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IR-4 Ornamental Horticulture Program Trinity (Triticonazole) Crop Safety

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Acknowledgements

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Abstract

Triticonazole was registered as Trinity 2SC in the United States in 2007 as a turf fungicide. Since that time it has been under development to expand to ornamental horticulture diseases, and use on ornamental horticulture crops was added to the label in 2013. Because triticonazole is in the triazole class, it could cause symptoms similar to plant growth regulators and testing is warranted on additional herbaceous and woody ornamental species. Between 2010 and 2016, the IR-4 Project completed 180 trials on 44 ornamental plant species examining phytotoxicity related to foliar applications of Trinity 2SC. In these trials, 30 species or genera exhibited minimal or no injury after foliar applications. Of these, nine are not yet listed on the label: *Alyssum sp.*, *Buxus sp.*, *Cornus sp.*, *Dahlia sp.*, *Hedera helix*, *Ilex sp.*, *Lantana sp.*, *Osteospermum sp.*, and *Pseudotsuga menziesii*.

Introduction

Triticonazole was registered as Trinity 2SC in the United States in 2007 as a turf fungicide. Since that time it has been under development to expand to ornamental horticulture diseases, and use on ornamental horticulture crops was added to the label in 2013. Because triticonazole is in the triazole class, it could cause symptoms similar to plant growth regulators and testing is warranted on additional herbaceous and woody ornamental species. Between 2010 and 2016, the IR-4 Project completed 180 trials on 44 ornamental plant species examining phytotoxicity related to foliar applications of Trinity 2SC.

Materials and Methods

Trinity 2SC was tested applied as foliar treatment typically thrice (3 times) at approximately 14 days intervals. The application rates during 2010 were 4, 8, and 16 fl oz per 100 gal, plus a water treated control. During 2011, application rates became 6, 12, and 24 fl oz per 100 gal, plus a water treated control. A minimum of six plants (replicate treatments) were required.

Phytotoxicity was planned to be recorded on a scale of 0 to 10 (0 = No phytotoxicity; 10 = Complete kill), although one research used a 0 to 5 or a 1 to 10 scale instead. Phytotoxicity was rated 7 days after each application. For IR-4 testing, the following protocols were used: 10-015, 11-008, 12-010, 13-010, 14-003, 15-003 and 16-004. 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.

Trinity 2SC was supplied to researchers (See list of researchers in Appendix 1) by BASF.

Results and Summary

Based on the type and nature of injury seen with pesticide applications, tested plant species 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 triticonazole, and 4) more data are needed to make informed recommendations.

Phytotoxicity

Across all plant species tested, Trinity 2SC exhibited no or minimal negative impact (Table 1) on 30 plant genera or species fell into this category. Wade (2012) did observe significant stunting on Begonia even at 6 fl oz per 100 gal, while Davis (2011) observed stunting only at the 8 and 16 fl oz per 100 gal rates (Table 2); Impatiens also exhibited some stunting, but not across all research sites. Additional research may be warranted to determine whether multiple applications contributed to stunting particularly during warmer temperatures. No crops exhibited significant injury at 1x (Table 3). There are 12 species or genera where less than 3 trials were conducted so there is not enough information available at this time (Table 4).

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

Table 1. List of Trinity 2SC treated crops with no or minimal transitory injury.

<i>Acer sp.</i> ¹	<i>Malus sp.</i> ¹
<i>Alyssum sp.</i> (See Davis 2011)	<i>Osteospermum sp.</i> (See Williams 2013)
<i>Antirrhinum majus</i> ¹	<i>Pelargonium sp.</i> ¹
<i>Buxus sp.</i>	<i>Petunia sp.</i> ¹
<i>Calibrachoa sp.</i> ¹	<i>Pseudotsuga menziesii</i>
<i>Camellia sp.</i> ¹	<i>Quercus sp.</i> ¹
<i>Chrysanthemum/Dendratherma sp.</i> ¹	<i>Rhododendron sp. (azalea)</i> ¹
<i>Cornus sp.</i>	<i>Rhododendron sp. (rhododendron)</i> ¹
<i>Dahlia sp.</i>	<i>Rosa sp.</i> ¹
<i>Hedera helix</i>	<i>Salvia officinalis</i>
<i>Hemerocallis sp.</i> ¹	<i>Tagetes sp.</i> ¹
<i>Hydrangea sp.</i> ¹	<i>Verbena sp.</i> ¹
<i>Ilex sp.</i>	<i>Viburnum sp.</i> ¹
<i>Lantana sp.</i>	<i>Viola sp.</i> ¹
<i>Liriope sp.</i> ¹	<i>Zinnia sp.</i> ¹

¹ Already labeled.

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

*Begonia sp.*¹ (see Davis 2011 and Wade 2012)
*Impatiens, New Guinea*¹ (See Davis 2011)

¹Injury observed was stunting; these crops are already listed on the label.

Table 3. List of Trinity 2SC treated crops with significant injury at 1X.

None

Table 4. List of Trinity 2SC treated crops where more information is needed.

<i>Chamaerops humilis</i>	<i>Pennisetum setaceum</i>
<i>Cortaderia sp.</i>	<i>Photinia sp.</i>
<i>Gaillardia sp.</i>	<i>Pseudotsuga menziesii</i>
<i>Lobularia maritima</i> ¹	<i>Pyrus callyerana</i>
<i>Loropetalum sp.</i>	<i>Raphiolepis umbellata</i>
<i>Nandina domestica</i> ¹	<i>Tulipa sp.</i>

¹ Already labeled.

Table 5 Detailed Summary of Crop Safety Testing with Trinity 2SC(triticonazole)

Notes: Table entries are sorted by crop Latin name. Only those trials with research reports received by 8/15/2016 are listed below.

PR#	Crop	Production Site	Researcher	State	Year	Application Type	Results
29433	Maple (Acer sp.) Acer palmatum	Field Container	DeFrancesco	OR	2010	Foliar	No injury or growth reduction at 4, 8 and 16 fl oz per 100 gal applied 3 times.
29433	Maple (Acer sp.) Acer rubrum 'Franksred'	Field Container	Pscheidt	OR	2010	Foliar	No injury or growth reduction at 4, 8 and 16 fl oz per 100 gal.
29433	Maple (Acer sp.) 'Autumn Blaze'	Field Container	Hausbeck	MI	2011	Foliar	No injury with 6, 12 and 24 fl oz per 100 gal applied 3 times.
29433	Maple (Acer sp.) 'Green Mountain'	Field Container	Hausbeck	MI	2011	Foliar	No injury with 6, 12 and 24 fl oz per 100 gal applied 3 times.
29433	Maple (Acer sp.) 'October Glory'	Field Container	Freiberger	NJ	2010	Foliar	No significant injury at 4, 8 and 16 fl oz per 100 gal.
29433	Maple (Acer sp.) 'October Glory'	Field Container	Hausbeck	MI	2011	Foliar	No injury with 6, 12 and 24 fl oz per 100 gal applied 3 times.
29433	Maple (Acer sp.) 'Red Sunset'	Field Container	Hausbeck	MI	2011	Foliar	No injury with 6, 12 and 24 fl oz per 100 gal applied 3 times.
31134	Madwort (Alyssum sp.)	Field Container	Reding	OH	2013	Foliar	No injury or growth reduction with 6, 12 and 24 fl oz per 100 gal applied 3 times; all plants marketable.
31134	Madwort (Alyssum sp.) A. saxatile 'Summit'	Field Container	Freiberger	NJ	2014	Foliar	No injury or growth reduction with 6, 12 and 24 fl oz per 100 gal applied 3 times.
31134	Madwort (Alyssum sp.) 'Clear Crystal Purple and 'Deep Purple'	Field Container	Freiberger	NJ	2013	Foliar	No injury or growth reduction with 6, 12 and 24 fl oz per 100 gal applied 3 times.
31134	Madwort (Alyssum sp.) 'Wonderland Rose'	Field Container	Davis	MI	2011	Foliar	No injury or growth reduction with 4 and 8 fl oz per 100 gal applied three times; unacceptable flower injury at 16 fl oz.
30392	Snapdragon (Antirrhinum majus)	Field Container	Reding	OH	2012	Foliar	No injury and no significant difference in growth or marketability with 6, 12 and 24 fl oz per 100 gal applied 3 times.
30392	Snapdragon (Antirrhinum majus) 'Chimes Rose'	Field Container	Davis	MI	2011	Foliar	No injury or growth reduction with 4, 8 and 16 fl oz per 100 gal applied three times.
29448	Snapdragon (Antirrhinum majus) 'Montego'	Greenhouse	Grunwald	OR	2011	Foliar	No injury or growth reduction with 6, 12 and 24 fl oz per 100 gal applied 3 times; all plants saleable.
30392	Snapdragon (Antirrhinum majus) 'Montego Mix'	Field Container	Grunwald	OR	2013	Foliar	No injury or growth reduction with 6, 12 and 24 fl oz per 100 gal applied 3 times; all plants marketable.
30392	Snapdragon (Antirrhinum majus) 'Peachey Dragon'	Field Container	Freiberger	NJ	2012	Foliar	No injury or growth reduction with 6, 12 and 24 fl oz per 100 gal applied 3 times.
29448	Snapdragon (Antirrhinum majus) 'Rocket Red'	Greenhouse	Freiberger	NJ	2010	Foliar	No significant injury at 4, 8 and 16 fl oz per 100 gal.

PR#	Crop	Production Site	Researcher	State	Year	Application Type	Results
29448	Snapdragon (<i>Antirrhinum majus</i>) 'Sonnet Mix'	Greenhouse	Freiberger	NJ	2010	Foliar	No significant injury at 4, 8 and 16 fl oz per 100 gal.
29445	Begonia (<i>Begonia</i> sp.) B. x tuberhybrida 'Mocca Mix'	Greenhouse	Grunwald	OR	2011	Foliar	No injury or growth reduction with 6, 12 and 24 fl oz per 100 gal applied 3 times; all plants saleable.
29445	Begonia (<i>Begonia</i> sp.) 'Baby Wing Pink'	Greenhouse	Freiberger	NJ	2010	Foliar	No injury at 4, 8, and 16 fl oz per 100 gal after one application, slight at 4X after the 3rd application.
29445	Begonia (<i>Begonia</i> sp.) 'Red'	Greenhouse	Davis	MI	2011	Foliar	No injury with 4, 8 and 16 fl oz per 100 gal applied three times; unacceptable stunting at 2X and 4X.
29445	Begonia (<i>Begonia</i> sp.) <i>Solenostemon</i> scutellarioides 'Big Red Green Leaf'	Greenhouse	Hausbeck	MI	2010	Foliar	No injury or growth reduction with 6, 12 and 24 fl oz per 100 gal applied 3 times.
30368	Begonia (<i>Begonia</i> sp.) 'Super Olympia Red'	Field Container	Wade	SC	2012	Foliar	Unacceptable stunting and discoloration with 6, 12 and 24 fl oz per 100 gal applied 3 times.
29445	Begonia (<i>Begonia</i> sp.) 'Whiskey Br Wh'	Greenhouse	Freiberger	NJ	2010	Foliar	No significant injury at 4, 8 and 16 fl oz per 100 gal.
31495	Boxwood (<i>Buxus</i> sp.) B. <i>microphylla</i> 'Winter Gem'	Field Container	Pscheidt	OR	2013	Foliar	No injury or growth reduction with 12 and 24 fl oz per 100 gal applied 3 times.
31495	Boxwood (<i>Buxus</i> sp.) B. <i>microphylla</i> 'Winter Gem'	Field Container	Pscheidt	OR	2013	Foliar	No injury or height reduction with 12 and 24 fl oz per 100 gal applied 3 times.
31495	Boxwood (<i>Buxus</i> sp.) B. <i>sempervirens</i> 'Suffruticosa'	Field Container	Pscheidt	OR	2013	Foliar	No injury or growth reduction with 12 and 24 fl oz per 100 gal applied 3 times.
31495	Boxwood (<i>Buxus</i> sp.) B. <i>sempervirens</i> 'Suffruticosa'	Field Container	Pscheidt	OR	2013	Foliar	No injury or height reduction with 12 and 24 fl oz per 100 gal applied 3 times.
31495	Boxwood (<i>Buxus</i> sp.) 'Green Velvet'	Field Container	Pscheidt	OR	2013	Foliar	No injury or growth reduction with 12 and 24 fl oz per 100 gal applied 3 times.
31495	Boxwood (<i>Buxus</i> sp.) 'Green Velvet'	Field Container	Pscheidt	OR	2014	Foliar	No injury or height reduction with 12 and 24 fl oz per 100 gal applied 3 times.
30729	Calibrachoa (<i>Calibrachoa</i> sp.)	Greenhouse	Williams	IL	2013	Drench	No injury with 6, 12 and 24 fl oz per 100 gal applied 3 times at monthly intervals; moderate growth reduction.
30729	Calibrachoa (<i>Calibrachoa</i> sp.)	Greenhouse	Williams	IL	2013	Foliar	No injury with 6, 12 and 24 fl oz per 100 gal applied 3 times at monthly intervals; moderate growth reduction.
30729	Calibrachoa (<i>Calibrachoa</i> sp.) C. x hybrida 'Cabaret Lavender'	Greenhouse	Hausbeck	MI	2013	Foliar	No injury or growth reduction with 6, 12 and 24 fl oz per 100 gal applied 3 times.
30729	Calibrachoa (<i>Calibrachoa</i> sp.) 'Cabaret Purple'	Greenhouse	Williams-Woodward	GA	2013	Foliar	No significant injury or growth reduction with 6, 12 and 24 fl oz per 100 gal applied 3 times.
30729	Calibrachoa (<i>Calibrachoa</i> sp.) 'Mini-famous Orange'	Greenhouse	Grunwald	OR	2013	Foliar	No injury or growth reduction with 6, 12 and 24 fl oz per 100 gal applied 3 times; all plants marketable.
30729	Calibrachoa (<i>Calibrachoa</i> sp.) 'Minifamous Red'	Greenhouse	Grunwald	OR	2012	Foliar	No injury or growth reduction with 6, 12 and 24 fl oz per 100 gal applied 3 times; all plants saleable.
29437	Camellia (<i>Camellia</i> sp.) C. japonica 'Nuccio's Pearl'	Field Container	DeFrancesco	OR	2011	Foliar	No injury or growth reduction with 6, 12, and 24 fl oz per 100 gal.

PR#	Crop	Production Site	Researcher	State	Year	Application Type	Results
29437	Camellia (Camellia sp.) C. sinensis	Field Container	Wade	SC	2011	Foliar	No injury or growth reduction with 6, 12 and 24 fl oz per 100 gal applied 3 times.; all plants marketable.
29437	Camellia (Camellia sp.) C. x hybrida 'Freedom Bell'	Field Container	Grunwald	OR	2011	Foliar	No injury or growth reduction with 6, 12 and 24 fl oz per 100 gal applied 3 times; all plants saleable.
30056	Palm, Dwarf Fan (Chamaerops humilis)	Field Container	Wade	SC	2015	Foliar	No injury with 6, 12 and 24 fl oz per 100 gal applied 3 times; all plants marketable.
29483	Chrysanthemum, Garden (Chrysanthemum/Dendranthema sp.)	Field Container	Reding	OH	2012	Foliar	No injury and no significant difference in growth or marketability with 6, 12 and 24 fl oz per 100 gal applied 3 times.
29483	Chrysanthemum, Garden (Chrysanthemum/Dendranthema sp.) 'Clara Curtis'	Field Container	Grunwald	OR	2012	Foliar	No injury or growth reduction with 6, 12 and 24 fl oz per 100 gal applied 3 times; all plants saleable.
29483	Chrysanthemum, Garden (Chrysanthemum/Dendranthema sp.) 'Clara Curtis'	Field Container	Grunwald	OR	2013	Foliar	No injury or growth reduction with 6, 12 and 24 fl oz per 100 gal applied 3 times; all plants marketable.
29483	Chrysanthemum, Garden (Chrysanthemum/Dendranthema sp.) Dendranthema sp.	Field Container	Wade	SC	2011	Foliar	No injury or growth reduction with 6, 12 and 24 fl oz per 100 gal applied 3 times.; all plants marketable.
29431	Dogwood (Cornus sp.)	Field Container	Harvey	WA	2011	Foliar	No injury with 6, 12 and 24 fl oz per 100 gal applied 3 times.
29431	Dogwood (Cornus sp.) 'Baileyi'	Field Container	Hausbeck	MI	2011	Foliar	No injury with 6, 12 and 24 fl oz per 100 gal applied 3 times.
29431	Dogwood (Cornus sp.) 'Pink'	Field Container	Hausbeck	MI	2011	Foliar	No injury with 6, 12 and 24 fl oz per 100 gal applied 3 times.
29431	Dogwood (Cornus sp.) 'Red'	Field Container	Hausbeck	MI	2011	Foliar	No injury with 6, 12 and 24 fl oz per 100 gal applied 3 times.
30066	Pampas Grass (Cortaderia sp.)	Field Container	Harvey	WA	2015	Foliar	No injury or growth reduction with 6, 12 and 24 fl oz per 100 gal applied 3 times.
30376	Dahlia (Dahlia sp.) 'Figaro Mix'	Field Container	Davis	MI	2011	Foliar	No injury or growth reduction with 4, 8 and 16 fl oz per 100 gal applied three times.
30376	Dahlia (Dahlia sp.) 'Figaro Mix'	Field Container	Freiberger	NJ	2013	Foliar	No injury or growth reduction with 6, 12 and 24 fl oz per 100 gal applied 3 times.
30376	Dahlia (Dahlia sp.) 'Mystic Wonder'	Field Container	Koivunen	CA	2015	Foliar	No injury or growth reduction with 6, 12 and 24 fl oz per 100 gal applied 3 times.
30319	Blanket Flower (Gaillardia x grandiflora) 'Arizona Red Shades'	Field Container	Reding	OH	2015	Foliar	No injury or growth reduction with 6, 12 and 24 fl oz per 100 gal applied 3 times; all plants marketable.
30319	Blanket Flower (Gaillardia x grandiflora) 'Golden Goblin'	Field Container	Hausbeck	MI	2010	Foliar	No injury at 4, 8 and 16 fl oz per 100 gal.
29440	English Ivy (Hedera helix L. ssp. Helix)	Field Container	Fraelich	GA	2015	Foliar	No injury or difference in plant growth and marketability with 6, 12 and 24 fl oz per 100 gal applied 3 times.
29440	English Ivy (Hedera helix L. ssp. Helix)	Field Container	Harvey	WA	2011	Foliar	No injury with 6, 12 and 24 fl oz per 100 gal applied 3 times.
29440	English Ivy (Hedera helix L. ssp. Helix)	Field Container	Reding	OH	2015	Foliar	No injury or growth reduction with 6, 12 and 24 fl oz per 100 gal applied 3 times; all plants marketable.
29442	Daylily (Hemerocallis sp.)	Field Container	Harvey	WA	2011	Foliar	No injury with 6, 12 and 24 fl oz per 100 gal applied 3 times.

PR#	Crop	Production Site	Researcher	State	Year	Application Type	Results
29442	Daylily (Hemerocallis sp.) 'Big Time Happy'	Field Container	Freiberger	NJ	2010	Foliar	No significant injury at 4, 8 and 16 fl oz per 100 gal.
29442	Daylily (Hemerocallis sp.) 'Chicago Apache'	Field Container	Hausbeck	MI	2010	Foliar	No injury at 4, 8 and 16 fl oz per 100 gal.
29442	Daylily (Hemerocallis sp.) 'Little Grapette'	Field Container	Hausbeck	MI	2010	Foliar	No injury at 4, 8 and 16 fl oz per 100 gal.
29442	Daylily (Hemerocallis sp.) 'Mini Pearl'	Field Container	Hausbeck	MI	2011	Foliar	No injury with 6, 12 and 24 fl oz per 100 gal applied 3 times.
29442	Daylily (Hemerocallis sp.) 'Raspberry Pixie'	Field Container	Freiberger	NJ	2010	Foliar	No significant injury at 4, 8 and 16 fl oz per 100 gal.
29442	Daylily (Hemerocallis sp.) 'Siloam Double Classic'	Field Container	Hausbeck	MI	2011	Foliar	No injury with 6, 12 and 24 fl oz per 100 gal applied 3 times.
29442	Daylily (Hemerocallis sp.) 'Stella de Oro'	Field Container	Hausbeck	MI	2011	Foliar	No injury with 6, 12 and 24 fl oz per 100 gal applied 3 times.
29442	Daylily (Hemerocallis sp.) 'Strawberry Candy'	Field Container	Hausbeck	MI	2011	Foliar	No injury with 6, 12 and 24 fl oz per 100 gal applied 3 times.
29435	Hydrangea (Hydrangea sp.)	Field Container	Harvey	WA	2011	Foliar	No injury with 6, 12 and 24 fl oz per 100 gal applied 3 times.
29435	Hydrangea (Hydrangea sp.) 'Glowing Ambers'	Field Container	Freiberger	NJ	2010	Foliar	No significant injury at 4, 8 and 16 fl oz per 100 gal.
29435	Hydrangea (Hydrangea sp.) H. macrophylla 'Taube'	Field Container	Grunwald	OR	2011	Foliar	No injury or growth reduction with 6, 12 and 24 fl oz per 100 gal applied 3 times; all plants saleable.
29435	Hydrangea (Hydrangea sp.) 'Limelight'	Field Container	Hausbeck	MI	2010	Foliar	No injury at 4, 8 and 16 fl oz per 100 gal.
29435	Hydrangea (Hydrangea sp.) 'Pinky Winky'	Field Container	Hausbeck	MI	2010	Foliar	No injury at 4, 8 and 16 fl oz per 100 gal.
30058	Holly (Ilex sp.) 'Emerald Collonade'	Field Container	Fraelich	GA	2014	Foliar	No injury or growth reduction with 6, 12 and 24 fl oz per 100 gal applied 3 times.
30058	Holly (Ilex sp.) I. verticillata	Field Container	DeFrancesco	OR	2014	Foliar	No injury or growth reduction with 6, 12 and 24 fl oz per 100 gal applied 3 times.
30058	Holly (Ilex sp.) Ilex x merserveae 'Castle Wall'	Field Container	Reding	OH	2015	Foliar	No injury or growth reduction with 6, 12 and 24 fl oz per 100 gal applied 3 times; all plants marketable.
30369	New Guinea Impatiens (Impatiens hawkeri)	Field Container	Reding	OH	2013	Foliar	No injury or growth reduction with 6, 12 and 24 fl oz per 100 gal applied 3 times; all plants marketable.
29447	New Guinea Impatiens (Impatiens hawkeri) 'Divine Orange'	Greenhouse	Hausbeck	MI	2015	Foliar	No significant injury with 6, moderate with 12 and 24, fl oz per 100 gal applied 3 times; no height reduction.
30369	New Guinea Impatiens (Impatiens hawkeri) I. walleriana 'Stardust Red'	Field Container	Davis	MI	2011	Foliar	Moderate to severe stunting increasing with rate (4, 8, 16 fl oz per 100 gal).
29447	New Guinea Impatiens (Impatiens hawkeri) 'Paradise Fuchia'	Greenhouse	Freiberger	NJ	2010	Foliar	Slight injury at 4, 8 and 16 fl oz per 100 gal.

PR#	Crop	Production Site	Researcher	State	Year	Application Type	Results
29447	New Guinea Impatiens (Impatiens hawkeri) 'Paradise Light Pink'	Greenhouse	Freiberger	NJ	2010	Foliar	No injury at 4, 8 and 16 fl oz per 100 gal.
30369	New Guinea Impatiens (Impatiens hawkeri) 'Pure Beauty White'	Field Container	Freiberger	NJ	2013	Foliar	No injury or growth reduction with 6, 12 and 24 fl oz per 100 gal applied 3 times.
29441	Shrub Verbena (Lantana sp.)	Field Container	Reding	OH	2012	Foliar	No injury and no significant difference in growth or marketability with 6, 12 and 24 fl oz per 100 gal applied 3 times.
29441	Shrub Verbena (Lantana sp.) 'Chapel Hill Yellow'	Field Container	Fraelich	GA	2013	Foliar	No injury or growth reduction with 6, 12 and 24 fl oz per 100 gal; all plants marketable.
29441	Shrub Verbena (Lantana sp.) 'Imagination'	Field Container	Kirk	MI	2011	Foliar	No injury or growth reduction with 4, 8 and 16 oz per 100 gal applied 5 times.
29441	Shrub Verbena (Lantana sp.) L. camara 'Confetti'	Field Container	Grunwald	OR	2012	Foliar	No injury or growth reduction with 6, 12 and 24 fl oz per 100 gal applied 3 times; all plants saleable.
29441	Shrub Verbena (Lantana sp.) L. montevidensis	Field Container	Uber	CA	2012	Foliar	No injury or growth reduction with 6, 12 and 24 fl oz per 100 gal applied 3 times.
29443	Lilyturf, Creeping (Liriope sp.)	Field Container	Harvey	WA	2011	Foliar	No injury with 6, 12 and 24 fl oz per 100 gal applied 3 times.
29443	Lilyturf, Creeping (Liriope sp.) 'Big Blue'	Field Container	Hausbeck	MI	2010	Foliar	No injury at 4, 8 and 16 fl oz per 100 gal.
29443	Lilyturf, Creeping (Liriope sp.) variegata	Field Container	Hausbeck	MI	2010	Foliar	No injury at 4, 8 and 16 fl oz per 100 gal.
29443	Lilyturf, Creeping (Liriope sp.) 'Variegata'	Field Container	Freiberger	NJ	2010	Foliar	No significant injury at 4, 8 and 16 fl oz per 100 gal.
31603	Sweet Alyssum (Lobulariamaritima) 'Clear Crystal White'	Field Container	DeFrancesco	OR	2013	Foliar	No injury or growth reduction with 6, 12 and 24 fl oz per 100 gal applied 3 times.
30062	Loropetalum (Loropetalum sp.)	Field Container	Wade	SC	2015	Foliar	No injury with 6, 12 and 24 fl oz per 100 gal applied 3 times; all plants marketable.
29432	Apple & Crabapple (Non-Bearing) (Malus sp.) 'Coralburst Crab' (crabapple)	Field Container	Hausbeck	MI	2011	Foliar	No injury with 6, 12 and 24 fl oz per 100 gal applied 3 times.
29432	Apple & Crabapple (Non-Bearing) (Malus sp.) 'Golden Delicious' (apple)	Field Container	Hausbeck	MI	2010	Foliar	No injury at 4, 8 and 16 fl oz per 100 gal.
29432	Apple & Crabapple (Non-Bearing) (Malus sp.) 'Honey Crisp' (apple)	Field Container	Hausbeck	MI	2010	Foliar	No injury at 4, 8 and 16 fl oz per 100 gal.
29432	Apple & Crabapple (Non-Bearing) (Malus sp.) 'Lancelot' (crabapple)	Field Container	Hausbeck	MI	2010	Foliar	No injury at 4, 8 and 16 fl oz per 100 gal.

PR#	Crop	Production Site	Researcher	State	Year	Application Type	Results
29432	Apple & Crabapple (Non-Bearing) (Malus sp.) 'McIntosh' (apple)	Field Container	Hausbeck	MI	2011	Foliar	No injury with 6, 12 and 24 fl oz per 100 gal applied 3 times.
29432	Apple & Crabapple (Non-Bearing) (Malus sp.) 'Mutsu' (apple)	Field Container	Hausbeck	MI	2011	Foliar	No injury with 6, 12 and 24 fl oz per 100 gal applied 3 times.
29432	Apple & Crabapple (Non-Bearing) (Malus sp.) 'Praire Fire Crab' (crabapple)	Field Container	Hausbeck	MI	2011	Foliar	No injury with 6, 12 and 24 fl oz per 100 gal applied 3 times.
29432	Apple & Crabapple (Non-Bearing) (Malus sp.) 'Sargent' (crabapple)	Field Container	Hausbeck	MI	2010	Foliar	No injury at 4, 8 and 16 fl oz per 100 gal.
29432	Apple & Crabapple (Non-Bearing) (Malus sp.) 'Winesap' (apple)	Field Container	Hausbeck	MI	2011	Foliar	No injury with 6, 12 and 24 fl oz per 100 gal applied 3 times.
29438	Heavenly Bamboo (Nandinadomestica) 'Fire Power'	Field Container	Freiberger	NJ	2010	Foliar	No significant injury at 4, 8 and 16 fl oz per 100 gal.
30816	African Daisy (Osteospermum sp.)	Greenhouse	Williams	IL	2013	Foliar	No injury with 6, 12 and 24 fl oz per 100 gal applied 3 times at monthly intervals; moderate growth reduction.
30816	African Daisy (Osteospermum sp.) 'Akila Purple'	Greenhouse	Hausbeck	MI	2013	Foliar	No injury or growth reduction with 6, 12 and 24 fl oz per 100 gal applied 3 times.
30816	African Daisy (Osteospermum sp.) 'Copper Purple'	Greenhouse	Grunwald	OR	2012	Foliar	No injury or growth reduction with 6, 12 and 24 fl oz per 100 gal applied 3 times; all plants saleable.
30816	African Daisy (Osteospermum sp.) 'Margarita White Spoon'	Greenhouse	Freiberger	NJ	2013	Foliar	No injury or growth reduction with 6, 12 and 24 fl oz per 100 gal applied 3 times.
30816	African Daisy (Osteospermum sp.) O. ecklonis 'Summertime Blueberry'	Greenhouse	DeFrancesco	OR	2013	Foliar	No injury or growth reduction with 6, 12 and 24 fl oz per 100 gal applied 3 times.
30377	Geranium (Pelargonium sp.)	Field Container	Reding	OH	2012	Foliar	No injury and no significant difference in growth or marketability with 6, 12 and 24 fl oz per 100 gal applied 3 times.
29451	Geranium (Pelargonium sp.) 'Maestro Lav Blue'	Greenhouse	Freiberger	NJ	2010	Foliar	No significant injury at 4, 8 and 16 fl oz per 100 gal.
29451	Geranium (Pelargonium sp.) 'Maestro Pac Lav Par'	Greenhouse	Freiberger	NJ	2010	Foliar	No significant injury at 4 and 8, slight at 16 fl oz per 100 gal.
30377	Geranium (Pelargonium sp.) P. peltatum 'Red Blizzard'	Field Container	Grunwald	OR	2012	Foliar	No injury or growth reduction with 6, 12 and 24 fl oz per 100 gal applied 3 times; all plants saleable.
29451	Geranium (Pelargonium sp.) P. x hortorum 'Orbit White'	Greenhouse	Hausbeck	MI	2010	Foliar	No injury or growth reduction with 6, 12 and 24 fl oz per 100 gal applied 3 times.
30377	Geranium (Pelargonium sp.) P. x hortorum 'Orbit Pink Seed'	Field Container	Davis	MI	2011	Foliar	No injury or growth reduction with 4, 8 and 16 fl oz per 100 gal applied three times.

PR#	Crop	Production Site	Researcher	State	Year	Application Type	Results
30065	Fountain Grass (Pennisetumsetaceum)	Field Container	Harvey	WA	2015	Foliar	No injury or growth reduction with 6, 12 and 24 fl oz per 100 gal applied 3 times.
30393	Petunia (Petunia sp.)	Field Container	Reding	OH	2012	Foliar	No injury and no significant difference in growth or marketability with 6, 12 and 24 fl oz per 100 gal applied 3 times.
30393	Petunia (Petunia sp.) 'Dreams White'	Field Container	Davis	MI	2011	Foliar	No injury or growth reduction with 4, 8 and 16 fl oz per 100 gal applied three times.
30393	Petunia (Petunia sp.) 'Mambo Purple'	Field Container	Wade	SC	2013	Foliar	No injury or growth reduction with 6, 12 and 24 fl oz per 100 gal applied 3 times; all plants marketable.
30393	Petunia (Petunia sp.) 'SGL Mambo Pink'	Field Container	Wade	SC	2013	Foliar	No injury or growth reduction with 6, 12 and 24 fl oz per 100 gal applied 3 times; all plants marketable.
30393	Petunia (Petunia sp.) 'Single Wave Purple'	Field Container	Grunwald	OR	2012	Foliar	No injury or growth reduction with 6, 12 and 24 fl oz per 100 gal applied 3 times; all plants saleable.
29434	Photinia (Photinia sp.) P. fraseri	Field Container	Grunwald	OR	2011	Foliar	No injury or growth reduction with 6, 12 and 24 fl oz per 100 gal applied 3 times; all plants saleable.
29434	Photinia (Photinia sp.) P. x fraseri 'Pink Marble'	Field Container	Reding	OH	2015	Foliar	No injury or growth reduction with 6, 12 and 24 fl oz per 100 gal applied 3 times; all plants marketable.
30817	Fir, Douglas (Pseudotsugamenziesii)	Greenhouse	DeFrancesco	OR	2012	Foliar	No injury or growth reduction with 6, 12 and 24 fl oz per 100 gal applied 3 times.
30817	Fir, Douglas (Pseudotsugamenziesii)	Greenhouse	Grunwald	OR	2012	Foliar	No injury or growth reduction with 6, 12 and 24 fl oz per 100 gal applied 3 times; all plants saleable.
30817	Fir, Douglas (Pseudotsugamenziesii)	Greenhouse	Grunwald	OR	2013	Foliar	No injury or growth reduction with 6, 12 and 24 fl oz per 100 gal applied 3 times; all plants marketable.
29428	Pear, Bradford (Non-Bearing) (Pyruscalleryana) 'Autumn Blaze'	Field Container	Grunwald	OR	2011	Foliar	No injury or growth reduction with 6, 12 and 24 fl oz per 100 gal applied 3 times; all plants saleable.
29427	Oak (Quercus sp.)	Field Container	Grunwald	OR	2011	Foliar	No injury or growth reduction with 6, 12 and 24 fl oz per 100 gal applied 3 times; all plants saleable.
29427	Oak (Quercus sp.) 'Northern Pin Oak'	Field Container	Freiberger	NJ	2010	Foliar	No significant injury at 4, 8 and 16 fl oz per 100 gal.
29427	Oak (Quercus sp.) 'Northern Red'	Field Container	Hausbeck	MI	2011	Foliar	No injury with 6, 12 and 24 fl oz per 100 gal applied 3 times.
29427	Oak (Quercus sp.) 'Pin Oak'	Field Container	Hausbeck	MI	2011	Foliar	No injury with 6, 12 and 24 fl oz per 100 gal applied 3 times.
29427	Oak (Quercus sp.) Q. rubra	Field Container	DeFrancesco	OR	2012	Foliar	No injury or growth reduction with 6, 12 and 24 fl oz per 100 gal applied 3 times.
29439	Indian Hawthorn (Raphiolepisindica) R. umbellata 'Southern Moon Yedda'	Field Container	Fraelich	GA	2014	Foliar	No injury or growth reduction with 6, 12 and 24 fl oz per 100 gal applied 3 times.
29430	Azalea (Rhododendron sp.)	Field Container	Grunwald	OR	2011	Foliar	No injury or growth reduction with 6, 12 and 24 fl oz per 100 gal applied 3 times; all plants saleable.
29430	Azalea (Rhododendron sp.) 'Dawn's Chorus'	Field Container	DeFrancesco	OR	2011	Foliar	No injury or growth reduction with 6, 12, and 24 fl oz per 100 gal.

PR#	Crop	Production Site	Researcher	State	Year	Application Type	Results
29430	Azalea (Rhododendron sp.) 'Hino Crimson'	Field Container	DeFrancesco	OR	2010	Foliar	No injury or growth reduction at 4, 8 and 16 fl oz per 100 gal applied 3 times.
29430	Azalea (Rhododendron sp.) 'Mandarin Lights'	Field Container	Pscheidt	OR	2010	Foliar	No injury or growth reduction at 4, 8 and 16 fl oz per 100 gal.
29430	Azalea (Rhododendron sp.) 'Mothers Day' & 'Haps Pink'	Field Container	Freiberger	NJ	2010	Foliar	No injury at 4, 8 and 16 fl oz per 100 gal.
29430	Azalea (Rhododendron sp.) 'Northern Hi-Lights'	Field Container	Hausbeck	MI	2010	Foliar	No injury at 4, 8 and 16 fl oz per 100 gal.
29430	Azalea (Rhododendron sp.) 'Orchid Lights'	Field Container	Hausbeck	MI	2010	Foliar	No injury at 4, 8 and 16 fl oz per 100 gal.
29429	Rhododendron (Rhododendron sp.)	Field Container	Grunwald	OR	2011	Foliar	No injury or growth reduction with 6, 12 and 24 fl oz per 100 gal applied 3 times; all plants saleable.
29429	Rhododendron (Rhododendron sp.) 'Boursault'	Field Container	Freiberger	NJ	2010	Foliar	No significant injury at 4, 8 and 16 fl oz per 100 gal.
29429	Rhododendron (Rhododendron sp.) 'Cunningham's White'	Field Container	DeFrancesco	OR	2010	Foliar	No injury or growth reduction at 4, 8 and 16 fl oz per 100 gal applied 3 times.
29429	Rhododendron (Rhododendron sp.) 'English'	Field Container	Hausbeck	MI	2010	Foliar	No injury at 4, 8 and 16 fl oz per 100 gal.
29429	Rhododendron (Rhododendron sp.) 'Nova Zembla'	Field Container	Freiberger	NJ	2010	Foliar	No significant injury at 4, 8 and 16 fl oz per 100 gal.
29429	Rhododendron (Rhododendron sp.) 'PJM'	Field Container	DeFrancesco	OR	2011	Foliar	No injury or growth reduction with 6, 12, and 24 fl oz per 100 gal.
29429	Rhododendron (Rhododendron sp.) 'PJM compact'	Field Container	Hausbeck	MI	2010	Foliar	No injury at 4, 8 and 16 fl oz per 100 gal.
29429	Rhododendron (Rhododendron sp.) 'Roseumelegans'	Field Container	Pscheidt	OR	2010	Foliar	No injury or growth reduction at 4, 8 and 16 fl oz per 100 gal.
29426	Rose (Rosa sp.)	Field Container	Harvey	WA	2011	Foliar	No injury with 6, 12 and 24 fl oz per 100 gal applied 3 times.
29426	Rose (Rosa sp.) 'Home Run'	Field Container	Freiberger	NJ	2010	Foliar	No significant injury at 4, 8 and 16 fl oz per 100 gal.
29426	Rose (Rosa sp.) 'MeidomonacBonica'	Field Container	Pscheidt	OR	2010	Foliar	No injury or growth reduction at 4, 8 and 16 fl oz per 100 gal; good black spot control.
29426	Rose (Rosa sp.) 'Nearly Wild'	Field Container	DeFrancesco	OR	2010	Foliar	No injury or growth reduction at 4, 8 and 16 fl oz per 100 gal applied 3 times.
29426	Rose (Rosa sp.) 'Radrazz'	Field Container	Freiberger	NJ	2010	Foliar	No significant injury at 4, 8 and 16 fl oz per 100 gal.
29426	Rose (Rosa sp.) 'Rainbow Knockout'	Field Container	Hausbeck	MI	2010	Foliar	No injury at 4, 8 and 16 fl oz per 100 gal.
29426	Rose (Rosa sp.) 'Sunny Knockout'	Field Container	Hausbeck	MI	2010	Foliar	No injury at 4, 8 and 16 fl oz per 100 gal.
29446	Sage, common (Salvia officinalis)	Greenhouse	Freiberger	NJ	2013	Foliar	No injury or growth reduction with 6, 12 and 24 fl oz per 100 gal applied 3 times.
29446	Sage, common (Salvia officinalis) 'Berggarten'	Greenhouse	DeFrancesco	OR	2011	Foliar	No injury or growth reduction with 6, 12, and 24 fl oz per 100 gal.

PR#	Crop	Production Site	Researcher	State	Year	Application Type	Results
29446	Sage, common (<i>Salvia officinalis</i>) 'Berrgarten'	Greenhouse	Grunwald	OR	2011	Foliar	No injury or growth reduction with 6, 12 and 24 fl oz per 100 gal applied 3 times; all plants saleable.
29449	Marigold (<i>Tagetes</i> sp.) 'Aurora Gold'	Greenhouse	Freiberger	NJ	2010	Foliar	No injury at 4, 8 and 16 fl oz per 100 gal.
29449	Marigold (<i>Tagetes</i> sp.) 'Bonanza'	Greenhouse	Grunwald	OR	2011	Foliar	No injury or growth reduction with 6, 12 and 24 fl oz per 100 gal applied 3 times; all plants saleable.
29449	Marigold (<i>Tagetes</i> sp.) 'Capriccio'	Greenhouse	Freiberger	NJ	2010	Foliar	No injury at 4, 8 and 16 fl oz per 100 gal.
29449	Marigold (<i>Tagetes</i> sp.) T. erecta 'African Perfect Yellow'	Greenhouse	Hausbeck	MI	2010	Foliar	No injury or growth reduction with 6, 12 and 24 fl oz per 100 gal applied 3 times.
29449	Marigold (<i>Tagetes</i> sp.) T. erecta 'African Perfect Yellow'	Greenhouse	Hausbeck	MI	2011	Foliar	No injury or growth reduction with 6, 12 and 24 fl oz per 100 gal applied 3 times.
30394	Marigold (<i>Tagetes</i> sp.) T. patula 'Bonanza Yellow'	Field Container	Davis	MI	2011	Foliar	No injury or growth reduction with 4, 8 and 16 fl oz per 100 gal applied three times.
30394	Marigold (<i>Tagetes</i> sp.) T. patula 'Durango Outback Mix'	Field Container	DeFrancesco	OR	2013	Foliar	No injury with 6, 12 and 24 fl oz per 100 gal applied 3 times; slight growth reduction at 2X.
30819	Tulip (<i>Tulipa</i> sp.) 'Oxford'	Greenhouse	Freiberger	NJ	2013	Foliar	Virtually no injury or growth reduction with 6, 12 and 24 fl oz per 100 gal applied 3 times.
30353	Vervain (<i>Verbena</i> sp.)	Field Container	Reding	OH	2012	Foliar	No injury or growth reduction with 6, 12 and 24 fl oz per 100 gal applied 3 times; all plants marketable.
30353	Vervain (<i>Verbena</i> sp.) 'Costa del Sol Magenta'	Field Container	Freiberger	NJ	2013	Foliar	No injury or growth reduction with 6, 12 and 24 fl oz per 100 gal applied 3 times.
30353	Vervain (<i>Verbena</i> sp.) 'Red Obsession'	Field Container	Wade	SC	2012	Foliar	No injury with 6, 12 and 24 fl oz per 100 gal applied 3 times.
30353	Vervain (<i>Verbena</i> sp.) V. canadensis 'Homestead Purple'	Field Container	Fraelich	GA	2013	Foliar	No injury or growth reduction with 6, 12 and 24 fl oz per 100 gal; all plants marketable.
30059	Arrowwood (<i>Viburnum</i> sp.)	Field Container	Harvey	WA	2015	Foliar	No injury or growth reduction with 6, 12 and 24 fl oz per 100 gal applied 3 times.
30059	Arrowwood (<i>Viburnum</i> sp.) V. dilatatum 'Cardinal Candy'	Field Container	Reding	OH	2015	Foliar	No injury or growth reduction with 6, 12 and 24 fl oz per 100 gal applied 3 times; all plants marketable.
30059	Arrowwood (<i>Viburnum</i> sp.)	Field Container	Fraelich	GA	2016	Foliar	No injury with 6, 12 and 24 fl oz per 100 gal applied 3 times; slight stunting at 2X and 4X; all plants marketable.
29452	Pansy (<i>Viola</i> sp.) 'Daffodil Mix'	Greenhouse	Freiberger	NJ	2010	Foliar	No significant injury at 4, 8 and 16 fl oz per 100 gal.
29452	Pansy (<i>Viola</i> sp.) 'Delta Cotton Candy'	Greenhouse	Freiberger	NJ	2010	Foliar	No significant injury at 4, 8 and 16 fl oz per 100 gal.
29452	Pansy (<i>Viola</i> sp.) V. tricolor 'Matrix Rose'	Greenhouse	Hausbeck	MI	2010	Foliar	No injury or growth reduction with 6, 12 and 24 fl oz per 100 gal applied 3 times.
29452	Pansy (<i>Viola</i> sp.) V. tricolor 'Matrix Rose'	Greenhouse	Hausbeck	MI	2011	Foliar	No injury but moderate growth reduction with 6, 12 and 24 fl oz per 100 gal applied 3 times.
29452	Pansy (<i>Viola</i> sp.) V. x hybrida 'Columbine'	Greenhouse	Grunwald	OR	2011	Foliar	No injury or growth reduction with 6, 12 and 24 fl oz per 100 gal applied 3 times; all plants saleable.

PR#	Crop	Production Site	Researcher	State	Year	Application Type	Results
29450	Zinnia (Zinnia sp.) 'Angustifolia Crystal White'	Greenhouse	Freiberger	NJ	2010	Foliar	No significant injury at 4, 8 and 16 fl oz per 100 gal.
29450	Zinnia (Zinnia sp.) 'Red Spider'	Greenhouse	Freiberger	NJ	2010	Foliar	No significant injury at 4, 8 and 16 fl oz per 100 gal.
29450	Zinnia (Zinnia sp.) Z. elegans 'Binary Mix'	Greenhouse	Grunwald	OR	2011	Foliar	No injury or growth reduction with 6, 12 and 24 fl oz per 100 gal applied 3 times; all plants saleable.
29450	Zinnia (Zinnia sp.) Z. marylandica 'Zahara Fire'	Greenhouse	Hausbeck	MI	2010	Foliar	No injury or growth reduction with 6, 12 and 24 fl oz per 100 gal applied 3 times.
29450	Zinnia (Zinnia sp.) Z. marylandica 'Zahara Fire'	Greenhouse	Hausbeck	MI	2011	Foliar	No injury but slight growth reduction with 6, 12 and 24 fl oz per 100 gal applied 3 times.

Label Suggestions

In this report, 30 species or genera exhibited minimal or no injury after foliar treatments of Trinity 2SC (triticonazole) at 6, 12 and 24 fl oz per 100gal; 21 of these are already on the label. We recommend that the following 9 species or genera be added to the current label: *Alyssum sp.*, *Buxus sp.*, *Cornus sp.*, *Dahlia sp.*, *Hedera helix*, *Ilex sp.*, *Lantana sp.*, *Pseudotsuga menziesii*, and *Osteospermum sp.*

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