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IR-4 Ornamental Horticulture Program
Scale and Mealybug Efficacy

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Abstract

Managing scale and mealybug insects presents unique challenges. Products with contact modes of action must be applied at specific timings in order to reach the most susceptible crawler stages. Products with systemic modes of action may work well for certain species and not others based on application timing and whether the insect feeds within phloem or xylem. In 2003, IR-4 initiated a high priority project to determine efficacy of several insecticides on several scale and mealybug species so data can be obtained to add appropriate species to existing registrations. This research was conducted between 2004 and 2015.This report is a brief summary of available data from eighty-two experiments received through the IR-4 Ornamental Horticulture Program.

Several neonicotinoids (Aloft SC/Celero 16WSG, Flagship 0.22G/25WP, Safari 2G/20SG/Transtect 70WSP, and TriStar 30SG/70WSP), insect growth regulators (Distance and Talus 40SC/70DF), and other products were tested against scales and mealybugs. All products tested generally provided excellent control of elongate hemlock scale, cryptomeria scale, gloomy scale, citrus mealybug and Mexican mealybug, generally mediocre to excellent control of false oleander scale, Fletcher scale, Florida wax scale, magnolia scale, and poor control of armored scale. For other species, efficacy levels varied with the active ingredient and method/timing of application.

All products tested on citrus mealybug and Mexican mealybug, including Aria, Flagship, Safari, Talus, and TriStar, generally provided good to excellent control of these species. A experiment on Madeira mealybug showed excellent control when TriStar was mixed with Capsil surfactant, and poor control without Capsil. Rycar, Safari and Talus provided good to excellent control of this species, while A16901B provided mediocre control when applied as drench but good when applied as foliar treatment. Phormium mealybug control was good to excellent with all neonicotinoids tested – Flagship, Safari and TriStar. Good to excellent control of Rhizoecus root mealybug was obtained with A16901B, Aria, Kontos, MBI-203, MBI-205 and Safari in single experiments.

Three recently registered products (Mainspring, Rycar and XXpire), and three new experimentals (BAS 440, BYI-2960 and IKI-3106) looked promising on several species based on their efficacy relative to standards. Further research is needed to obtain additional efficacy data to recommend actions to register or amend labels for these pests.

Introduction

Managing scale and mealybug insects presents unique challenges. Products with contact modes of action have to be applied at specific timings in order to reach the most susceptible crawler stages. Products with systemic modes of action may work well for certain species and not others based on application timing and whether the insect feeds within phloem or xylem. In 2003, IR-4 initiated a high priority project to determine efficacy of several insecticides on several scale and mealybug species so data can be obtained to add appropriate species to existing registrations.This research was conducted during 2004 and continued through 2015.This report is a brief summary of available data from eighty-two experiments received through the IR-4 Ornamental Horticulture Program.

Materials and Methods

Several neonicotinoids (Aloft SC/Celero 16WSG, Flagship 0.22G/25WP, Safari 2G/20SG, and TriStar 30SG/70WSP), insect growth regulators (Distance and Talus 40SC) were tested against scales and mealybugs. Other products, including A16901B, Aria 50SG, BotaniGard ES, GF-2626 1SC, Xxpire 40WG, Kontos (BYI 8330), Mainspring, MBI-203, MBI 205, and Rycar 20SCwere also included in some studies. Two foliar applications of insecticides were made approximately 14 days apart. Safari, Flagship and Mainspring were also applied as container drench, in-ground drench, trunk spray, soil broadcast, or media mix. A minimum of four plants (replicate treatments) were required with most researchers exceeding this minimum. Insect counts were recorded pre-treatment and then 7, 14 (prior to 2nd application), 28 and 42 days after initial application. Phytotoxicity was recorded on a scale of 0 to 10 (0 = No phytotoxicity; 10 = Complete kill) at each rating date.The following protocols were used: 09-021, 10-005, 10-006, 10-007, 11-018, 11-019, 11-020, 12-003, 12-004, 14-006, 14-007, 15-006 and 17-007. For more detailed materials and methods, including application rates for various products, please visit http://ir4.rutgers.edu/ornamental/OrnamentalDrafts.cfm,to view and download these protocols.

Products were supplied to researchers (See list of researchers in Appendix 1) by their respective manufacturers.

For all research data tables, product names have been updated where manufacturers have established trade names and tables have been rearranged by product alphanumeric order.

Table 1. List of Products and Rates Tested from 2004 to 2015

Product	Active Ingredient(s)	Manufacturer	Application Method & Rates		# Experiments
A16901B	A16901B	Syngenta	Drench	5 oz per 100 gal	6
			Drench	10 oz per 100 gal	11
			Foliar	6.7 oz per 100 gal	4
Acelepryn	Chlorantraniliprole	DuPont	Foliar	0.8 fl oz per 100 gal	2
			Foliar	4.0 fl oz per 100 gal	1
Acephate 75WP	Acephate		Foliar	0.67 lb per 100 gal	1

Product	Active Ingredient(s)	Manufacturer	Application Method & Rates		# Experiments
Admire 2F	Imidacloprid	Bayer	Drench	0.5 lb per acre	1
Aloft SC **	Clothianidin + bifenthrin	Arysta	Sprench	5 fl oz per 100 gal	3
			Sprench	10 fl oz per 100 gal	6
Arena 50WDG	Clothianidin	Valent	Drench	2.4 g per ft ht	2
			Drench	2.4 g per in DBH	1
			Drench	4.8 g per in DBH	1
			Drench	3.6 g ai per in DBH	1
Aria 50SG	Flonicamid	FMC	Foliar	60 g per 100 gal	3
			Foliar	120 g per 100 gal	3
			Drench	120 g per 100 gal	1
AzaGuard	Azadirachtin	BioSafe	Foliar	20 fl oz per 100 gal	2
BAS 440	Afidopyropen	BASF	Foliar	7.0 fl oz per 100 gal	4
BotaniGard ES	*Beauveria bassiana*	BioWorks	Foliar	64 fl oz per acre	1
BYI-2960	Flupyradifurone	Bayer	Foliar	2.7 fl oz per acre	3
			Foliar	5.4 fl oz per acre	3
Celero 16WSG **	Clothianidin	Valent/Arysta	Foliar	4 oz per 100 gal	5
Cygon 267	Dimethoate		Drench	60 ml per tree	1
			Foliar	32 fl oz per 100 gal	1
Diazinon	Diazinon		Foliar	8.96 oz per 100 gal	1
Discus	Cyfluthrin+Imidacloprid	OHP	Banded	1.91 gal per acre	1
			Foliar	25 fl oz per 100 gal	1
Distance	Pyriproxifen	Valent	Foliar	8 fl oz per 100 gal	5
			Foliar	12 fl oz per 100 gal	34
			Foliar	16 fl oz per 100 gal	5
			Foliar	32 fl oz per 100 gal	5
Dursban Pro	Chlorpyrifos	Dow	Foliar	1 qt per 100 gal	1
Esteem 35WP	Pyriproxyfen	Valent	Foliar	2.5 oz per 100 gal	1
Facin 25 % EC	*Chenopodiumambrosioides* Extract	AgraQuest	Foliar	0.25 % w ai/v	2
			Foliar	0.50 % w ai/v	2
Flagship 0.22G	Thiamethoxam	Syngenta	Broadcast	6 g per gal media	1
			Broadcast	20 g per gal media	1
			Broadcast	6 g per 6-in pot	2
			Broadcast	60 g per plant	3
			Broadcast	114 g per ft ht	3
			Broadcast	227 g per ft ht	6
			Broadcast	227 g per in DBH	1
			Broadcast	454 g per in DBH	1
			Media mix	40 g per 2-gal pot	1
			Banded	0.125 lb ai per acre	1
Flagship 25WG	Thiamethoxam	Syngenta	Drench	8.0 oz per 100 gal	2
			Drench	0.5 g per ft ht	1
			Drench	1 g per ft ht	1
			Drench	4 g per ft ht	5
			Drench	4 g per in DBH	3
			Foliar	2.0 oz per 100 gal	19
			Foliar	4.0 oz per 100 gal	19
			Foliar	8.0 oz per 100 gal	15
GF-2626 1SC	GF-2626	Dow	Foliar	11 fl oz per 100 gal	3
			Foliar	3.5 oz per 100 gal	3
Hachi-Hachi	Tolfenpyrad	Nichino	Foliar	32 fl oz per 100 gal	1
Horticultural Oil	Horticultural Oil	Various	Foliar	1 gal per 100 gal	1

Product	Active Ingredient(s)	Manufacturer	Application Method & Rates		# Experiments
			Foliar	2 gal per 100 gal	4
			Foliar	4 fl oz per 100 gal	1
IKI-3106	Cyclaniliprole	ISK	Foliar	22 fl oz per 100 gal	5
			Foliar	28 fl oz per 100 gal	5
Kontos	Spirotetramat	OHP	Drench	3.4 fl oz per 100 gal	1
			Foliar	3.4 fl oz per 100 gal	15
			Foliar	20 fl oz per 100 gal	1
			Foliar	40 fl oz per 100 gal	1
			Foliar	1 gal per 100 gal	1
Lesco Oil	Paraffinic oil		Foliar	2 gal per 100 gal	1
			Foliar	0.66 lb per 100 gal	1
Lorsban 75WDG	Chlorpyrifos	Dow	Foliar	1.7 fl oz per 100 gal	1
Mainspring/ A20520A	Cyantraniliprole	DuPont	Drench	0.125 fl oz/inch DBH	4
			Drench	0.25 fl oz/inch DBH	5
			Drench	3.4 fl oz per 100 gal	4
			Drench	8 fl oz per 100 gal	7
			Drench	12 fl oz per 100 gal	7
			Foliar	4 fl oz per 100 gal	1
			Foliar	8 fl oz per 100 gal	2
Marathon II	Imidacloprid	OHP	Drench	3 g per ft ht	1
Meridian 25WG	Thiamethoxam	Syngenta	Drench	0.2 fl oz per in DBH	1
Merit 2F	Imidacloprid	Bayer	Drench	0.2 fl oz per ft ht	1
			Drench	20 g per 1250 6-in pots	1
Merit 75WP	Imidacloprid	Bayer	Foliar	0.5 lb per 100 gal	1
Mesurol	Methiocarb	Gowan	Foliar	1:500	1
MBI-203	*Chromobacterium subtsugae*	Marrone	Drench	2 qt per 100 gal	1
			Foliar	2 gal per 100 gal	2
MBI-205	MBI 205	Marrone	Drench	4 qt per 100 gal	1
			Foliar	3 gal per 100 gal	2
			Foliar	5 fl oz per acre	1
MOI 201	MOI 201	Marrone	Foliar	1:800	1
Movento 240SC (Kontos)	Spirotetramat	OHP	Foliar	10 fl oz per acre	1
			Foliar	1:1000	1
Natural Solutions	*Verticillium lecanii*		Foliar	8.6 fl oz per 100 gal	1
Rycar/SP-3009	Pyrifluquinazon	Nichino	Foliar	12 fl oz per 100 gal	1
			Foliar	18 fl oz per 100 gal	15
			Foliar	2.6 oz per 100 gal	1
Onyx	Bifenthrin	FMC	Foliar	6.4 fl oz per acre	1
			Foliar	10.5 oz per 100 gal	2
Orthene	Acephate	Ortho	Foliar	150 fl oz per 100 gal	1
Orthene 75S	Acephate		Foliar	8 oz per 100 gal	14
Orthene TTO	Acephate	Valent	Foliar	8 oz per 100 gal	1
			Foliar	10.7 oz per 100 gal	2
			Foliar	16 oz per 100 gal	1
			Foliar	1.5 gal per 100 gal	1
Paraffinic Oil	Paraffinic Oil		Foliar	2 gal per 100 gal	7
			Foliar	128 oz per 100 gal	1
QRD 452	QRD 452	AgraQuest	Broadcast	1 g per 6-in pot	1
Safari 2G	Dinotefuran	Valent	Broadcast	7.8 g per plant	2
			Broadcast	60 g per ft ht	5
			Broadcast	60 g in DBH	4

Product	Active Ingredient(s)	Manufacturer	Application Method & Rates		# Experiments
			Broadcast	3 g ai per in DBH	1
			Foliar	4.0 oz per 100 gal	11
			Media mix	2.6 g per gal media	5
			Foliar	8.0 oz per 100 gal	13
Safari 20SG	Dinotefuran	Valent	Banded	12 oz per 100 gal	1
			Banded	24 oz per 100 gal	1
			Banded	48 oz per 100 gal	1
			Drench	12 oz per 100 gal	9
			Drench	24 oz per 100 gal	23
			Drench	48 oz per 100 gal	4
			Drench	6 g per in DBH	5
			Drench	12 g per in DBH	1
			Drench	3 g per ft ht	5
			Drench	6 g per ft ht	15
			Drench	12 g per ft ht	1
			Drench	0.68 lb per acre	1
			Drench	12 oz per acre	2
			Drench	24 oz per acre	2
			Drench	1.35 lb per acre	1
			Drench	2.7 lb per acre	1
			Foliar	12 oz per 100 gal	2
			Foliar	18 oz per 100 gal	1
			Foliar	24 oz per 100 gal	1
			Foliar	48 oz per 100 gal	1
			Foliar	2 gal per 100 gal	1
			Foliar	2 gal per 100 gal	1
			Incorporation	2.6 g per gal soil media	1
			Soil injection	7.6 g per in DBH	1
			Soil injection	8.85 g per in DBH	1
			Trunk spray	13 oz per 1.1 gal	1
			Trunk spray	24 oz per 100 gal	1
			Trunk spray	0.68 lb per acre	1
			Trunk spray	1.35 lb per acre	1
			Trunk spray	2.7 lb per acre	1
Saf-T-Side Oil	Petroleum Oil	Monterey	Foliar	2 gal per 100 gal	2
SuffOil-X	Horticultural Oil	BioWorks	Foliar	1 gal per 100 gal	2
			Foliar	2 gal per 100 gal	2
			Foliar	3 gal per 100 gal	1
Sunspray Ultrafine Oil	Paraffinic Oil		Foliar	10 fl oz per 100 gal	1
			Foliar	20 fl oz per 100 gal	3
Talstar F	Bifenthrin	FMC	Foliar	20 fl oz per 100 gal	2
			Foliar	21.5 fl oz per 100 gal	27
			Foliar	43.0 fl oz per 100 gal	8
Talus 40SC	Buprofezin	SePro/BASF	Foliar	86.0 fl oz per 100 gal	6
			Foliar	12 oz per 100 gal	2
			Foliar	14 oz per 100 gal	8
Talus 70DF	Buprofezin	SePro	Foliar	14 oz per 100 gal	13
			Foliar	28 oz per 100 gal	1
Talus 70WP	Buprofezin	BASF	Drench	1.45 g ai per in DBH	1
			Trunk Spray	1.7 g ai per in DBH	1
Transtect 70WSP	Dinotefuran		Foliar	2 gal per 100 gal	2

Product	Active Ingredient(s)	Manufacturer	Application Method & Rates		# Experiments
		Rainbow Treecare	Foliar	32 g per 100 gal	1
			Soil incorp	1.46 g ai per in DBH	2
TriAct 70	Neem oil extract	OHP	Foliar	64 g per 100 gal	2
TriStar 30SG	Acetamiprid	Cleary	Foliar	112 g per 100 gal	4
			Foliar	128 g per 100 gal	2
			Foliar	224 g per 100 gal	4
			Foliar	4 oz per 100 gal	5
			Foliar	8 oz per 100 gal	23
			Foliar	32 g per 100 gal	5
			Foliar	48 g per 100 gal	5
TriStar 70WSP	Acetamiprid	Cleary	Drench	1.38 g ai per in DBH	1
			Foliar	64 g per 100 gal	5
			Foliar	96 g per 100 gal	5
			Foliar	112 g per 100 gal	2
			Foliar	128 g per 100 gal	5
			Foliar	224 g per 100 gal	2
			Trunk Spray	1.7 g ai per in DBH	1
Ultra-Pure Oil	Mineral Oil	BASF	Foliar	12 fl oz per 100 gal	1
XXpire 40WG / GF-2860	Spinetoram + Sulfoxaflor	Dow	Foliar	2 oz per 100 gal	10
			Foliar	2.75 qt per 100 gal	11
			Foliar	3.5 oz per 100 gal	11
			Foliar	5 qt per 100 gal	1
			Foliar	7 oz per 100 gal	3
Xytect 75WSP	Imidacloprid	Bayer	Drench	1.38 g ai per in DBH	1
			Trunk Spray	1.7 g ai per in DBH	1

** Product not registered for the production of ornamental horticulture crops.

Results and Summary

Comparative Efficacy on Soft Scale

Calico Scale. In 2007, Potter conducted an experiment examining efficacy of Safari 20SG (dinotefuran) on calico scale (*Eulecanium cerasorum*) infesting Japanese zelkova (*Zelkova serrata*). Safari 20SG was applied using two methods of systemic application: soil injection or basal trunk trunk spray with Pentra-Bark, a bark-penetrating surfactant. Treatments were made to 4 trees either April 18 or May 15, 2007. Efficacy was evaluated from July 30 to August 2 by sampling eight twigs within each tree canopy, removing the two oldest leaves from each twig, and counting all living scale nymphs on the left half of the abaxial surface of each leaf. Safari 20SG, particularly the application with Pentra-Bark, provided significant control of calico scale nymphs on the leaves (Table 2), which should translate to fewer honeydew-producing adults the next spring.

Table 2. Efficacy on Calico Scale on Japanese Zelkova, Potter, KY, 2007.

Treatment	Rate	Application Method (Treatment Date)	Population Counts	Percent Control
Safari 20SG (dinotefuran)	8.85 g/inch trunk diam.	Soil Injection (18 April)	159 ± 33*	61.9
Safari 20SG (dinotefuran)	8.85 g/inch trunk diam.	Soil Injection (15 May)	119± 34*	71.5
Safari 20SG (dinotefuran) + Pentra-Bark	13 oz/1.1 gal	Trunk Spray (18 April)	65± 29*	84.4
Untreated	-	-	332± 109	-

* Asterisk denotes mean is significantly lower than mean for untreated trees (Dunnett's test, $P < 0.05$).

In 2011, Sadoff conducted experiments examining efficacy of systemic and foliar insecticides targeted to egg-laying calico scale females infesting honeylocust (Tables 3 and 4). Systemic insecticides were applied to the soil or sprayed to trunk with Pentrabark. Systemics were applied April 10 (clothianidin and imidacloprid) and May 4 (dinotefuran). Foliar treatments were applied on May 4. Systemic insecticides provided significant, but generally mediocre, control of calico scales; high scale mortality on trees treated with Arena was attributed to the phytotoxic effects of this product on honeylocust. Similarly, the foliar insecticides generally provided mediocre efficacy.

No phytotoxicity was observed on any of the treated plants except with Arena which caused up to 50 % leaf drop.

Table 3. Efficacy of Systemic Insecticides on Calico Scale on Honeylocust (*Gleditzia triacanthos inermis)*, Sadoff, IN, 2011.

Applic. Method	Treatment	Rate Per Inch DBH	% Dead Female Adults[x]		First Instar Mortality 29 DAT (6/14)		Second Instar Mortality 59 DAT	
			7 DAT (5/11)	14 DAT (5/18)	No. Live Scales	% Dead Scales	No. Live Scales	% Dead Scales
Trunk Applic.	Transtect 70WSP (dinotefuran)	1.7 g ai	16.00 ab	18.94 a	12.58 c	23.77 bcd	7.70 c	49.84 ab
	Transtect 70WSP + Pentrabark	1.7 g ai	27.33 a	42.98 a	6.36 ab	36.83 bc	2.47 ab	68.54 a
	Xytect 75WSP (imidacloprid)	1.7 g ai	10.83 b	23.89 a	13.93 bc	12.47 d	5.81 ab	42.52 b
	Xytect 75WSP + Pentrabark	1.7 g ai	12.50 ab	20.00 a	11.80 c	20.50 bcd	6.81 bc	41.33 b
Soil Applic.	Arena 50WDG (clothianidin)	3.6 g ai	9.00 b	46.00 a	1.82 a	80.90 a	0.75 a	58.68 ab
	Safari 2G	3.0 g ai	12.00 ab	23.45 a	5.60 a	39.83 b	2.95 abc	58.15 ab
	Transtect 70WSP	1.45 g ai	6.67 b	36.67 a	4.59 a	26.92 bcd	1.92 ab	61.84 ab
	Xytect 75WSP	1.38 g ai	16.25 ab	43.81 a	5.98 a	26.76 bcd	4.50 abc	56.94 ab
-	Untreated	-	7.25 b	20.00 a	12.50 c	13.96 cd	4.71 abc	44.06 ab

[x] Means within a column followed by the same letter are not significantly different based on LSD test (P=0.05).

In 2012, Sadoff conducted two experiments examining efficacy of Distance and other insecticides targeted to egg-laying calico scale females in Carmel, IN (Table 6), and to settled

crawler stages in Indianapolis Table 6) on honeylocust. In Carmel, treatments were applied on Mar 20, except Transtect which was applied Mar 25. At 44 DAT, Distance and Safari significantly reduced scale numbers; at 74 DAT, Safari and Transtech, Talstar, and Mainspring had significantly reduced scales. In Indianapolis, treatments were applied on June 6, targeted to crawler stages, showed significant effects of treatment at 14 DAT. Talstar had the lowest number of scales, followed by Distance. Transtect failed to reduce scale abundance likely due to the short period of time between application and evaluation.

Overall, these studies suggest that dinotefuran (Safari or Transtect) works to suppress calico scale if applied to target ovipositing females. Mainspring may also provide some level of scale suppression if applied at this time. Talstar would require repeated applications targeting ovipositing females and settled crawlers.

Table 4. Efficacy of Foliar Insecticides on Calico Scale on Honeylocust (*Gleditzia triacanthos inermis)*, Sadoff, IN, 2011.

Treatment	Rate Per 100 Gal	% Dead Female Adults[x]		First Instar Mortality 29 DAT (6/14)		Second Instar Mortality 59 DAT (7/13)	
		7 DAT (5/11)	14 DAT (5/18)	No. Live Scales	% Dead Scales	No. Live Scales	% Dead Scales
Acelepryn (chlorantraniprilole)	4 fl oz	8.33 c	23.93 bc	6.18 abc	42.14 a	1.71 a	85.12 a
Acelepryn + Capsil	4 + 8 fl oz	7.14 c	22.62 bc	8.96 bc	25.44 b	1.49 a	67.78 ab
Capsil	8 fl oz	4.59 c	10.71 c	10.58 cd	21.77 b	4.04 a	37.33 c
HWG 355 (cyantraniprilole) + Capsil	4 + 8 oz	10.06 c	44.48 b	3.82 a	50.12 a	1.56 a	62.13 b
Talstar One (bifenthrin)	20 fl oz	19.29 b	70.00 a	6.47 abc	16.98 b	2.66 a	25.78 c
Talstar One + Capsil	20 + 8 fl oz	35.00 a	77.14 a	4.14 ab	15.73 b	2.04 a	23.97 c
Untreated	-	5.71 c	9.37 c	14.85 d	11.70 b	3.72 a	38.62 c

[x] Means within a column followed by the same letter are not significantly different based on LSD test (P=0.05).

Table 5. Efficacy of Foliar Insecticides on Calico Scale on Honeylocust (Gleditzia triacanthos inermis), 'Skyline' Sadoff, Carmel, IN, 2012.

Treatment	Rate Per 100 Gal	Number of Dead Ovipositing Females [x]		Live Females at 74 DAT (5/31)	
		29 DAT (4/18)	44 DAT (5/3)	Number	% Reduction
Distance (pyriproxyfen)	12 fl oz	14.03 a	45.62 a	34.64 ab	23.05
Mainspring (cyantraniprilole)	4 fl oz	19.25 a	41.94 ab	24.91 a	44.66
Safari 20SG (dinotefuran) soil	1.52 gm ai/in DBH	10.47 a	43.64 a	20.34 a	54.81
Talstar One (bifenthrin)	20 fl oz	18.61 a	34.08 ab	29.68 a	34.07
Transtect 70WSP (dinotefuran) soil	1.46 gm ai/ in DBH	7.20 a	40.14 ab	27.06 a	39.89
Untreated	-	8.32 a	32.93 b	45.02 b	0

[x] Means within a column followed by the same letter are not significantly different based on LSD test (P=0.05).

Table 6. Efficacy of Foliar Insecticides on Calico Scale on Honeylocust (Gleditzia triacanthos inermis), 'Skyline' Sadoff, Indianapolis, IN, 2012.

Treatment	Rate Per 100 Gal	Pretrt (6/6)	14 DAT (6/20)		
		No. Live Females	No. Live Females	% Change	% Reduction
Distance (pyriproxyfen)	12 fl oz	28.01 ab	17.48a	-60.28	28.67b
Talstar One (bifenthrin)	20 fl oz	23.03 a	12.12a	-90.10	69.32a
Transtect 70WSP (dinotefuran) soil	1.46 gm ai/ in DBH	ND	ND	-31.21*	12.01b
Untreated	-	33.97 ab	23.99 ab	-41.58	11.23b

[x] Means within a column followed by the same letter are not significantly different based on LSD test (P=0.05).
* Estimated from average of pre treatment densities.

In 2014, Persad conducted an experiment examining efficacy of systemic and foliar insecticides on calico scale (*Eulecanium cerasorum*) infesting honeylocust (*Gleditzia triacanthos inermis*).The systemic insecticide Safari provided the best control, with the other systemic Mainspring, and the foliar products Kontos and Xxpire generally less effective (Table 7).

Table 7. Efficacy of Insecticides on Calico Scale on Honeylocust (*Gleditzia triacanthos inermis)*, Persad, OH, 2014.

Treatment*	Rate Per 100 Gal	Population Averages[x] (Henderson's Percent Control)				
		Pre	7 DAT	15 DAT	28 DAT	107 DAT
Kontos (spirotetramat)	3.4 oz	14.75 a	6.75 c (53)	2.50 cd (76)	2.50 b (77)	0 a
Mainspring (cyantraniliprole)	0.25 fl oz/inch DBH	13.25 a	13 ab (11)	4.25 bcd (54)	0.25 b (84)	0 a
Safari 20SG (dinotefuran)	6 g/inch DBH	14.25 a	12.25 ab (0)	0.75 d (92)	0.00 b (100)	0 a
Xxpire 40WG (spinoteram+sulfoxaflor)	2.0 oz	13.75 a	9.00 bc (32)	7.50 ab (18)	5.75 b (42)	0 a
	2.75 oz	17.5 a	6.00 c (65)	5.75 bc (53)	3.75 b (70)	0 a
	3.5 oz	23.00 a	5.75 c (74)	5.25 bcd (67)	2.00 b (88)	0 a
Untreated Check	-	16.25 a	15.75 a (0)	11.25 a (0)	11.75 a (0)	0 a

[x] Numbers of live nymphs were counted on 3 branchlets15 cm in length randomly selected and cut from each tree Means within column followed by the same letter are not significantly different (LSD, P=0.05).
* Mainspring and Safari applied as drench.

Cottony Maple Scale. In 2005, Davis and Smitley examined various treatments to manage cottony maple scale (*Pulvinaria innumerabilis*) on silver maple (*Acer saccharinum*). Treatments were applied to 5 trees starting July 19, 2005. Safari 20SG was drenched once; the remaining treatments were foliar sprays applied on July 19 and August 2. Populations were assessed prior to the first applications and then on August 15 and August 22 by collecting 5 leaves per tree and counting the number of crawlers. The untreated populations declined rapidly after the 28 DAT confounding the results (Table 8). However, at 28 DAT there appeared to be good control achieved with foliar applications of Flagship 25WP (2 and 4 oz per 100 gallons) and Safari 20SG (4 oz per 100 gallons), although populations were not statistically different from the untreated control. More research is needed to clarify response of cottony maple scale with these treatments.

Table 8. Efficacy on Cottony Maple Scale on Silver Maple, Smitley & Davis, MI, 2005.

Treatment	Rate Per 100 Gal (No. Applications)	Pretreatment Counts	28 DAT	35 DAT	Combined 28 + 35 DAT
Flagship 25WP	2.0 oz (2)	45.0 a	0.2 a (96)	0.8 a (0)	1.0 a (82)
Flagship 25WP	4.0 oz (2)	37.0 a	0.8 a (81)	1.0 a (0)	1.8 a (61)
Safari 20SG	4.0 oz (2)	43.2 a	1.2 a (76)	1.6 a (0)	2.8 a (48)
Safari 20SG	8.0 oz (2)	63.8 a	3.4 a (54)	2.6 a (0)	6.0 a (25)
Safari 20SG – Drench	3 g (2)	39.2 a	6.6 a (0)	0.6 a (0)	7.2 a (0)
Safari 20SG – Drench	6 g (2)	37.2 a	1.4 a (67)	1.8 a (0)	3.2 a (31)
Talus 40SC	21.5 fl oz (2)	51.4 a	2.6 a (56)	0.8 a (0)	3.4 a (47)
TriStar 30SG	112 g (2)	35.8 a	5.0 a (0)	0.0 a (100)	5.0 a (0)
TriStar 30SG	224 g (2)	40.4 a	1.8 a (61)	0.2 a (49)	2.0 a (60)
Marathon II	1.7 fl oz (2)	61.2 a	4.2 a (41)	2.6 a (0)	6.8 a (11)
Talstar 0.67 F	10 fl oz (2)	55.2 a	2.0 a (69)	6.4 a (0)	8.4 a (0)
Untreated check	-	62.4 a	7.2 a (0)	0.6 a (0)	7.8 a (0)

* B-1956 surfactant mixed with Safari and TriStar foliar applications.

Fletcher Scale. In 2004, Smitley and Davis conducted an experiment examining efficacy on Fletcher scale (*Lecanium fletcheri*) on yew (*Taxus sp.*). These researchers added a number of treatments above and beyond the 2004 IR-4 protocol for scale efficacy, testing a total of 23 treatments as either foliar applications or banded applications around the base. The best efficacy was achieved with foliar applications of Discus + OSS and TriStar at 128 grams per 100 gal (Table 9). However, Dursban Pro, Flagship either banded or foliar sprays, Safari banded, Talus, and Tristar provided statistically equivalent control levels.

Table 9. Efficacy on Fletcher Scale on Yew, Smitley & Davis, MI, 2004.

Treatment	Rate	Application Type	Application Date(s)	Population Counts	Percent Control
Discus	1.91 gal/A	banded	6/18	3.00 ± 2.83 abcde	67
Discus + OSS	25 fl oz/100	foliar	6/29 & 7/14	1.17 ± 1.33 a	87
Distance 0.86E+ OSS	8fl oz/100 gal	foliar	6/29 & 7/20	8.17 ± 12.00 def	9
Distance 0.86E+ OSS	16 fl oz/100 gal	foliar	6/29 & 7/14	3.33 ± 2.07 bcde	63
Distance 0.86E+ OSS	32fl oz/100 gal	foliar	6/29 & 7/20	4.50 ± 2.59 def	50
Dursban Pro + OSS	1 qt/100 gal	foliar	6/29 & 7/14	2.83 ± 2.32 abcde	69
Flagship 25 WP	0.125 lb ai/A	banded	6/15	1.67 ± 1.97 abc	81
Flagship 25WP+ OSS	2 oz/100 gal	foliar	6/29 & 7/14	2.00 ± 1.55 abcd	78
Flagship 25WP+ OSS	4 oz/100 gal	foliar	6/29 & 7/14	3.33 ± 1.97 bcde	63
Flagship 25WP+ OSS	8 oz/100 gal	foliar	6/29 & 7/14	2.50 ± 0.84 abcde	72
Safari 20SG + OSS	8 oz/100 gal	foliar	6/29 & 7/14	3.50 ± 2.17 cde	61
Safari 20SG	12 oz/100 gal	banded	6/15	4.67 ± 1.75 ef	48
Safari 20SG	24 oz/100 gal	banded	6/15	2.00 ±1.10 abcde	78
Safari 20SG	48 oz/100 gal	banded	6/15	3.17 ± 2.93 abcde	72
Talus 40SC+ OSS	21.5 fl oz/100 gal	foliar	6/29	2.00 ± 1.79 abcd	78
Talus 40SC+ OSS	43.0 fl oz/100 gal	foliar	6/29	2.33 ± 1.21 abcde	74
Talus 40SC+ OSS	86.0 fl oz/100 gal	foliar	6/29	3.17 ± 2.93 abcde	65
Talus 70WP+ OSS	14 oz/100 gal	foliar	6/29	2.17 ± 1.47 abcde	76
Talus 70WP+ OSS	28 oz/100 gal	foliar	6/29	3.83 ± 2.64 de	57
Talus 70WP+ OSS	14 oz/100 gal **	foliar	6/29	4.83 ± 4.45 def	46
TriStar	32 grams/100 gal	foliar	6/29 & 7/14	3.50 ± 2.43 abcde	61
TriStar	64 grams/100 gal	foliar	6/29 & 7/14	2.00 ± 1.10 abcde	78
TriStar	128 grams/100 gal	foliar	6/29 & 7/14	1.17 ± 1.17 ab	87
Untreated Control	-	-	-	9.00 ± 3.63 f	0

* All data were transformed log (1+x) before statistical analysis.Means followed by the same letter are not significantly different ($p<0.05$). Untransformed means are presented in the table.See experiment report in Appendix 3 for additional information on statistical separation.
** This treatment was supposed to have been 56 oz/100 gal

Florida Wax Scale.

From 2004 through 2009, 5 experiments were conducted to examine insecticide efficacy for Florida wax scale (*Ceroplastes floridensis*). In general, the neonicotinoids Flagship, Safari and TriStar provided excellent control, and the IGR Talus provided good control.

During 2004 and 2005, Ludwig conducted four Florida wax scale (*Ceroplastes floridensis*) efficacy experiments on dwarf Burford holly (*Ilex cornuta* 'Burfordii Nana'), holly ‘China Doll’ (*Ilex sp.*), and Indian hawthorn (*Rhaphiolepis indica*).

Ludwig 2004. Dwarf Burford hollies with natural infestations of Florida wax scale were treated with foliar or drench applications depending on the product. Three rates of each product were applied to 4 plant replicates. Foliar applications were applied at 0 DAT and 16 DAT. Safari 20SG drenches were applied just at 0 DAT. Visual assessments of live scales on twenty leaves per plant were made using the same leaves throughout the experiment. At 45 DAT these same leaves were harvested, taken to the lab, scales were flipped over and live ones were counted. The best treatments were Flagship (2, 4, and 8 oz), Safari (24 and 48 oz), and TriStar 70WSP (32, 64, and 128 g), however all treatments did reduce the number of live scale (Table 10).

Table 10. Efficacy on Florida Wax Scale (*Ceroplastes floridensis*) on Dwarf Burford Holly, Ludwig, TX, 2004.

	Population Averages (Henderson's Percent Control)				
Treatment (Rate)	0 DAT (Visual)	16 DAT (Visual)	30 DAT (Visual)	43 DAT (Visual)	45 DAT (Microscope)
Distance (8 fl oz/100 gal)	124.8	164.3 (11)	142.5 (14)	118.5 (15)	23.8 bc (73)
Distance (16 fl oz/100 gal)	113.8	173.0 (0)	149.8 (1)	101.5 (20)	19.8 bc (76)
Distance (32 fl oz/100 gal)	143.0	173.0 (18)	199.8 (0)	174.3 (0)	14.0 bc (86)
Flagship (2 oz/100 gal)	128.5	162.5 (14)	89.3 (48)	65.5 (54)	0.3 d (100)
Flagship (4 oz/100 gal)	129.3	146.0 (23)	93.8 (46)	70.5 (51)	0.0 d (100)
Flagship (8 oz/100 gal)	128.3	181.8 (4)	73.3 (57)	47.5 (67)	0.0 d (100)
Safari (12 oz/100 gal) - Drench	117.0	181.3 (0)	164.8 (0)	119.0 (9)	6.0 cd (93)
Safari (24 oz/100 gal) - Drench	129.5	137.8 (28)	125.8 (27)	96.3 (33)	1.0 d (99)
Safari (48 oz/100 gal) - Drench	104.5	131.3 (15)	110.3 (21)	38.5 (67)	0.0 d (100)
Talus 40SC (21.5 fl oz/100 gal)	105.0	152.5 (2)	121.5 (13)	94.0 (20)	13.8 bc (82)
Talus 40SC (43 fl oz/100 gal)	110.8	143.0 (12)	114.3 (23)	96.5 (22)	13.0 bc (84)
Talus 40SC (86 fl oz/100 gal)	185.8	203.5 (26)	200.0 (19)	160.3 (23)	17.5 bc (87)
TriStar 70WSP (32 g/100 gal)	125.5	112.5 (39)	54.8 (67)	40.5 (71)	0.0 d (100)
TriStar 70WSP (64 g/100 gal)	142.8	179.3 (15)	88.5 (54)	79.8 (50)	0.0 d (100)
TriStar 70WSP (128 g/100 gal)	107.3	125.0 (21)	59.3 (59)	42.5 (64)	0.0 d (100)
Untreated	132.5	195.5 (0)	177.0 (0)	147.5 (0)	94.8 a (0)

* Letters after numbers are based on separation of average number of scale on the same 20 leaves throughout the experiment.

Ludwig 2005a. In 2005, Dwarf Burford hollies with natural infestations of Florida wax scale were treated with foliar applications of 4 products (Celero 16WSG, Flagship 25WG, Orthene TTO97, and TriStar 30SG) with repeat applications 14 days after initial application. This experiment was conducted in a commercial nursery with 5 plants per treatment. Visual assessments of live scales on twenty leaves per plant were made using the same leaves throughout the experiment. At 56 DAT these same leaves were harvested, taken to the lab, scales were flipped over and live ones were counted. By 56 DAT, the three neonicotinoids (Flagship 25WG, TriStar 30SG, Celero 16WSG) provided excellent control of adult scales. Orthene TTO exhibited 60% control, statistically equivalent to the untreated.

Table 11. Efficacy on Florida Wax Scale (*Ceroplastes floridensis*) on Dwarf Burford Holly, Ludwig, TX, 2005a.

Scale Stage	Treatment	Rate Per 100 Gal	Population Averages (Henderson's Percent Control)				
			Pre-treatment counts	14 DAT (visual)	28 DAT (visual)	42 DAT (visual)	56 DAT (microscope)
Nymph	Flagship 25WG	2 oz	0.0	13.4 ab	8.2 ab	3.8 ab	0.0
	Flagship 25WG	4 oz	0.0	21.6 a	12.6 a	10.2 a	0.0
	TriStar 30SG	4 oz	0.0	10.4 ab	7.2 ab	6.0 b	0.0
	TriStar 30SG	8 oz	0.0	10.6 b	6.6 ab	4.6 ab	0.0
	Celero 16WSG	4 oz	0.0	11.8 ab	7.8 ab	7.2 ab	0.0
	Orthene TTO 97	8 oz	0.0	15.2 ab	7.0 ab	4.2 ab	0.0
	Untreated		0.0	8.6 ab	4.2 b	3.6 b	0.0
Adults	Flagship 25WG	2 oz	21.0 ab	57.8 ab (49)	92.2 a (8)	75.0 a (36)	2.4 b (98)
	Flagship 25WG	4 oz	24.6 a	51.6 ab (61)	74.4 ab (37)	72.2 a (47)	2.6 bc (98)
	TriStar 30SG	4 oz	21.0 ab	47.0 ab (58)	41.0 bc (59)	39.0 ab (67)	0.2 d (100)
	TriStar 30SG	8 oz	20.0 ab	33.4 b (69)	34.8 c (64)	30.0 b (73)	0.4 cd (100)
	Celero 16WSG	4 oz	19.2 ab	39.4 ab (62)	49.8 abc (46)	50.2 ab (53)	1.2 bcd (99)
	Orthene TTO 97	8 oz	18.2 ab	61.2 a (38)	84.8 ab (3)	78.6 a (23)	34.0 a (60)
	Untreated		13.8 b	74.4 a (0)	66.0 ab (0)	77.0 a (0)	65.0 a (0)
Total	Flagship 25WG	2 oz	21.0	71.2 (44)	100.4 (6)	78.8 (36)	2.4 (98)
	Flagship 25WG	4 oz	24.6	73.2 (51)	87.0 (30)	82.4 (43)	2.6 (98)
	TriStar 30SG	4 oz	21.0	57.6 (54)	47.6 (55)	43.6 (64)	0.2 (100)
	TriStar 30SG	8 oz	20.0	43.8 (64)	42.0 (59)	36.0 (69)	0.4 (100)
	Celero 16WSG	4 oz	19.2	51.2 (56)	57.6 (41)	57.4 (49)	1.2 (99)
	Orthene TTO 97	8 oz	18.2	76.4 (30)	91.8 (1)	82.8 (22)	34.0 (60)
	Untreated		13.8	83.0 (0)	70.2 (0)	80.6 (0)	65.0 (0)

* Letters after numbers are based on separation of average number of scale on 5 plants.

Ludwig 2005b. In 2005, 'China Doll' hollies with natural infestations of Florida wax scale were treated with foliar applications of 4 products (Celero 16WSG, Flagship 25WG, Orthene TTO97, and TriStar 30SG) with repeat applications 14 days after initial application. This experiment was conducted in a commercial nursery with 4 plants per treatment. Visual assessments of live scales on twenty leaves per plant were made using the same leaves throughout the experiment. At 45 DAT these same leaves were harvested, taken to the lab, scales were flipped over and live ones were counted. By 45 DAT, the best treatments were the 4 oz rate of Flagship 25WP, both rates of TriStar 30SG, and Orthene TTO (Table 12).

Held 2009. In 2009, Held investigated efficacy of the systemic neonicotinoid insecticides Arena, Meridian, Merit and Safari applied as drench at different timings targeted to first or second generation of Florida wax scale on holly 'Needlepoint'. Each product was applied once at pre-crawler hatch (4/13/10) or crawler hatch (5/26/10) for the first generation, or at pre-crawler hatch (8/31/10) for the second generation. All products targeting the first generation (applied at pre-crawler hatch or crawler hatch) provided excellent control, performing better than those applied in August against the second generation (Table 13).

Ludwig 2005c. During 2005, Ludwig tested Florida wax scale efficacy on a third crop, Indian hawthorn. In this test, only neonicotinoids were applied (Table 14). All three products – Celero, Flagship and TriStar – provided great to excellent control.

Table 12. Efficacy on Florida Wax Scale (*Ceroplastes floridensis*) on Holly 'China Doll', Ludwig, TX, 2005b.

Scale Stage	Treatment	Rate Per 100 Gal	Population Averages (Henderson's Percent Control)			
			Pretreatment counts (Visual)	14 DAT (Visual)	28 DAT (Visual)	45 DAT (Microscope)
Nymph	Flagship 25WG	2 oz	247.3 a	13.3 ab (59)	12.3 ab (77)	0.0
	Flagship 25WG	4 oz	121.8 bc	1.5 bcd (91)	6.0 abc (77)	0.0
	TriStar 30SG	4 oz	149.8 bc	1.5 abc (92)	0.5 bcd (98)	0.0
	TriStar 30SG	8 oz	120.0 bc	6.5 cd (59)	2.8 d (89)	0.0
	Celero 16WSG	4 oz	87.3 c	3.0 abcd (74)	4.0 abcd (79)	0.0
	Orthene TTO 97	8 oz	200.5 ab	0.0 d (100)	2.3 cd (95)	0.0
	Talus 40SC	21.5 fl oz	133.0 abc	9.5 ab (46)	13.0 a (55)	0.0
	Untreated		77.5 c	10.3 a (0)	16.8 a (0)	0.0
Adults	Flagship 25WG	2 oz	0.3	184.0 a	80.8 a	37.3 a
	Flagship 25WG	4 oz	0.0	86.8 bc	48.5 abc	5.0 bc
	TriStar 30SG	4 oz	0.0	65.5 abc	21.3 abc	5.8 ab
	TriStar 30SG	8 oz	0.3	77.8 c	44.5 d	13.8 c
	Celero 16WSG	4 oz	0.0	42.0 c	21.8 cd	11.8 ab
	Orthene TTO 97	8 oz	0.0	124.0 ab	57.5 ab	4.8 bc
	Talus 40SC	21.5 fl oz	0.8	87.5 bc	49.8 bc	29.3 a
	Untreated		0.0	54.3 bc	30.5 bc	28.3 a
Total	Flagship 25WG	2 oz	247.5	197.3 (4)	93.0 (38)	37.3 (59)
	Flagship 25WG	4 oz	121.8	88.3 (13)	54.5 (27)	5.0 (89)
	TriStar 30SG	4 oz	120.0	72.0 (28)	24.0 (67)	5.8 (87)
	TriStar 30SG	8 oz	150.0	79.3 (37)	45.0 (51)	13.8 (75)
	Celero 16WSG	4 oz	87.3	45.0 (38)	25.8 (52)	11.8 (63)
	Orthene TTO 97	8 oz	200.5	124.0 (26)	59.8 (51)	4.8 (94)
	Talus 40SC	21.5 fl oz	133.8	97.0 (13)	62.8 (23)	29.3 (40)
	Untreated		77.5	64.5 (0)	47.3 (0)	28.3 (0)

* Letters after numbers are based on separation of average number of scale on 20 leaves on each of 5 plants.

Table 13. Efficacy on Florida Wax Scale (*Ceroplastes floridensis*) on Holly 'Needlepoint', Held, AL, 2009.

Treatment	Rate	Application Timing	Total Population Counts [z], Means Separations [x], and Henderson's Percent Control		
			Pretreatment	First Generation 6/24/10	Second Generation 10/25/10
Arena 50WDG	2.4 g/ft ht	April 13	28.25 ± 10.3	0.0 (100) b	0.0 (100) b
Meridian 25WG	3 g/ft ht	April 13	42.75 ± 23.9	1.0 ± 0.4 (96) b	0.0 (100) b
Merit 2F	0.2 fl oz/ft ht	April 13	30.75 ± 13.9	0.0 (100) b	0.0 (100) b
Safari 20SG	6 g/ft ht	April 13	30 ± 12.1	1.25 ± 1.25 (92) b	0.0 (100) b
Arena 50WDG	2.4 g/ft ht	May 26	21 ± 7.1	0.0 (100) b	0.0 (100) b
Meridian 25WG	3 g/ft ht	May 26	20.75 ± 8.1	0.25 ± 0.25 (98) b	0.0 (100) b
Merit 2F	0.2 fl oz/ft ht	May 26	21.75 ± 7.9	1.5 ± 0.87 (87) b	0.0 (100) b
Safari 20SG	6 g/ft ht	May 26	21.25 ± 7.2	0.25 ± 0.25 (98) b	0.5 ± 0.5 (99) b
Arena 50WDG	2.4 g/ft ht	August 31	40.75 ± 30	---	3.5 ± 1.7 (96) b
Meridian 25WG	3 g/ft ht	August 31	16.0 ± 8.8	---	9.25 ± 5.5 (73) ab
Merit 2F	0.2 fl oz/ft ht	August 31	15.25 ± 9	---	1.75 ± 1.75 (95) b
Safari 20SG	6 g/ft ht	August 31	15.5 ± 6.6	---	6.0 ± 2.9 (82) ab
Untreated	-		44.25 ± 7.4	---	95.0 ± 78.6 (0) a

[x] Means within a column followed by the same letter are not significantly different based on Tukey's HSD test P=0.05).

Table 14. Efficacy on Florida Wax Scale (*Ceroplastes floridensis*) on Indian Hawthorn, Ludwig, TX, 2005.

Scale Stage	Treatment	Rate Per 100 Gal	Population Averages (Henderson's Percent Control)				
			Pretreatment counts (Visual)	15 DAT (Visual)	28 DAT (Visual)	41 DAT (Visual)	57 DAT (Microscope)
Nymph	Celero 16WSG	4 oz	0.0	42.0 a	50.4 a	12.2 bc	14.0 b
	Flagship 25WG	2 oz	0.0	32.2 a	45.4 a	24.2 b	13.6 ab
	Flagship 25WG	4 oz	0.0	42.8 a	55.6 a	30.2 b	9.2 ab
	TriStar 30SG	4 oz	0.0	35.5 a	6.5 a	4.0 c	7.5 b
	TriStar 30SG	8 oz	0.0	25.2 a	7.8 a	1.8 c	5.4 b
	Untreated		0.0	42.0 a	64.2 a	140.2 a	32.0 a
Adults	Celero 16WSG	4 oz	41.4 a	--	--	--	27.8 b (90)
	Flagship 25WG	2 oz	51.0 a	--	--	--	22.0 b (94)
	Flagship 25WG	4 oz	48.6 a	--	--	--	13.8 b (96)
	TriStar 30SG	4 oz	46.8 a	--	--	--	6.5 b (98)
	TriStar 30SG	8 oz	32.6 a	--	--	--	6.2 b (97)
	Untreated		37.2 a	--	--	--	248.6 a (0)
Total	Celero 16WSG	4 oz	41.4	42.0 (10)	50.4 (29)	12.2 (92)	41.8 (87)
	Flagship 25WG	2 oz	51.0	32.2 (44)	45.4 (48)	24.2 (87)	35.6 (91)
	Flagship 25WG	4 oz	48.6	42.8 (22)	55.6 (34)	30.2 (84)	23.0 (94)
	TriStar 30SG	4 oz	46.8	35.5 (33)	6.5 (92)	4.0 (98)	14.0 (96)
	TriStar 30SG	8 oz	32.6	25.2 (32)	7.8 (86)	1.8 (99)	11.6 (95)
	Untreated		37.2	42.0 (0)	64.2 (0)	140.2 (0)	280.6 (0)

* Letters after numbers are based on separation of average number of scale on 20 leaves on each of 5 plants. See experiment report in Appendix 3 for statistical separation details and scale averages for each treatment.

Magnolia White Scale. In 2014, Chen conducted anexperiment examining efficacy on magnolia white scale (*Pseudaulacaspis cockerelli*) on Southern magnolia (*M. grandiflora*)'Little Gem'. All treatments, except AzaGuard and the lowest rate of XXpire, provided100 % control of a moderate infestation within 30-60 days after the second application (Table 15).

Table 15. Efficacy of Insecticides on Magnolia White Scale on Southern Magnolia (M. grandiflora), Chen, LA, 2014.

Treatment	Rate Per 100 Gal	Applic. Method, Timing	Population Averages[x] (Percent Control)				
			30 DAT2	60 DAT2	90 DAT2	120 DAT2	180 DAT2
AzaGuard (azadirachtin)	20 fl oz	Foliar, 3/28	2.9 b (55)	2.8 b (54)	2.3 b (56)	3.4 a (35)	6.2 ab (9)
Distance (pyriproxyfen)	12 fl oz	Foliar, 3/28, 4/18	2.1 b (67)	0 c (100)	0 c (100)	0 c (100)	0.4 c (94)
Mainspring 200SC (cyanthraniliprole)	8 fl oz	Drench, 4/11, 5/12	0 c (100)	0 c (100)	0 c (100)	0 c (100)	0.3 c (96)
Mainspring 200SC	12 fl oz	Drench, 4/11	0 c (100)	0 c (100)	0 c (100)	0 c (100)	0.8 c (88)
SuffOil-X (horticultural oil)	1 gal	Foliar 3/28, 4/11	0 c (100)	0 c (100)	0 c (100)	0 c (100)	1.7 bc (75)
Talus 70DF (buprofezin)	14 oz	Foliar, 3/28	0 c (100)	0 c (100)	0 c (100)	0 c (100)	0.8 c (88)
XXpire 40WG (spinetoram + sulfoxaflor) + Capsil	2 oz + 6 fl oz	Foliar, 3/28, 4/11	1.0 bc (84)	0.9 b (85)	1.5 bc (71)	2.6 ab (50)	4.1 abc (40)
XXpire 40WG + Capsil	2.75 oz + 6 fl oz	Foliar, 3/28, 4/11	0 c (100)	0 c (100)	0 c (100)	0 c (100)	1.7 bc (75)
XXpire 40WG + Capsil	3.5 oz + 6 fl oz	Foliar, 3/28, 4/11	1.6 bc (75)	0 c (100)	0 c (100)	0 c (100)	0.2 c (97)
Untreated (water)	-	Foliar 3/28, 4/11	6.4 a (0)	6.1 a (0)	5.2 a (0)	5.2 a (0)	6.8 a (0)

[x] Numbers of large size nymphs and adults on 6 leaves at days after 2nd application (DAT2). Means within column followed by the same letter are not significantly different (LSD, P=0.05).

Comparative Efficacy on Armored Scale

Armored Scale on Wax Myrtle

In 2008 and 2009, Chong conducted four experiments on armored scale (*Melanaspis deklei*) on wax myrtle (*Myrica cerifera*) to evaluate efficacy of neonicotinoids (Aloft, Flagship, Merit, Safari and TriStar), insect growth regulators (Distance and Talus) and other insecticides. In three of the four experiments, no statistical differences were observed among treatments (Table 16-Table 19). In two experiments, the comparatively low number of live scales on the untreated plants resulting from parasitoid activities might have confounded results of these experiments. In a 2009 test, all insecticides, Distance, Talus, Safari and paraffinic oil, significantly reduced armored scale population only by 6 weeks after treatment (Table 19). The management of *M. deklei* may require repeated applications of insecticides at the time of crawler emergence over a 2-3 year period. In 2014, Chong conducted another experiment to evaluate the efficacy of GF-2860/XXpire on armored scale (*Melanaspis deklei*) on wax myrtle (*Myrica cerifera*) (Table 20). Both GF-2860 and the standard paraffinic oil provided significant controlof adults and nymphs at 14 DAT and for the rest of the growing season. Paraffinic oil was the most efficacious treatment, followed by GF-2860 at 2.75 and 3.5 oz/100 gal.

No phytotoxicity was observed on any of the treated wax myrtle shrubs.

Table 16. Efficacy on Armored Scale on Wax Myrtle, Chong, SC, 2008a.

Treatment	Rate	Application Method, Timing	Population Averages (Henderson's Percent Control)				
			Pretreatment Counts	1 WAT	2 WAT	4 WAT	8 WAT
Aloft LC SC(Clothianidin + bifenthrin)	5 fl oz per 100 gal	Sprench, May	1.0 a	0.7 a (42)	2.9 a (0)	1.8 a (38)	0.9 a (0)
Aloft LC SC(Clothianidin + bifenthrin)	10 fl oz per 100 gal	Sprench, May	0.7 a	0.9 a (0)	1.2 a (33)	2.0 a (0)	1.5 a (0)
Flagship 25 WG (thiamethoxam)	8 oz per 100 gal	Foliar, May	0.4 a	0.7 a (0)	0.1 a (29)	1.7 a (0)	2.3 a (0)
Merit 2F (imidacloprid)	0.2 fl oz/in DBH	Drench, May	1.0 a	0.5 a (58)	0.2 a (80)	2.4 a (0)	1.9 a (0)
Orthene TTO (acephate)	8 oz per 100 gal	Foliar, May	1.2 a	1.6 a (0)	3.9 a (0)	4.8 a (0)	2.4 a (0)
Safari 20SG (dinotefuran)	12 g/in DBH	Drench, May	1.1 a	0.3 a (77)	0.5 a (17)	0.6 a (0)	0.1 a (67)
Safari 20SG (dinotefuran)	12 g/in DBH	Drench, July	0.8 a	1.0 a (0)	1.8 a (10)	2.5 a (0)	0.5 a (60)
Safari 20SG (dinotefuran) + PentraBark	12 g/in DBH	Drench, May	1.3 a	1.4 a (10)	2.4 a (14)	3.8 a (0)	6.4 a (0)
TriStar 30 SG (acetamiprid)	4 oz per 100 gal	Foliar, May	0.4 a	0.7 a (0)	0.5 a (64)	1.0 a (0)	2.6 a (0)
TriStar 30 SG (acetamiprid)	8 oz per 100 gal	Foliar, May	0.3 a	0.4 a (0)	0.2 a (75)	0.9 a (0)	0.6 a (0)
Untreated	-	-	0.5 a	0.6 a (0)	1.2 a (0)	1.2 a (0)	0.6 a (0)

* Means within a column followed by the same letter are not significantly different based on data analysis using PROC GLM for completely randomized design with sub-sampling (SAS).

Table 17. Efficacy on Armored Scale on Wax Myrtle, Chong, SC, 2008b.

Treatment	Rate	Application Method, Timing	Population Averages (Henderson's Percent Control)				
			Pretreatment Counts	1 WAT	2 WAT	4 WAT	8 WAT
Distance (pyriproxyfen)	12 fl oz/100 gal	Foliar, July	3.8 a	10.1 a (0)	3.8 a (0)	4.6 a (32)	45.5 a (37)
Safari 20 SG (dinotefuran)	8 oz/100 gal	Foliar, July	1.0 a	1.4 a(43)	0.8 a(0)	1.3 a(9)	28.2 a(0)
SunSpray Ultrafine	2% (2 gal/100 gal)	Foliar, July	3.4 a	7.3 a(13)	2.5 a(0)	1.4 a(68)	20.8 a(6)
Talus 40 SC (buprofezin)	21.5 fl oz/100 gal	Foliar, July	5.1 a	9.2 a (27)	4.5 a (0)	3.5 a (56)	29.5 a (47)
Untreated	-	-	4.7 a	11.6 a(0)	2.7 a(0)	4.8 a(0)	75.7 a(0)

* Means within a column followed by the same letter are not significantly different based on data analysis using PROC GLM for completely randomized design with sub-sampling (SAS).

Table 18. Efficacy on Armored Scale on Wax Myrtle, Chong, SC, 2009a.

Treatment	Rate	Application Method	Population Averages (Henderson's Percent Control)				
			Pretreatment Counts	1 WAT	2 WAT	4 WAT	8 WAT
Aloft LC SC(clothianidin + bifenthrin)	10 fl oz/100 gal	Sprench	1.6 a	0.6 a (0)	0.8 a (0)	3.2 a (14)	0.4 a (34)
Flagship 25 WG (thiamethoxam)	4 g/ft height	Drench	0.5 a	0.9 a (0)	0.2 a (83)	0.1 a (89)	0.2 a (0)
Flagship 0.22G (thiamethoxam)	227 g/ft height	Broadcast	10.1 a	0.6 a (81)	1.0 a (0)	15.7 a (0)	3.2 a (0)
Rycar (pyrifluquinazon)	18 fl oz/100 gal	Foliar	4.6 a	1.8 a (0)	1.6 a (33)	5.0 a (32)	0.4 a (58)
Orthene TTO (acephate)	8 oz/100 gal	Foliar	0.6 a	1.1 a (0)	2.0 a (0)	4.7 a (49)	3.1 a (0)
Safari 20SG (dinotefuran)	6 g/ft height	Drench	0.2 a	0.9 a (0)	0.3 a (75)	0.7 a (50)	0.2 a (0)
Safari 2G (dinotefuran)	60 g/ft height	Soil surface	3.2 a	0.7 a (31)	0.7 a (25)	0.5 a(85)	0 a (100)
TriStar 30 SG (acetamiprid) + Capsil	8 oz/100 gal + 6 fl oz/100 gal	Foliar	2.8 a	0.8 a (10)	0.6 a (44)	3.3 a (0)	1.3 a (0)
Untreated	-	-	1.9 a	0.6 a (0)	0.8 a (0)	3.7 a (0)	0.7 a (0)

* Means within a column followed by the same letter are not significantly different based on data analysis using PROC GLM for completely randomized design with sub-sampling (SAS).

Table 19. Efficacy on Armored Scale on Wax Myrtle, Chong, SC, 2009b.

Treatment	Rate	Application Method	Population Averages (Henderson's Percent Control)				
			Pretreatment Counts	1 WAT	2 WAT	4 WAT	8 WAT
Distance 10EC (pyriproxyfen)	12 fl oz/100 gal; twice 14 days apart	Foliar	3.0 a	3.6 a (42)	2.3 a (37)	2.7 a (0)	2.7 b (31)
Paraffinic oil	2 gal/100 gal	Foliar	2.1 a	2.5 a (58)	2.6 a (0)	3.6 a (0)	2.9 b (45)
Safari 20 SG (dinotefuran)	8 oz/100 gal	Foliar	4.5 a	12.2 a (0)	4.2 a (66)	3.1 a (0)	3.6 b (20)
Talus 40 SC (buprofezin)	21.5 fl oz/100 gal	Foliar	2.8 a	11.0 a (0)	5.6 a (50)	4.2 a (0)	4.1 b (33)
Untreated	-	-	7.0 a	14.4 a (0)	14.6 a (0)	5.3 a (0)	7.7 a (0)

* Means within a column followed by the same letter are not significantly different based on data analysis using PROC GLM for completely randomized design with sub-sampling (SAS).

Table 20. Efficacy on Armored Scale on Wax Myrtle, Chong, SC, 2014.

Treatment	Rate (per 100 gal)	Population Averages (Henderson's Percent Control) [x]				
		Pretreat	7 DAT [y]	13 DAT	27 DAT	6 MAT
GF-2860	2 oz	18.5 a	13.2 a (43)	7.8 ab (51)	6.2 b (59)	8.0 b (51)
GF-2860	2.75 oz	19.0 a	9.8 a (59)	5.3 b (67)	3.2 bc (79)	5.5 b (68)
GF-2860	3.5 oz	12.5 a	9.2 a (41)	4.5 b (58)	2.8 bc (73)	5.5 b (51)
Paraffin oil	2%	16.3 a	7.5 a (63)	2.7 b (81)	1.3 c (90)	3.8 b (74)
Untreated	-	13.8 a	17.3 a (0)	11.8 a (0)	11.3 a (0)	12.3 a (0)

[x] Means followed by same letter do not significantly differ (Fisher's LSD test, P=0.05).
[y] DAT = days after the first treatment; MAT = months after first treatment.
* Treatments applied foliar on 5/13 and 5/26; Capsil (at 6 fl oz/100 gal) was mixed in the solutions of GF-2860.

Camellia Scale

In 2010, Chong investigated the efficacy of systemic neonicotenoids (Arena, Flagship, Safari and Tristar) and A16901B for the control of camellia scale (*Lepidosaphes camelliae*) on camellia (*Camellia japonica*). A16901B, Arena, Flagship 25WG and Safari 20SG were applied as drench while Flagship 0.22G and Safari 2G were applied as broadcast on Sept 9; Orthene and Tristar were applied as foliar spray on Sept 9 and 24. No significant difference in the percent mortality of nymphs among the treatments was observed, and significant difference in the percent mortality of adult camellia scales was observed only at 6 WAT (Table 21).Safari 2G was the only treatment that provided significantly higher mortality from the untreated control (20% difference). Unfavorable rainfall conditions during the study might have contributed to the poor performance of products. More research is needed to determine viable product choices for this species.

In 2014, Chong evaluated the efficacy of GF-2860/XXpire, Mainspring, Distance, Talus 70DF, Kontos and paraffinic oil against the camellia scale.Treatments were targeted on the emergence of crawlers. Mainspring was applied as soil drench on Jun 13 and Jul 11, while other products were applied as foliar spray. Talus 70DF was applied on Jun 13, GF-2860 + Capsil, Kontos and paraffinic oil applied on Jun 13 and 27, and Distance applied on Jun 13 and Jul 3. Overall, XXpire at 2.75 and 3.5 oz/100 gal, Distance, Kontos and paraffinic oil provided consistent and high efficacy against the camellia scales in outdoor, landscape situation (Table 22). One application of Talus 70DF did not significantly reduced the numbers of nymphs at 28 DAT; however, when considering the total number of camellia scales, Talus performed as well as the effective products before 28 DAT. It is therefore prudent to make a second Talus application at 28 DAT or during the time of crawler emergence of the next generation to achieve long-term reduction in the scale insect population. Performance of Mainspring was inconsistent, indicating that it may not provide sufficient suppression when applied as soil drench.

No phytotoxicity or insecticide residue was observed on the treated camellia shrubs.

Table 21. Efficacy on Camellia Scale on Camellia, Chong, SC, 2010.

Scale Stage	Treatment	Rate	Average Percent Mortality				
			Pretreat	1 WAT	2 WAT	4 WAT	6 WAT
Nymphs	A16901B	10 oz/100 gal	63.6 ± 3.1	66.1 ± 4.8	79.1 ± 3.9	77.0 ± 4.6	64.6 ± 7.7
	Arena 50 WDG	2.4 g/ft ht	58.7 ± 7.8	56.3 ± 5.5	80.3 ± 4.5	68.7 ± 8.5	74.0 ± 5.8
	Flagship 0.22G	227 g/ft ht	56.1 ± 4.7	64.9 ± 8.9	77.4 ± 5.2	78.7 ± 4.1	71.9 ± 10.3
	Flagship 25WG	1 g/ft ht	64.5 ± 3.3	58.2 ± 10.8	82.6 ± 3.9	79.7 ± 1.7	76.7 ± 4.2
	Flagship 25WG	4 g/ft ht	59.0 ± 3.8	76.8 ± 4.0	82.2 ± 3.8	76.5 ± 1.9	72.3 ± 3.2
	Orthene TTO	8 oz/100 gal	60.9 ± 4.1	69.4 ± 3.8	82.0 ± 5.0	78.6 ± 7.4	75.5 ± 9.1
	Safari 2G	60 g/ft ht	64.7 ± 4.8	67.5 ± 5.4	87.1 ± 4.3	79.6 ± 3.0	81.2 ± 5.3
	Safari 20SG	6 g/ft ht	62.6 ± 4.2	81.3 ± 3.9	82.6 ± 5.2	83.2 ± 4.5	68.8 ± 5.2
	Tristar 30SG + Capsil	8 oz + 6 fl oz/100 gal	53.0 ± 4.4	65.3 ± 4.2	81.5 ± 5.8	71.7 ± 4.6	73.5 ± 11.2
	Untreated	-	58.5 ± 6.6	64.1 ± 6.3	74.1 ± 5.4	75.9 ± 6.2	83.2 ± 4.2
Adults	A16901B	10 oz/100 gal	32.6 ± 4.2	36.9 ± 6.6	44.7 ± 13.1	47.9 ± 3.4	32.0 ± 5.3 d
	Arena 50 WDG	2.4 g/ft ht	40.6 ± 7.5	44.8 ± 10.2	45.6 ± 4.7	54.6 ± 5.8	49.3 ± 5.1 bcd
	Flagship 0.22G	227 g/ft ht	35.4 ± 7.8	44.6 ± 10.3	43.3 ± 12.3	52.4 ± 4.9	53.0 ± 5.1 bc
	Flagship 25WG	1 g/ft ht	44.0 ± 5.3	31.5 ± 6.9	46.4 ± 4.1	49.8 ± 4.1	45.7 ± 3.4 cd
	Flagship 25WG	4 g/ft ht	28.4 ± 4.3	49.7 ± 4.2	48.9 ± 4.3	54.5 ± 7.7	65.1 ± 1.9 ab
	Orthene TTO	8 oz/100 gal	39.1 ± 5.0	49.1 ± 10.7	47.7 ± 5.6	49.3 ± 5.7	54.5 ± 9.7 abc
	Safari 2G	60 g/ft ht	31.9 ± 5.1	44.7 ± 2.9	65.1 ± 9.1	62.1 ± 3.3	69.0 ± 7.0 a
	Safari 20SG	6 g/ft ht	41.5 ± 3.3	45.6 ± 8.7	48.4 ± 13.7	58.5 ± 6.7	60.4 ± 4.9 abc
	Tristar 30SG + Capsil	8 oz + 6 fl oz/100 gal	39.7 ± 2.4	33.3 ± 4.6	60.9 ± 6.0	46.0 ± 5.2	48.8 ± 5.8 bcd
	Untreated	-	37.5 ± 4.2	42.6 ± 10.4	55.6 ± 12.5	40.6 ± 8.3	49.3 ± 7.0 bcd

* ANOVA for Completely Randomized Design at $\alpha = 0.05$. Means within a column with the same letters are not significantly different among the treatments by LSD.

Table 22. Efficacy on Camellia Scale on Camellia, Chong, SC, 2014.

Treatment	Rate (per 100 gal)	Population Averages (Henderson's Percent Control) [x]				
		Pretreat	7 DAT [y]	14 DAT	28 DAT	6 MAT
Adults						
Distance	12 fl oz	14.0 a	0.2 a (81)	0 c (100)	0.5 b (95)	0.2 d (89)
Kontos	3.4 fl oz	17.0 a	0 a (100)	0.5 bc (74)	0 b (100)	0.3 d (86)
Mainspring*	0.125 fl oz	13.0 a	2.2 a (0)	0.8 abc (46)	10.0 a (0)	3.8 a (0)
Mainspring	0.25 fl oz	12.7 a	0.3 a (68)	0.3 c (79)	10.2 a (0)	1.7 bcd (0)
Paraffin oil	2%	8.2 a	0.3 a (50)	0.2 c (78)	0 b (100)	0 d (100)
Talus 70DF	14 oz	11.8 a	0.2 a (77)	0.3 c (77)	1.3 b (84)	3.2 ab (0)
XXpire**	2 oz	12.2 a	1.0 a (0)	1.8 ab (0)	6.0 ab (30)	0.5 cd (68)
XXpire	2.75 oz	13.7 a	0.2 a (80)	0.2 c (87)	0 b (100)	0 d (100)
XXpire	3.5 oz	13.8 a	0 a (100)	0.2 c (87)	0.5 b (95)	1.3 bcd (28)
Untreated	-	17.7 a	1.3 a (0)	2.0 a (0)	12.5 a (0)	2.3 abc (0)
Nymphs						
Distance	12 fl oz	13.3 a	0.5 c (98)	0.8 bc (90)	2.5 b (90)	0.3 bc (97)
Kontos	3.4 fl oz	12.5 a	1.7 c (91)	0.5 bc (94)	1.2 b (98)	0.5 d (95)
Mainspring*	0.125 fl oz	12.7 a	7.0 ab (63)	1.3 bc (84)	16.7 a (30)	10.5 a (6)
Mainspring	0.25 fl oz	6.2 a	5.2 bc (44)	0.7 bc (82)	13.5 a (0)	5.3 a (3)
Paraffin oil	2%	6.5 a	1.2 c (88)	0.8 bc (80)	0.5 b (96)	1.0 cd (83)
Talus 70DF	14 oz	16.5 a	0.5 c (98)	0.5 bc (95)	10.3 ab (67)	1.2 cd (92)
XXpire**	2 oz	17.0 a	9.7 ab (62)	2.8 ab (74)	13.7 a (57)	1.7 cd (89)
XXpire	2.75 oz	15.5 a	4.8 bc (79)	1.3 bc (87)	2.0 b (93)	0 d (100)
XXpire	3.5 oz	6.8 a	3.5 bc (66)	0.3 c (93)	0.7 b (95)	2.3 cd (62)
Untreated	-	8.3 a	12.5 a (0)	5.2 a (0)	15.7 a (0)	7.3 ab (0)
Total						
Distance	12 fl oz	27.3 a	0.7 d (95)	0.8 b (89)	3.0 b (90)	0.5 d (95)
Kontos	3.4 fl oz	29.5 a	1.7 cd (89)	1.0 b (88)	1.2 b (96)	0.8 d (93)
Mainspring*	0.125 fl oz	25.7 a	9.2 abc (33)	2.2 b (69)	27.7 a (1)	14.3 a (0)
Mainspring	0.25 fl oz	18.8 a	5.5 bcd (45)	1.0 b (81)	23.7 a (15)	7.0 bc (0)
Paraffin oil	2%	14.7 a	1.5 cd (81)	1.0 b (75)	0.5 b (97)	1.0 d (82)
Talus 70DF	14 oz	28.3 a	0.7 d (95)	0.8 b (90)	11.7 ab (62)	4.3 bcd (59)
XXpire**	2 oz	29.7 a	10.7 ab (32)	2.2 b (73)	19.7 a (39)	2.2 cd (80)
XXpire	2.75 oz	29.2 a	5.0 bcd (68)	1.5 b (81)	2.0 b (94)	0 d (100)
XXpire	3.5 oz	20.7 a	3.5 bcd (68)	0.5 b (91)	2.5 a (89)	3.7 cd (52)
Untreated	-	26.0 a	13.8 a (0)	7.2 a (0)	28.2 a (0)	9.7 ab (0)

[x] Means followed by same letter do not significantly differ (Fisher's LSD test, P=0.05).

[y] DAT = days after the first treatment; MAT = months after first treatment.

* Mainspring applied as drench once at 0.25 fl oz per foot shrub height on Jun 13, and twice at the lower rate on Jun 13 and Jul 11.

** Capsil (at 6 fl oz/100 gal) was mixed in the solutions of GF-2860.

Elongate Hemlock and Cryptomeria Scales

In 2005 and 2008, Cowles conducted two experiments for control of both elongate hemlock scale (*Fiorinia externa*) and Cryptomeria scale (*Aspidiotus cryptomeriae*) on Frasier Fir (*Abies fraseri*). In 2005, Flagship 25WP, Safari 20SG, Talus 40SC, and TriStar 70WSP provided excellent control at all tested rates (Table 23). Cygon 267 and Onyx also performed well. Another product providing good efficacy was Esteem 35WP. Lesco Oil provided poor control except when paired with Silwet L-77. In 2008, Safari trunk spray was the only treatment that provided good control, better than the standard Onyx foliar spray (Table 24). Safari also has minimal impact on natural enemies that may make this treatment a preferable approach for scale management.

Table 23. Efficacy on Elongate Hemlock Scale and Cryptomeria Scale on Frasier Fir, Cowles, CT, 2005.

Treatment	Rate (No. of applications)	Live per 1000 needles	Percent Control
Admire 2F - Drench	0.5 lb/Acre, drench	3080 ab	63
Cygon 267	32 fl oz/100 gal (2)	507 b-f	94
Cygon 267 - Drench	60 ml/tree, drench	313 efg	96
Esteem 35WP	2.5 oz/100 gal (2)	800 b-f	90
Flagship 25WP	2.0 oz/100 gal (2)	273 c-f	97
Flagship 25WP	4.0 oz/100 gal (2)	240 b-f	97
Lesco Oil	1%	3280 ab	60
Lesco Oil	2%	5270 a	36
Lesco Oil + Silwet L-77	2% + 4 fl oz/100 gal	2244 abc	73
Lorsban 75WDG	0.66 lb/100 gal (2)	1320 a-d	84
Onyx	2.6 oz/100 gal	452 b-e	94
Onyx + Lesco Oil	2.6 oz/100 gal + 1%	1160 a-d	86
Safari 20SG	4.0 oz/100 gal (2)	453 b-f	94
Safari 20SG	8.0 oz/100 gal (2)	49.1 fgh	99
Safari 20SG – Drench	3 g/ft of tree height	12.4 gh	100
Safari 20SG – Drench	6 g/ft of tree height	0.0 h	100
Talus 40SC	21.5 fl oz/100 gal (2)	348 b-f	96
TriStar 70WSP	48 g/100 gal (2)	225 def	97
TriStar 70WSP	96 g/100 gal (2)	554 fgh	93
Untreated check	-	8220 a	-

* Letters after numbers are based on separation of average number of scale on 4 plants. See experiment report in Appendix 3 for statistical separation details.

Table 24. Efficacy on Elongate Hemlock Scale and Cryptomeria Scale and its Parasite *Encarsia citrina* on Frasier Fir, Cowles, CT, 2008.

Treatment	Rate per acre	Application Method, Timing	# Scales per 100 needles	Percent Control	Percent Parasitism
BotaniGard ES (*Beauveria bassiana*)	64 fl oz	Foliar, June 3	1530 a	0	15.5 a
BotaniGard ES (*Beauveria bassiana*) + Prev-Am	64 fl oz	Foliar, June 3	1230 abc	0	8.5 bcde
Movento 240SC 240(spirotetramat) + MSO	5 fl oz	Foliar, May 19	1470 ab	0	14.3 ab
Movento 240SC 240(spirotetramat) + MSO	10 fl oz	Foliar, May 19	742 def	7	13.2 ab
Movento 240SC (spirotetramat) + MSO	5 fl oz	Foliar, June 3	1090 bcd	0	14.5 ab
Movento 240SC (spirotetramat) + MSO	10 fl oz	Foliar, June 3	857 cde	0	10.9 abcd
Onyx Pro (bifenthrin)	6.4 fl oz	Foliar, June 3	279 g	65	2.5 e
Safari 20SG (dinotefuran)	0.68 lb	Soil, June 3	528 efg	34	7.2 cde
Safari 20SG (dinotefuran)	1.35 lb	Soil, June 3	810 cde	0	9.6 abcd
Safari 20SG (dinotefuran)	2.7 lb	Soil, June 3	328 fg	59	8.9 abcde
Safari 20SG (dinotefuran)	0.68 lb	Trunk spray, June 3	106 g	87	5.6 de
Safari 20SG (dinotefuran)	1.35 lb	Trunk spray, June 3	114 g	86	7.6 cde
Safari 20SG (dinotefuran)	2.7 lb	Trunk spray, June 3	194 g	76	5.3 de
Untreated	-	-	796 de	-	11.8 abcd

* Means followed by the same letter in the same column are not significantly different, for non-transformed data(LSD test, $P < 0.05$).

Euonymus Scale

From 2004 through 2014, several researchers have examined insecticide efficacy for euonymus scale. In general, neonicotinoids tended to provide good control, as did Distance; variable control was obtained with Talus, A16901B and XXpire.

Freiberger. In 2004 and 2005, efficacy of several products and new active ingredients were tested in two experiments conducted at the Rutgers Cream Ridge Station for winged euonymus scale (*Lepidosaphes yanagicola*) on euonymus. In the 2004 experiment, treatments did not start exhibiting good efficacy until 27 DAT, but only Talus SC provided 100% control by 45 DAT (Table 25). Most of the systemic products had delayed efficacy similar to the growth regulators Talus and Distance. Kontos provided some efficacy in this experiment. In the 2005 experiment, none of the products performed better than 87% control with only Orthene and Flagship providing reasonable control throughout the experiment (Table 26). Talus did achieve the same level by the end of the experiment. Safari 20SG did not reduce mealybug populations either as a drench or foliar application.

Table 25. Efficacy on Winged Euonymus Scale on Euonymus, Freiberger, NJ, 2004.

		Population Averages (Henderson's Percent Control)				
Treatment	**Rate**	**Pretreatment counts (6/28/04 & 6/30/04)**	**6 DAT**	**13 DAT**	**27 DAT**	**45 DAT**
Diazinon	8.96 oz/100 gal	7.2	13.4 (13)	7.9 (28)	5.3 (71)	48.8 (38)
Distance 0.86E	8 fl oz/100 gal	14.5	30.4 (3)	22.9 (0)	20.6 (44)	72.1 (55)
Distance 0.86E	16 fl oz/100 gal	3.4	19.2 (0)	11.8 (0)	6.4 (26)	26.3 (30)
Distance 0.86E	32 fl oz/100 gal	12.5	32.1 (0)	14.9 (22)	7.2 (77)	19.4 (86)
Flagship 25 WG	2 oz/100 gal	9.7	15.4 (26)	11.1 (25)	11.5 (53)	113.1 (0)
Flagship 25 WG	4 oz/100 gal	32.4	30.6 (56)	13.3 (73)	14.7 (82)	80.0 (77)
Flagship 25 WG	8 oz/100 gal	31.9	47.3 (31)	23.1 (53)	22.8 (72)	105.0 (70)
Kontos *	20 fl oz/100 gal	18.7	26.9 (33)	7.8 (73)	6.3 (87)	58.8 (71)
Kontos *	40 fl oz/100 gal	7.3	10.8 (32)	7.1 (37)	9.6 (49)	97.0 (0)
Safari 20SG **	12 oz/100 gal	9.8	23.5 (0)	21.6 (0)	35.0 (0)	228.6 (0)
Safari 20SG **	24 oz/100 gal	3.4	11.5 (0)	17.2 (0)	20.8 (0)	80.5 (0)
Safari 20SG **	48 oz/100 gal	6.2	10.6 (20)	13.6 (0)	15.5 (1)	101.4 (0)
Talus 40 SC	21.5 fl oz/100 gal	8.8	20.2 (0)	20.4 (0)	12.4 (45)	25.9 (73)
Talus 40 SC	43 fl oz/100 gal	9.0	23.5 (0)	9.3 (33)	7.0 (69)	0.0 (100)
Talus 40 SC	86 fl oz/100 gal	15.4	29.3 (12)	10.7 (55)	5.6 (86)	0.7 (100)
TriStar 70WSP	32 g/100 gal	8.6	26.1 (0)	6.3 (53)	6.9 (68)	33.2 (65)
TriStar 70WSP	64 g/100 gal	9.8	17.0 (19)	12.0 (20)	12.7 (49)	18.3 (83)
TriStar 70WSP	128 g/100 gal	33.0	50.5 (29)	21.5 (58)	20.8 (75)	87.3 (76)
Untreated Control	---	13.7	29.6 (0)	21.1 (0)	34.8 (0)	150.5 (0)

* Kontos (BYI-8330) was applied solely on 7/2/04.

** Safari SG was applied as foliar spray instead of drench.

Table 26. Efficacy on Euonymus Scale on Euonymus, Freiberger, NJ, 2005.

Treatment	Rate	Population Averages (Henderson's Percent Control)				
		Pretreatment Counts	7 DAT	15 DAT	29 DAT	44 DAT
Flagship	2 oz per 100 gal	21.2	25.9 (55)	36.7 (36)	20.7 (63)	22.6 (66)
Flagship	4 oz per 100 gal	25.4	16.6 (76)	22.8 (67)	9.1 (87)	15.6 (81)
Orthene TTO	8 oz per 100 gal	24.0	12.1 (81)	21.9 (66)	20.1 (69)	10.7 (86)
Safari drench	12 oz/acre	3.9	8.1 (24)	10.9 (0)	10.9 (0)	24.0 (0)
Safari drench	24 oz/acre	5.1	16.2 (0)	22.3 (0)	22.7 (0)	41.8 (0)
Safari foliar	4 oz per 100 gal	11.4	20.7 (32)	39.7 (0)	39.0 (0)	57.9 (0)
Safari foliar	8 oz per 100 gal	11.8	14.0 (56)	20.3 (36)	16.2 (48)	28.7 (23)
Talus 40SC	21.5 fl oz per 100 gal	5.3	13.8 (4)	8.6 (40)	2.1 (85)	4.7 (72)
TriStar 70WSP	112 g per 100 gal	20.3	24.1 (56)	30.6 (44)	33.8 (37)	29.5 (54)
TriStar 70WSP	224 g per 100 gal	16.1	14.7 (66)	41.5 (4)	59.8 (0)	42.3 (17)
Untreated Control		16.2	43.6 (0)	43.5 (0)	43.1 (0)	51.0 (0)

* Note: outlier data point in Flagship 4 oz per 100 gallon rate was removed. This bush started with 348 scale in the initial count, an amount far greater than any other plant.

Nielsen. In 2007 and 2009, Nielsen investigated the efficacy of neonicotinoids (Flagship, Safari and TriStar), insect growth regulators (Distance and Talus) and Rycar (pyrifluquinazon)on euonymus scale (*Unaspis euonymi*) infesting euonymus (*Euonymus vegetus*) 'Fortunei' in the landscape.

In the 2007 experiment comparing drench and trunk spray applications of Safari, only the spray treatment controlled first generation nymphs at 34 DAT (Table 27). The drench application looked somewhat succesful on the second generation nymphs at 89 DAT. The early spray treatment was beginning to fail at that time, indicating that two spray applications might be required to "clean-up" scale-infested euonymus in the landscape.

In the 2009 study on container plants, foliar sprays of Distance, Talus and UltraFine oil, and Safari drench provided a high level of scale control. TriStar looked promising, but Flagship, Rycar and Safari top-dress were relatively ineffective. These results were mostly reflected when evaluating treatment effects on second generation production of new adults in mid-September. At this time, TriStar looked ineffective.

No phytotoxicity was observed in either study.

Table 27. Efficacy on Euonymus Scale on Euonymus 'Fortunei', Nielsen, OH, 2007.

Treatment	Rate	Application Method, Timing	Percent Nymphs Dead	
			34 DAT	89 DAT
Safari 20SG (dinotefuran)	24 oz/100gal	Trunk spray, May 3	98	84
Safari 20SG (dinotefuran)	6 g/ ft height	Drench, May 3	3	80
Safari 20SG (dinotefuran)	6 g/ ft height	Drench, May 30	9	44
Untreated	-	-	6	4

Table 28. Efficacy on Euonymus Scale on Euonymus 'Sunspot', Nielsen, OH, 2009.

Treatment	Rate	Application Method, Timing	% Nymph Mortality 15 DAT (6/27/09)	# Live adult scales 91 DAT (9/11/09)
Distance 10EC (pyriproxyfen)	12 fl oz/100 gal	Foliar, June 12, 26	99	0
Flagship 0.22G (thiamethoxam)	114 g/ft. ht	Top-dress, June 26	-	100+
Flagship 25WG (thiamethoxam)	8 oz/100gal	Foliar, June 12, 26	63	75
Rycar 20SC (pyrifluquinazon)	12 fl oz/100 gal	Foliar, June 12, 26	49	100+
Safari 2G (dinotefuran)	60 g/ft. ht	Top-dress, June 12	71	38
Safari 20SG (dinotefuran)	6 g/ft. ht	Drench, June 12	91	3
Talus 40 SC (buprofezin)	21.5 fl oz/100 gal	Foliar, June 12, 26	92	0
TriStar 30 SG (acetamiprid)	8 oz/100 gal	Foliar, June 12, 26	88	91
UltraFine Oil	3 % solution	Foliar, June 12, 26	90	0
Untreated	-	-	15	100+

Frank. In 2009 and 2010, Frank evaluated the efficacy of neonicotinoids (Flagship, Safari and TriStar),insect growth regulators (Distance and Talus), A16901B, Kontos,Rycarand Talstar on euonymus scale (*Unaspis euonymi*) infesting spindle tree (*Euonymus japonica*) 'Mycrophylla'. All treatments significantly reduced scale population, comparable to the standard Acephate and Horticultural oil (Table 29,Table 30).

No phytotoxicity was observed on any of the treated plants.

Table 29. Efficacy on Euonymus Scale on Spindle Tree'Microphylla', Frank, NC, 2009.

Treatment	Rate	Application Method	Population Averages (Henderson's Percent Control)				
			Pretreatment Counts	1 WAT	2 WAT	4 WAT	6 WAT
Acephate 75WP	0.67 lb/100 gal	Foliar	151.2 a	68.0 c (45)	4.3 d (67)	2.5 c (18)	0.5 b (56)
Distance 10EC (pyriproxyfen)	12 fl oz/100 gal	Foliar	102.3 a	50.8 c (40)	5.7 d (41)	0.5 c (88)	0.2 b (11)
Flagship 0.22G (thiamethoxam)	60 g/plant	Broadcast	203.7 a	108.0 bc (36)	32.0 abc (0)	18.0 b (20)	3.7 b (54)
Flagship 25WG (thiamethoxam) + Dyne-Amic	8 oz/100gal	Foliar	184.5 a	103.0 bc (32)	12.3 cd (37)	0.5 c (94)	1.3 b (0)
Rycar20SC (pyrifluquinazon)	18 fl oz/100 gal	Foliar	265.2 a	160.2 ab (27)	9.5 cd (69)	1.3 c (81)	1.2 b (0)
Safari 2G (dinotefuran)	7.8 g/plant	Broadcast	213.0 a	129.7 bc (26)	39.7 ab (0)	5.0 c (82)	1.2 b (47)
Safari 20SG (dinotefuran)	24 oz/100gal	Drench	166.7 a	167.0 ab (0)	3.2 d (90)	1.0 c (56)	0.5 b (0)
Talus 40 SC (buprofezin)	21.5 fl oz/100 gal	Foliar	204.3 a	65.0 c (68)	4.7 d (62)	2.7 c (19)	0.2 b (32)
TriStar 30 SG (acetamiprid) + Capsil	8 oz/100 gal + 6 fl oz/100 gal	Foliar	158.3 a	111.5 bc (14)	17.3 bcd (18)	4.2 c (66)	2.5 b (0)
Untreated	-	-	265.5 a	218.3 a (0)	41.5 a (0)	29.3 a (0)	13.2 a (0)

* Means followed by same letter do not significantly differ (Duncan's New MRT, P=0.05)

Table 30. Efficacy on Euonymus Scale on Spindle Tree 'Microphylla', Frank, NC, 2010.

Treatment	Rate	Application Method	Population Averages (Henderson's Percent Control)				
			Pretreat	1 WAT	2 WAT	4 WAT	6 WAT
A16901B	5 oz/100 gal	Drench	221.5 a	65.8 a (61)	9.0 b (95)	6.2 b (97)	6.2 b (95)
Distance 10EC (pyriproxyfen)	12 fl oz/100 gal	Foliar	242.0 a	122.7 a (33)	76.8 b (59)	33.5 b (87)	9.0 b (93)
Flagship 0.22G (thiamethoxam)	60 g/plant	Broadcast	202.5 a	64.2 a (58)	39.5 b (75)	14.0 b (94)	4.8 b(96)
Flagship 25WG (thiamethoxam) + Dyne-Amic	8 oz/100gal	Foliar	225.3 a	102.0 a (41)	43.7 b (75)	22.5 b (91)	2.8 b (98)
Horticultural Oil	5 qt/100 gal	Foliar	135.0 a	48.3 a (53)	8.2 b (92)	3.0 b (98)	1.0 b(99)
Kontos (spirotetramat)	3.4 fl oz/100gal	Foliar	234.7 a	68.7 a (62)	24.3 b (87)	7.8 b (97)	0.5 b (100)
Rycar 20SC (pyrifluquinazon)	18 fl oz/100 gal	Foliar	229.7 a	109.3 a (38)	46.8 b (74)	3.2 b (99)	0.0 b (100)
Safari 2G (dinotefuran)	7.8 g/plant	Broadcast	172.7 a	86.7 a (34)	33.8 b (75)	7.0 b (96)	1.0 b (99)
Safari 20SG (dinotefuran)	24 oz/100gal	Drench	206.8 a	109.3 a (31)	41.8 b (74)	7.2 b (97)	2.2 b (98)
Talstar (bifenthrin)	21.7 oz/100 gal	Foliar	166.3 a	122.3 a (3)	41.8 b (68)	4.7 b (97)	1.0 b (99)
Talus70 DF (buprofezin)	14 oz/100 gal	Foliar	199.2 a	55.7 a (63)	50.3 b (68)	2.7 b (99)	0.8 b (99)
TriStar 30 SG (acetamiprid) + DyneAmic	8 oz/100 gal	Foliar	184.3 a	95.3 a (32)	32.3 b (78)	6.8 b (97)	1.8 b (98)
Untreated	-	-	238.0 a (0)	181.3 a (0)	186.3 a (0)	261.8 a (0)	127.0 a (0)

* Means followed by same letter do not significantly differ (Duncan's New MRT, P=0.05).

Ludwig. In 2009, Ludwig evaluated the efficacy of neonicotinoids (Aloft, Flagship, Safari and TriStar), insect growth regulators (Distance and Talus) and Triact (neem oil extract) on euonymus scale (*Unaspis euonymi*) infesting spindle tree (*Euonymus japonica*) 'Mycrophylla'. All treatments provided significantlyhigher scale mortality 57 days after the first application (Table 31).Safari was the best, and Tristar the least effective treatment.

Table 31. Efficacy on Euonymus Scale on Spindle Tree 'Microphylla', Ludwig, TX, 2009.

Treatment	Rate	Application Method	Percent Female Adult Scale Mortality		
			Pretreatment	29 DAT	57 DAT
Aloft SC	5 fl oz/100 gal	Foliar	23.3a	94.0a	77.3ab
Aloft SC	10 fl oz/100 gal	Foliar	32.7a	82.7abc	97.3ab
Distance 10EC (pyriproxyfen)	12 fl oz	Foliar	38.7a	46.7cde	92.8ab
Flagship 25WG (thiamethoxam)	8 oz/100gal	Foliar	26.7a	68.0abcd	80.1ab
Safari 2G (dinotefuran)	2.6 g / gallon of media	Media mix	34.7a	96.0a	99.2a
Safari 20SG (dinotefuran)	24 oz/100gal	Drench	18.7a	66.4abcd	99.3a
Talus 40 SC (buprofezin)	21.5 fl oz/100 gal	Foliar	21.3a	29.3de	82.7ab
Triact 70 (neem oil extract)	2 gal/100 gal	Foliar	29.6a	91.3ab	90.0ab
TriStar 30 SG (acetamiprid)	8 oz/100 gal + 6 fl oz/100 gal	Foliar	30.0 a	57.3 bcde	62.0 b
Untreated	-	-	25.3 a	17.3 e	12.0 c

* Means within a column followed by the same letter are not significantly different (Tukey's HSD, P< 0.05).

Potter. In 2010, Potter evaluated the efficacy of neonicotinoids (Flagship, Safari and TriStar), insect growth regulators (Distance and Talus), A16901B, Kontos and Rycar on euonymus scale (*Unaspis euonymi*) infesting spindle tree (*Euonymus japonica*) 'Moonshadow'. Distance, Safari and Talus provided good control while A16901B, Flagship, Kontos, Rycar, Tristar and the standard Horticultural Oil performed poorly (Table 32). No phytotoxicity was observed on any of the treated plants.

Kunkel. In 2011, Kunkel evaluated the efficacy of neonicotinoids (Flagship, Safari and TriStar), insect growth regulators (Distance and Talus), QRD 452 and Rycar on euonymus scale (*Unaspis euonymi*) infesting wintercreeper (*Euonymus fortunei*) 'Radicans'. Safari and Talus provided good control while Distance, Horticultural Oil, QRD 452 and Tristar were generally inferior (Table 33). No phytotoxicity or growth reduction was observed on any of the treated plants.

Table 32. Efficacy on Euonymus Scale on Spindle Tree 'Moonshadow', Potter,KY, 2010.

Treatment	Rate (per 100 gal)	Application Method, Timing	No. Live Scales, 1st Generation (% Control)	No. Live Scales, 2nd Generation (% Control)
A16901B	5 oz	Drench, May 10	16.8 ± 3.7 e (0)	20.5 ± 4.3 d (0)
Distance 10EC (pyriproxyfen)	12 fl oz	Foliar, May 10, June 1	1.1 ± 0.5 ab (84)	2.8 ± 1.3 a (59)
Flagship 0.22G broadcast	40 g/2 gal pot	Media mix, May 10	5.6 ± 1.5 cd (20)	9.4 ± 2.3 bc (0)
Flagship 25WG + spreader-sticker	8 oz	Foliar, May 10, June 1	5.4 ± 1.6 bcd (23)	13.3 ± 2.5 c (0)
Horticultural Oil	2 gal	Foliar, May 10	3.7 ± 0.9 a-d (47)	9.4 ± 2.4 bc (0)
Kontos (spirotetramat)	3.4 fl oz	Foliar, May 10	7.7 ± 2.8 d (0)	6.3 ± 1.4 ab (7)
Rycar 20SC (pyrifluquinazon)	18 fl oz	Foliar, May 24	2.1 ± 0.9 abc (70)	9.9 ± 2.5 bc (0)
Safari 20SG (dinotefuran)	24 oz	Drench, May 10	0.2 ± 0.1 a (97)	0.7 ± 0.3 a (90)
Talus 40 SC (buprofezin)	21.5 fl oz	Foliar, May 10	0.3 ± 0.1 a (96)	1.0 ± 0.6 a (85)
TriStar 30 SG (acetamiprid)	8 oz	Foliar, May 10, 24	2.2 ± 0.7 abc (69)	4.8 ± 1.3 ab (29)
Untreated	-	-	7.0 ± 1.7 d (0)	6.8 ± 2.4 ab (0)

* Means within a column followed by the same letter are not significantly different (LSD All-Pairwise Comparisons Test). First and 2nd generation scales counted June 21-22 and October 4-7, respectively.

Table 33. Efficacy on Euonymus Scale on Wintercreeper, (*Euonymus fortunei*) 'Radicans', Kunkel, DE, 2011.

Treatment	Rate (per 100 gal)	Average % Mortality[x]				
		Pretreat	7 DAT	14 DAT	28 DAT	42 DAT
Distance 10EC	12 fl oz	6.6 a	30.4 a	30.3 ab	72.4 ab	73.5 bc
Flagship 25WG + Capsil	8 oz	10.3 a	46.6 a	27.7 ab	46.5 cd	64.7 cd
Flagship 0.22G broadcast	20 g/1 gal pot	8.4 a	30.1 a	55.4 a	60.2 abc	65.4 cd
Horticultural Oil	1 gal	11.1 a	33.0 a	46.7 ab	69.7 abc	71.7 bc
Rycar 20SC	18 fl oz	7.7 a	30.0 a	43.3 ab	51.8 bcd	56.3 cd
QRD 452	128 oz	4.3 a	42.0 a	31.1 ab	58.9 abc	73.0 bc
Safari 20SG drench	24 oz	10.3 a	51.3 a	35.6 ab	72.2 abc	90.0 ab
Talus 40SC	21.5 fl oz	17.5 a	62.3 a	49.6 a	76.5 a	92.0 a
TriStar 30SG + Capsil	8 oz	3.9 a	41.4 a	41.7 ab	47.8 bcd	69.3 bc
Untreated	-	7.6 a	24.6 a	12.0 b	30.0 d	43.0 d

[x] Means followed by same letter do not significantly differ (Tukey's HSD, P=0.05).

Gilrein. In 2011, Gilrein evaluated the efficacy of neonicotinoids (Flagship, Safari and TriStar), insect growth regulators (Distance and Talus), A16901B, Kontos and Rycar on euonymus scale (*Unaspis euonymi*) infesting euonymus (*Euonymus japonicus*) 'Green Spire'. Talus and Distance were most effective for controlling euonymus scale, followed closely by Kontos (Table 34). No or nearly no live females were found at final observation (Sept. 11) on plants treated with Distance or Talus. TriStar, Safari, Rycar and A16901 all had noticeably lower numbers of females on treated plants than the untreated, but differences were not significant; Flagship was ineffective. No differences in plant heights, widths and overall quality were seen among treatments (data not shown). No phytotoxicity was observed in any of the treated plants.

Table 34. Efficacy on Euonymus Scale on Euonymus, (*Euonymus japonicus*) 'Green Spire', Gilrein, NY, 2011.

Treatment	Rate Per 100 Gal	Applic. Method, Timing	Population Averages[x] (Percent Control)						
			Crawlers 6/10	Crawlers 7/11	Females 7/11	Males 7/11	Females + Males 7/11	All Stages 7/11	Females 9/19
A16901B 40WG	5 oz	Drench, 6/15	135.6 a	36.2a (0)	115.6a (0)	18.4ab (0)	134.0a (0)	170.0a (0)	22.4ab (53)
Distance 0.86EC	12fl oz	Spray, 6/15, 7/6	147.0 a	16.6 ab (0)	16.8 cd (71)	0.6 c (81)	17.4 cd (71)	34.0 b (55)	0.4 cd (99)
Flagship 25WG	0.5 g/ft ht	Drench, 6/15	128.2 a	48.4a (0)	77.0ab (0)	61.8a (0)	138.8a (0)	187.2a (0)	53.4a (0)
Kontos 2F	3.4 fl oz	Spray, 6/15	128.6 a	6.2 b (59)	23.2 bc (60)	26.6 bc (0)	32.8 b (46)	7.8 bc (90)	26.6 bc (44)
Rycar 1.80SC	18 fl oz	Spray, 6/15	144.2 a	13.0 ab (14)	51.4 abc (10)	3.8 bc (0)	55.2 abc (9)	68.2 ab (10)	12.4 ab (74)
Safari 20SG	24 oz	Drench, 6/15	153.0 a	54.6 a (0)	33.2 abc (42)	46.6 a (0)	79.8 ab (0)	134.4 a (0)	17.8 ab (62)
Talus 70DF	14 oz	Spray, 6/15	131.6 a	3.2 b (80)	5.6 d (90)	0.2 c (94)	5.8 d (90)	9.0 c (88)	0.0 d (100)
TriStar 30SG + Capsil	8 oz + 6 fl oz	Spray, 6/15, 6/29	141.6 a	33.2 a (0)	49.6 abc (14)	9.4 abc (0)	59.0 abc (3)	92.2 ab (0)	17.6 ab (63)
Untreated	water	Spray, 6/15	133.8 a	15.2 ab (0)	57.4 abc (0)	3.2 bc (0)	60.6 abc (0)	75.8 ab (0)	47.2 a (0)

[x] Means within columns followed by the same letter are not significantly different at p=0.05 (LSMeans Tukey's HSD).

Braman. In 2014, Braman evaluated the efficacy of various insecticides applied as foliar sprays on May 14 and 28 for euonymus scale (*Unaspis euonymi*) infesting euonymus in containers. All treatments provided excellent control of nymphs within 2 weeks after treatment and through 6 months for adults (Table 35).

Table 35. Efficacy on Euonymus Scale on Euonymus, Braman, GA, 2014.

Treatment	Rate Per 100 Gal	Population Averages[x] (Percent Control)				
		Nymphs			Adults	
		Day 0	Day 7	Day 14	4 Months	6 Months
Distance	12 floz	14.2 a	3.2 a (98)	3.2 ab (99)	0.0 b	0.0 b (100)
Horticultural Oil	2 gal	0.7 b	5.3 a (29)	0.5 b (96)	0.0 b	0.0 b (100)
Mainspring 200SC	8 floz	7.3 ab	14.5 a (81)	0.2 b (99)	0.3 b	2.7 b (99)
	12 floz	0.8 b	0.8 a (91)	0.3 b (98)	0.0 b	0.0 b (100)
Orthene TTO 97	8 oz	1.7 b	3.2 a (82)	0.8 b (97)	0.0 b	0.0 b (100)
Safari 20SG	24 oz	7.0 ab	18.7 a (75)	1.5 ab (99)	0.0 b	0.0 b (100)
Talus 70DF	14 oz	0.2 b	1.0 a (53)	0.0 b (100)	0.0 b	0.0 b (100)
XXpire 40WG + Capsil	2 oz + 6 floz	0.7 b	0.3 a (96)	0.0 b (100)	0.0 b	0.0 b (100)
	2.75 oz + 6 floz	14.7 a	0.8 a (99)	0.0 b (100)	0.0 b	0.0 b (100)
	3.5 oz + 6 floz	0.2 b	2.5 a (0)	0.5 b (84)	0.0 b	0.0 b (100)
Untreated	-	0.3 b	3.2 a (0)	4.8 a (0)	0.0 b	9.8 a (0)

[x] Number counted from 3 leaves. Means followed by same letter do not significantly differ (LSD, P=0.05).
* Mainspring and Safari applied as drench.

Potter. In 2014, Potter evaluated the efficacy of several insecticides on euonymus scale (*Unaspis euonymi*) infesting potted wintercreeper (*Euonymus fortunei*) 'Emerald N Gold'. Orthene and XXpire(3.5 oz rate) provided the best control (more than 70%) of scale populations (Table 36). XXpire (2.0 oz rate) and Mainspring (12 oz rate) both significantly reduced scale populations, but to lower degree at 61.0% and 36.4%, respectively. The IGR's Distance and Talus looked ineffective. No phytotoxicity was observed on any of the treated plants.

Table 36. Efficacy on Euonymus Scale on Wintercreeper (*Euonymus fortunei*) 'Emerald N Gold', Potter, KY, 2014.

Treatment	Rate (per 100 gal)	Application Method, Timing	Adult Female Scales[x]	Percent Reduction
Distance	12 fl oz	Foliar At crawler stage. Repeat at 3 wks	7.8± 2.6 bc	0%
Mainspring 200SC	8 floz	Soil drench. 30 day prior to hatch. 3 floz per pot.	6.0 ± 1.2 bc	22.1%
	12 floz		4.9± 1.5 ab	36.4%
Orthene	150 fl oz	Foliar At crawler stage. Repeat at 1 wk	2.0± 0.5 a	74.0%
Talus 70DF	14 oz	Foliar At crawler stage.	5.6 ± 1.4 bc	27.3%
XXpire 40WG + Capsil	2 oz + 6 floz	Foliar At crawler stage. Repeat at 2 wks.	3.0± 0.6 ab	61.0%
	2.75 oz + 6 floz		5.9 ± 1.7 bc	23.4%
	3.5 oz + 6 floz		1.9± 0.4 a	75.3%
Untreated	-	-	7.7 ± 1.5 c	-

[x]Number per 10 cm of twig. Means within a column followed by the same letter are not significantly different (LSD All-Pairwise Comparisons Test).

False Florida Red Scale

In 2009, Chong evaluatedthe efficacy of neonicotinoids (Flagship, Safari and TriStar), insect growth regulators (Distance and Talus) and Rycar (pyrifluquinazon) on false Florida red scale (*Chrysomphalus bifasciculatus*) on Chinese holly (*Ilex cornuta*) 'Carissa'. Insecticide treatments did not significantly reduce the numbers of live scales in the first 2 weeks after the application (Table 37). At 4 and 6 WAT, only Flagship and Safari provided effective control, providing 99% mortality (Table 38).

No phytotoxicity was observed on any of the treated holly shrubs.

Table 37. Efficacy on False Florida Red Scale on Chinese Holly'Carissa', Chong, SC, 2009.

Treatment	Rate	Application Method	Population Averages (Henderson's Percent Control)				
			Pretreatment Counts	1 WAT	2 WAT	4 WAT	6 WAT
Distance 10EC (pyriproxyfen)	12 fl oz	Foliar	28.9 a	12.4 a (87)	12.9 a (50)	4.5 b(0)	10.7 bc(0)
Flagship 25 WG (thiamethoxam)	4 g/ft height	Drench	33.3 a	24.2 a (78)	84.6 a (0)	14.3 ab(46)	1.1 c(94)
Rycar20SC (pyrifluquinazon)	18 fl oz/100 gal	Foliar	49.5 a	24.6 a (85)	14.2 a (72)	12.3 ab(0)	21.0 abc (0)
Paraffinic oil	2 gal/100 gal	Foliar	49.6 a	44.7 a (73)	47.8 a (49)	14.0 ab(7)	17.6 abc(7)
Safari 20SG (dinotefuran)	6 g/ft height	Drench	11.1 a	16.8 a (55)	24.3 a (31)	2.2 b(71)	0.2 c(93)
Talus 40 SC (buprofezin)	21.5 fl oz/100 gal	Foliar	58.1 a	47.8 a (75)	44.6 a (56)	36.3 a(0)	30.4 ab (38)
TriStar 30 SG (acetamiprid) + Capsil	8 oz/100 gal + 6 fl oz/100 gal	Foliar	41.2 a	50.3 a (63)	30.3 a (71)	15.3 ab(0)	11.6 abc(44)
Untreated	-	-	14.5 a	48.5 a (0)	101.8 a (0)	32.1 a(0)	43.3 a(0)

* Means within columns with the same letter are not significantly different (LSD test, $P<0.10$).

Table 38. Efficacy on False Florida Red Scale on Chinese Holly , 'Carissa', Chong, SC, 2009.

Treatment	Rate	Application Method	Average % Mortality				
			Pretreatment	1 WAT	2 WAT	4 WAT	6 WAT
Distance 10EC (pyriproxyfen)	12 fl oz	Foliar	85.9 a	90.8 a	93.8 a	96.8 a	95.1 ab
Flagship 25WG (thiamethoxam)	4 g/ft height	Drench	72.6 a	80.5 a	81.0 a	90.6 abc	99.4 a
Rycar20SC (pyrifluquinazon)	18 fl oz/100 gal	Foliar	73.5 a	84.6 a	89.8 a	93.3 abc	90.9 bc
Paraffinic oil	2 gal/100 gal	Foliar	67.5 a	83.9 a	79.4 a	94.0 abc	89.3 bc
Safari 20SG (dinotefuran)	6 g/ft height	Drench	85.8 a	89.6 a	91.8 a	98.5 a	99.9 a
Talus 40SC (buprofezin)	21.5 fl oz/100 gal	Foliar	71.3 a	80.0 a	76.4 a	82.1 bc	88.6 bc
TriStar 30SG (acetamiprid) + Capsil	8 oz/100 gal + 6 fl oz/100 gal	Foliar	62.3 a	71.9 a	81.3 a	90.0 abc	90.6 bc
Untreated	-	-	86.7 a	80.9 a	73.3 a	75.8 c	80.3 c

* Means within columns with the same letter are not significantly different (LSD test, $P<0.10$).

False Oleander Scale.
In 2004, Ludwig investigated efficacy of Flagship, Safari, Talus and TriStar on false oleander scale (*Pseudaulacaspis cockerelli)* on aucuba (*Aucuba japonica*).None of the treatments provided statistically or biologically significant mortality on this scale species at 13 or 27 days after treatment (Table 39).

Table 39. Efficacy on False Oleander Scaleon Aucuba, Ludwig, TX, 2004.

Treatment	Rate (per 100 gal)	Population Averages (Henderson's Percent Control)		
		Pretreatment	13 DAT	27 DAT
Flagship 25WG + NIS	2 oz	65.0 a	230.3 a (8)	55.5 a (28)
Flagship 25WG + NIS	4 oz	54.0 a	197.3 a (5)	44.3 a (0)
Flagship 25WG+ NIS	8 oz	68.8 a	181.3 a (32)	65.5 a (0)
Safari 20SG – Drench	12 oz	61.8 a	166.3 a (30)	43.0 a (23)
Safari 20SG – Drench	24 oz	55.0 a	172.3 a (19)	68.0 a (0)
Safari 20SG – Drench	48 oz	78.5 a	118.8 a (61)	56.8 a (0)
Talus 40SC+ NIS	21.5 fl oz	52.0 a	187.5 a (6)	62.5 a (1)
Talus 40SC+ NIS	43 fl oz	73.3 a	179.3 a (36)	53.3 a (11)
Talus 40SC+ NIS	86 fl oz	73.3 a	173.5 a (39)	50.0 a (14)
Tristar 30SG + NIS	32 g	71.5 a	192.0 a (30)	63.0 a (2)
Tristar 30SG + NIS	64 g	59.8 a	141.0 a (39)	30.8 a (35)
Tristar 30SG + NIS	128 g	79.0 a	261.3 a (14)	70.5 a (20)
Untreated	-	43.0 a	165.5 a (0)	55.5 a (0)

* Means within columns with the same letter are not significantly different (LSD test, $P<0.05$).

In 2010, Chong conducted two experiments to evaluate the efficacy of neonicotinoids (Arena, Flagship, Safari and TriStar), insect growth regulators (Distance and Talus), A16901B, Kontos and Rycar on false oleander scale (*Pseudaulacaspis cockerelli*) on Southern magnolia (Table 40 and Table 41). In the first experiment, only the soil drench with Safari achieved 90% mortality in the scale insect population by 6 WAT. By 4 months after treatment, Arena drench, Flagship drench, and Safari broadcast and drench applications provided significant increase in scale mortality. A16901B, Kontos, Orthene and Tristar were ineffective. In the second experiment, Distance, Talus and paraffinic oil provided significantly higher mortality (30.8-50.2%) than the untreated check (2.5%) by 2 WAT. Rycar looked ineffective.

In 2012, Braman conducted a field experiment to determine efficacy of neonicotinoids (Arena, Flagship and Safari), insect growth regulators (Distance and Talus), A16901B, GF-2626 and GF-2860 on false oleander scale on Southern magnolia (Table 42). In general, all treatments providedgood to excellent control of immatures, comparable to the standard Orthene at 7 days post-treatment. At 28 DAT, A16901B, GF-2626, GF-4860, Arena, Flagship and Safari provided better control of immatures compared to Orthene. Five months after initial treatment, A16901B, Arena, Flagship, GF-2626 at the high rate and Safari were still showing significant suppression of egg production.

No phytotoxicity was observed from any treatment.

In 2014, Chong conducted an experiment to evaluate the efficacy of GF-2860/XXpire on false oleander scale (*Pseudaulacaspis cockerelli*) on Southern magnolia (Table 43). Both GF-2860 and the standard paraffin oil provided good control of adults and immatures throughout the growing season, resulting in significantly lower numbers of live false oleander scales. No phytotoxicity or residue of the insecticides was observed during the course of this study.

Table 40. Efficacy on False Oleander Scale on Southern Magnolia, Chong, SC, 2010a.

Treatment	Rate	Applic. Method	Mean Percent Mortality[x]						
			5/20 Pretreat	6/2 1 WAT	6/11 2 WAT	6/24 4 WAT	7/8 6 WAT	9/17 4 MAT	5/31/11 1 YAT
A16901B	10 oz/100 gal	Drench	16.7 ± 2.9	12.7 ± 5.5	15.8 ± 7.8	30.1 ± 13.8	23.2 ± 6.1 cd	28.8 ± 5.9 cde	58.8 ± 4.6 c
Arena 50WDG	4.8 g/in dbh	Drench	15.9 ± 4.9	8.5 ± 4.6	7.0 ± 3.2	26.3 ± 7.9	69.1 ± 12.0 b	73.4 ± 5.6 bc	64.4 ± 12.1 bc
Flagship 0.22G	227 g/in dbh	Broadcast	11.8 ± 2.7	0.3 ± 0.3	11.0 ± 4.3	25.6 ± 9.6	34.9 ± 12.9 cd	47.9 ± 3.4 de	71.5 ± 6.4 bc
	454 g/in dbh		10.2 ± 3.0	13.3 ± 3.7	16.1 ± 5.6	22.8 ± 7.1	38.2 ± 4.3 cd	62.9 ± 4.6 bcde	81.2 ± 8.7 b
Flagship 25WG	4 g/in dbh	Drench	11.8 ± 5.3	3.2 ± 3.2	15.5 ± 7.7	28.8 ± 9.5	38.5 ± 12.1 cd	67.3 ± 5.6 bc	70.5 ± 10.1 bc
Kontos	3.4 fl oz/100gal	Foliar	13.3 ± 3.3	12.8 ± 6.4	16.7 ± 6.4	33.8 ± 7.3	35.0 ± 14.3 cd	51.1 ± 2.6 de	59.6 ± 4.1 c
Orthene 97	8 oz/100gal	Foliar	11.8 ± 4.3	11.3 ± 3.2	19.8 ± 9.6	33.9 ± 12.5	31.8 ± 8.7 cd	43.5 ± 2.6 e	61.0 ± 3.8 c
Safari 2G	60 g/in dbh	Broadcast	11.5 ± 3.5	11.2 ± 5.0	7.2 ± 4.1	44.4 ± 10.1	46.5 ± 11.9 bc	75.1 ± 7.8 b	83.5 ± 6.4 b
Safari 20SG	6 g/in dbh	Drench	24.0 ± 7.2	11.0 ± 3.7	12.7 ± 4.6	44.3 ± 13.4	90.3 ± 34.5 a	87.9 ± 8.0 a	97.6 ± 1.5 a
TriStar 30 SG + Capsil	8 oz/100 gal	Foliar	18.7 ± 6.3	9.0 ± 4.5	12.7 ± 3.5	11.7 ± 6.0	25.9 ± 12.3 cd	49.8 ± 7.6 de	62.8 ± 3.6 c
Untreated	-	-	12.3 ± 1.7	9.8 ± 4.6	3.3 ± 1.4	34.7 ± 9.9	14.5 ± 7.4 d	41.2 ± 3.8 e	57.1 ± 2.3 c

[x] Means followed by same letter do not significantly differ (LSD test, P=0.05). No significant differences from Pretreatment to 4 WAT.

* All treatments applied once on 5/25/10 except Tristar which was applied 5/25/10 and 6/11/10.

Table 41. Efficacy on False Oleander Scale on Southern Magnolia, Chong, SC, 2010b.

Treatment	Rate (per 100 gal	Mean Percent Mortality[x]				
		Pretreat	1 WAT	2 WAT	4 WAT	6 WAT
Distance 10EC	12 fl oz	17.7 ± 5.0 a	26.4 ± 4.2 a	32.3 ± 4.8 ab	80.4 ± 9.9 a	85.1 ± 2.2 a
Rycar 20SC	18 fl oz	22.0 ± 3.0 a	18.0 ± 1.4 a	17.8 ± 5.8 bc	15.6 ± 4.9 cd	51.1 ± 2.1 b
Paraffinic Oil	2 gal	42.4 ± 16.8 a	28.9 ± 5.3 a	30.8 ± 4.6 b	33.8 ± 10.5 bc	86.8 ± 8.3 a
Talus70 DF	14 oz	19.6 ± 7.2 a	27.2 ± 0.8 a	50.2 ± 11.7 a	57.1 ± 8.4 b	85.2 ± 1.9 a
Untreated	-	17.5 ± 2.2 a	20.3 ± 3.9 a	2.5 ± 1.6 c	1.7 ± 1.1 d	5.3 ± 2.3 c

[x] Means followed by same letter do not significantly differ (LSD test, P=0.05).

* Treatments applied foliar starting on 5/27/10; Distance and Paraffinic oil applied a second time on 6/17/10.

Table 42. Efficacy on False Oleander Scale on Southern Magnolia 'Little Gem', Braman, GA, 2012.

Count Date	Treatment	Rate	Application Method	Mean No. Per 2 Leaves (% Control)			
				Adults	Crawlers	Eggs	Nymphs
Pretreat 5/03	A16901B	5 oz/100 gal	Drench	2.0 a	3.2 a	8.8 a	0.0 a
	A16901B	10 oz/100 gal	Drench	2.7 a	10.0 a	5.2 a	0.0 a
	Arena 50WDG	2.4 g/in dbh	Drench	1.2 a	9.2 a	4.0 a	0.0 a
	Distance 10EC	12 fl oz/100 gal	Foliar	1.7 a	21.0 a	5.7 a	0.0 a
	Flagship 0.22G	114 g/ft ht	Broadcast	1.7 a	9.7 a	14.3 a	0.0 a
	Flagship 0.22G	227 g/ft ht	Broadcast	2.5 a	18.0 a	16.0 a	0.0 a
	GF-2626 1SC	8 fl oz/100 gal	Foliar	2.0 a	4.2 a	4.5 a	0.0 a
	GF-2626 1SC	11 fl oz/100 gal	Foliar	1.8 a	8.3 a	3.0 a	0.0 a
	Xxpire 40WG	3.5 oz/100 gal	Foliar	0.8 a	13.0 a	10.5 a	0.0 a
	Xxpire 40WG	7 oz/100 gal	Foliar	1.7 a	5.0 a	5.5 a	0.0 a
	Orthene TTO	10.7 oz/100 gal	Foliar	1.2 a	2.5 a	9.0 a	0.0 a
	Safari 20SG	6 g/in dbh	Drench	0.3 a	10.3 a	0.0 a	0.0 a
	Talus 70DF	14 oz/100 gal	Foliar	1.0 a	3.5 a	2.0 a	0.0 a
	Untreated	-	-	1.0 a	13.6 a	14.2 a	0.0 a
7 DAT 5/10	A16901B	5 oz/100 gal	Drench	1.3 a	1.7 bc (95)	6.0 b (76)	1.3 b (89)
	A16901B	10 oz/100 gal	Drench	1.3 a	15.7 b (54)	6.2 b (75)	0.7 b (94)
	Arena 50WDG	2.4 g/in dbh	Drench	1.2 a	0.7 c (98)	4.0 b (84)	0.7 b (94)
	Distance 10EC	12 fl oz/100 gal	Foliar	1.6 a	0.2 c (99)	2.2 b (94)	0.2 b (98)
	Flagship 0.22G	114 g/ft ht	Broadcast	0.5 a	0.2 c (99)	0.8 b (97)	0 b(100)
	Flagship 0.22G	227 g/ft ht	Broadcast	0.3 a	0 c (100)	0 b (100)	0.3 b (98)
	GF-2626 1SC	8 fl oz/100 gal	Foliar	0.5 a	2.0 bc (94)	3.2 b (87)	0 b(100)
	GF-2626 1SC	11 fl oz/100 gal	Foliar	1.0 a	2.3 bc (93)	7.8 b (68)	0 b(100)
	Xxpire 40WG	3.5 oz/100 gal	Foliar	0.8 a	1.3 c (96)	10.0 b (60)	1.8 b (85)
	Xxpire 40WG	7 oz/100 gal	Foliar	0.3 a	0.8 c (98)	0 b (100)	0 b(100)
	Orthene TTO	10.7 oz/100 gal	Foliar	0.7 a	0.8 c (98)	4.2 b (83)	0 b(100)
	Safari 20SG	6 g/in dbh	Drench	0.5 a	0.3 c (99)	3.3 b (87)	0 b(100)
	Talus 70DF	14 oz/100 gal	Foliar	0.7 a	6.2 bc (82)	0.3 b (99)	0 b(100)
	Untreated	-	-	3.0 a	33.8 a (0)	24.7 a (0)	12 a (0)
14 DAT 5/17	A16901B	5 oz/100 gal	Drench	2.2 a	0.7 a	22.5 a	3.7 a
	A16901B	10 oz/100 gal	Drench	1.0 a	1.3 a	10.0 a	2.2 a
	Arena 50WDG	2.4 g/in dbh	Drench	1.3 a	0.0 a	3.3 a	1.3 a
	Distance 10EC	12 fl oz/100 gal	Foliar	0.5 a	1.3 a	26.3 a	2.3 a
	Flagship 0.22G	114 g/ft ht	Broadcast	1.7 a	1.3 a	19.2 a	0.8 a
	Flagship 0.22G	227 g/ft ht	Broadcast	1.3 a	0.7 a	3.0 a	0.5 a
	GF-2626 1SC	8 fl oz/100 gal	Foliar	1.5 a	0.8 a	9.0 a	0.8 a

Count Date	Treatment	Rate	Application Method	Mean No. Per 2 Leaves (% Control)			
				Adults	Crawlers	Eggs	Nymphs
	GF-2626 1SC	11 fl oz/100 gal	Foliar	2.2 a	0.3 a	1.3 a	0.3 a
	Xxpire 40WG	3.5 oz/100 gal	Foliar	1.3 a	0.5 a	15.5 a	2.3 a
	Xxpire 40WG	7 oz/100 gal	Foliar	2.2 a	0.5 a	2.0 a	1.7 a
	Orthene TTO	10.7 oz/100 gal	Foliar	1.0 a	0.8 a	10.5 a	3.2 a
	Safari 20SG	6 g/in dbh	Drench	0.7 a	0.7 a	3.0 a	0.7 a
	Talus 70DF	14 oz/100 gal	Foliar	2.0 a	0.8 a	9.3 a	3.2 a
	Untreated	-	-	2.7 a	1.0 a	11.1 a	0.7 a
28 DAT 5/31	A16901B	5 oz/100 gal	Drench	3.5 a	0.2 c (95)	20.7 bc (53)	3.2 b (90)
	A16901B	10 oz/100 gal	Drench	3.0 a	1.0 bc (76)	15.0 bc (66)	3.5 b (89)
	Arena 50WDG	2.4 g/in dbh	Drench	2.7 a	0.5 bc (88)	6.2 c (86)	12.5 ab (59)
	Distance 10EC	12 fl oz/100 gal	Foliar	5.0 a	6.7 a (0)	67.0 a (0)	13.7 ab (55)
	Flagship 0.22G	114 g/ft ht	Broadcast	3.5 a	2.7 bc (36)	22.2 bc (50)	11.0 ab (64)
	Flagship 0.22G	227 g/ft ht	Broadcast	2.7 a	0.5 bc (88)	5.3 c (88)	6.0 b (80)
	GF-2626 1SC	8 fl oz/100 gal	Foliar	2.7 a	0.5 bc (88)	7.8 c (82)	19.5 ab (36)
	GF-2626 1SC	11 fl oz/100 gal	Foliar	2.3 a	0.0 c (100)	23.2 a (48)	5.5 b (82)
	Xxpire 40WG	3.5 oz/100 gal	Foliar	1.2 a	1.0 bc (76)	15.7 bc (64)	4.7 b (85)
	Xxpire 40WG	7 oz/100 gal	Foliar	2.7 a	2.8 abc (33)	27.3 abc (38)	7.2 b (76)
	Orthene TTO	10.7 oz/100 gal	Foliar	4.3 a	3.5 abc (17)	55.3 ab (0)	20.5 ab (33)
	Safari 20SG	6 g/in dbh	Drench	4.8 a	0.8 bc (81)	2.8 c (94)	20.8 ab (32)
	Talus 70DF	14 oz/100 gal	Foliar	2.8 a	2.7 bc (36)	67.0 a (0)	12.5 ab (59)
	Untreated	-	-	4.5 a	4.2 ab (0)	44.2 abc (0)	30.5 a (0)
5 Mo. 10/03	A16901B	5 oz/100 gal	Drench	2.8 cde	3.2 a	29.5 bcd (63)	2.3 a
	A16901B	10 oz/100 gal	Drench	2.0 de	0.5 a	20.5 bcd (74)	6.2 a
	Arena 50WDG	2.4 g/in dbh	Drench	0.3 e	0.5 a	0.3 d (100)	1.8 a
	Distance 10EC	12 fl oz/100 gal	Foliar	3.0 a-e	2.7 a	59.0 ab (26)	2.0 a
	Flagship 0.22G	114 g/ft ht	Broadcast	4.2 a-e	0.5 a	12.3 bcd (85)	1.2 a
	Flagship 0.22G	227 g/ft ht	Broadcast	2.2 de	3.8 a	3.5 cd (96)	3.8 a
	GF-2626 1SC	8 fl oz/100 gal	Foliar	5.5 a-d	7.0 a	46.3 a-d (42)	12.7 a
	GF-2626 1SC	11 fl oz/100 gal	Foliar	7.7 a	1.7 a	17.8 bcd (78)	9.2 a
	Xxpire 40WG	3.5 oz/100 gal	Foliar	6.8 abc	2.5 a	58.8 ab (27)	9.0 a
	Xxpire 40WG	7 oz/100 gal	Foliar	7.2 ab	4.0 a	36.3 a-d (55)	8.0 a
	Orthene TTO	10.7 oz/100 gal	Foliar	6.8 abc	5.8 a	51.0 abc (36)	20.2 a
	Safari 20SG	6 g/in dbh	Drench	0.0 e	0.0 a	0.0 d (100)	0.0 a
	Talus 70DF	14 oz/100 gal	Foliar	7.0 abc	0.2 a	38.4 a-d (52)	1.8 a
	Untreated	-	-	7.7 a	6.2 a	80.0 a (0)	7.8 a

[x] Means within a column followed by the same letter are not significantly different (LSD test, P= 0.05).

* First app 5/3 to coincide with crawler emergence. Second app 5/17 except for Distance which was applied on the 5/24 as a 21-day post second app.

Table 43. Efficacy on False Oleander Scale on Southern Magnolia, Chong, SC, 2014.

Treatment	Rate (per 100 gal)	Population Averages (Henderson's Percent Control) [x]				
		Pretreat	1 WAT [y]	2 WAT	4 WAT	6 MAT
GF-2860	2 oz	15.0 a	17.3 a (29)	3.8 b (87)	2.7 b (86)	3.5 b (84)
GF-2860	2.75 oz	17.8 a	16.8 a (42)	2.7 b (92)	2.8 b (88)	2.8 b (89)
GF-2860	3.5 oz	21.8 a	7.5 bc (79)	3.7 b (92)	2.7 b (90)	2.0 b (94)
Paraffin oil	2%	19.5 a	7.2 c (77)	1.3 b (97)	1.0 b (96)	1.8 b (94)
Untreated	-	10.0 a	16.2 ab (0)	20.0 a (0)	12.8 a (0)	14.5 a (0)

[x] Means followed by same letter do not significantly differ (Fisher's LSD test, P=0.05).

[y] WAT = weeks after the first treatment; MAT = months after first treatment.

* Treatments applied foliar on 4/13 and 4/27; Capsil (at 6 fl oz/100 gal) was mixed in the solutions of GF-2860.

Florida Red Scale

Ludwig investigated efficacy offour neonicotinoids (Celero, Flagship, Safari and TriStar) have activity on Florida red scale (*Chrysomphalus aonidum*) infesting dwarf Burford holly (*Ilex cornuta* 'Burfordii Nana'). During the course of this research, the average daily temperatures decreased which may have contributed to the increased mortality observed in all the treatments throughout the experiment. None of the treatments provided statistically or biologically significant mortality on this scale species at 32 or 43 days after treatment. Only the standard, Orthene provided statistically significant mortality for both small and large nymphs, but only 72% and 32% mortality was achieved respectively. More research is needed to determine viable product choices for Florida red scale.

Table 44. Efficacy on Florida Red Scale on Dwarf Burford Holly, Ludwig, TX, 2005.

Stage	Treatment	Rate	Population Averages (Henderson's Percent Control)			
			Pretreatment	7 DAT	15 DAT	29 DAT
Small Nymphs	Celero 16WSG	4 oz per 100 gal	50.0	39.2 cd (0)	27.2 a (0)	60.3 ab (0)
	Flagship	2 oz per 100 gal	50.0	69.6 a (0)	27.2 a (0)	56.3 ab (0)
	Flagship	4 oz per 100 gal	50.0	59.2 ab (0)	12.8 a (0)	81.9 a (0)
	Orthene TTO	8 oz per 100 gal	50.0	72.0 a (0)	37.6 a (0)	57.6 ab (0)
	Safari drench	12 oz/acre	50.0	61.6 ab (0)	24.8 a (0)	58.8 ab (0)
	Safari drench	24 oz/acre	50.0	44.0 bcd (0)	20.0 a (0)	60.7 ab (0)
	Safari foliar	4 oz per 100 gal	50.0	60.8 ab (0)	16.0 a (0)	71.8 ab (0)
	Safari foliar	8 oz per 100 gal	50.0	47.2 bcd (0)	14.4 a (0)	72.9 ab (0)
	TriStar 30SG	112 g per 100 gal	50.0	44.0 bcd (0)	35.2 a (0)	61.8 ab (0)
	TriStar 30SG	224 g per 100 gal	50.0	56.0 abc (0)	23.2 a (0)	54.7 ab (0)
	Untreated Control		50.0	31.2 d (0)	8.8 a (0)	49.5 b (0)
Large Nymphs	Celero 16WSG	4 oz per 100 gal	0.0	4.0 c	36.0 a	53.7 a
	Flagship	2 oz per 100 gal	0.0	6.4 bc	18.4 ab	43.2 a
	Flagship	4 oz per 100 gal	0.0	13.6 bc	11.2 b	55.1 a
	Orthene TTO	8 oz per 100 gal	0.0	32.0 a	18.4 ab	64.0 a
	Safari drench	12 oz/acre	0.0	9.6 bc	25.6 ab	56.5 a
	Safari drench	24 oz/acre	0.0	20.0 ab	19.2 ab	67.7 a
	Safari foliar	4 oz per 100 gal	0.0	12.0 bc	12.0 b	56.1 a
	Safari foliar	8 oz per 100 gal	0.0	7.2 bc	14.4 ab	62.4 a
	TriStar 30SG	112 g per 100 gal	0.0	7.2 bc	18.4 ab	57.5 a
	TriStar 30SG	224 g per 100 gal	0.0	9.6 bc	25.6 ab	55.0 a
	Untreated Control		0.0	7.2 bc	11.2 b	47.3 a
Total	Celero 16WSG	4 oz per 100 gal	50.0	43.2 (0)	63.2 (0)	114.0 (0)
	Flagship	2 oz per 100 gal	50.0	76.0 (0)	45.6 (0)	99.6 (0)
	Flagship	4 oz per 100 gal	50.0	72.8 (0)	24.0 (0)	137.0 (0)
	Orthene TTO	8 oz per 100 gal	50.0	104.0 (0)	56.0 (0)	121.6 (0)
	Safari drench	12 oz/acre	50.0	71.2 (0)	50.4 (0)	115.4 (0)
	Safari drench	24 oz/acre	50.0	64.0 (0)	39.2 (0)	128.4 (0)
	Safari foliar	4 oz per 100 gal	50.0	72.8 (0)	28.0 (0)	127.9 (0)
	Safari foliar	8 oz per 100 gal	50.0	54.4 (0)	28.8 (0)	135.2 (0)
	TriStar 30SG	112 g per 100 gal	50.0	51.2 (0)	53.6 (0)	119.3 (0)
	TriStar 30SG	224 g per 100 gal	50.0	65.6 (0)	48.8 (0)	109.8 (0)
	Untreated Control		50.0	38.4 (0)	20.0 (0)	96.8 (0)

Gloomy Scale

In 2011 and 2014, Frank investigated the efficacy of systemic neonicotenoids (Flagship, Safari and Tristar), insect growth regulators (Distance and Talus), A16901B, Kontos, Rycar, Mainspring, SuffOil-X and XXpire for the control ofgloomy scale (*Melanaspis tenebricosa*) on red maple (*Acer rubrum*). In 2011, all treatments were effective on nymphs and adults, with over 90 % control by 14 days after application (Table 45). However, abundance of gloomy scale was not significantly different between treatments on any of the observations in 2014 (Table 46).

No phytotoxicity was observed from any treatment.

Table 45. Efficacy on Gloomy Scale on Red Maple (*Acer rubrum)*, Frank, NC, 2011.

Scale Stage	Treatment	Rate	Application Method	Mean No. Per Inch (Henderson's % Control)				
				Pretreat	7 DAT	14 DAT	28 DAT	180 DAT
Nymphs	A16901B	5 oz/100 gal	Drench	14.2 a	7.5b (87)	3.8b (97)	4.3b (99)	0.3b (99)
	Distance	12 fl oz/100 gal	Foliar	12.7 a	0.2b (100)	0.0b (100)	0.0b (100)	0.0b (100)
	Flagship 0.22G	114 g/ft ht	Broadcast	18.3 a	6.3 b (93)	0.5 b (100)	0.2 b (100)	0.0 b (100)
	Flagship 25WG	1 g/ft ht	Drench	8.7 a	2.5 b (97)	0.0 b (100)	0.0 b (100)	0.0 b (100)
	Kontos	3.4 fl oz/100 gal	Foliar	12.3 a	8.0 b (94)	5.2 b (96)	4.8 b (98)	0.2 b (99)
	Rycar 20SC	18 fl oz/100 gal	Foliar	19.5 a	11.8 b (85)	6.8 b (96)	5.7 b (99)	0.3 b (99)
	Paraffinic Oil	1.5 gal/100 gal	Foliar	10.5 a	5.3 b (87)	3.2 b (97)	5.3 b (98)	0.3 b (99)
	Safari 2G	60 g/in dbh	Broadcast	12.7 a	5.0 b (90)	0.7 b (99)	0.0 b (100)	0.0 b (100)
	Safari 20SG	12 oz/1 gal	Trunk	18.0 a	4.7 b (93)	0.0 b (100)	0.0 b (100)	0.0 b (100)
	Talus 70DF	14 oz/100 gal	Foliar	14.7 a	2.2 b (96)	0.2 b (100)	0.0 b (100)	0.0 b (100)
	Tristar 30SG	8 oz/100 gal	Foliar	13.0 a	3.3 b (94)	0.0 b (100)	0.0 b (100)	0.0 b (100)
	Untreated	-	-	12.8 a	51.2 a (0)	125.8 a (0)	284.5 a (0)	34.0 a (0)
Adults	A16901B	5 oz/100 gal	Drench	3.3 a	1.7 bc (74)	1.0 b (94)	1.2 b (95)	3.0 b (98)
	Distance	12 fl oz/100 gal	Foliar	4.7 a	0.0 c (100)	0.0 b (100)	0.0 b (100)	0.0 b (100)
	Flagship 0.22G	114 g/ft ht	Broadcast	8.7 a	2.3 bc (87)	0.5 b (99)	0.0 b (100)	0.0 b (100)
	Flagship 25WG	1 g/ft ht	Drench	2.5 a	0.8 bc (84)	0.0 b (100)	0.0 b (100)	0.0 b (100)
	Kontos	3.4 fl oz/100 gal	Foliar	5.7 a	3.3 bc (71)	2.0 b (93)	1.3 b (97)	3.7 b (99)
	Rycar 20SC	18 fl oz/100 gal	Foliar	10.2 a	5.2 b (74)	3.0 b (94)	2.2 b (97)	4.3 b (99)
	Paraffinic Oil	1.5 gal/100 gal	Foliar	3.5 a	1.7 bc (75)	1.2 b (93)	1.3 b (95)	3.8 b (98)
	Safari 2G	60 g/in dbh	Broadcast	4.8 a	2.0 bc (89)	0.0 b (100)	0.2 b (99)	0.0 b (100)
	Safari 20SG	12 oz/1 gal	Trunk	8.0 a	2.0 bc (87)	0.0 b (100)	0.0 b (100)	0.0 b (100)
	Talus 70DF	14 oz/100 gal	Foliar	6.7 a	0.7 c (96)	0.0 b (100)	0.0 b (100)	0.0 b (100)
	Tristar 30SG	8 oz/100 gal	Foliar	6.0 a	0.3 c (97)	0.0 b (100)	0.0 b (100)	0.0 b (100)
	Untreated	-	-	5.5 a	10.8 a (0)	27.7 a (0)	37.3 a (0)	315.5 a (0)

* Means within a column followed by the same letter are not significantly different (LSD test, P= 0.05).

Table 46. Efficacy on Gloomy Scale on Red Maple (*Acer rubrum)*, Frank, NC, 2014.

Treatment	Rate	Application Method	Mean No. Per Inch			
			Pre	14 DAT	30 DAT	172 DAT
Distance	12.0 oz/100 gal	Foliar	78.1 a	29.4 a	24.9 a	18.8 a
Mainspring 200SC	0.125 fl oz/in DBH	Drench	70.4 a	35.0 a	22.3 a	10.5 a
Mainspring 200SC	0.25 fl oz/in DBH	Drench	51.9 a	26.2 a	21.7 a	25.0 a
Suffoil-X	2 gal/100 gal	Foliar	27.5 a	14.0 a	17.2 a	17.9 a
Talus 70DF	14.0 oz/100 gal	Foliar	26.7 a	22.7 a	18.3 a	10.3 a
Tristar 30SG	8.0 oz/100 gal	Foliar	40.4 a	68.4 a	23.5 a	7.5 a
XXpire 40WG	2.0 oz/100 gal	Foliar	39.8 a	52.4 a	20.1 a	12.1 a
XXpire 40WG	2.75 oz/100 gal	Foliar	64.9 a	52.1 a	22.1 a	12.9 a
XXpire 40WG	3.5 oz/100 gal	Foliar	38.9 a	38.3 a	18.0 a	25.4 a
Untreated	-	-	45.5 a	24.6 a	17.1 a	12.5 a

* Means within a column followed by the same letter are not significantly different (LSD test, P= 0.05).

Holly Pit Scale

Holly pit scale (*Aterolecanium puteanum*) attacks certain hollies including American holly, Burford holly, and Japanese holly. It causes pitting and distortion of woody tissue on branches and trunk of the tree. Severe infestations may result in branch dieback.

In 2009, Buss conducted a test on the efficacy of neonicotinoids (Aloft, Flagship, Safari and TriStar), insect growth regulators (Distance and Talus) and Rycar (pyrifluquinazon) for control of holly pit scale on holly (*Ilex x attenuata*). No statistically significant differences were observed until 6 weeks after treatment (Table 47). At this date, only Aloft provided good control.

No significant phytotoxicity was observed.

Oystershell Scale

In three experiments on oystershell scale (*Lepidosaphes ulmi*), Nielsen (Table 48 - Table 50) demonstrated that drench applications of Safari 20SG and foliar applications of Talus 40SC provided great control of this pest on tree lilac (*Syringasp*.) and Carolina silverbell (*Halesia carolina* var. 'Carolina'). The other products tested, Flagship 25WP, foliar Safari 20SG, MOI 201, Orthene TTO 97 and Tristar provided unacceptable control.

No phytotoxicity was observed on any of the treated plants.

Table 47. Efficacy on Holly Pit Scale on Holly, 'East Palatka', Buss, FL, 2009.

Treatment	Rate Per 100 Gal	Application Method	Number of Holly Pit Scale Nymphs(Henderson's % Control)				
			Pretreat	1 WAT	2 WAT	4 WAT	6 WAT
Aloft SC	10 fl oz	Foliar	44.7 a	131.5 a (0)	90.8 a (0)	123.2 a (0)	26.5 a (80)
Distance IGR	12 fl oz	Foliar	31.0 a	281.3 a (0)	217.5 a (0)	386.7 a (0)	181.8 c (57)
Flagship 25WG	4 gm/in DBH	Drench	55.5 a	343.7 a (0)	243.0 a (0)	177.5 a (0)	74.7 abc (62)
Rycar 20SC	18 fl oz	Foliar	64.0 a	137.5 a (17)	153.0 a (0)	155.5 a (0)	58.7 abc (66)
Orthene TTO	8 oz	Foliar	26.2 a	262.7 a (0)	157.8 a (11)	80.2 a (29)	45.8 ab (48)
Safari 20SG	6 g/ft ht	Sprench	38.0 a	170.5 a (0)	153.2 a (0)	108.8 a (0)	43.2 ab (64)
Safari 2G	60 g/ft ht	Soil surface	155.8 a	350.5 a (13)	117.5 a (50)	222.2 a (0)	91.2 abc (63)
Talus 40 SC	21.5 fl oz	Foliar	17.8 a	313.5 a (0)	191.5 a (9)	255.0 a (0)	76.2 abc (73)
TriStar 30 SG	8 oz	Foliar	102.2 a	204.5 a (23)	77.7 a (43)	190.0 a (0)	80.0 abc (62)
Untreated	-	-	122.5 a	316.5 a (0)	212.7 a (0)	151.2 a (0)	166.2 bc (0)

* Means within columns with the same letter are not significantly different ($P<0.05$, LSD test).

Table 48. Efficacy on Oystershell Scale on Tree Lilac 'Sensation', Nielsen, OH, 2005.

Treatment	Rate (Number of Applications)	No. Live Females in a 5 min Search*	Percent Control
Flagship 25WP	2.0 oz/100 gal (2)	4	27
Flagship 25WP	4.0 oz/100 gal (2)	7	0
Orthene 97	8.0 oz/100 gal (2)	3	45
Safari 20SG	4.0 oz/100 gal (2)	7	0
Safari 20SG	8.0 oz/100 gal (2)	5	9
Safari 20SG – Drench	3 g/ft of tree height	0.67	88
Safari 20SG – Drench	6 g/ft of tree height	0.25	95
Talus 40SC	21.5 fl oz/100 gal (2)	0.25	95
TriStar 70WSP	48 g/100 gal (2)	4.3	22
TriStar 70WSP	96 g/100 gal (2)	7.5	0
Untreated check	-	5.5	-

* Two evaluators, so this equates to a 10 minute search/sample.

Table 49. Efficacy on Oystershell Scale on Carolina Silverbell, Nielsen, OH, 2005.

Treatment	Rate (Number of Applications)	No. Females with Eggs/m	Percent Control
Flagship 25WP	2.0 oz/100 gal (2)	11	21
Flagship 25WP	4.0 oz/100 gal (2)	8	43
Safari 20SG	4.0 oz/100 gal (2)	23	0
Safari 20SG	8.0 oz/100 gal (2)	55	0
Safari 20SG – Drench	3 g/ft of tree height	0	100
Safari 20SG – Drench	6 g/ft of tree height	0	100
Talus 40SC	21.5 fl oz/100 gal (2)	0	100
TriStar 70WSP	48 g/100 gal (2)	20	0
TriStar 70WSP	96 g/100 gal (2)	2*	86
Orthene 97	8.0 oz/100 gal (2)	10	26
Untreated check	-	14	-

* Many dead nymphs.

Table 50. Efficacy on Oystershell Scale on Carolina Silverbell, Nielsen, OH, 2008.

Treatment	Rate Per 100 Gal	Application Method	Percent Infested 6/24/2008	Percent Infested 9/8/2008
Aloft SC	5 fl oz	Sprench	50	0
Aloft SC	10 fl oz	Sprench	50	0
MOI 201	1:500	Spray	100	0
MOI 201	1:800	Spray	100	0
Safari 20SG	6 g/ft height	Drench	50	0
Safari 20SG	12 g/ft height	Drench	0	0
TriStar 30SG	4 oz	Spray	100	0
TriStar 30 SG	8 oz	Spray	100	0
Untreated	-	-	100	0

Applications were made on June 6, 2008.
Evaluations were made on June 24, 2008 for the 1st generation and on Sept 8, 2008 for the 2nd generation as number of live scales in a 2 minute search.

Pine Needle Scale.

Nielsen. In 2010 and 2011, Nielsen conducted two field experiments to determine the efficacy of several products on pine needle scale (*Phenacaspis pinifoliae*) on pine (*Pinus* sp.). In 2010, Aloft SC, Distance, Kontos, Rycar, Talus 70DF and Tristar 30SG provided complete or nearly complete control of second generation pine needle scale (Table 51). The only soil treatment that was effective 16-DAT was Safari 20SG. By 57-DAT, both formulations of Safari eliminated pine needle scale from treated trees. A16901B dramatically reduced scale survival. Neither formulation of Flagship was effective. In 2011, Talus 70DF, Tristar 30SG and horticultural oil provided complete control of pine needle scale nymphs within 12 DAT; Rycar was almost as effective (Table 52). Nineteen days later, control with Flagship 25WG, Safari 2G and Kontos improved. On Oct 6, more than 3.5 months after treatment, the scale population on trees treated with Kontos had recovered somewhat. No reproduction had occurred on trees treated with A16901B, Flagship 25WG, Safari 2G or Safari 20SG. No phytotoxicity was observed on any of the treated plants.

Jones. In 2012, Jones conducted a field experiment to determine the efficacy of several products on pine needle scale on Scotch pine (*Pinus sylvestris*).All treatments significantly reduced scale survival by 28 days post-treatment; Flagship provided poor control, GF-2626 and Safari provided mediocre control, and Xxpire provided good control at the high rate (Table 53). By 180 DAT, all treatments, except Flagship, significantly reduced scale cover presence and increased aesthetic appearance of pine leaves. No phytotoxicity was observed on any of the treated plants.

Sadof. In 2015, Sadof conducted a field experiment to determine the efficacy of several products targeted to overwintering females and young crawlers of the first generation on pine needle scale on white pine (*Pinus strobus*). There were no significant differences among scale densities on 7 and 14 DAT (Table 54). However, at 28 and 167 DAT, XXpire and Distance significantly reduced densities of pine needle scale. To directly assess the capacity of an insecticide to kill the scales, mortality at different times was calculated. At 7 DAT Horticultural oil caused higher mortality when compared with the water control; XXpire and Horticultural oil caused higher mortality at 14 DAT (Table 55). At 167 DAT, Distance, Horticultural oil and XXpire at the high rate showed superior mortality when compared with the water control.

Table 51. Efficacy on Pine Needle Scale on Pine, Nielsen, OH, 2010.

Treatment	Rate per 100 Gal	Application Method	No New Adults (% Control) 7/30/2010	% Mortality of 1st Gen Nymphs 7/30/2010	No. New Adults (% Control) 9/9/2010
A16901B	10 oz	Drench	89 (11)	34	7 (88)
Aloft SC	10 fl oz	Sprench	0 (100)	100	-
Distance	12 fl oz	Spray	0 (100)	100	-
Flagship 0.22G	227 g/in dbh	Broadcast	100 (0)	8	78 (0)
Flagship 25WG	4 g/in dbh	Drench	100 (0)	18	42 (28)
Kontos	3.4 fl oz	Spray	0 (100)	62	-
Rycar	18 fl oz	Spray	0 (100)	100	-
Safari 2G	60 g/in dbh	Broadcast	84 (16)	63	0 (100)
Safari 20SG	6 g/in dbh	Drench	0 (100)	96	0 (100)
Talus 70DF	14 oz	Spray	1 (99)	99	-
TriStar 30SG	8 oz	Spray	0 (100)	100	-
Untreated	-	-	100 (0)	24	58 (0)

Applications were made on July 14, 2010.
Evaluations were made on July 30 and September 9 (soil treatments only).

Table 52. Efficacy on Pine Needle Scale on Pine, Nielsen, OH, 2011.

Treatment	Rate per 100 Gal	Application Method	% Mortality of 1st Gen Nymphs		Presence (+) or Absence (A) of 2nd Gen Eggs on 10/6/11			
			6/1/11	6/20/11	Rep 1	Rep 2	Rep 3	Rep 4
A16901B	10 oz	Drench	27	29	A	A	A	A
Flagship 0.22G	227 g/ft ht	Broadcast	23	13	+	A	A	+
Flagship 25WG	4 g/ft ht	Drench	27	83	A	A	A	A
Kontos	3.4 fl oz	Spray	52	90	+	+	+	+[y]
Rycar	18 fl oz	Spray	97[x]	*	This treatment not re-sampled			
Safari 2G	60 g/in dbh	Broadcast	8	67	A	A	A	A
Safari 20SG	6 g/in dbh	Drench	82	100	A	A	A	A
Sunspray Ultra-Fine Oil	2 % v:v	Spray	100	*	This treatment not re-sampled			
Talus 70DF	14 oz	Spray	100	*	This treatment not re-sampled			
TriStar 30SG	8 oz	Spray	100	*	This treatment not re-sampled			
Untreated	-	-	12	13	+	+	+	+

Applications were made on May 20, 2011.
[x] Scales died more slowly in this, effective treatment.
[y] Many fewer new female scales on new growth than on untreated check trees.
* This treatment not re-sampled.

Table 53. Efficacy on Pine Needle Scale on Scotch Pine, Jones, OH, 2012.

Treatment	Rate	Application Method	% Scale Infestation 5/2	% Mortality 5/10	% Mortality 5/17	% Mortality 5/31	% Mortality 10/23	% Scale Infestation 10/23	% Reduction 10/23
Flagship G	227 g/ft ht	Broadcast	29.17 a	56.00 a	30.17 a	49.00 b	55.33 a	11.25 a	62.11 ab
GF-2626 1SC	8 oz/100 gal	Foliar	11.5 a	38.17 a	40.50 a	57.67 b	42.83 a	1.83 a	82.33 a
GF-2626 1SC	11 fl oz/100 gal	Foliar	34.17 a	54.33 a	36.83 a	69.00 ab	65.83 a	9.08 a	78.47 a
XXpire 40WG	3.5 oz/100 gal	Foliar	23.17 a	33.67 a	13.33 a	53.67 b	52.33 a	8.83 a	69.06 a
XXpire 40WG	7 oz/100 gal	Foliar	31.17 a	46.50 a	37.67 a	83.83 a	53.67 a	7.67 a	70.06 a
Safari 20SG	6 g/ft ht	Drench	26.83 a	51.67 a	20.83 a	71.83 ab	54.50 a	4.50 a	84.93 a
Untreated	-	-	23.92 a	0.00 a	0.00 a	3.67 c	13.67 b	16.00 a	33.06 b

[x]Means followed by same letter do not significantly differ (P=.05, Duncan's New MRT).
* All treatments applied on 5/3/12; foliar treatments applied a second time on 7/6/12.

Table 54. Efficacy on Pine Needle Scale on White Pine (*Pinus strobus)*, Sadof, IN, 2015a.

Treatment	Rate Per 100 Gal	Applic Dates	Number of Live Scales Per cm [x]				
			Pretreat	7 DAT (1st instar) [y]	14 DAT (2nd instar)	28 DAT (Adults)	167 DAT (Adults)
Distance	12 fl oz	5/1	0.86 a	0.08 a (0)	0.38 a (0)	0.66 bc (0)	0.01 a (62)
Horticultural oil	labeled rate	5/1	1.08 a	0.14 a (0)	0.23 a (29)	0.29 ab (24)	0.03 ab (20)
IKI-3106	28 fl oz	5/1, 14	1.76 a	0.09 a (0)	0.43 a (19)	1.01 cd (0)	0.18 c (0)
IKI-3106	22 fl oz	5/1, 14	1.40 a	0.18 a (0)	0.70 a (0)	0.97 cd (0)	0.18 c (0)
Kontos Drench	3.4 fl oz	5/1	1.95 a	0.11 a (0)	0.52 a (11)	0.99 cd (0)	0.11 c (0)
Kontos Foliar	3.4 fl oz	5/1	1.91 a	0.14 a (0)	0.53 a (7)	0.56 abc (18)	0.11 c (0)
Mainspring 200SC	0.125 fl oz per ft ht	5/1	2.85 a	0.17 a (0)	0.84 a (2)	1.66 d (0)	0.13 c (0)
Mainspring 200SC	0.25 fl oz per ft ht	5/1	1.00 a	0.05 a (0)	0.47 a (0)	0.94 cd (0)	0.16 c (0)
Safari 20SG	18 oz	5/1	1.62 a	0.16 a (0)	1.22 a (0)	0.68 bc (0)	0.02 ab (67)
XXpire 40WG + Capsil	2.75 oz + 6 fl oz	5/1, 14	2.21 a	0.11 a (0)	0.69 a (0)	0.51 abc (35)	0.08 bc (0)
XXpire 40WG + Capsil	3.5 oz + 6 fl oz	5/1, 14	1.35 a	0.11 a (0)	0.41 a (0)	0.13 a (73)	0.01 a (75)
Untreated	-	-	2.56 a	0.10 a (0)	0.77 a (0)	0.91 c (0)	0.09 bc (0)

[x] Means within a column followed by the same letter are not significantly different (Fisher's LSD, P= 0.05).
[y] DAT = days after the first treatment.
* Mainspring applied as drench at 0.125 and 0.25 fl oz per foot tree height.

Table 55. Efficacy on Pine Needle Scale on White Pine (*Pinus strobus)*, Sadof, IN, 2015b.

Treatment	Rate Per 100 Gal	Application Dates	Mortality on Needles			
			7 DAT (1st instar) [y]	14 DAT (2nd instar)	28 DAT (Adults)	167 DAT (Adults)
Distance	12 fl oz	5/1	0.27 bc	0.40 cde	0.26 a	0.81 a
Horticultural oil		5/1	0.55 a	0.55 bc	0.29 a	0.84 a
IKI-3106	28 fl oz	5/1, 14	0.30 bc	0.26 def	0.51 a	0.31 c
IKI-3106	22 fl oz	5/1, 14	0.09 c	0.40 cde	0.54 a	0.37 bc
Kontos Drench	3.4 fl oz	5/1	0.13 c	0.20 e	0.62 a	0.45 bc
Kontos Foliar	3.4 fl oz	5/1	0.17 bc	0.42 cd	0.42 a	0.38 bc
Mainspring 200SC	0.125 fl oz per ft ht	5/1	0.16 bc	0.14 f	0.63 a	0.48 bc
Mainspring 200SC	0.25 fl oz per ft ht	5/1	0.06 c	0.29 def	0.51 a	0.39 bc
Safari 20SG	18 oz	5/1	0.38 ab	0.35 def	0.35 a	0.67 ab
XXpire 40WG + Capsil	2.75 oz + 6 fl oz	5/1, 14	0.12 c	0.65 b	0.20 a	0.20 c
XXpire 40WG + Capsil	3.5 oz + 6 fl oz	5/1, 14	0.17 bc	0.81 a	0.55 a	0.82 a
Untreated	-	-	0.14 bc	0.29 def	0.66 a	0.41 bc

[x] Means within a column followed by the same letter are not significantly different (Fisher's LSD, P= 0.05).

[y] DAT = days after the first treatment.

* Mainspring applied as drench at 0.125 and 0.25 fl oz per foot tree height.

Tea Scale.
During 2009, two researchers evaluated the efficacy of several products on tea scale (*Fiorinia theae*). Hesselein evaluated Safari on tea scale infesting dwarf Burford holly (*Ilex cornuta*)' Burfordii 'Nana' in a commercial landscape. Both Safari 20SG drench and 2G soil treatment significantly increased mortality of female tea scale (Table 56). Ludwig evaluated efficacy of Safari, Talus and Triact on tea scale (*Fiorinia theae*) infesting Japanese camellia (*Camellia japonica*) grown in containers. Safari drench was the only treatment that resulted in significantly higher mortality 32 and 68 days after treatment (Table 57). Sixty-eight days after the Safari 20SG treatment was applied, 100% of the female scales were dead.

In 2010, Frank evaluated Kontos, Safari and Talus on tea scale infesting Japanese camellia (*Camellia japonica*) grown in containers. Scale abundance was significantly less than the untreated control in all treatments by 7 DAT (Table 58). Differences persisted through the experiment to the last sample date 70 DAT.

In 2014, Chen conducted an experiment examining efficacy of various insecticides on tea scale on sasanqua (*Camellia sasanqua*) 'Mountain Snow'. All treatments, including the standard SuffOil-X, provided good to excellent control of a moderate to high infestation within 60 days after the second application (Table 59). XXpire at 3.5 oz per 100 gal provided the best control.

In 2014, Arthurs evaluated the efficacy of various insecticides applied in the spring against crawler stages of tea scale infesting Japanese camellia (*C. japonica*) 'In the Pink'. All treatments provided excellent control of tea scale during the study (Table 60, Table 61). XXpire, Distance, SuffOil-X and Safari, eliminated (or came close to eliminating) the scale infestation, whereas some residual scale infestation remained in the Mainspring and Talus treatments at the end of the study, providing the likelihood for scale reestablishment in the following year.

Table 56. Efficacy on Tea Scale on Dwarf Burford Holly 'Burfordii Nana', Hesselein, AL, 2009.

Treatment	Rate	Application Method	Average % Mortality				
			Pretreatment	10 DAT	14 DAT	31 DAT	42 DAT
Safari 20SG	6 g/ft height	Drench	52 a	96 a	84 a	90 a	94 a
Safari 2G	60 g/ft height	Soil surface	50 a	91 a	86 a	81 ab	92 a
Saf-T-Side Oil	2 % solution	Foliar	50 a	93 a	91 a	91 a	97 a
Untreated	-	-	51 a	63 b	59 b	68 b	67 b

* Means within a column followed by the same letter are not significantly different (Tukey'sHSD, P< 0.05).

Table 57. Efficacy on Tea Scale on Japanese Camellia (*Camellia japonica*), Ludwig, TX, 2009.

Treatment	Rate	Application Method	Percent Female Adult Scale Mortality			
			Pretreatment	14 DAT	32 DAT	68 DAT
Safari 2G	2.6 g/gallon of media	Media mix	41.6a	90.4a	69.0ab	45.6a
Safari 20SG	24 oz/100gal	Drench	37.4a	92.0a	98.4b	100b
Talus 40 SC	21.5 fl oz/100 gal	Foliar	52.7a	85.3a	54.7a	69.3a
Triact 70	2 gal/100 gal	Foliar	76.0a	93.3a	60.0a	72.7a
Untreated	-	-	60.7a	78.0a	38.7a	45.3a

* Means within a column followed by the same letter are not significantly different (Tukey's HSD, P< 0.05).

Table 58. Efficacy on Tea Scale on Japanese Camellia, Frank, NC, 2010.

Treatment	Rate	Application Method	No. of Scales (Henderson's % Control)				
			Pretreatment	7 DAT	14 DAT	28 DAT	70 DAT
Kontos	3.4 fl oz/100 gal	Foliar	133.5 a	9.2 b (91)	4.5 b (95)	0.8 b (99)	0.0 b (100)
Safari 2G	2.6 g/gal media	Broadcast	134.7 a	14.0 b (87)	6.5 b (93)	2.0 b (97)	0.0 b (100)
Safari 20SG	24 oz/100 gal	Drench	161.7 a	14.7 b (88)	7.2 b (94)	1.5 b (98)	0.0 b (100)
Talus 70DF	14 oz/100 gal	Foliar	152.0 a	13.5 b (89)	6.3 b (94)	1.8 b (98)	6.3 b (92)
Untreated	-	-	128.8 a	99.7 a (0)	90.7 a (0)	68.8 a (0)	66.7 a (0)

* Means within a column followed by the same letter are not significantly different (LSD test, P= 0.05).

Table 59. Efficacy of Insecticides on Tea Scale on Sasanqua (*Camellia sasanqua*), Chen, LA, 2014.

Treatment	Rate Per 100 Gal	Applic. Method, Timing	No. of Scales (% Control)			
			Nymphs	Adults	Crawlers	Total
30 DAT2						
AzaGuard (azadirachtin)	20 fl oz	Foliar, 3/28	2.4 a (71)	1.4 ab (72	0.9 ab (0)	4.7 ab (66)
Distance (pyriproxyfen)	12 fl oz	Foliar, 3/28, 4/18	3.4 a (60)	4.3 ab (14)	0 b (100)	7.7 ab (44)
Mainspring 200SC	12 fl oz	Drench, 4/11	1.8 a (79)	2.0 ab (60)	1.6 a (0)	5.4 ab (61)
Mainspring 200SC (cyanthraniliprole)	8 fl oz	Drench, 4/11, 5/12	3.0 a (64)	0 b (100)	0.2 ab (50)	3.2 b (77)
SuffOil-X (horticultural oil)	1 gal	Foliar 3/28, 4/11	6.1 a (27)	0 b (100)	0 b (100)	6.1 ab (56)
Talus 70DF (buprofezin)	14 oz	Foliar, 3/28	1.3 a (85)	6.7 a (0)	0 b (100)	8.0 ab (42)
Xxpire 40WG (spinetoram + sulfoxaflor) + Capsil	2 oz + 6 fl oz	Foliar, 3/28, 4/11	3.4 a (60)	0 b (100)	0 b (100)	3.4 b (75)
Xxpire 40WG + Capsil	2.75 oz + 6 fl oz	Foliar, 3/28, 4/11	2.5 a (70)	1.8 ab (64)	0.2 ab (50)	4.5 ab (67)
Xxpire 40WG + Capsil	3.5 oz + 6 fl oz	Foliar, 3/28, 4/11	4.9 a (42)	0.7 b (86)	0 b (100)	5.6 ab (59)
Untreated (water)	-	Foliar 3/28, 4/11	8.4 a (0)	5.0 ab (0)	0.4 ab (0)	13.8 a (0)
60 DAT2						
AzaGuard (azadirachtin)	20 fl oz	Foliar, 3/28	1.7 b (88)	0.6 b (92)	0.3 b (62)	2.5 bc (88)
Distance (pyriproxyfen)	12 fl oz	Foliar, 3/28, 4/18	2.8 b (80)	2.1 b (71)	0 b (100)	4.8 bc (78)
Mainspring 200SC	12 fl oz	Drench, 4/11	4.2 b (69)	3.4 b (53)	2.0 a (0)	9.5 b (56)
Mainspring 200SC (cyanthraniliprole)	8 fl oz	Drench, 4/11, 5/12	1.9 b (86)	0.4 b (95)	0 b (100)	2.3 bc (89)
SuffOil-X (horticultural oil)	1 gal	Foliar 3/28, 4/11	3.7 b (73)	0 b (100)	0 b (100)	3.7 bc (83)
Talus 70DF (buprofezin)	14 oz	Foliar, 3/28	2.4 b (82)	3.3 b (55)	0.3 b (62)	6.0 bc (72)
Xxpire 40WG (spinetoram + sulfoxaflor) + Capsil	2 oz + 6 fl oz	Foliar, 3/28, 4/11	0.1 b (99)	0.5 b (93)	0.3 b (62)	0.9 bc (96)
Xxpire 40WG + Capsil	2.75 oz + 6 fl oz	Foliar, 3/28, 4/11	1.9 b (86)	2.3 b (68)	0 b (100)	4.2 bc (81)
Xxpire 40WG + Capsil	3.5 oz + 6 fl oz	Foliar, 3/28, 4/11	0 b (100)	0 b (100)	0 b (100)	0 c (100)
Untreated (water)	-	Foliar 3/28, 4/11	13.7 a (0)	7.3 a (0)	0.8 ab (0)	21.8 a (0)

[x] Numbers on 6 leaves at days after 2nd application (DAT2). Means within column followed by the same letter are not significantly different (LSD, P=0.05).

Table 60. Efficacy on Tea Scale on Japanese Camellia, (*Camellia japonica*) 'In the Pink' (Counts), Arthurs, FL, 2014.

Treatment	Rate Per 100 Gal	Applic. Method, Timing	Population Averages[x] (Henderson's Percent Control)						
			Pretreat	7 DAT	14 DAT	21 DAT	35 DAT	76 DAT	150 DAT
Total # tea scale (adults + large nymphs) per older leaf									
Distance	12 floz	Foliar, 3/13, 4/3	71.0 a	53.8 a (36)	60.8 a (3)	33.9 a (19)	38.2 a (9)	3.1 a-d (63)	0.3 d (99)
Xxpire 40WG + Capsil	2 oz + 6 fl oz	Foliar, 3/13, 3/27	71.8 a	64.9 a (23)	64.9 a (0)	58.6 a (0)	28.8 a (32)	0.3 d (96)	2.0 cd (96)
Xxpire 40WG + Capsil	2.75 oz + 6 fl oz	Foliar, 3/13, 3/27	63.7 a	44.9 a (40)	37.5 a (33)	19.6 a (48)	21.8 a (42)	0.3 d (96)	0..1 d (99)
Xxpire 40WG + Capsil	3.5 oz + 6 fl oz	Foliar, 3/13, 3/27	67.3 a	47.8 a (40)	60.1 a (0)	35.0 a (12)	28.4 a (39)	3.4 a-d (57)	0.3 d (99)
Mainspring 200SC	8 floz	Drench, 3/13, 4/10	68.7 a	65.5 a (19)	48.9 a (19)	42.6 a (0)	31.8 a (22)	15.4 ab (0)	9.6 bc (78)
Mainspring 200SC	12 floz	Drench, 3/13	71.0 a	93.8 a (0)	61.7 a (1)	38.6 a (8)	36.3 a (14)	16.9 a (0)	13.3 b (71)
Safari 20SG	24 oz	Drench, 3/13	70.3 a	62.5 a (24)	79.8 a (0)	24.1 a (42)	27.1 a (35)	2.6 bcd (68)	0.0 d (100)
SuffOil-X	2 gal	Foliar, 3/13, 3/27, 4/10	67.7 a	47.6 a (40)	57.0 a (4)	20.6 a (48)	20.2 a (50)	1.8 cd (77)	0.0 d (100)
Talus 70DF	14 oz	Foliar, 3/13, 3/27	68.4 a	71.2 a (12)	72.9 a (0)	43.6 a (0)	38.5 a (5)	14.7 abc (0)	1.5 cd (97)
Untreated	-	-	75.9 a	89.3 a (0)	66.7 a (0)	44.8 a (0)	44.9 a (0)	8.9 abc (0)	49.2 a (0)
Total # tea scale (adults + large nymphs) per new leaf (seasonal growth)									
Distance	12 floz	Foliar, 3/13, 4/3	n/a	n/a	0.0 a (100)	0.0 a (100)	0.0 b (100)	0.0 b (100)	0.3 c (99)
Xxpire 40WG + Capsil	2 oz + 6 fl oz	Foliar, 3/13, 3/27	n/a	n/a	0.0 a (100)	0.0 a (100)	0.0 b (100)	0.1 b (99)	0.2 c (99)
Xxpire 40WG + Capsil	2.75 oz + 6 fl oz	Foliar, 3/13, 3/27	n/a	n/a	0.0 a (100)	0.0 a (100)	0.0 b (100)	0.0 b (100)	0.1 c (99)
Xxpire 40WG + Capsil	3.5 oz + 6 fl oz	Foliar, 3/13, 3/27	n/a	n/a	0.0 a (100)	0.0 a (100)	0.0 b (100)	0.0 b (100)	0.3 c (99)
Mainspring 200SC	8 floz	Drench, 3/13, 4/10	n/a	n/a	0.0 a (100)	0.0 a (100)	0.2 ab (75)	0.4 b (98)	7.4 b (84)
Mainspring 200SC	12 floz	Drench, 3/13	n/a	n/a	0.0 a (100)	0.0 a (100)	1.0 a (0)	0.1 b (99)	5.0 b (90)
Safari 20SG	24 oz	Drench, 3/13	n/a	n/a	0.1 a (95)	0.2 a (78)	0.0 b (100)	0.0 b (100)	0.0 c (100)
SuffOil-X	2 gal	Foliar, 3/13, 3/27, 4/10	n/a	n/a	0.0 a (100)	0.0 a (100)	0.0 b (100)	0.0 b (100)	0.0 c (100)
Talus 70DF	14 oz	Foliar, 3/13, 3/27	n/a	n/a	0.0 a (100)	0.7 a (22)	0.2 ab (75)	0.0 b (100)	3.5 b (93)
Untreated	-	-	n/a	n/a	2.0 a (0)	0.9 a (0)	0.8 a (0)	21.3 a (0)	47.6 a (0)

[x] Data based on average of 6 plants. Column means followed by different letters (where present) are significantly different($P<0.05$, Tukey's HSD).
[y]Data based on average of 6 plants rated on a 5 point scale where 0 = no infestation, 1 = ≤ 10% leaf infestation, 2 = 11–30%, 3 = 31–50%, 4 =51–70%, 5 = ≥71% leaf infestation. Chi-square values (2-sided tests) based on cross tabulation among treatment and infestation scale.

Table 61. Efficacy on Tea Scale on Japanese Camellia, (*Camellia japonica*) 'In the Pink' (Infestation Index), Arthurs, FL, 2014.

Treatment	Rate Per 100 Gal	Applic. Method, Timing	Population Averages[x] (Henderson's Percent Control)						
			Pretreat	7 DAT	14 DAT	21 DAT	35 DAT	76 DAT	150 DAT
Infestation Index[y]									
Distance	12 floz	Foliar, 3/13, 4/3	2.7 a	2.2 a	2.0 a	1.8 a	1.3 a	0.8 a	0.0 a
Xxpire 40WG + Capsil	2 oz + 6 fl oz	Foliar, 3/13, 3/27	2.2 a	2.0 a	1.8 a	1.7 a	1.3 a	0.8 a	0.5 a
Xxpire 40WG + Capsil	2.75 oz + 6 fl oz	Foliar, 3/13, 3/27	2.0 a	1.8 a	1.8 a	1.3 a	1.2 a	1.0 a	0.2 a
Xxpire 40WG + Capsil	3.5 oz + 6 fl oz	Foliar, 3/13, 3/27	2.2 a	1.7 a	1.8 a	1.5 a	1.3 a	1.0 a	0.2 a
Mainspring 200SC	8 floz	Drench, 3/13, 4/10	2.5 a	2.5 a	2.2 a	1.7 a	1.3 a	1.0 a	1.3 a
Mainspring 200SC	12 floz	Drench, 3/13	2.7 a	2.7 a	2.3 a	1.7 a	1.5 a	1.2 a	2.0 a
Safari 20SG	24 oz	Drench, 3/13	2.5 a	2.5 a	2.2 a	1.3 a	1.3 a	0.8 a	0.0 a
SuffOil-X	2 gal	Foliar, 3/13, 3/27, 4/10	2.7 a	2.0 a	1.7 a	1.3 a	1.3 a	0.5 a	0.0 a
Talus 70DF	14 oz	Foliar, 3/13, 3/27	2.5 a	2.8 a	2.5 a	1.8 a	1.5 a	1.2 a	0.8 a
Untreated	-	-	2.3 a	2.3 a	2.3 a	1.7 a	1.8 a	1.0 a	2.5 b

[x] Data based on average of 6 plants. Column means followed by different letters (where present) are significantly different (P<0.05, Tukey's HSD).

[y]Data based on average of 6 plants rated on a 5 point scale where 0 = no infestation, 1 = ≤ 10% leaf infestation, 2 = 11–30%, 3 = 31–50%, 4 =51–70%, 5 = ≥71% leaf infestation. Chi-square values (2-sided tests) based on cross tabulation among treatment and infestation scale.

During 2015, four researchers investigated the efficacy of various insecticides on tea scale (*Fiorinia theae*). Braman evaluated effficacy of BAS 440, BYI-2960, Distance, Distance + Tristar, IKI-3106, Mainspring and Talus on tea scale crawlers infesting Japanese camellia (*C. japonica*). All treatments, except Mainspring at the low rate, provided significant control by 28 DAT after applying most of the 2nd and 3rd applications (Table 62). Six months after the initial application, all treatments kept the population to low levels. Chen evaluated efficacy of Distance, IKI-3106, Mainspring, Talus 70DF, Ultra-Pure Oil, Distance + TriStar, and BAS 440 + Ultra-Pure Oil applied foliar twice on 14-day intervals on tea scale crawlers infesting Japanese camellia. Talus 70DF provided the best control keeping total scale density less than 0.6 per leaf for up to 157 DAT. Distance and Distance + TriStar provided similar control with both being effective in keeping total scale density below 1 per leaf for up to 157 DAT. BAS440 + Ultra-Pure Oil provided better control than Ultra-Pure Oil alone, with the former being effective up to 128 DAT and the later up to 90 DAT. Mainspring and IKI-3106 provided less residual efficacy. Chong evaluated efficacy of BAS 440 + Ultra-Pure Oil, BYI-2960, Distance, IKI-3106, Mainspring, and Talus 70DF on tea scale crawlers infesting holly (Table 63). Distance, Talus, Distance + TriStar and BAS 440 + Ultra-Pure Oil provided the best control in this study; BYI-2960, IKI-3106, and Mainspring were less effective. Frank evaluated efficacy of BAS 440, BYI-2960, Distance, IKI-3106, Mainspring, and Talus 70DF on tea scale crawlers infesting holly. No significant differences between treatments and untreated check was obtained probably because of high variance due to patchy scale distribution within plants (Table 64). Also unexpected precipitation occurred 3 hours after one application.

Table 62. Efficacy on Tea Scale on Japanese Camellia, (Camellia japonica), Braman, GA, 2015.

Treatment	Rate Per 100 Gal	Application Dates	Number of Crawlers Per 3 Leaves [x]				
			Pretreat	7 DAT [y]	14 DAT	28 DAT	6 MAT
BAS 440 00I	7 fl oz	5/20, 6/3, 17	4.87 abc	2.25 b (63)	0.25 c (88)	0.87 bc (80)	0.37 b (95)
BYI-2960 200 SL	2.7 fl oz	5/20, 27, 6/3	3.87 abc	4.25 ab (12)	1.87 abc (0)	2.37 bc (31)	0.87 b (85)
BYI-2960 200 SL	5.4 fl oz	5/20, 27, 6/3	9.25 a	7.00ab (39)	4.25 a (0)	0.25 c (97)	0.37 b (97)
Distance	12 fl oz	5/20, 6/10	3.37 bc	2.87 b (31)	4.00 a (0)	1.75 bc (41)	1.50 b (71)
Distance + Tristar	12 fl oz + 12 fl oz	5/20	6.00 abc	5.12 ab (31)	2.37abc (9)	1.12 bc (79)	0.83 b (91)
IKI-3106	22 fl oz	5/20, 6/3	4.75 abc	6.25 ab (0)	1.12 bc (46)	2.12 bc (50)	0.50 b (93)
IKI-3106	28 fl oz	5/20	6.62 abc	3.62 ab (56)	1.12 bc (61)	1.25 bc (79)	0.62 b (94)
Mainspring 200SC	.125 fl oz/ft ht	5/20, 6/17	4.50 bc	5.75 ab (0)	1.62 abc (17)	4.00 ab (0)	0.33 b (95)
Mainspring 200SC	.25 fl oz/ft ht	5/20	3.87 bc	3.25 b (32)	2.25abc (0)	1.87 bc (46)	0.71 b (88)
Talus 70DF	14 oz	5/20	2.75 c	1.62 b (53)	0.25 c (79)	0.37 c (85)	0.57 b (87)
UTC	-	-	7.75 ab	9.62 a (0)	3.37 ab (0)	6.87 a (0)	12.0 a (0)

[x] Means within a column followed by the same letter are not significantly different (LSD, P= 0.05).

[y] DAT = days after the first treatment; MAT = months after first treatment.

* Mainspring applied as drench at 0.125 and 0.25 fl oz per foot shrub height.

Table 63. Efficacy on Tea Scale on Japanese Camellia, (Camellia japonica), Chen, LA, 2015.

Treatment	Rate (per 100 gal)	Number of Scales Per Leaf (Henderson's Percent Control) [x]					
		30 DAT	68 DAT	90 DAT	128 DAT	157 DAT	197 DAT
Immatures							
BAS440 + Ultra-Pure Oil	7 fl oz + 12 fl oz	0.3 a (70)	0 b (100)	0.4 c (67)	0.5 a (17)	1.0 b (55)	11.1 a (0)
Distance	12 fl oz	0.3 a (70)	3.2 b (76)	0.1 c (92)	0.1 a (83)	0.7 b (68)	1.3 a (0)
Distance + TriStar	12 fl oz + 12 fl oz	0.5 a (50)	0.1 b (99)	0.2 c (83)	0.3 a (50)	0.3 b (86)	0.4 a (0)
IKI-3106	22 fl oz	0.3 a (70)	0.3 b (98)	2.6 a (0)	1.3 a (0)	6.8 a (0)	11.0 a (0)
IKI-3106	28 fl oz	0.9 a (10)	2.5 b (81)	0.7 bc (42)	0.9 a (0)	2.3 b (0)	0.1 a (67)
Mainspring 200SC	8 fl oz	0.3 a (70)	0.5 b (96)	0.7 bc (42)	0.6 a (0)	2.7 b (0)	0.7 a (0)
Talus 70DF	14 oz	0 a (100)	0 b (100)	0 c (100)	0.5 a (17)	0.1 b (95)	1.2 a (0)
Ultra-Pure Oil	12 fl oz	0.3 a (70)	1.8 b (87)	2.0 ab (0)	2.25 a (0)	1.9 b (14)	1.5 a (0)
Untreated	-	1.0 a (0)	13.4 a (0)	1.2 abc (0)	0.6 a (0)	2.2 b (0)	0.3 a (0)
Adults							
BAS440 + Ultra-Pure Oil	7 fl oz + 12 fl oz		0 b (100)	0.8 a (0)	0 b (100)	0.5 ab (44)	22.8 a (0)
Distance	12 fl oz		0.3 b (91)	0.7 a (0)	0.1 b (91)	0 b (100)	13.0 a (0)
Distance + TriStar	12 fl oz + 12 fl oz		0 b (100)	1.7 a (0)	0.1 b (91)	0.1 b (89)	20.4 a (0)
IKI-3106	22 fl oz		0 b (100)	0.1 a (86)	0.1 b (91)	1.9 a (0)	27.4 a (0)
IKI-3106	28 fl oz		0 b (100)	0.4 a (43)	0.2 b (82)	1.5 ab (0)	21.8 a (0)
Mainspring 200SC	8 fl oz		0 b (100)	0.1 a (86)	0 b (100)	0.9 ab (0)	30.4 a (0)
Talus 70DF	14 oz		0.1 b (97)	0 a (100)	0.1 b (91)	0 b (100)	45.7 a (0)
Ultra-Pure Oil	12 fl oz		0.1 b (97)	0.6 a (14)	5.3 a (0)	0.4 ab (56)	37.3 a (0)
Untreated	-		3.2 a (0)	0.7 a (0)	1.1 b (0)	0.9 ab (0)	12.4 a (0)
Total							
BAS440 + Ultra-Pure Oil	7 fl oz + 12 fl oz		0 b (100)	1.2 a (37)	0.5 b (93)	1.5 b (52)	33.9 a (0)
Distance	12 fl oz		3.5 b (79)	0.8 a (58)	0.1 b (99)	0.7 b (77)	14.3 a (0)
Distance + TriStar	12 fl oz + 12 fl oz		0.1 b (99)	1.9 a (0)	0.4 b (94)	0.4 b (87)	20.8 a (0)

IKI-3106	22 fl oz		0.3 b (98)	2.7 a (0)	1.4 b (79)	8.6 a (0)	38.4 a (0)
IKI-3106	28 fl oz		2.5 b (85)	1.1 a (42)	1.1 ab (84)	3.7 b (0)	21.9 a (0)
Mainspring 200SC	8 fl oz		0.5 b (97)	0.8 a (58)	0.6 b (91)	3.6 b (0)	31.1 a (0)
Talus 70DF	14 oz		0.1 b (99)	0 a (100)	0.6 b (91)	0.1 b (97)	46.9 a (0)
Ultra-Pure Oil	12 fl oz		1.9 b (89)	2.6 a (0)	2.3 ab (66)	2.2 b (29)	38.8 a (0)
Untreated	-		16.6 a (0)	1.9 a (0)	6.8 a (0)	3.1 b (0)	12.8 a (0)

[x] Numbers on new growth at days after 1st application (DAT). Means within column followed by the same letter are not significantly different (LSD, P=0.05).
[y] DAT = days after the first treatment; MAT = months after first treatment.

Table 64. Efficacy on Tea Scale on Holly (Ilex sp.) 'Nellie Stevens', Chong, SC, 2015.

Treatment	Rate (per 100 gal)	Application Dates	Number of Scales Per Square Inch Leaf Surface (Henderson's Percent Control) [x]						
			Pretreat	7 DAT [y]	14 DAT	21 DAT	28 DAT	4 MAT	6 MAT
BAS 440 + UltraPure Oil	7 fl oz + 1%	7/10, 24, 8/7	8.7 a	2.5 e (74)	1.0 c (89)	1.5 ef (85)	1.0 d (90)	1.2 cd (81)	1.0 a (84)
BYI-2960	2.7 fl oz	7/10, 17, 24	9.0 a	4.5 cde (54)	5.7 ab (41)	6.7 ab (37)	3.7 b (63)	3.3 ab (51)	2.0 a (69)
BYI-2960	5.4 fl oz	7/10, 17, 24	8.2 a	3.3 de (63)	4.5 b (49)	4.8 bc (50)	1.3 cd (86)	2.0 bc (67)	2.0 a (65)
Distance	12 fl oz	7/10, 31	9.3 a	3.2 e (69)	1.3 c (87)	1.2 f (89)	1.0 d (90)	1.0 cd (85)	1.5 a (77)
Distance + TriStar	12 + 12 fl oz	7/10, 31	8.8 a	3.5 de (64)	1.2 c (87)	1.2 f (88)	1.0 d (90)	1.0 cd (85)	1.3 a (79)
IKI-3106 + Capsil	22 + 6 fl oz	7/10, 24, 8/7	9.5 a	5.5 bc (47)	4.3 b (58)	3.7 cd (67)	1.5 bcd (86)	2.7 b (62)	1.3 a (81)
IKI-3106 + Capsil	28 + 6 fl oz	7/10, 24, 8/7	8.5 a	5.5 bcd (41)	3.5 b (62)	2.5 de (75)	1.2 cd (87)	1.7 bcd (73)	1.3 a (78)
Mainspring	8 fl oz	7/10, 8-7	10.9 a	7.2 ab (40)	7.8 a (34)	7.5 ab (42)	2.8 bc (77)	2.7 bcd (67)	1.5 a (81)
Talus 70DF	14 oz	7/10	8.5 a	3.3 e (65)	1.2 c (87)	1.2 f (88)	0.8 d (92)	0.8 d (87)	1.0 a (83)
Untreated	-	-	8.5 a	9.3 a (0)	9.2 a (0)	10.0 a (0)	9.5 a (0)	6.3 a (0)	6.0 a (0)

[x] Means followed by same letter do not significantly differ (Fisher's LSD test, P=0.05).
[y] DAT = days after the first treatment; MAT = months after first treatment.
* All treatments applied foliar, except Mainspring applied as drench to potting medium.

Table 65. Efficacy on Tea Scale on Holly (Ilex sp.), Frank, NC, 2015.

Treatment	Rate (per 100 gal)	Application Dates	Number of Scales Per 5 Leaves (Henderson's Percent Control) [x]			
			Pretreat	7 DAT [y]	14 DAT	28 DAT
BAS 440 00I	7 fl oz	10/20, 11/3	13.3 a	31.3 a (32)	34.5 a (15)	10.8 bc (55)
BYI-2960 200 S	2.7 fl oz	10/20, 11/3	7.3 a	7.0 a (72)	28.3 abc (0)	5.5 c (59)
BYI-2960 200 SL	5.4 fl oz	10/20, 11/3	5.3 a	21.5 a (0)	12.0 bc (25)	6.0 c (38)
Distance	12 fl oz	10/20	7.5 a	30.5 a (0)	16.0 abc (30)	20.8 a (0)
Distance + TriStar	12 + 12 fl oz	10/20	15.5 a	50.3 a (6)	31.8 a (32)	16.3 ab (42)
IKI-3106	22 fl oz	10/20, 11/3	8.5 a	39.0 a (0)	35.0 a (0)	10.8 bc (30)
IKI-3106	28 fl oz	10/20, 11/3	4.5 a	26.8 a (0)	10.5 c (23)	8.0 bc (2)
Mainspring 200SC	8 fl oz	10/20	12.0 a	31.0 a (25)	30.5 ab (16)	21.3 a (3)
Mainspring 200SC	12 fl oz	10/20	7.0 a	38.3 a (0)	11.5 bc (46)	12.0 abc (6)
Untreated	-	-	6.75 a	23.3 a (0)	20.5 abc (0)	12.3 abc (0)

[x] Means followed by same letter do not significantly differ (LSD test, P=0.05).
[y] DAT = days after the first treatment.
* All treatments applied foliar, except Mainspring applied as drench to potting medium.

Comparative Efficacy on Cushion Scale

Cushion scale species are not as common as the other scale species tested in this program. They are a unique group and, unlike other scale species, adults are able to move around.

Cottony Cushion Scale

Three researchers evaluated the efficacy of neonicotinoids (Flagship, Safari and TriStar), insect growth regulators (Distance and Talus), A16901B, GF-2626, XXpire, Kontos and Rycar on cottony cushion scale (*Icerya purchasi*). A test on cleyera (*Ternstroemeria sp*.) had and extremely high scale population that caused early plant death in some treatments and the test was terminated early. No statistically significant differences were observed until 21 DAT; on this date, TriStar and Orthene provided good control (Table 66). Two experiments on heavenly bamboo (*Nandina domestica*) showed all treatments providing good to excellent controlof nymphs and adults in 2011 (Table 67); Flagship, GF-2626, XXpire, and Distance provided good to excellent control of nymphs in 2012 (Table 68). In a 2011 experiment on pittosporum (*P. tobira*), all treatments except A16901B significantly reduced live nymphs (Table 69). Of the neonicotinoids, Safari performed the best with no difference in efficacy between the drench and broadcast applications. On the other hand, foliar sprays of Flagship appeared to perform slightly (though not significantly) better than broadcast application. For the insect growth regulators, Talus provided better efficacy than Distance. In a 2012 experiment on pittosporum, both rates of GF-2626 andXXpire, along with Distance, Talus 70DF, Safari G and paraffinic oil, significantly reduced the numbers of nymphs feeding on the leaves one week after treatment (Table 70). At 4 WAT, both rates of GF-2626 and XXpire, along with all other treatments except for Flagship G and Kontos, achieved significantly lower nymphs densities. At this time, all treatments significantly reduced adult numbers on the leaves. However, none of the treatments were effective in reducing the numbers of nymphs and adults feeding on the stems (Data not shown, refer to researcher report).

No phytotoxicity was observed on any of the treated plants.

Table 66. Efficacy on Cottony Cushion Scale on Cleyera, Ludwig, TX, 2005.

Treatment	Rate	Population Averages (Henderson's Percent Control)			
		Pretreat-ment	9 DAT (Visual)	16 DAT (Visual)	21 DAT (Microscope)
Celero	4 oz	197.3 a	210.0 a (0)	210.5 a (0)	209.3 ab (48)
Safari 20SG	4 oz	156.5 a	97.5 a (42)	64.8 a (57)	100.8 a (69)
Safari 20SG	8 oz	170.0 a	158.5 a (13)	221.0 a (0)	259.3 a (26)
Safari 20SG – Drench	12 oz	101.0 a	155.7 a (0)	190.3 a (0)	346.7 a (0)
Safari 20SG – Drench	24 oz	190.8 a	216.3 a (0)	125.0 a (32)	205.5 ab (47)
TriStar 30SG	112 g	132.8 a	115.0 a (19)	84.0 a (34)	58.8 bc (78)
TriStar 30SG	124 oz	111.8 a	155.0 a (0)	121.5 a (0)	30.3 cd (87)
Orthene TTO 97	8 oz	403.0 a	330.0 a (23)	200.0 a (48)	80.0 d (90)
Untreated	-	160.5 a	171.5 a (0)	154.0 a (0)	328.8 a (0)

* Letters after numbers are based on separation of average number of scale on 5 plants. See experiment report in Appendix 3 for statistical separation details.

Table 67. Efficacy on Cottony Cushion Scale on Heavenly Bamboo 'Harbour Dwarf', Frank, NC, 2011.

Stage	Treatment	Rate	Applic. Method	Population Averages (Henderson's % Control)				
				Pretreat	7 DAT	14 DAT	28 DAT	75 DAT
Adults	A16901B	5 oz/100 gal	Drench	1.0 a	0.0 b (100)	0.3 b (97)	0.2 b (98)	0.7 b (86)
	Distance IGR	8 fl oz/100 gal	Foliar	0.3 a	0.0 b (100)	0.0 b (100)	0.0 b (100)	0.0 b (100)
	Flagship 0.22G	30 g/plant	Broadcast	0.7 a	0.0 b (100)	0.0 b (100)	0.0 b (100)	0.0 b (100)
	Flagship 25WG	0.5 g/plant	Drench	0.2 a	0.0 b (100)	0.3 b (86)	0.3 b (83)	0.2 b (80)
	Horticultural Oil	50 fl oz/100 gal	Foliar	1.0 a	0.3 b (94)	0.7 b (93)	0.3 b (97)	0.8 b (84)
	Kontos	3.4 fl oz/100 gal	Foliar	0.5 a	0.0 b (100)	0.3 b (94)	0.2 b (96)	0.3 b (88)
	Rycar 20SC	18 fl oz/100 gal	Foliar	0.5 a	0.0 b (100)	0.5 b (90)	0.3 b (93)	1.0 b (60)
	Safari 2G	2.6 g/plant	Broadcast	0.7 a	0.0 b (100)	0.0 b (100)	0.2 b (97)	0.0 b (100)
	Safari 20SG	24 oz/100 gal	Drench	1.0 a	0.2 b (96)	0.0 b (100)	0.0 b (100)	0.0 b (100)
	Talus 70DF	14 oz/100 gal	Foliar	0.5 a	0.5 b (80)	1.0 b (81)	0.0 b (100)	0.0 b (100)
	Tristar 30SG	8 oz/100 gal	Foliar	1.5 a	0.0 b (100)	0.0 b (100)	0.0 b (100)	0.0 b (100)
	Untreated	-	-	0.7 a	3.5 a (0)	7.3 a (0)	6.3 a (0)	3.5 a (0)
Nymphs	A16901B	5 oz/100 gal	Drench	8.8a	1.5 b (89)	1.0 b (89)	1.2 b (89)	0.0 b (100)
	Distance IGR	8 fl oz/100 gal	Foliar	11.0 a	0.7 b (96)	0.3 b (98)	0.7 b (95)	0.0 b (100)
	Flagship 0.22G	30 g/plant	Broadcast	8.3 a	0.0 b (100)	0.0 b (100)	0.2 b (98)	0.0 b (100)
	Flagship 25WG	0.5 g/plant	Drench	10.7 a	1.2 b (92)	0.5 b (97)	0.8 b (94)	0.0 b (100)
	Horticultural Oil	50 fl oz/100 gal	Foliar	9.0 a	3.7 b (72)	3.0 b (81)	2.5 b (78)	0.0 b (100)
	Kontos	3.4 fl oz/100 gal	Foliar	8.7 a	1.5 b (88)	1.7 b (89)	1.2 b (89)	0.0 b (100)
	Rycar 20SC	18 fl oz/100 gal	Foliar	9.8 a	2.8 b (85)	2.2 b (87)	2.5 b (80)	0.0 b (100)
	Safari 2G	2.6 g/plant	Broadcast	11.0 a	0.3 b (98)	0.0 b (100)	0.0 b (100)	0.0 b (100)
	Safari 20SG	24 oz/100 gal	Drench	11.0 a	0.3 b (98)	0.2 b (99)	0.0 b (100)	0.0 b (100)
	Talus 70DF	14 oz/100 gal	Foliar	8.5 a	1.7 b (97)	0.7 b (95)	0.3 b (97)	0.0 b (100)
	Tristar 30SG	8 oz/100 gal	Foliar	9.5 a	0.0 b (100)	0.0 b (100)	0.0 b (100)	0.0 b (100)
	Untreated	-	-	9.7 a	14.5 a (0)	16.7 a (0)	12.5 a (0)	1.3 a (0)

* Means within a column followed by the same letter are not significantly different (LSD test, P= 0.05).

Table 68. Efficacy of Insecticides on Cottony Cushion Scale on Heavenly Bamboo 'Harbour Dwarf', Frank, NC, 2012.

Scale Stage	Treatment*	Rate Per 100 Gal	Population Averages (Henderson's Percent Control)				
			Pre	6 DAT	14 DAT	28 DAT	134 DAT
Nymphs	A16901B	5 fl oz	45.3 a	32.8 a (30)	25.2 a (49)	42.5 ab (70)	0.2 a
	A16901B	10 fl oz	45.2 a	43.3 a (21)	15.0 a (70)	50.5 ab (65)	0.0 a
	Distance	12 fl oz	34.2 a	29.7 a (28)	5.5 a (85)	22.5 b (79)	0.0 a
	Flagship G	40 g/pot	44.3 a	30.0 a (44)	15.8 a (84)	10.3 b (93)	0.0 a
	GF-2626 ISC	8 fl oz	51.8 a	38.5 a (38)	12.3 a (78)	0.0 b (100)	0.0 a
	GF-2626 ISC	11 fl oz	55.7 a	27.7 a (59)	1.2 a (98)	16.7 b (91)	0.2 a
	Xxpire 40WG	3.5 oz	49.8 a	9.7 a (84)	12.0 a (78)	2.0 b (99)	0.0 a
	Xxpire 40WG	7 oz	43.8 a	21 a (60)	4.8 a (90)	3.5 b (97)	0.0 a
	Horticultural Oil	150 fl oz	21.2 a	16.8 a (35)	4.2 a (82)	21.2 b (68)	0.0 a
	Kontos	3.4 fl oz	21.7 a	16.8 a (36)	19.7 a (18)	41.8 ab (39)	0.2 a
	Talus 70DF	14 fl oz	33.2 a	12.0 a (70)	30.8 a (16)	51.2 ab (51)	0.0 a
	Untreated	-	25.7 a	31.0 a (0)	28.3 a (0)	81.2 a (0)	0.0 a
Adults	A16901B	5 fl oz	2.0 a	2.2 a (4)	3.0 a (0)	4.5 ab (0)	0.0 a
	A16901B	10 fl oz	5.0 a	4.0 a (51)	3.5 a (49)	3.7 ab (59)	0.0 a
	Distance	12 fl oz	1.7 a	1.5 a (23)	1.2 a (98)	0.7 bc (77)	0.0 a
	Flagship G	40 g/ pot	1.5 a	2.2 a (0)	2.2 a (0)	3.3 abc (0)	0.0 a
	GF-2626 ISC	8 fl oz	1.5 a	1.0 a (42)	1.3 a (36)	0.7 bc (74)	0.0 a
	GF-2626 ISC	11 fl oz	2.7 a	1.8 a (42)	3.3 a (10)	2.7 abc (45)	0.0 a
	Xxpire 40WG	3.5 oz	7.0 a	4.2 a (48)	4.7 a (51)	2.3 abc (82)	0.0 a
	Xxpire 40WG	7 oz	2.3 a	2.0 a (24)	2.3 a (27)	0.5 c (88)	0.0 a
	Horticultural Oil	150 fl oz	2.3 a	2.5 a (6)	3.2 a (0)	2.2 bc (47)	0.0 a
	Kontos	3.4 fl oz	2.2 a	2.0 a (21)	2.8 a (7)	2.0 bc (50)	0.0 a
	Talus 70DF	14 fl oz	2.5 a	3.2 a (0)	4.0 a (0)	4.0 abc (12)	0.2 a
	Untreated	-	3.3 a	3.8 a (0)	4.5 a (0)	6.0 a (0)	0.0 a

[x] Numbers of live nymphs or adults per plant counted days after initial treatment. Means within column followed by the same letter are not significantly different (LSD, P=0.05).

* A16901B applied as drench, Flagship as soil broadcast, and the other products as foliar treatments.

Table 69. Efficacy on Cottony Cushion Scale on Pittosporum 'Variegata', Chong, SC, 2011.

Treatment	Rate	Applic. Method	Number of Nymphs (Henderson's % Control)				
			Pretreat	1 WAT	2 WAT	4 WAT	6 WAT
A16901B	10 oz/100 gal	Drench	19.7 a	19.8 a (0)	19.2 a (0)	20.0 a (0)	20.2 a (0)
Distance IGR	12 fl oz/100 gal	Foliar	20.7 a	11.0 bc (41)	9.5 b (50)	3.7 b (81)	2.8 bc (86)
Flagship 25WG	8 oz/100 gal	Foliar	18.5 a	2.7 de (84)	2.2 d (87)	2.5 b (86)	1.8 bc (90)
Flagship 0.22G	227 g/ft ht	Broadcast	20.7 a	8.0 cd (57)	8.8 bc (53)	3.7 b (81)	4.3 b (78)
Kontos	3.4 fl oz/100gal	Foliar	17.8 a	7.8 cd (77)	6.8 bc (58)	0.2 b (99)	0 d (100)
Rycar 20SC	18 fl oz/100 gal	Foliar	20.8 a	10.8 b (42)	4.8 bcd (75)	1.7 b (91)	0.3 d (98)
Orthene TTO97	8 oz/100 gal	Foliar	19.7 a	5.8 cde (67)	6.0 bc (67)	3.8 b (80)	3.8 bc (79)
Safari 20SG	6 g/ft ht	Drench	19.7 a	2.2 de (88)	1.2 d (93)	0 b (100)	0 d (100)
Safari 2G	60 g/ft ht	Broadcast	18.7 a	0.7 e (96)	0.8 d (95)	0 b (100)	0 d (100)
Talus70 DF	14 oz/100 gal	Foliar	17.7 a	4.0 de (75)	1.3 d (92)	0.2 b (99)	0 d (100)
TriStar 30 SG	8 oz/100 gal	Foliar	16.5 a	2.5 de (83)	3.0 c (80)	0.8 b (95)	0.5 cd (97)
Untreated	-	-	19.0 a	17.0 ab (0)	17.3 a (0)	18.0 a (0)	17.8 a (0)

* ANOVA for Completely Randomized Design at $\alpha = 0.05$. Means within a column with the same letters are not significantly different among the treatments by LSD.

Table 70. Efficacy on Cottony Cushion Scale on Pittosporum 'Variegata', Chong, SC, 2012.

Scale Stage	Treatment	Rate	Applic Method	Mean No. Per 3 Leaves (Henderson's % Control)					
				0 DAT	1 WAT	2 WAT	4 WAT	6 WAT	6 MAT
Nymphs	A16901B	5 oz/100 gal	Drench	17.5 a	15.5 ab (25)	72.7 a (0)	25.3 bc (40)	39.7 ab (0)	12.7 a (0)
	A16901B	10 oz/100 gal	Drench	24.7 a	14.2 ab (51)	41.0 a (18)	15.7 c (74)	35.2 abc (0)	21.7 a (0)
	Distance	12 fl oz/100 gal	Foliar	23.0 a	11.8 b (57)	47.0 a (0)	20.5 bc (63)	15.2 cd (0)	17.3 a (0)
	Flagship G	60 g/plant	Broadcast	69.5 a	28.2 a (66)	79.5 a (44)	44.0 ab (74)	20.7 bcd (51)	11.0 a (76)
	GF-2626 1SC	8 fl oz/100 gal	Foliar	24.2 a	10.2 b (64)	37.7 a (23)	7.3 c (87)	12.7 d (14)	7.0 a (57)
	GF-2626 1SC	11 fl oz/100 gal	Foliar	19.3 a	5.0 b (78)	31.3 a (20)	4.2 c (91)	11.7 d (1)	16.8 a (0)
	Xxpire 40WG	3.5 oz/100 gal	Foliar	35.2 a	10.2 b (75)	26.7 a (63)	7.2 c (91)	15.0 cd (31)	8.5 a (64)
	Xxpire 40WG	7 oz/100 gal	Foliar	24.8 a	6.3 b (78)	29.8 a (41)	9.7 c (84)	6.5 d (57)	8.2 a (50)
	Kontos	3.4 fl oz/100 gal	Drench	32.0 a	16.2 ab (57)	59.8 a (8)	54.3 a (29)	37.7 ab (0)	23.8 a (0)
	Paraffinic oil	2% v/v	Foliar	30.8 a	8.2 b (77)	30.0 a (52)	26.2 bc (65)	11.8 d (38)	11.2 a (45)
	Safari 2G	2.6 g/gal pot	Broadcast	23.3 a	8.8 b (68)	27.0 a (43)	22.2 bc (60)	44.8 a (0)	22.2 a (0)
	Talus 70DF	14 oz/100 gal	Foliar	11.5 a	8.0 b (41)	27.2 a (0)	15.2 c (45)	6.0 d (15)	16.2 a (0)
	Untreated	-	-	23.3 a	27.5 a (0)	47.3 a (0)	56.0 a (0)	14.3 cd (0)	15.5 a (0)
Adults	A16901B	5 oz/100 gal	Drench	0.7 a	0.3 a (98)	0.5 a (93)	0.7 cd (97)	1.5 b (57)	0 a (100)
	A16901B	10 oz/100 gal	Drench	2.3 a	2.0 a (96)	0.3 a (97)	0.5 cd (99)	1.0 b (91)	0.8 a (91)
	Distance	12 fl oz/100 gal	Foliar	0.8 a	2.8 a (82)	1.7 a (47)	3.0 bc (89)	4.8 a (0)	0.2 a (94)
	Flagship G	60 g/plant	Broadcast	5.8 a	9.7 a (92)	1.2 a (95)	0.7 cd (100)	1.2 b (96)	0 a (100)
	GF-2626 1SC	8 fl oz/100 gal	Foliar	1.5 a	2.5 a (92)	0.2 a (93)	0 d (100)	0.5 b (93)	0.3 a (95)
	GF-2626 1SC	11 fl oz/100 gal	Foliar	1.7 a	5.3 a (84)	0 a (100)	0.2 d (100)	0.3 b (96)	0 a (100)
	Xxpire 40WG	3.5 oz/100 gal	Foliar	4.2 a	1.0 a (99)	0.2 a (99)	0.2 d (100)	0.5 b (98)	0.3 a (98)
	Xxpire 40WG	7 oz/100 gal	Foliar	1.5 a	3.2 a (89)	0.7 a (95)	0.3 d (99)	0.5 b (93)	0.3 a (95)
	Kontos	3.4 fl oz/100 gal	Drench	1.7 a	3.5 a (90)	1.5 a (78)	4.0 b (93)	1.8 b (79)	0.7 a (90)
	Paraffinic oil	2% v/v	Foliar	2.5 a	2.7 a (95)	1.2 a (88)	1.8 bcd (98)	2.2 b (82)	0.5 a (95)
	Safari 2G	2.6 g/gal pot	Broadcast	1.8 a	2.8 a (95)	0.2 a (97)	1.0 cd (98)	1.8 b (82)	0.7 a (90)
	Talus 70DF	14 oz/100 gal	Foliar	1.2 a	7.0 a (71)	1.6 a (67)	0.5 cd (99)	0.4 b (93)	2.2 a (54)
	Untreated	-	-	0.2 a	4.0 a (0)	0.8 a (0)	6.7 a (0)	1.0 b (0)	0.8 a (0)

* Means within a column followed by the same letter are not significantly different (LSD test, P= 0.05).

Comparative Efficacy on Mealybugs

Citrus Mealybug

Ludwig. In the first of two experiments conducted by Ludwig on citrus mealybug (*Planococcus citri*) in 2004, five pesticides wereevaluated against this pest on greenhouse grown coleus (*Coleus* sp.). Plants grown in 6.5 inch azalea pots were infested with all mealybug life stages at the initiation of the experiment.Treatments were applied on 0 and 13 DAT. To monitor the mealybug population, the same two inches of plant stem was monitored each sample period. All three of the systemic insecticides provided excellent control of the mealybug by 13 DAT (Table 71). Talus and Distance (32 oz) were slightly slower acting but were providing control by 21 DAT.

Ludwig's second experiment was a repeat of the first, except treatments were only applied at 0 DAT. In this experiment Flagship (4 oz) was the only treatment to result in a population lower than the control on 7 DAT (Table 72). All the treatments were significantly lower than the control by 17 DAT. Distance at 8 oz had higher populations than the other chemical treatments. This is most likely a result of the fact that the population was three times higher than the other treatments at the start of the experiment.

Oetting. In a study conducted by Oetting for control of citrus mealybug on coleus, most of the tested products provided good to excellent control by 6 weeks after the initial treatment (Table 73). Those that exhibited excellent control 2 weeks after application included Facin at both 0.25% and 0.5%, Safari drenched at 24 oz per 100 gal, TriStar at 96 oz per 100 gal, and Orthene at 10.5 oz per 100 gal.

Parrella. Parella conducted studies for control of citrus mealybug on coleus ((*Solenostemon x hybridus)* in 2005-06, on zinnia (*Zinnia elegans*) 'Sunny Time' in 2009, and on rose (*Rosa* sp) 'Akita' in 2011. In the 2005-06 study, Flagship, Tristar and Safari (foliar) significantly reduced mealybugs for the duration of the experiment (Data not shown; refer to researcher report). Aria, Marathon and Talus took longer to control the mealybugs and did not control the mealybugs for the duration of the experiment. Facin foliar and Safari drench were not effective. In the 2009 study, all pesticides except the low rate of Aria provided some degree of citrus mealybug control (Table 74). Of most interest to a grower, however, is those materials that quickly reduced mealybug populations to the lowest levels. One week after application, no mealybugs were observed on the Natural Solutions and the high rate of Tristar treatments. The low rate of Tristar and high rate of the Safari foliar application and had very low mealybug levels. The Safari foliar applications and both rates of Tristar continued to provide the best control for the duration of the experiment. Natural Solutions provided good initial control but did not provide sustained mealybug management; populations on plants treated with this material began to rise one month after the initial infestation. In the 2011 study of chemical and biorational products on rose, A16901B applied twice as a foliar spray provided the best mealybug control; good control was obtained with A16901B drench, Rycar (foliar twice), Kontos (foliar once) and the standards Safari drench and Talstar foliar (Data not shown; refer to researcher report). Of the biorationals, only Talus provided mealybug reduction comparable to that of the industry standard Talstar; Distance, MBI 203 and MBI 205 did not significantly reduce mealybug levels.

Table 71. Efficacy on Citrus Mealybug on Coleus - 1, Ludwig, TX, 2004.

Treatment (Rate)	Population Averages (Henderson's Percent Control)				
	0 DAT	6 DAT	13 DAT	21 DAT	28 DAT
Distance (8 fl oz / 100 gal)	27.0	41.3 ab (0)	57.8 ab (0)	68.3 a (0)	70.0 a (0)
Distance (16 fl oz / 100 gal)	16.0	37.3 a (0)	58.3 a (0)	58.8 a (0)	62.8 a (0)
Distance (32 fl oz / 100 gal)	17.0	9.0 bcd (46)	3.3 cdefg (72)	0.0 e (100)	0.0 c (100)
Flagship (2 oz / 100 gal)	27.8	14.5 abcd (47)	9.0 bcd (53)	0.8 cde (98)	0.8 bc (99)
Flagship (4 oz / 100 gal)	28.3	5.8 cd (79)	1.3 efg (94)	0.3 e (99)	0.0 c (100)
Flagship (8 oz / 100 gal)	30.8	4.3 cd (86)	0.5 fg (98)	0.0 e (100)	0.0 c (100)
Safari (12 oz / 100 gal) - Drench	21.5	16.5 abcd (22)	11.3 cdef (24)	3.0 cde (87)	0.0 c (100)
Safari (24 oz / 100 gal) - Drench	17.8	10.8 abcd (38)	2.3 cdefg (81)	1.5 cde (92)	0.3 c (99)
Safari (48 oz / 100 gal) - Drench	11.3	5.5 cd (50)	1.5 defg (81)	0.5 de (96)	0.0 c (100)
Talus 40SC (21.5 fl oz)	22.8	17.8 abc (21)	27.3 ab (0)	13.8 ab (45)	5.5 b (88)
Talus 40SC (43 fl oz)	10.5	12.0 abcd (0)	23.8 abc (0)	6.8 bc (42)	6.5 bc (68)
Talus 40SC (86 fl oz)	16.5	24.3 abcd (0)	22.8 bcd (0)	1.0 cde (94)	1.8 bc (95)
TriStar 70WSP (32 g / 100 gal)	11.8	4.0 cd (65)	3.0 cdefg (63)	0.8 cde (94)	0.0 c (100)
TriStar 70WSP (64 g / 100 gal)	15.0	3.0 cd (80)	1.0 defg (90)	0.0 e (100)	0.0 c (100)
TriStar 70WSP (128 g / 100 gal)	21.8	1.3 d (94)	0.0 g (100)	0.3 e (99)	0.0 c (100)
Untreated	27.8	27.3 abcd (0)	19.0 bcde (0)	30.5 bcd (0)	54.0 a (0)

* Letters after numbers are based on separation of average number of mealybug on the same 2 inches of stem. See experiment report in Appendix 3 for statistical separation details.

Table 72. Efficacy on Citrus Mealybug on Coleus - 2, Ludwig, TX, 2004.

Treatment (Rate)	Population Averages (Henderson's Percent Control)			
	0 DAT	17 DAT	22 DAT	28 DAT
Distance (8 fl oz / 100 gal)	135.0	74.8 ab (64)	16.8 ab (93)	7.3 a (97)
Distance (16 fl oz / 100 gal)	24.3	11.0 a (71)	4.8 a (90)	1.5 a (96)
Distance (32 fl oz / 100 gal)	19.8	14.8 bcd (52)	2.8 cdefg (93)	6.3 e (82)
Flagship (2 oz / 100 gal)	53.3	18.5 abcd (78)	3.0 bcd (97)	2.5 cde (97)
Flagship (4 oz / 100 gal)	41.8	10.3 cd (84)	0.5 efg (99)	0.0 e (100)
Flagship (8 oz / 100 gal)	25.5	37.3 cd (6)	9.0 fg (81)	5.0 e (89)
Safari (12 oz / 100 gal) - Drench	47.3	34.3 abcd (53)	0.0 cdef (100)	0.0 cde (100)
Safari (24 oz / 100 gal) - Drench	37.8	24.5 abcd (58)	0.3 cdefg (100)	0.3 cde (100)
Safari (48 oz / 100 gal) - Drench	27.8	41.5 cd (4)	1.0 defg (98)	1.5 de (97)
Talus 40SC (21.5 fl oz)	19.0	18.5 abc (37)	0.3 ab (99)	0.3 ab (99)
Talus 40SC (43 fl oz)	33.5	21.3 abcd (59)	3.8 abc (94)	0.8 bc (99)
Talus 40SC (86 fl oz)	43.3	39.3 abcd (42)	4.3 bcd (95)	3.8 cde (95)
TriStar 70WSP (32 g / 100 gal)	28.0	17.0 cd (61)	0.3 cdefg (100)	0.0 cde (100)
TriStar 70WSP (64 g / 100 gal)	19.0	14.0 cd (53)	0.3 defg (99)	0.0 e (100)
TriStar 70WSP (128 g / 100 gal)	28.5	16.8 d (62)	0.3 g (100)	0.0 e (100)
Untreated	26.0	40.5 abcd (0)	49.0 bcde (0)	45.8 bcd (0)

* Letters after numbers are based on separation of average number of mealybug on the same 10 leaves throughout the experiment. See experiment report in Appendix 3 for statistical separation details.

Table 73. Efficacy on Citrus Mealybug on Coleus, Oetting, GA, 2005.

Treatment	Rate (per 100 gal)	Pre Treatment Rating	Percent Control (Henderson's)				
			Week 2	Week 3	Week 4	Week 5	Week 6
Aria (flonicamid)	60 g	2.6 cde	37 ab	72 bcde	88 cdef	89 def	89 e
Aria (flonicamid)	120 g	4.3 abcde	81 bcde	93 def	100 f	98 f	99 e
Facin	0.25%	2.4 de	96 e	82 bc	84 bc	79 b	80 bc
Facin	0.50%	3.8 abcde	93 de	81 b	88 bcd	91 cd	87 bc
Flagship (thiamethoxam)	2 oz	2.4 de	52 bcd	91 ef	93 def	87 cdef	92 e
Flagship (thiamethoxam)	4 oz	3.8 abcde	79 bcde	86 cdef	96 def	97 ef	98 e
Safari (dinotefuran)	4 oz	3.1 cde	65 bcde	73 bc	81 bcde	85 cde	81 cd
Safari (dinotefuran)	8 oz	2.9 cde	46 ab	73 bcd	71 b	77 bc	67 b
Safari (dinotefuran) – drench	12 oz	4.5 abcd	68 abc	96 f	96 def	97 ef	100 e
Safari (dinotefuran) - drench	24 oz	2.8 cde	94 e	94 f	97 f	98 f	100 e
Talus (buprofezin)	21.5 oz	3.7 bcde	67 bcde	83 bcdef	95 def	98 f	99 e
Talus (buprofezin)	43 oz	2.1 e	49 bcde	80 cdef	84 cdef	95 f	97 e
TriStar (acetamiprid)	48 oz	5.9 ab	86 bcde	95 def	95 cdef	98 ef	97 e
TriStar (acetamiprid)	96 oz	4.8 abc	92 de	96 f	97 ef	96 def	95 de
Orthene (acephate)	10.5 oz	6.1 a	92 cde	96 def	98 ef	98 ef	97 e
Untreated	-	2.1 e	0 a	0 a	0 a	0 a	0 a
Untreated (Population Rating)		2.1	10.2	16.6	20.8	28.5	38.7

* Letters after numbers are based on separation of raw whole plant population rating. See experiment report in Appendix 3 for statistical separation details.

Table 74. Efficacy on Citrus Mealybug on Zinnia 'Sunny Time', Parella, CA, 2009.

Treatment	Rate Per 100 Gal	Population Averages (Henderson's Percent Control)				
		Pretreat	1 WAT	2 WAT	4 WAT	6 WAT
Aria (flonicamid)	2.1 oz	4.72 a	4.44 a (0)	10.44 ab (70)	2.89 b (89)	43.00 ab (0)
Aria (flonicamid)	4.3 oz	5.06 a	3.00 a (9)	4.28 b (82)	0.28 b (97)	2.24 b (0)
Flagship (thiamethoxam)	2 oz	8.06 a	3.11 a (42)	0.44 b (98)	0.44 b (60)	2.67 b (0)
Flagship (thiamethoxam)	4 oz	3.28 a	4.22 a (0)	2.28 b (93)	0.11 b (98)	1.89 b (0)
Mesurol (methiocarb)	0.5 lb	4.33 a	5.00 a (0)	9.11 ab (77)	7.44 b (67)	14.41 b (0)
Natural Solutions (*Verticillium lecanii*)	1:1000	5.06a	0.00 a (100)	0.67 b (97)	2.33 b (0)	12.6 b (0)
Safari (dinotefuran) - drench	12 oz	2.50 a	5.78 a (0)	6.00 b (87)	4.06 b (73)	13.94 b (0)
Safari (dinotefuran) - drench	24 oz	6.22 a	5.39 a (0)	2.00 b (95)	3.83 b (23)	23.72 ab (0)
Safari (dinotefuran)	0.2 oz	4.83 a	0.47 a (85)	0.39 b (89)	0.17 b (82)	0.00 b (100)
Safari (dinotefuran)	0.4 oz	2.83 a	0.50 a (73)	0.28 b (93)	0.11 b (84)	0.06 b (64)
Talus (buprofezin)	12 oz	2.06 a	0.39 a (71)	3.33 b (0)	4.11 b (50)	5.56 b (11)
Tristar (acetamiprid)	2.7 oz	6.00 a	0.06 a (98)	1.56 b (0)	0.39 b (90)	0.06 b (90)
Tristar (acetamiprid)	5.3 oz	3.17 a	0.00 a (100)	0.11 b (99)	0.06 b(78)	0.00 b (100)
Untreated	-	4.00 a	2.61 a (0)	20.5 a (0)	51.11 a (0)	77.24 a (0)

* Means within a column followed by the same letter are not significantly different (Tukey's means separation test, $P< 0.05$).

Madeira Mealybug.
Four experiments were conducted between 2005 and 2011 evaluating several insecticides for efficacy on Madeira mealybug.

Oetting 2005. In an experiment conducted by Oetting to control Madeira mealybug (*Phenacoccus madeiresis*) on coleus (*Coleus sp.*), Talus at 21.5 and 43 oz per 100 gal, TriStar at 48 oz + Capsil at 6 oz per 100 gal, and Orthene at 10.5 oz per 100 gal provided the best control by 6 weeks after initial application (Table 75). However, products did not begin to provide good to excellent control until 3 weeks after initial applications. The addition of Capsil at 6 oz enhanced the level of control of both Safari at 4 oz and TriStar at 48 oz.

Ludwig 2011. A experiment conducted by Ludwig in 2011 showed Hachi-Hachi, Rycar (18 fl oz/100 gal), Safari 20SG, Safari 2G, SuffOil-X and Talus providing good to excellent control by 4 weeks after initial applications (Table 76). A16901B (foliar) and Kontos (foliar or drench) required longer to provide good to excellent control.

Davis 2010 and 2011. In a study conducted by Davis in 2010 for control of Madeira mealybug on marigold (*Tagetes patula*), Distance, Rycar, Tristar, Talus and Orthene applied as foliar applications twice, 2 weeks apart, all gave 80-100 % control with the standard Orthene providing the best population reduction (Table 77). A16901B as a drench, Safari 20SG as a drench, Flagship 0.22G and Safari 2G (both applied to media surface in pot) all gave 60-80 % population reduction. Flagship 25WG, Kontos and Merit applied as drench provided poor control. In a 2011 study, A16901B and Flagship 25WG were applied as drench or foliar, Horticultural Oil and Orthene applied foliar, and Flagship 0.22G applied broadcast to media surface in pot. All foliar treatments provided excellent control while broadcast and drench treatments were inferior (Table 78).

Table 75. Efficacy on Madeira Mealybug on Coleus, Oetting, GA, 2005.

Treatment	Rate per 100 gal	Pre Treatment Rating	Percent Control (Henderson's)				
			Week 2	Week 3	Week 4	Week 5	Week 6
Facin	0.25%	12.3 ab	26 abc	42 bc	54 bc	50 bc	55 bc
Facin	0.50%	12.9 ab	1 a	39 bc	47 bc	62 cd	75 cd
Orthene (acephate)	10.5 oz	7.1 cd	78 d	93 d	100 d	100 f	99 d
Safari (dinotefuran)	4 oz	4.8 d	46 a	65 bc	70 bc	80 cde	71 bc
Safari (dinotefuran) +Capsil	4 oz +6 oz	9.6 abc	62 abc	62 bc	90 cd	91 def	82 cd
Talus (buprofezin)	21.5 oz	13.5 a	29 bcd	90 d	95 d	98 f	98 d
Talus (buprofezin)	43 oz	8.7 bcd	62 bcd	82 cd	97 d	96 ef	98 d
TriStar (acetamiprid)	48 oz	7.0 cd	55 abc	34 a	49 a	57 ab	57 ab
TriStar (acetamiprid)	96 oz	6.0 cd	19 a	42 bc	57 bc	58 bc	42 ab
TriStar (acetamiprid) +Capsil	48 oz+6 oz	7.4 cd	53 cd	77 cd	61 cd	95 ef	93 d
Untreated	-	6.4 cd	0 a	0 a	0 a	0 a	0 a
Untreated (Population Rating)		6.4	16.8	13.3	12.3	16.2	15.3

* Letters after numbers are based on separation of raw whole plant population rating. See experiment report in Appendix 3 for statistical separation details.

Table 76. Efficacy on Madeira Mealybug on Coleus 'King Salmon Pink', Ludwig, TX, 2011.

Stage	Treatment	Rate per 100 gal	Applic. Method	Number of Mealybugs (Henderson's % Control)				
				Pretreat	1 WAT	2 WAT	4 WAT	6 WAT
Crawlers	A16901B	6.7 oz	Foliar	17.5±5.3 abc	27.2±7.1 abc (0)	25.8±5.1 a-d (0)	1.3±0.6 bcd (87)	0.0±0.0 d (100)
	A16901B	10 oz	Drench	46.0±6.8 a	27.0±9.7 abc (6)	29.5±10.1 a-d (48)	2.7±1.6 bcd (89)	4.5±2.8 bc (29)
	Capsil	6 fl oz	Foliar	23.7±6.5 abc	14.8±5.9 bcd (0)	66.8±16.8 c (0)	12.5±5.5 ab (5)	16.2±6.5 a (0)
	Distance	12 fl oz	Foliar	24.0±14.4 abc	10.3±6.4 de (31)	16.0±4.6 cd (46)	10.5±7.1 abc (21)	4.0±2.6 bcd (0)
	Flagship 0.22G	6 g/gal media	Broadcast	8.7±3.9 c	17.3±7.8 cde (0)	26.8±12.3 bcd (0)	9.3±4.2 ab (0)	9.5±7.0 ab (0)
	Flagship 25WG	8 oz	Foliar	21.0±8.9 abc	10.2±2.2 cde (22)	13.0±5.0 d (50)	0.2±0.2 cd (98)	1.2±1.2 cd (58)
	Hachi-Hachi	32 fl oz	Foliar	38.6±16.2 abc	67.8±15.7 a (0)	60.6±11.8 ab (0)	20.4±7.9 a (4)	0.6±0.6 cd (89)
	Kontos	3.4 fl oz	Foliar	41.2±12.5 ab	20.5±6.6 a-d (20)	10.3±3.3 cd (80)	2. 7±1.7 bcd (88)	0.0±0.0 d (100)
	Kontos	3.4 fl oz	Drench	25.2±10.9 abc	53.0±6.6 ab (0)	22.7±7.1 a-d (27)	3.5±1.5 a-d (75)	0.0±0.0 d (100)
	MBI 203	2 gal	Foliar	21.7±8.3 abc	8.0±2.8 cde (41)	28.6±14.0 a-d (0)	8.8±4.9 ab (27)	9.2±5.4 ab (0)
	MBI 205	3 gal	Foliar	30.5±10.3 abc	17.0±4.8 a-d (11)	45.2±15.4 abc (0)	4.8±3.5 bcd (72)	0.0±0.0 d (100)
	Rycar	18 fl oz	Foliar	10.0±3.7 bc	4.3±2.8 e (31)	22.5±11.4 cd (0)	2.0±1.6 bcd (64)	0.0±0.0 d (100)
	Safari 2G	2.6 g/gal media	Broadcast	11.3±6.8 c	20.2±12.7 cde (0)	24.7±10.2 a-d (0)	0.0±0.0 d (100)	0.0±0.0 d (100)
	Safari 20SG	24 oz	Drench	15.3±5.5 abc	30.3±10.8 a-d (0)	19.0±7.8 bcd (0)	5.7±5.7 bcd (33)	0.0±0.0 d (100)
	SuffOil-X	2 gal	Foliar	25.5±15.4 abc	14.3±6.8 cde (10)	51.5±22.8 a-d (0)	5.0±3.0 a-d (65)	1.0±1.0 cd (71)
	Talus 70DF	12 oz	Foliar	12.5±11.3 c	1.7±01.0 e (78)	0.0±0.0 e (100)	0.0±0.0 d (100)	0.0±0.0 d (100)
	Untreated	-	-	24.8±11.1 abc	15.5±8.5 cde (0)	30.7±17.5 cd (0)	13.7±11.8 a-d (0)	3.4±3.2 bcd (0)
Nymphs (not including crawlers)	A16901B	6.7 oz	Foliar	4.3±1.5 a	2.0±1.0 efg (42)	1.8±0.7 f-i (77)	14.2±7.4 cd (0)	1.3±0.5 efg (88)
	A16901B	10 oz	Drench	8.0±3.4 a	26.5±5.0 a (0)	39.2±10.7 a (0)	23.0±8.3 abc (0)	31.7±10.1 a (0)
	Capsil	6 fl oz	Foliar	10.8±4.4 a	11.8±4.4 bc (0)	32.8±7.4 ab (0)	27.5±4.1 a (0)	21.8±5.1 ab (17)
	Distance	12 fl oz	Foliar	9.0±6.2 a	4.7±1.9 cde (34)	15.2±11.6 c-f (7)	8.7±2.8 cd (57)	4.5±1.7 de (79)
	Flagship 0.22G	6 g/gal media	Broadcast	5.7±1.7 a	6.8±4.0 def (0)	15.7±6.9 b-e (0)	14.7±7.0 bcd (0)	14.8±6.5 bc (0)
	Flagship 25WG	8 oz	Foliar	3.5±1.5 a	0.2±0.2 gh (93)	4.5±2.8 f-i (29)	7.5±2.3 cd (5)	2.8±1.4 def (67)
	Hachi-Hachi	32 fl oz	Foliar	10.4±4.0 a	0.6±0.4 gh (99)	6.6±3.3 d-g (65)	1.4±0.7 efg (94)	2.0±1.5 efg (92)
	Kontos	3.4 fl oz	Foliar	5.8±2.7 a	6.3±3.7 def (0)	9.2±6.9 e-h (13)	8.3±5.8 de (36)	0.2±0.2 fg (99)

Stage	Treatment	Rate per 100 gal	Applic. Method	Number of Mealybugs (Henderson's % Control)				
				Pretreat	1 WAT	2 WAT	4 WAT	6 WAT
	Kontos	3.4 fl oz	Drench	10.3±3.0 a	6.2±1.2 bcd (24)	3.5±2.4 f-i (81)	12.0±7.3 de (48)	1.3±1.0 fg (95)
	MBI 203	2 gal	Foliar	9.8±2.3 a	11.7±3.0 ab (0)	14.4±4.5 a-d (19)	11.4±4.0 cd (48)	12.8±2.3 ab (46)
	MBI 205	3 gal	Foliar	4.7±1.1 a	0.5±0.2 gh (87)	11.8±4.5 cde (0)	4.0±1.7 def (62)	6.5±2.3 cd (43)
	Rycar	18 fl oz	Foliar	4.2±2.0 a	0.5±0.5 gh (85)	0.3±0.3 hi (96)	0.8±0.8 fg (92)	0.2±0.2 fg (98)
	Safari 2G	2.6 g/gal media	Broadcast	3.7±0.7 a	0.2±0.2 gh (93)	0.3±0.2 hi (96)	0.0±0.0 g (100)	0.0±0.0 g (100)
	Safari 20SG	24 oz	Drench	9.7±5.6 a	1.7±1.3 fgh (78)	0.8±0.4 ghi (95)	1.7±0.8 efg (92)	0.8±0.8 fg (97)
	SuffOil-X	2 gal	Foliar	10.7±4.3 a	0.3±0.3 gh (96)	1.8±0.9 f-i (91)	0.2±0.2 g (99)	0.0±0.0 g (100)
	Talus 70DF	12 oz	Foliar	5.7±2.1 a	0.0±0.0 h (100)	0.0±0.0 i (100)	0.0±0.0 g (100)	0.0±0.0 g (100)
	Untreated	-	-	12.3±5.3 a	9.8±4.5 bcd (0)	22.3±11.8 abc (0)	27.7±7.2 ab (0)	29.8±10.1 ab (0)
Egg Masses	A16901B	6.7 oz	Foliar	4.7±2.2 a-d	5.3±1.9 a-d (57)	4.5±2.3 b-e (46)	1.2±0.6 d-g (94)	1.2±0.7 bcd (96)
	A16901B	10 oz	Drench	2.5±0.4 a-d	3.2±0.7 b-g (49)	6.2±2.3 a-d (0)	6.7±1.9 ab (37)	13.8±2.4 a (6)
	Capsil	6 fl oz	Foliar	4.8±1.8 a-d	11.0±3.6 a (9)	12.0±4.5 a (0)	7.8±2.8 a (62)	10.2±3.3 a (64)
	Distance	12 fl oz	Foliar	1.8±0.7 bcd	9.3±4.7 abc (0)	7.7±4.3 abc (0)	5.2±3.0 a-d (32)	3.2±1.4 b (70)
	Flagship 0.22G	6 g/gal media	Broadcast	5.5±1.5 ab	6.3±1.2 abc (55)	6.3±1.9 abc (35)	6.7±2.2 ab (71)	10.0±4.6 a (69)
	Flagship 25WG	8 oz	Foliar	5.2±1.9 a-d	0.8±0.3 fg (94)	0.7±0.3 e (92)	0.2±0.2 fg (99)	0.5±0.3 cd (98)
	Hachi-Hachi	32 fl oz	Foliar	6.0±0.7 a	4.0±1.0 a-e (74)	2.0±0.7 b-e (81)	0.8±0.5 efg (97)	0.4±0.4 d (99)
	Kontos	3.4 fl oz	Foliar	2.2±0.8 bcd	6.2±2.6 a-e (0)	1.7±0.8 de (56)	2.8±1.5 c-f (70)	0.2±0.2 d (98)
	Kontos	3.4 fl oz	Drench	3.5±1.1 a-d	4.0±0.8 a-e (55)	4.3±1.6 a-d (30)	1.5±0.5 c-g (90)	0.2±0.2 d (99)
	MBI 203	2 gal	Foliar	3.0±0.9 a-d	8.7±1.5 ab (0)	7.4±3.5 ab (0)	5.4±2.0 abc (57)	8.0±1.7 a (46)
	MBI 205	3 gal	Foliar	2.5±1.0 bcd	4.0±1.7 b-f (37)	5.7±2.3 abc (0)	2.0±1.6 d-g (81)	2.2±1.0 bc (85)
	Rycar	18 fl oz	Foliar	1.7±0.7 cd	1.3±1.0 g (70)	2.3±1.1 b-e (23)	0.2±0.2 fg (97)	0.2±0.2 d (98)
	Safari 2G	2.6 g/gal media	Broadcast	2.3±1.3 bc	1.8±0.8 d-g (69)	1.5±0.7 de (63)	1.0±0.8 efg (90)	0.0±0.0 d (100)
	Safari 20SG	24 oz	Drench	2.0±0.8 bcd	1.5±1.0 fg (70)	2.2±1.4 cde (38)	1.0±0.5 efg (88)	0.0±0.0 d (100)
	SuffOil-X	2 gal	Foliar	3.5±1.1 ad	2.0±1.3 efg (77)	2.8±1.1 b-e (55)	0.0±0.0 g (100)	0.0±0.0 d (100)
	Talus 70DF	12 oz	Foliar	4.2±0.9 abc	7.0±2.2 abc (34)	6.2±1.7 ab (16)	2.8±1.0 b-e (84)	0.0±0.0 d (100)
	Untreated	-	-	1.7±0.8 d	4.3±1.9 c-g (0)	3.0±1.3 b-e (0)	7.2±2.5 ab (0)	10.0±3.1 a (0)

[x] Means within column with the same letter are not significantly different (P>0.05, Tukey's HSD Test).

* All treatments applied on 4/7/11; foliar treatments applied a second time on 4/23/11 except Distance which was applied on 4/29/11.

Table 77. Efficacy on Madeira Mealybug on Marigold, Davis, MI, 2010.

Treatment	Rate	Applic. Method	Population Averages (Henderson's Percent Control)[x]					
			Pretreat	1 WAT	2 WAT	3 WAT	4 WAT	5 WAT
A16901B	10 oz/100 gal	Drench	48.8 a	17.2 bc (77)	15.7 bc (68)	30.5 de (73)	19.5 bcd (83)	31.5 def (73)
Distance 10EC	12 fl oz/100 gal	Foliar	60.7 a	10.7 b (88)	13.7 b (78)	15.7 cd (89)	26.2 bcd (81)	18.3 de (87)
Flagship 0.22G	6 g/6-in pot	Broadcast	48.2 a	28.0 b-e (62)	38.8 cd (20)	40.3 ef (64)	46.0 def (59)	39.7 ef (65)
Flagship 25WG	8 oz/100 gal	Drench	59.7 a	41.3 b-e (55)	41.7 bcd (31)	68.2 def (51)	57.7 cde (58)	68.7 def (52)
Kontos	3.4 fl oz/100gal	Drench	49.3 a	60.0 cde (20)	40.8 cd (18)	63.5 ef (44)	71.5 ef (37)	67.0 fgh (43)
Merit 75WP	20 g/1250 pots	Drench	49.7 a	76.7 de (0)	44.3 d (12)	102.0 f (11)	103.5 f (10)	110.7 gh (7)
Rycar 20SC	18 fl oz/100 gal	Foliar	62.0 a	47.7 cde (50)	30.8 bcd (51)	30.3 cde (79)	20.2 bc (86)	20.8 cd (86)
Orthene 97WP	8 oz/100gal	Foliar	57.2 a	1.3 a (99)	1.8 a (97)	1.0 a (99)	0.3 a (100)	1.5 a (99)
Safari 2G	1 g/6-in pot	Broadcast	60.8 a	30.8 bcd (67)	10.2 b (83)	15.5 cde (89)	27.8 cde (80)	40.8 ef (72)
Safari 20SG	24 oz/100 gal	Drench	48.7 a	29.2 b-e (61)	21.2 bcd (57)	40.5 ef (64)	33.2 cde (70)	44.8 fg (61)
Talus70 DF	14 oz/100 gal	Foliar	49.8 a	92.7 e (0)	10.5 b (79)	5.0 ab (96)	2.5 a (98)	5.3 ab (96)
TriStar 30 SG + Dynamic	8 oz/100 gal	Foliar	54.3 a	65.3 cde (21)	18.3 bc (67)	10.7 bc (91)	11.7 b (91)	9.8 bc (92)
Untreated			49.8 a	76.2 e (0)	50.2 d (0)	115.3 f (0)	115.0 f (0)	118.7 h (0)

[x] Number of mealybugs counted in 1 minute. Means followed by the same letter are not significantly different. All data were transformed log (x+1) prior to ANOVA ($p < 0.05$). Untransformed means are presented in table.

* All treatments applied on 8/16/10; foliar treatments applied a second time on 8/31/10.

Table 78. Efficacy on Madeira Mealybug on Marigold, Davis, MI, 2011.

Treatment	Rate	Application Method	Population Averages (Henderson's Percent Control)[x]				
			Pretreat	9 DAT	16 DAT	23 DAT	29 DAT
A16901B	6.7 oz/100 gal	Foliar	16.33 a	4.50 b (76)	1.50 ab (95)	1.67 b (97)	5.00 b (95)
A16901B	10 oz/100 gal	Drench	17.50 a	9.67 c (52)	3.50 cd (87)	11.00 c (82)	15.17 cd (85)
Flagship 0.22G	6 g/6-in pot	Broadcast	15.33 a	10.17 c (42)	2.83 bcd (89)	10.50 c (81)	18.33 d (79)
Flagship 25WG	8 oz/100 gal	Foliar	18.83 a	3.33 b (85)	1.50 abc (95)	0.00 a (100)	0.83 a (99)
Flagship 25WG	8 oz/100 gal	Drench	16.00 a	11.50 c (37)	6.50 d (77)	6.50 c (89)	8.17 c (91)
Horticultural Oil	2 % v/v	Foliar	15.67 a	3.83 b (79)	2.83 bc (90)	0.00 a (100)	0.00 a (100)
Orthene 97WP	8 oz/100gal	Foliar	19.67 a	0.67 a (97)	0.50 a (99)	0.00 a (100)	0.33 a (100)
Untreated			18.00 a	20.67 d (0)	31.33 e (0)	64.33 d (0)	101.83 e (0)

[x] Number of mealybugs counted in 1 minute. Means followed by the same letter are not significantly different. All data were transformed log (x+1) prior to ANOVA ($p < 0.05$). Untransformed means are presented in table.

* All treatments applied on 9/27/11; foliar treatments applied a second time on 10/12/11.

Mexican Mealybug

In a single experiment conducted by Smitley & Davis to control Mexican mealybug (*Phenacoccus gossypii*) on marigold (*Tagetes* sp.)'Queen Sophia', all products tested provided good to excellent control starting 17 days after initial applications with excellent control continuing through the end of the experiment at 38 days after initial applications (Table 79).

Table 79. Efficacy on Mexican Mealybug on Marigold, Smitley & Davis, MI, 2005.

Treatment	Rate Per 100 Gal	Pre Treatment Count	Henderson's Percent Control				
			7 DAT	17 DAT	25 DAT	33 DAT	38 DAT
Aria 50SG	60 g	21.0	90	93	100	100	100
Aria 50SG	120 g	17.3	91	95	98	100	100
Flagship 25WP	2 oz	17.0	0	81	99	100	93
Flagship 25WP	4 oz	16.2	68	95	100	100	100
Safari 20SG	4 oz	18.7	71	98	99	100	100
Safari 20SG	8 oz	15.8	49	93	99	100	100
Safari 20SG - Drench	12 oz	17.8	70	84	95	96	100
Safari 20SG - Drench	24 oz	17.2	27	80	97	100	99
Talus 40SC	18 fl oz	19.7	10	66	98	99	99
TriStar 30SG	112 g	18.5	56	90	98	97	97
TriStar 30SG	224 g	17.5	80	83	99	89	96
Orthene 97	1 lb	16.0	95	100	100	100	100
Untreated	-	20.5	0	0	0	0	0
Untreated (Population Average)		20.5	105.3	221.0	240.3	323.8	489.8

*B-1956 surfactant mixed with Flagship, Safari, TriStar and Orthene foliar applications.

Phormium Mealybug

In one experiment with Phormium mealybug (*Balanococcus diminutus*) on New Zealand flax (*Phormium tenax*)'Dazler', both adults and nymphs were assessed. Very few adults were observed, so the remaining discussion will be on total nymph counts. Flagship 25WG applied as a foliar spray provided good to great control from 8 DAT to 43 DAT. Precise, commonly used for this pest, only provided approximately 50% control 4 and 6 weeks after treatment. Safari 20SG provided excellent control (>95%) at 4 and 6 weeks after treatment. TriStar 70WSP exhibited good to excellent control throughout this experiment (Table 80).

Table 80. Efficacy on Phormium Mealybug on New Zealand Flax, Bethke, CA, 2005.

Scale Stage	Treatment	Rate per 100 gal	Population Averages (Henderson's Percent Control)				
			Pre-treatment counts	8 DAT	15 DAT	29 DAT	43 DAT
Live Nymphs	Flagship 25WG	2 oz	41.0 a	10.7 (83)	0.3 (99)	13.2 (85)	0.5 (98)
	Flagship 25WG	4 oz	45.5 a	0.0 (100)	1.2 (98)	0.5 (99)	0.0 (100)
	Precise	1 tbs per pot	36.7 a	33.5 (40)	77.0 (0)	33.7 (57)	14.8 (42)
	Safari 20SG	4 oz	30.7 a	14.5 (69)	15.7 (67)	0.0 (100)	0.2 (99)
	Safari 20SG	8 oz	9.5 a	23.5 (0)	1.3 (91)	0.0 (100)	0.0 (100)
	Safari 20SG – Drench	12 oz	22.5 a	6.3 (82)	0.8 (98)	0.2 (100)	0.7 (96)
	Safari 20SG – Drench	24 oz	15.8 a	23.8 (1)	19.2 (21)	1.2 (97)	6.7 (40)
	TriStar 70WSP	4 oz	37.5 a	4.7 (92)	2.2 (96)	0.0 (100)	1.2 (96)
	TriStar 70WSP	8 oz	42.7 a	11.3 (83)	1.7 (97)	0.0 (100)	1.5 (95)
	Untreated	-	33.2 a	50.7 (0)	50.7 (0)	70.7 (0)	23.3 (0)
Live Adults	Flagship 25WG	2 oz	1.0 a	0.0 (100)	29.7 (0)	0.0 (100)	0.0 (100)
	Flagship 25WG	4 oz	2.0 a	0.0 (100)	18.8 (0)	0.0 (100)	0.0 (100)
	Precise	1 tbs per pot	3.0 a	1.7 (76)	10.3 (0)	5.7 (0)	1.3 (92)
	Safari 20SG	4 oz	3.0 a	0.5 (93)	11.2 (0)	0.0 (100)	0.2 (99)
	Safari 20SG	8 oz	1.3 a	0.2 (95)	15.0 (0)	0.0 (100)	0.2 (98)
	Safari 20SG – Drench	12 oz	4.2 a	0.2 (98)	11.8 (0)	0.0 (100)	0.0 (100)
	Safari 20SG – Drench	24 oz	0.5 a	0.2 (85)	7.5 (0)	0.0 (100)	0.3 (88)
	TriStar 70WSP	4 oz	1.2 a	0.0 (100)	9.2 (0)	0.7 (0)	0.5 (93)
	TriStar 70WSP	8 oz	0.3 a	0.7 (13)	3.7 (0)	0.0 (100)	0.0 (100)
	Untreated	-	1.2 a	2.7 (0)	2.7 (0)	0.3 (0)	6.7 (0)
Total Live	Flagship 25WG	2 oz	42.0 a	10.7 cd (84)	30.0 bc (54)	13.2 c (85)	0.5 d (99)
	Flagship 25WG	4 oz	47.5 a	0.0 d (100)	20.0 c (73)	0.5 c (99)	0.0 d (100)
	Precise	1 tbs per pot	39.7 a	35.2 ab (43)	87.3 a (0)	39.3 b (52)	16.2 b (53)
	Safari 20SG	4 oz	33.7 a	15.0 bcd (71)	26.8 bc (49)	0.0 c (100)	0.3 d (99)
	Safari 20SG	8 oz	10.8 a	23.7 bc (0)	16.3 c (3)	0.0 c (100)	0.2 d (98)
	Safari 20SG – Drench	12 oz	26.7 a	6.5 cd (84)	12.7 c (69)	0.2 c (100)	0.7 d (97)
	Safari 20SG – Drench	24 oz	16.3 a	24.0 bc (5)	26.7 abc (0)	1.2 c (97)	7.0 bc (51)
	TriStar 70WSP	4 oz	38.7 a	4.7 cd (92)	11.3 c (81)	0.7 c (99)	1.7 d (95)
	TriStar 70WSP	8 oz	43.0 a	12.0 cd (82)	5.3 c (92)	0.0 c (100)	1.5 cd (96)
	Untreated	-	34.3 a	53.3 a (0)	53.3 ab (0)	71.0 a (0)	30.0 a (0)

* Letters after numbers are based on separation of average number of scale on 5 plants. See experiment report in Appendix 3 for statistical separation details.

Rhizoecus Root Mealybug

In 2010, Hara conducted a study with Acelepryn, Aria, Kontos and Safari for control of rhizoecus root mealybug, (*Rhizoecus hibisci*) on Rhapis palm (*Rhapis robusta*). Products were applied once as drench; in addition, Kontos was applied as foliar spray in two weekly applications (Table 81). All treatments except Acelepryn provided good to excellent control of root mealybug. In 2012, Hara conducted another study on parapara or birdcatcher tree (*Pisonia brunoniana*). A16901B, Orthene and Safari were applied as drench once, MBI 203 and MBI 205 applied as drench twice, while Kontos was applied as drench or foliar spray twice (Table 82). All treatments except Orthene provided good to excellent control of root mealybug.

No phytotoxicity was observed on any of the treated plants.

Table 81. Efficacy on Rhizoecus Root Mealybug on Rhapis Palm, Hara, HI, 2010.

Treatment	Rate Per 100 Gal	Application Method	Live Adults and Nymphs[x]	
			Pretreatment	4 WAT
Acelepryn	0.8 fl oz	Drench	75.11 ±14.9 a	75.89 ±23.3 (51) b
Aria 50 SG	120 g	Drench	75.56 ±14.5 a	9.22 ±2.3 (94) c
Kontos	3.4 fl oz	Drench	75.11 ±15.1 a	0.44 ±0.4 (100) c
Kontos + Silwet	3.4 + 3 fl oz	Foliar	75.33 ±15.3 a	13.56±7.0 (91) c
Safari 20SG	6 g/ft ht	Drench	75.56 ±15.8 a	0.00 ±0.0 (100) c
Untreated	-	-	63.61 ±9.0* a	130.44 ±19.3* (0) a

[x] Means within a column followed by the same letter are not significantly different based on Tukey's HSD, P = 0.05.
* Does not include Rep3 Plant 2 data.

Table 82. Efficacy on Rhizoecus Root Mealybug on Parapara or Birdcatcher Tree, Hara, HI, 2012.

Treatment	Rate Per 100 Gal	Application Method	Live Adults and Nymphs[x] (Henderson's Percent Control)	
			Pretreatment	5 WAT
A16901B	10 oz	Drench 4/11	21.86 a	0.43 b (98)
Kontos	3.4 fl oz	Drench4/11,4/25	35.14 a	4.29 b (90)
Kontos	3.4 fl oz	Foliar 4/11,4/25	38.57 a	6.57 b (86)
MBI 203	2 qt	Drench 4/11,4/25	22.00 a	2.57 b (90)
MBI 205	4 qt	Drench 4/11,4/25	22.43 a	2.71 b (90)
Orthene TTO	10.7 oz	Drench 4/11	21.43 a	33.57 a (0)
Safari 20SG	24 oz	Drench 4/11	30.43 a	2.29 b (94)
Untreated	-	-	18.43 a	22.57 a (0)

[x] Means within a column followed by the same letter are not significantly different based on Tukey's HSD, P = 0.05.

Efficacy Summary by Active Ingredient

A16901B. This product applied as drench provided poor control of camellia scale in one experiment, mixed results on Euonymus scale in three experiments, and on false oleander scale in two experiments, and mediocre control of pine needle scale in two experiments. On cottony cushion scale, it provided excellent control in one, but no to mediocre efficacy in three other experiments. It had excellent control of gloomy scale in one experiment. On rhizoecus root mealybug, it provided excellent control in one experiment. It provided excellent control of citrus mealybug when applied foliar, and good control when applied as drench treatment. Control of Madeira mealybug was good to excellent when applied foliar, and poor to good when applied as drench treatment.

Aloft SC/Celero 16WSG. Celero provided poor control of cottony cushion scale and mixed results in 3 experiments on Florida wax scale with minimal to excellent control of nymphs and adults. Aloft provided good control of euonymus scale and holly pit scale, but poor control of armored scale and oystershell scale.

Aria 50SG. Aria foliar provided good to excellent control of citrus mealybug and Mexican mealybug; when applied as drench, it provided good control of rhizoecus root mealybug in one experiment.

BAS 440. This product applied foliar provided good to excellent control of tea scale in three experiments; a fourth experiment was inconclusive.

Botanigard ES. This biological product provided no control of elongate hemlock scale and cryptomeria scale in one experiment on Frasier fir.

BYI-2960 200 SL. This product applied foliar provided poor and excellent control of tea scale in two experiments; a third experiment was inconclusive.

Discus. In one yew experiment, Discus foliar provided good control of Fletcher scale.

Distance 0.86E. Distance provided excellent control of false oleander scale, gloomy scale,pine needle scale, magnolia white scale, and camellia scale, good to excellent control of tea scale and euonymus scale, good control of Florida wax scale, mixed efficacy on cottony cushion scale, and poor control of Fletcher scale, armored scale, false Florida red scale, holly pit scale and calico scale. Results of a pine needle scale experiment were inconclusive. Mixed results were obtained with citrus and Madeira mealybugs, with poor control in one experiment and good control in another.

Facin. Facin provided good control of citrus mealybug and poor to good control of Madeira mealybug at 0.25 and 0.5 % rates.

Flagship 0.22G/25WG. Flagship foliar at both rates provided excellent control of elongate hemlock scale and cryptomeria scale, mediocre to good control of cottony maple scale, and poor control of armored scale, false oleander scale, and oystershell scale. On Florida wax scale, overall control was excellent although mixed results were obtained in 3 experiments, with good control of nymphs and excellent control of adults at both rates in one experiment, minimal impact on nymphs and excellent control of adults at both rates in another experiment, and minimal impact on adults and excellent control of nymphs at the higher rate in a third experiment. Better control of Fletcher scale was obtained with banded vs. foliar application.

Euonymus scale control with foliar application was variable - good in a 2005, two 2009 and a 2010 experiments, mediocre in a 2004 and another 2009 experiment and poor in a 2010 experiment. Drench application provided excellent control of false Florida red scale but poor control of pine needle scale in two experiments, and of camellia, false oleander and holly pit scales in single experiments. On cottony cushion scale, foliar, drench and soil broadcast application provided good to excellent control. Flagship 0.22G applied broadcast provided excellent conttol of false oleander scale in one experiment, poor and good control of cottony cushion scale, and poor control of pine needle scale in single experiments. On gloomy scale, Flagship applied broadcast or drench provided excellent control. Flagship at both rates applied as foliar treatment provided good to excellent control of citrus mealybug, Mexican mealybug and phormium mealybug. Mixed efficacy on Madeira mealybug (poor to excellent) was obtained in three experiments, with foliar generally superior to drench or broadcast treatment.

GF-2626 1SC. GF-2626 foliar provided excellent control of false oleander scale, mediocre control of pine needle scale, and poor and excellent control of cottony cushion scale, in single experiments.

IKI-3106. This product applied foliar provided good to excellent control of tea scale in 3 experiments; a fourth experiment was inconclusive. Poor control of pine needle scale was obtained in one experiment.

Kontos/Movento 240SC. This product provided mixed results on euonymus scale (poor, mediocre, good and excellent) in single experiments. It provided excellent control of gloomy scale, tea scale and camellia scale, but mediocre control of calico scale, and no control of elongate hemlock scale, cryptomeria scale, false oleander scale and pine needle scale in single experiments. Kontos applied foliar provided good to excellent control of pine needle scale, and poor to excellent control of cottony cushion scale in three experiments; when applied drench, it was poor on cottony cushion scale in a single experiment. Control of Madeira mealybug was variable – good in one, and poor in another experiment. It provided good to excellent control of rhizoecus root mealybug applied as foliar or drench in two experiments.

Mainspring 200SC. This product applied as drench provided good to excellent control of tea scale in six experiments; a seventh experiment was inconclusive. In single experiments, excellent control of magnolia white scale, good control of calico scale, poor and excellent control of euonymus scale, and poor control of camellia scale were obtained. When applied foliar, Mainspring provided good control of tea scale in one experiment.

MBI 203. MBI 203 foliar provided no control of Madeira mealybug in a coleus experiment and of citrus mealybug in a rose experiment. It provided good control of rhizoecus root mealybug applied as drench on parapara.

MBI 205. MBI 205 foliar provided no control of Madeira mealybug in a coleus experiment and of citrus mealybug in a rose experiment. It provided good control of rhizoecus root mealybug applied as drench on parapara.

MOI 201. In one Carolina silverbell experiment, MOI 201 foliar provided no control of oystershell scale.

Natural Solutions. This biological product provided good initial control of citrus mealybug though with relatively short residual activity in one experiment.

Rycar/Rycar20SC. Rycar foliar provided excellent control of gloomy scale and pine needle

scale, good to excellent control of cottony cushion scale, poor to good control of euonymus scale, and poor control of armored scale, false Florida red scale, false oleander scale and holly pit scale. Control of citrus mealybug was good in a rose experiment, and on Madeira mealybug, good in coleus and marigold experiments.

Safari 2G/20SG/Transect 70WSP. Safari applied as a trunk spray provided good control of elongate hemlock scale, Cryptomeria scale, and euonymus scale in single experiments. Control of gloomy scale from Safari or Transect applied as trunk spray or soil treatment was excellent, but control of calico scale was mediocre; Pentrabark slightly improved performance. Excellent control of calico scale was obtained when it was applied as a drench in one experiment. Safari at both rates foliar or drench provided excellent control of elongate hemlock scale and cryptomeria scale, mediocre to good control of Fletcher scale and euonymus scale. On cottony cushion scale, Safari applied as drench or soil broadcast provided excellent control in two experiments but poor control in another experiment; a fourth experiment that was terminated early showed poor control with foliar or drench applications. Drench application provided excellent control of euonymus scale, false Florida red scale, Florida wax scale, and tea scale, variable results on false oleander scale and pine needle scale, and poor control of armored scale and camellia scale. On oystershell scale, Safari at both rates provided excellent control when applied as drench but poor control when applied foliar. Cottony maple scale control was poor to mediocre with foliar, and none to poor with drench application. Holly pit scale efficacy with drench or soil surface application was poor in a single experiment. Safari at both rates applied foliar provided excellent control of citrus mealybug, better than drench. It provided good control of Madeira mealybug when applied foliar with Capsil, and variable efficacy when applied drench. Excellent control of Mexican mealybug and phormium mealybug was obtained with foliar or drench application in single experiments. Also, it provided excellent control of rhizoecus root mealybug applied as foliar or drench.

Talus 40SC/70DF. Talus provided excellent control of elongate hemlock scale, cryptomeria scale, oystershell scale, gloomy scale, magnolia white scale and camellia scale. Excellent control of pine needle scale and poor to excellent control of cottony cushion scale was also obtained with Talus 70DF in three experiments. It provided good to excellent controlof euonymus scale and tea scale, and good control of Fletcher scale. Variable efficacy on Florida wax scale and false oleander scale, and poor control of cottony maple scale, armored scale, false Florida red scale, and holly pit scale were obtained. Talus provided excellent control of Madeira mealybug and Mexican mealybug, and mediocre to excellent control of citrus mealybug.

TriStar 30SG/70WSP. TriStar provided excellent control of elongate hemlock scale and cryptomeria scale, gloomy scale, and pine needle scale. For Florida wax scale, overall control was excellent although mixed results were obtained in 3 experiments, with good control of nymphs and excellent control of adults at both rates in one experiment, minimal impact on nymphs and excellent control of adults at both rates in another experiment, and minimal impact on adults and excellent control of nymphs in a third experiment. Good control of Fletcher scale was obtained with the higher rate, and of cottony cushion scale with both rates. It provided variable, but generally mediocre, control of euonymus scale. Efficacy was generally none to mediocre on cottony maple scale, armored scale, camellia scale, false Florida red scale, false oleander scale, Florida red scale, holly pit scale, and oystershell scale. Both rates of TriStar provided excellent control of citrus mealybug, Mexican mealybug and phormium mealybug. A experiment on Madeira mealybug showed excellent control when TriStar was mixed with Capsil

surfactant and poor control without Capsil; another experiment confirmed the good efficacy with a surfactant.

XXpire 40WG/GF-2860. XXpire foliar provided excellent control of magnolia white scale, false oleander scale, tea scale and camellia scale, good control of armored scale, mediocre control of pine needle scale, poor and excellent control of cottony cushion scale and euonymus scale, and poor to good control of calico scale.

Please see Table 83 and Table 84 for a list of all researchable studies and the summary of experiments conducted from 2004 to 2015.

Phytotoxicity

No phytotoxicity was observed with any treatments by any researcher with the exception of Arena on honeylocust and Precise on Phormium (*Phormium tenax*).

Table 83. Summary of Efficacy By Product for Scale

Note: Table entries are sorted by crop Latin name. Only those experiments received by2/28/2017 are included in the table below.

PR#	Product (Active Ingredients)	Target	Crop	Production Site	Researcher	State	Year	Application Type	Results
30224	A16901B 45WG (Cyantraniliprole + thiamethoxam)	Cottony Cushion Scale (Icerya purchasi)	Heavenly Bamboo (Nandina domestica) 'Harbour Dwarf'	Field Container	Frank	NC	2011	Drench	Significantly reduced adults and immatures with 5 oz per 100 gal applied once; comparable to horticultural oil.
32151	A16901B 45WG (Cyantraniliprole + thiamethoxam)	Cottony Cushion Scale (Icerya purchasi)	Heavenly Bamboo (Nandina domestica) 'Harbour Dwarf'	Greenhouse	Frank	NC	2012	Foliar	Did not significantly reduce immatures with 5 and 10 oz per 100 gal applied once.
30452	A16901B 45WG (Cyantraniliprole + thiamethoxam)	Cottony Cushion Scale (Icerya purchasi)	Pittosporum (Pittosporum sp.) P. tobira cv.'variegata'	Field Container	Chong	SC	2012	Drench	No consistent and significant reduction of scale population with 5 and 10 oz per 100 gal; comparable to standard paraffinic oil.
30296	A16901B 45WG (Cyantraniliprole + thiamethoxam)	Cottony Cushion Scale (Icerya purchasi)	Pittosporum (Pittosporum sp.) P. tobira 'Verigata'	Field In-Ground	Chong	SC	2011	Drench	Did not significantly reduce immatures with 10 oz per 100 gal.
30079	A16901B 45WG (Cyantraniliprole + thiamethoxam)	Camelia Scale (Lepidosaphes camelliae)	Camellia, Japanese (Camellia japonica)	Commercial Landscape	Chong	SC	2010	Drench	Did not significantly reduce camellia scale population at 10 oz per 100 gal; comparable to all other treatments including the standard Orthene; no injury observed.
30234	A16901B 45WG (Cyantraniliprole + thiamethoxam)	Gloomy Scale (Melanaspis tenebricosa)	Maple (Acer sp.) A. rubrum	Field In-Ground	Frank	NC	2011	Drench	Excellent control of adults and immatures with 5 oz per 100 gal applied once; comparable to standard paraffin oil.
31285	A16901B 45WG (Cyantraniliprole + thiamethoxam)	Magnolia Scale (Neolecanium cornuparvum)	Sweet Bay (Magnolia virginiana) M. grandiflora, ‘Little Gem’	Field In-Ground	Braman	GA	2012	Foliar	Great control of false oleander scale immatures with 5 and 10 oz per 100 gal; comparable to Orthene.
29765	A16901B 45WG (Cyantraniliprole + thiamethoxam)	Pine Needle Scale (Phenacaspis pinifoliae)	Pine (Pinus sp.) P. sylvestris	Field In-Ground	Nielsen	OH	2010	Drench	Poor efficacy at 10 oz per 100 gal.
29765	A16901B 45WG (Cyantraniliprole + thiamethoxam)	Pine Needle Scale (Phenacaspis pinifoliae)	Pine (Pinus sp.) P. sylvestris	Field In-Ground	Nielsen	OH	2011	Drench	Poor efficacy with 10 oz per 100 gal.

PR#	Product (Active Ingredients)	Target	Crop	Production Site	Researcher	State	Year	Application Type	Results
29625	A16901B 45WG (Cyantraniliprole + thiamethoxam)	False Oleander Scale (Pseudaulacaspis cockerelli)	Magnolia, Southern (Magnolia grandiflora)	Commercial Landscape	Chong	SC	2010	Drench	Charleston, SC: Did not significantly reduce false oleander scale population at 10 oz per 100 gal; comparable to the standard Orthene; no injury observed.
29638	A16901B 45WG (Cyantraniliprole + thiamethoxam)	Euonymus Scale (Unaspis euonymi)	Spindle Tree (Euonymus japonicus)	Field Container	Frank	NC	2010	Drench	Excellent control with 5 oz per 100 gal; comparable to horticultural oil.
29638	A16901B 45WG (Cyantraniliprole + thiamethoxam)	Euonymus Scale (Unaspis euonymi)	Spindle Tree (Euonymus japonicus) E. fortunei 'Moonshadow'	Field Container	Potter	KY	2010	Drench	No significant reduction of adult scales with 5 oz per 100 gal.
29638	A16901B 45WG (Cyantraniliprole + thiamethoxam)	Euonymus Scale (Unaspis euonymi)	Spindle Tree (Euonymus japonicus) 'Green Spire'	Field Container	Gilrein	NY	2011	Drench	Did not significantly reduce population with 5 oz per 100 gal applied once.
29264	Acephate Pro 75 WSP (Acephate)	Euonymus Scale (Unaspis euonymi)	Spindle Tree (Euonymus japonicus) 'Microphylla'	Field Container	Frank	NC	2009	Foliar	Excellent control at 0.67 lb per 100 gal
28692	Aloft SC (Clothianadin + bifenthrin)	Holly Pit Scale (Asterolecanium puteanum)	Holly (Ilex sp.) 'East Palatka'	Field In-Ground	Buss	FL	2009	Foliar	Significantly reduced number of immatures at 10 fl oz per 100 gal; comparable to Orthene. 56% control with HendersonsTilton 6 WAT.
28879	Aloft SC (Clothianadin + bifenthrin)	Oystershell Scale (Diaspidiotus ostreiformis)	Silverbell Carolina (Halesia carolina var. carolina)	Field In-Ground	Nielsen	OH	2008	Sprench	Very low infestation; poor control at 5 and 10 fl oz per 100 gal
28130	Aloft SC (Clothianadin + bifenthrin)	Wax Myrtle Scale (Melanaspis deklei)	Wax Myrtle (Myrica cerifera)	Commercial Landscape	Chong	SC	2008	Sprench	Experiment 1: Did not significantly reduce scale population at 5 and 10 fl oz per 100 gal; similar to Orthene std; untreated population very low and no statistical differences were observed.
28130	Aloft SC (Clothianadin + bifenthrin)	Wax Myrtle Scale (Melanaspis deklei)	Wax Myrtle (Myrica cerifera)	Commercial Landscape	Chong	SC	2009	Sprench	Did not significantly reduce scale population at 10 fl oz per 100 gal; similar to Orthene std; very low non treated population so no statistical significance.

PR#	Product (Active Ingredients)	Target	Crop	Production Site	Researcher	State	Year	Application Type	Results
29978	Aloft SC (Clothianadin + bifenthrin)	Pine Needle Scale (Phenacaspis pinifoliae)	Pine (Pinus sp.) P. sylvestris	Field In-Ground	Nielsen	OH	2010	Sprench	Excellent efficacy at 10 fl oz per 100 gal.
27834	Aloft SC (Clothianadin + bifenthrin)	Euonymus Scale (Unaspis euonymi)	Spindle Tree (Euonymus japonicus) E. vegetus 'Coloratus'	Field In-Ground	Nielsen	OH	2008	Sprench	Good efficacy at 10 fl oz per 100 gal.
29583	Aloft SC (Clothianadin + bifenthrin)	Euonymus Scale (Unaspis euonymi)	Spindle Tree (Euonymus japonicus) 'Microphylla'	Field Container	Ludwig	TX	2008	Foliar	Good efficacy at 5 and 10 fl oz per 100 gal.
28974	Arena 50WDG (Clothianadin)	Florida Wax Scale (Ceroplastes floridensis)	Holly (Ilex sp.) I. cornuta 'Needlepoint'	Commercial Landscape	Held	TN	2009	Drench	Excellent control at 2.4 g per ft height applied for first or second generation.
29847	Arena 50WDG (Clothianadin)	Calico Scale (Eulecanium cerasorum)	Honey Locust (Gleditsia sp.) G. triacanthos inermis	Commercial Landscape	Sadof	IL	2010	Drench	Good efficacy with 3.6 g ai per inch DBH.
30080	Arena 50WDG (Clothianadin)	Camelia Scale (Lepidosaphes camelliae)	Camellia, Japanese (Camellia japonica)	Commercial Landscape	Chong	SC	2010	Drench	Did not significantly reduce camellia scale population at 2.4 g per ft height; comparable to all other treatments including the standard Orthene; no injury observed.
32407	AzaGuard (Azadirachtin)	Tea Scale (Fiorinia theae)	(Camellia sasanqua) 'Mountain Snow'	Field Container	Chen	LA	2014	Foliar	Significantly reduced infestation with 20 fl oz per 100 gal applied once; comparable to standard SuffOil-X.
32401	AzaGuard (Azadirachtin)	False Oleander Scale (Pseudaulacaspis cockerelli)	Magnolia, Southern (Magnolia grandiflora) 'Little Gem'	Field Container	Chen	LA	2014	Foliar	Significantly reduced infestation with 20 fl oz per 100 gal applied once; much inferior to standard SuffOil-X.
32352	BAS 440 00I (BAS 440)	Tea Scale (Fiorinia theae)	Camellia, Japanese (Camellia japonica)	Field In-Ground	Braman	GA	2015	Foliar	Very good control with 7 fl oz per 100 gal applied 3 times biweekly.
32844	BAS 440 00I (BAS 440)	Tea Scale (Fiorinia theae)	Holly (Ilex sp.) 'Nellie Stevens'	Field Container	Chong	SC	2015	Foliar	Good efficacy with 7 fl oz per 100 gal + oil applied 3 times biweekly; comparable to Distance.
28386	Botanigard 22WP (Beauveria bassiana GHA)	Elongate Hemlock Scale (Fiorinia externa)	Fir, Fraser (Abies fraseri)	Field In-Ground	Cowles	CT	2008	Foliar	No control with 64 oz per acre.
32353	BYI-2960 (Flupyradifurone)	Tea Scale (Fiorinia theae)	Camellia, Japanese (Camellia japonica)	Field In-Ground	Braman	GA	2015	Foliar	Good and excellent control with 2.7 and 5.4 fl oz per 100 gal applied 3 times weekly.

PR#	Product (Active Ingredients)	Target	Crop	Production Site	Researcher	State	Year	Application Type	Results
32845	BYI-2960 (Flupyradifurone)	Tea Scale (Fiorinia theae)	Holly (Ilex sp.) 'Nellie Stevens'	Field Container	Chong	SC	2015	Foliar	Poor and good efficacy with 2.7 and 5.4 fl oz per 100 gal applied 3 times weekly; inferior to Distance.
25729	Celero 16WSG (Clothianidin)	Florida Wax Scale (Ceroplastes floridensis)	Holly (Ilex sp.) 'China Doll'	Field Container	Ludwig	TX	2005	Foliar	Minimal impact on adults; some efficacy on nymphs at 14 DAT at 4 oz per 100 gal
25729	Celero 16WSG (Clothianidin)	Florida Wax Scale (Ceroplastes floridensis)	Holly (Ilex sp.) I. cornuta 'bufordii nana'	Field Container	Ludwig	TX	2005	Foliar	Minimal impact on nymphs; excellent efficacy on adults by 56 DAT at 4 oz per 100 gal
25773	Celero 16WSG (Clothianidin)	Florida Wax Scale (Ceroplastes floridensis)	Indian Hawthorn (Raphiolepis indica)	Field Container	Ludwig	TX	2005	Foliar	By 41 DAT, excellent efficacy on nymphs and on adults at 4 oz per 100 gal
25777	Celero 16WSG (Clothianidin)	Florida Red Scale (Chrysomphalus aonidum)	Holly, Chinese (Ilex cornuta) 'Dwarf Buford'	Field Container	Ludwig	TX	2005	Foliar	No significant control of nymphs and on adults at 4 oz per 100 gal probably due to cooler temperatures
25731	Celero 16WSG (Clothianidin)	Cottony Cushion Scale (Icerya purchasi)	Ternstroemia (Ternstroemia sp.) T. gymnanthera	Field Container	Ludwig	TX	2005	Foliar	Poor efficacy at 4 oz per 100 gallon rate
32354	Cyclaniliprole (IKI-3106) 50SL (Cyclaniliprole)	Tea Scale (Fiorinia theae)	Camellia, Japanese (Camellia japonica)	Field In-Ground	Braman	GA	2015	Foliar	Very good control with 22 and 28 fl oz per 100 gal applied twice biweekly.
32871	Cyclaniliprole (IKI-3106) 50SL (Cyclaniliprole)	Tea Scale (Fiorinia theae)	Camellia, Japanese (Camellia japonica)	Field Container	Chen	LA	2015	Foliar	Excellent control with 22 and 28 fl oz per 100 gal; comparable to standards Ultra-Pure Oil and Distance.
32846	Cyclaniliprole (IKI-3106) 50SL (Cyclaniliprole)	Tea Scale (Fiorinia theae)	Holly (Ilex sp.) 'Nellie Stevens'	Field Container	Chong	SC	2015	Foliar	Good efficacy with 22 and 28 fl oz per 100 gal + Capsil applied 3 times biweekly; inferior to Distance.
32222	Cyclaniliprole (IKI-3106) 50SL (Cyclaniliprole)	Pine Needle Scale (Phenacaspis pinifoliae)	Pine (Pinus sp.) P. strobus	Field In-Ground	Sadof	IN	2015	Foliar	No significant efficacy on immatures and adults with 22 and 28 fl oz per 100 gal.
30589	Cygon 2E (Dimethoate)	Indian Wax Scale (Ceroplastes ceriferus)	Fatsia, Japanese Aralia (Fatsia japonica)	Greenhouse	Williams	AL	1977	Foliar	About 50% efficacy with 0.5 lb ai per 100 gal, with a population of mostly adult females and 2nd instar nymphs; no injury.
30583	Cygon 2E (Dimethoate)	Florida Wax Scale (Ceroplastes floridensis)	Camellia, Japanese (Camellia japonica)	Field Container	Schalk	SC	1984	Trunk spray	No injury at 1, 2, and 4 inch band applied to truck; low population and no statistical differences among treatments.

PR#	Product (Active Ingredients)	Target	Crop	Production Site	Researcher	State	Year	Application Type	Results
30584	Cygon 2E (Dimethoate)	Elongate Hemlock Scale (Fiorinia externa)	Camellia, Japanese (Camellia japonica)	Field Container	Williams	AL	1983	Foliar	Good efficacy at 0.5 lb ai per 100 gal; no phytotoxicity.
30584	Cygon 2E (Dimethoate)	Elongate Hemlock Scale (Fiorinia externa)	Camellia, Japanese (Camellia japonica)	Field Container	Williams	AL	1983	Trunk spray	Good efficacy with 1 and 2 inch banding; no phytotoxicity.
08765	Cygon 2E (Dimethoate)	Tea Scale (Fiorinia theae)	Camellia (Camellia sp.)	Greenhouse	Schalk	SC	1984	Trunk spray	Insufficient population to determine efficacy; no injury with 1, 2, and 4 inch banding on trunks.
30585	Cygon 2E (Dimethoate)	Euonymus Scale (Unaspis euonymi)	Spindle Tree (Euonymus japonicus)	Field In-Ground	Schuder	IN	1984	Trunk spray	Excellent efficacy with 1 and 2 inch banding; no phytotoxicity.
30585	Cygon 2E (Dimethoate)	Euonymus Scale (Unaspis euonymi)	Spindle Tree (Euonymus japonicus)	Field Container	Williams	AL	1983	Foliar	Good efficacy with 0.5 lb ai per 100 gal; no injury.
30585	Cygon 2E (Dimethoate)	Euonymus Scale (Unaspis euonymi)	Spindle Tree (Euonymus japonicus)	Field Container	Williams	AL	1983	Trunk spray	Good efficacy with 1 and 2 inch banding; mortality within 1 month of second application at 2 inch banding rate.
00932	Diazinon 4E (Diazinon)	Euonymus Scale (Unaspis euonymi)	Purpleleaf Wintercreeper (Euonymus radicans)	Field In-Ground	Schuder	IN	1984		Excellent efficacy with 1 lb ai per 100 gal; no phytotoxicity.
25165	Discus (Imidacloprid + cyfluthrin)	Fletcher scale (Parthenolecanium fletcheri)	Yew (Taxus media) Densiformis	Field In-Ground	Davis	MI	2004	Banded	Good efficacy with banded application.
25165	Discus (Imidacloprid + cyfluthrin)	Fletcher scale (Parthenolecanium fletcheri)	Yew (Taxus media) Densiformis	Field In-Ground	Davis	MI	2004	Foliar	Good efficacy.
28693	Distance (Pyriproxyfen)	Holly Pit Scale (Asterolecanium puteanum)	Holly (Ilex sp.) 'East Palatka'	Field In-Ground	Buss	FL	2009	Foliar	Did not reduce number of immatures at 12 fl oz per 100 gal. 0% control with HendersonsTilton 6 WAT.
25051	Distance (Pyriproxyfen)	Florida Wax Scale (Ceroplastes floridensis)	Holly (Ilex sp.) 'Dwarf Buford'	Field Container	Ludwig	TX	2004	Foliar	Significant mortality 45 days with all rates (8, 16, 32 oz per 100 gal).
28685	Distance (Pyriproxyfen)	False Florida Red Scale (Chrysomphalus bifasciculatus)	Holly, Chinese (Ilex cornuta) 'Cassina'	Field In-Ground	Chong	SC	2009	Foliar	Good efficacy at 12 fl oz per 100 gal
30415	Distance (Pyriproxyfen)	Calico Scale (Eulecanium cerasorum)	Honey Locust (Gleditsia sp.)	Commercial Landscape	Sadof	IL	2012	Foliar	Carmel: Poor control of ovipositing adults with 12 fl oz per 100 gal.

PR#	Product (Active Ingredients)	Target	Crop	Production Site	Researcher	State	Year	Application Type	Results
32037	Distance (Pyriproxyfen)	Tea Scale (Fiorinia theae)	Camellia, Japanese (Camellia japonica)	Field Container	Chen	LA	2015	Foliar	Great control with 12 oz per 100 gal; comparable to Ultra-Pure Oil.
32037	Distance (Pyriproxyfen)	Tea Scale (Fiorinia theae)	Camellia, Japanese (Camellia japonica) 'In the Pink'	Field Container	Arthurs	FL	2014	Foliar	Excellent control with 12 fl oz per 100 gal + Capsil applied twice; comparable to SuffOil X.
32404	Distance (Pyriproxyfen)	Tea Scale (Fiorinia theae)	(Camellia sasanqua) 'Mountain Snow'	Field Container	Chen	LA	2014	Foliar	Significantly reduced infestation with 12 fl oz per 100 gal applied twice; comparable to standard SuffOil-X.
32848	Distance (Pyriproxyfen)	Tea Scale (Fiorinia theae)	Holly (Ilex sp.) 'Nellie Stevens'	Field Container	Chong	SC	2015	Foliar	Good efficacy with 12 fl oz per 100 gal applied twice every 21 days; one of 3 most effective treatments.
30225	Distance (Pyriproxyfen)	Cottony Cushion Scale (Icerya purchasi)	Heavenly Bamboo (Nandina domestica) 'Harbour Dwarf'	Field Container	Frank	NC	2011	Foliar	Significantly reduced adults and immatures with 12 fl oz per 100 gal applied twice; comparable to horticultural oil.
32154	Distance (Pyriproxyfen)	Cottony Cushion Scale (Icerya purchasi)	Heavenly Bamboo (Nandina domestica) 'Harbour Dwarf'	Greenhouse	Frank	NC	2012	Foliar	Significantly reduced immatures with 12 fl oz per 100 gal applied twice; comparable to horticultural oil.
30453	Distance (Pyriproxyfen)	Cottony Cushion Scale (Icerya purchasi)	Pittosporum (Pittosporum sp.) P. tobira cv.'variegata'	Field Container	Chong	SC	2012	Foliar	No consistent and significant reduction of scale population with 12 fl oz per 100 gal; comparable to standard paraffinic oil.
30297	Distance (Pyriproxyfen)	Cottony Cushion Scale (Icerya purchasi)	Pittosporum (Pittosporum sp.) P. tobira 'Verigata'	Field In-Ground	Chong	SC	2011	Foliar	Significantly reduced immatures with 12 fl oz per 100 gal applied twice; comparable to the standard Orthene.
30081	Distance (Pyriproxyfen)	Camelia Scale (Lepidosaphes camelliae)	Camellia, Japanese (Camellia japonica) C. japonica and C. sasanqua	Commercial Landscape	Chong	SC	2014	Foliar	Consistent and high efficacy with 12 fl oz per 100 gal applied twice every 3 weeks; comparable to the standard paraffin oil.
25151	Distance (Pyriproxyfen)	Winged Euonymus Scale (Lepidosaphes yanagicola)	Winged Burning Bush (Euonymus alatus)	Field Container	Freiberger	NJ	2004	Foliar	Good efficacy at 32 oz per 100 gal; lower rates were not effective
28136	Distance (Pyriproxyfen)	Wax Myrtle Scale (Melanaspis deklei)	Wax Myrtle (Myrica cerifera)	Commercial Landscape	Chong	SC	2008	Foliar	Experiment 2: Did not significantly reduce scale population at 12 fl oz per 100 gal; similar to Sunspray Ultrafine std

PR#	Product (Active Ingredients)	Target	Crop	Production Site	Researcher	State	Year	Application Type	Results
28136	Distance (Pyriproxyfen)	Wax Myrtle Scale (Melanaspis deklei)	Wax Myrtle (Myrica cerifera)	Commercial Landscape	Chong	SC	2009	Foliar	Experiment 2: Significantly reduced scale population at 12 fl oz per 100 gal; similar to paraffinic oil std; very low non treated population so no statistical significance.
30235	Distance (Pyriproxyfen)	Gloomy Scale (Melanaspis tenebricosa)	Maple (Acer sp.) A. rubrum	Field In-Ground	Frank	NC	2011	Foliar	Excellent control of adults and immatures with 12 fl oz per 100 gal applied twice; comparable to standard paraffin oil.
30235	Distance (Pyriproxyfen)	Gloomy Scale (Melanaspis tenebricosa)	Maple (Acer sp.) A. rubrum	Field In-Ground	Frank	NC	2014	Foliar	Data inconclusive because there were no significant differences between treatments, including untreated check.
31290	Distance (Pyriproxyfen)	Magnolia Scale (Neolecanium cornuparvum)	Sweet Bay (Magnolia virginiana) M. grandiflora, 'Little Gem'	Field In-Ground	Braman	GA	2012	Foliar	Excellent control of false oleander scale immatures with 12 fl oz per 100 gal; comparable to Orthene.
25164	Distance (Pyriproxyfen)	Fletcher scale (Parthenolecanium fletcheri)	Yew (Taxus media) Densiformis	Field In-Ground	Davis	MI	2004	Foliar	Poor efficacy.
29766	Distance (Pyriproxyfen)	Pine Needle Scale (Phenacaspis pinifoliae)	Pine (Pinus sp.) P. strobus	Field In-Ground	Sadof	IL	2015	Foliar	Significant efficacy on immatures and adults with 12 fl oz per 100 gal.
29766	Distance (Pyriproxyfen)	Pine Needle Scale (Phenacaspis pinifoliae)	Pine (Pinus sp.) P. sylvestris	Field In-Ground	Nielsen	OH	2010	Foliar	Excellent efficacy at 12 fl oz per 100 gal.
29627	Distance (Pyriproxyfen)	False Oleander Scale (Pseudaulacaspis cockerelli)	Magnolia, Southern (Magnolia grandiflora)	Commercial Landscape	Chong	SC	2010	Foliar	Litchfield, SC: Significantly reduced false oleander scale population at 12 fl oz per 100 gal; comparable to the standard Paraffinic oil; no injury observed.
32398	Distance (Pyriproxyfen)	False Oleander Scale (Pseudaulacaspis cockerelli)	Magnolia, Southern (Magnolia grandiflora) 'Little Gem'	Field Container	Chen	LA	2014	Foliar	Excellent control with 12 fl oz per 100 gal applied twice; comparable to standard SuffOil-X.
28947	Distance (Pyriproxyfen)	White Peach Scale (Pseudaulacaspis pentagona)	Holly, Blue (Ilex x meserveae)	Field In-Ground	Kunkel	DE	2009	Foliar	Mortality in untreated controls was high; no conclusions can be drawn.
28870	Distance (Pyriproxyfen)	Euonymus Scale (Unaspis euonymi)	Spindle Tree (Euonymus japonicus)	Field Container	Braman	GA	2014	Foliar	Good to excellent control with 12 fl oz per 100 gal applied twice at 14-day interval.

PR#	Product (Active Ingredients)	Target	Crop	Production Site	Researcher	State	Year	Application Type	Results
28870	Distance (Pyriproxyfen)	Euonymus Scale (Unaspis euonymi)	Spindle Tree (Euonymus japonicus)	Field Container	Frank	NC	2010	Foliar	Excellent control with 12 fl oz per 100 gal; slower acting than horticultural oil.
28870	Distance (Pyriproxyfen)	Euonymus Scale (Unaspis euonymi)	Spindle Tree (Euonymus japonicus) E. fortunei 'Emerald N Gold'	Field Container	Potter	KY	2014	Foliar	Did not reduce scales with 12 fl oz per 100 gal applied at crawler stage and 3 weeks later.
28870	Distance (Pyriproxyfen)	Euonymus Scale (Unaspis euonymi)	Spindle Tree (Euonymus japonicus) E. fortunei 'Moonshadow'	Field Container	Potter	KY	2010	Foliar	Significantly reduced 1st generation adult scales with 12 fl oz per 100 gal; better than horticultural oil.
28870	Distance (Pyriproxyfen)	Euonymus Scale (Unaspis euonymi)	Spindle Tree (Euonymus japonicus) E. fortunei 'Radicans'	Field Container	Kunkel	DE	2011	Foliar	Significantly increased mortality with 12 fl oz per 100 gal applied once; comparable to horticultural oil applied twice.
29980	Distance (Pyriproxyfen)	Euonymus Scale (Unaspis euonymi)	Spindle Tree (Euonymus japonicus) E. vegetus 'Coloratus'	Field In-Ground	Nielsen	OH	2008	Foliar	Good efficacy at 12 fl oz per 100 gal.
28870	Distance (Pyriproxyfen)	Euonymus Scale (Unaspis euonymi)	Spindle Tree (Euonymus japonicus) E. vegetus 'SunSpot'	Field Container	Nielsen	OH	2009	Foliar	Excellent control at 12 fl oz per 100 gal
28870	Distance (Pyriproxyfen)	Euonymus Scale (Unaspis euonymi)	Spindle Tree (Euonymus japonicus) 'Green Spire'	Field Container	Gilrein	NY	2011	Foliar	Excellent control with 12 fl oz per 100 gal applied twice.
28870	Distance (Pyriproxyfen)	Euonymus Scale (Unaspis euonymi)	Spindle Tree (Euonymus japonicus) 'Microphylla'	Field Container	Frank	NC	2009	Foliar	Excellent control at 12 fl oz per 100 gal; equal to Acephate
28870	Distance (Pyriproxyfen)	Euonymus Scale (Unaspis euonymi)	Spindle Tree (Euonymus japonicus) 'Microphylla'	Field Container	Ludwig	TX	2008	Foliar	Fair to good efficacy at 12 fl oz per 100 gal.
30226	Flagship 0.22G (Thiamethoxam)	Cottony Cushion Scale (Icerya purchasi)	Heavenly Bamboo (Nandina domestica) 'Harbour Dwarf'	Field Container	Frank	NC	2011	Broadcast to soil surface	Significantly reduced adults and immatures with 30 g per plant applied once; comparable to horticultural oil.
32152	Flagship 0.22G (Thiamethoxam)	Cottony Cushion Scale (Icerya purchasi)	Heavenly Bamboo (Nandina domestica) 'Harbour Dwarf'	Greenhouse	Frank	NC	2012	Broadcast	Significantly reduced immatures with 40 g per item; comparable to horticultural oil.

PR#	Product (Active Ingredients)	Target	Crop	Production Site	Researcher	State	Year	Application Type	Results
30454	Flagship 0.22G (Thiamethoxam)	Cottony Cushion Scale (Icerya purchasi)	Pittosporum (Pittosporum sp.) P. tobira cv.'variegata'	Field Container	Chong	SC	2012	Broadcast	No consistent and significant reduction of scale population with 60 g per pot; comparable to standard paraffinic oil.
30298	Flagship 0.22G (Thiamethoxam)	Cottony Cushion Scale (Icerya purchasi)	Pittosporum (Pittosporum sp.) P. tobira 'Verigata'	Field In-Ground	Chong	SC	2011	Broadcast to soil surface	Significantly reduced immatures with 227 g per ft applied once; comparable to the standard Orthene.
30082	Flagship 0.22G (Thiamethoxam)	Camelia Scale (Lepidosaphes camelliae)	Camellia, Japanese (Camellia japonica)	Commercial Landscape	Chong	SC	2010	Broadcast	Did not significantly reduce camellia scale population at 227 g per ft height; comparable to all other treatments including the standard Orthene; no injury observed.
28918	Flagship 0.22G (Thiamethoxam)	Wax Myrtle Scale (Melanaspis deklei)	Wax Myrtle (Myrica cerifera)	Commercial Landscape	Chong	SC	2009	Broadcast	Did not significantly reduce scale population at 227 g per ft shrub height; similar to Orthene std; very low non treated population so no statistical significance.
30236	Flagship 0.22G (Thiamethoxam)	Gloomy Scale (Melanaspis tenebricosa)	Maple (Acer sp.) A. rubrum	Field In-Ground	Frank	NC	2011	Drench	Excellent control of adults and immatures with 4 g per ft ht applied once; comparable to standard paraffin oil.
31286	Flagship 0.22G (Thiamethoxam)	Magnolia Scale (Neolecanium cornuparvum)	Sweet Bay (Magnolia virginiana) M. grandiflora, 'Little Gem'	Field In-Ground	Braman	GA	2012	Broadcast	Excellent control of false oleander scale immatures with 114 and 227 g per ft ht; comparable to Orthene.
29767	Flagship 0.22G (Thiamethoxam)	Pine Needle Scale (Phenacaspis pinifoliae)	Pine (Pinus sp.) P. sylvestris	Field In-Ground	Jones	OH	2012	Broadcast to soil	Significant, but poor, control with 227 g per ft height applied once.
29767	Flagship 0.22G (Thiamethoxam)	Pine Needle Scale (Phenacaspis pinifoliae)	Pine (Pinus sp.) P. sylvestris	Field In-Ground	Nielsen	OH	2010	Broadcast	No efficacy at 227 g per inch DBH.
29767	Flagship 0.22G (Thiamethoxam)	Pine Needle Scale (Phenacaspis pinifoliae)	Pine (Pinus sp.) P. sylvestris	Field In-Ground	Nielsen	OH	2011	Broadcast	No efficacy with 227 g per ft ht; some second generation eggs were present.
29628	Flagship 0.22G (Thiamethoxam)	False Oleander Scale (Pseudaulacaspis cockerelli)	Magnolia, Southern (Magnolia grandiflora)	Commercial Landscape	Chong	SC	2010	Broadcast	Charleston, SC: Significantly reduced false oleander scale population at 454 g per indbh, but not at 227 g; better than the standard Orthene; no injury observed.

PR#	Product (Active Ingredients)	Target	Crop	Production Site	Researcher	State	Year	Application Type	Results
28948	Flagship 0.22G (Thiamethoxam)	White Peach Scale (Pseudaulacaspis pentagona)	Holly, Blue (Ilex x meserveae)	Field In-Ground	Kunkel	DE	2009	Broadcast soil surface	Mortality in untreated controls was high; no conclusions can be drawn.
28871	Flagship 0.22G (Thiamethoxam)	Euonymus Scale (Unaspis euonymi)	Spindle Tree (Euonymus japonicus)	Field Container	Frank	NC	2010	Broadcast to soil surface	Excellent control with 60 g ai per 3 gal media; slower acting than horticultural oil.
28871	Flagship 0.22G (Thiamethoxam)	Euonymus Scale (Unaspis euonymi)	Spindle Tree (Euonymus japonicus) E. fortunei 'Moonshadow'	Field Container	Potter	KY	2010	Broadcast media surface	No significant reduction of adult scales with 40 g per 2 gal pot.
28871	Flagship 0.22G (Thiamethoxam)	Euonymus Scale (Unaspis euonymi)	Spindle Tree (Euonymus japonicus) E. fortunei 'Radicans'	Field Container	Kunkel	DE	2011	Broadcast to soil surface	Significantly increased mortality with 20 g per gal pot applied once; comparable to horticultural oil applied twice.
29087	Flagship 0.22G (Thiamethoxam)	Euonymus Scale (Unaspis euonymi)	Spindle Tree (Euonymus japonicus) E. vegetus 'Coloratus'	Field In-Ground	Nielsen	OH	2008	Broadcast	Poor efficacy at 114 g per ft height.
28871	Flagship 0.22G (Thiamethoxam)	Euonymus Scale (Unaspis euonymi)	Spindle Tree (Euonymus japonicus) E. vegetus 'SunSpot'	Field Container	Nielsen	OH	2009	Top Dress	Not effective at 112 g per pot.
28871	Flagship 0.22G (Thiamethoxam)	Euonymus Scale (Unaspis euonymi)	Spindle Tree (Euonymus japonicus) 'Microphylla'	Field Container	Frank	NC	2009	Broadcast	Good control but slow acting at 60 g per 3 gal container; inferior to Acephate
28694	Flagship 25WG (Thiamethoxam)	Holly Pit Scale (Asterolecanium puteanum)	Holly (Ilex sp.) 'East Palatka'	Field In-Ground	Buss	FL	2009	Drench	Did not significantly reduce number of immatures at 4 g per inch dbh. 1% control with HendersonsTilton 6 WAT.
25052	Flagship 25WG (Thiamethoxam)	Florida Wax Scale (Ceroplastes floridensis)	Holly (Ilex sp.) 'China Doll'	Field Container	Ludwig	TX	2005	Foliar	Minimal impact on adults; great efficacy on nymphs at 14 DAT at 4 oz per 100 gal
25052	Flagship 25WG (Thiamethoxam)	Florida Wax Scale (Ceroplastes floridensis)	Holly (Ilex sp.) 'Dwarf Buford'	Field Container	Ludwig	TX	2004	Foliar	Excellect efficacy at 2, 4, and 8 oz per 100 gal at 45DAT.
25052	Flagship 25WG (Thiamethoxam)	Florida Wax Scale (Ceroplastes floridensis)	Holly (Ilex sp.) I. cornuta 'bufordii nana'	Field Container	Ludwig	TX	2005	Foliar	Minimal impact on nymphs; excellent efficacy on adults by 56 DAT at both 2 and 4 oz per 100 gal

PR#	Product (Active Ingredients)	Target	Crop	Production Site	Researcher	State	Year	Application Type	Results
31139	Flagship 25WG (Thiamethoxam)	Florida Wax Scale (Ceroplastes floridensis)	Holly (Ilex sp.) I. cornuta 'Needlepoint'	Commercial Landscape	Held	MS	2009	Drench	Excellent control at 3 g per ft height applied for first generation, less effective when applied for 2nd generation.
25771	Flagship 25WG (Thiamethoxam)	Florida Wax Scale (Ceroplastes floridensis)	Indian Hawthorn (Raphiolepis indica)	Field Container	Ludwig	TX	2005	Foliar	By 41 DAT, good efficacy on nymphs and great efficacy on adults at both rates
25775	Flagship 25WG (Thiamethoxam)	Florida Red Scale (Chrysomphalus aonidum)	Holly, Chinese (Ilex cornuta) 'Dwarf Buford'	Field Container	Ludwig	TX	2005	Foliar	No significant control of nymphs and on adults at 2 and 4 oz per 100 gal probably due to cooler temperatures
28686	Flagship 25WG (Thiamethoxam)	False Florida Red Scale (Chrysomphalus bifasciculatus)	Holly, Chinese (Ilex cornuta) 'Cassina'	Field In-Ground	Chong	SC	2009	Drench	Excellent efficacy at 4 g per ft of shrub height; better than paraffinic oil std.
25134	Flagship 25WG (Thiamethoxam)	Oystershell Scale (Diaspidiotus ostreiformis)	Silverbell Carolina (Halesia carolina var. carolina)	Field In-Ground	Nielsen	OH	2005	Foliar	Poor efficacy
25133	Flagship 25WG (Thiamethoxam)	Oystershell Scale (Diaspidiotus ostreiformis)	Lilac, Common (Syringa vulgaris)	Field In-Ground	Nielsen	OH	2005	Foliar	Poor control at 2 and 4 oz per 100 gal
25314	Flagship 25WG (Thiamethoxam)	Elongate Hemlock Scale (Fiorinia externa)	Fir, Fraser (Abies fraseri)	Field In-Ground	Cowles	CT	2005	Foliar	Excellent efficacy - both elongate hemlock scale and cryptomeria scale included in population
30227	Flagship 25WG (Thiamethoxam)	Cottony Cushion Scale (Icerya purchasi)	Heavenly Bamboo (Nandina domestica) 'Harbour Dwarf'	Field Container	Frank	NC	2011	Drench	Significantly reduced adults and immatures with 0.5 g per plant applied once; comparable to horticultural oil.
30299	Flagship 25WG (Thiamethoxam)	Cottony Cushion Scale (Icerya purchasi)	Pittosporum (Pittosporum sp.) P. tobira 'Verigata'	Field In-Ground	Chong	SC	2011	Foliar	Significantly reduced immatures with 8 oz per 100 gal applied twice; comparable to the standard Orthene.
30083	Flagship 25WG (Thiamethoxam)	Camelia Scale (Lepidosaphes camelliae)	Camellia, Japanese (Camellia japonica)	Commercial Landscape	Chong	SC	2010	Drench	Did not significantly reduce camellia scale population at 1 and 4 g per ft height; comparable to all other treatments including the standard Orthene; no injury observed.
25152	Flagship 25WG (Thiamethoxam)	Winged Euonymus Scale (Lepidosaphes yanagicola)	Winged Burning Bush (Euonymus alatus)	Field Container	Freiberger	NJ	2004	Foliar	Some reduction in scale counts at 4 and 8 oz per 100 gal rates

PR#	Product (Active Ingredients)	Target	Crop	Production Site	Researcher	State	Year	Application Type	Results
25152	Flagship 25WG (Thiamethoxam)	Winged Euonymus Scale (Lepidosaphes yanagicola)	Winged Burning Bush (Euonymus alatus)	Field Container	Freiberger	NJ	2005	Foliar	Efficacy comparable or better than Orthene at the 4 oz per 100 gal rate
28132	Flagship 25WG (Thiamethoxam)	Wax Myrtle Scale (Melanaspis deklei)	Wax Myrtle (Myrica cerifera)	Commercial Landscape	Chong	SC	2008	Foliar	Experiment 1: Did not significantly reduce scale population at 8 oz per 100 gal; similar to Orthene std; untreated population very low and no statistical differences were observed.
28132	Flagship 25WG (Thiamethoxam)	Wax Myrtle Scale (Melanaspis deklei)	Wax Myrtle (Myrica cerifera)	Commercial Landscape	Chong	SC	2009	Drench	Did not significantly reduce scale population at 4 g per ft shrub height; similar to Orthene std; very low non treated population so no statistical significance.
30237	Flagship 25WG (Thiamethoxam)	Gloomy Scale (Melanaspis tenebricosa)	Maple (Acer sp.) A. rubrum	Field In-Ground	Frank	NC	2011	Drench	Excellent control of adults and immatures with 1 g per ft ht applied once; comparable to standard paraffin oil.
25444	Flagship 25WG (Thiamethoxam)	Cottony maple scale (Neopulvinaria innumerabilis)	Maple, Silver (Acer saccharinum)	Field In-Ground	Davis	MI	2005	Foliar	Mediocre to good efficacy
25132	Flagship 25WG (Thiamethoxam)	Fletcher scale (Parthenolecanium fletcheri)	Yew (Taxus media) Densiformis	Field In-Ground	Davis	MI	2004	Banded	Great efficacy with banded application.
25132	Flagship 25WG (Thiamethoxam)	Fletcher scale (Parthenolecanium fletcheri)	Yew (Taxus media) Densiformis	Field In-Ground	Davis	MI	2004	Foliar	Good efficacy with foliar application.
29768	Flagship 25WG (Thiamethoxam)	Pine Needle Scale (Phenacaspis pinifoliae)	Pine (Pinus sp.) P. sylvestris	Field In-Ground	Nielsen	OH	2010	Drench	No efficacy at 4 g per inch DBH.
29768	Flagship 25WG (Thiamethoxam)	Pine Needle Scale (Phenacaspis pinifoliae)	Pine (Pinus sp.) P. sylvestris	Field In-Ground	Nielsen	OH	2011	Drench	Good efficacy with 4 g per ft ht; no second generation eggs were present.
25057	Flagship 25WG (Thiamethoxam)	False Oleander Scale (Pseudaulacaspis cockerelli)	Aucuba (Aucuba sp.)	Field Container	Ludwig	TX	2004	Foliar	No impact on number of adults or nymphs, and only some reduction in percent alive at the highest tested rate (2, 4, 8 oz per 100 gal).

PR#	Product (Active Ingredients)	Target	Crop	Production Site	Researcher	State	Year	Application Type	Results
29629	Flagship 25WG (Thiamethoxam)	False Oleander Scale (Pseudaulacaspis cockerelli)	Magnolia, Southern (Magnolia grandiflora)	Commercial Landscape	Chong	SC	2010	Drench	Charleston, SC: Significantly reduced false oleander scale population at 4 g per indbh; better than the standard Orthene; no injury observed.
28949	Flagship 25WG (Thiamethoxam)	White Peach Scale (Pseudaulacaspis pentagona)	Holly, Blue (Ilex x meserveae)	Field In-Ground	Kunkel	DE	2009	Drench	Mortality in untreated controls was high; no conclusions can be drawn.
29981	Flagship 25WG (Thiamethoxam)	Euonymus Scale (Unaspis euonymi)	Wintercreeper (Euonymus fortunei) E. vegetus 'Coloratus'	Field Container	Nielsen	OH	2008	Drench	Poor efficacy at 4 g per ft height.
28872	Flagship 25WG (Thiamethoxam)	Euonymus Scale (Unaspis euonymi)	Spindle Tree (Euonymus japonicus)	Field Container	Frank	NC	2010	Foliar	Excellent control with 8 oz per 100 gal + Dyne-amic; slower acting than horticultural oil.
28872	Flagship 25WG (Thiamethoxam)	Euonymus Scale (Unaspis euonymi)	Spindle Tree (Euonymus japonicus) E. fortunei 'Moonshadow'	Field Container	Potter	KY	2010	Foliar	No significant reduction of adult scales with 8 oz per 100 gal + spreader.
28872	Flagship 25WG (Thiamethoxam)	Euonymus Scale (Unaspis euonymi)	Spindle Tree (Euonymus japonicus) E. fortunei 'Radicans'	Field Container	Kunkel	DE	2011	Foliar	Did not significantly increase mortality with 8 oz per 100 gal + Capsil applied twice.
28872	Flagship 25WG (Thiamethoxam)	Euonymus Scale (Unaspis euonymi)	Spindle Tree (Euonymus japonicus) E. vegetus 'SunSpot'	Field Container	Nielsen	OH	2009	Foliar	Poor control at 8 oz + 6 oz Capsil per 100 gal
28872	Flagship 25WG (Thiamethoxam)	Euonymus Scale (Unaspis euonymi)	Spindle Tree (Euonymus japonicus) 'Green Spire'	Field Container	Gilrein	NY	2011	Drench	Did not significantly reduce population with 0.5 g per ft ht applied once.
28872	Flagship 25WG (Thiamethoxam)	Euonymus Scale (Unaspis euonymi)	Spindle Tree (Euonymus japonicus) 'Microphylla'	Field Container	Frank	NC	2009	Foliar	Excellent control at 8 oz per 100 gal + Dyne-amic; slower acting than Acephate
28872	Flagship 25WG (Thiamethoxam)	Euonymus Scale (Unaspis euonymi)	Spindle Tree (Euonymus japonicus) 'Microphylla'	Field Container	Ludwig	TX	2008	Foliar	Fair to good efficacy at 8 oz per 100 gal.
32153	GF-2626 1SC (Sulfoxaflor)	Cottony Cushion Scale (Icerya purchasi)	Heavenly Bamboo (Nandina domestica) 'Harbour Dwarf'	Greenhouse	Frank	NC	2012	Foliar	Significantly reduced immatures with 8 and 11 fl oz per 100 gal applied twice; comparable to horticultural oil.

PR#	Product (Active Ingredients)	Target	Crop	Production Site	Researcher	State	Year	Application Type	Results
31283	GF-2626 1SC (Sulfoxaflor)	Cottony Cushion Scale (Icerya purchasi)	Pittosporum (Pittosporum sp.) P. tobira cv.'variegata'	Field Container	Chong	SC	2012	Foliar	No consistent and significant reduction of scale population with 8 and 11 fl oz per 100 gal; comparable to standard paraffinic oil.
31288	GF-2626 1SC (Sulfoxaflor)	Magnolia Scale (Neolecanium cornuparvum)	Sweet Bay (Magnolia virginiana) M. grandiflora, 'Little Gem'	Field In-Ground	Braman	GA	2012	Foliar	Excellent control of false oleander scale immatures with 8 and 11 fl oz per 100 gal; comparable to Orthene.
31353	GF-2626 1SC (Sulfoxaflor)	Pine Needle Scale (Phenacaspis pinifoliae)	Pine (Pinus sp.) P. sylvestris	Field In-Ground	Jones	OH	2012	Foliar	Mediocre control with 8 and 11 fl oz per 100 gal applied twice.
32149	Horticultural Oil (Horticultural Oil)	Cottony Cushion Scale (Icerya purchasi)	Heavenly Bamboo (Nandina domestica) 'Harbour Dwarf'	Greenhouse	Frank	NC	2012	Foliar	Significantly reduced immatures with 150 fl oz per 100 gal applied once.
32859	Horticultural Oil (Horticultural Oil)	Pine Needle Scale (Phenacaspis pinifoliae)	Pine (Pinus sp.) P. strobus	Field In-Ground	Sadof	IL	2015	Foliar	Significant efficacy on immatures and adults with labeled rate.
31227	Horticultural Oil (Horticultural Oil)	White Peach Scale (Pseudaulacaspis pentagona)	Holly, Blue (Ilex x meserveae)	Field In-Ground	Kunkel	DE	2009	Foliar	Mortality in untreated controls was high; no conclusions can be drawn.
31229	Horticultural Oil (Horticultural Oil)	Euonymus Scale (Unaspis euonymi)	Spindle Tree (Euonymus japonicus)	Field Container	Braman	GA	2014	foliar	Excellent control with 2 gal per 100 gal applied twice at 14-day interval.
31229	Horticultural Oil (Horticultural Oil)	Euonymus Scale (Unaspis euonymi)	Spindle Tree (Euonymus japonicus) E. fortunei 'Radicans'	Field Container	Kunkel	DE	2011	Foliar	Significantly increased mortality with 1 % v/v solution applied twice.
29986	Horticultural Oil (Horticultural Oil)	Euonymus Scale (Unaspis euonymi)	Spindle Tree (Euonymus japonicus) E. vegetus 'Coloratus'	Field In-Ground	Nielsen	OH	2010	Foliar	Excellent efficacy on nymphs at 3 % v/v; may have short resdidual.
28384	Judo 2SC (Spiromesifen)	Elongate Hemlock Scale (Fiorinia externa)	Fir, Fraser (Abies fraseri)	Field In-Ground	Cowles	CT	2008	Foliar	Very little control with at 5 and 10 fl oz per acre applied either May 19 or June 3.
30418	Kontos (BYI 8330 240SC) (Spirotetramat)	Calico Scale (Eulecanium cerasorum)	Honey Locust (Gleditsia sp.) G. triacanthos var. inermis	Commercial Landscape	Persad	OH	2014	Foliar	Mediocre control of nymphs with 3.4 fl oz per 100 gal by 28 DAT.

PR#	Product (Active Ingredients)	Target	Crop	Production Site	Researcher	State	Year	Application Type	Results
29811	Kontos (BYI 8330 240SC) (Spirotetramat)	Tea Scale (Fiorinia theae)	Camellia, Japanese (Camellia japonica) C. sasanqua 'Showa-no-sakae'	Field Container	Frank	NC	2010	Foliar	Excellent control with 3.4 fl oz per 100 gal.
32156	Kontos (BYI 8330 240SC) (Spirotetramat)	Cottony Cushion Scale (Icerya purchasi)	Heavenly Bamboo (Nandina domestica) 'Harbour Dwar'	Greenhouse	Frank	NC	2012	Foliar	Did not significantly reduce immatures with 3.4 fl oz per 100 gal applied once.
30228	Kontos (BYI 8330 240SC) (Spirotetramat)	Cottony Cushion Scale (Icerya purchasi)	Heavenly Bamboo (Nandina domestica) 'Harbour Dwarf'	Field Container	Frank	NC	2011	Foliar	Significantly reduced adults and immatures with 3.4 fl oz per 100 gal applied once; comparable to horticultural oil.
30300	Kontos (BYI 8330 240SC) (Spirotetramat)	Cottony Cushion Scale (Icerya purchasi)	Pittosporum (Pittosporum sp.) P. tobira 'Verigata'	Field In-Ground	Chong	SC	2011	Foliar	Significantly reduced immatures with 3.4 oz per 100 gal applied once; comparable to the standard Orthene.
32855	Kontos (BYI 8330 240SC) (Spirotetramat)	Camelia Scale (Lepidosaphes camelliae)	Camellia, Japanese (Camellia japonica) C. japonica and C. sasanqua	Commercial Landscape	Chong	SC	2014	Foliar	Consistent and high efficacy with 3.4 fl oz per 100 gal applied twice biweekly; comparable to the standard paraffin oil.
25149	Kontos (BYI 8330 240SC) (Spirotetramat)	Winged Euonymus Scale (Lepidosaphes yanagicola)	Winged Burning Bush (Euonymus alatus)	Field Container	Freiberger	NJ	2004		Some reduction in scale counts at 20 fl oz per 100 gal
30238	Kontos (BYI 8330 240SC) (Spirotetramat)	Gloomy Scale (Melanaspis tenebricosa)	Maple (Acer sp.) A. rubrum	Field In-Ground	Frank	NC	2011	Foliar	Excellent control of adults and immatures with 3.4 fl oz per 100 gal applied once; comparable to standard paraffin oil.
29769	Kontos (BYI 8330 240SC) (Spirotetramat)	Pine Needle Scale (Phenacaspis pinifoliae)	Pine (Pinus sp.) P. strobus	Field In-Ground	Sadof	IL	2015	Drench	No significant efficacy on immatures and adults with 3.4 oz per 100 gal.
29769	Kontos (BYI 8330 240SC) (Spirotetramat)	Pine Needle Scale (Phenacaspis pinifoliae)	Pine (Pinus sp.) P. strobus	Field In-Ground	Sadof	IL	2015	Foliar	No significant efficacy on immatures and adults with 3.4 oz per 100 gal.
29769	Kontos (BYI 8330 240SC) (Spirotetramat)	Pine Needle Scale (Phenacaspis pinifoliae)	Pine (Pinus sp.) P. sylvestris	Field In-Ground	Nielsen	OH	2010	Foliar	Excellent efficacy at 3.4 oz per 100 gal.
29769	Kontos (BYI 8330 240SC) (Spirotetramat)	Pine Needle Scale (Phenacaspis pinifoliae)	Pine (Pinus sp.) P. sylvestris	Field In-Ground	Nielsen	OH	2011	Foliar	Good efficacy with 3.4 oz per 100 gal through 31 DAT, but second generation eggs were present albeit in lower amounts than the nontreated check.

PR#	Product (Active Ingredients)	Target	Crop	Production Site	Researcher	State	Year	Application Type	Results
29630	Kontos (BYI 8330 240SC) (Spirotetramat)	False Oleander Scale (Pseudaulacaspis cockerelli)	Magnolia, Southern (Magnolia grandiflora)	Commercial Landscape	Chong	SC	2010	Foliar	Charleston, SC: Did not significantly reduce false oleander scale population at 3.4 fl oz per 100 gal; comparable to the standard Orthene; no injury observed.
29150	Kontos (BYI 8330 240SC) (Spirotetramat)	Euonymus Scale (Unaspis euonymi)	Spindle Tree (Euonymus japonicus) E. fortunei 'Moonshadow'	Field Container	Potter	KY	2010	Foliar	No significant reduction of adult scales with 3.4 oz per 100 gal.
26829	Kontos (BYI 8330 240SC) (Spirotetramat)	Euonymus Scale (Unaspis euonymi)	Spindle Tree (Euonymus japonicus) E. vegetus 'Coloratus'	Field In-Ground	Nielsen	OH	2008	Foliar	Some efficacy on nymphs at 3.4 fl oz per 100 gal; may have short residual.
29150	Kontos (BYI 8330 240SC) (Spirotetramat)	Euonymus Scale (Unaspis euonymi)	Spindle Tree (Euonymus japonicus) 'Green Spire'	Field Container	Gilrein	NY	2011	Foliar	Good control with 3.4 fl oz per 100 gal applied once.
32164	Mainspring (A20520A) 200SC (Cyantraniliprole)	Calico Scale (Eulecanium cerasorum)	Honey Locust (Gleditsia sp.) G. triacanthos var. inermis	Commercial Landscape	Persad	OH	2014	Drench	Excellent control of nymphs with 0.25 fl oz per inch DBH by 28 DAT.
32355	Mainspring (A20520A) 200SC (Cyantraniliprole)	Tea Scale (Fiorinia theae)	Camellia, Japanese (Camellia japonica)	Field In-Ground	Braman	GA	2015	Drench	Very good control with 0.125 fl oz per ft height applied twice and 0.25 fl oz per ft height applied once.
32872	Mainspring (A20520A) 200SC (Cyantraniliprole)	Tea Scale (Fiorinia theae)	Camellia, Japanese (Camellia japonica)	Field Container	Chen	LA	2015	Foliar	Excellent control with 8 fl oz per 100 gal; comparable to standards Ultra-Pure Oil and Distance.
32355	Mainspring (A20520A) 200SC (Cyantraniliprole)	Tea Scale (Fiorinia theae)	Camellia, Japanese (Camellia japonica) 'In the Pink'	Field In-Ground	Arthurs	FL	2014	Drench	Good control with 12 fl oz per 100 gal applied once and 8 fl oz applied twice; inferior to SuffOil X.
32406	Mainspring (A20520A) 200SC (Cyantraniliprole)	Tea Scale (Fiorinia theae)	(Camellia sasanqua) 'Mountain Snow'	Field Container	Chen	LA	2014	Drench	Significantly reduced infestation with 8 fl oz per 100 gal applied twice and 12 fl oz applied twice; comparable to standard SuffOil-X.
32847	Mainspring (A20520A) 200SC (Cyantraniliprole)	Tea Scale (Fiorinia theae)	Holly (Ilex sp.) 'Nellie Stevens'	Field Container	Chong	SC	2015	Drench	Mediocre efficacy with 8 fl oz per 100 gal applied twice every 28 days; inferior to Distance.

PR#	Product (Active Ingredients)	Target	Crop	Production Site	Researcher	State	Year	Application Type	Results
32853	Mainspring (A20520A) 200SC (Cyantraniliprole)	Camelia Scale (Lepidosaphes camelliae)	Camellia, Japanese (Camellia japonica) C. japonica and C. sasanqua	Commercial Landscape	Chong	SC	2014	Drench	Poor efficacy with 0.125 oz per ft height applied twice ever 4 weeks and 0.25 fl oz applied once.
32529	Mainspring (A20520A) 200SC (Cyantraniliprole)	Gloomy Scale (Melanaspis tenebricosa)	Maple (Acer sp.) A. rubrum	Field In-Ground	Frank	NC	2014	Drench	Data inconclusive because there were no significant differences between treatments, including untreated check.
32529	Mainspring (A20520A) 200SC (Cyantraniliprole)	Gloomy Scale (Melanaspis tenebricosa)	Maple (Acer sp.) A. rubrum	Field In-Ground	Frank	NC	2014	Foliar	Data inconclusive because there were no significant differences between treatments, including untreated check.
32223	Mainspring (A20520A) 200SC (Cyantraniliprole)	Pine Needle Scale (Phenacaspis pinifoliae)	Pine (Pinus sp.) P. strobus	Field In-Ground	Sadof	IN	2015	Drench	No significant efficacy on immatures and adults with 0.125 and 0.25 oz per ft ht.
32400	Mainspring (A20520A) 200SC (Cyantraniliprole)	False Oleander Scale (Pseudaulacaspis cockerelli)	Magnolia, Southern (Magnolia grandiflora) 'Little Gem'	Field Container	Chen	LA	2014	Drench	Excellent control with 8 fl oz per 100 gal applied twice and 12 fl oz applied twice; comparable to standard SuffOil-X.
32158	Mainspring (A20520A) 200SC (Cyantraniliprole)	Euonymus Scale (Unaspis euonymi)	Spindle Tree (Euonymus japonicus)	Field Container	Braman	GA	2014	Drench	Excellent control with 12 fl oz per 100 gal applied once, and with 8 fl oz per 100 gal applied twice at 28-day interval.
32158	Mainspring (A20520A) 200SC (Cyantraniliprole)	Euonymus Scale (Unaspis euonymi)	Spindle Tree (Euonymus japonicus) E. fortunei 'Emerald N Gold'	Field Container	Potter	KY	2014	Drench	Significantly reduced scales (36%) with 12 fl oz per 100 gal applied at 30 days before scale hatching; inferior to Orthene.
29590	Marathon II (Imidacloprid)	Florida Wax Scale (Ceroplastes floridensis)	Holly (Ilex sp.) I. cornuta 'Needlepoint'	Commercial Landscape	Held	MS	2009	Drench	Excellent control with Merit 2F at 6 ml per ft height applied for first or second generation
25448	Marathon II (Imidacloprid)	Cottony maple scale (Neopulvinaria innumerabilis)	Maple, Silver (Acer saccharinum)	Field In-Ground	Davis	MI	2005	Foliar	Poor efficacy
28133	Merit 2F (Imidacloprid)	Wax Myrtle Scale (Melanaspis deklei)	Wax Myrtle (Myrica cerifera)	Commercial Landscape	Chong	SC	2008	Drench	Experiment 1: Did not significantly reduce scale population at 0.2 fl oz per indbh; similar to Orthene std; untreated population very low and no statistical differences were observed.

PR#	Product (Active Ingredients)	Target	Crop	Production Site	Researcher	State	Year	Application Type	Results
28880	MOI 201 (MOI 201)	Oystershell Scale (Diaspidiotus ostreiformis)	Silverbell Carolina (Halesia carolina var. carolina)	Field In-Ground	Nielsen	OH	2008	Foliar	Very low infestation; no control at 1:500 and 1:800 conc.
28385	Onyx (Bifenthrin)	Elongate Hemlock Scale (Fiorinia externa)	Fir, Fraser (Abies fraseri)	Field In-Ground	Cowles	CT	2008	Foliar	Some control with 6.4 fl oz per acre.
29553	Orthene TTO 97 (Valent) (Acephate)	Holly Pit Scale (Asterolecanium puteanum)	Holly (Ilex sp.) 'East Palatka'	Field In-Ground	Buss	FL	2009	Foliar	Significantly reduced number of immatures at 8 oz per 100 gal. 0% control with HendersonsTilton 6 WAT.
25730	Orthene TTO 97 (Valent) (Acephate)	Florida Wax Scale (Ceroplastes floridensis)	Holly (Ilex sp.) 'China Doll'	Field Container	Ludwig	TX	2005	Foliar	No efficacy on nymphs, poor on adults at 8 oz per 100 gal.
25730	Orthene TTO 97 (Valent) (Acephate)	Florida Wax Scale (Ceroplastes floridensis)	Holly (Ilex sp.) I. cornuta 'bufordii nana'	Field Container	Ludwig	TX	2005	Foliar	No efficacy on nymphs and adults at 8 oz per 100 gal.
25778	Orthene TTO 97 (Valent) (Acephate)	Florida Red Scale (Chrysomphalus aonidum)	Holly, Chinese (Ilex cornuta) 'Dwarf Buford'	Field Container	Ludwig	TX	2005	Foliar	No significant control of nymphs and on adults at 10.5 oz per 100 gal probably due to cooler temperatures
25486	Orthene TTO 97 (Valent) (Acephate)	Oystershell Scale (Diaspidiotus ostreiformis)	Silverbell Carolina (Halesia carolina var. carolina) Carolina silverbell	Field In-Ground	Nielsen	OH	2005	Foliar	Poor efficacy at 8 oz per 100 gal.
25485	Orthene TTO 97 (Valent) (Acephate)	Oystershell Scale (Diaspidiotus ostreiformis)	Lilac, Common (Syringa vulgaris)	Field In-Ground	Nielsen	OH	2005	Foliar	Poor control at 8 oz per 100 gal
31662	Orthene TTO 97 (Valent) (Acephate)	Cottony Cushion Scale (Icerya purchasi)	Pittosporum (Pittosporum sp.) P. tobira 'Verigata'	Field In-Ground	Chong	SC	2011	Foliar	Significantly reduced immatures with 8 ox per 100 gal applied once.
25732	Orthene TTO 97 (Valent) (Acephate)	Cottony Cushion Scale (Icerya purchasi)	Ternstroemia (Ternstroemia sp.) T. gymnanthera	Field Container	Ludwig	TX	2005	Foliar	Good efficacy at 8 oz per 100 gal.
30084	Orthene TTO 97 (Valent) (Acephate)	Camelia Scale (Lepidosaphes camelliae)	Camellia, Japanese (Camellia japonica)	Commercial Landscape	Chong	SC	2010	Foliar	No significant increase in mortality at 8 oz per 100 gal; no injury observed.
28134	Orthene TTO 97 (Valent) (Acephate)	Wax Myrtle Scale (Melanaspis deklei)	Wax Myrtle (Myrica cerifera)	Commercial Landscape	Chong	SC	2008	Foliar	Experiment 1: Did not significantly reduce scale population at 8 fl oz per 100 gal; untreated population very low and no statistical differences were observed.

PR#	Product (Active Ingredients)	Target	Crop	Production Site	Researcher	State	Year	Application Type	Results
29265	Orthene TTO 97 (Valent) (Acephate)	Wax Myrtle Scale (Melanaspis deklei)	Wax Myrtle (Myrica cerifera)	Field In-Ground	Chong	SC	2009	Foliar	Did not significantly reduce scale population at 8 oz per 100 gal + Capsil; similar to paraffinic oil std; very low non treated population so no statistical significance.
29636	Orthene TTO 97 (Valent) (Acephate)	False Oleander Scale (Pseudaulacaspis cockerelli)	Magnolia, Southern (Magnolia grandiflora)	Commercial Landscape	Chong	SC	2010	Foliar	Charleston, SC: Did not significantly reduce false oleander scale population at 8 oz per 100 gal; no injury observed.
32159	Orthene TTO 97 (Valent) (Acephate)	Euonymus Scale (Unaspis euonymi)	Spindle Tree (Euonymus japonicus)	Field Container	Braman	GA	2014	foliar	Good to excellent control with 8 oz per 100 gal applied twice at 14-day interval.
32159	Orthene TTO 97 (Valent) (Acephate)	Euonymus Scale (Unaspis euonymi)	Spindle Tree (Euonymus japonicus) E. fortunei 'Emerald N Gold'	Field Container	Potter	KY	2014	Foliar	Significantly reduced scales (74%) with 1.5 fl oz per 100 gal applied at crawler stage and 1 week later.
31228	QRD 452 (Extract of Chenopodium ambrosioides)	Euonymus Scale (Unaspis euonymi)	Spindle Tree (Euonymus japonicus) E. fortunei 'Radicans'	Field Container	Kunkel	DE	2011	Foliar	Significantly increased mortality with 128 oz per 100 gal applied once; comparable to horticultural oil applied twice.
28696	Rycar (SP3009/NNI-0101) (Pyrifluquinazon)	Holly Pit Scale (Asterolecanium puteanum)	Holly (Ilex sp.) 'East Palatka'	Field In-Ground	Buss	FL	2009	Foliar	Did not significantly reduce number of immatures at 18 fl oz per 100 gal. 32% control with HendersonsTilton 6 WAT.
28688	Rycar (SP3009/NNI-0101) (Pyrifluquinazon)	False Florida Red Scale (Chrysomphalus bifasciculatus)	Holly, Chinese (Ilex cornuta) 'Cassina'	Field In-Ground	Chong	SC	2009	Foliar	Good efficacy at 18 fl oz per 100 gal; equivalent to paraffinic oil standard.
30229	Rycar (SP3009/NNI-0101) (Pyrifluquinazon)	Cottony Cushion Scale (Icerya purchasi)	Heavenly Bamboo (Nandina domestica) 'Harbour Dwarf'	Field Container	Frank	NC	2011	Foliar	Significantly reduced adults and immatures with 18 fl oz per 100 gal applied once; comparable to horticultural oil.
30301	Rycar (SP3009/NNI-0101) (Pyrifluquinazon)	Cottony Cushion Scale (Icerya purchasi)	Pittosporum (Pittosporum sp.) P. tobira 'Verigata'	Field In-Ground	Chong	SC	2011	Foliar	Significantly reduced immatures with 18 fl oz per 100 gal applied once; almost comparable to the standard Orthene, though slower-acting.
28919	Rycar (SP3009/NNI-0101) (Pyrifluquinazon)	Wax Myrtle Scale (Melanaspis deklei)	Wax Myrtle (Myrica cerifera)	Commercial Landscape	Chong	SC	2009	Foliar	Did not significantly reduce scale population at 18 oz per 100 gal; similar to Orthene std; very low non treated population so no statistical significance.

PR#	Product (Active Ingredients)	Target	Crop	Production Site	Researcher	State	Year	Application Type	Results
30239	Rycar (SP3009/NNI-0101) (Pyrifluquinazon)	Gloomy Scale (Melanaspis tenebricosa)	Maple (Acer sp.) A. rubrum	Field In-Ground	Frank	NC	2011	Foliar	Excellent control of adults and immatures with 18 fl oz per 100 gal applied once; comparable to standard paraffin oil.
29770	Rycar (SP3009/NNI-0101) (Pyrifluquinazon)	Pine Needle Scale (Phenacaspis pinifoliae)	Pine (Pinus sp.) P. sylvestris	Field In-Ground	Nielsen	OH	2010	Foliar	Excellent efficacy at 18 fl oz per 100 gal.
29770	Rycar (SP3009/NNI-0101) (Pyrifluquinazon)	Pine Needle Scale (Phenacaspis pinifoliae)	Pine (Pinus sp.) P. sylvestris	Field In-Ground	Nielsen	OH	2011	Foliar	Excellent efficacy with 18 fl oz per 100 gal.
29631	Rycar (SP3009/NNI-0101) (Pyrifluquinazon)	False Oleander Scale (Pseudaulacaspis cockerelli)	Magnolia, Southern (Magnolia grandiflora)	Commercial Landscape	Chong	SC	2010	Foliar	Litchfield, SC: Significantly reduced false oleander scale population at 18 fl oz per 100 gal;much inferior to the standard Paraffinic oil; no injury observed.
28951	Rycar (SP3009/NNI-0101) (Pyrifluquinazon)	White Peach Scale (Pseudaulacaspis pentagona)	Holly, Blue (Ilex x meserveae)	Field In-Ground	Kunkel	DE	2009	Foliar	Mortality in untreated controls was high; no conclusions can be drawn.
28873	Rycar (SP3009/NNI-0101) (Pyrifluquinazon)	Euonymus Scale (Unaspis euonymi)	Spindle Tree (Euonymus japonicus)	Field Container	Frank	NC	2010	Foliar	Excellent control with 18 fl oz per 100 gal; slower acting than horticultural oil.
28873	Rycar (SP3009/NNI-0101) (Pyrifluquinazon)	Euonymus Scale (Unaspis euonymi)	Spindle Tree (Euonymus japonicus) E. fortunei 'Moonshadow'	Field Container	Potter	KY	2010	Foliar	Significantly reduced 1st generation adult scales with 18 fl oz per 100 gal; better than horticultural oil; no impact on 2nd generation.
28873	Rycar (SP3009/NNI-0101) (Pyrifluquinazon)	Euonymus Scale (Unaspis euonymi)	Spindle Tree (Euonymus japonicus) E. fortunei 'Radicans'	Field Container	Kunkel	DE	2011	Foliar	Did not significantly increase mortality with 18 fl oz per 100 gal applied once.
29982	Rycar (SP3009/NNI-0101) (Pyrifluquinazon)	Euonymus Scale (Unaspis euonymi)	Spindle Tree (Euonymus japonicus) E. vegetus 'Coloratus'	Field In-Ground	Nielsen	OH	2008	Foliar	Poor efficacy at 18 fl oz per 100 gal.
28873	Rycar (SP3009/NNI-0101) (Pyrifluquinazon)	Euonymus Scale (Unaspis euonymi)	Spindle Tree (Euonymus japonicus) E. vegetus 'Sunspot'	Field Container	Nielsen	OH	2009	Foliar	Poor control at 18 fl oz per 100 gal
28873	Rycar (SP3009/NNI-0101) (Pyrifluquinazon)	Euonymus Scale (Unaspis euonymi)	Spindle Tree (Euonymus japonicus) 'Green Spire'	Field Container	Gilrein	NY	2011	Foliar	Did not significantly reduce population with 18 fl oz per 100 gal applied once.

PR#	Product (Active Ingredients)	Target	Crop	Production Site	Researcher	State	Year	Application Type	Results
28873	Rycar (SP3009/NNI-0101) (Pyrifluquinazon)	Euonymus Scale (Unaspis euonymi)	Spindle Tree (Euonymus japonicus) 'Microphylla'	Field Container	Frank	NC	2009	Foliar	Excellent control at 18 fl oz per 100 gal; slower acting than Acephate
28697	Safari 20SG (Dinotefuran)	Holly Pit Scale (Asterolecanium puteanum)	Holly (Ilex sp.) 'East Palatka'	Field In-Ground	Buss	FL	2009	Sprench	Significantly reduced number of immatures at 6 g per ft height; comparable to Orthene. 16% control with HendersonsTilton 6 WAT.
25050	Safari 20SG (Dinotefuran)	Florida Wax Scale (Ceroplastes floridensis)	Holly (Ilex sp.) 'Dwarf Buford'	Field Container	Ludwig	TX	2004	Drench	Great to excellent efficacy at 12, 24, and 48 oz per 100 gal at 45DAT.
28972	Safari 20SG (Dinotefuran)	Florida Wax Scale (Ceroplastes floridensis)	Holly (Ilex sp.) I. cornuta 'Needlepoint'	Commercial Landscape	Held	TN	2009	Drench	Excellent control at 6 g per ft height applied for first generation, less effective when applied for 2nd generation.
25774	Safari 20SG (Dinotefuran)	Florida Red Scale (Chrysomphalus aonidum)	Holly, Chinese (Ilex cornuta) 'Dwarf Buford'	Field Container	Ludwig	TX	2005	Drench	No significant control of nymphs and on adults at 12 and 24 oz per 100 gal probably due to cooler temperatures
25774	Safari 20SG (Dinotefuran)	Florida Red Scale (Chrysomphalus aonidum)	Holly, Chinese (Ilex cornuta) 'Dwarf Buford'	Field Container	Ludwig	TX	2005	Foliar	No significant control of nymphs and on adults at 4 and 8 oz per 100 gal probably due to cooler temperatures
28689	Safari 20SG (Dinotefuran)	False Florida Red Scale (Chrysomphalus bifasciculatus)	Holly, Chinese (Ilex cornuta) 'Cassina'	Field In-Ground	Chong	SC	2009	Drench	Excellent efficacy at 6 g per ft of shrub height; better than paraffinic oil std
25141	Safari 20SG (Dinotefuran)	Oystershell Scale (Diaspidiotus ostreiformis)	Silverbell Carolina (Halesia carolina var. carolina)	Field In-Ground	Nielsen	OH	2005	Drench	Excellent efficacy with drench application
25141	Safari 20SG (Dinotefuran)	Oystershell Scale (Diaspidiotus ostreiformis)	Silverbell Carolina (Halesia carolina var. carolina)	Field In-Ground	Nielsen	OH	2008	Drench	Very low infestation; poor control at 6, acceptable at 12 g per ft ht
25141	Safari 20SG (Dinotefuran)	Oystershell Scale (Diaspidiotus ostreiformis)	Silverbell Carolina (Halesia carolina var. carolina) Carolina silverbell	Field In-Ground	Nielsen	OH	2005	Foliar	Poor efficacy with foliar application
25140	Safari 20SG (Dinotefuran)	Oystershell Scale (Diaspidiotus ostreiformis)	Lilac, Common (Syringa vulgaris) 'Sensation'	Field In-Ground	Nielsen	OH	2005	Drench	Excellent efficacy with foliar application

PR#	Product (Active Ingredients)	Target	Crop	Production Site	Researcher	State	Year	Application Type	Results
25140	Safari 20SG (Dinotefuran)	Oystershell Scale (Diaspidiotus ostreiformis)	Lilac, Common (Syringa vulgaris) 'Sensation'	Field In-Ground	Nielsen	OH	2005	Foliar	Poor efficacy with foliar application
29845	Safari 20SG (Dinotefuran)	Calico Scale (Eulecanium cerasorum)	Honey Locust (Gleditsia sp.) G. triacanthos inermis	Commercial Landscape	Sadof	IL	2011	Drench	Poor efficacy with Transtect 70WSP at 1.45 g ai per inch DBH.
29845	Safari 20SG (Dinotefuran)	Calico Scale (Eulecanium cerasorum)	Honey Locust (Gleditsia sp.) G. triacanthos inermis	Commercial Landscape	Sadof	IL	2011	Trunk spray	Poor efficacy with Transtect 70WSP at 1.7 g ai per in dbh.
29845	Safari 20SG (Dinotefuran)	Calico Scale (Eulecanium cerasorum)	Honey Locust (Gleditsia sp.) G. triacanthos var. inermis	Commercial Landscape	Persad	OH	2014	Drench	100 % control of nymphs with 6 g per inch DBH by 28 DAT.
26720	Safari 20SG (Dinotefuran)	Calico Scale (Eulecanium cerasorum)	Japanese Zelkova (Zelkova serrata)	Commercial Landscape	Potter	KY	2007	Soil Injection	Good to great control using 8.5 g product per inch dbh.
26720	Safari 20SG (Dinotefuran)	Calico Scale (Eulecanium cerasorum)	Japanese Zelkova (Zelkova serrata)	Commercial Landscape	Potter	KY	2007	Trunk spray	Excellent control using 13 oz + 3.1 ox Pentrabark per 1.1 gal.
25315	Safari 20SG (Dinotefuran)	Elongate Hemlock Scale (Fiorinia externa)	Fir, Fraser (Abies fraseri)	Field In-Ground	Cowles	CT	2005	Drench	Excellent efficacy - 100% control
25315	Safari 20SG (Dinotefuran)	Elongate Hemlock Scale (Fiorinia externa)	Fir, Fraser (Abies fraseri)	Field In-Ground	Cowles	CT	2005	Foliar	Excellent efficacy >90% control
25315	Safari 20SG (Dinotefuran)	Elongate Hemlock Scale (Fiorinia externa)	Fir, Fraser (Abies fraseri)	Field In-Ground	Cowles	CT	2008	Drench	No to some efficacy at 0.68, 1.35, and 2.70 lb product per acre with soil applications.
25315	Safari 20SG (Dinotefuran)	Elongate Hemlock Scale (Fiorinia externa)	Fir, Fraser (Abies fraseri)	Field In-Ground	Cowles	CT	2008	Trunk spray	Good efficacy at 0.68, 1.35, and 2.70 lb product per acre with truck applications.
29585	Safari 20SG (Dinotefuran)	Tea Scale (Fiorinia theae)	Camellia, Japanese (Camellia japonica)	Field In-Ground	Ludwig	TX	2008	Drench	Good efficacy at 24 fl oz per 100 gal; high mortality in untreated Check.
29858	Safari 20SG (Dinotefuran)	Tea Scale (Fiorinia theae)	Camellia, Japanese (Camellia japonica) C. sasanqua 'Showa-no-sakae'	Field Container	Frank	NC	2010	Drench	Excellent control with 24 oz per 100 gal.
29858	Safari 20SG (Dinotefuran)	Tea Scale (Fiorinia theae)	Camellia, Japanese (Camellia japonica) 'In the Pink'	Field Container	Arthurs	FL	2014	Drench	Excellent control with 24 oz per 100 gal applied once; comparable to SuffOil X.

PR#	Product (Active Ingredients)	Target	Crop	Production Site	Researcher	State	Year	Application Type	Results
29362	Safari 20SG (Dinotefuran)	Tea Scale (Fiorinia theae)	Holly (Ilex sp.) 'Burfordii Nana'	Field In-Ground	Hesselein	AL	2009	Drench	Significantly increased % scale mortality at 6 g per ft plant height; equal to petroleum oil spray
30230	Safari 20SG (Dinotefuran)	Cottony Cushion Scale (Icerya purchasi)	Heavenly Bamboo (Nandina domestica) 'Harbour Dwarf'	Field Container	Frank	NC	2011	Drench	Significantly reduced adults and immatures with 24 oz per 100 gal applied once; comparable to horticultural oil.
30302	Safari 20SG (Dinotefuran)	Cottony Cushion Scale (Icerya purchasi)	Pittosporum (Pittosporum sp.) P. tobira 'Verigata'	Field In-Ground	Chong	SC	2011	Drench	Significantly reduced immatures with 6 g per ft ht applied once; best product, better than the standard Orthene.
25060	Safari 20SG (Dinotefuran)	Cottony Cushion Scale (Icerya purchasi)	Ternstroemia (Ternstroemia sp.) T. gymnanthera	Field Container	Ludwig	TX	2005	Drench	Poor efficacy
25060	Safari 20SG (Dinotefuran)	Cottony Cushion Scale (Icerya purchasi)	Ternstroemia (Ternstroemia sp.) T. gymnanthera	Field Container	Ludwig	TX	2005	Foliar	Poor efficacy
30086	Safari 20SG (Dinotefuran)	Camelia Scale (Lepidosaphes camelliae)	Camellia, Japanese (Camellia japonica)	Commercial Landscape	Chong	SC	2010	Drench	Did not significantly reduce camellia scale population at 6 g per ft height; comparable to all other treatments including the standard Orthene; no injury observed.
25153	Safari 20SG (Dinotefuran)	Winged Euonymus Scale (Lepidosaphes yanagicola)	Winged Burning Bush (Euonymus alatus)	Field Container	Freiberger	NJ	2004	Foliar	Poor efficacy
25153	Safari 20SG (Dinotefuran)	Winged Euonymus Scale (Lepidosaphes yanagicola)	Winged Burning Bush (Euonymus alatus)	Field Container	Freiberger	NJ	2005	Drench	Little to no control
25153	Safari 20SG (Dinotefuran)	Winged Euonymus Scale (Lepidosaphes yanagicola)	Winged Burning Bush (Euonymus alatus)	Field Container	Freiberger	NJ	2005	Foliar	Little to no control
28129	Safari 20SG (Dinotefuran)	Wax Myrtle Scale (Melanaspis deklei)	Wax Myrtle (Myrica cerifera)	Commercial Landscape	Chong	SC	2008	Drench	Experiment 1 (Early and Late Drenches): Did not significantly reduce scale population at 12 g per indbh; similar to Orthene std; untreated population very low and no statistical differences were observed.

PR#	Product (Active Ingredients)	Target	Crop	Production Site	Researcher	State	Year	Application Type	Results
28129	Safari 20SG (Dinotefuran)	Wax Myrtle Scale (Melanaspis deklei)	Wax Myrtle (Myrica cerifera)	Commercial Landscape	Chong	SC	2008	Foliar	Experiment 2: Reduced scale population but not statistically significantly at 8 oz per 100 gal; similar to Sunspray Ultrafine std
28129	Safari 20SG (Dinotefuran)	Wax Myrtle Scale (Melanaspis deklei)	Wax Myrtle (Myrica cerifera)	Commercial Landscape	Chong	SC	2009	Drench	Did not significantly reduce scale population at 6 g per ft shrub height; similar to Orthene std; very low non treated population so no statistical significance.
28129	Safari 20SG (Dinotefuran)	Wax Myrtle Scale (Melanaspis deklei)	Wax Myrtle (Myrica cerifera)	Commercial Landscape	Chong	SC	2009	Foliar	Experiment 2: Significantly reduced scale population at 6 g per ft shrub height; similar to Orthene std; very low non treated population so no statistical significance.
30240	Safari 20SG (Dinotefuran)	Gloomy Scale (Melanaspis tenebricosa)	Maple (Acer sp.) A. rubrum	Field In-Ground	Frank	NC	2011	Trunk spray	Excellent control of adults and immatures with 12 oz per 100 gal applied once; comparable to standard paraffin oil.
25445	Safari 20SG (Dinotefuran)	Cottony maple scale (Neopulvinaria innumerabilis)	Maple, Silver (Acer saccharinum)	Field In-Ground	Davis	MI	2005	Drench	Poor efficacy
25445	Safari 20SG (Dinotefuran)	Cottony maple scale (Neopulvinaria innumerabilis)	Maple, Silver (Acer saccharinum)	Field In-Ground	Davis	MI	2005	Foliar	Poor to mediocre efficacy
25139	Safari 20SG (Dinotefuran)	Fletcher scale (Parthenolecanium fletcheri)	Yew (Taxus media) Densiformis	Field In-Ground	Davis	MI	2004	Foliar	Mediocre control.
25139	Safari 20SG (Dinotefuran)	Fletcher scale (Parthenolecanium fletcheri)	Yew (Taxus media) 'Densiformis'	Field In-Ground	Davis	MI	2004	Banded	Mediocre to good efficacy increasing with rate.
29771	Safari 20SG (Dinotefuran)	Pine Needle Scale (Phenacaspis pinifoliae)	Pine (Pinus sp.) P. strobus	Field In-Ground	Sadof	IL	2015	Foliar	No significant efficacy on immatures and adults with 18 oz per 100 gal.
29771	Safari 20SG (Dinotefuran)	Pine Needle Scale (Phenacaspis pinifoliae)	Pine (Pinus sp.) P. sylvestris	Field In-Ground	Jones	OH	2012	Soil injection	Mediocre control with 6 g per ft height applied once.
29771	Safari 20SG (Dinotefuran)	Pine Needle Scale (Phenacaspis pinifoliae)	Pine (Pinus sp.) P. sylvestris	Field In-Ground	Nielsen	OH	2010	Drench	Excellent efficacy at 6 g per inch DBH.

PR#	Product (Active Ingredients)	Target	Crop	Production Site	Researcher	State	Year	Application Type	Results
29771	Safari 20SG (Dinotefuran)	Pine Needle Scale (Phenacaspis pinifoliae)	Pine (Pinus sp.) P. sylvestris	Field In-Ground	Nielsen	OH	2011	Drench	Excellent efficacy with 6 g per inch DBH.
25055	Safari 20SG (Dinotefuran)	False Oleander Scale (Pseudaulacaspis cockerelli)	Aucuba (Aucuba sp.)	Field Container	Ludwig	TX	2004	Drench	No impact on number of adults or nymphs, but some reduction in percent alive with 12, 24, and 48 oz per 100 gal.
29632	Safari 20SG (Dinotefuran)	False Oleander Scale (Pseudaulacaspis cockerelli)	Magnolia, Southern (Magnolia grandiflora)	Commercial Landscape	Chong	SC	2010	Drench	Charleston, SC: Significantly reduced false oleander scale population at 6 g per indbh; best treatment; no injury observed.
28952	Safari 20SG (Dinotefuran)	White Peach Scale (Pseudaulacaspis pentagona)	Holly, Blue (Ilex x meserveae)	Field In-Ground	Kunkel	DE	2009	Drench	Mortality in untreated controls was high; no conclusions can be drawn.
28874	Safari 20SG (Dinotefuran)	Euonymus Scale (Unaspis euonymi)	Spindle Tree (Euonymus japonicus)	Field Container	Braman	GA	2014	Drench	Excellent control with 24 oz per 100 gal applied once.
28874	Safari 20SG (Dinotefuran)	Euonymus Scale (Unaspis euonymi)	Spindle Tree (Euonymus japonicus)	Field Container	Frank	NC	2010	Drench	Excellent control with 24 oz per 100 gal; slower acting than horticultural oil.
28874	Safari 20SG (Dinotefuran)	Euonymus Scale (Unaspis euonymi)	Spindle Tree (Euonymus japonicus) E. fortunei 'Moonshadow'	Field Container	Potter	KY	2010	Drench	Significantly reduced 1st generation adult scales with 24 oz per 100 gal; better than horticultural oil.
28874	Safari 20SG (Dinotefuran)	Euonymus Scale (Unaspis euonymi)	Spindle Tree (Euonymus japonicus) E. fortunei 'Radicans'	Field Container	Kunkel	DE	2011	Drench	Significantly increased mortality with 24 oz per 100 gal applied once; slightly better than horticultural oil applied twice.
26683	Safari 20SG (Dinotefuran)	Euonymus Scale (Unaspis euonymi)	Spindle Tree (Euonymus japonicus) E. vegetus 'Coloratus'	Field In-Ground	Nielsen	OH	2008	Drench	Good efficacy at 6 g per ft height.
28874	Safari 20SG (Dinotefuran)	Euonymus Scale (Unaspis euonymi)	Spindle Tree (Euonymus japonicus) E. vegetus 'Sunspot'	Field Container	Nielsen	OH	2009	Drench	Excellent control at 6 g per ft height.
26683	Safari 20SG (Dinotefuran)	Euonymus Scale (Unaspis euonymi)	Spindle Tree (Euonymus japonicus) Euonymus vegetus 'Fortunei'	Field In-Ground	Nielsen	OH	2007	Bark spray or soil drench	Excellent control of 1st, good control of 2nd generation nymphs with bark spray at 24 oz per 100 gal; soil drench at 6 g per ft height poor on 1st, fair on second generation

PR#	Product (Active Ingredients)	Target	Crop	Production Site	Researcher	State	Year	Application Type	Results
28874	Safari 20SG (Dinotefuran)	Euonymus Scale (Unaspis euonymi)	Spindle Tree (Euonymus japonicus) 'Green Spire'	Field Container	Gilrein	NY	2011	Drench	Did not significantly reduce population with 24 oz per 100 gal applied once.
28874	Safari 20SG (Dinotefuran)	Euonymus Scale (Unaspis euonymi)	Spindle Tree (Euonymus japonicus) 'Microphylla'	Field Container	Frank	NC	2009	Drench	Excellent control at 24 oz per 100 gal; slower acting than Acephate
28874	Safari 20SG (Dinotefuran)	Euonymus Scale (Unaspis euonymi)	Spindle Tree (Euonymus japonicus) 'Microphylla'	Field Container	Ludwig	TX	2008	Foliar	Fair to good efficacy at 24 fl oz per 100 gal.
28878	Safari 2G (V-10112 2G) (Dinotefuran)	Holly Pit Scale (Asterolecanium puteanum)	Holly (Ilex sp.) 'East Palatka'	Field In-Ground	Buss	FL	2009	Broadcast	Did not significantly reduce number of immatures at 60 g per ft height. 57% control with HendersonsTilton 6 WAT.
29846	Safari 2G (V-10112 2G) (Dinotefuran)	Calico Scale (Eulecanium cerasorum)	Honey Locust (Gleditsia sp.) G. triacanthos inermis	Commercial Landscape	Sadof	IL	2011	Broadcast	Mediocre efficacy with 3 g ai per inch DBH.
29586	Safari 2G (V-10112 2G) (Dinotefuran)	Tea Scale (Fiorinia theae)	Camellia, Japanese (Camellia japonica)	Field In-Ground	Ludwig	TX	2008	Soil Incorporation	No significant efficacy at 2.6 g per gal of media; high mortality in untreated Check.
29859	Safari 2G (V-10112 2G) (Dinotefuran)	Tea Scale (Fiorinia theae)	Camellia, Japanese (Camellia japonica) C. sasanqua 'Showa-no-sakae'	Field Container	Frank	NC	2010	Broadcast to soil surface	Excellent control with 2.6 g per gal potting media.
29363	Safari 2G (V-10112 2G) (Dinotefuran)	Tea Scale (Fiorinia theae)	Holly (Ilex sp.) 'Bufordii Nana'	Field In-Ground	Hesselein	AL	2009	Top Dress	Significantly increased % scale mortality at 60 g per ft plant height; equal to petroleum oil
30231	Safari 2G (V-10112 2G) (Dinotefuran)	Cottony Cushion Scale (Icerya purchasi)	Heavenly Bamboo (Nandina domestica) 'Harbour Dwarf'	Field Container	Frank	NC	2011	Broadcast to soil surface	Significantly reduced adults and immatures with 2.6 g per plant applied once; comparable to horticultural oil.
30303	Safari 2G (V-10112 2G) (Dinotefuran)	Cottony Cushion Scale (Icerya purchasi)	Pittosporum (Pittosporum sp.) P. tobira 'Verigata'	Field In-Ground	Chong	SC	2011	Broadcast to soil surface	Significantly reduced immatures with 60 g per ft ht applied once; best product, better than the standard Orthene.

PR#	Product (Active Ingredients)	Target	Crop	Production Site	Researcher	State	Year	Application Type	Results
30087	Safari 2G (V-10112 2G) (Dinotefuran)	Camelia Scale (Lepidosaphes camelliae)	Camellia, Japanese (Camellia japonica)	Commercial Landscape	Chong	SC	2010	Broadcast	Did not significantly reduce camellia scale population at 60 g per ft height; comparable to all other treatments including the standard Orthene; no injury observed.
28917	Safari 2G (V-10112 2G) (Dinotefuran)	Wax Myrtle Scale (Melanaspis deklei)	Wax Myrtle (Myrica cerifera)	Commercial Landscape	Chong	SC	2009	Broadcast	Did not significantly reduce scale population at 60 g per ft shrub height; similar to Orthene std; very low non treated population so no statistical significance.
30241	Safari 2G (V-10112 2G) (Dinotefuran)	Gloomy Scale (Melanaspis tenebricosa)	Maple (Acer sp.) A. rubrum	Field In-Ground	Frank	NC	2011	Drench	Excellent control of adults and immatures with 6 g per inch dbh applied once; comparable to standard paraffin oil.
29772	Safari 2G (V-10112 2G) (Dinotefuran)	Pine Needle Scale (Phenacaspis pinifoliae)	Pine (Pinus sp.) P. sylvestris	Field In-Ground	Nielsen	OH	2010	Broadcast	Poor efficacy at 60 g per inch DBH
29772	Safari 2G (V-10112 2G) (Dinotefuran)	Pine Needle Scale (Phenacaspis pinifoliae)	Pine (Pinus sp.) P. sylvestris	Field In-Ground	Nielsen	OH	2011	Broadcast	Poor efficacy through 21 DAT with 60 g per inch DBH; however no second generation eggs were present.
29633	Safari 2G (V-10112 2G) (Dinotefuran)	False Oleander Scale (Pseudaulacaspis cockerelli)	Magnolia, Southern (Magnolia grandiflora)	Commercial Landscape	Chong	SC	2010	Broadcast	Charleston, SC: Significantly reduced false oleander scale population at 60 g per indbh; better than the standard Orthene; no injury observed.
28953	Safari 2G (V-10112 2G) (Dinotefuran)	White Peach Scale (Pseudaulacaspis pentagona)	Holly, Blue (Ilex x meserveae)	Field In-Ground	Kunkel	DE	2009	Broadcast soil surface	Mortality in untreated controls was high; no conclusions can be drawn.
28875	Safari 2G (V-10112 2G) (Dinotefuran)	Euonymus Scale (Unaspis euonymi)	Spindle Tree (Euonymus japonicus)	Field Container	Frank	NC	2010	Broadcast to soil surface	Excellent control with 7.8 g ai per 3 gal media; slower acting than horticultural oil.
29985	Safari 2G (V-10112 2G) (Dinotefuran)	Euonymus Scale (Unaspis euonymi)	Spindle Tree (Euonymus japonicus) E. vegetus 'Coloratus'	Field In-Ground	Nielsen	OH	2008	Broadcast	Good efficacy at 60 g per ft height.
28875	Safari 2G (V-10112 2G) (Dinotefuran)	Euonymus Scale (Unaspis euonymi)	Spindle Tree (Euonymus japonicus) E. vegetus 'Sunspot'	Field Container	Nielsen	OH	2009	Top Dress	Poor control at 60 g per ft height

PR#	Product (Active Ingredients)	Target	Crop	Production Site	Researcher	State	Year	Application Type	Results
28875	Safari 2G (V-10112 2G) (Dinotefuran)	Euonymus Scale (Unaspis euonymi)	Spindle Tree (Euonymus japonicus) 'Microphylla'	Field Container	Frank	NC	2009	Broadcast	Good control but slow acting at 7.8 g per 3 gal container; inferior to Acephate
28875	Safari 2G (V-10112 2G) (Dinotefuran)	Euonymus Scale (Unaspis euonymi)	Spindle Tree (Euonymus japonicus) 'Microphylla'	Field Container	Ludwig	TX	2008	Soil incorporation	Excellent efficacy at 2.6 g per gal of media.
32035	SuffOil X (Synergy) (Petroleum Oil)	Tea Scale (Fiorinia theae)	Camellia, Japanese (Camellia japonica) 'In the Pink'	Field Container	Arthurs	FL	2014	Foliar	Excellent control with 256 fl oz per 100 gal applied 3 times.
32408	SuffOil X (Synergy) (Petroleum Oil)	Tea Scale (Fiorinia theae)	(Camellia sasanqua) 'Mountain Snow'	Field Container	Chen	LA	2014	Foliar	Significantly reduced infestation with 1 gal per 100 gal applied twice.
32530	SuffOil X (Synergy) (Petroleum Oil)	Gloomy Scale (Melanaspis tenebricosa)	Maple (Acer sp.) A. rubrum	Field In-Ground	Frank	NC	2014	Foliar	Data inconclusive because there were no significant differences between treatments, including untreated check.
32403	SuffOil X (Synergy) (Petroleum Oil)	False Oleander Scale (Pseudaulacaspis cockerelli)	Magnolia, Southern (Magnolia grandiflora) 'Little Gem'	Field Container	Chen	LA	2014	Foliar	Excellent control with 1 gal per 100 gal applied twice.
28137	Sun Spray Ultra-Fine Spray Oil (Paraffinic oil)	Wax Myrtle Scale (Melanaspis deklei)	Wax Myrtle (Myrica cerifera)	Commercial Landscape	Chong	SC	2008	Foliar	Experiment 2: Did not significantly reduce scale population at 2 % (2 gal per 100 gal.
30579	Sun Spray Ultra-Fine Spray Oil (Paraffinic oil)	Pine Needle Scale (Phenacaspis pinifoliae)	Pine (Pinus sp.) P. sylvestris	Field In-Ground	Nielsen	OH	2011	Foliar	Excellent efficacy with 2 gal per 100 gal.
29291	Sun Spray Ultra-Fine Spray Oil (Paraffinic oil)	Euonymus Scale (Unaspis euonymi)	Euonymus (Euonymus sp.) E. vegetus 'Sunspot'	Field Container	Nielsen	OH	2009	Foliar	Excellent control at 3%.
25449	Talstar Flowable Insecticide/Miticide (Bifenthrin)	Cottony maple scale (Neopulvinaria innumerabilis)	Maple, Silver (Acer saccharinum)	Field In-Ground	Davis	MI	2005	foliar	No efficacy.
28698	Talus 40SC (Buprofezin)	Holly Pit Scale (Asterolecanium puteanum)	Holly (Ilex sp.) 'East Palatka'	Field In-Ground	Buss	FL	2009	Foliar	Did not significantly reduce number of immatures at 21.5 fl oz per 100 gal. 0% control with HendersonsTilton 6 WAT.
25049	Talus 40SC (Buprofezin)	Florida Wax Scale (Ceroplastes floridensis)	Holly (Ilex sp.) 'China Doll'	Field Container	Ludwig	TX	2005	Foliar	Minimal impact on adults; some efficacy on nymphs at 14 DAT at 21.5 fl oz per 100 gal

PR#	Product (Active Ingredients)	Target	Crop	Production Site	Researcher	State	Year	Application Type	Results
25049	Talus 40SC (Buprofezin)	Florida Wax Scale (Ceroplastes floridensis)	Holly (Ilex sp.) 'Dwarf Buford'	Field Container	Ludwig	TX	2004	Foliar	Significant mortality 45 days with all rates (21.5, 43, 86 fl oz per 100 gal).
28690	Talus 40SC (Buprofezin)	False Florida Red Scale (Chrysomphalus bifasciculatus)	Holly, Chinese (Ilex cornuta) 'Cassina'	Field In-Ground	Chong	SC	2009	Foliar	Good efficacy at 21.5 fl oz per 100 gal + Capsil; similar to paraffinic oil std
25143	Talus 40SC (Buprofezin)	Oystershell Scale (Diaspidiotus ostreiformis)	Silverbell Carolina (Halesia carolina var. carolina)	Field In-Ground	Nielsen	OH	2005	Foliar	Excellent efficacy
25144	Talus 40SC (Buprofezin)	Oystershell Scale (Diaspidiotus ostreiformis)	Lilac, Common (Syringa vulgaris)	Field In-Ground	Nielsen	OH	2005	Foliar	Excellent control at 21.5 fl oz per 100 gal
25316	Talus 40SC (Buprofezin)	Elongate Hemlock Scale (Fiorinia externa)	Fir, Fraser (Abies fraseri)	Field In-Ground	Cowles	CT	2005	Foliar	Great efficacy
32038	Talus 40SC (Buprofezin)	Tea Scale (Fiorinia theae)	Camellia, Japanese (Camellia japonica) 'In the Pink'	Field Container	Arthurs	FL	2014	Foliar	Very good control with 14 oz per 100 gal + Capsil applied twice; inferior to SuffOil X.
25154	Talus 40SC (Buprofezin)	Winged Euonymus Scale (Lepidosaphes yanagicola)	Winged Burning Bush (Euonymus alatus)	Field Container	Freiberger	NJ	2004	Foliar	Excellent efficacy
25154	Talus 40SC (Buprofezin)	Winged Euonymus Scale (Lepidosaphes yanagicola)	Winged Burning Bush (Euonymus alatus)	Field Container	Freiberger	NJ	2005	Foliar	Excellent efficacy comparable to Orthene
27842	Talus 40SC (Buprofezin)	Wax Myrtle Scale (Melanaspis deklei)	Wax Myrtle (Myrica cerifera)	Commercial Landscape	Chong	SC	2008	Foliar	Experiment 2: Did not significantly reduce scale population at 21.5 fl oz per 100 gal; similar to Sunspray Ultrafine std
27842	Talus 40SC (Buprofezin)	Wax Myrtle Scale (Melanaspis deklei)	Wax Myrtle (Myrica cerifera)	Commercial Landscape	Chong	SC	2009	Foliar	Experiment 2: Significantly reduced scale population at 21.5 fl oz per 100 gal; similar to paraffinic oil std; very low non treated population so no statistical significance.
25446	Talus 40SC (Buprofezin)	Cottony maple scale (Neopulvinaria innumerabilis)	Maple, Silver (Acer saccharinum)	Field In-Ground	Davis	MI	2005	Foliar	Poor efficacy
25156	Talus 40SC (Buprofezin)	Fletcher scale (Parthenolecanium fletcheri)	Yew (Taxus media) Densiformis	Field In-Ground	Nielsen	OH	2001	Foliar	

PR#	Product (Active Ingredients)	Target	Crop	Production Site	Researcher	State	Year	Application Type	Results
25156	Talus 40SC (Buprofezin)	Fletcher scale (Parthenolecanium fletcheri)	Yew (Taxus media) 'Densiformis'	Field In-Ground	Davis	MI	2004	Foliar	Mediocre to good efficacy.
25054	Talus 40SC (Buprofezin)	False Oleander Scale (Pseudaulacaspis cockerelli)	Aucuba (Aucuba sp.)	Field Container	Ludwig	TX	2004	Foliar	No impact on number of adults or nymphs or percent alive with 21.5, 43 or 86 oz per 100 gal.
28954	Talus 40SC (Buprofezin)	White Peach Scale (Pseudaulacaspis pentagona)	Holly, Blue (Ilex x meserveae)	Field In-Ground	Kunkel	DE	2009	Foliar	Mortality in untreated controls was high; no conclusions can be drawn.
28876	Talus 40SC (Buprofezin)	Euonymus Scale (Unaspis euonymi)	Spindle Tree (Euonymus japonicus) E. fortunei 'Radicans'	Field Container	Kunkel	DE	2011	Foliar	Significantly increased mortality with 21.5 fl oz per 100 gal applied once; better than horticultural oil applied twice.
28876	Talus 40SC (Buprofezin)	Euonymus Scale (Unaspis euonymi)	Spindle Tree (Euonymus japonicus) E. vegetus 'Sunspot'	Field Container	Nielsen	OH	2009	Foliar	Excellent control at 21.5 fl oz per 100 gal
28876	Talus 40SC (Buprofezin)	Euonymus Scale (Unaspis euonymi)	Spindle Tree (Euonymus japonicus) 'Microphylla'	Field Container	Frank	NC	2009	Foliar	Excellent control at 21.5 fl oz per 100 gal; equal to Acephate
28876	Talus 40SC (Buprofezin)	Euonymus Scale (Unaspis euonymi)	Spindle Tree (Euonymus japonicus) 'Mycrophylla'	Field Container	Ludwig	TX	2008	Foliar	Fair to good efficacy at 21.5 fl oz per 100 gal.
29587	Talus 70DF (Buprofezin)	Tea Scale (Fiorinia theae)	Camellia, Japanese (Camellia japonica)	Field In-Ground	Braman	GA	2015	Foliar	Good control with 14 oz per 100 gal.
29860	Talus 70DF (Buprofezin)	Tea Scale (Fiorinia theae)	Camellia, Japanese (Camellia japonica)	Field Container	Chen	LA	2015	Foliar	
29860	Talus 70DF (Buprofezin)	Tea Scale (Fiorinia theae)	Camellia, Japanese (Camellia japonica)	Field Container	Chen	LA	2015	Foliar	Excellent control with 14 oz per 100 gal; comparable to standards Ultra-Pure Oil and Distance.
29587	Talus 70DF (Buprofezin)	Tea Scale (Fiorinia theae)	Camellia, Japanese (Camellia japonica)	Field In-Ground	Ludwig	TX	2008	Foliar	No significant efficacy at 21.5 fl oz per 100 gal; high mortality in untreated Check.
29860	Talus 70DF (Buprofezin)	Tea Scale (Fiorinia theae)	Camellia, Japanese (Camellia japonica) C. sasanqua 'Showa-no-sakae'	Field Container	Frank	NC	2010	Foliar	Excellent control with 14 oz per 100 gal.

PR#	Product (Active Ingredients)	Target	Crop	Production Site	Researcher	State	Year	Application Type	Results
32356	Talus 70DF (Buprofezin)	Tea Scale (Fiorinia theae)	(Camellia sasanqua) 'Mountain Snow'	Field Container	Chen	LA	2014	Foliar	Significantly reduced infestation with 14 oz per 100 gal applied once; comparable to standard SuffOil-X.
32850	Talus 70DF (Buprofezin)	Tea Scale (Fiorinia theae)	Holly (Ilex sp.) 'Nellie Stevens'	Field Container	Chong	SC	2015	Foliar	Great efficacy with 14 oz per 100 gal applied once; one of 3 most effective treatments.
30232	Talus 70DF (Buprofezin)	Cottony Cushion Scale (Icerya purchasi)	Heavenly Bamboo (Nandina domestica) 'Harbour Dwarf'	Field Container	Frank	NC	2011	Foliar	Significantly reduced adults and immatures with 14 oz per 100 gal applied once; comparable to horticultural oil.
32155	Talus 70DF (Buprofezin)	Cottony Cushion Scale (Icerya purchasi)	Heavenly Bamboo (Nandina domestica) 'Harbour Dwarf'	Greenhouse	Frank	NC	2012	Foliar	Did not significantly reduce immatures with 14 oz per 100 gal applied once.
30460	Talus 70DF (Buprofezin)	Cottony Cushion Scale (Icerya purchasi)	Pittosporum (Pittosporum sp.) P. tobira cv.'variegata'	Field Container	Chong	SC	2012	Foliar	No consistent and significant reduction of scale population with 14 oz per 100 gal; comparable to standard paraffinic oil.
30304	Talus 70DF (Buprofezin)	Cottony Cushion Scale (Icerya purchasi)	Pittosporum (Pittosporum sp.) P. tobira 'Verigata'	Field In-Ground	Chong	SC	2011	Foliar	Significantly reduced immatures with 14 oz per 100 gal applied once; generally better than the standard Orthene.
32854	Talus 70DF (Buprofezin)	Camelia Scale (Lepidosaphes camelliae)	Camellia, Japanese (Camellia japonica) C. japonica and C. sasanqua	Commercial Landscape	Chong	SC	2014	Foliar	Excellent efficacy with 14 oz per 100 gal applied once; would require a second application for longer residual control.
30242	Talus 70DF (Buprofezin)	Gloomy Scale (Melanaspis tenebricosa)	Maple (Acer sp.) A. rubrum	Field In-Ground	Frank	NC	2011	Foliar	Excellent control of adults and immatures with 14 oz per 100 gal applied once; comparable to standard paraffin oil.
30242	Talus 70DF (Buprofezin)	Gloomy Scale (Melanaspis tenebricosa)	Maple (Acer sp.) A. rubrum	Field In-Ground	Frank	NC	2014	Foliar	Data inconclusive because there were no significant differences between treatments, including untreated check.
31291	Talus 70DF (Buprofezin)	Magnolia Scale (Neolecanium cornuparvum)	Sweet Bay (Magnolia virginiana) M. grandiflora, ‘Little Gem’	Field In-Ground	Braman	GA	2012	Foliar	Good control of false oleander scale immatures with 14 oz per 100 gal; inferior to Orthene.
29773	Talus 70DF (Buprofezin)	Pine Needle Scale (Phenacaspis pinifoliae)	Pine (Pinus sp.) P. sylvestris	Field In-Ground	Nielsen	OH	2010	Foliar	Excellent efficacy at 14 oz per 100 gal.

PR#	Product (Active Ingredients)	Target	Crop	Production Site	Researcher	State	Year	Application Type	Results
29773	Talus 70DF (Buprofezin)	Pine Needle Scale (Phenacaspis pinifoliae)	Pine (Pinus sp.) P. sylvestris	Field In-Ground	Nielsen	OH	2011	Foliar	Excellent efficacy with 14 oz per 100 gal.
29634	Talus 70DF (Buprofezin)	False Oleander Scale (Pseudaulacaspis cockerelli)	Magnolia, Southern (Magnolia grandiflora)	Commercial Landscape	Chong	SC	2010	Foliar	Litchfield, SC: Significantly reduced false oleander scale population at 14 oz per 100 gal; comparable to the standard Paraffinic oil; no injury observed.
32402	Talus 70DF (Buprofezin)	False Oleander Scale (Pseudaulacaspis cockerelli)	Magnolia, Southern (Magnolia grandiflora) 'Little Gem'	Field Container	Chen	LA	2014	Foliar	Excellent control with 14 oz per 100 gal applied once; comparable to standard SuffOil-X.
29758	Talus 70DF (Buprofezin)	Euonymus Scale (Unaspis euonymi)	Spindle Tree (Euonymus japonicus)	Field Container	Braman	GA	2014	Foliar	Excellent control with 14 oz per 100 gal.
29758	Talus 70DF (Buprofezin)	Euonymus Scale (Unaspis euonymi)	Spindle Tree (Euonymus japonicus)	Field Container	Frank	NC	2010	Foliar	Excellent control with 14 oz per 100 gal; slower acting than horticultural oil.
29758	Talus 70DF (Buprofezin)	Euonymus Scale (Unaspis euonymi)	Spindle Tree (Euonymus japonicus) E. fortunei 'Emerald N Gold'	Field Container	Potter	KY	2014	Foliar	Did not significantly reduce scales with 14 oz per 100 gal applied at crawler stage.
29758	Talus 70DF (Buprofezin)	Euonymus Scale (Unaspis euonymi)	Spindle Tree (Euonymus japonicus) E. fortunei 'Moonshadow'	Field Container	Potter	KY	2010	Foliar	Significantly reduced 1st generation adult scales with 21.5 fl oz per 100 gal; better than horticultural oil.
29983	Talus 70DF (Buprofezin)	Euonymus Scale (Unaspis euonymi)	Spindle Tree (Euonymus japonicus) E. vegetus 'Coloratus'	Field In-Ground	Nielsen	OH	2008	Foliar	Good efficacy at 14 oz per 100 gal.
29758	Talus 70DF (Buprofezin)	Euonymus Scale (Unaspis euonymi)	Spindle Tree (Euonymus japonicus) 'Green Spire'	Field Container	Gilrein	NY	2011	Foliar	Excellent control with 14 oz per 100 gal applied once.
25163	Talus WP (Buprofezin)	Fletcher scale (Parthenolecanium fletcheri)	Yew (Taxus media) 'Densiformis'	Field In-Ground	Davis	MI	2004	Foliar	Mediocre to good efficacy.
26135	Talus WP (Buprofezin)	Euonymus Scale (Unaspis euonymi)	Spindle Tree (Euonymus japonicus)	Field Container	Ludwig	TX	2003	Foliar	Excellent efficacy at 0.6, 1.2 and 2.4 lb ai per 100 gallons

PR#	Product (Active Ingredients)	Target	Crop	Production Site	Researcher	State	Year	Application Type	Results
32357	Tank Mix: Distance + TriStar (Pyriproxifen + acetamiprid)	Tea Scale (Fiorinia theae)	Camellia, Japanese (Camellia japonica)	Field In-Ground	Braman	GA	2015	Foliar	Very good control with 12 fl oz + 12 fl oz per 100 gal.
32873	Tank Mix: Distance + TriStar (Pyriproxifen + acetamiprid)	Tea Scale (Fiorinia theae)	Camellia, Japanese (Camellia japonica)	Field Container	Chen	LA	2015	Foliar	Excellent control with 12 fl oz + 12 fl oz per 100 gal; comparable to standards Ultra-Pure Oil and Distance.
32849	Tank Mix: Distance + TriStar (Pyriproxifen + acetamiprid)	Tea Scale (Fiorinia theae)	Holly (Ilex sp.) 'Nellie Stevens'	Field Container	Chong	SC	2015	Foliar	Good efficacy with 12 + 12 fl oz per 100 gal applied twice every 21 days; one of 3 most effective treatments.
28138	Tank Mix: Safari + Pentrabark (Dinotefuron + Pentrabark)	Wax Myrtle Scale (Melanaspis deklei)	Wax Myrtle (Myrica cerifera)	Commercial Landscape	Chong	SC	2008	Drench	Experiment 1: Did not significantly reduce scale population at 12 g per indbh; similar to Orthene std; untreated population very low and no statistical differences were observed.
29588	Triact (Clarified hydrophobic extract of neem oil)	Tea Scale (Fiorinia theae)	Camellia, Japanese (Camellia japonica)	Field In-Ground	Ludwig	TX	2008	Foliar	No significant efficacy at 2 gal per 100 gal; high mortality in untreated Check.
29584	Triact (Clarified hydrophobic extract of neem oil)	Euonymus Scale (Unaspis euonymi)	Spindle Tree (Euonymus japonicus) 'Microphylla'	Field Container	Ludwig	TX	2008	Foliar	Good efficacy at 2 gal per 100 gal.
28699	TriStar 30SG (Acetamiprid)	Holly Pit Scale (Asterolecanium puteanum)	Holly (Ilex sp.) 'East Palatka'	Field In-Ground	Buss	FL	2009	Foliar	Did not significantly reduce number of immatures at 8 oz per 100 gal + Capsil. 42% control with HendersonsTilton 6 WAT.
25772	TriStar 30SG (Acetamiprid)	Florida Wax Scale (Ceroplastes floridensis)	Indian Hawthorn (Raphiolepis indica)	Field Container	Ludwig	TX	2005	Foliar	By 41 DAT, excellent efficacy on nymphs and adults at both rates
25776	TriStar 30SG (Acetamiprid)	Florida Red Scale (Chrysomphalus aonidum)	Holly, Chinese (Ilex cornuta) 'Dwarf Buford'	Field Container	Ludwig	TX	2005	Foliar	No significant control of nymphs and on adults at 4 and 8 oz per 100 gal probably due to cooler temperatures
28691	TriStar 30SG (Acetamiprid)	False Florida Red Scale (Chrysomphalus bifasciculatus)	Holly, Chinese (Ilex cornuta) 'Cassina'	Field In-Ground	Chong	SC	2009	Foliar	Good efficact at 8 oz per 100 gal + Capsil; similar to paraffinic oil std.

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28881	TriStar 30SG (Acetamiprid)	Oystershell Scale (Diaspidiotus ostreiformis)	Silverbell Carolina (Halesia carolina var. carolina)	Field In-Ground	Nielsen	OH	2008	Foliar	Very low infestation; no control at 4 and 8 oz per 100 gal
30233	TriStar 30SG (Acetamiprid)	Cottony Cushion Scale (Icerya purchasi)	Heavenly Bamboo (Nandina domestica) 'Harbour Dwarf'	Field Container	Frank	NC	2011	Foliar	Significantly reduced adults and immatures with 8 oz per 100 gal applied twice; comparable to horticultural oil.
30305	TriStar 30SG (Acetamiprid)	Cottony Cushion Scale (Icerya purchasi)	Pittosporum (Pittosporum sp.) P. tobira 'Verigata'	Field In-Ground	Chong	SC	2011	Foliar	Significantly reduced immatures with 8 oz per 100 gal applied twice; comparable to the standard Orthene.
30088	TriStar 30SG (Acetamiprid)	Camelia Scale (Lepidosaphes camelliae)	Camellia, Japanese (Camellia japonica)	Commercial Landscape	Chong	SC	2010	Foliar	Did not significantly reduce camellia scale population at 8 oz per 100 gal + Capsil; comparable to all other treatments including the standard Orthene; no injury observed.
27995	TriStar 30SG (Acetamiprid)	Wax Myrtle Scale (Melanaspis deklei)	Wax Myrtle (Myrica cerifera)	Commercial Landscape	Chong	SC	2008	Foliar	Experiment 1: Did not significantly reduce scale population at 4 and 8 oz per 100 gal; similar to Orthene std; untreated population very low and no statistical differences were observed.
27995	TriStar 30SG (Acetamiprid)	Wax Myrtle Scale (Melanaspis deklei)	Wax Myrtle (Myrica cerifera)	Commercial Landscape	Chong	SC	2009	Foliar	Did not significantly reduce scale population at 8 oz per 100 gal + Capsil; similar to Orthene std; very low non treated population so no statistical significance.
30243	TriStar 30SG (Acetamiprid)	Gloomy Scale (Melanaspis tenebricosa)	Maple (Acer sp.) A. rubrum	Field In-Ground	Frank	NC	2011	Foliar	Excellent control of adults and immatures with 8 oz per 100 gal applied twice; comparable to standard paraffin oil.
30243	TriStar 30SG (Acetamiprid)	Gloomy Scale (Melanaspis tenebricosa)	Maple (Acer sp.) A. rubrum	Field In-Ground	Frank	NC	2014	Foliar	Data inconclusive because there were no significant differences between treatments, including untreated check.
25447	TriStar 30SG (Acetamiprid)	Cottony maple scale (Neopulvinaria innumerabilis)	Maple, Silver (Acer saccharinum)	Field In-Ground	Davis	MI	2005	Foliar	No to mediocre efficacy

PR#	Product (Active Ingredients)	Target	Crop	Production Site	Researcher	State	Year	Application Type	Results
29774	TriStar 30SG (Acetamiprid)	Pine Needle Scale (Phenacaspis pinifoliae)	Pine (Pinus sp.) P. sylvestris	Field In-Ground	Nielsen	OH	2010	Foliar	Excellent efficacy at 8 oz per 100 gal.
29774	TriStar 30SG (Acetamiprid)	Pine Needle Scale (Phenacaspis pinifoliae)	Pine (Pinus sp.) P. sylvestris	Field In-Ground	Nielsen	OH	2011	Foliar	Excellent efficacy with 8 oz per 100 gal.
29635	TriStar 30SG (Acetamiprid)	False Oleander Scale (Pseudaulacaspis cockerelli)	Magnolia, Southern (Magnolia grandiflora)	Commercial Landscape	Chong	SC	2010	Foliar	Charleston, SC: Did not significantly reduce false oleander scale population at 8 oz per 100 gal; comparable to the standard Orthene; no injury observed.
28955	TriStar 30SG (Acetamiprid)	White Peach Scale (Pseudaulacaspis pentagona)	Holly, Blue (Ilex x meserveae)	Field In-Ground	Kunkel	DE	2009	Foliar	Mortality in untreated controls was high; no conclusions can be drawn.
28877	TriStar 30SG (Acetamiprid)	Euonymus Scale (Unaspis euonymi)	Spindle Tree (Euonymus japonicus)	Field Container	Frank	NC	2010	Foliar	Excellent control with 8 oz per 100 gal; slower acting than horticultural oil.
28877	TriStar 30SG (Acetamiprid)	Euonymus Scale (Unaspis euonymi)	Spindle Tree (Euonymus japonicus) E. fortunei 'Moonshadow'	Field Container	Potter	KY	2010	Foliar	Significantly reduced 1st generation adult scales with 12 fl oz per 100 gal; better than horticultural oil; no impact on 2nd generation.
28877	TriStar 30SG (Acetamiprid)	Euonymus Scale (Unaspis euonymi)	Spindle Tree (Euonymus japonicus) E. fortunei 'Radicans'	Field Container	Kunkel	DE	2011		Significantly increased mortality with 8 oz per 100 gal + Capsil applied twice; comparable to horticultural oil applied twice.
29984	TriStar 30SG (Acetamiprid)	Euonymus Scale (Unaspis euonymi)	Spindle Tree (Euonymus japonicus) E. vegetus 'Coloratus'	Field In-Ground	Nielsen	OH	2008	Foliar	Good efficacy at 8 oz per 100 gal.
28877	TriStar 30SG (Acetamiprid)	Euonymus Scale (Unaspis euonymi)	Spindle Tree (Euonymus japonicus) E. vegetus 'Sunspot'	Field Container	Nielsen	OH	2009	Foliar	Poor control at 8 oz + 6 oz Capsil per 100 gal
28877	TriStar 30SG (Acetamiprid)	Euonymus Scale (Unaspis euonymi)	Spindle Tree (Euonymus japonicus) 'Green Spire'	Field Container	Gilrein	NY	2011	Foliar	Did not significantly reduce population with 8 oz per 100 gal + Capsil applied twice.
28877	TriStar 30SG (Acetamiprid)	Euonymus Scale (Unaspis euonymi)	Spindle Tree (Euonymus japonicus) 'Microphylla'	Field Container	Frank	NC	2009	Foliar	Excellent control at 8 oz per 100 gal + Dyne-amic; slower acting than Acephate

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28877	TriStar 30SG (Acetamiprid)	Euonymus Scale (Unaspis euonymi)	Spindle Tree (Euonymus japonicus) 'Microphylla'	Field Container	Ludwig	TX	2008	Foliar	Fair efficacy at 8 oz per 100 gal.
25219	TriStar 70WSP (Acetamiprid)	Florida Wax Scale (Ceroplastes floridensis)	Holly (Ilex sp.) 'China Doll'	Field Container	Ludwig	TX	2005	Foliar	Minimal impact on adults; excellent efficacy on nymphs at 28 DAT at 4 oz and 8 oz per 100 gal
25219	TriStar 70WSP (Acetamiprid)	Florida Wax Scale (Ceroplastes floridensis)	Holly (Ilex sp.) 'Dwarf Buford'	Field Container	Ludwig	TX	2004	Foliar	Excellent efficacy at 32, 64, and 128 g per 100 gal at 45DAT.
25219	TriStar 70WSP (Acetamiprid)	Florida Wax Scale (Ceroplastes floridensis)	Holly (Ilex sp.) I. cornuta 'bufordii nana'	Field Container	Ludwig	TX	2005	Foliar	Minimal impact on nymphs; excellent efficacy on adults by 56 DAT at both 4 and 8 oz per 100 gal
25147	TriStar 70WSP (Acetamiprid)	Oystershell Scale (Diaspidiotus ostreiformis)	Silverbell Carolina (Halesia carolina var. carolina)	Field In-Ground	Nielsen	OH	2005	Foliar	No control at 48 g/100 gal, good control at 96 g/100 gal
25146	TriStar 70WSP (Acetamiprid)	Oystershell Scale (Diaspidiotus ostreiformis)	Lilac, Common (Syringa vulgaris)	Field In-Ground	Nielsen	OH	2005	Foliar	No to poor control at 48 and 96 g per 100 gal
25317	TriStar 70WSP (Acetamiprid)	Elongate Hemlock Scale (Fiorinia externa)	Fir, Fraser (Abies fraseri)	Field In-Ground	Cowles	CT	2005	Foliar	Excellent efficacy
25058	TriStar 70WSP (Acetamiprid)	Cottony Cushion Scale (Icerya purchasi)	Ternstroemia (Ternstroemia sp.) T. gymnanthera	Field Container	Ludwig	TX	2005	Foliar	Good efficacy with 124 oz per 100 gallon rate almost to the level of Orthene TTO 97 standard
25155	TriStar 70WSP (Acetamiprid)	Winged Euonymus Scale (Lepidosaphes yanagicola)	Winged Burning Bush (Euonymus alatus)	Field Container	Freiberger	NJ	2004	Foliar	Some efficacy at 64 g per 100 gal rate.
25155	TriStar 70WSP (Acetamiprid)	Winged Euonymus Scale (Lepidosaphes yanagicola)	Winged Burning Bush (Euonymus alatus)	Field Container	Freiberger	NJ	2005	Foliar	Little efficacy at either rate
25117	TriStar 70WSP (Acetamiprid)	Fletcher scale (Parthenolecanium fletcheri)	Yew (Taxus media) 'Densiformis'	Field In-Ground	Davis	MI	2004	Foliar	Good efficacy.
25053	TriStar 70WSP (Acetamiprid)	False Oleander Scale (Pseudaulacaspis cockerelli)	Aucuba (Aucuba sp.)	Field Container	Ludwig	TX	2004	Foliar	No impact on number of adults or nymphs and some reduction in percent alive at the higher two rates (32, 64, 128 g per 100 gal).
32875	Ultra Pure Oil (BASF) (Petroleum Oil)	Tea Scale (Fiorinia theae)	Camellia, Japanese (Camellia japonica)	Field Container	Chen	LA	2015	Foliar	Great control with 12 fl oz per 100 gal.

PR#	Product (Active Ingredients)	Target	Crop	Production Site	Researcher	State	Year	Application Type	Results
31486	Xxpire (GF-2860) 40WG (Spinetoram + sulfoxaflor)	Calico Scale (Eulecanium cerasorum)	Honey Locust (Gleditsia sp.) G. triacanthos var. inermis	Commercial Landscape	Persad	OH	2014	Foliar	Increasing efficacy on nymphs (poor to good by 28 DAT) with increasing rates (2, 2.75 and 3.5 fl oz per 100 gal).
32034	Xxpire (GF-2860) 40WG (Spinetoram + sulfoxaflor)	Tea Scale (Fiorinia theae)	Camellia, Japanese (Camellia japonica) 'In the Pink'	Field Container	Arthurs	FL	2014	Foliar	Excellent control with 2.0, 2.75 and 3.5 oz per 100 gal + Capsil applied twice; comparable to SuffOil X.
32405	Xxpire (GF-2860) 40WG (Spinetoram + sulfoxaflor)	Tea Scale (Fiorinia theae)	(Camellia sasanqua) 'Mountain Snow'	Field Container	Chen	LA	2014	Foliar	Significantly reduced infestation with 2, 2.75 and 3.5 oz per 100 gal + Capsil applied twice; best treatment.
32150	Xxpire (GF-2860) 40WG (Spinetoram + sulfoxaflor)	Cottony Cushion Scale (Icerya purchasi)	Heavenly Bamboo (Nandina domestica) 'Harbour Dwarf'	Greenhouse	Frank	NC	2012	Foliar	Significantly reduced immatures with 3.5 and 7 oz per 100 gal applied twice; comparable to horticultural oil.
31284	Xxpire (GF-2860) 40WG (Spinetoram + sulfoxaflor)	Cottony Cushion Scale (Icerya purchasi)	Pittosporum (Pittosporum sp.) P. tobira cv.'variegata'	Field Container	Chong	SC	2012	Foliar	No consistent and significant reduction of scale population with 3.5 and 7 oz per 100 gal; comparable to standard paraffinic oil.
31543	Xxpire (GF-2860) 40WG (Spinetoram + sulfoxaflor)	Camelia Scale (Lepidosaphes camelliae)	Camellia, Japanese (Camellia japonica) C. japonica and C. sasanqua	Commercial Landscape	Chong	SC	2014	Foliar	Consistent and high efficacy with 2.75 and 3.5 oz per 100 gal + Capsil applied twice biweekly; comparable to the standard paraffin oil.
31545	Xxpire (GF-2860) 40WG (Spinetoram + sulfoxaflor)	Wax Myrtle Scale (Melanaspis deklei)	Wax Myrtle (Myrica cerifera)	Commercial Landscape	Chong	SC	2013	Foliar	Significantly reduced scale population with 2.0, 2.75 and 3.5 oz per 100 gal + Capsil applied twice biweekly; comparable to the standard paraffin oil.
32528	Xxpire (GF-2860) 40WG (Spinetoram + sulfoxaflor)	Gloomy Scale (Melanaspis tenebricosa)	Maple (Acer sp.) A. rubrum	Field In-Ground	Frank	NC	2014	Foliar	Data inconclusive because there were no significant differences between treatments, including untreated check.
31289	Xxpire (GF-2860) 40WG (Spinetoram + sulfoxaflor)	Magnolia Scale (Neolecanium cornuparvum)	Sweet Bay (Magnolia virginiana) M. grandiflora, 'Little Gem'	Field In-Ground	Braman	GA	2012	Foliar	Excellent control of false oleander scale immatures with 3.5 and 7 oz per 100 gal; comparable to Orthene.

PR#	Product (Active Ingredients)	Target	Crop	Production Site	Researcher	State	Year	Application Type	Results
31354	Xxpire (GF-2860) 40WG (Spinetoram + sulfoxaflor)	Pine Needle Scale (Phenacaspis pinifoliae)	Pine (Pinus sp.) P. strobus	Field In-Ground	Sadof	IL	2015	Foliar	Significant efficacy on immatures and adults with 2.75 and 3.5 oz + Capsil per 100 gal; comparable to the standards Distance and Horticultural Oil.
31354	Xxpire (GF-2860) 40WG (Spinetoram + sulfoxaflor)	Pine Needle Scale (Phenacaspis pinifoliae)	Pine (Pinus sp.) P. sylvestris	Field In-Ground	Jones	OH	2012	Foliar	Mediocre and good control with 3.5 and 7 oz per 100 gal applied twice.
31354	Xxpire (GF-2860) 40WG (Spinetoram + sulfoxaflor)	Pine Needle Scale (Phenacaspis pinifoliae)	Pine (Pinus sp.) P. sylvestris	Field In-Ground	Jones	OH	2013	Foliar	Good control with 2.0, 2.75 and 3.5 oz per 100 gal + Capsil.
31544	Xxpire (GF-2860) 40WG (Spinetoram + sulfoxaflor)	False Oleander Scale (Pseudaulacaspis cockerelli)	Magnolia, Southern (Magnolia grandiflora)	Commercial Landscape	Chong	SC	2014	Foliar	Good control with 2.0, 2.75 and 3.5 oz per 100 gal + Capsil applied twice biweekly; comparable to the standard paraffin oil.
32399	Xxpire (GF-2860) 40WG (Spinetoram + sulfoxaflor)	False Oleander Scale (Pseudaulacaspis cockerelli)	Magnolia, Southern (Magnolia grandiflora) 'Little Gem'	Field Container	Chen	LA	2014	Foliar	Good to excellent control with 2, 2.75 and 3.5 oz per 100 gal + Capsil applied twice; comparable to standard SuffOil-X.
32157	Xxpire (GF-2860) 40WG (Spinetoram + sulfoxaflor)	Euonymus Scale (Unaspis euonymi)	Spindle Tree (Euonymus japonicus)	Field Container	Braman	GA	2014	Foliar	Excellent control with 2, 2.75 and 3.5 fl oz per 100 gal + Capsil applied twice at 14-day interval.
32157	Xxpire (GF-2860) 40WG (Spinetoram + sulfoxaflor)	Euonymus Scale (Unaspis euonymi)	Spindle Tree (Euonymus japonicus) E. fortunei 'Emerald N Gold'	Field Container	Potter	KY	2014	Foliar	Significantly reduced scales (up to 75%) with 2, 2.75 and 3.5 oz per 100 gal + Capsil applied at crawler stage and 2 weeks later; comparable to Orthene.

Table 84. Summary of Efficacy By Product for Mealybug

Note: Table entries are sorted by crop Latin name. Only those experiments received by 2/28/2016 are included in the table below.

PR#	Product (Active Ingredients)	Target	Crop	Production Site	Researcher	State	Year	Application Type	Results
29618	A16901B 45WG (Cyantraniliprole + thiamethoxam)	Madeira Mealybug (Phenacoccus madeiresis)	Coleus, Flamenettle (Coleus sp.) 'King Salmon Pink'	Greenhouse	Ludwig	TX	2011	Drench	No significant reduction of nymphs with 10 oz per 100 gal applied once.
29618	A16901B 45WG (Cyantraniliprole + thiamethoxam)	Madeira Mealybug (Phenacoccus madeiresis)	Coleus, Flamenettle (Coleus sp.) 'King Salmon Pink'	Greenhouse	Ludwig	TX	2011	Foliar	Significantly reduced number of nymphs with 6.7 oz per 100 gal applied twice.
30487	A16901B 45WG (Cyantraniliprole + thiamethoxam)	Madeira Mealybug (Phenacoccus madeiresis)	French marigold (Tagetes patula) 'Yellow Boy'	Greenhouse	Davis	MI	2010	Drench	About 60-80 % control with 10 oz per 100 gal applied once.
30487	A16901B 45WG (Cyantraniliprole + thiamethoxam)	Madeira Mealybug (Phenacoccus madeiresis)	French marigold (Tagetes patula) 'Yellow Boy'	Greenhouse	Davis	MI	2011	Drench	About 53-89 % control with 10 oz per 100 gal applied once.
30487	A16901B 45WG (Cyantraniliprole + thiamethoxam)	Madeira Mealybug (Phenacoccus madeiresis)	French marigold (Tagetes patula) 'Yellow Boy'	Greenhouse	Davis	MI	2011	Foliar	About 78-97 % control of a high infestation with 6.7 oz per 100 gal applied twice.
30289	A16901B 45WG (Cyantraniliprole + thiamethoxam)	Citrus Mealybug (Planococcus citri)	Rose (Rosa sp.) 'Akita'	Greenhouse	Parrella	CA	2011	Drench	Experiment 1: Good control of a very high infestation with 10 oz per 100 gal; comparable to Talstar.
30289	A16901B 45WG (Cyantraniliprole + thiamethoxam)	Citrus Mealybug (Planococcus citri)	Rose (Rosa sp.) 'Akita'	Greenhouse	Parrella	CA	2011	Foliar	Experiment 1: Excellent control of a very high infestation with 6.7 oz per 100 gal applied twice; best treatment, better than Talstar applied once.
31347	A16901B 45WG (Cyantraniliprole + thiamethoxam)	Rhizoecus hibisci (Rhizoecus hibisci)	Parapara or Birdcatcher tree (Pisonia brunoniana)	Field Container	Hara	HI	2012	Drench	Significantly reduced adults and nymphs with 10 oz per 100 gal applied once; better than Orthene.
29369	Acelepryn (aka DPX-E2Y45) 1.67 (Chlorantraniliprole)	Rhizoecus hibisci (Rhizoecus hibisci)	Rhapis robusta (Rhapis robusta)	Greenhouse	Hara	HI	2009	Drench	Poor control of rhizoecus root and pineapple mealybugs at 0.8 fl oz per 100 gal.
24898	Aria 50SG (Flonicamid)	Mexican Mealybug (Phenacoccus gossypii)	Marigold (Tagetes sp.) 'Queen Sophia'	Greenhouse	Davis	MI	2005	Foliar	Excellent efficacy at 60 g and 120 g per 100 gal
25083	Aria 50SG (Flonicamid)	Citrus Mealybug (Planococcus citri)	Coleus, Flamenettle (Coleus sp.)	Greenhouse	Parrella	CA	2005	Foliar	Experiment 2: Good control at 60 and 120 g per 100 gal + Silwet; better than Marathon.
25083	Aria 50SG (Flonicamid)	Citrus Mealybug (Planococcus citri)	Coleus, Flamenettle (Coleus sp.) 'Kong Scarlet'	Greenhouse	Oetting	GA	2005	foliar	Excellent efficacy at 120 g per 100 gal

PR#	Product (Active Ingredients)	Target	Crop	Production Site	Researcher	State	Year	Application Type	Results
28059	Aria 50SG (Flonicamid)	Citrus Mealybug (Planococcus citri)	Zinnia (Zinnia sp.) 'Sunny Time'	Greenhouse	Parrella	CA	2008	Foliar	No significant control at 2.1. good to excellent control at 4.3 oz per 100 gal.
29370	Aria 50SG (Flonicamid)	Rhizoecus hibisci (Rhizoecus hibisci)	Rhapis robusta (Rhapis robusta)	Greenhouse	Hara	HI	2009	Drench	Good control of rhizoecus root and pineapple mealybugs at 120 g per 100 gal.
29619	Distance (Pyriproxyfen)	Madeira Mealybug (Phenacoccus madeiresis)	Coleus, Flamenettle (Coleus sp.) 'King Salmon Pink'	Greenhouse	Ludwig	TX	2011	Foliar	Significantly reduced number of nymphs with 12 fl oz per 100 gal applied twice.
30486	Distance (Pyriproxyfen)	Madeira Mealybug (Phenacoccus madeiresis)	French marigold (Tagetes patula) 'Yellow Boy'	Greenhouse	Davis	MI	2010	Foliar	About 77-86 % control with 12 oz per 100 gal applied twice.
29844	Distance (Pyriproxyfen)	Citrus Mealybug (Planococcus citri)	Coleus, Flamenettle (Coleus sp.)	Greenhouse	Ludwig	TX	2004	Foliar	Great control at 17 DAT with 16 and 32 oz per 100 gal and by 28 DAT the 8 oz rate also provided good control.
29844	Distance (Pyriproxyfen)	Citrus Mealybug (Planococcus citri)	Coleus, Flamenettle (Coleus sp.)	Greenhouse	Ludwig	TX	2004	Foliar	Poor efficacy using 8 and 16 oz per 100 gal, but excellent at 32 oz per 100 gal starting at 21 DAT.
30290	Distance (Pyriproxyfen)	Citrus Mealybug (Planococcus citri)	Rose (Rosa sp.) 'Akita'	Greenhouse	Parrella	CA	2011	Foliar	Experiment 2: Poor control of a very high infestation with 12 fl oz per 100 gal applied twice; inferior to Talstar applied once.
29620	Flagship 0.22G (Thiamethoxam)	Madeira Mealybug (Phenacoccus madeiresis)	Coleus, Flamenettle (Coleus sp.) 'King Salmon Pink'	Greenhouse	Ludwig	TX	2011	Broadcast media surface	No significant reduction of nymphs with 6 g per pot applied once.
30488	Flagship 0.22G (Thiamethoxam)	Madeira Mealybug (Phenacoccus madeiresis)	French marigold (Tagetes patula) 'Yellow Boy'	Greenhouse	Davis	MI	2010	Broadcast to media surface	About 60-80 % control with 6 g per 6" pot applied once.
30488	Flagship 0.22G (Thiamethoxam)	Madeira Mealybug (Phenacoccus madeiresis)	French marigold (Tagetes patula) 'Yellow Boy'	Greenhouse	Davis	MI	2011	Broadcast to media surface	About 51-91 % control of a high infestation with 6 g per 6" pot applied once;some tip burn on foliage a week after application.
25135	Flagship 25WG (Thiamethoxam)	Phormium Mealybug (Balanococcus diminutus)	New Zealand Flax (Phormium sp.) 'Dazler'	Field Container	Bethke	CA	2005	Foliar	Good to great control from 8 DAT to 43 DAT
24897	Flagship 25WG (Thiamethoxam)	Mexican Mealybug (Phenacoccus gossypii)	Marigold (Tagetes sp.) 'Queen Sophia'	Greenhouse	Davis	MI	2005	Foliar	Good to excellent efficacy by 17 DAT
25067	Flagship 25WG (Thiamethoxam)	Madeira Mealybug (Phenacoccus madeiresis)	Coleus, Flamenettle (Coleus sp.) 'King Salmon Pink'	Greenhouse	Ludwig	TX	2011	Foliar	Good control of nymphs with 8 oz per 100 gal applied twice.

PR#	Product (Active Ingredients)	Target	Crop	Production Site	Researcher	State	Year	Application Type	Results
30489	Flagship 25WG (Thiamethoxam)	Madeira Mealybug (Phenacoccus madeiresis)	French marigold (Tagetes patula) 'Yellow Boy'	Greenhouse	Davis	MI	2010	Drench	About 45 % control with 8 oz per 100 gal applied once.
30489	Flagship 25WG (Thiamethoxam)	Madeira Mealybug (Phenacoccus madeiresis)	French marigold (Tagetes patula) 'Yellow Boy'	Greenhouse	Davis	MI	2011	Drench	About 44-92% control with 8 oz per 100 gal applied once.
30489	Flagship 25WG (Thiamethoxam)	Madeira Mealybug (Phenacoccus madeiresis)	French marigold (Tagetes patula) 'Yellow Boy'	Greenhouse	Davis	MI	2011	Foliar	About 84-100 % control of a high infestation with 8 oz per 100 gal + Dynamic applied twice.
25084	Flagship 25WG (Thiamethoxam)	Citrus Mealybug (Planococcus citri)	Coleus, Flamenettle (Coleus sp.)	Greenhouse	Ludwig	TX	2004	Foliar	Excellent efficacy at 2, 4, and 8 oz per 100 gal starting at 21 DAT.
25084	Flagship 25WG (Thiamethoxam)	Citrus Mealybug (Planococcus citri)	Coleus, Flamenettle (Coleus sp.)	Greenhouse	Ludwig	TX	2004	Foliar	Good to excellent control starting at 17 DAT (2, 4, 8 oz per 100 gal).
25084	Flagship 25WG (Thiamethoxam)	Citrus Mealybug (Planococcus citri)	Coleus, Flamenettle (Coleus sp.)	Greenhouse	Parrella	CA	2005	Foliar	Experiment 2: Excellent control at 2 and 4 oz per 100 gal + Silwet; better than Marathon.
25084	Flagship 25WG (Thiamethoxam)	Citrus Mealybug (Planococcus citri)	Coleus, Flamenettle (Coleus sp.) 'Wizard Jade'	Greenhouse	Oetting	GA	2005	Foliar	Good to excellent efficacy at both 2 oz and 4 oz per 100 gal from 3 weeks after treatment
28058	Flagship 25WG (Thiamethoxam)	Citrus Mealybug (Planococcus citri)	Zinnia (Zinnia sp.) 'Sunny Time'	Greenhouse	Parrella	CA	2008	Foliar	Good to excellent control at 2 and 4 oz per 100 gal.
30277	Grandevo (MBI 203 DF) (Chromobacterium subtsugae NRRL B-30655)	Madeira Mealybug (Phenacoccus madeiresis)	Coleus, Flamenettle (Coleus sp.) 'King Salmon Pink'	Greenhouse	Ludwig	TX	2011	Foliar	No significant reduction of nymphs with 2 gal per 100 gal applied twice.
30287	Grandevo (MBI 203 DF) (Chromobacterium subtsugae NRRL B-30655)	Citrus Mealybug (Planococcus citri)	Rose (Rosa sp.) 'Akita'	Greenhouse	Parrella	CA	2011	Foliar	Experiment 2: Poor control of a very high infestation with 2 gal per 100 gal applied twice; inferior to Talstar applied once.
31350	Grandevo (MBI 203 DF) (Chromobacterium subtsugae NRRL B-30655)	Rhizoecus hibisci (Rhizoecus hibisci)	Parapara or Birdcatcher tree (Pisonia brunoniana)	Field Container	Hara	HI	2012	Drench	Significantly reduced adults and nymphs with 2 qt per 100 gal applied twice; better than Orthene.
30495	Hachi-Hachi EC (Tolfenpyrad)	Madeira Mealybug (Phenacoccus madeiresis)	Coleus, Flamenettle (Coleus sp.) 'King Salmon Pink'	Greenhouse	Ludwig	TX	2011	Foliar	Good control of nymphs with 32 fl oz per 100 gal applied twice.

PR#	Product (Active Ingredients)	Target	Crop	Production Site	Researcher	State	Year	Application Type	Results
31421	Horticultural Oil (Horticultural Oil)	Madeira Mealybug (Phenacoccus madeiresis)	French marigold (Tagetes patula) 'Yellow Boy'	Greenhouse	Davis	MI	2011	Foliar	About 81-100 % control of a high infestation with 2% solution applied twice; slight leaf burn a few days after applications.
29621	Kontos (BYI 8330 240SC) (Spirotetramat)	Madeira Mealybug (Phenacoccus madeiresis)	Coleus, Flamenettle (Coleus sp.) 'King Salmon Pink'	Greenhouse	Ludwig	TX	2011	Drench	Significantly reduced number of nymphs with 3.4 fl oz per 100 gal applied once.
29621	Kontos (BYI 8330 240SC) (Spirotetramat)	Madeira Mealybug (Phenacoccus madeiresis)	Coleus, Flamenettle (Coleus sp.) 'King Salmon Pink'	Greenhouse	Ludwig	TX	2011	Foliar	Significantly reduced number of nymphs with 3.4 fl oz per 100 gal applied once.
30492	Kontos (BYI 8330 240SC) (Spirotetramat)	Madeira Mealybug (Phenacoccus madeiresis)	French marigold (Tagetes patula) 'Yellow Boy'	Greenhouse	Davis	MI	2010	Drench	About 45 % control with 3.4 fl oz per 100 gal applied once.
30291	Kontos (BYI 8330 240SC) (Spirotetramat)	Citrus Mealybug (Planococcus citri)	Rose (Rosa sp.) 'Akita'	Greenhouse	Parrella	CA	2011	Drench	Experiment 1: Good initial control through 3 WAT, then poor control of a very high infestation with 3.4 oz per 100 gal; inferior to Talstar.
30291	Kontos (BYI 8330 240SC) (Spirotetramat)	Citrus Mealybug (Planococcus citri)	Rose (Rosa sp.) 'Akita'	Greenhouse	Parrella	CA	2011	Foliar	Experiment 1: Good initial control through 3 WAT then mediocre control of a very high infestation with 3.4 oz per 100 gal applied once; inferior to Talstar.
31348	Kontos (BYI 8330 240SC) (Spirotetramat)	Rhizoecus hibisci (Rhizoecus hibisci)	Parapara or Birdcatcher tree (Pisonia brunoniana)	Field Container	Hara	HI	2012	Drench	Significantly reduced adults and nymphs with 3.4 fl oz per 100 gal applied twice; better than Orthene.
31348	Kontos (BYI 8330 240SC) (Spirotetramat)	Rhizoecus hibisci (Rhizoecus hibisci)	Parapara or Birdcatcher tree (Pisonia brunoniana)	Field Container	Hara	HI	2012	Foliar	Significantly reduced adults and nymphs with 3.4 fl oz per 100 gal applied twice; better than Orthene.
29364	Kontos (BYI 8330 240SC) (Spirotetramat)	Rhizoecus hibisci (Rhizoecus hibisci)	Rhapis robusta (Rhapis robusta)	Greenhouse	Hara	HI	2009	Drench	Virtually 100 % control of rhizoecus root and pineapple mealybugs at 3.4 fl oz per 100 gal.
29364	Kontos (BYI 8330 240SC) (Spirotetramat)	Rhizoecus hibisci (Rhizoecus hibisci)	Rhapis robusta (Rhapis robusta)	Greenhouse	Hara	HI	2009	Foliar	Good control of rhizoecus root and pineapple mealybugs at 3.4 fl oz per 100 gal + Silwet applied twice.
26477	Marathon II (Imidacloprid)	Citrus Mealybug (Planococcus citri)	Coleus, Flamenettle (Coleus sp.)	Greenhouse	Parrella	CA	2005	Foliar	Experiment 1: Fair control at 1.7 oz per 100 gal.
26477	Marathon II (Imidacloprid)	Citrus Mealybug (Planococcus citri)	Coleus, Flamenettle (Coleus sp.)	Greenhouse	Parrella	CA	2005	Foliar	Experiment 2: Poor control at 1.7 oz per 100 gal.
30278	MBI 205 (MBI205)	Madeira Mealybug (Phenacoccus madeiresis)	Coleus, Flamenettle (Coleus sp.) 'King Salmon Pink'	Greenhouse	Ludwig	TX	2011	Foliar	Significantly reduced number of nymphs with 3 gal per 100 gal applied twice.

PR#	Product (Active Ingredients)	Target	Crop	Production Site	Researcher	State	Year	Application Type	Results
30288	MBI 205 (MBI205)	Citrus Mealybug (Planococcus citri)	Rose (Rosa sp.) 'Akita'	Greenhouse	Parrella	CA	2011	Foliar	Experiment 2: Poor control initally of a very high infestation with 3 gal per 100 gal applied twice; inferior to Talstar applied once; however 3 WAT good control was achieved.
31351	MBI 205 (MBI205)	Rhizoecus hibisci (Rhizoecus hibisci)	Parapara or Birdcatcher tree (Pisonia brunoniana)	Field Container	Hara	HI	2012	Drench	Significantly reduced adults and nymphs with 4 qt per 100 gal applied twice; better than Orthene.
30493	Merit 75WP (Imidacloprid)	Madeira Mealybug (Phenacoccus madeiresis)	French marigold (Tagetes patula) 'Yellow Boy'	Greenhouse	Davis	MI	2010	Drench	No significant reduction with 20 g per 1250 pots applied once.
29761	Mesurol 75-W (Methicarb)	Citrus Mealybug (Planococcus citri)	Zinnia (Zinnia sp.) 'Sunny Time'	Greenhouse	Parrella	CA	2008	Foliar	Fair to good control at 0.5 lb per 100 gal.
29760	Natural Solutions - V. lecanii (Verticillium lecanii)	Citrus Mealybug (Planococcus citri)	Zinnia (Zinnia sp.) 'Sunny Time'	Greenhouse	Parrella	CA	2008	Foliar	Good initial control at 1:1000 dilution; comparable to registered products but may have shorter residual activity.
25450	Orthene TTO 97 (Valent) (Acephate)	Mexican Mealybug (Phenacoccus gossypii)	Marigold (Tagetes sp.) 'Queen Sophia'	Greenhouse	Davis	MI	2005	Foliar	Excellent efficacy with 1 lb per 100 gal.
26035	Orthene TTO 97 (Valent) (Acephate)	Madeira Mealybug (Phenacoccus madeiresis)	Coleus, Flamenettle (Coleus sp.) 'Kong Scarlet'	Greenhouse	Oetting	GA	2005	Foliar	Excellent efficacy with 10.5 oz per 100 gal.
30482	Orthene TTO 97 (Valent) (Acephate)	Madeira Mealybug (Phenacoccus madeiresis)	French marigold (Tagetes patula) 'Yellow Boy'	Greenhouse	Davis	MI	2010	Foliar	About 99 % control with 8 oz per 100 gal applied twice; best treatment.
30482	Orthene TTO 97 (Valent) (Acephate)	Madeira Mealybug (Phenacoccus madeiresis)	French marigold (Tagetes patula) 'Yellow Boy'	Greenhouse	Davis	MI	2011	Foliar	About 97-100 % control of a high infestation with 8 oz per 100 gal applied twice.
31349	Orthene TTO 97 (Valent) (Acephate)	Rhizoecus hibisci (Rhizoecus hibisci)	Parapara or Birdcatcher tree (Pisonia brunoniana)	Field Container	Hara	HI	2012	Drench	No significant reduction of adults and nymphs with 0.67 lb per 100 gal applied once.
25832	Precise Acephate (Acephate)	Phormium Mealybug (Balanococcus diminutus)	New Zealand Flax (Phormium sp.) 'Dazler'	Field Container	Bethke	CA	2005		50% control 4 and 6 WAT
25068	QRD 400 (Extract of Chenopodium ambrosioides)	Madeira Mealybug (Phenacoccus madeiresis)	Coleus, Flamenettle (Coleus sp.) 'Kong Scarlet'	Greenhouse	Oetting	GA	2005	Foliar	At 0.5% rate good efficacy, but not as good as standards
25085	QRD 400 (Extract of Chenopodium ambrosioides)	Citrus Mealybug (Planococcus citri)	Coleus, Flamenettle (Coleus sp.)	Greenhouse	Parrella	CA	2005	Foliar	Experiment 2: No control at 4 oz per 100 gal.

PR#	Product (Active Ingredients)	Target	Crop	Production Site	Researcher	State	Year	Application Type	Results
25085	QRD 400 (Extract of Chenopodium ambrosioides)	Citrus Mealybug (Planococcus citri)	Coleus, Flamenettle (Coleus sp.) 'Wizard Jade'	Greenhouse	Oetting	GA	2005	Foliar	Mediocre efficacy at both 0.25% and 0.5% rates
29622	Rycar (SP3009/NNI-0101) (Pyrifluquinazon)	Madeira Mealybug (Phenacoccus madeiresis)	Coleus, Flamenettle (Coleus sp.) 'King Salmon Pink'	Greenhouse	Ludwig	TX	2011	Foliar	Excellent control of nymphs with 18 fl oz per 100 gal applied twice.
30485	Rycar (SP3009/NNI-0101) (Pyrifluquinazon)	Madeira Mealybug (Phenacoccus madeiresis)	French marigold (Tagetes patula) 'Yellow Boy'	Greenhouse	Davis	MI	2010	Foliar	About 74-82 % control with 18 fl oz per 100 gal applied twice.
30292	Rycar (SP3009/NNI-0101) (Pyrifluquinazon)	Citrus Mealybug (Planococcus citri)	Rose (Rosa sp.) 'Akita'	Greenhouse	Parrella	CA	2011	Foliar	Experiment 1: Excellent control of a very high infestation with 8.6 fl oz per 100 gal applied twice; comparable to Talstar applied once.
25138	Safari 20SG (Dinotefuran)	Phormium Mealybug (Balanococcus diminutus)	New Zealand Flax (Phormium sp.)	Field Container	Bethke	CA	2005	Drench	Provided excellent control at 4 and 6 weeks after treatment
25138	Safari 20SG (Dinotefuran)	Phormium Mealybug (Balanococcus diminutus)	New Zealand Flax (Phormium sp.)	Field Container	Bethke	CA	2005	Foliar	Provided excellent control at 4 and 6 weeks after treatment
25137	Safari 20SG (Dinotefuran)	Mexican Mealybug (Phenacoccus gossypii)	Marigold (Tagetes sp.) 'Queen Sophia'	Greenhouse	Davis	MI	2005	Drench	Excellent efficacy by 17 DAT with foliar, by 25 DAT with drench applications
25065	Safari 20SG (Dinotefuran)	Madeira Mealybug (Phenacoccus madeiresis)	Coleus, Flamenettle (Coleus sp.) 'King Salmon Pink'	Greenhouse	Ludwig	TX	2011	Drench	Excellent control of nymphs with 24 oz per 100 gal applied once.
25065	Safari 20SG (Dinotefuran)	Madeira Mealybug (Phenacoccus madeiresis)	Coleus, Flamenettle (Coleus sp.) 'Kong Scarlet'	Greenhouse	Oetting	GA	2005	Foliar	With and without Capsil, provided good efficacy
30490	Safari 20SG (Dinotefuran)	Madeira Mealybug (Phenacoccus madeiresis)	French marigold (Tagetes patula) 'Yellow Boy'	Greenhouse	Davis	MI	2010	Drench	About 60-80 % control with 24 oz per 100 gal applied once.
25071	Safari 20SG (Dinotefuran)	Citrus Mealybug (Planococcus citri)	Coleus, Flamenettle (Coleus sp.)	Greenhouse	Ludwig	TX	2004	Drench	Excellent control starting at 17 DAT (12, 24, and 48 oz per 100 gal).
25071	Safari 20SG (Dinotefuran)	Citrus Mealybug (Planococcus citri)	Coleus, Flamenettle (Coleus sp.)	Greenhouse	Ludwig	TX	2004	Drench	Excellent efficacy at 12, 24, and 48 oz per 100 gal starting at 21 DAT.
25071	Safari 20SG (Dinotefuran)	Citrus Mealybug (Planococcus citri)	Coleus, Flamenettle (Coleus sp.)	Greenhouse	Parrella	CA	2005	Drench	Experiment 1: Poor control at 12 and 24 oz per 100 gal.
25071	Safari 20SG (Dinotefuran)	Citrus Mealybug (Planococcus citri)	Coleus, Flamenettle (Coleus sp.)	Greenhouse	Parrella	CA	2005	Foliar	Experiment 1: Good control at 4 and 8 oz per 100 gal + Silwet; better than Marathon.

PR#	Product (Active Ingredients)	Target	Crop	Production Site	Researcher	State	Year	Application Type	Results
25071	Safari 20SG (Dinotefuran)	Citrus Mealybug (Planococcus citri)	Coleus, Flamenettle (Coleus sp.) 'Wizard King'	Greenhouse	Oetting	GA	2005	Foliar	Safari drenches provided better control (mostly >95% throughout experiment) than foliar sprays (between 43 and 85% control)
30295	Safari 20SG (Dinotefuran)	Citrus Mealybug (Planococcus citri)	Rose (Rosa sp.) 'Akita'	Greenhouse	Parrella	CA	2011	Drench	Experiment 1: Good control of a very high infestation with 24 oz per 100 gal; comparable to Talstar.
28055	Safari 20SG (Dinotefuran)	Citrus Mealybug (Planococcus citri)	Zinnia (Zinnia sp.) 'Sunny Time'	Greenhouse	Parrella	CA	2008	Drench	Good to excellent control at 12 and 24 oz per 100 gal.
28055	Safari 20SG (Dinotefuran)	Citrus Mealybug (Planococcus citri)	Zinnia (Zinnia sp.) 'Sunny Time'	Greenhouse	Parrella	CA	2008	Foliar	Excellent control at 0.2 and 0.4 oz per 100 gal.
31352	Safari 20SG (Dinotefuran)	Rhizoecus hibisci (Rhizoecus hibisci)	Parapara or Birdcatcher tree (Pisonia brunoniana)	Field Container	Hara	HI	2012	Foliar	Significantly reduced adults and nymphs with 24 oz per 100 gal applied once; better than Orthene.
29367	Safari 20SG (Dinotefuran)	Rhizoecus hibisci (Rhizoecus hibisci)	Rhapis robusta (Rhapis robusta)	Greenhouse	Hara	HI	2009	Drench	100 % control of rhizoecus root and pineapple mealybugs at 6 g per ft plant height.
29623	Safari 2G (V-10112 2G) (Dinotefuran)	Madeira Mealybug (Phenacoccus madeiresis)	Coleus, Flamenettle (Coleus sp.) 'King Salmon Pink'	Greenhouse	Ludwig	TX	2011	Broadcast media surface	Excellent control of nymphs with 2.6 g per gal potting media applied once.
30491	Safari 2G (V-10112 2G) (Dinotefuran)	Madeira Mealybug (Phenacoccus madeiresis)	French marigold (Tagetes patula) 'Yellow Boy'	Greenhouse	Davis	MI	2010	Broadcast media surface	About 60-80 % control with 2.6 g per gal media applied once.
30494	SuffOil X (Synergy) (Petroleum Oil)	Madeira Mealybug (Phenacoccus madeiresis)	Coleus, Flamenettle (Coleus sp.) 'King Salmon Pink'	Greenhouse	Ludwig	TX	2011	Foliar	Excellent control of nymphs with 2 gal per 100 gal applied twice.
30294	Talstar NF (Bifenthrin)	Citrus Mealybug (Planococcus citri)	Rose (Rosa sp.) 'Akita'	Greenhouse	Parrella	CA	2011	Foliar	Experiment 1: Good control of a very high infestation with 20 oz per 100 gal.
30294	Talstar NF (Bifenthrin)	Citrus Mealybug (Planococcus citri)	Rose (Rosa sp.) 'Akita'	Greenhouse	Parrella	CA	2011	Foliar	Experiment 2:Good initial control through 3 WAT; by 2 MAT poor control of a very high infestation with 20 oz per 100 gal.
25142	Talus 40SC (Buprofezin)	Mexican Mealybug (Phenacoccus gossypii)	Marigold (Tagetes sp.) 'Queen Sophia'	Greenhouse	Davis	MI	2005	Foliar	Excellent efficacy by 25 DAT
25064	Talus 40SC (Buprofezin)	Madeira Mealybug (Phenacoccus madeiresis)	Coleus, Flamenettle (Coleus sp.) 'King Scarlet'	Greenhouse	Oetting	GA	2005	Foliar	Both 21.5 an 43 oz per 100 gal provided excellent control
25070	Talus 40SC (Buprofezin)	Citrus Mealybug (Planococcus citri)	Coleus, Flamenettle (Coleus sp.)	Greenhouse	Ludwig	TX	2004	Foliar	Great efficacy starting at 21 DAT with 21.5, 43, and 86 fl oz per 100 gal.

PR#	Product (Active Ingredients)	Target	Crop	Production Site	Researcher	State	Year	Application Type	Results
25070	Talus 40SC (Buprofezin)	Citrus Mealybug (Planococcus citri)	Coleus, Flamenettle (Coleus sp.)	Greenhouse	Ludwig	TX	2004	Foliar	Great to excellent control starting at 17 DAT (21.5, 43, and 86 fl oz per 100 gal).
25070	Talus 40SC (Buprofezin)	Citrus Mealybug (Planococcus citri)	Coleus, Flamenettle (Coleus sp.)	Greenhouse	Parrella	CA	2005	Foliar	Experiment 2: Good control at 18 oz per 100 gal + Silwet; better than Marathon.
25070	Talus 40SC (Buprofezin)	Citrus Mealybug (Planococcus citri)	Coleus, Flamenettle (Coleus sp.) 'Jade Wizard'	Greenhouse	Oetting	GA	2005	Foliar	Excellent efficacy from 4 weeks on until the end of the experiment
28056	Talus 40SC (Buprofezin)	Citrus Mealybug (Planococcus citri)	Zinnia (Zinnia sp.) 'Sunny Time'	Greenhouse	Parrella	CA	2008	Foliar	Good to excellent control at 12 oz per 100 gal.
29759	Talus 70DF (Buprofezin)	Madeira Mealybug (Phenacoccus madeiresis)	Coleus, Flamenettle (Coleus sp.) 'King Salmon Pink'	Greenhouse	Ludwig	TX	2011	Foliar	Excellent control of nymphs with 12 oz per 100 gal applied twice.
30483	Talus 70DF (Buprofezin)	Madeira Mealybug (Phenacoccus madeiresis)	French marigold (Tagetes patula) 'Yellow Boy'	Greenhouse	Davis	MI	2010	Foliar	About 95-98 % control with 14 oz per 100 gal applied twice.
30293	Talus 70DF (Buprofezin)	Citrus Mealybug (Planococcus citri)	Rose (Rosa sp.) 'Akita'	Greenhouse	Parrella	CA	2011	Foliar	Experiment 2: Good control of a very high infestation by 3 WAT with 12 oz per 100 gal applied once; this was only treatment to persist with good efficacy at 2 MAT.
25205	TriStar 30SG (Acetamiprid)	Mexican Mealybug (Phenacoccus gossypii)	Marigold (Tagetes sp.) 'Queen Sophia'	Greenhouse	Davis	MI	2005	Foliar	Excellent efficacy by 25 DAT
30484	TriStar 30SG (Acetamiprid)	Madeira Mealybug (Phenacoccus madeiresis)	French marigold (Tagetes patula) 'Yellow Boy'	Greenhouse	Davis	MI	2010	Foliar	About 90-92 % control with 8 oz per 100 gal applied twice.
28057	TriStar 30SG (Acetamiprid)	Citrus Mealybug (Planococcus citri)	Zinnia (Zinnia sp.) 'Sunny Time'	Greenhouse	Parrella	CA	2008	Foliar	Excellent control at 2.7 and 5.3 oz per 100 gal.
25081	TriStar 70WSP (Acetamiprid)	Phormium Mealybug (Balanococcus diminutus)	New Zealand Flax (Phormium sp.)	Field Container	Bethke	CA	2005		Good to excellent control throughout this experiment
25063	TriStar 70WSP (Acetamiprid)	Madeira Mealybug (Phenacoccus madeiresis)	Coleus, Flamenettle (Coleus sp.) 'Kong Scarlet'	Greenhouse	Oetting	GA	2005	Foliar	Without Capsil poor efficacy; with Capsil provided great efficacy
25069	TriStar 70WSP (Acetamiprid)	Citrus Mealybug (Planococcus citri)	Coleus, Flamenettle (Coleus sp.)	Greenhouse	Ludwig	TX	2004	Foliar	Excellenct control starting at 17 DAT (32, 64, 128 g per 100 gal).
25069	TriStar 70WSP (Acetamiprid)	Citrus Mealybug (Planococcus citri)	Coleus, Flamenettle (Coleus sp.)	Greenhouse	Ludwig	TX	2004	Foliar	Excellent efficacy using 32, 64, and 128 g per 100 gal starting at 21 DAT.

PR#	Product (Active Ingredients)	Target	Crop	Production Site	Researcher	State	Year	Application Type	Results
25069	TriStar 70WSP (Acetamiprid)	Citrus Mealybug (Planococcus citri)	Coleus, Flamenettle (Coleus sp.)	Greenhouse	Parrella	CA	2005	Foliar	Experiment 1: Excellent control at 1.7 and 3.4 oz per 100 gal + Silwet; better than Marathon.
25069	TriStar 70WSP (Acetamiprid)	Citrus Mealybug (Planococcus citri)	Coleus, Flamenettle (Coleus sp.) 'Jade Wizard'	Greenhouse	Oetting	GA	2005	Foliar	Excellent efficacy

Label Suggestions

Based upon data contained within this summary, we suggest that Syngenta consider adding tea scale (*Fiorinia theae*) to the Mainspring label. Similarly, we suggest that Dow consider adding this pest to the XXpire label.

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