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IR-4 Ornamental Horticulture Program Tourney (Metconazole) Crop Safety

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Acknowledgements

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Abstract

Metconazole was registered as Tourney50WDG in the United States in 2007 as a turf fungicide. In 2010, uses for ornamental horticulture plants in greenhouse, nurseries, and landscapes were added. The commercial label contains a list of 49 woody ornamental plants exhibiting no or minimal injury. However, because metconazole is in the triazole class it could cause symptoms similar to plant growth regulators and additional testing is warranted on additional herbaceous and woody ornamental species. Between 2010 and 2016, the IR-4 Project completed 166 trials on 41 ornamental plant species examining phytotoxicity related to foliar applications of Tourney. In these trials, 22 species or genera exhibited minimal or no injury after foliar applications. Of these, 14 are already on the Tourney label; *Buxus* sp., *Calibrachoa* sp., *Chamaerops humilis*, *Hemerocallis* sp., *Hydrangea* sp., *Lantana* sp., *Liriope* sp. and *Verbena* sp. are the eight crops not yet listed. Based on this information, it is recommended that these be added to the list of tolerant plants on the Tourney 50WDG label. Four crops exhibited stunting: begonia, impatiens, pansy and zinnia.

Introduction

Metconazole was registered as Tourney 50WDG in the United States in 2007 as a turf fungicide. In 2010, uses for ornamental horticulture plants in greenhouse, nurseries, and landscapes were added. The commercial label contains a list of 49 woody ornamental plants exhibiting no or minimal injury. However, because metconazole is in the triazole class it could cause symptoms similar to plant growth regulators and additional testing is warranted on additional herbaceous and woody ornamental species. Between 2010 and 2014, the IR-4 Project completed 166 trials on 41 ornamental plant species examining phytotoxicity related to foliar applications of Tourney.

Materials and Methods

Tourney 50WDG was tested applied as foliar treatment typically 3 times at approximately 14 days intervals. The application rates were 2, 4 and 8 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 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.

Tourney 50WDG was supplied to researchers (See list of researchers in Appendix 1) by Valent and Nufarm.

Results and Summary

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

Phytotoxicity

Across all plant species tested, Tourney50WDG exhibited no or minimal negative impact (Table 1) on 22 plant genera or species fell into this category. One species exhibited little injury at 1X but significant at 2X (Marigold). Four bedding plants exhibited significant stunting – Begonia, New Guinea Impatiens, Viola, and Zinnia (Table 3). There are 15 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 Tourney 50WDG treated crops with no or minimal transitory injury.

<i>Acer palmatum</i> ¹	<i>Liriope</i> sp.
<i>Acer</i> sp. ¹	<i>Malus</i> sp. ¹
<i>Antirrhinum majus</i> ¹	<i>Osteospermum</i> sp. (See Williams 2013)
<i>Buxus</i> sp.	<i>Petunia</i> sp. ¹
<i>Calibrachoa</i> sp.	<i>Pseudotsuga menziesii</i> ¹
<i>Chamaerops humilis</i>	<i>Quercus</i> sp. ¹
<i>Camellia</i> sp. ¹	<i>Rhododendron</i> sp (azalea) ¹
<i>Cornus</i> sp. ¹	<i>Rhododendron</i> sp. (rhododendron) ¹
<i>Hemerocallis</i> sp.	<i>Rosa</i> sp. ¹
<i>Hydrangea</i> sp.	<i>Spirea</i> sp. ¹
<i>Lantana</i> sp.	<i>Verbena</i> sp. (see DeFrancesco 2013) ¹

¹ Already registered

Table 2. List of Tourney 50WDG treated crops with no injury at 1X but significant injury at 2X or 4X.

Tagetes sp.¹

Table 3. List of Tourney 50WDG treated crops with significant injury at 1X.

<i>Begonia</i> sp. (stunting) ¹	<i>Viola</i> sp. ¹
<i>Impatiens, New Guinea</i> (stunting)	<i>Zinnia</i> sp. ¹

Table 4. List of Tourney 50WDG treated crops where more information is needed.

<i>Catharanthus roseus</i>	<i>Pelargonium</i> sp. ¹
<i>Chrysanthemum/Dendrathera</i> sp. ¹	<i>Pyrus calleryana</i> ¹
<i>Gaillardia</i> sp.	<i>Raphiolepis indica</i>
<i>Hedera helix</i>	<i>Salvia officinalis</i>
<i>Ilex</i> sp.	<i>Tulipa</i> sp.
<i>Loropetalum</i> sp.	<i>Thuja occidentalis</i>
<i>Nandina domestica</i>	<i>Ulmus</i> sp.
<i>Narcissus</i> sp.	

¹ Already registered

Table 5 Detailed Summary of Crop Safety Testing with Tourney 50WDG (metconazole)

Notes: Table entries are sorted by crop Latin name. Only those trials with research reports received by 12/14/2017 are listed below.

PR#	Crop	Production Site	Researcher	State	Year	Application Type	Results
29406	Maple (Acer sp.) A. palmatum 'Bloodgood'	Field Container	Pscheidt	OR	2010	Foliar	No injury or growth reduction at 2, 4, and 8 oz per 100 gal.
29406	Maple (Acer sp.) Acer palmatum	Field Container	DeFrancesco	OR	2010	Foliar	No injury or growth reduction at 2, 4 and 8 oz per 100 gal applied 3 times.
29406	Maple (Acer sp.) 'Autumn Blaze'	Field Container	Hausbeck	MI	2011	Foliar	No injury with 2, 4 and 8 oz per 100 gal applied 3 times.
29406	Maple (Acer sp.) 'Green Mountain'	Field Container	Hausbeck	MI	2011	Foliar	No injury with 2, 4 and 8 oz per 100 gal applied 3 times.
29406	Maple (Acer sp.) 'October Glory'	Field Container	Freiberger	NJ	2010	Foliar	No significant injury at 2, 4 and 8 fl oz per 100 gal.
29406	Maple (Acer sp.) 'October Glory'	Field Container	Hausbeck	MI	2011	Foliar	No injury with 2, 4 and 8 oz per 100 gal applied 3 times.
29406	Maple (Acer sp.) 'Red Sunset'	Field Container	Hausbeck	MI	2011	Foliar	No injury with 2, 4 and 8 oz per 100 gal applied 3 times.
29421	Garden Snapdragon (Antirrhinum majus) 'Montego'	Greenhouse	Grunwald	OR	2011	Foliar	No injury or growth reduction with 2, 4 and 8 fl oz per 100 gal applied 3 times; all plants saleable.
29421	Garden Snapdragon (Antirrhinum majus) 'Rocket Red'	Greenhouse	Freiberger	NJ	2010	Foliar	No significant injury at 2, 4 and 8 oz per 100 gal.
29421	Garden Snapdragon (Antirrhinum majus) 'Sonnet Mix'	Greenhouse	Freiberger	NJ	2010	Foliar	No significant injury at 2, 4 and 8 oz per 100 gal.
30366	Begonia (Begonia sp.)	Field Container	Harvey	WA	2015	Foliar	No injury or growth reduction with 2, 4 and 8 oz per 100 gal, applied 3 times.
30366	Begonia (Begonia sp.) B. semperflorens	Field Container	Fraelich	GA	2016	Foliar	No injury but severe growth reduction with 2, 4 and 8 oz per 100 gal applied 3 times; treated plants not marketable.
29418	Begonia (Begonia sp.) 'Baby Wing Pink'	Greenhouse	Freiberger	NJ	2010	Foliar	Severe injury (stunting) at 2, 4 and 8 oz per 100 gal.
30366	Begonia (Begonia sp.) 'Bossa Nova White'	Field Container	Reding	OH	2015	Foliar	No injury or significant growth reduction with 2, 4 and 8 oz per 100 gal applied 3 times; all plants marketable.
29418	Begonia (Begonia sp.) Solenostemon scutellarioides 'Big Red Green Leaf'	Greenhouse	Hausbeck	MI	2010	Foliar	Slight injury and moderate stunting with 2, 4 and 8 oz per 100 gal applied 3 times.
30366	Begonia (Begonia sp.) 'Super Olympia Red'	Field Container	Wade	SC	2012	Foliar	Unacceptable stunting and discoloration with 2, 4 and 8 oz per 100 gal applied 3 times.
29418	Begonia (Begonia sp.) 'Whiskey Br Wh'	Greenhouse	Freiberger	NJ	2010	Foliar	Severe injury (stunting) at 2, 4 and 8 oz per 100 gal.
31492	Boxwood (Buxus sp.) B. microphylla 'Winter Gem'	Field Container	Pscheidt	OR	2013	Foliar	No injury or growth reduction with 4 and 8 oz per 100 gal applied 3 times.
31492	Boxwood (Buxus sp.) B. microphylla 'Winter Gem'	Field Container	Pscheidt	OR	2014	Foliar	No injury or height reduction with 4 and 8 oz per 100 gal applied 3 times.

PR#	Crop	Production Site	Researcher	State	Year	Application Type	Results
31492	Boxwood (Buxus sp.) B. sempervirens 'Suffruticosa'	Field Container	Pscheidt	OR	2013	Foliar	No injury or growth reduction with 4 and 8 oz per 100 gal applied 3 times.
31492	Boxwood (Buxus sp.) B. sempervirens 'Suffruticosa'	Field Container	Pscheidt	OR	2014	Foliar	No injury or height reduction with 4 and 8 oz per 100 gal applied 3 times.
31492	Boxwood (Buxus sp.) 'Green Velvet'	Field Container	Pscheidt	OR	2013	Foliar	No injury or growth reduction with 4 and 8 oz per 100 gal applied 3 times.
31492	Boxwood (Buxus sp.) 'Green Velvet'	Field Container	Pscheidt	OR	2014	Foliar	No injury or height reduction with 4 and 8 oz per 100 gal applied 3 times.
30727	Calibrachoa (Calibrachoa sp.)	Greenhouse	Williams	IL	2013	Drench	No injury with 2, 4 and 8 oz per 100 gal applied 3 times at monthly intervals; slight growth reduction.
30727	Calibrachoa (Calibrachoa sp.)	Greenhouse	Williams	IL	2013	Foliar	No injury with 2, 4 and 8 oz per 100 gal applied 3 times at monthly intervals; moderate growth reduction.
30727	Calibrachoa (Calibrachoa sp.) C. x hybrida 'Cabaret Lavender'	Greenhouse	Hausbeck	MI	2013	Foliar	No injury or growth reduction with 2, 4 and 8 oz per 100 gal applied 3 times.
30727	Calibrachoa (Calibrachoa sp.) 'Cabaret Purple'	Greenhouse	Williams-Woodward	GA	2013	Foliar	No significant injury or growth reduction with 2, 4 and 8 oz per 100 gal applied 3 times.
30727	Calibrachoa (Calibrachoa sp.) 'Minifamous Orange'	Greenhouse	Grunwald	OR	2013	Foliar	No injury or growth reduction with 2, 4 and 8 oz per 100 gal applied 3 times; all plants marketable.
30727	Calibrachoa (Calibrachoa sp.) 'Minifamous Red'	Greenhouse	Grunwald	OR	2012	Foliar	No injury or growth reduction with 2, 4 and 8 oz per 100 gal applied 3 times; all plants saleable.
29410	Camellia (Camellia sp.) C. japonica 'Nuccio's Pearl'	Field Container	DeFrancesco	OR	2011	Foliar	No injury or growth reduction with 2, 4 and 8 oz per 100 gal.
29410	Camellia (Camellia sp.) C. sinensis	Field Container	Wade	SC	2011	Foliar	No injury or growth reduction with 2, 4 and 8 oz per 100 gal applied 3 times.; all plants marketable.
29410	Camellia (Camellia sp.) C. x hybrida 'Freedom Bell'	Field Container	Grunwald	OR	2011	Foliar	No injury or growth reduction with 2, 4 and 8 fl oz per 100 gal applied 3 times; all plants saleable.
29417	Madagascar Periwinkle (Catharanthus roseus) 'Cora Burgundy'	Greenhouse	Freiberger	NJ	2014	Foliar	Slight injury and growth reduction with 2, 4 and 8 oz per 100 gal applied 3 times; some delay in blooming at all rates.
29417	Madagascar Periwinkle (Catharanthus roseus) 'Pacifica XP Burgundy Halo'	Greenhouse	Hand	OH	2016	Foliar	No injury with 2, 4 and 8 oz per 100 gal applied 3 times; increased plant width at 2X and 4X.
30045	Palm,Mediterranean Fan (Chamaerops humilis)	Field Container	Palmateer	FL	2016	Foliar	No injury or growth reduction with 2, 4 and 8 oz per 100 gal applied 3 times.
30045	Palm,Mediterranean Fan (Chamaerops humilis)	Field Container	Uber	CA	2016	Foliar	No injury or growth reduction with 2, 4 and 8 oz per 100 gal applied 3 times.
30045	Palm,Mediterranean Fan (Chamaerops humilis)	Field Container	Wade	SC	2015	Foliar	No injury or growth reduction with 2, 4 and 8 oz per 100 gal applied 3 times; all plants marketable.
29482	Chrysanthemum, Garden (Chrysanthemum/Dendranthema sp.) 'Clara Curtis'	Field Container	Grunwald	OR	2012	Foliar	No injury or growth reduction with 2, 4 and 8 oz per 100 gal applied 3 times; all plants saleable.
29482	Chrysanthemum, Garden (Chrysanthemum/Dendranthema sp.) Dendranthema sp.	Field Container	Wade	SC	2011	Foliar	No injury, but some growth reduction, with 2, 4 and 8 oz per 100 gal applied 3 times.; may result in delayed marketability.

PR#	Crop	Production Site	Researcher	State	Year	Application Type	Results
29404	Dogwood (Cornus sp.)	Field Container	Harvey	WA	2011	Foliar	No injury with 2, 4 and 8 oz per 100 gal applied 3 times.
29404	Dogwood (Cornus sp.) 'Baileyi'	Field Container	Hausbeck	MI	2011	Foliar	No injury with 2, 4 and 8 oz per 100 gal applied 3 times.
29404	Dogwood (Cornus sp.) 'Pink'	Field Container	Hausbeck	MI	2011	Foliar	No injury with 2, 4 and 8 oz per 100 gal applied 3 times.
29404	Dogwood (Cornus sp.) 'Red'	Field Container	Hausbeck	MI	2011	Foliar	No injury with 2, 4 and 8 oz per 100 gal applied 3 times.
30318	Blanket Flower (Gaillardia x grandiflora) 'Arizona Apricot'	Field Container	Reding	OH	2015	Foliar	No injury or significant growth reduction with 2, 4 and 8 oz per 100 gal applied 3 times; all plants marketable.
30318	Blanket Flower (Gaillardia x grandiflora) 'Goblin'	Field Container	Koivunen	CA	2016	Foliar	No injury or growth reduction with 2, 4 and 8 oz per 100 gal applied 3 times biweekly.
30318	Blanket Flower (Gaillardia x grandiflora) 'Golden Goblin'	Field Container	Hausbeck	MI	2010	Foliar	No injury at 2, 4, and 8 oz per 100 gal.
29413	English Ivy (Hedera helix ssp. Helix)	Field Container	Fraelich	GA	2016	Foliar	No injury or difference in plant growth and marketability with 2, 4 and 8 oz per 100 gal applied 3 times.
29413	English Ivy (Hedera helix ssp. Helix)	Field Container	Harvey	WA	2011	Foliar	No injury with 2, 4 and 8 oz per 100 gal applied 3 times.
29413	English Ivy (Hedera helix ssp. Helix)	Field Container	Reding	OH	2015	Foliar	No injury with 2, 4 and 8 oz per 100 gal applied 3 times; slight and severe stunting with 2X and 4X, but all plants marketable at the end of trial.
29415	Daylily (Hemerocallis sp.)	Field Container	Harvey	WA	2011	Foliar	No injury with 2, 4 and 8 oz per 100 gal applied 3 times.
29415	Daylily (Hemerocallis sp.) 'Big Time Happy'	Field Container	Freiberger	NJ	2010	Foliar	No significant injury at 2, 4 and 8 fl oz per 100 gal.
29415	Daylily (Hemerocallis sp.) 'Chicago Apache'	Field Container	Hausbeck	MI	2010	Foliar	No injury at 2, 4, and 8 oz per 100 gal.
29415	Daylily (Hemerocallis sp.) 'Little Grapette'	Field Container	Hausbeck	MI	2010	Foliar	No injury at 2, 4, and 8 oz per 100 gal.
29415	Daylily (Hemerocallis sp.) 'Mini Pearl'	Field Container	Hausbeck	MI	2011	Foliar	No injury with 2, 4 and 8 oz per 100 gal applied 3 times.
29415	Daylily (Hemerocallis sp.) 'Purple d' Oro'	Field Container	Grunwald	OR	2011	Foliar	No injury or growth reduction with 2, 4 and 8 fl oz per 100 gal applied 3 times; all plants saleable.
29415	Daylily (Hemerocallis sp.) 'Raspberry Pixie'	Field Container	Freiberger	NJ	2010	Foliar	No significant injury at 2, 4 and 8 fl oz per 100 gal.
29415	Daylily (Hemerocallis sp.) 'Siloam Double Classic'	Field Container	Hausbeck	MI	2011	Foliar	No injury with 2, 4 and 8 oz per 100 gal applied 3 times.
29415	Daylily (Hemerocallis sp.) 'Stella de Oro'	Field Container	Hausbeck	MI	2011	Foliar	No injury with 2, 4 and 8 oz per 100 gal applied 3 times.
29415	Daylily (Hemerocallis sp.) 'Strawberry Candy'	Field Container	Hausbeck	MI	2011	Foliar	No injury with 2, 4 and 8 oz per 100 gal applied 3 times.

PR#	Crop	Production Site	Researcher	State	Year	Application Type	Results
29408	Hydrangea (Hydrangea sp.)	Field Container	Harvey	WA	2011	Foliar	No injury with 2, 4 and 8 oz per 100 gal applied 3 times.
29408	Hydrangea (Hydrangea sp.) 'Glowing Ambers'	Field Container	Freiberger	NJ	2010	Foliar	No significant injury at 2, 4 and 8 fl oz per 100 gal.
29408	Hydrangea (Hydrangea sp.) H. macrophylla 'Taube'	Field Container	Grunwald	OR	2011	Foliar	No injury or growth reduction with 2, 4 and 8 fl oz per 100 gal applied 3 times; all plants saleable.
29408	Hydrangea (Hydrangea sp.) 'Limelight'	Field Container	Hausbeck	MI	2010	Foliar	No injury at 2, 4, and 8 oz per 100 gal.
29408	Hydrangea (Hydrangea sp.) 'Pinky Winky'	Field Container	Hausbeck	MI	2010	Foliar	No injury at 2, 4, and 8 oz per 100 gal.
30048	Holly (Ilex sp.) 'Emerald Collonade'	Field Container	Fraelich	GA	2014	Foliar	No injury or growth reduction with 2, 4 and 8 oz per 100 gal applied 3 times.
30048	Holly (Ilex sp.) I. cornuta 'Burfordi'	Field Container	Fraelich	GA	2016	Foliar	No injury or difference in plant growth and marketability with 2, 4 and 8 oz per 100 gal applied 3 times.
30048	Holly (Ilex sp.) I. verticillata	Field Container	DeFrancesco	OR	2014	Foliar	No injury with 2, 4 and 8 oz per 100 gal applied 3 times; moderate growth reduction with 4X rate.
30048	Holly (Ilex sp.) I. x meserveae 'Castle Spire'	Field Container	Reding	OH	2015	Foliar	No injury with 2, 4 and 8 oz per 100 gal applied 3 times; slight and severe stunting with 2X and 4X, but all plants marketable at the end of trial.
30367	New Guinea Impatiens (Impatiens hawkeri)	Field Container	Harvey	WA	2015	Foliar	No injury with 2, 4 and 8 oz per 100 gal after 1st application; moderate injury and less bloom with 2X and 4X after 2nd application.
29420	New Guinea Impatiens (Impatiens hawkeri) 'Divine Orange'	Greenhouse	Hausbeck	MI	2015	Foliar	Severe injury with 2, 4 and 8 oz per 100 gal applied 3 times.
30367	New Guinea Impatiens (Impatiens hawkeri) 'Divine Pink'	Field Container	Freiberger	NJ	2013	Foliar	Moderate to high injury and growth reduction with 2, 4 and 8 oz per 100 gal applied 3 times.
29420	New Guinea Impatiens (Impatiens hawkeri) 'Paradise Fuchia'	Greenhouse	Freiberger	NJ	2010	Foliar	Severe injury (stunting) at 2, 4 and 8 oz per 100 gal.
29420	New Guinea Impatiens (Impatiens hawkeri) 'Paradise Light Pink'	Greenhouse	Freiberger	NJ	2010	Foliar	No injury at 2, slight and moderate stunting at 4 and 8 oz per 100 gal.
30367	New Guinea Impatiens (Impatiens hawkeri) 'Sunpatiens Compact Deep Rose'	Field Container	Reding	OH	2015	Foliar	Moderate to high injury (reduced flowering and stunted growth) increasing with rates (2, 4 and 8 oz per 100 gal). Plants recovered from damage late in the season and were marketable at conclusion of study.
29414	Lantana (Lantana sp.) 'Chapel Hill Yellow'	Field Container	Fraelich	GA	2013	Foliar	No injury or growth reduction with 2, 4 and 8 oz per 100 gal; all plants marketable.
29414	Lantana (Lantana sp.) 'Imagination'	Field Container	Kirk	MI	2011	Foliar	No injury or growth reduction with 2, 4 and 8 oz per 100 gal applied 5 times.
29414	Lantana (Lantana sp.) L. camara 'Confetti'	Field Container	Grunwald	OR	2012	Foliar	No injury or growth reduction with 2, 4 and 8 oz per 100 gal applied 3 times; all plants saleable.
29414	Lantana (Lantana sp.) L. montevidensis	Field Container	Uber	CA	2012	Foliar	No injury or growth reduction with 2, 4 and 8 fl oz per 100 gal applied 3 times.

PR#	Crop	Production Site	Researcher	State	Year	Application Type	Results
29416	Lilyturf (Liriope sp.)	Field Container	Harvey	WA	2011	Foliar	No injury with 2, 4 and 8 oz per 100 gal applied 3 times.
29416	Lilyturf (Liriope sp.) 'Big Blue'	Field Container	Hausbeck	MI	2010	Foliar	No injury at 2, 4, and 8 oz per 100 gal.
29416	Lilyturf (Liriope sp.) variegata	Field Container	Hausbeck	MI	2010	Foliar	No injury at 2, 4, and 8 oz per 100 gal.
29416	Lilyturf (Liriope sp.) 'Variegata'	Field Container	Freiberger	NJ	2010	Foliar	No significant injury at 2, 4 and 8 fl oz per 100 gal.
30052	Loropetalum (Loropetalum sp.)	Field Container	Wade	SC	2015	Foliar	No injury or growth reduction with 2, 4 and 8 oz per 100 gal applied 3 times; all plants marketable.
29405	Apple (Malus sp.) 'Coralburst Crab' (crabapple)	Field Container	Hausbeck	MI	2011	Foliar	No injury with 2, 4 and 8 oz per 100 gal applied 3 times.
29405	Apple (Malus sp.) 'Golden Delicious' (apple)	Field Container	Hausbeck	MI	2010	Foliar	No injury at 2, 4, and 8 oz per 100 gal.
29405	Apple (Malus sp.) 'Honey Crisp' (apple)	Field Container	Hausbeck	MI	2010	Foliar	No injury at 2, 4, and 8 oz per 100 gal.
29405	Apple (Malus sp.) 'Lancelot' (crabapple)	Field Container	Hausbeck	MI	2010	Foliar	No injury at 2, 4, and 8 oz per 100 gal.
29405	Apple (Malus sp.) 'McIntosh' (apple)	Field Container	Hausbeck	MI	2011	Foliar	No injury with 2, 4 and 8 oz per 100 gal applied 3 times.
29405	Apple (Malus sp.) 'Mutsu' (apple)	Field Container	Hausbeck	MI	2011	Foliar	No injury with 2, 4 and 8 oz per 100 gal applied 3 times.
29405	Apple (Malus sp.) 'Praire Fire Crab' (crabapple)	Field Container	Hausbeck	MI	2011	Foliar	No injury with 2, 4 and 8 oz per 100 gal applied 3 times.
29405	Apple (Malus sp.) 'Sargent' (crabapple)	Field Container	Hausbeck	MI	2010	Foliar	No injury at 2, 4, and 8 oz per 100 gal.
29405	Apple (Malus sp.) 'Winesap' (apple)	Field Container	Hausbeck	MI	2011	Foliar	No injury with 2, 4 and 8 oz per 100 gal applied 3 times.
29411	Sacred Bamboo (Nandina domestica)	Field Container	Wade	SC	2015	Foliar	No injury or growth reduction with 2, 4 and 8 oz per 100 gal applied 3 times; all plants marketable.
29411	Sacred Bamboo (Nandina domestica) 'Fire Power'	Field Container	Freiberger	NJ	2010	Foliar	No significant injury at 2, 4 and 8 fl oz per 100 gal.
30739	Daffodil (Narcissus sp.) 'Tete-a-Tete'	Greenhouse	Freiberger	NJ	2013	Foliar	Moderate injury starting after the final application with 2, 4 and 8 oz per 100 gal applied 3 times; slight growth reduction.
30742	Daisybush (Osteospermum sp.)	Greenhouse	Williams	IL	2013	Foliar	No injury with 2, 4 and 8 oz per 100 gal applied 3 times at monthly intervals; moderate growth reduction.
30742	Daisybush (Osteospermum sp.) 'Copper Purple'	Greenhouse	Grunwald	OR	2012	Foliar	No injury or growth reduction with 2, 4 and 8 oz per 100 gal applied 3 times; all plants saleable.
30742	Daisybush (Osteospermum sp.) 'Margarita Cool Purple'	Greenhouse	Freiberger	NJ	2013	Foliar	No injury or growth reduction with 2, 4 and 8 oz per 100 gal applied 3 times.
29424	Geranium (Pelargonium sp.) 'Maestro Lav Blue'	Greenhouse	Freiberger	NJ	2010	Foliar	No significant injury at 2 and 4, slight at 8 oz per 100 gal.

PR#	Crop	Production Site	Researcher	State	Year	Application Type	Results
29424	Geranium (Pelargonium sp.) 'Maestro Pac Lav Par'	Greenhouse	Freiberger	NJ	2010	Foliar	Slight injury at 2, 4 and 8 oz per 100 gal.
29424	Geranium (Pelargonium sp.) P. x hortorum 'Orbit White'	Greenhouse	Hausbeck	MI	2010	Foliar	Very slight injury, no stunting with 2, 4 and 8 oz per 100 gal applied 3 times.
30746	Petunia (Petunia sp.)	Greenhouse	Grunwald	OR	2014	Foliar	No injury or growth reduction with 2, 4 and 8 oz per 100 gal; all plants saleable.
30746	Petunia (Petunia sp.) 'Dream Neon Rose'	Greenhouse	Freiberger	NJ	2014	Foliar	No injury or growth reduction with 2, 4 and 8 oz per 100 gal applied 3 times.
30746	Petunia (Petunia sp.) 'Picobella Salmon'	Greenhouse	Freiberger	NJ	2012	Foliar	Minor injury (stunting) with complete recovery at 2, 4 and 8 oz per 100 gal applied 3 times.
30746	Petunia (Petunia sp.) 'Purple'	Greenhouse	Freiberger	NJ	2012	Foliar	No injury or growth reduction with 2, 4 and 8 oz per 100 gal applied 3 times.
30723	Fir, Douglas (Pseudotsuga menziesii)	Greenhouse	DeFrancesco	OR	2012	Foliar	No injury or growth reduction with 2, 4 and 8 oz per 100 gal applied 3 times.
30723	Fir, Douglas (Pseudotsuga menziesii)	Greenhouse	Grunwald	OR	2012	Foliar	No injury or growth reduction with 2, 4 and 8 oz per 100 gal applied 3 times; all plants saleable.
30723	Fir, Douglas (Pseudotsuga menziesii)	Greenhouse	Grunwald	OR	2013	Foliar	No injury or growth reduction with 2, 4 and 8 oz per 100 gal applied 3 times; all plants marketable.
29401	Callery Pear (Pyrus calleryana) 'Autumn Blaze'	Field Container	Grunwald	OR	2011	Foliar	No injury or growth reduction with 2, 4 and 8 fl oz per 100 gal applied 3 times; all plants saleable.
29400	Oak (Quercus sp.)	Field Container	Grunwald	OR	2011	Foliar	No injury or growth reduction with 2, 4 and 8 fl oz per 100 gal applied 3 times; all plants saleable.
29400	Oak (Quercus sp.) 'Northern Pin Oak'	Field Container	Freiberger	NJ	2010	Foliar	No significant injury at 2, 4 and 8 fl oz per 100 gal.
29400	Oak (Quercus sp.) 'Northern Red'	Field Container	Hausbeck	MI	2011	Foliar	No injury with 2, 4 and 8 oz per 100 gal applied 3 times.
29400	Oak (Quercus sp.) 'Pin Oak'	Field Container	Hausbeck	MI	2011	Foliar	No injury with 2, 4 and 8 oz per 100 gal applied 3 times.
29400	Oak (Quercus sp.) Q. rubra	Field Container	DeFrancesco	OR	2012	Foliar	No injury with 2 and 4, very minor with 8, oz per 100 gal applied 3 times; no growth reduction.
29412	Indian Hawthorn (Raphiolepis indica)	Field Container	Uber	CA	2016	Foliar	No injury or growth reduction with 2, 4 and 8 oz per 100 gal applied 3 times.
29412	Indian Hawthorn (Raphiolepis indica) R. umbellata 'Southern Moon Yedda'	Field Container	Fraelich	GA	2014	Foliar	No injury or growth reduction with 2, 4 and 8 oz per 100 gal applied 3 times.
29402	Rhododendron (Rhododendron sp.) 'Boursault'	Field Container	Freiberger	NJ	2010	Foliar	No significant injury at 2, 4 and 8 fl oz per 100 gal.
29402	Rhododendron (Rhododendron sp.) 'Cunningham's White'	Field Container	DeFrancesco	OR	2010	Foliar	No injury or growth reduction at 2, 4 and 8 oz per 100 gal applied 3 times.
29402	Rhododendron (Rhododendron sp.) 'English'	Field Container	Hausbeck	MI	2010	Foliar	No injury at 2, 4, and 8 oz per 100 gal.
29403	Rhododendron (Rhododendron sp.) 'Hino Crimson'	Field Container	DeFrancesco	OR	2010	Foliar	No injury or growth reduction at 2, 4 and 8 oz per 100 gal applied 3 times.

PR#	Crop	Production Site	Researcher	State	Year	Application Type	Results
29403	Rhododendron (Rhododendron sp.) 'Mandarin Lights'	Field Container	Pscheidt	OR	2010	Foliar	No injury or growth reduction at 2, 4, and 8 oz per 100 gal.
29403	Rhododendron (Rhododendron sp.) 'Mothers Day' & 'Haps Pink'	Field Container	Freiberger	NJ	2010	Foliar	No significant injury at 2, 4 and 8 fl oz per 100 gal.
29403	Rhododendron (Rhododendron sp.) 'Northern Hi-Lights'	Field Container	Hausbeck	MI	2010	Foliar	No injury at 2, 4, and 8 oz per 100 gal.
29402	Rhododendron (Rhododendron sp.) 'Nova Zembla'	Field Container	Freiberger	NJ	2010	Foliar	No significant injury at 2, 4 and 8 fl oz per 100 gal.
29403	Rhododendron (Rhododendron sp.) 'Orchid Lights'	Field Container	Hausbeck	MI	2010	Foliar	No injury at 2, 4, and 8 oz per 100 gal.
29402	Rhododendron (Rhododendron sp.) 'PJM Compact'	Field Container	Hausbeck	MI	2010	Foliar	No injury at 2, 4, and 8 oz per 100 gal.
29402	Rhododendron (Rhododendron sp.) 'Roseum elegans'	Field Container	Pscheidt	OR	2010	Foliar	No injury or growth reduction at 2, 4, and 8 oz per 100 gal.
29399	Rose (Rosa sp.) 'Home Run'	Field Container	Freiberger	NJ	2010	Foliar	No significant injury at 2, 4 and 8 fl oz per 100 gal.
29399	Rose (Rosa sp.) 'Meidomonac Bonica'	Field Container	Pscheidt	OR	2010	Foliar	No injury or growth reduction at 2, 4, and 8 oz per 100 gal; significantly reduced black spot incidence only at the highest rate.
29399	Rose (Rosa sp.) 'Nearly Wild'	Field Container	DeFrancesco	OR	2010	Foliar	No injury or growth reduction at 2, 4 and 8 oz per 100 gal applied 3 times.
29399	Rose (Rosa sp.) 'Radrazz'	Field Container	Freiberger	NJ	2010	Foliar	No significant injury at 2, 4 and 8 fl oz per 100 gal.
29399	Rose (Rosa sp.) 'Rainbow Knockout'	Field Container	Hausbeck	MI	2010	Foliar	No injury at 2, 4, and 8 oz per 100 gal.
29399	Rose (Rosa sp.) 'Sunny Knockout'	Field Container	Hausbeck	MI	2010	Foliar	No injury at 2, 4, and 8 oz per 100 gal.
29419	Common Sage (Salvia officinalis)	Greenhouse	Freiberger	NJ	2013	Foliar	No injury with 2, 4 and 8 oz per 100 gal applied 3 times; slight growth reduction with 4X.
29419	Common Sage (Salvia officinalis)	Greenhouse	Meador	CA	2015	Foliar	No injury or growth reduction with 2, 4 and 8 oz per 100 gal applied 3 times; comparable to Heritage.
29419	Common Sage (Salvia officinalis) 'Berggarten'	Greenhouse	DeFrancesco	OR	2011	Foliar	No injury or growth reduction with 2, 4 and 8 oz per 100 gal.
29419	Common Sage (Salvia officinalis) 'Berggarten'	Greenhouse	Grunwald	OR	2011	Foliar	No injury or growth reduction with 2, 4 and 8 oz per 100 gal applied 3 times; all plants saleable.
30038	Bridal-Wreath (Spiraea sp.)	Field Container	Reding	OH	2013	Foliar	No injury or growth reduction with 2, 4 and 8 oz per 100 gal applied 3 times; all plants marketable.
30038	Bridal-Wreath (Spiraea sp.) 'Little Princess'	Field Container	Grunwald	OR	2013	Foliar	No injury or growth reduction with 2, 4 and 8 oz per 100 gal applied 3 times; all plants marketable.
30038	Bridal-Wreath (Spiraea sp.) S. japonica 'Neon Flash'	Field Container	Fraelich	GA	2013	Foliar	No injury or growth reduction with 2, 4 and 8 oz per 100 gal; all plants marketable.

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30038	Bridal-Wreath (<i>Spiraea</i> sp.) <i>Spiraea x bumalda</i> 'BL0601'	Field Container	Fraelich	GA	2013	Foliar	No injury or growth reduction with 2, 4 and 8 oz per 100 gal; all plants marketable.
29422	Marigold (<i>Tagetes</i> sp.) 'Aurora Gold'	Greenhouse	Freiberger	NJ	2010	Foliar	Slight injury (stunting) at 2, severe at 4 and 8 oz per 100 gal.
29422	Marigold (<i>Tagetes</i> sp.) 'Bonanza'	Greenhouse	Grunwald	OR	2011	Foliar	No injury or growth reduction with 2, 4 and 8 fl oz per 100 gal applied 3 times; all plants saleable.
29422	Marigold (<i>Tagetes</i> sp.) 'Capriccio'	Greenhouse	Freiberger	NJ	2010	Foliar	Slight injury (stunting) at 2, severe at 4 and 8 oz per 100 gal.
29422	Marigold (<i>Tagetes</i> sp.) <i>T. erecta</i> 'African Perfect Yellow'	Greenhouse	Hausbeck	MI	2010	Foliar	Slight injury and moderate stunting with 2 and 4 oz per 100 gal applied 3 times.
29422	Marigold (<i>Tagetes</i> sp.) <i>T. erecta</i> 'African Perfect Yellow'	Greenhouse	Hausbeck	MI	2011	Foliar	No injury or growth reduction with 2, 4 and 8 oz per 100 gal applied 3 times.
30041	American Arborvitae (<i>Thuja occidentalis</i>)	Field Container	Grunwald	OR	2015	Foliar	No injury or growth reduction with 2, 4 and 8 oz per 100 gal applied 3 times.
30041	American Arborvitae (<i>Thuja occidentalis</i>) 'Emerald Green'	Field Container	Wade	SC	2016	Foliar	No injury or growth reduction with 2, 4 and 8 oz per 100 gal applied 3 times; all plants marketable.
30726	Tulip (<i>Tulipa</i> sp.) 'Oxford'	Greenhouse	Freiberger	NJ	2013	Foliar	Moderate injury starting after the final application with 2, 4 and 8 oz per 100 gal applied 3 times; slight to moderate growth reduction.
29999	Elm (<i>Ulmus</i> sp.)	Field Container	Grunwald	OR	2014	Foliar	No injury or growth reduction with 2, 4 and 8 oz per 100 gal; all plants saleable.
29999	Elm (<i>Ulmus</i> sp.) <i>U. parvifolia</i>	Field Container	Henn	MS	2014	Foliar	Slight injury (bleaching/interveinal chlorosis) with 2, 4 and 8 oz per 100 gal applied 3 times; no significant growth reduction.
30352	Vervain (<i>Verbena</i> sp.)	Field Container	Reding	OH	2013	Foliar	No injury or growth reduction with 2, 4 and 8 oz per 100 gal applied 3 times; all plants marketable.
30352	Vervain (<i>Verbena</i> sp.) 'Costa del Sol Magenta'	Field Container	Freiberger	NJ	2013	Foliar	No injury or growth reduction with 2, 4 and 8 oz per 100 gal applied 3 times.
30352	Vervain (<i>Verbena</i> sp.) 'Obsession Red'	Field Container	Wade	SC	2012	Foliar	No injury with 2, 4 and 8 oz per 100 gal applied 3 times.
30352	Vervain (<i>Verbena</i> sp.) <i>V. canadensis</i> 'Homestead Purple'	Field Container	Fraelich	GA	2013	Foliar	No injury or growth reduction with 2, 4 and 8 oz per 100 gal; all plants marketable.
30352	Vervain (<i>Verbena</i> sp.) 'Veralena Red'	Field Container	DeFrancesco	OR	2013	Foliar	No injury with 2, 4 and 8 oz per 100 gal applied 3 times; moderate growth reduction.
29425	Pansy (<i>Viola</i> sp.) 'Daffodil Mix'	Greenhouse	Freiberger	NJ	2010	Foliar	Moderate to severe injury (stunting) increasing with rates (2, 4 and 8 oz per 100 gal).
29425	Pansy (<i>Viola</i> sp.) 'Delta Cotton Candy'	Greenhouse	Freiberger	NJ	2010	Foliar	Severe injury (stunting) at 2, 4 and 8 oz per 100 gal.
29425	Pansy (<i>Viola</i> sp.) <i>V. tricolor</i> 'Matrix Rose'	Greenhouse	Hausbeck	MI	2010	Foliar	Slight injury, but moderate to severe stunting, with 2, 4 and 8 oz per 100 gal applied 3 times.
29425	Pansy (<i>Viola</i> sp.) <i>V. tricolor</i> 'Matrix Rose'	Greenhouse	Hausbeck	MI	2011	Foliar	No injury but severe growth reduction with 2, 4 and 8 oz per 100 gal applied 3 times.
29425	Pansy (<i>Viola</i> sp.) <i>V. x hybrida</i> 'Columbine'	Greenhouse	Grunwald	OR	2011	Foliar	No injury or growth reduction with 2, 4 and 8 fl oz per 100 gal applied 3 times; all plants saleable.

PR#	Crop	Production Site	Researcher	State	Year	Application Type	Results
29423	Zinnia (Zinnia sp.) 'Angustifolia Crystal White'	Greenhouse	Freiberger	NJ	2010	Foliar	Moderate to severe injury (stunting) at 2, 4 and 8 oz per 100 gal.
29423	Zinnia (Zinnia sp.) 'Red Spider'	Greenhouse	Freiberger	NJ	2010	Foliar	Moderate to severe injury (stunting) at 2, 4 and 8 oz per 100 gal.
29423	Zinnia (Zinnia sp.) Z. elegans 'Binary Mix'	Greenhouse	Grunwald	OR	2011	Foliar	No injury or growth reduction with 2, 4 and 8 fl oz per 100 gal applied 3 times; all plants saleable.
29423	Zinnia (Zinnia sp.) Z. marylandica 'Zahara Fire'	Greenhouse	Hausbeck	MI	2010	Foliar	Slight injury with 2 and 4, severe with 8 oz per 100 gal applied 3 times; no stunting.
29423	Zinnia (Zinnia sp.) Z. marylandica 'Zahara Fire'	Greenhouse	Hausbeck	MI	2011	Foliar	No injury but slight to moderate growth reduction with 2, 4 and 8 oz per 100 gal applied 3 times.

Label Suggestions

In this report, 22 species or genera exhibited minimal or no injury after foliar treatments of Tourney 50WG (metconazole) at 2, 4, and 8 oz per 100 gal. Of these, *Buxus*, *Calibrachoa*, *Chamaerops humilis*, *Hemerocallis*, *Hydrangea*, *Lantana*, *Liriope*, and *Verbena* could be added to the EPA label.

It is highly suggested that the label also contain a caution about applying Tourney over the top of herbaceous annuals in that significant foliar injury and/or stunting occurred with begonia, impatiens, pansy and zinnia.

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