, an experiment was conducted examining various products on petunia 'Dreams Midnight' for western flower thrips management (Table 35). Thrips adults and immatures were counted by the number shaken

from plant samples, those visibly seen in destructively harvested flowers and buds, and those extracted from meristems with alcohol extraction. All were counted as either immatures or adults. Infestation levels were moderate and efficacy levels were able to be separated statistically with biological significance. Celero at 2 and 4 oz per 100 gal provided excellent control of adults with the higher rate also providing excellent control of immatures. Pylon and Hachi-Hachi 15EC (tolfenpyrad) provided good to excellent control of adults and/or immatures depending on rate. Conserve and BAS 320i did not exhibit adequate levels of thrips management.

Table 35. Western Flower Thrips Control on Petunia (*Petunia sp.*) 'Dreams Midnight', Chen, LA 2006d.

Treatment (Active Ingredient) Rate per 100 gal [z]	Population Counts [y], Means Separations [x], and % Control	
	10 DAT	15 DAT
Adults		
BAS320i 8 fl oz	25.7 a (0)	14.7 a (0)
BAS320i 16 fl oz	19.2 abc (2)	4.5 b (20)
Celero 2 oz	1.2 cd (94)	0.8 b (86)
Celero 4 oz	0.3 d (98)	0.0 b (100)
Conserve 6 oz	14.7 abc (25)	3.2 b (43)
Pylon 5 fl oz	1.0 d (95)	4.3 b (23)
Pylon 10 fl oz	3.8 bcd (81)	1.3 b (77)
Hachi-Hachi 15EC (tolfenpyrad) 14 fl oz	0.5 d (97)	0.8 b (86)
Hachi-Hachi 15EC (tolfenpyrad) 21 fl oz	3.0 cd (85)	3.7 b (34)
Untreated	19.5 ab (0)	5.6 b (0)
Immatures		
BAS320i 8 fl oz	45.5 a (0)	40.7 a (0)
BAS320i 16 fl oz	32.7 a (0)	15.0 bcd (41)
Celero 2 oz	0.8 b (88)	6.5 d (74)
Celero 4 oz	0.0 b (100)	0.8 d (97)
Conserve 6 oz	6.8 b (0)	24.5 ab (3)
Pylon 5 fl oz	0.3 b (96)	7.7 cd (70)
Pylon 10 fl oz	2.3 b (66)	6.0 d (76)
Hachi-Hachi 15EC (tolfenpyrad) 14 fl oz	2.0 b (71)	6.3 d (75)
Hachi-Hachi 15EC (tolfenpyrad) 21 fl oz	2.2 b (68)	16.7 bcd (34)
Untreated	6.8 b (0)	25.3 ab (0)
Total Population		
BAS320i 8 fl oz	71.2 (0)	55.4 (0)
BAS320i 16 fl oz	51.9 (0)	19.5 (37)
Celero 2 oz	2.0 (92)	7.3 (76)
Celero 4 oz	0.3 (99)	0.8 (97)
Conserve 6 oz	21.5 (18)	27.7 (10)
Pylon 5 fl oz	1.3 (95)	12.0 (61)
Pylon 10 fl oz	6.1 (77)	7.3 (76)
Hachi-Hachi 15EC (tolfenpyrad) 14 fl oz	2.5 (90)	7.1 (77)
Hachi-Hachi 15EC (tolfenpyrad) 21 fl oz	5.2 (80)	20.4 (34)
Untreated	26.3 (0)	30.9 (0)

[z] All treatments were foliar sprays applied on June 18, 2007.

[y] Mean number of thrips were counted three ways: 1) the number shaken from plant samples 2) destructively harvesting flowers and buds, and 3) alcohol extraction of meristems.

Portulaca. During 2006 and 2007, two experiments were conducted for western flower thrips control on portulaca. In both experiments, adult and immature thrips were counted after alcohol extraction of flowers. In the first experiment (Table 36), infestation levels were moderate, but the population dramatically decreased by 21 DAT so no more meaningful data could be collected. By 14 DAT all treatments except Aria and Conserve provided statistically significantly control of immature thrips. In the second experiment (Table 37), infestation levels were quite high with the initial populations ranging from 51.5 to 122.3 adults and 17.5 to 69.0 immatures per 5 flowers. At 7 DAT, DPX-HGW86, Overture, Pylon, and Hachi-Hachi 15EC (tolfenpyrad) provided good to excellent control of immatures; however, this control appeared to be short-lived perhaps because infestation levels were quite high and because portulaca is constantly blooming and flowers assessed later had not been treated. The best product for residual control of immatures in this experiment was Kontos (BYI-8330) with 91% control 28 days after the initial foliar application.

Table 36. Western Flower Thrips Control on Portulaca (*Portulaca grandiflora*), Ludwig, TX 2006.

Treatment (Active Ingredient) Rate per 100 gal [z]	Population Counts [y], Means Separations [x], and % Control		
	0 DAT	7 DAT	14 DAT
Adults			
Acelepryn (DPX-E2Y45)	2.7	24.8 (0)	4.0 (0)
Aria 120 g	9.8	22.8 (0)	4.0 (25)
Celero (drench) 4 oz	7.2	25.8 (0)	5.3 (0)
Conserve 11 fl oz	6.7	32.2 (0)	11.3 (0)
Flagship (drench) 4 oz	8.3	9.3 (39)	1.7 (63)
Flagship 4 oz	7.7	17.7 (0)	10.2 (0)
Kontos (BYI-8330) 1.7 fl oz	10.0	30.3 (0)	9.0 (0)
Overture 8 oz	9.2	23.0 (0)	7.3 (0)
Overture 12 oz	4.2	16.2 (0)	7.2 (0)
Hachi-Hachi 15EC (tolfenpyrad) 21 oz	12.2	19.3 (13)	5.5 (16)
TriStar 30SG 96g	5.5	5.7 (44)	4.2 (0)
Untreated	12.3	22.5 (0)	6.7 (0)
Immatures			
Acelepryn (DPX-E2Y45)	3.7 a	2.0 a (87)	6.5 b (83)
Aria 120 g	2.5 a	4.8 a (55)	11.7 ab (56)
Celero (drench) 4 oz	1.5 a	1.3 a (79)	1.7 b (89)
Conserve 11 fl oz	2.3 a	1.3 a (87)	6.2 ab (75)
Flagship (drench) 4 oz	2.8 a	0.8 a (93)	0.5 b (98)
Flagship 4 oz	5.2 a	1.7 a (92)	1.0 b (98)
Kontos (BYI-8330) 1.7 fl oz	3.2 a	4.7 a (65)	2.2 b (93)
Overture 8 oz	3.5 a	1.5 a (90)	0.7 b (98)
Overture 12 oz	4.2 a	1.0 a (94)	1.2 b (97)
Hachi-Hachi 15EC (tolfenpyrad) 21 oz	2.3 a	7.3 a (26)	0.5 b (98)
TriStar 30SG 96g	4.0 a	1.0 a (94)	0.8 b (98)
Untreated	2.0 a	8.5 a (0)	21.0 b (0)

[z] All treatments were applied on June 30.

[y] Mean number of thrips were counted after alcohol extraction.

[x] Means within a column followed by the same letter are not significantly different Scheffe All-Pairwise Comparisons Test at the $P<0.05$ level.

Table 37. Western Flower Thrips Control on Portulaca (*Portulaca grandiflora*), Ludwig, TX 2007.

Treatment (Active Ingredient) Rate per 100 gal [z]	Population Counts [y], Means Separations [x], and Henderson's Percent Control				
	0 DAT	7 DAT	14 DAT	21 DAT	28 DAT
Adults					
Acelepryn (DPX-E2Y45) (20 fl oz)	81.5 a	54.2 a (3)	34.2 a (44)	19.7 a (17)	34.0 a (0)
Celero (2 oz - drench)	99.3 a	32.2 ab (53)	38.2 a (49)	20.7 a (28)	28.2 a (0)
Celero (4 oz – drench)	53.3 a	24.0 ab (34)	31.0 a (22)	27.8 a (0)	21.8 a (0)
Conserve (11 fl oz)	61.0 a	25.0 ab (40)	41.8 a (9)	40.3 a (0)	28.5 a (0)
DPX-HGW86 (40 fl oz)	119.8 a	10.0 b (88)	24.8 a (72)	12.8 a (63)	20.3 a (38)
Flagship (4 oz – drench)	44.0 a	32.2 ab (0)	35.0 a (0)	13.0 a (0)	32.8 a (0)
Flagship (4 oz)	69.2 a	26.4 ab (44)	36.2 a (30)	19.5 a (3)	30.8 a (0)
Kontos (BYI-8330) (1.7 fl oz)	122.3 a	44.8 a (46)	35.3 a (62)	19.0 a (47)	33.2 a (1)
Overture (12 oz)	73.0 a	12.6 b (75)	18.7 a (66)	9.8 a (54)	23.0 a (0)
Overture (8 oz)	118.2 a	11.2 b (86)	23.3 a (74)	9.0 a (74)	17.5 a (46)
Pylon (10 fl oz)	51.5 a	11.6 b (67)	24.7 a (36)	13.3 a (11)	41.5 a (0)
Pylon (5 fl oz)	140.2 a	16.8 ab (82)	19.7 a (81)	9.5 a (77)	16.8 a (56)
S1812 (12 oz)	102.5 a	19.2 ab (73)	47.3 a (39)	17.8 a (40)	37.2 a (0)
S1812 (8 oz)	57.8 a	26.6 ab (33)	33.7 a (22)	8.3 a (51)	21.3 a (0)
Hachi-Hachi 15EC (14 fl oz)	108.5 a	17.8 ab (76)	28.7 a (65)	11.2 a (64)	42.7 a (0)
Hachi-Hachi 15EC (21 fl oz)	83.0 a	14.8 ab (74)	31.3 a (50)	12.2 a (49)	23.2 a (0)
TriStar 30SG (96 g)	71.7 a	36.4 ab (26)	34.7 a (36)	12.3 a (41)	27.5 a (0)
Untreated	63.7 a	43.6 a (0)	47.8 a (0)	18.5 a (0)	17.5 a (0)
Nymphs					
Acelepryn (DPX-E2Y45) (20 fl oz)	34.0 a	180.8 a (0)	25.5 ab (33)	26.5 ab (0)	26.5 abc (0)
Celero (2 oz - drench)	69.0 a	76.4 abc (76)	24.0 ab (69)	23.8 abcd (41)	15.0 abcde (67)
Celero (4 oz – drench)	38.7 a	73.6 abc (59)	29.2 ab (32)	36.5 a (0)	17.8 abcde (30)
Conserve (11 fl oz)	51.7 a	48.0 abcd (80)	27.0 ab (53)	31.2 abc (0)	11.7 abcde (65)
DPX-HGW86 (40 fl oz)	36.2 a	6.2 fg (96)	33.5 ab (17)	7.5 bcdef (64)	6.2 cde (74)
Flagship (4 oz – drench)	30.7 a	62.8 abc (55)	27.8 ab (19)	14.8 abcde (17)	12.2 bcde (39)
Flagship (4 oz)	21.0 a	87.0 abc (10)	24.2 ab (0)	24.3 ab (0)	13.3 abcde (3)
Kontos (BYI-8330) (1.7 fl oz)	66.0 a	63.8 bcd (79)	5.2 b (93)	2.7 def (93)	4.0 de (91)
Overture (12 oz)	17.5 a	1.8 g (98)	19.2 ab (1)	2.7 f (74)	7.5 cde (34)
Overture (8 oz)	34.0 a	1.4 g (99)	12.0 ab (68)	5.2 cdef (74)	2.5 e (89)
Pylon (10 fl oz)	26.8 a	19.4 cdef (84)	50.2 ab (0)	5.3 abcdef (66)	10.3 abcde (41)
Pylon (5 fl oz)	32.7 a	14.6 def (90)	17.0 ab (53)	3.5 cdef (82)	3.6 de (83)
S1812 (12 oz)	34.7 a	30.4 cde (81)	65.5 a (0)	4.5 def (78)	3.3 de (85)
S1812 (8 oz)	19.7 a	17.4 cdef (81)	26.8 ab (0)	5.7 bcdef (50)	11.0 cde (15)
Hachi-Hachi 15EC (14 fl oz)	76.3 a	11.8 def (97)	48.3 a (43)	6.7 bcdef (85)	44.2 ab (11)
Hachi-Hachi 15EC (21 fl oz)	16.8 a	5.8 efg (92)	51.3 a (0)	3.2 ef (67)	51.0 a (0)
TriStar 30SG (96 g)	37.8 a	49.6 abcd (71)	26.3 ab (37)	17.3 abcdef (22)	12.0 abcde (51)
Untreated	29.5 a	135.6 ab (0)	32.8 ab (0)	17.2 abcde (0)	19.3 abcd (0)

[z] All treatments were applied on June 11; all foliar applications were repeated on June 25.

[y] Mean number of thrips were counted from 5 flowers per plant after alcohol extraction.

[x] Means separation was accomplished by using Tukeys HSD test (LSD) at the $P<0.05$ level. Data transformed prior to ANOVA log (x+1); untransformed means presented in table

Rose. In 2006, one experiment was conducted to examine various treatments to manage western flower thrips on miniature rose 'Red Sunblase' (Table 56). Thrips adults and immatures were counted on two blossoms from each treated plant at each reading date. In this experiment, infestation levels were fairly high with an average of 79.0 adult and immature thrips per two flowers. While all products had significantly reduced population levels from the control, none of the treatments provided outstanding percent control; however, the infestation levels were high and it is difficult for materials to fully penetrate flowers structured like roses. The best treatment was Hachi-Hachi 15EC (tolfenpyrad) at 21 fl oz which provided good control of both adults and immatures. The next best were Celero at 4 oz and thiamethoxam drenched at 4 oz. Conserve, acetamiprid, imidacloprid, and Pylon did not provide adequate levels of control in this experiment.

Table 38. Efficacy of several insecticides for *Frankliniella occidentalis* on Miniature Rose 'Red Sunblase', Walsh, 2006.

Treatment	Rate	Population Counts [z], Means Separations [y], Percent Control [x]	
		6 DAT	12 DAT
Adults			
Assail 30G (acetamiprid)	5 oz dry rate/100 gal	4.0 a (69)	2.7 a (68)
Avid (abamectin)	8 fluid oz/ 100 gal	3.7 a (71)	5.5 a (36)
Celero 16 WSG (clothianadin)	2 oz/100 gal	4.2 a (68)	3.8 a (55)
Celero 16 WSG (clothianadin)	4 oz/100 gal	2.6 a (80)	3.0 a (65)
Conserve SC (spinosad)	11 fluid oz/ 100 gal	4.2 a (68)	4.3 a (49)
Movento OD (spirotetramat) + OSS	8 oz/100 gal	8.0 a (39)	3.5 a (59)
Movento OD (spirotetramat) + OSS	12 oz/ 100 gal	7.0 a (46)	6.1 a (29)
Pylon (chlorfenapyr)	5 fl oz/ 100 gal	3.4 a (74)	3.5 a (59)
Pylon (chlorfenapyr)	10 fl oz/ 100 gal	5.7 a (57)	4.2 a (51)
Thiamethoxam	4 oz per 100 gal	3.3 a (75)	3.3 a (62)
Thiamethoxam	4 oz per 100 gal Drench	3.8 a (71)	3.6 a (58)
Hachi-Hachi 15EC (tolfenpyrad)	14 fl oz/ 100 gal	3.8 a (71)	3.5 a (59)
Hachi-Hachi 15EC (tolfenpyrad)	21 fl oz/ 100 gal	1.5 a (88)	1.3 a (84)
Untreated		13.1 b (0)	8.5 b (0)
Immatures			
Assail 30G (acetamiprid)	5 oz dry rate/100 gal	37.1 a (44)	23.0 a (59)
Avid (abamectin)	8 fluid oz/ 100 gal	65.9 b (0)	65.3 b (0)
Celero 16 WSG (clothianadin)	2 oz/100 gal	21.8 a (67)	34.6 a (39)
Celero 16 WSG (clothianadin)	4 oz/100 gal	14.9 a (77)	31.9 a (44)
Conserve SC (spinosad)	11 fluid oz/ 100 gal	39.6 a (40)	33.9 a (40)
Movento OD (spirotetramat) + OSS	8 oz/100 gal	38.3 a (42)	34.7 a (39)
Movento OD (spirotetramat) + OSS	12 oz/ 100 gal	37.7 a (43)	38.6 a (32)
Pylon (chlorfenapyr)	5 fl oz/ 100 gal	26.2 a (60)	28.7 a (49)
Pylon (chlorfenapyr)	10 fl oz/ 100 gal	36.3 a (45)	31.7 a (44)
Thiamethoxam	4 oz per 100 gal	31.9 a (52)	33.9 a (40)
Thiamethoxam	4 oz per 100 gal Drench	16.6 a (75)	18.4 a (68)
Hachi-Hachi 15EC (tolfenpyrad)	14 fl oz/ 100 gal	17.9 a (73)	30.4 a (46)
Hachi-Hachi 15EC (tolfenpyrad)	21 fl oz/ 100 gal	8.5 a (87)	14.2 a (75)
Untreated		65.9 b (0)	56.7 b (0)

[z] Populations were counted on two blossoms per plant at each reading

[y] All letters following numbers within a column, that are different, are significantly different at the <0.05 level

[x] Percent control was calculated as follows (Untreated – Treatment)/Untreated * 100.

Verbena. In 2008, one experiment was conducted to examine various treatments to manage western flower thrips on verbena 'Lorgo Purple (Tables 57 and 58). Counts were made of live thrips and feeding scars on leaves, and damage rating (0-100) taken at the end of experiment. Conserve, Flagship, BYI 8330, NAI 2302 and MOI 201 were effective in reducing the number of thrips and feeding damage. The standard Conserve was consistently the best treatment. Data indicated that Tick-EX has less residual activity.

Table 39. Western Flower Thrips Control on Verbena 'Lorgo Purple' – Application Rates and Dates, Oetting, GA 2008.

Treatment (Active Ingredient)	Rate / 100 gal	Application Dates		
		0 DAT	6 DAT	13 DAT
Acelepryn (DPX E2Y45) (chlorantraniliprole)	20 fl oz	X		X
Conserve (spinosad)	8 fl oz	X		X
Flagship (thiamethoxam)	8 oz	X		X
Hachi-Hachi 15EC (tolfenpyrad)	21 fl oz	X		X
Kontos (BYI 8330) (spirotetramat)	1.7 fl oz	X		X
MOI 201	1:500	X	X	X
MOI 201	1:800	X	X	X
NNI-0101 (pyrifluquinazon)	6.3 fl oz	X		X
Tick-EX (*Metarhizium anisopliae*)	29 fl oz	X	X	X
Untreated				

Treatments applied on April 11, 17, and 24, 2008.

Table 40. Western Flower Thrips Control on and Damage on Verbena 'Lorgo Purple', Oetting, GA 2008.

Treatment	Population Counts [x], Means Separations [y], and Percent Control				Number of Feeding Scars[x], Means Separations [y], and Percent Reduction				Damage Rating (0-100) 34 DAT
	6 DAT	13 DAT	27 DAT	34 DAT	6 DAT	13 DAT	27 DAT	34 DAT	
Acelepryn	2.0 a (5)	2.0 b (59)	4.7 c (80)	4.0 bc (79)	37.7 a (0)	25.6 ab (23)	23.3 c (65)	28.1 c (67)	34.3 bcd (55)
Conserve	0.1 b (95)	0.0 c (100)	2.3 c (90)	1.9 c (90)	16.4 cd (50)	4.4 e (87)	10.3 d (84)	10.0 d (88)	24.3 de (68)
Flagship	0.4 b (81)	1.4 bc (71)	4.3 c (81)	1.3 c (93)	21.3 bcd (36)	10.0 de (70)	13.6 cd (79)	17.3 cd (80)	17.9 e (77)
Kontos	1.4 ab (33)	2.1 b (57)	3.4 c (85)	2.4 c (87)	26.1 a-d (21)	20.9 bc (37)	21.7 c (67)	26.9 c (69)	28.6 cde (63)
MOI 201 (1:500)	0.9 ab (57)	0.0 c (100)	2.0 c (91)	3.4 bc (82)	13.3 d (60)	3.9 e (88)	15.3 de (77)	23.1 c (73)	27.1 cde (65)
MOI 201 (1:800)	1.1 ab (48)	0.6 bc (88)	5.6 c (76)	2.7 c (86)	18.0 cd (46)	8.0 e (76)	20.9 cd (68)	24.3 c (72)	31.4 cde (59)
NAI 2302	0.4 b (81)	1.4 bc (71)	3.1 c (87)	1.3 c (93)	27.3 abc (18)	12.1 de (64)	14.4 cd (78)	17.7 cd (79)	25.0 de (67)
NNI-0101	1.1 ab (48)	1.1 bc (78)	6.9 bc (70)	2.3 c (88)	17.4 cd (47)	10.4 de (69)	17.9 cd (73)	17.1 cd (80)	41.1 bc (47)
Tick-EX	1.1 ab (48)	1.4 bc (71)	11.4 b (50)	7.0 b (63)	20.1 bcd (39)	16.7 cd (50)	42.0 b (36)	46.9 b (45)	48.3 b (37)
Untreated	2.1 a (0)	4.9 a (0)	23.0 a (0)	18.8 a (0)	33.1 ab (0)	33.3 a (0)	66.0 a (0)	85.8 a (0)	76.9 a (0)

[x] Mean number of live thrips and feeding scars on 18 leaves (6 most fully developed leaves each on 3 stems).

[y] Means followed by the same letter are not significantly different at p=0.05 (ANOVA and mean separation test).

Phytotoxicity

In general, Hachi-Hachi 15EC appeared to have little negative effects on crops tested during the efficacy experiments. However, in the gladiolus bulb dip experiment, Hachi-Hachi did cause stunting and chlorosis and did injure impatiens. In the first data set received for examining crop safety on a wide variety of crops, did injure impatiens to a level that it not be recommended for use on this crop. Hachi-Hachi also caused temporary moderate damage on begonia and marigold but did not impact petunia. The other tolfenpyrad formulation (Tolfenpyrad SC) also caused significant damage on impatiens with slight temporary impact on begonia and marigold. It also did not injure petunia.

Additional crop safety testing is warranted to clarify the list of sensitive species.

Table 41. Summary of Efficacy By Product and Pest

Note: Table entries are sorted by crop Latin name. Only those trials received by 9/17/2010 are included in the table below.

PR #	Product	Pest Common Name	Pest Latin Name	Crop Common Name	Crop Latin Name	Crop Cultivar	Production Site	Researcher	Year	Application	Results	File Name
28768	Hachi-Hachi	Privet Thrips	Dendrothrips ornatus	New Mexican Privet	Forestiera neomexicana		Field In-Ground	Cranshaw	2008	Foliar	Trial was sprinkler irrigated 3 hours after treatment. Good control at 21 fl oz per 100 gal; equal to Conserve	20090129o.pdf
27983	Hachi-Hachi	Western Flower Thrips	Frankliniella occidentalis	Cosmos	Cosmos sp.	C. binnatus 'Picotee'	Field In-Ground	Cranshaw	2008	Foliar	Under continuous reinvasion by migrant thrips in this trial, no treatment provided significant control	20090129o.pdf
26130	Hachi-Hachi	Western Flower Thrips	Frankliniella occidentalis	Transvaal Daisy	Gerbera sp.	G. jamesonii 'Festival Dark Eye Golden Yellow'	Greenhouse	Canas	2006	Foliar	Good initial control of nymph populations on leaves at 21 oz per 100 gal.	20061005t.pdf
26130	Hachi-Hachi	Western Flower Thrips	Frankliniella occidentalis	Transvaal Daisy	Gerbera sp.	G. jamesonii 'Royal'	Greenhouse	Parrella	2006	Foliar	Delayed excellent efficacy at 14 and 21 oz per 100 gal as assessed by adult populations on yellow sticky cards after plants placed into paper bags.	20070719d.pdf
26185	Hachi-Hachi	Western Flower Thrips	Frankliniella occidentalis	New Guinea Impatiens	Impatiens New Guinea hybrids	I. wallerana 'Super Elfin Cherry'	Greenhouse	Chen	2006	Foliar	Inconsistent control of a low infestation at 14 and 21 fl oz per 100 gal; inferior to standard	20071022e.pdf
26185	Hachi-Hachi	Western Flower Thrips	Frankliniella occidentalis	New Guinea Impatiens	Impatiens New Guinea hybrids	I. wallerana 'Super Elfin Cherry'	Greenhouse	Chen	2006	Foliar	Poor control at 14 and 21 fl oz per 100 gal; minor flower injury.	20071022f.pdf
26185	Hachi-Hachi	Western Flower Thrips	Frankliniella occidentalis	New Guinea Impatiens	Impatiens New Guinea hybrids	I. balsamina	Greenhouse	Reding	2007	Foliar	Significantly reduced thrips (adults and nymphs) but caused high injury at 14 and 21 fl oz per 100 gal; higher Impatiens	20080128i.pdf

											Necrotic Spot Virus infection vs. Untreated	
27367	Hachi-Hachi	Western Flower Thrips	Frankliniella occidentalis	Petunia	Petunia sp.	'Dreams Midnight'	Greenhouse	Chen	2006	Foliar	Good control of a high infestation at 14 and 21 fl oz per 100 gal; better than standard	20071022f.pdf
26118	Hachi-Hachi	Western Flower Thrips	Frankliniella occidentalis	Purslane	Portulaca sp.	P. grandiflora	Greenhouse	Ludwig	2006	Foliar	Excellent efficacy on nymphs 14 DAT at 21 fl oz per 100 gal; trial ended prematurely	20070411c.pdf
26118	Hachi-Hachi	Western Flower Thrips	Frankliniella occidentalis	Purslane	Portulaca sp.		Greenhouse	Ludwig	2007	Foliar	Short residual activity at 14 and 21 fl oz per 100 gal	20071220g.pdf
26045	Hachi-Hachi	Western Flower Thrips	Frankliniella occidentalis	Rose	Rosa sp.	'Red Sunblase'	Greenhouse	Walsh	2006	Foliar	Significantly reduced adult and immature thrips at 14 and 21 fl oz per 100 gal; higher rate more effective	20080401a.pdf
26057	Hachi-Hachi	Western Flower Thrips	Frankliniella occidentalis	Marigold	Tagetes sp.	T. patula 'Yellow Boy'	Greenhouse	Davis	2007	Foliar	Good control at 14 and 21 oz per 100 gal	20080207b.pdf
26057	Hachi-Hachi	Western Flower Thrips	Frankliniella occidentalis	Marigold	Tagetes sp.	T. patula 'Yellow Boy'	Greenhouse	Davis	2008	Foliar	Good control at 21 fl oz per 100 gal; equal to Conserve and Mesurol	20090122a.pdf
26057	Hachi-Hachi	Western Flower Thrips	Frankliniella occidentalis	Marigold	Tagetes sp.	T. patula 'Yellow Boy'	Greenhouse	Davis	2009	Foliar	Excellent control of immatures at 21 fl oz + NIS per 100 gal applied 2 times; better than Conserve applied 4 times	20090930b.pdf
26057	Hachi-Hachi	Western Flower Thrips	Frankliniella occidentalis	Marigold	Tagetes sp.	'Jaguar'	Greenhouse	Gilrein	2008	Foliar	Great to excellent control of adults and immatures using 27 fl oz per 100 gal.	20090319g.pdf
26057	Hachi-Hachi	Western Flower Thrips	Frankliniella occidentalis	Marigold	Tagetes sp.	'Hero Mix'	Greenhouse	Oetting	2008	Foliar	Significantly reduced immatures on flowers and damage to flowers and foliage at 21 fl oz per 100 gal; equal to standard	20081021a.pdf
241	Hachi-Hachi	Western Flower Thrips	Frankliniella occidentalis	Vervain	Verbena sp.	'Lorgo Purple'	Greenhouse	Oetting	2008	Foliar	Significantly reduced immatures on and damage to foliage at	20081021a.pdf

											21 fl oz per 100 gal; equal to standard	
27621	Hachi-Hachi	Black Vine Weevil - adults	Otiorhynchus sulcatus - adults	Yew	Taxus media		Field Container	Nielsen	2007	Foliar	No efficacy at 21 fl oz per 100 gal.	20071220a.pdf
27920	Hachi-Hachi	Black Vine Weevil - grubs	Otiorhynchus sulcatus - grubs	Strawberry (Non-Bearing)	Fragaria sp.	'Idea'	Field Container	Cowles	2008	Soil Incorporation	Inconclusive data due to low untreated population; excellent root rating at 10 ppm.	20080910c.pdf
29327	Hachi-Hachi	Phytotoxicity	Phytotoxicity	Begonia	Begonia sp.		Greenhouse	Davis	2010	Foliar	Moderate, but transitory injury at 21, 42, and 84 fl oz per 100 gal.	
29330	Hachi-Hachi	Phytotoxicity	Phytotoxicity	Balsam	Impatiens sp.	I. walleriana 'Dazzler Pink'	Greenhouse	Davis	2010	Foliar	Significant injury at 21, 42, and 84 fl oz per 100 gal.	
29332	Hachi-Hachi	Phytotoxicity	Phytotoxicity	Petunia	Petunia sp.	P. x hybrida 'Prism Sunshine'	Greenhouse	Davis	2010	Foliar	No significant injury at 21, 42, and 84 fl oz per 100 gal.	
29333	Hachi-Hachi	Phytotoxicity	Phytotoxicity	Marigold	Tagetes sp.	T. erecta 'Inca Orange'	Greenhouse	Davis	2010	Foliar	Moderate, but transitory injury at 21, 42, and 84 fl oz per 100 gal.	
27840	Hachi-Hachi	Banded Ash Clearwing Borer	Podosesia aureocincta	Ash	Fraxinus sp.	F. pennsylvanica	Field In-Ground	Nielsen	2008	Trunk spray	Low infestation. Excellent efficacy at 24 fl oz per 100 gal.	20090929a.pdf
26951	Hachi-Hachi	Japanese Beetle - adults	Popillia japonica - adults	Rose	Rosa sp.	'Blushing'	Field Container	Braman	2008	Foliar	Virtually no control at 21 fl oz per 100 gal.	20081013a.pdf
26951	Hachi-Hachi	Japanese Beetle - adults	Popillia japonica - adults	Rose	Rosa sp.	R. x odorata 'Tiffany	Field Container	Davis	2009	Foliar	Poor efficacy at 21 fl oz per 100 gal + NIS.	20090928a.pdf
26951	Hachi-Hachi	Japanese Beetle - adults	Popillia japonica - adults	Rose	Rosa sp.	'Julia Child Butter Gold'	Field Container	Schultz	2007	Foliar	Good efficacy; some foliar feeding damage.	20071219k.pdf
26404	Hachi-Hachi	Viburnum leaf beetle	Pyrrhalta viburni	Arrowwood	Viburnum sp.		Field Container	Costa	2007	Foliar	Some reduction in defoliation severity and extent using 21 fl (?) oz per 100 gal, equivalent level to permethrin.	20071219l.pdf

29869	Hachi-Hachi	Viburnum leaf beetle	Pyrrhalta viburni	Arrowwood	Viburnum sp.		Field In-Ground	Weston	2007	Foliar	Effective control at 21 oz per 100 gal; equal to imidacloprid.	20071219m.pdf
26679	Hachi-Hachi	Chilli Thrips, Yellow Tea Thrips	Scirtothrips dorsalis	Rose	Rosa sp.	'Knockout'	Greenhouse	Ludwig	2007	Foliar	Significantly reduced immature thrips on flowers at 14, but not at 21 fl oz per 100 gal	20080204f.pdf
29296	Hachi-Hachi	Peachtree Borer	Synanthedon exitiosa	Cherry (Non-Bearing)	Prunus sp.	P. cistina	Field In-Ground	Nielsen	2009	Foliar	Poor control at 21 fl oz per 100 gal.	20090923c.pdf
28853	Hachi-Hachi	Red Headed Flea Beetle	Systena frontalis	Joepye weed, Spotted	Eupatorium maculatum		Field Container	Kunkel	2008	Foliar	No significant control at 21 oz per 100 gal; data not reliable due to high Control mortality and unfavorable environment.	20090212a.pdf
25555	Hachi-Hachi	Gladiolus Thrips	Thrips simplex	Corn Flag, Sword Lily	Gladiolus sp.		Cold Storage	Davis	2006	Dipped in solution	Excellent efficacy at 9.29 ml per 3 gal	20070202a.pdf
29139	Hachi-Hachi	Redbay Ambrosia Beetle	Xyleborus glabratus	Redbay	Persea borbonia		Field In-Ground	Pena	2009	Foliar	Trial not successful - no damage developed after infesting trees with beetles 3 different times.	20091120a.pdf
29496	Hachi-Hachi	Ambrosia Beetle	Xylosandrus crassiusculus	Sweet Bay	Magnolia virginiana		Field Container	Reding	2009	Trunk spray	Signifcantly reduced X. germanus beetle attacks for < 5 days at 21 fl oz per 100 gal; comparable to Onyx.	20091130q.pdf
29496	Hachi-Hachi	Ambrosia Beetle	Xylosandrus crassiusculus	Sweet Bay	Magnolia virginiana		Field Container	Schultz	2009	Trunk spray	No control at 21 fl oz per 100 gal.	20100512a.pdf
29337	Tolfenpyrad SC	Phytotoxicity	Phytotoxicity	Begonia	Begonia sp.		Greenhouse	Davis	2010	Foliar	Slight, but transitory injury at 21, 42, and 84 fl oz per 100 gal.	
29341	Tolfenpyrad SC	Phytotoxicity	Phytotoxicity	Balsam	Impatiens sp.	I. walleriana 'Dazzler Pink'	Greenhouse	Davis	2010	Foliar	Significant injury at 21, 42, and 84 fl oz per 100 gal.	
29342	Tolfenpyrad SC	Phytotoxicity	Phytotoxicity	Petunia	Petunia sp.	P. x hybrida 'Prism Sunshine'	Greenhouse	Davis	2010	Foliar	No significant injury at 21, 42, and 84 fl oz per 100 gal.	
29343	Tolfenpyrad SC	Phytotoxicity	Phytotoxicity	Marigold	Tagetes sp.	T. erecta 'Inca Orange'	Greenhouse	Davis	2010	Foliar	Moderate, but transitory injury at 21,	

											42, and 84 fl oz per 100 gal.	

Label Suggestions

Based upon data accumulated through the IR-4 research program in 2006-2010, we suggest Viburnum leaf beetle be added to the Hachi-Hachi label along with several other coleopteran insects if additional data are available. It is also suggested that Impatiens be added to the label as a crop that should not be treated with Hachi-Hachi:

Appendix 1: Protocols

Efficacy of Several Products for Managing Thrips Insects.

Ornamental Protocol Number: 06-004

Objective: Determine efficacy of new active ingredient formulations and new biopesticides for managing thrips infesting ornamental horticulture plants.

Experimental Design:

Plot Size: Must be adequate to reflect actual use conditions.

Replicates: Minimum of 6 if infesting plant materials or 12 replications if relying upon natural infestations

Application Instructions: Apply each treatment according to directions below. For foliar applications, make two consecutive applications 7 to 14 days apart according to manufacturer instructions. If no such instructions are available in the table below, apply at 14 days apart. For drench applications, make a single treatment to soil profile using sufficient volume to treat soil profile or a volume specified by manufacturer. Applications should be made using application equipment consistent with conventional commercial equipment.

Target Species: Western Flower Thrips (*Frankliniella occidentalis*), Onion Thrips (*Thrips tabaci*), Cuban Laurel Thrips (*Gynaikothrips ficorum*) or other species. Contact your regional coordinator if additional target species are of interest.

Plant Hosts: Use a plant host suitable for target species, such as snapdragons, cosmos or lisianthus. Record crop species and variety used.

Use Site: May be greenhouse, field container or field in-ground. Please specify in final report.

Evaluations: Record initial thrips population (all countable life stages – larvae, pupae, adults) and initial thrips feeding damage. Larvae and pupae may be counted together as immatures. Evaluations should occur 0, 7, 14, 28, 42, and 56 days after application or until no efficacy. Record plant height & width at initial and final evaluations only. Record phytotoxicity at each rating date on a scale of 0 to 10 (0 = no phytotoxicity; 10 = complete kill). If phytotoxicity is observed in treated plants, take pictures comparing treated and untreated plant material.

If different application methods or evaluations are made, please clearly specify differences in final report and explain how they enhanced results.

Recordkeeping: Keep detailed records of weather conditions including temperature and precipitation, soil-type or soil-less media, application equipment, application volume per area, irrigation, pot/liner size, plant height & width, and plant growth stage at application and data collection dates.

Treatments:

See tables on the following pages. Standards and A priority treatments are in the first table. B and C priority treatments are in the second table.

Reports:

Reports must include:

Results summary (no more than one page)

Summary table with appropriate statistical analyses

Experimental design and materials and methods

Appendices: raw data and recordkeeping information as listed above

If pictures were taken, please include them.

A report submitted electronically is preferred but not required. If the report is provided electronically, the basic report can be sent in MS Word or WordPerfect, the recordkeeping information as pdf or other electronic documents, and the raw data in MS Excel or other suitable program such as ARM.

Please direct questions to: Cristi Palmer, IR-4 HQ, Rutgers University, 681 US Hwy 1 S, North Brunswick, NJ 08902-3390, Phone 732-932-9575 x629, palmer@aesop.rutgers.edu **OR** Ely Vea, 308 Aston Forest Lane, Crownsville, MD 21032, Phone & FAX#: 410-923-4880, E-mail: evvea@comcast.net.

Draft Date: 7/19/2006
Revised By: CLP

Priority A and Standard Treatments List with rates, special application instructions, and contact information to obtain product and any suitable adjuvant needed.

Priority	#	**Product (active)**	**Rates**	**Special Application Instructions**	**Contact Information to obtain materials and any needed adjuvants**
A	1	BAS 320i	11.5 fl oz per 100 gal	Heavy foliar spray (sprench)	BASF, Kathie Kalmowitz, 919-785-9659, kalmowk@basf-corp.com
	2	BAS 320i	23 fl oz per 100 gal		
	3	Celero 16WSG (clothianadin)	2 oz per 100 gal	Single application. Drench to fully wet root profile	Arysta, Doug Houseworth, 904-321-0795, LlHouse9@aol.com
	4	Celero 16WSG (clothianadin)	4 oz per 100 gal		
	5	Flagship 25WG (thiamethoxam)	4 oz per 100 gal	Foliar spray treatment – using 200 gal per acre	Syngenta, Dave Ross, 336-632-6411, david.ross@syngenta.com
	6	Flagship 25WG (thiamethoxam)	4 oz per 100 gal	Drench Treatment - using 2 oz per l/4 inch pot	
	7	Pylon (chlorfenapyr)	5 fl oz per 100 gal	Greenhouse uses only; two applications 7 d apart spraying to wet the foliage; do not use surfactants	OHP, Jeff Dobbs, 770.992.0121, jdobbs@ohp.com
	8	Pylon (chlorfenapyr)	10 fl oz per 100 gal		
	9	Tolfenpyrad	14 fl oz per 100 gal	Evaluate all stages of development	Nichino America, David King, 302-636-9001x220, david.king@nichino.net
	10	Tolfenpyrad	21 fl oz per 100 gal	Evaluate all stages of development	
Standards	11	Standard Control Tool 1*	See below	See below	See below
	12	Standard Control Tool 2*	See below	See below	See below
	13	Untreated	--	--	

Standards	a	Avid (abamectin)	8 fl oz / 100 gal	Note: suppression only, immature thrips must be in contact with spray	Syngenta, Dave Ross, 336-632-6411, david.ross@syngenta.com
	b	Conserve (spinosad)	6 – 11 fl oz / 100 gal		Dow AgroSciences, Mike Melichar, (317) 337-4982, mwmelichar@dow.com
	c	Mesurol (methiocarb)	½ -1 lb / 100 gallon	Do not combine with foliar fertilizers; make only 2 applications per season; 10 day interval required	Gowan, Kory Wheeler, 928-819-1592, Kwheeler@gowanco.com
	d	Other suitable registered material	See label for use directions		

Priority B & C Treatments List with rates, special application instructions, and contact information to obtain product and any suitable adjuvant needed.

Priority	#	Product	Rates	Special Application Instructions	Contact Information to obtain materials and any needed adjuvants
B		ADV-5004	6.4 fl oz per 100 gal (0.5 ml per liter)	Two foliar applications, 7 day interval	Advan LLC, Rob Fritts, 559-299-2741, RFritts@AdvanLLC.com
			6.4 fl oz per 100 gal (0.5 ml per liter)	Two foliar applications, 14 day interval	
B		Allectus (bifenthrin + imidacloprid)	21.3 fl oz per 100 gal	Two foliar applications, 14 d interval	Bayer, Mike Gorrell, , mike.gorrell@bayercropscience.com
B		BYI-8330 (spirotetramat)	1.7 fl oz (50 ml) per 100 gal OR 1.7 fl oz (50 ml) per 1500 4 inch pots or per 1000 6 inch pots	Two foliar applications, 14 d interval OR Single application drench application. Use appropriate volume to sufficiently wet soil media with out any leaching from bottom of pot.	Bayer, Mike Gorrell, , mike.gorrell@bayercropscience.com
B		Discus (imidacloprid + cyfluthrin)	50 oz per 100 gal	Two applications 7 d apart spraying to wet the foliage; do not use surfactants	OHP, Jeff Dobbs, 770.992.0121, jdobbs@ohp.com
B		DPX-E2Y45	20 fl oz per 100 gal	Two applications, 14 d interval	Dupont, Chuck Silcox, 302-999-5953, charles.a.silcox@usa.dupont.com
B		DPX-HGW86	40 fl oz per 100 gal	Foliar repeat at 7 days	DuPont, Chuck Silcox, 302-999-5953, charles.a.silcox@usa.dupont.com
		DPX-HGW86 + MSO	40 fl oz per 100 gal + standard rate	Foliar repeat at 7 days	
B		Overture (pyridalyl)	8 oz per 100 gal	Two foliar sprays on a 14 day interval	Valent, Joe Chamberlin, 770-985-0303, jcham@valent.com
B		Pedestal (novaluron)	8 fl oz per 100 gal	Product is an IGR, effective on only immature stages of thrips. Activity may not be observed until 7 days after applications; multiple applications / rotation with other chemistry may be required for optimum results	Chemtura, Kevin Donovan, 203-573-2028, kevin.donovan@chemtura.com
B		Safari (dinotefuran)	8 oz/100 gal (foliar spray) OR 24 oz/100 gal (soil drench)	Two foliar sprays on a 14 day interval or one soil drench with 4 oz solution/ gallon of potting media	Valent, Joe Chamberlin, 770-985-0303, jcham@valent.com
B		Sugar Mover	1 pt per acre per week in drip irrigation		Albert Liptay, Stoller USA, ?, ALiptay@stollerusa.com
B		TriCon (BW 420)	Rate range is 0.4% to 0.8% solution (1/2 to 1 ounce per gallon). Recommend the 0.4% rate of TriCon as a tank-mix partner or rotational material.	TriCon is also an excellent surfactant – do not add surfactants to a spray solution containing TriCon; phytotoxicity may result. TriCon is a contact only material; coverage is the key to efficacy.	BioWorks, Randy Martin, , rmartin@bioworksinc.com

Priority	#	Product	Rates	Special Application Instructions	Contact Information to obtain materials and any needed adjuvants
B		TriStar 70WSP (acetamiprid)	96 g per 100gal	Spray to wet; two foliar sprays on a 14 d interval with a wetting agent such as Capsil.	Cleary Chemical, Rick Fletcher, 732-329-8399, rick.fletcher@clearychemical.com
C		Aria 50SG (flonicamid)	90 – 120 g per 100 gal	Note: suppression only.	FMC, Bobby Walls, 919-735-3862, bobby_walls@fmc.com
C		BotaniGard ES (*Beauvaria bassiana)*	1 – 2 quarts per 100 gal	Apply BotaniGard ES at 5-10 day intervals. Severe insect pressure may require application at 2-5 day intervals.	BioWorks, Randy Martin, 317-272-1303, rmartin@bioworksinc.com
C		MilStop (potassium bicarbonate)	For greenhouse plants, recommend 1.25 to 2.5 lbs/100 gallons.	Best used in a program as a rotational material with systemic chemicals. Contact only efficacy. Do not acidify the spray solution. MilStop is a contact-only material; coverage is the key to efficacy.	BioWorks, Randy Martin, 317-272-1303, rmartin@bioworksinc.com

Efficacy of Several Products for Managing Thrips Insects.

Ornamental Protocol Number: 07-004

Objective: Determine efficacy of new active ingredient formulations and new biopesticides for managing thrips infesting ornamental horticulture plants.

Experimental Design:

Plot Size: Must be adequate to reflect actual use conditions.

Replicates: Minimum of 6 with previously infested plant materials or 12 replications if relying upon attracting natural infestations or if infesting plant materials.

Application Instructions: Apply each treatment according to directions below. For foliar applications, make two consecutive applications 7 to 14 days apart according to manufacturer instructions. If no such instructions are available in the table below, apply at 14 days apart. For drench applications, make a single treatment to soil profile using sufficient volume to treat soil profile or a volume specified by manufacturer. Applications should be made using application equipment consistent with conventional commercial equipment.

Target Species: Western Flower Thrips (*Frankliniella occidentalis*), Onion Thrips (*Thrips tabaci*), Cuban Laurel Thrips (*Gynaikothrips ficorum*) or other species. Contact your regional coordinator if additional target species are of interest.

Plant Hosts: Use a plant host suitable for target species, such as snapdragons, cosmos or lisianthus. Record crop species and variety used.

Use Site: May be greenhouse, field container or field in-ground. Please specify in final report.

Evaluations: Record initial thrips population (all countable life stages – larvae, pupae, adults) and initial thrips feeding damage. Larvae and pupae may be counted together as immatures. Evaluations should occur 0, 7, 14, 28, 42, and 56 days after application or until no efficacy. Record plant height & width at initial and final evaluations only. Record phytotoxicity at each rating date on a scale of 0 to 10 (0 = no phytotoxicity; 10 = complete kill). If phytotoxicity is observed in treated plants, take pictures comparing treated and untreated plant material.

If different application methods or evaluations are made, please clearly specify differences in final report and explain how they enhanced results.

Recordkeeping: Keep detailed records of weather conditions including temperature and precipitation, soil-type or soil-less media, application equipment, application volume per area, irrigation, pot/liner size, plant height & width, and plant growth stage at application and data collection dates.

Treatments:

See tables on the following pages. Standards and A priority treatments are in the first table. B and C priority treatments are in the second table.

Reports:

Reports submitted on the standard IR-4 Ornamental Horticulture Research Report Form are preferred. However, reports in the AMT Tests format are acceptable as long as those reports are amended with detailed experimental design and materials and methods, along with raw data, recordkeeping information, and any pictures.

A report submitted electronically is preferred but not required. If the report is provided electronically, the basic report can be sent in MS Word or WordPerfect, the recordkeeping information as pdf or other electronic documents, and the raw data in MS Excel or other suitable program such as ARM.

Please direct questions to: Cristi Palmer, IR-4 HQ, Rutgers University, 500 College Road East, Suite 201W, Princeton, NJ 08540, Phone 732-932-9575 x4629, palmer@aesop.rutgers.edu.

Draft Date: 3/7/07
Revised By: CLP

Priority A and Standard Treatments List with rates, special application instructions, and contact information to obtain product and any suitable adjuvant needed.

Priority	#	Product (active)	Rates	Special Application Instructions	Contact Information to obtain materials and any needed adjuvants
A	1	BYI-8330 (spirotetramat)	1.7 fl oz (50 ml) per 100 gal	Two foliar applications, 14 d interval	Bayer, Mike Gorrell, 919-549-2423, mike.gorrell@bayercropscience.com
	2	BYI-8330 (spirotetramat)	1.7 fl oz (50 ml) per 1500 4 inch pots or per 1000 6 inch pots	Single application drench application. Use appropriate volume to sufficiently wet soil media with out any leaching from bottom of pot.	
	3	Flagship 25WG (thiamethoxam)	8 oz per 100 gal	Foliar spray treatment – using 200 gal per acre ***NOTE: need data on flowers only, not foliage***	Syngenta, Nancy Rechsigl, 941-708-9338, nancy.rechcigl@syngenta.com
	4	Flagship 25WG (thiamethoxam)	8 oz per 100 gal	Drench Treatment - using 2 oz per 6 inch pot ***NOTE: need data on flowers only, not foliage***	
	5	Tick-EX EC (Metarhizium anisopliae F52)	15 oz per 100 gal	Apply at 7 day intervals. Evaluate all stages of development	Novozymes Biologicals Inc., Jarrod Leland, 540-302-1225, JRRL@novozymes.com
	6	Tick-EX EC Metarhizium anisopliae F52	29 oz per 100 gal		
	7	Tolfenpyrad	14 fl oz per 100 gal	Evaluate all stages of development; spray to run off	Nichino, Marie Maks, 302-636-9001 x 3, mmaks@nichino.net
	8	Tolfenpyrad	21 fl oz per 100 gal	Evaluate all stages of development; spray to run off	
Standards	9	Standard Control Tool 1*	See below	See below	See below
	10	Standard Control Tool 2*	See below	See below	See below
	11	Untreated	--	--	

Standards	a	Avid (abamectin)	8 fl oz / 100 gal	Note: suppression only, immature thrips must be in contact with spray	Syngenta, Nancy Rechsigl, 941-708-9338, nancy.rechcigl@syngenta.com
	b	Conserve (spinosad)	6 – 11 fl oz / 100 gal		Dow AgroSciences, Anita Alexander, 770-339-7322, alalexander@dow.com
	c	Mesurol (methiocarb)	½ -1 lb / 100 gallon	Do not combine with foliar fertilizers; make only 2 applications per season; 10 day interval required	Gowan, Julie Butcher, 928-819-1578, jbutcher@gowanco.com
	d	Tempo (cyfluthrin)	See label for use directions		
	e	Other suitable registered material	See label for use directions		

Priority B & C Treatments List with rates, special application instructions, and contact information to obtain product and any suitable adjuvant needed.

Priority	#	Product	Rates	Special Application Instructions	Contact Information to obtain materials and any needed adjuvants
B		ADV-5004	6.4 fl oz per 100 gal (0.5 ml per liter)	Two foliar applications, 7 day interval	Advan LLC, Rob Fritts, 559-299-2741, RFritts@AdvanLLC.com
C		Allectus (bifenthrin + imidacloprid)	21.3 fl oz per 100 gal	Two foliar applications, 14 d interval	Bayer, Mike Gorrell, 919-549-2423, mike.gorrell@bayercropscience.com
C		Aria 50SG (flonicamid)	90 – 120 g per 100 gal	Note: suppression only.	FMC, Bobby Walls, 919-735-3862, bobby_walls@fmc.com
B		BAS350i (fipronil)	1.2 oz per 100 gal	Two foliar applications, 14 d interval	BASF, Kathie Kalmowitz, 919-270-4592, kathie.kalmowitz@basf.com
C		BotaniGard ES (*Beauvaria bassiana)*	1 – 2 quarts per 100 gal	Apply BotaniGard ES at 5-10 day intervals. Severe insect pressure may require application at 2-5 day intervals.	BioWorks, Randy Martin, 317-272-1303, rmartin@bioworksinc.com
C		Celero 16WSG (clothianadin)	4 oz per 100 gal	Single application. Drench to fully wet root profile	Arysta, Doug Houseworth, 904-321-0795, LlHouse9@aol.com
C		Marathon Ultra (imidacloprid + cyfluthrin)	25 fl oz per 100 gal	Two applications 14 d apart spraying to wet the foliage; do not use surfactants	OHP, Jeff Dobbs, 770.992.0121, jdobbs@ohp.com
B		DPX-E2Y45	20 fl oz per 100 gal	Two applications, 14 d interval	Dupont, Chuck Silcox, 302-999-5953, charles.a.silcox@usa.dupont.com
C		MilStop (potassium bicarbonate)	For greenhouse plants, recommend 1.25 to 2.5 lbs/100 gallons.	Best used in a program as a rotational material with systemic chemicals. Contact only efficacy. Do not acidify the spray solution. MilStop is a contact-only material; coverage is the key to efficacy.	BioWorks, Randy Martin, 317-272-1303, rmartin@bioworksinc.com
C		Overture (pyridalyl)	8 oz per 100 gal	Two foliar sprays on a 14 day interval ***NOTE: need data on thrips other than WFT***	Valent, Joe Chamberlin, 770-985-0303, jcham@valent.com
C		Pedestal (novaluron)	8 fl oz per 100 gal	Product is an IGR, effective on only immature stages of thrips. Activity may not be observed until 7 days after applications; multiple applications / rotation with other chemistry may be required for optimum results	Chemtura, Kevin Donovan, 203-573-2028, kevin.donovan@chemtura.com
C		Proud 3 (thyme oil)			
C		Pylon (chlorfenapyr)	5 fl oz per 100 gal	Greenhouse uses only; two applications 7 d apart spraying to wet the foliage; do not use surfactants	OHP, Jeff Dobbs, 770.992.0121, jdobbs@ohp.com
A/B		QRD 400	1.3 oz per gal		AgraQuest, Brett Highland, bhighland@agraquest.com

Priority	#	Product	Rates	Special Application Instructions	Contact Information to obtain materials and any needed adjuvants
B		Safari (dinotefuran)	8 oz/100 gal (foliar spray) OR 24 oz/100 gal (soil drench)	Two foliar sprays on a 14 day interval or one soil drench with 4 oz solution/ gallon of potting media	Valent, Joe Chamberlin, 770-985-0303, jcham@valent.com
C		Sugar Mover	1 pt per acre per week in drip irrigation		Albert Liptay, Stoller USA, ?, ALiptay@stollerusa.com
B		TriCon (BW 420)	Rate range is 0.4% to 0.8% solution (1/2 to 1 ounce per gallon). Recommend the 0.4% rate of TriCon as a tank-mix partner or rotational material.	TriCon is also an excellent surfactant – do not add surfactants to a spray solution containing TriCon; phytotoxicity may result. TriCon is a contact only material; coverage is the key to efficacy.	BioWorks, Randy Martin, , rmartin@bioworksinc.com
B		TriStar 70WSP (acetamiprid)	96 g per 100gal	Spray to wet; two foliar sprays on a 14 d interval with a wetting agent such as Capsil. ***NOTE: need data on thrips other than WFT***	Cleary Chemical, Rick Fletcher, 732-329-8399, rick.fletcher@clearychemical.com

Priority A and Standard Treatments List with rates, special application instructions, and contact information to obtain product and any suitable adjuvant needed.

Priority	#	Product (active)	Rates	Special Application Instructions	Contact Information to obtain materials and any needed adjuvants
A	1	BYI-8330 (spirotetramat)	1.7 fl oz (50 ml) per 100 gal	Two foliar applications, 14 d interval	Bayer, Mike Gorrell, 919-549-2423, mike.gorrell@bayercropscience.com
	3	Flagship 25WG (thiamethoxam)	8 oz per 100 gal	Two foliar applications, 7 d interval ***NOTE: need data on flowers only, not foliage***	Syngenta, Nancy Rechsigl, 941-708-9338, nancy.rechcigl@syngenta.com
	4	NNI-0101 SC (pyrifluquinazon)	6.38 fl oz per 100 gal	Two foliar applications, 14 d interval	Nichino, James Adams, 302-636-9001 x 8, jadams@nichino.net
	5	Tick-EX EC (Metarhizium anisopliae F52)	29 oz per 100 gal	Apply at 7 day intervals. Evaluate all stages of development	Novozymes Biologicals Inc., Jarrod Leland, 540-302-1225, JRRL@novozymes.com
	6	Tolfenpyrad EC	21 fl oz per 100 gal	Two foliar applications, 14 d interval	Nichino, James Adams, 302-636-9001 x 8, jadams@nichino.net
	7	MOI 201	1:500 (0.8 quarts per 100 gal)		Marrone Organic Innovations, Cruz Avila-Adame, 530-574-7255, cavila@marroneorganics.com
	8	BotaniGard WP	2 lb per 100 gal		BioWorks, Marla Faver, Marla Faver, 251-228-1012, mfaver@bioworksinc.com
B	9	QRD 416	64 or 128 oz/100 gal	Apply at 7 day intervals. Evaluate all stages of development	AgraQuest, Inc. Brett Highland, 941-484-4523 bhighland@agraquest.com
	10	Standard Control Tool 1*	See below	See below	See below
Standards	11	Standard Control Tool 2*	See below	See below	See below
	12	Untreated	--	--	
	a	Avid (abamectin)	8 fl oz / 100 gal	Note: suppression only, immature thrips must be in contact with spray	Syngenta, Nancy Rechsigl, 941-708-9338, nancy.rechcigl@syngenta.com
Standards	b	Conserve (spinosad)	6 – 11 fl oz / 100 gal		Dow AgroSciences, Anita Alexander, 770-339-7322, alalexander@dow.com
	c	Mesurol (methiocarb)	½ -1 lb / 100 gallon	Do not combine with foliar fertilizers; make only 2 applications per season; 10 day interval required	Gowan, Julie Butcher, 928-819-1578, jbutcher@gowanco.com
	d	Tempo (cyfluthrin)	See label for use directions		
	e	Other suitable registered material	See label for use directions		

Priority B & C Treatments List with rates, special application instructions, and contact information to obtain product and any suitable adjuvant needed.

Priority	#	Product	Rates	Special Application Instructions	Contact Information to obtain materials and any needed adjuvants
C		ADV-5004	6.4 fl oz per 100 gal (0.5 ml per liter)	Two foliar applications, 7 day interval	Advan LLC, Rob Fritts, 559-299-2741, RFritts@AdvanLLC.com
C		Allectus (bifenthrin + imidacloprid)	21.3 fl oz per 100 gal	Two foliar applications, 14 d interval	Bayer, Mike Gorrell, 919-549-2423, mike.gorrell@bayercropscience.com
C		Aloft SC (clothianadin + bifenthrin)	5 fl oz per 100 gal 10 fl oz per 100 gal	For Chilli Thrips only, single application	Arysta, Doug Houseworth, 904-321-0795, LlHouse9@aol.com
C		Arena 16WSG (clothianadin)	4 oz per 100 gal	Single application. Drench to fully wet root profile	Valent, Joe Chamberlin, 770-985-0303, jcham@valent.com
C		Aria 50SG (flonicamid)	90 – 120 g per 100 gal	Note: suppression only.	FMC, Bobby Walls, 919-735-3862, bobby_walls@fmc.com
C		Discus (imidacloprid + cyfluthrin)	25 fl oz per 100 gal	Two applications 14 d apart spraying to wet the foliage; do not use surfactants	OHP, Jeff Dobbs, 770.992.0121, jdobbs@ohp.com
C		MilStop (potassium bicarbonate)	For greenhouse plants, recommend 1.25 to 2.5 lbs/100 gallons.	Best used in a program as a rotational material with systemic chemicals. Contact only efficacy. Do not acidify the spray solution. MilStop is a contact-only material; coverage is the key to efficacy.	BioWorks, Marla Faver, Marla Faver, 251-228-1012, mfaver@bioworksinc.com
C		Overture (pyridalyl)	8 oz per 100 gal	Two foliar sprays on a 14 day interval ***NOTE: need data on thrips other than WFT***	Valent, Joe Chamberlin, 770-985-0303, jcham@valent.com
C		Proud 3 (thyme oil)			
C		Pylon (chlorfenapyr)	5 fl oz per 100 gal	Greenhouse uses only; two applications 7 d apart spraying to wet the foliage; do not use surfactants	OHP, Jeff Dobbs, 770.992.0121, jdobbs@ohp.com
B		Safari (dinotefuran)	8 oz/100 gal (foliar spray) OR 24 oz/100 gal (soil drench)	Two foliar sprays on a 14 day interval or one soil drench with 4 oz solution/ gallon of potting media	Valent, Joe Chamberlin, 770-985-0303, jcham@valent.com
B		TriCon (BW 420)	Rate range is 0.4% to 0.8% solution (1/2 to 1 ounce per gallon). Recommend the 0.4% rate of TriCon as a tank-mix partner or rotational material.	TriCon is also an excellent surfactant – do not add surfactants to a spray solution containing TriCon; phytotoxicity may result. TriCon is a contact only material; coverage is the key to efficacy.	BioWorks, Marla Faver, Marla Faver, 251-228-1012, mfaver@bioworksinc.com
A/C		TriStar 70WSP (acetamiprid)	96 g per 100gal	Spray to wet; two foliar sprays on a 14 d interval with a wetting agent such as Capsil. ***NOTE: need data on thrips other than WFT***	Cleary Chemical, Rick Fletcher, 732-329-8399, rick.fletcher@clearychemical.com

Appendix 2: Contributing Researchers

Dr. Yan Chen	Louisiana State University AgCenter Hammond Research Station 21549 Old Covington Hwy. Hammond, LA 70403 985-543-4125
Dr. Raymond A Cloyd	Kansas State University Department of Entomology 239 W. Waters Hall Manhattan, KS 66506 785-532-4750
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Mr. Dan Gilrein	Cornell Cooperative Extension Long Island Horticulture Research & Experiment Station 3059 Sound Avenue Riverhead, NY 11901 631-727-3595
Dr. David Held	Mississippi State University Coastal Research and Extension Center 1815 Popps Ferry Road Biloxi, MS 39532 228-546-1019
Dr. Dick Lindquist	*Retired from* Ohio State University
Dr. Scott Ludwig	Texas Cooperative Extension P.O. Box 38 Overton, TX 75684 903-834-6191
Dr. Ron Oetting	University of Georgia Department of Entomology Griffin, GA 30223 770-412-4714
Dr. Michael Parrella	University of California College of Agri.& Environ. Sciences One Shields Drive Davis, CA, 95615-8571 530-752-8473

Dr. Michael Reding	USDA-ARS Hort Insects Lab 1680 Madison Ave. Wooster, OH, 44691 330-263-3629
Dr. Dave Smitley & Terry Davis	Michigan State University Department of Entomology Michigan State University East Lansing, MI 48824-1115 517-353-9672
Dr. Doug Walsh	Washington State University IAREC 24106 N. Bunn Road Prosser, WA, 99350 509-786-9287

Appendix 3: Submitted Data Reports

The reports in this Appendix cover multiple PR numbers and are arranged alphabetically by researcher and year the experiments were conducted.

These reports can also be found at www.rutgers.ir4.edu by searching under the thrips efficacy project.