Project Name: Scale Efficacy

<table>
<thead>
<tr>
<th>New</th>
<th>Ongoing</th>
<th>Completed</th>
<th>Duration if ongoing or completed:</th>
<th>2004 - 2015</th>
</tr>
</thead>
</table>

Project Description:

During the 2003 IR-4 Ornamental Horticulture Workshop certain studies were designated “Super A” to start devoting time and resources to groups of studies with the same general goal. Researching new and existing pest management tools for scale insects was one set. This concept then morphed into high priority projects. Scale insects, especially armored scale, present difficulties for growers and landscape managers. While there are several tools in different classes, product efficacy is often unknown for many species of new ornamental horticulture crops. Screening for mealybug efficacy initially occurred in 2004 and continued through 2012.

Research Project Abstract (if available):

Abstract from 2017 Scale & Mealybug Efficacy Summary

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/Transsect 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.

Target Species (Phytotoxicity, or common and Latin name of arthropod, pathogen, weed):

<table>
<thead>
<tr>
<th>Scale Efficacy</th>
<th>Target Species</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calico Scale</td>
<td>Ceroplastes floridensis</td>
</tr>
<tr>
<td>Cottone Cushion Scale</td>
<td>Melanaspis tenebricosa</td>
</tr>
<tr>
<td>Cottny Maple Scale</td>
<td>Melanaspis cornuparvum</td>
</tr>
<tr>
<td>Elongate Hemlock (Fiorinia externa) and Cryptomera Scales</td>
<td>Melanaspis ostreiformis</td>
</tr>
<tr>
<td>Euonymus Scale</td>
<td>Diaspidiotus ostreiformis</td>
</tr>
<tr>
<td>False Florida Red Scale</td>
<td>Phenacaspis pinifoliae</td>
</tr>
<tr>
<td>False Oleander Scale</td>
<td>Lepidosaphes theae</td>
</tr>
<tr>
<td>Fletcher Scale</td>
<td>Pseudaulacaspis cockerellii</td>
</tr>
<tr>
<td>Florida Red Scale</td>
<td>Melanaspis deklei</td>
</tr>
</tbody>
</table>
| Florida Wax Scale | Lepidosaphes yanagica
### Target Crops (list tested crops if ongoing or completed project)

<table>
<thead>
<tr>
<th>Crop Description</th>
<th>Scientific Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aucuba</td>
<td><em>Aucuba sp.</em></td>
</tr>
<tr>
<td>Camellia, Japanese</td>
<td><em>Camellia japonica</em></td>
</tr>
<tr>
<td>Euonymus sp.</td>
<td></td>
</tr>
<tr>
<td>Fir, Fraser</td>
<td><em>Abies fraseri</em></td>
</tr>
<tr>
<td>Heavenly Bamboo</td>
<td><em>Nandina domestica</em></td>
</tr>
<tr>
<td>Holly</td>
<td><em>Ilex sp.</em></td>
</tr>
<tr>
<td>Holly, Blue</td>
<td><em>Ilex x meserveae</em></td>
</tr>
<tr>
<td>Holly, Chinese</td>
<td><em>Ilex cornuta</em></td>
</tr>
<tr>
<td>Honey Locust</td>
<td><em>Gleditsia triacanthos inermis</em></td>
</tr>
<tr>
<td>Indian Hawthorn</td>
<td><em>Raphiolepis indica</em></td>
</tr>
<tr>
<td>Japanese Aralia</td>
<td><em>Fatsia japonica</em></td>
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<tr>
<td>Japanese Zelkova</td>
<td><em>Zelkova serrata</em></td>
</tr>
<tr>
<td>Lilac, Common</td>
<td><em>Syringa vulgaris</em></td>
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<tr>
<td>Magnolia, Southern</td>
<td><em>Magnolia grandiflora</em></td>
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<tr>
<td>Maple, Red</td>
<td><em>Acer rubrum</em></td>
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<tr>
<td>Maple, Silver</td>
<td><em>Acer saccharinum</em></td>
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<tr>
<td>Pittospora</td>
<td><em>Pittosporum tobira</em></td>
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<tr>
<td>Purpleleaf Winter creeper</td>
<td><em>Euonymus radicans</em></td>
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<tr>
<td>Silverbell Carolina</td>
<td><em>Halesia carolina var. carolina</em></td>
</tr>
<tr>
<td>Spindle Tree</td>
<td><em>Euonymus japonicus</em></td>
</tr>
<tr>
<td>Ternstroemia gymnanthera</td>
<td></td>
</tr>
<tr>
<td>Wax Myrtle</td>
<td><em>Myrica cerifera</em></td>
</tr>
<tr>
<td>Winged Burning Bush</td>
<td><em>Euonymus alatus</em></td>
</tr>
<tr>
<td>Yew</td>
<td><em>Taxus media</em></td>
</tr>
</tbody>
</table>

### Target Product(s) (list tested products or numbered compounds if ongoing or completed project)

<table>
<thead>
<tr>
<th>Product</th>
<th>Cycle/Use</th>
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<tbody>
<tr>
<td>A16901B</td>
<td></td>
</tr>
<tr>
<td>Acephate Pro 75WSP</td>
<td></td>
</tr>
<tr>
<td>Aloft SC</td>
<td></td>
</tr>
<tr>
<td>Altus</td>
<td></td>
</tr>
<tr>
<td>Arena 50WDG</td>
<td></td>
</tr>
<tr>
<td>Azaguard</td>
<td></td>
</tr>
<tr>
<td>BAS 440 i</td>
<td></td>
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<tr>
<td>BotaniGard 22WP</td>
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</tr>
<tr>
<td>Celero 16WSG</td>
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</tr>
<tr>
<td>Cyclaniliprole</td>
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</tr>
<tr>
<td>Cygon 2E</td>
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<tr>
<td>Diazinon 4E</td>
<td></td>
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<tr>
<td>Discus</td>
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<tr>
<td>Distance</td>
<td></td>
</tr>
<tr>
<td>Flagship 25WG</td>
<td></td>
</tr>
<tr>
<td>Flagship 0.22G</td>
<td></td>
</tr>
<tr>
<td>GF-2626 1SC</td>
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</tr>
<tr>
<td>Horticultural Oil</td>
<td></td>
</tr>
<tr>
<td>Judo 2SC</td>
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<tr>
<td>Kontos</td>
<td></td>
</tr>
<tr>
<td>Mainspring 200SC</td>
<td></td>
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<tr>
<td>Marathon II</td>
<td></td>
</tr>
<tr>
<td>Merit 2F</td>
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<tr>
<td>MOI 201</td>
<td></td>
</tr>
<tr>
<td>Onyx</td>
<td></td>
</tr>
<tr>
<td>Orthene TTO</td>
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</tr>
<tr>
<td>QRD 452</td>
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<tr>
<td>Rycar</td>
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</tr>
<tr>
<td>Safari 20SG</td>
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<td>Safari 2G</td>
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<tr>
<td>SuffOil X</td>
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<tr>
<td>Sun Spray Ultra-Fine oil</td>
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<tr>
<td>Talstar NF</td>
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<tr>
<td>Talus 40SC</td>
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<tr>
<td>Talus 70DF</td>
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<tr>
<td>Talus WP</td>
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<tr>
<td>Triact</td>
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<tr>
<td>TriStar 30SG</td>
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<td>TriStar 70WSP</td>
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<tr>
<td>Ultra Pure Oil</td>
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<tr>
<td>Xxpire</td>
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</table>

### Product Registration and Research Status

<table>
<thead>
<tr>
<th>Status</th>
<th>Fully Screened (also includes standards)</th>
<th>Partially Screened through IR-4</th>
<th>Need Data for Additional Species?</th>
<th>Labeled for Scale Generally &amp; Commercialized</th>
</tr>
</thead>
<tbody>
<tr>
<td>A16901B</td>
<td>Acephate Pro 75WSP</td>
<td>Cygon 2E</td>
<td>Aria 20SG</td>
<td>Aloft SC</td>
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<td></td>
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<td>Diazinon 4E</td>
<td>Discus</td>
<td>Arena 50WDG</td>
</tr>
<tr>
<td></td>
<td>Flagship 25WG</td>
<td>Orthene TTO</td>
<td>Distance</td>
<td>EcoTrol</td>
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<td>Kontos*</td>
<td>Hachi-Hachi</td>
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<td></td>
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<td>Safari 20SG</td>
<td>M-Pede</td>
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<td></td>
<td>TriStar 30SG</td>
<td>Rycar *</td>
</tr>
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<td>Sun Spray Ultra-Fine oil</td>
<td>Talstar NF</td>
<td>Safari 2G</td>
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<td>Talus 40SC</td>
<td>SuffOil X</td>
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<td>Talus 70DF</td>
<td>Xxpire *</td>
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<td>Ultra Pure Oil</td>
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<tr>
<td>Labeled for Specific Scale &amp; Commercialized</td>
<td>Scimitar CS</td>
<td>Onyx</td>
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<tr>
<td>Labeled for Specific Scale but NOT Commercialized</td>
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<tr>
<td>Not yet registered or labeled for Scale</td>
<td>A16901B</td>
<td>Flagship 0.22G</td>
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<tr>
<td>No longer available for development for Scale</td>
<td>Acelepryn</td>
<td>MOI 201</td>
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<tr>
<td></td>
<td>Celero</td>
<td>QRD 452</td>
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</tr>
<tr>
<td></td>
<td>16WSG</td>
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<tr>
<td></td>
<td>GF-2626 1SC</td>
<td></td>
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<td></td>
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</tbody>
</table>

* IR-4 Data contributed to registration decision – either adding pest to label or not pursuing further research
1 At least one species screened fully
2 Product not available for production ornamentals
<table>
<thead>
<tr>
<th>Area</th>
<th>Characteristic</th>
<th>Pro</th>
<th>Con</th>
</tr>
</thead>
<tbody>
<tr>
<td>Availability &amp; effectiveness of alternative management tools</td>
<td>Very few new tools for screening</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Damage potential of target</td>
<td></td>
<td></td>
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<tr>
<td>Performance and crop safety of proposed products (from other systems)</td>
<td>Need more armored scale data</td>
<td>X</td>
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<tr>
<td></td>
<td>Need more lac scale data</td>
<td></td>
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<tr>
<td>Compatibility with IPM, resistance management programs</td>
<td>Several IRAC classes are available for resistance</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>management</td>
<td></td>
<td></td>
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<tr>
<td>Economics</td>
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<td></td>
</tr>
<tr>
<td>Geographic distribution</td>
<td></td>
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</tr>
<tr>
<td>Manufacturer interest in labeling products</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Other</td>
<td>Successful project with data clearly contributing to</td>
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</tr>
<tr>
<td></td>
<td>expanded labels</td>
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</tr>
<tr>
<td></td>
<td>Some labels are general, some are specific</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Sites can be difficult to locate</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**IR-4 Efficacy Trials to Date**

Average rating on a scale of 1 – 5 with 1 = 0 to about 50% efficacy (not effective) and 5 = 95 to 100 efficacy (very effective); minimum to maximum rating; number of trials (See table on next page). For product/insect combinations that are blank, IR-4 has not screened this combination.

‘Labeled’ indicates that this insect species or genera is listed on the label. A rating of 2 or lower is considered unacceptable efficacy (red text). A rating of 3 or higher is considered commercially acceptable (black text). Non-labeled, completed product/insect combinations (3 or more trials) with an average rating of 3 or higher are highlighted with green text. For insect/product combinations that are blank, IR-4 has not screened this combination.
<table>
<thead>
<tr>
<th>Product (Active Ingredients)</th>
<th>Holly Pit Scale (Asterolecanium puteanum)</th>
<th>Indian Wax Scale (Ceroplastes ceriferus)</th>
<th>Florida Wax Scale (Ceroplastes floridensis)</th>
<th>False Florida Red Scale (Chrysomphalus bifasciculatus)</th>
<th>Florida Red Scale (Chrysomphalus aonidum)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A169018B 45WG (Cyantraniliprole + thiamethoxam)</td>
<td></td>
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<tr>
<td>Acephate Pro 75 WSP (Acephate)</td>
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</tr>
<tr>
<td>Aloft SC (Clothianadin + bifenthrin)</td>
<td></td>
<td></td>
<td></td>
<td>1.0 (1 - 1) n1</td>
<td></td>
</tr>
<tr>
<td>Altus (aka BYI-2960) (Flupyradifurone)</td>
<td></td>
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<tr>
<td>Arena 50WDP (Clothianadin)</td>
<td></td>
<td></td>
<td>5.0 (5 - 5) n1</td>
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<td></td>
</tr>
<tr>
<td>AzaGuard (Azadirachtin)</td>
<td></td>
<td></td>
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<tr>
<td>BAS 440 00I (Afidopyropen)</td>
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</tr>
<tr>
<td>Botanigard 22WP (Beauveria bassiana GHA)</td>
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</tr>
<tr>
<td>Cebalos 16WSG (Clothianidin)</td>
<td></td>
<td>3.7 (3 - 5) n3</td>
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<td>1.0 (1 - 1) n1</td>
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<tr>
<td>Cyclaniliprole (IKI-3106) 50SL (Cyclaniliprole)</td>
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<tr>
<td>Cygon 2E (Dimethoate)</td>
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<td>1.0 (1 - 1) n1</td>
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<tr>
<td>Diazinon 4E (Diazinon)</td>
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</tr>
<tr>
<td>Discus (Imidacloprid + cyfluthrin)</td>
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<tr>
<td>Distance (Pyriproxyfen)</td>
<td>1.0 (1 - 1) n1</td>
<td>4.0 (4 - 4) n1</td>
<td>3.0 (3 - 3) n1</td>
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<tr>
<td>Flagship 0.22G (Thiamethoxam)</td>
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<tr>
<td>Flagship 25WG (Thiamethoxam)</td>
<td>1.0 (1 - 1) n1</td>
<td>3.8 (3 - 5) n5</td>
<td>5.0 (5 - 5) n1</td>
<td></td>
<td>1.0 (1 - 1) n1</td>
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<tr>
<td>GF-2626 1SC (Sulfoxaxiflor)</td>
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<tr>
<td>Horticultural Oil (Horticultural Oil)</td>
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<tr>
<td>Judo 25C (Spiromesifen)</td>
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<tr>
<td>Kontos (BYI 8330 240SC) (Spirotetramat)</td>
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<tr>
<td>Mainspring (A20520A) 200SC (Cyantraniliprole)</td>
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<tr>
<td>Marathon II (Imidacloprid)</td>
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<td></td>
<td>5.0 (5 - 5) n1</td>
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<tr>
<td>MOI 201 (MOI 201)</td>
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<tr>
<td>Orthene TTO 97 (Valent) (Acephate)</td>
<td>1.0 (1 - 1) n1</td>
<td>1.0 (1 - 1) n2</td>
<td>1.0 (1 - 1) n1</td>
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<tr>
<td>QRD 452 (Extract of Chenopodium ambrosioides)</td>
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<tr>
<td>Rycar (SP3009/NNI-0101) (Pyridfluquinazon)</td>
<td>1.0 (1 - 1) n1</td>
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<td>3.0 (3 - 3) n1</td>
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<tr>
<td>Safari 20SG (Dinotefuran)</td>
<td>1.0 (1 - 1) n1</td>
<td>5.0 (5 - 5) n1</td>
<td>5.0 (5 - 5) n1</td>
<td></td>
<td>1.0 (1 - 1) n2</td>
</tr>
</tbody>
</table>

**Labeled** indicates that the product is labeled for use on the specific scale type.
<table>
<thead>
<tr>
<th>Product (Active Ingredients)</th>
<th>Holly Pit Scale (Asterolecanium puteanum)</th>
<th>Indian Wax Scale (Ceroplastes ceriferus)</th>
<th>Florida Wax Scale (Ceroplastes floridensis)</th>
<th>False Florida Red Scale (Chrysomphalus bifasciculatus)</th>
<th>Florida Red Scale (Chrysomphalus aonidum)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safari 2G (V-10112 2G) (Dinofuran)</td>
<td>1.0 (1 - 1) n1 Labeled</td>
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<td>Xxpire (GF-2860) 40WG (Spinetoram + sulfoxaflor)</td>
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Table 2 of 4

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<th>Oystershell Scale (Diaspidiotus ostreiformis)</th>
<th>Calico Scale (Eulecanium cerasorum)</th>
<th>Elongate Hemlock Scale (Fiorinia externa)</th>
<th>Tea Scale (Fiorinia theae)</th>
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<td>5.0 (5 - 5) n1</td>
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**Table 3 of 4**

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<th>Product (Active Ingredients)</th>
<th>Camelia Scale (Lepidosaphes camelliae)</th>
<th>Winged Euonymus Scale (Lepidosaphes yanagicola)</th>
<th>Wax Myrtle Scale (Melanaspis deklei)</th>
<th>Gloomy Scale (Melanaspis tenebricosa)</th>
<th>Magnolia Scale (Neolecanium cornuparvum)</th>
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<td>Product (Active Ingredients)</td>
<td>Cottony maple scale ((\text{Neopulvinaria innumerabilis}))</td>
<td>Fletcher scale ((\text{Parthenolecanium fletcheri}))</td>
<td>Pine Needle Scale ((\text{Phenacaspis pinifoliae}))</td>
<td>False Oleander Scale ((\text{Pseudaulacaspis cockerelli}))</td>
<td>Euonymus Scale (Unaspis euonymi)</td>
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<tr>
<td>A16901B 45WG (Cyantraniliprole + thiamethoxam)</td>
<td>1.0 (1-1) n2</td>
<td>1.0 (1-1) n1</td>
<td>2.3 (1-5) n3</td>
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<tr>
<td>Acephate Pro 75 WSP (Acephate)</td>
<td>5.0 (5-5) n1</td>
<td>Labeled</td>
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<tr>
<td>Aloft SC (Clothianadin + bifenthrin)</td>
<td>5.0 (5-5) n1</td>
<td>Labeled</td>
<td>4.0 (3-5) n2</td>
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<tr>
<td>Altus (aka BYI-2960) (Flupyradifurone)</td>
<td>1.0 (1-1) n1</td>
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<tr>
<td>Arena 50WDG (Clothianadin)</td>
<td>3.7 (3-5) n3</td>
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<td>AzaGuard (Azadirachtin)</td>
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<td>1.0 (1-1) n1</td>
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<td>BAS 440 00l (Afidopyropen)</td>
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<td>3.7 (3-5) n3</td>
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<tr>
<td>Botanigard 22WP (Beauveria bassiana GHA)</td>
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<tr>
<td>Celerio 16WSG (Clothianadin)</td>
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<tr>
<td>Cyclaniliprole (IKI-3106) 50SL (Cyclaniliprole)</td>
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<td>Cygon 2E (Dimethoate)</td>
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<td>3.7 (3-5) n3</td>
<td>Labeled</td>
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<tr>
<td>Diazinon 4E (Diazinon)</td>
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<td>5.0 (5-5) n1</td>
<td>Labeled</td>
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<tr>
<td>Discus (Imidacloprid + cyfluthrin)</td>
<td>3.0 (3-3) n2</td>
<td>Labeled</td>
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<tr>
<td>Distance (Pyriproxyfen)</td>
<td>1.0 (1-1) n1</td>
<td>Labeled</td>
<td>4.0 (3-5) n2</td>
<td>Labeled</td>
<td>3.9 (1-5) n10</td>
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<tr>
<td>Flagship 0.22G (Thiamethoxam)</td>
<td>1.0 (1-1) n3</td>
<td>2.0 (2-2) n1</td>
<td>2.2 (1-4) n6</td>
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<tr>
<td>Flagship 25WG (Thiamethoxam)</td>
<td>3.0 (3-3) n1</td>
<td>Labeled</td>
<td>3.5 (3-4) n2</td>
<td>Labeled</td>
<td>2.0 (1-3) n2</td>
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<tr>
<td>GF-2626 1SC (Sulfoxaflor)</td>
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<td>Horticultural Oil (Horticultural Oil)</td>
<td>2.0 (2-2) n1</td>
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<td>4.3 (3-5) n3</td>
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<td>Judo 2SC (Spiromesifen)</td>
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<tr>
<td>Kontos (BYI 8330 240SC) (Spirotetramat)</td>
<td>2.5 (1-5) n4</td>
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<td>1.0 (1-1) n1</td>
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<td>2.0 (1-3) n3</td>
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<td>Mainspring (A20520A) 200SC (Cyantraniliprole)</td>
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<td>5.0 (5-5) n1</td>
<td>3.0 (1-5) n2</td>
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<td>Marathon II (Imidacloprid)</td>
<td>1.0 (1-1) n1</td>
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<td>MOI 201 (MOI 201)</td>
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<td>Onyx (Bifenthrin)</td>
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<tr>
<td>Product (Active Ingredients)</td>
<td>Cottony maple scale (Neopulvinaria innumerabilis)</td>
<td>Fletcher scale (Parthenolecanium fletcheri)</td>
<td>Pine Needle Scale (Phenacaspis pinifoliae)</td>
<td>False Oleander Scale (Pseudaulacaspis cockerelli)</td>
<td>Euonymus Scale (Unaspis euonymi)</td>
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<td>Orthene TTO 97 (Valent) (Acephate)</td>
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<td>3.0 (2 - 4) n2</td>
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<tr>
<td>QRD 452 (Extract of Chenopodium ambrosioides)</td>
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<td>3.0 (3 - 3) n1</td>
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<tr>
<td>Rycar (SP3009/NNI-0101) (Pyrifluquinazon)</td>
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<td>2.6 (1 - 5) n7</td>
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<tr>
<td>Safari 20SG (Dinotefuran)</td>
<td>1.0 (1 - 1) n2 Labeled</td>
<td>2.0 (2 - 2) n2 Labeled</td>
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<td></td>
<td>3.0 (2 - 4) n2</td>
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<td></td>
<td>3.7 (1 - 5) n10</td>
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<tr>
<td>Safari 2G (V-10112 2G) (Dinotefuran)</td>
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<td>4.0 (2 - 5) n5</td>
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<tr>
<td>SuffOil X (Synergy) (Petroleum Oil)</td>
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<td>5.0 (5 - 5) n1</td>
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<tr>
<td>Sun Spray Ultra-Fine Spray Oil (Paraffinic oil)</td>
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<td>5.0 (5 - 5) n1</td>
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<tr>
<td>Talstar Flowable Insecticide/Miticide (Bifenthrin)</td>
<td>1.0 (1 - 1) n1</td>
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<tr>
<td>Talus 40SC (Buprofezin)</td>
<td>1.0 (1 - 1) n1 Labeled</td>
<td>2.0 (1 - 3) n2 Labeled</td>
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<td>4.3 (3 - 5) n4</td>
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<tr>
<td>Talus 70DF (Buprofezin)</td>
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<td>4.0 (1 - 5) n6</td>
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<td>Talus WP (Buprofezin)</td>
<td>3.0 (3 - 3) n1 Labeled</td>
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<td>5.0 (5 - 5) n1</td>
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<tr>
<td>Tank Mix: Distance + TriStar (Pyriproxifen + acetamiprid)</td>
<td>5.0 (5 - 5) n2 Labeled</td>
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<tr>
<td>Triact (Clarified hydrophobic extract of neem oil)</td>
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<td>4.0 (4 - 4) n1</td>
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<tr>
<td>TriStar 30SG (Acetamiprid)</td>
<td>1.0 (1 - 1) n1 Labeled</td>
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<td>2.6 (1 - 5) n8</td>
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<tr>
<td>TriStar 70WSP (Acetamiprid)</td>
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<tr>
<td>Ultra Pure Oil (BASF) (Petroleum Oil)</td>
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<tr>
<td>Xxpire (GF-2860) 40WG (Spinetoram + sulfoxaflor)</td>
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<td>3.0 (3 - 3) n2</td>
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</tbody>
</table>
## Registered and Experimental Products for Scale & Mealybug Management

<table>
<thead>
<tr>
<th>Foliar Applied Insecticides (active ingredients)</th>
<th>IRAC Class</th>
<th>Registered Use Site(s</th>
<th>Knock Down</th>
<th>Residual Control (days)</th>
<th>REI</th>
<th>Scale-Mealybug Efficacy</th>
<th>Life Stages</th>
<th>Treatment Program</th>
</tr>
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<tbody>
<tr>
<td></td>
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<td></td>
<td>Armored Scales</td>
<td>Cushion Scales</td>
<td>Soft Scales</td>
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<tr>
<td>Cygon, Dimentioned (dimethoate)</td>
<td>1B</td>
<td>N</td>
<td>F</td>
<td>5-7</td>
<td>48h</td>
<td>G</td>
<td>?</td>
<td>?</td>
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<tr>
<td>Discus Tablet (cyfluthrin-imidaclopid)</td>
<td>3A + 4A</td>
<td>N</td>
<td>F</td>
<td>5-7</td>
<td>12h</td>
<td>?</td>
<td>?</td>
<td>?</td>
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<tr>
<td>Distance (pyriproxyfen)</td>
<td>7D</td>
<td>G, I, L, S</td>
<td>S</td>
<td>?</td>
<td>12h</td>
<td>P-E</td>
<td>P-E</td>
<td>P-F</td>
</tr>
<tr>
<td>Duraguard, Dursban (chlorpyrifos)</td>
<td>1B</td>
<td>G, N</td>
<td>F</td>
<td>5-7</td>
<td>24h</td>
<td>?</td>
<td>P</td>
<td>G</td>
</tr>
<tr>
<td>Grandevo, MBI-203 DF (Chromobacterium subsugae strain PRAA-4-1)</td>
<td>-</td>
<td>G, N</td>
<td>S</td>
<td>4h</td>
<td>4h</td>
<td>G</td>
<td>?</td>
<td>?</td>
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<tr>
<td>Hachi-Hachi EC (tolfenpyrad)</td>
<td>21A</td>
<td>G</td>
<td>F</td>
<td>7-14</td>
<td>12h</td>
<td>?</td>
<td>?</td>
<td>?</td>
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<tr>
<td>Kontos, BYI-8330 (spirotetramat)</td>
<td>23</td>
<td>G, I, N</td>
<td>S</td>
<td>7-14</td>
<td>24h</td>
<td>P-E</td>
<td>P-E</td>
<td>E</td>
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<tr>
<td>Malathion</td>
<td>1B</td>
<td>G, N</td>
<td>F</td>
<td>5-7</td>
<td>12h</td>
<td>E</td>
<td>?</td>
<td>?</td>
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<tr>
<td>Marathon (imidacloprid)</td>
<td>4A</td>
<td>G, I, N</td>
<td>F</td>
<td>?</td>
<td>12h</td>
<td>G</td>
<td>?</td>
<td>?</td>
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<tr>
<td>Met 52, Tick Ex (Metarhizium anisopliae F52)</td>
<td>-</td>
<td>G, N</td>
<td>M</td>
<td>5-7</td>
<td>4h</td>
<td>?</td>
<td>E</td>
<td>?</td>
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<tr>
<td>M-Pede, Safer Soap (potassium salts of fatty acids)</td>
<td>-</td>
<td>G, I, N</td>
<td>F</td>
<td>Contact</td>
<td>12h</td>
<td>?</td>
<td>?</td>
<td>?</td>
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<tr>
<td>NoFly WP (Paecilomyces fumosoroseus strain FE 9901)</td>
<td>-</td>
<td>G</td>
<td>M</td>
<td>3-7</td>
<td>4h</td>
<td>P-G</td>
<td>P-G</td>
<td>P-G</td>
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<tr>
<td>Orthene T&amp;O, Acephane 97 UP (acephate)</td>
<td>1B</td>
<td>G, N</td>
<td>F</td>
<td>7</td>
<td>24h</td>
<td>P-E</td>
<td>F-G</td>
<td>P-G</td>
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<tr>
<td>Pretox Pyronyl Crop Spray, Pyreneo Crop Spray, etc. (pyrethrins + PBO)</td>
<td>3A + -</td>
<td>G, N</td>
<td>F</td>
<td>Contact</td>
<td>12h</td>
<td>?</td>
<td>?</td>
<td>?</td>
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Information presented is based on the best data available on October 1, 2017.
## Registered and Experimental Products for Scale & Mealybug Management

### Foliar Applied Insecticides (active ingredients)

<table>
<thead>
<tr>
<th>Product Name</th>
<th>IRAC Class</th>
<th>Registered Use Sites</th>
<th>Knock Down</th>
<th>Residual Control (days)</th>
<th>REI</th>
<th>Scale-Mealybug Efficacy</th>
<th>Life Stages</th>
<th>Treatment Program</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safari 20SG (dinofuran)</td>
<td>4A</td>
<td>G, N</td>
<td>M</td>
<td>7</td>
<td>12 h</td>
<td>P-E</td>
<td>P</td>
<td>P-E</td>
</tr>
<tr>
<td>Talstar, Onyx (bifenthrin)</td>
<td>3A</td>
<td>G, I, N</td>
<td>F</td>
<td>7</td>
<td>12 h</td>
<td>P-E</td>
<td>?</td>
<td>P</td>
</tr>
<tr>
<td>Talus (buprofezin)</td>
<td>16</td>
<td>G, L, N, S</td>
<td>S</td>
<td>14</td>
<td>12 h</td>
<td>P-E</td>
<td>P-E</td>
<td>P-G</td>
</tr>
<tr>
<td>Triact, Trilogy Neem Oil (extract of neem oil)</td>
<td>18B</td>
<td>G, N</td>
<td>S</td>
<td>7</td>
<td>4 h</td>
<td>G</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>TriStar (acetamiprid)</td>
<td>4A</td>
<td>G, L, N, S</td>
<td>F</td>
<td>?</td>
<td>12 h</td>
<td>P-E</td>
<td>G-E</td>
<td>G-E</td>
</tr>
<tr>
<td>Ultra pure oil, SuffOil-X, etc. (paraffinic oil)</td>
<td>-</td>
<td>G, N</td>
<td>F</td>
<td>Contact</td>
<td>4 h</td>
<td>P-E</td>
<td>P-E</td>
<td>?</td>
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<tr>
<td>XXpire (spinoteram+ sulfoxaflor)</td>
<td>5+4C</td>
<td>G, N</td>
<td>F</td>
<td>14</td>
<td>12 h</td>
<td>F-E</td>
<td>P-E</td>
<td>P-G</td>
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### Experimental Products

<table>
<thead>
<tr>
<th>Product Name</th>
<th>IRAC Class</th>
<th>Registered Use Sites</th>
<th>Knock Down</th>
<th>Residual Control (days)</th>
<th>REI</th>
<th>Scale-Mealybug Efficacy</th>
<th>Life Stages</th>
<th>Treatment Program</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arena, Celero 16WG (clothianidin)</td>
<td>4A</td>
<td>TBD</td>
<td>?</td>
<td>?</td>
<td>12 h</td>
<td>P-E</td>
<td>P</td>
<td>F-E</td>
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</tbody>
</table>

Registered Use Sites: G = Greenhouse; L = Lath House; I = Indoors; N = Nursery; S = Shade House; TBD = To Be Determined

Knockdown: Fast (< 1 day), Medium (1-7 days), Slow (>7 days).

Efficacy: P = Poor (< 70% control); F = Fair (70% to 85% control); G = Good (85% to 95% control), E = Excellent (>95% control) on immatures and/or adults 1 to 3 weeks after first app.

Residual Control taken from product technical and label info, recommendations on earliest application intervals; Scale, Mealybug Efficacy taken from the 2017 IR-4 efficacy summary draft and 19 AMT reports. Effect on biological control agent for scales/mealybugs taken from Koppert, Biobest and some extension publications/recommendations.

Armored scales: Aspidiotus cryptomeriae, Aterolecanium putanum, Aulacaspis yasumatsui Chrysomphalus aonidum, Chrysomphalus bifasciatus, Fiorinia externa, Fiorinia theae, Lepidosaphes camelliae, Lepidosaphes ulmi, Lepidosaphes yunagicolora, Melanaspis deklei, Phenacoccus pinifoliicola, Pseudaulacaspis cockerelli and Unaspis euonymi

Information presented is based on the best data available on October 1, 2017.
Cushion scales: *Icerya purchasi*,
Soft scales: *Ceroplastes floridensis, Eulecanium cerasorum, Lecanium fletcheri* and *Pulvinaria innumerabilis*
Mealybugs: *Balanococcus diminutus, Phenacoccus gossypii, Phenococcus madeirensis, Planococcus citri* and *Rhizoecus hibisci*

* Results of efficacy trials have been variable for entomopathogens and impact on beneficial organisms is presumed to be less than that of traditional pesticide chemistries but the data are sparse.
** This insecticide is toxic to many BCA’s but has a short residual and may be suitable for treating hot spots and re-introducing BCA’s soon thereafter.
*Milstop has a New York 2ee recommendation to control mealybugs, aphids, spider mites, stink bugs and whiteflies.*