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IR-4 Ornamental Horticulture Program Pyrifluquinazon Crop Safety

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Acknowledgements

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Abstract

Pyriproxyfen was registered for use on greenhouse ornamental horticulture crops as foliar sprays in the United States in 2013 to manage whiteflies, aphids, leafhoppers, chilli thrips, and mealybugs. The label contains a list of crops tested for tolerance. From 2010 to 2015, the IR-4 Project conducted 127 trials on 29 ornamental plant species / genera examining phytotoxicity related to pyriproxyfen applications. In these trials, 23 species or genera exhibited minimal or no injury after foliar applications in a minimum of 3 trials for each crop. Nineteen of these are already in the current Rycar label; the other four can be added to the label. All trials for six other species or genera exhibited minimal or no injury in the limited number of trials (one or two) for each crop, and two of these are already registered.

Introduction

Pyriproxyfen was registered for use on greenhouse ornamental horticulture crops as foliar sprays in the United States in 2013 to manage whiteflies, aphids, leafhoppers, chilli thrips, and mealybugs. The label contains a list of crops tested for tolerance. From 2010 to 2015, the IR-4 Project conducted 127 trials on 29 ornamental plant species / genera examining phytotoxicity related to pyriproxyfen applications.

Materials and Methods

Pyriproxyfen was tested as foliar treatment typically three times at approximately 14 days interval or as a single drench application. The foliar application rates were typically 6.38, 12.76 and 25.52 fl oz per 100 gal, plus a water treated control. A minimum of three plants (replicate treatments) were required with most researchers exceeding this minimum. Phytotoxicity was recorded on a scale of 0 to 10 (0 = No phytotoxicity; 10 = Complete kill) one to four times from 1 to 8 weeks after initial application. For IR-4 testing, the following protocols were used: 10-004, 11-016, 12-002, 13-002, 14-008 and 15-008. 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.

Pyriproxyfen was supplied to researchers (See list of researchers in Appendix 1) by Nichino and SePro.

Results and Summary

Phytotoxicity

Based on the type and nature of injury seen with pesticide applications, tested plant species /genera were placed into three categories: 1) no significant phytotoxicity or growth differences from the untreated check or any injury was transitory, 2) no or minimal transitory injury seen at the 1X rate, but the 2X and/or 4X rates did cause significant phytotoxicity, 3) significant injury sufficient to recommend growers not utilize pyriproxyfen, and 4) more data is needed to make informed recommendations.

No significant injury was observed.

Please see Table 5 for a summary of the individual trial results.

Table 1. List of Pyrifluquinazon treated crops with no or minimal transitory injury.

<i>Alyssum sp.</i> ¹	<i>Impatiens sp.</i> ¹
<i>Angelonia angustifolia</i> ¹	<i>Impatiens hawkeri</i> ¹
<i>Antirrhinum majus</i> ¹	<i>Lobularia maritima</i> ¹
<i>Bacopa sp.</i>	<i>Pelargonium x hortorum.</i> ¹
<i>Begonia sp.</i> ¹	<i>Petunia sp.</i> ¹
<i>Calibrachoa sp.</i>	<i>Rosa sp.</i> ¹
<i>Chrysanthemum sp.</i> ¹	<i>Salvia splendens</i> ¹
<i>Dahlia sp.</i> ¹	<i>Tagetes sp.</i> ¹
<i>Dracaena sp.</i>	<i>Verbena sp.</i> ¹
<i>Fuschia sp.</i>	<i>Viola sp.</i> ¹
<i>Gerbera sp.</i> ¹	<i>Zinnia sp.</i> ¹
<i>Hedera sp.</i>	

¹ Already registered

Table 2. List of Pyrifluquinazon treated crops with no injury at 1X but significant injury at 2X or 4X.

None

Table 3. List of Pyrifluquinazon treated crops with significant injury at 1X.

None

Table 4. List of Pyrifluquinazon treated crops where more information is needed.

<i>Coreopsis sp.</i> ¹	<i>Hydrangea sp.</i> ³
<i>Dianthus sp.</i> ²	<i>Rosa sp.</i> ^{1,2}
<i>Gardenia sp.</i> ¹	
<i>Hibiscus sp.</i> ¹	

¹ No injury in 1 trial

² Already registered

³ No injury in 2 trials

Table 5 Detailed Summary of Crop Safety Testing with Rycar (Pyrifluquinazon)

Notes: Table entries are sorted by crop Latin name. Only those trials with research reports received by 8/10/2016 are listed below.

PR#	Crop	Production Site	Researcher	State	Year	Application Type	Results
31133	Madwort (Alyssum sp.) 'Clear Crystal Purple'	Field Container	Freiberger	NJ	2013	Foliar	No phytotoxicity with 6.38, 12.76 and 25.52 fl oz per 100 gal applied 3 times.
31133	Madwort (Alyssum sp.) 'Wonderland DP Purple' & 'Wonderland Pink'	Field Container	Wade	SC	2013	Foliar	No injury or growth reduction with 6.38, 12.76 and 25.52 fl oz per 100 gal applied 3 times; all plants marketable.
31133	Madwort (Alyssum sp.) 'Wonderland Rose'	Field Container	Davis	MI	2011	Foliar	No injury or growth reduction with 6.38, 12.76 and 25.52 fl oz per 100 gal applied three times.
30183	Angelonia (Angelonia angustifolia) 'Angel Mist Pink'	Greenhouse	Chen	LA	2011	Foliar	No injury or significant difference in plant growth and quality with 6.38, 12.76 and 25.52 fl oz per 100 gal applied twice.
30183	Angelonia (Angelonia angustifolia) 'Serena Purple'	Greenhouse	Chen	LA	2011	Foliar	No injury or significant difference in plant growth and quality with 6.38, 12.76 and 25.52 fl oz per 100 gal applied twice.
30183	Angelonia (Angelonia angustifolia) 'Sundancer Pink'	Greenhouse	Freiberger	NJ	2013	Foliar	No injury or growth reduction with 6.38, 12.76 and 25.52 fl oz per 100 gal mixed with surfactant applied 3 times.
30351	Snapdragon (Antirrhinum majus)	Field Container	Reding	OH	2013	Foliar	No injury or growth reduction with 6.38, 12.76 and 25.52 fl oz per 100 gal applied 3 times with NIS; all plants marketable.
30351	Snapdragon (Antirrhinum majus) 'Chimes Rose'	Field Container	Davis	MI	2011	Foliar	No injury or growth reduction with 6.38, 12.76 and 25.52 fl oz per 100 gal applied three times.
30351	Snapdragon (Antirrhinum majus) 'Peachy Dragon'	Field Container	Freiberger	NJ	2012	Foliar	No injury or growth reduction with 6.38, 12.76 and 25.52 fl oz per 100 gal applied 3 times.
30351	Snapdragon (Antirrhinum majus) 'Speedy Sonnet White'	Field Container	DeFrancesco	OR	2013	Foliar	No injury or growth reduction with 6.38, 12.76 and 25.52 fl oz per 100 gal applied 3 times.
30665	Water Hyssop (Bacopa sp.) 'Abunda Colossal Blue'	Greenhouse	Chen	LA	2013	Foliar	No significant injury or growth reduction with 6.38, 12.76 and 25.52 fl oz per 100 gal applied twice.
30665	Water Hyssop (Bacopa sp.) 'Abunda Colossal White'	Greenhouse	Chen	LA	2013	Foliar	No significant injury or growth reduction with 6.38, 12.76 and 25.52 fl oz per 100 gal applied twice.
30665	Water Hyssop (Bacopa sp.) 'Blutopia Blue'	Greenhouse	Freiberger	NJ	2014	Foliar	No injury or growth reduction with 6.38, 12.76 and 25.52 fl oz per 100 gal + NIS applied 3 times.
30665	Water Hyssop (Bacopa sp.) Suteracordata 'Snowstorm Pink'	Greenhouse	Gilrein	NY	2013	Foliar	No injury on foliage or flowers with 6.38, 12.76, and 25.52 fl oz per 100 gal applied biweekly three times.
30665	Water Hyssop (Bacopa sp.) Suteracordata 'Snowstorm White'	Greenhouse	Gilrein	NY	2013	Foliar	No injury on foliage or flowers with 6.38, 12.76, and 25.52 fl oz per 100 gal applied biweekly three times.
30362	Begonia (Begonia sp.) B. semperflorans 'Bada Boom'	Field Container	Davis	MI	2014	Foliar	No injury with 6.38, 12.76 and 25.52 fl oz per 100 gal + Capsil applied 3 times.

PR#	Crop	Production Site	Researcher	State	Year	Application Type	Results
30362	Begonia (Begonia sp.) B. semperflorens 'Green Leaf'	Field Container	Davis	MI	2010	Foliar	No significant injury at 6.38, 12.76, and 25.52 fl oz per 100 gal.
29317	Begonia (Begonia sp.) B. x semperflorens-cultorum 'Cocktail Rum'	Greenhouse	Gilrein	NY	2011	Foliar	No injury or growth reduction with 6.38, 12.76 and 25.52 fl oz per 100 gal.
29317	Begonia (Begonia sp.) B. x semperflorens-cultorum 'Eureka GL White'	Greenhouse	Gilrein	NY	2011	Foliar	No injury or growth reduction with 6.38, 12.76 and 25.52 fl oz per 100 gal.
30362	Begonia (Begonia sp.) 'Big Rose'	Field Container	Uber	CA	2013	Foliar	No injury or growth reduction with 6.38, 12.76 and 25.52 fl oz per 100 gal + Capsil applied 3 times.
29317	Begonia (Begonia sp.) 'Cocktail Pink'	Greenhouse	Chen	LA	2012	Foliar	No injury with 6.38, 12.76 and 25.52 fl oz per 100 gal applied twice; virtually no growth reduction.
29317	Begonia (Begonia sp.) 'Cocktail White'	Greenhouse	Chen	LA	2012	Foliar	No injury or growth reduction with 6.38, 12.76 and 25.52 fl oz per 100 gal applied twice.
29317	Begonia (Begonia sp.) 'Dragon Wing Red'	Greenhouse	Freiberger	NJ	2011	Foliar	No and very minor injury (at 4X) with 6.4, 12.8 and 25.5 fl oz per 100 gal + surfactant applied 3 times.
29317	Begonia (Begonia sp.) 'Non-stop Orange'	Greenhouse	Freiberger	NJ	2011	Foliar	No and very minor injury (at 4X) with 6.4, 12.8 and 25.5 fl oz per 100 gal + surfactant applied 3 times.
30362	Begonia (Begonia sp.) 'Red'	Field Container	Davis	MI	2011	Foliar	No injury or growth reduction with 6.38, 12.76 and 25.52 fl oz per 100 gal applied three times.
31689	Calibrachoa (Calibrachoa sp.) 'Banana Chocolate'	Greenhouse	Gilrein	NY	2014	Foliar	No injury on leaves and flowers, and no growth reduction with 6.38, 12.76 and 25.52 fl oz per 100 gal applied 3 times.
31689	Calibrachoa (Calibrachoa sp.) 'Kabloom White'	Greenhouse	Freiberger	NJ	2014	Foliar	No injury or growth reduction with 6.38, 12.76 and 25.52 fl oz per 100 gal applied 3 times.
31689	Calibrachoa (Calibrachoa sp.) 'Lemon Slice'	Greenhouse	Gilrein	NY	2014	Foliar	No injury on leaves and flowers, and no growth reduction with 6.38, 12.76 and 25.52 fl oz per 100 gal applied 3 times.
31689	Calibrachoa (Calibrachoa sp.) 'MiniFamous TM Compact Blue'	Greenhouse	DeFrancesco	OR	2015	Foliar	No injury or growth reduction with 6.4, 12.8 and 25.6 fl oz per 100 gal applied biweekly.
31689	Calibrachoa (Calibrachoa sp.) 'Superbells Lemon Slice'	Greenhouse	Vafaie	TX	2015	Foliar	No injury or growth reduction with 6.4, 12.8 and 25.6 fl oz per 100 gal + Preference applied 3 times biweekly.
30536	Chrysanthemum, Garden (Chrysanthemum/Dendranthema sp.) 'Jamestown'	Greenhouse	Uber	CA	2015	Foliar	No injury or growth reduction with 6.4, 12.8 and 25.7 fl oz per 100 gal + Capsil applied 3 times.
30536	Chrysanthemum, Garden (Chrysanthemum/Dendranthema sp.) 'Outrageous Orange'	Greenhouse	Gilrein	NY	2012	Foliar	No injury on foliage or flowers at 6.38, 12.76, and 25.52 fl oz per 100 gal applied biweekly 3 times.
30536	Chrysanthemum, Garden (Chrysanthemum/Dendranthema sp.) 'Sly Jenna'	Greenhouse	Chen	LA	2010	Foliar	No injury or growth reduction with 6.4, 12.8 and 25.5 fl oz per 100 gal applied twice.

PR#	Crop	Production Site	Researcher	State	Year	Application Type	Results
30536	Chrysanthemum, Garden (Chrysanthemum/Dendranthema sp.) 'Sparkle White'	Greenhouse	Gilrein	NY	2012	Foliar	No injury on foliage or flowers at 6.38, 12.76, and 25.52 fl oz per 100 gal applied biweekly 3 times.
31691	Tickseed (Coreopsis sp.) 'Early Sunrise Yellow'	Greenhouse	Freiberger	NJ	2014	Foliar	No injury or growth reduction with 6.38, 12.76 and 25.52 fl oz per 100 gal applied 3 times.
30374	Dahlia (Dahlia sp.) 'Dahlietta Leanne'	Field Container	Chen	LA	2013	Foliar	No significant injury or growth reduction with 6.38, 12.76 and 25.52 fl oz per 100 gal applied twice.
30374	Dahlia (Dahlia sp.) 'Dahlietta Marissa'	Field Container	Chen	LA	2013	Foliar	No significant injury or growth reduction with 6.38, 12.76 and 25.52 fl oz per 100 gal applied twice.
30374	Dahlia (Dahlia sp.) 'Figaro Mix'	Field Container	Davis	MI	2011	Foliar	No injury or growth reduction with 6.38, 12.76 and 25.52 fl oz per 100 gal applied three times.
30374	Dahlia (Dahlia sp.) 'Figaro Mix'	Field Container	Freiberger	NJ	2013	Foliar	No phytotoxicity with 6.38, 12.76 and 25.52 fl oz per 100 gal applied 3 times.
30595	Pinks (Dianthus sp.) D. barbatus	Greenhouse	DeFrancesco	OR	2015	Foliar	No injury, but moderate growth reduction, with 6.4, 12.8 and 25.6 fl oz per 100 gal applied biweekly.
30595	Pinks (Dianthus sp.) 'Floral Lace Crimson'	Greenhouse	Freiberger	NJ	2013	Foliar	No injury or growth reduction with 6.38, 12.72 and 25.58 fl oz per 100 gal mixed with surfactant applied 3 times.
31696	Dracaena (Dracaena sp.) D. indivisa	Greenhouse	Gilrein	NY	2014	Foliar	No injury on leaves and flowers, and no growth reduction with 6.38, 12.76 and 25.52 fl oz per 100 gal applied 3 times.
31696	Dracaena (Dracaena sp.) D. marginata	Greenhouse	Uber	CA	2014	Foliar	No injury or growth reduction with 6.4, 12.8 and 25.5 fl oz per 100 gal + Capsil applied 3 times.
31696	Dracaena (Dracaena sp.) D. marginata	Greenhouse	Uber	CA	2015	Foliar	No injury or growth reduction with 6.4, 12.8 and 25.6 fl oz per 100 gal + Capsil applied 3 times.
31696	Dracaena (Dracaena sp.) 'Spikes'	Greenhouse	Freiberger	NJ	2014	Foliar	No injury or growth reduction with 6.38, 12.76 and 25.52 fl oz per 100 gal applied 3 times.
29318	Fuschia, Ladies-Eardrops (Fuschia sp.) 'Dollar Princess'	Greenhouse	Freiberger	NJ	2015	Foliar	No injury or growth reduction with 6.38, 12.76 and 25.52 fl oz per 100 gal applied 3 times.
29318	Fuschia, Ladies-Eardrops (Fuschia sp.) F. magellanica 'Lena'	Greenhouse	Gilrein	NY	2014	Foliar	No injury on leaves and flowers, and no growth reduction with 6.38, 12.76 and 25.52 fl oz per 100 gal applied 3 times.
29318	Fuschia, Ladies-Eardrops (Fuschia sp.) F. magellanica 'Swingtime'	Greenhouse	Gilrein	NY	2014	Foliar	No injury on leaves and flowers, and no growth reduction with 6.38, 12.76 and 25.52 fl oz per 100 gal applied 3 times.
30596	Jasmine, Cape, Common Gardenia (Gardenia sp.) G. augusta	Greenhouse	Uber	CA	2013	Foliar	No injury or growth reduction with 6.38, 12.76 and 25.52 fl oz per 100 gal + Capsil applied 3 times.
29319	Transvaal Daisy (Gerbera sp.) 'Festival Lt. Eye Orange'	Greenhouse	Edmunds	CO	2010	Spray-to-wet	No injury at 6.38, 12.76 and 25.52 fl oz per 100 gal applied 3 times.
29319	Transvaal Daisy (Gerbera sp.) 'Jaguar Pink'	Greenhouse	Gilrein	NY	2012	Foliar	No injury on foliage or flowers with 6.38, 12.76, and 25.52 fl oz per 100 gal applied biweekly three times.

PR#	Crop	Production Site	Researcher	State	Year	Application Type	Results
29319	Transvaal Daisy (Gerbera sp.) 'Royal Red'	Greenhouse	Gilrein	NY	2012	Foliar	No injury on foliage or flowers with 6.38, 12.76, and 25.52 fl oz per 100 gal applied biweekly three times.
31695	Ivy (Hedera sp.) 'Baltica'	Greenhouse	Gilrein	NY	2014	Foliar	No injury on leaves and flowers, and no growth reduction with 6.38, 12.76 and 25.52 fl oz per 100 gal applied 3 times.
31695	Ivy (Hedera sp.) 'Gold Child'	Greenhouse	Gilrein	NY	2014	Foliar	No injury on leaves and flowers, and no growth reduction with 6.38, 12.76 and 25.52 fl oz per 100 gal applied 3 times.
31695	Ivy (Hedera sp.) H. Algeriensis 'Gloire de Marengo'	Greenhouse	Gilrein	NY	2015	Foliar	No injury or reduction of plant growth and quality with 6.38, 12.76 and 25.52 fl oz per 100 gal applied 3 times.
31695	Ivy (Hedera sp.) H. helix	Greenhouse	Uber	CA	2015	Foliar	No injury or growth reduction with 6.4, 12.8 and 25.6 fl oz per 100 gal + Capsil applied 3 times.
31695	Ivy (Hedera sp.) H. helix 'Needlepoint'	Greenhouse	Gilrein	NY	2015	Foliar	No injury or reduction of plant growth and quality with 6.38, 12.76 and 25.52 fl oz per 100 gal applied 3 times.
31692	Rosemallow (Hibiscus sp.) 'Luna White'	Greenhouse	Freiberger	NJ	2015	Foliar	No injury or growth reduction with 6.4, 12.8 and 25.6 fl oz per 100 gal applied 3 times.
31693	Hydrangea (Hydrangea sp.) H. macrophylla 'Nikko Blue'	Field Container	Gilrein	NY	2014	Foliar	No injury on leaves and flowers, and no growth reduction with 6.38, 12.76 and 25.52 fl oz per 100 gal applied 3 times.
31693	Hydrangea (Hydrangea sp.) H. paniculata 'Grandiflora'	Field Container	Gilrein	NY	2014	Foliar	No injury on leaves and flowers, and no growth reduction with 6.38, 12.76 and 25.52 fl oz per 100 gal applied 3 times.
30363	New Guinea Impatiens (Impatiens hawkeri)	Field Container	Reding	OH	2013	Foliar	No injury or growth reduction with 6.38, 12.76 and 25.52 fl oz per 100 gal applied 3 times; all plants marketable.
30363	New Guinea Impatiens (Impatiens hawkeri) 'Cherry Red'	Field Container	Freiberger	NJ	2013	Foliar	No phytotoxicity with 6.38, 12.76 and 25.52 fl oz per 100 gal applied 3 times.
29321	New Guinea Impatiens (Impatiens hawkeri) 'Dazzler Violet'	Greenhouse	Chen	LA	2010	Foliar	No injury or growth reduction with 6.4, 12.8 and 25.5 fl oz per 100 gal applied twice.
30363	New Guinea Impatiens (Impatiens hawkeri) 'Divine Violet'	Field Container	Freiberger	NJ	2013	Foliar	No phytotoxicity with 6.38, 12.76 and 25.52 fl oz per 100 gal applied 3 times.
30363	New Guinea Impatiens (Impatiens hawkeri) I. walleriana 'Stardust Red'	Field Container	Davis	MI	2011	Foliar	No injury or growth reduction with 6.38, 12.76 and 25.52 fl oz per 100 gal applied three times.
29321	New Guinea Impatiens (Impatiens hawkeri) 'Paradise Bright Red'	Greenhouse	Freiberger	NJ	2011	Foliar	No to very minor injury with 6.4, 12.8 and 25.5 fl oz per 100 gal + surfactant applied 3 times.
29321	New Guinea Impatiens (Impatiens hawkeri) 'Paradise Lavender Blue'	Greenhouse	Freiberger	NJ	2011	Foliar	No to very minor injury with 6.4, 12.8 and 25.5 fl oz per 100 gal + surfactant applied 3 times.
29321	New Guinea Impatiens (Impatiens hawkeri) 'Patchwork Salmon'	Greenhouse	Chen	LA	2011	Foliar	No significant injury or growth reduction with 6.38, 12.76 and 25.52 fl oz per 100 gal applied twice.
29321	New Guinea Impatiens (Impatiens hawkeri) 'Sonic Lilac'	Greenhouse	Chen	LA	2011	Foliar	No significant injury or growth reduction with 6.38, 12.76 and 25.52 fl oz per 100 gal applied twice.

PR#	Crop	Production Site	Researcher	State	Year	Application Type	Results
29321	New Guinea Impatiens (Impatiens hawkeri) 'Super Elfin Red'	Greenhouse	Chen	LA	2010	Foliar	No injury or growth reduction with 6.4, 12.8 and 25.5 fl oz per 100 gal applied twice.
30363	New Guinea Impatiens (Impatiens hawkeri) 'Sweet Cherry'	Field Container	Uber	CA	2013	Foliar	No injury or growth reduction with 6.38, 12.76 and 25.52 fl oz per 100 gal + Capsil applied 3 times.
29320	Balsam (Impatiens sp.) 'Cherry Splash'	Greenhouse	Gilrein	NY	2012	Foliar	No injury at 6.38, 12.76, and 25.52 fl oz per 100 gal applied biweekly three times.
29320	Balsam (Impatiens sp.) 'Double Camellia Mix'	Greenhouse	Freiberger	NJ	2011	Foliar	Minor injury with 6.4, 12.8 and 25.5 fl oz per 100 gal + surfactant applied 3 times.
29320	Balsam (Impatiens sp.) 'Extra Dwarf Tom Thumb'	Greenhouse	Freiberger	NJ	2011	Foliar	Minor injury with 6.4, 12.8 and 25.5 fl oz per 100 gal + surfactant applied 3 times.
30382	Balsam (Impatiens sp.) I. walleriana 'Dazzler Pink'	Field Container	Davis	MI	2010	Foliar	No significant injury at 6.38, 12.76, and 25.52 fl oz per 100 gal.
30382	Balsam (Impatiens sp.) 'Super Elfin Lavender'	Field Container	Wade	SC	2012	Foliar	No injury or growth reduction with 6.38, 12.76 and 25.52 fl oz per 100 gal applied with surfactant 3 times; all plants marketable.
30382	Balsam (Impatiens sp.) 'Super Elfin XP Pink'	Field Container	Wade	SC	2012	Foliar	No injury or growth reduction with 6.38, 12.76 and 25.52 fl oz per 100 gal applied with surfactant 3 times; all plants marketable.
29320	Balsam (Impatiens sp.) 'Super Elfin XP Red'	Greenhouse	Gilrein	NY	2012	Foliar	No injury at 6.38, 12.76, and 25.52 fl oz per 100 gal applied biweekly three times.
31599	Sweet Alyssum (Lobulariamaritima) 'Clear Crystal Lavender Shades'	Field Container	Gilrein	NY	2015	Foliar	No injury or growth reduction with 6.38, 12.76 and 25.52 fl oz per 100 gal applied 3 times; improved plant quality.
31599	Sweet Alyssum (Lobulariamaritima) 'Easter Bonnet Peach'	Field Container	Gilrein	NY	2015	Foliar	No injury or growth reduction with 6.38, 12.76 and 25.52 fl oz per 100 gal applied 3 times; improved plant quality.
31599	Sweet Alyssum (Lobulariamaritima) 'Clear Crystal White'	Field Container	DeFrancesco	OR	2013	Foliar	No injury or growth reduction with 6.38, 12.76 and 25.52 fl oz per 100 gal applied 3 times.
30375	Geranium, Zonal (Pelargonium x hortorum) 'Cranesbill'	Field Container	Uber	CA	2013	Foliar	No injury or growth reduction with 6.38, 12.76 and 25.52 fl oz per 100 gal + Capsil applied 3 times.
30375	Geranium, Zonal (Pelargonium x hortorum) 'Orbit Pink Seed'	Field Container	Davis	MI	2011	Foliar	No injury or growth reduction with 6.38, 12.76 and 25.52 fl oz per 100 gal applied three times.
30375	Geranium, Zonal (Pelargonium x hortorum) 'Pinto Salmon'	Field Container	Gilrein	NY	2014	Foliar	No injury on leaves and flowers, and no growth reduction with 6.38, 12.76 and 25.52 fl oz per 100 gal applied 3 times.
30375	Geranium, Zonal (Pelargonium x hortorum) 'Pinto White'	Field Container	Gilrein	NY	2014	Foliar	No injury on leaves and flowers, and no growth reduction with 6.38, 12.76 and 25.52 fl oz per 100 gal applied 3 times.
30364	Petunia (Petunia sp.)	Field Container	Reding	OH	2013	Foliar	No injury or growth reduction with 6.38, 12.76 and 25.52 fl oz per 100 gal applied 3 times with NIS; all plants marketable.

PR#	Crop	Production Site	Researcher	State	Year	Application Type	Results
30364	Petunia (Petunia sp.) 'Dreams White'	Field Container	Davis	MI	2011	Foliar	No injury or growth reduction with 6.38, 12.76 and 25.52 fl oz per 100 gal applied three times.
29322	Petunia (Petunia sp.) 'Easy Wave Rose'	Greenhouse	Chen	LA	2010	Foliar	No injury or growth reduction with 6.4, 12.8 and 25.5 fl oz per 100 gal applied twice.
30364	Petunia (Petunia sp.) P. x hybrida 'Prism Sunshine'	Field Container	Davis	MI	2010	Foliar	No significant injury at 6.38, 12.76, and 25.52 fl oz per 100 gal.
30364	Petunia (Petunia sp.) 'SGL Dreams Red'	Field Container	Wade	SC	2012	Foliar	No injury or growth reduction with 6.38, 12.76 and 25.52 fl oz per 100 gal applied with surfactant 3 times; all plants marketable.
30364	Petunia (Petunia sp.) 'SGL Dreams White'	Field Container	Wade	SC	2012	Foliar	No injury or growth reduction with 6.38, 12.76 and 25.52 fl oz per 100 gal applied with surfactant 3 times; all plants marketable.
29322	Petunia (Petunia sp.) 'Shockwave Coconut'	Greenhouse	Freiberger	NJ	2011	Foliar	Virtually no injury with 6.4, 12.8 and 25.5 fl oz per 100 gal + surfactant applied 3 times.
29322	Petunia (Petunia sp.) 'Wave Purple'	Greenhouse	Freiberger	NJ	2011	Foliar	Virtually no injury with 6.4, 12.8 and 25.5 fl oz per 100 gal + surfactant applied 3 times.
30597	Rose (Rosa sp.) 'First Impression'	Greenhouse	Gilrein	NY	2014	Foliar	No injury on leaves and flowers, and no growth reduction with 6.38, 12.76 and 25.52 fl oz per 100 gal applied 3 times.
30597	Rose (Rosa sp.) 'Powerhouse'	Greenhouse	Gilrein	NY	2014	Foliar	No injury on leaves and flowers, and no growth reduction with 6.38, 12.76 and 25.52 fl oz per 100 gal applied 3 times.
30597	Rose (Rosa sp.) 'Radrazz'	Greenhouse	Freiberger	NJ	2013	Foliar	No injury or growth reduction with 6.4, 12.8 and 25.5 fl oz per 100 gal applied 3 times.
31690	Sage, Scarlet (Salvia splendens)	Greenhouse	Freiberger	NJ	2014	Foliar	No injury or growth reduction with 6.38, 12.76 and 25.52 fl oz per 100 gal applied 3 times.
31690	Sage, Scarlet (Salvia splendens)	Greenhouse	Uber	CA	2015	Foliar	No injury or growth reduction with 6.4, 12.8 and 25.6 fl oz per 100 gal + Capsil applied 3 times.
31690	Sage, Scarlet (Salvia splendens) 'Lighthouse Red'	Greenhouse	Gilrein	NY	2014	Foliar	No injury on leaves and flowers with 6.38 and 12.76, moderate with 25.52 fl oz per 100 gal applied 3 times; no significant growth reduction; unacceptable plant quality at 4X.
31690	Sage, Scarlet (Salvia splendens) S. splendens 'Sally'	Greenhouse	Davis	MI	2014	Foliar	No injury with 6.38, 12.76 and 25.52 fl oz per 100 gal + Capsil applied 3 times.
31690	Sage, Scarlet (Salvia splendens) 'Vista Purple'	Greenhouse	Gilrein	NY	2014	Foliar	No injury on leaves and flowers with 6.38 and 12.76, moderate with 25.52 fl oz per 100 gal applied 3 times; no significant growth reduction; unacceptable plant quality at 4X.
30383	Marigold (Tagetes sp.) 'Antigua Orange'	Field Container	Wade	SC	2012	Foliar	No injury or growth reduction with 6.38, 12.76 and 25.52 fl oz per 100 gal applied with surfactant 3 times; all plants marketable.

PR#	Crop	Production Site	Researcher	State	Year	Application Type	Results
30383	Marigold (Tagetes sp.) 'Antigua Yellow'	Field Container	Wade	SC	2012	Foliar	No injury or growth reduction with 6.38, 12.76 and 25.52 fl oz per 100 gal applied with surfactant 3 times; all plants marketable.
29323	Marigold (Tagetes sp.) 'Marvel Orange'	Greenhouse	Freiberger	NJ	2011	Foliar	No to very minor injury (at 4X) with 6.4, 12.8 and 25.5 fl oz per 100 gal + surfactant applied 3 times.
30383	Marigold (Tagetes sp.) T. erecta 'Inca Orange'	Field Container	Davis	MI	2010	Foliar	No significant injury at 6.38, 12.76, and 25.52 fl oz per 100 gal.
30383	Marigold (Tagetes sp.) T. patula 'Bonanza Yellow'	Field Container	Davis	MI	2011	Foliar	No injury or growth reduction with 6.38, 12.76 and 25.52 fl oz per 100 gal applied three times.
29323	Marigold (Tagetes sp.) 'Taishan Orange'	Greenhouse	Chen	LA	2010	Foliar	No injury or growth reduction with 6.4, 12.8 and 25.5 fl oz per 100 gal applied twice.
29323	Marigold (Tagetes sp.) 'Taishan Yellow'	Greenhouse	Chen	LA	2010	Foliar	No injury or growth reduction with 6.4, 12.8 and 25.5 fl oz per 100 gal applied twice.
29323	Marigold (Tagetes sp.) 'Tiger Eyes'	Greenhouse	Freiberger	NJ	2011	Foliar	No to very minor injury (at 4X) with 6.4, 12.8 and 25.5 fl oz per 100 gal + surfactant applied 3 times.
29324	Vervain (Verbena sp.)	Greenhouse	Davis	MI	2013	Foliar	No injury with 6.38, 12.76 and 25.52 fl oz per 100 gal + Capsil applied 3 times.
29324	Vervain (Verbena sp.) 'Homestead Purple'	Greenhouse	Chen	LA	2010	Foliar	No injury with 6.4, 12.8 and 25.5 fl oz per 100 gal applied twice.
30365	Vervain (Verbena sp.) 'Obsession Pink'	Field Container	Wade	SC	2012	Foliar	No injury or growth reduction with 6.38, 12.76 and 25.52 fl oz per 100 gal applied with surfactant 3 times; all plants marketable.
30365	Vervain (Verbena sp.) 'Obsession Scarlet'	Field Container	Davis	MI	2014		Moderate injury after the 3rd application with 6.38, 12.76 and 25.52 fl oz per 100 gal + Capsil.
29324	Vervain (Verbena sp.) 'Quartz x P Scarlet'	Greenhouse	Edmunds	CO	2010	Spray-to-wet	No injury at 6.38, 12.76 and 25.52 fl oz per 100 gal applied 3 times.
30365	Vervain (Verbena sp.) 'Quartz XP Purple'	Field Container	Wade	SC	2012	Foliar	No injury or growth reduction with 6.38, 12.76 and 25.52 fl oz per 100 gal applied with surfactant 3 times; all plants marketable.
29324	Vervain (Verbena sp.) 'Serenity Pink'	Greenhouse	Chen	LA	2010	Foliar	No injury with 6.4, 12.8 and 25.5 fl oz per 100 gal applied twice; height reduction at 4X.
29324	Vervain (Verbena sp.) V. hybrida 'Obsession Blue with Eye'	Greenhouse	Gilrein	NY	2011	Foliar	No injury or growth reduction with 6.38, 12.76 and 25.52 fl oz per 100 gal.
29324	Vervain (Verbena sp.) V. hybrida 'Quartz White'	Greenhouse	Gilrein	NY	2011	Foliar	No injury or growth reduction with 6.38, 12.76 and 25.52 fl oz per 100 gal.
29325	Pansy (Viola sp.)	Greenhouse	Uber	CA	2015	Foliar	No injury or growth reduction with 6.4, 12.8 and 25.6 fl oz per 100 gal + Capsil applied 3 times.
29325	Pansy (Viola sp.) 'Dynamite Scarlet'	Greenhouse	Chen	LA	2010	Foliar	No injury or growth reduction with 6.4, 12.8 and 25.5 fl oz per 100 gal applied twice.
29325	Pansy (Viola sp.) 'Matrix Blue Cross'	Greenhouse	Freiberger	NJ	2014	Foliar	No injury or growth reduction with 6.38, 12.76 and 25.52 fl oz per 100 gal applied 3 times.

PR#	Crop	Production Site	Researcher	State	Year	Application Type	Results
29325	Pansy (Viola sp.) V. wittrockiana	Greenhouse	Davis	MI	2014	Foliar	Slight injury after the 1st application with complete recovery at 6.38, 12.76 and 25.52 fl oz per 100 gal + Capsil applied 3 times.
29326	Zinnia (Zinnia sp.) 'Elegans Envy'	Greenhouse	Freiberger	NJ	2011	Foliar	No to minor injury with 6.4, 12.8 and 25.5 fl oz per 100 gal + surfactant applied 3 times.
29326	Zinnia (Zinnia sp.) 'Magellan Coral'	Greenhouse	Edmunds	CO	2010	Spray-to-wet	No injury at 6.38, 12.76 and 25.52 fl oz per 100 gal applied 3 times.
29326	Zinnia (Zinnia sp.) 'Profusion Knee-high Yellow'	Greenhouse	Chen	LA	2011	Foliar	No injury or growth reduction with 6.4, 12.8 and 25.5 fl oz per 100 gal applied twice.
29326	Zinnia (Zinnia sp.) 'Red Spider'	Greenhouse	Freiberger	NJ	2011	Foliar	No to minor injury with 6.4, 12.8 and 25.5 fl oz per 100 gal + surfactant applied 3 times.
29326	Zinnia (Zinnia sp.) 'Zahra White'	Greenhouse	Chen	LA	2011	Foliar	No injury or growth reduction with 6.4, 12.8 and 25.5 fl oz per 100 gal applied twice.

Label Suggestions

We recommend that these four crops listed below be added to the current label:

Calibrachoa sp.

Dracaena sp.

Fuschia sp.

Hedera sp.

Given the lack of phytotoxicity across so many different plant species and genera, it is suggested that all the 4 plants in Table 4 (listed below) that showed no injury be added to the Rycar label if SePro have similar results on these crops:

Coreopsis sp.

Gardenia sp.

Hibiscus sp.

Hydrangea sp.

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