



[Environment Horticulture Program Research Summaries](#)

## **IR-4 Ornamental Horticulture Program Acibenzolar Crop Safety**

**Authors: Cristi L. Palmer and Ely Vea  
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**Acknowledgements  
Susan Bierbrunner  
Lori Harrison**

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## Abstract

Acibenzolar is an active ingredient that stimulates plant defense systems. In 2002, IR-4 started testing Insimmo (acibenzolar) for safety on several ornamental horticulture crops. In 2008, IR-4 continued crop safety screening after a renewed interest in bringing this active ingredient to ornamental horticulture growers. From 2002 through 2015, the IR-4 Project completed 262 trials on 93 ornamental plant genera or species examining phytotoxicity related to foliar and/or drench applications of Insimmo. In these trials, 42 species or genera exhibited minimal or no injury after foliar applications. Based on this information, it is recommended that all but 2 of these crops be added to a list of tolerant plants when this active ingredient gains registration. While there was sufficient evidence of minimal or no injury for *Dianthus* sp. and *Pelargonium x hortorum*, a single trial for each crop did elicit moderate to severe injury. Further investigation on cultivar or species differences may be warranted.

## **Introduction**

Acibenzolar is an active ingredient that stimulates plant defense systems. In 2002, IR-4 started testing Insimmo (acibenzolar) for safety on several ornamental horticulture crops. In 2008, IR-4 continued crop safety screening after a renewed interest in bringing this active ingredient to ornamental horticulture growers. From 2002 through 2015, the IR-4 Project completed 262 trials on 93 ornamental plant genera or species examining phytotoxicity related to foliar and/or drench applications of Insimmo.

## **Materials and Methods**

Insimmo was tested as foliar and drench applications. Foliar applications were applied 5 times at 7 day intervals. The drench applications were applied once. For foliar applications, the application rates were 0.25, 0.5, 1.0 and 2.0 oz per 100 gal; for drench applications, the rates were 0.125 and 0.25 oz per 100 gal. All experiments had an untreated 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 rate 7 days after each application. For testing, the following protocols were used: 08-012, 09-014, 10-009, 11-007, 12-010, 13-010, 14-003 and 15-003. Please visit <https://www.ir4project.org/ehc/ehc-registration-support-research/env-hort-researcher-resources/> to view and download these protocols.

Insimmo was supplied to 23 researchers (See list of researchers in Appendix 1) by Syngenta.

## **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 acibenzolar, and 4) more data are needed to make informed recommendations.

### **Phytotoxicity**

Across all plant species tested, acibenzolar exhibited no or minimal negative impact (Table 1) on 42 plant genera or species fell into this category. No crops exhibited significant injury (Table s 2 and 3). There are 24 species or genera where less than 3 trials were conducted for either foliar or drench applications 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 acibenzolar treated crops with no or minimal transitory injury.**

<i>Acer</i> sp.	<i>Hydrangea</i> sp.
<i>Antirrhinum majus</i>	<i>Juniperus</i> sp.
<i>Aster</i> sp.	<i>Osteospermum</i> sp.
<i>Begonia</i> sp.	<i>Pelargonium x hortorum</i> (see Freiburger)
<i>Berberis</i> sp.	<i>Petunia</i> sp.
<i>Bougainvillea</i> sp.	<i>Phlox</i> sp.
<i>Buddleia davidii</i>	<i>Pinus</i> sp.
<i>Calibrachoa</i> sp.	<i>Pseudotsuga menziesii</i>
<i>Camellia</i> sp.	<i>Pyracantha</i> sp.
<i>Chrysanthemum</i> sp.	<i>Quercus</i> sp.
<i>Coleus</i> sp.	<i>Raphiolepis indica</i>
<i>Coreopsis</i> sp.	<i>Rhododendron</i> sp. (azalea)
<i>Cotoneaster</i> sp.	<i>Rosa</i> sp.
<i>Dianthus</i> sp (see Reding 2008)	<i>Salvia officinalis</i>
<i>Echinacea</i> sp.	<i>Scindapsus aureaus</i>
<i>Epipremnum pinnatum</i>	<i>Thuja</i> sp.
<i>Euonymus</i> sp.	<i>Verbena</i> sp.
<i>Helianthus</i> sp.	<i>Viburnum</i> sp.
<i>Hemerocallis</i> sp.	<i>Vinca</i> sp.
<i>Hibiscus</i> sp.	<i>Viola</i> sp.
<i>Hosta</i> sp.	<i>Zinnia</i> sp.

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

None

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

None

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

*Abies* sp.  
*Aglaonema* sp.  
*Buxus mycophylla*  
*Buxus sempervirens*  
*Cornus florida*  
*Dahlia* sp.  
*Euphorbia pulcherrima*  
*Geranium magniflorum*  
*Gerbera* sp.  
*Gladiolus* sp.  
*Heuchera* sp.  
*Ilex crenata*

*Impatiens* sp.  
*Lantana camara*  
*Liriope muscari*  
*Lavandula angustifolia*  
*Malus* sp.  
*Picea* sp.  
*Potentilla* sp.  
*Rudbeckia fulgida*  
*Spiraea japonica*  
*Syngonium podophyllum*  
*Syringa* sp.  
*Taxus* sp.

**Table 5 Detailed Summary of Crop Safety Testing with acibenzolar.**

Notes: Table entries are sorted by crop Latin name. Only those trials with research reports received by 11/9/2018 are listed below.

PR#	Crop	Production Site	Researcher	State	Year	Application Type	Results
27314	Fir ( <i>Abies</i> sp.) <i>A. balsamea</i>	Field Container	Freiberger	NJ	2008	Foliar	No injury at 0.5, 1.0 and 2.0 oz per 100 gal.
27314	Fir ( <i>Abies</i> sp.) <i>A. grandis</i> and <i>A. concolor</i>	Field Container	Grunwald	OR	2009	Foliar	No injury or growth reduction at 0.5, 1 and 2 oz per 100 gal; all plants saleable.
27315	Maple ( <i>Acer</i> sp.) <i>A. circinatum</i>	Field Container	Grunwald	OR	2008	Foliar	No injury at 0.5, 1 and 2 oz per 100 gal
27315	Maple ( <i>Acer</i> sp.) <i>A. circinatum</i> and <i>A. macrophyllum</i>	Field Container	Grunwald	OR	2009	Foliar	No injury or growth reduction at 0.5, 1 and 2 oz per 100 gal; all plants saleable.
27315	Maple ( <i>Acer</i> sp.) <i>A. rubrum</i>	Field Container	Reding	OH	2008	Foliar	No injury at 0.5, 1 and 2 oz per 100 gal; slight growth difference at 2X and 4X; all plants marketable
27317	<i>Aglaonema</i> ( <i>Aglaonema</i> sp.)	Field Container	Palmateer	FL	2015	Foliar	No injury or growth reduction with 0.25, 0.5 and 1.0 oz per 100 gal applied 5 times weekly.
27317	<i>Aglaonema</i> ( <i>Aglaonema</i> sp.) 'Silver Queen'	Field Container	Grunwald	OR	2010	Drench	No injury or growth reduction at 0.125 and 0.25 oz per 100 gal applied drench; all treated plants saleable.
27317	<i>Aglaonema</i> ( <i>Aglaonema</i> sp.) 'Silver Queen'	Field Container	Grunwald	OR	2010	Foliar	No injury or growth reduction at 0.25, 0.5, 1 and 2 oz per 100 gal applied foliar; all treated plants saleable.
20284	Garden Snapdragon ( <i>Antirrhinum majus</i> )	Greenhouse	Hausbeck	MI	2002	Foliar	No injury at 1, 2, and 4 oz per 100 gal.
20284	Garden Snapdragon ( <i>Antirrhinum majus</i> )	Greenhouse	Krause	OH	2002	Foliar	No injury at 1, 2, and 4 oz per acre.
20284	Garden Snapdragon ( <i>Antirrhinum majus</i> ) 'Bells Purple'	Greenhouse	Freiberger	NJ	2010	Drench	No injury at 0.125 and 0.25 oz per 100 gal.
20284	Garden Snapdragon ( <i>Antirrhinum majus</i> ) 'Bells Purple'	Greenhouse	Freiberger	NJ	2010	Foliar	No injury at 0.25, 0.5, 1 and 2 oz per 100 gal.
20284	Garden Snapdragon ( <i>Antirrhinum majus</i> ) 'Classic Lavender'	Greenhouse	Linderman	OR	2002	Foliar	No injury at 1, 2, and 4 oz per acre.
20284	Garden Snapdragon ( <i>Antirrhinum majus</i> ) 'Montego'	Greenhouse	Grunwald	OR	2010	Drench	No injury or growth reduction at 0.125 and 0.25 oz per 100 gal applied drench; all treated plants saleable.
20284	Garden Snapdragon ( <i>Antirrhinum majus</i> ) 'Montego'	Greenhouse	Grunwald	OR	2010	Foliar	No injury or growth reduction at 0.25, 0.5, 1 and 2 oz per 100 gal applied foliar; all treated plants saleable.
20284	Garden Snapdragon ( <i>Antirrhinum majus</i> ) 'Montego Red'	Greenhouse	Freiberger	NJ	2010	Drench	No injury at 0.125 and 0.25 oz per 100 gal.
20284	Garden Snapdragon ( <i>Antirrhinum majus</i> ) 'Montego Red'	Greenhouse	Freiberger	NJ	2010	Foliar	No injury at 0.25, 0.5, 1 and 2 oz per 100 gal.
20284	Garden Snapdragon ( <i>Antirrhinum majus</i> ) 'Pink Rocket'	Greenhouse	Locke	MD	2002	Foliar	No injury at 1 oz per 100 gal, but moderate injury with 2 and 4 oz per 100 gal.
20284	Garden Snapdragon ( <i>Antirrhinum majus</i> ) 'Sonnet Mix'	Greenhouse	Grunwald	OR	2010	Drench	No injury or growth reduction at 0.125 and 0.25 oz per 100 gal applied drench; all treated plants saleable.



PR#	Crop	Production Site	Researcher	State	Year	Application Type	Results
20284	Garden Snapdragon ( <i>Antirrhinum majus</i> ) 'Sonnet Mix'	Greenhouse	Grunwald	OR	2010	Foliar	No injury or growth reduction at 0.25, 0.5, 1 and 2 oz per 100 gal applied foliar; all treated plants saleable.
29490	Aster ( <i>Aster</i> sp.)	Field Container	Wade	SC	2011	Drench	No injury or growth reduction with 0.25, 0.50, 1.0 and 2.0 oz per 100 gal applied foliar 5 times or with 0.25 and 0.5 oz applied drench once; all plants marketable.
29490	Aster ( <i>Aster</i> sp.)	Field Container	Wade	SC	2011	Foliar	No injury or growth reduction with 0.25, 0.50, 1.0 and 2.0 oz per 100 gal applied foliar 5 times or with 0.25 and 0.5 oz applied drench once; all plants marketable.
29490	Aster ( <i>Aster</i> sp.) <i>A. dumosus</i> 'Sapphire Mist'	Field Container	Koivunen	CA	2015	Foliar	No injury or growth reduction with 0.25, 0.5 and 1 oz per 100 gal applied 5 times.
29490	Aster ( <i>Aster</i> sp.) 'Believe Purple'	Field Container	Freiberger	NJ	2014	Foliar	No injury or growth reduction with 0.25, 0.5 and 1.0 oz per 100 gal applied 3 times.
27319	Begonia ( <i>Begonia</i> sp.)	Field Container	Harvey	WA	2009	Foliar	No injury at 0.5, 1 and 2 oz per 100 gal.
27319	Begonia ( <i>Begonia</i> sp.) <i>B. x tuberhybrida</i> 'Illumination Trailing'	Field Container	Grunwald	OR	2010	Drench	No injury or growth reduction at 0.125 and 0.25 oz per 100 gal applied drench; all treated plants saleable.
27319	Begonia ( <i>Begonia</i> sp.) <i>B. x tuberhybrida</i> 'Illumination Trailing'	Field Container	Grunwald	OR	2010	Foliar	No injury or growth reduction at 0.25, 0.5, 1 and 2 oz per 100 gal applied foliar; all treated plants saleable.
27319	Begonia ( <i>Begonia</i> sp.) <i>B. x tuberhybrida</i> 'Nonstop'	Field Container	Grunwald	OR	2010	Drench	No injury or growth reduction at 0.125 and 0.25 oz per 100 gal applied drench; all treated plants saleable.
27319	Begonia ( <i>Begonia</i> sp.) <i>B. x tuberhybrida</i> 'Nonstop'	Field Container	Grunwald	OR	2010	Foliar	No injury or growth reduction at 0.25, 0.5, 1 and 2 oz per 100 gal applied foliar; all treated plants saleable.
27319	Begonia ( <i>Begonia</i> sp.) 'Olympia Red'	Field Container	Freiberger	NJ	2008	Foliar	No injury at 0.5, 1.0 and 2.0 oz per 100 gal.
27319	Begonia ( <i>Begonia</i> sp.) 'Vodka Bright Red'	Field Container	Freiberger	NJ	2008	Foliar	No injury at 0.5, 1.0 and 2.0 oz per 100 gal.
27320	Barberry ( <i>Berberis</i> sp.)	Field Container	Harvey	WA	2014	Foliar	No injury with 0.25, 0.5 and 1.0 oz per 100 gal applied 5 times.
27320	Barberry ( <i>Berberis</i> sp.) <i>B. thunbergii</i> 'Rose Glow & 'Pow Wow'	Field Container	Grunwald	OR	2009	Foliar	No injury or growth reduction at 0.5, 1 and 2 oz per 100 gal; all plants saleable.
27320	Barberry ( <i>Berberis</i> sp.) 'Orange Rocket'	Field Container	Gu	TX	2015	Foliar	No injury or growth reduction with 0.25, 0.5 and 1 oz per 100 gal applied 3 times. Researcher recommends repeating trial.
29996	Bougainvillea ( <i>Bougainvillea</i> sp.)	Field Container	Meador	CA	2015	Foliar	No injury or growth reduction with 0.25, 0.5 and 1 oz per 100 gal applied 3 times; comparable to Heritage.
29996	Bougainvillea ( <i>Bougainvillea</i> sp.)	Field Container	Palmateer	FL	2015	Foliar	No injury or growth reduction with 0.25, 0.5 and 1.0 oz per 100 gal applied 5 times weekly.
29996	Bougainvillea ( <i>Bougainvillea</i> sp.)	Field Container	Wade	SC	2011	Drench	No injury or growth reduction with 0.25, 0.50, 1.0 and 2.0 oz per 100 gal applied foliar 5 times or with 0.25 and 0.5 oz applied drench once; all plants marketable.

PR#	Crop	Production Site	Researcher	State	Year	Application Type	Results
29996	Bougainvillea ( <i>Bougainvillea</i> sp.)	Field Container	Wade	SC	2011	Foliar	No injury or growth reduction with 0.25, 0.50, 1.0 and 2.0 oz per 100 gal applied foliar 5 times or with 0.25 and 0.5 oz applied drench once; all plants marketable.
29997	Butterfly Bush ( <i>Buddleia davidii</i> )	Field Container	Harvey	WA	2011	Drench	No injury with 0.125 and 0.25 oz per 100 gal applied once.
29997	Butterfly Bush ( <i>Buddleia davidii</i> )	Field Container	Harvey	WA	2011	Foliar	No injury with 0.25, 0.5, 1 and 2 oz per 100 gal applied 5 times.
29997	Butterfly Bush ( <i>Buddleia davidii</i> )	Field Container	Wade	SC	2011	Drench	No injury or growth reduction with 0.25, 0.50, 1.0 and 2.0 oz per 100 gal applied foliar 5 times or with 0.25 and 0.5 oz applied drench once; all plants marketable.
29997	Butterfly Bush ( <i>Buddleia davidii</i> )	Field Container	Wade	SC	2011	Foliar	No injury or growth reduction with 0.25, 0.50, 1.0 and 2.0 oz per 100 gal applied foliar 5 times or with 0.25 and 0.5 oz applied drench once; all plants marketable.
29997	Butterfly Bush ( <i>Buddleia davidii</i> ) 'Monum'	Field Container	Fraelich	GA	2012	Foliar	No injury or significant difference in plant growth or marketability with 0.25, 0.5 and 1 oz per 100 gal applied 5 times.
27321	Boxwood ( <i>Buxus</i> sp.) <i>B. mycophylla</i> 'Faulkner'	Field Container	Fraelich	GA	2012	Foliar	No injury or significant difference in plant growth or marketability with 0.25, 0.5 and 1 oz per 100 gal applied 5 times.
27321	Boxwood ( <i>Buxus</i> sp.) <i>B. sempervirens</i> 'Green Mountain'	Field Container	Grunwald	OR	2009	Foliar	No injury or growth reduction at 0.5, 1 and 2 oz per 100 gal; all plants saleable.
27322	Calibrachoa ( <i>Calibrachoa</i> sp.)	Field Container	Grunwald	OR	2008	Foliar	No injury at 0.5, 1 and 2 oz per 100 gal.
27322	Calibrachoa ( <i>Calibrachoa</i> sp.)	Field Container	Reding	OH	2008	Foliar	No injury and no significant difference in growth or marketability at 0.5, 1 and 2 oz per 100 gal
27322	Calibrachoa ( <i>Calibrachoa</i> sp.)	Field Container	Williams	IL	2013	Drench	No injury or growth reduction with 0.125, 0.25 and 0.5 oz per 100 gal applied 3 times at monthly intervals.
27322	Calibrachoa ( <i>Calibrachoa</i> sp.)	Field Container	Williams	IL	2013	Foliar	No injury or growth reduction with 0.125, 0.25 and 0.5 oz per 100 gal applied 3 times at monthly intervals.
27322	Calibrachoa ( <i>Calibrachoa</i> sp.) c. x <i>hybrida</i> 'Yellow'	Field Container	Hausbeck	MI	2011	Foliar or Drench	No injury with 0.25, 0.50, 0.75 and 2 oz per 100 gal applied foliar 5 times or with 0.125 and 0.25 oz per 100 gal applied drench once; slight delay in flowering with higher rates.
27322	Calibrachoa ( <i>Calibrachoa</i> sp.) 'Callie Light Pink'	Field Container	Catlin	NY	2011	Drench	No injury or growth reduction with 0.125 and 0.25 oz per 100 gal.
27322	Calibrachoa ( <i>Calibrachoa</i> sp.) 'Callie Light Pink'	Field Container	Catlin	NY	2011	Foliar	No injury or growth reduction with 1 and 2 oz per 100 gal applied 5 times.
27322	Calibrachoa ( <i>Calibrachoa</i> sp.) 'Minifamous'	Field Container	Grunwald	OR	2010	Drench	No injury or growth reduction at 0.125 and 0.25 oz per 100 gal applied drench; all treated plants saleable.
27322	Calibrachoa ( <i>Calibrachoa</i> sp.) 'Minifamous'	Field Container	Grunwald	OR	2010	Foliar	No injury or growth reduction at 0.25, 0.5, 1 and 2 oz per 100 gal applied foliar; all treated plants saleable.
27323	Camellia ( <i>Camellia</i> sp.) <i>C. japonica</i> 'Eg Waterhouse' and 'Magnoliaeflora'	Field Container	Grunwald	OR	2009	Foliar	No injury or growth reduction at 0.5, 1 and 2 oz per 100 gal; all plants saleable.

PR#	Crop	Production Site	Researcher	State	Year	Application Type	Results
27323	Camellia (Camellia sp.) C. japonica 'Elena'	Field Container	Henn	MS	2014	Foliar	No injury or growth reduction with 0.25, 0.5 and 1.0 oz per 100 gal applied 5 times.
27323	Camellia (Camellia sp.) 'Magnoliae flora'	Field Container	Grunwald	OR	2008	Foliar	No injury at 0.5, 1 and 2 oz per 100 gal
20895	Chrysanthemum, Garden (Chrysanthemum/Dendranthema sp.) C. carinatum	Field Container	Hitcher	NJ	2002	Foliar	No injury at 1, 2, and 4 oz per 100 gal.
20895	Chrysanthemum, Garden (Chrysanthemum/Dendranthema sp.) C. carinatum	Field Container	Krause	OH	2002	Foliar	No injury at 1, 2, and 4 oz per 100 gal.
20895	Chrysanthemum, Garden (Chrysanthemum/Dendranthema sp.) 'Hillside Sheffield Pink', 'Clara Curtis'	Field Container	Grunwald	OR	2010	Drench	No injury or growth reduction at 0.125 and 0.25 oz per 100 gal applied drench; all treated plants saleable.
20895	Chrysanthemum, Garden (Chrysanthemum/Dendranthema sp.) 'Hillside Sheffield Pink', 'Clara Curtis'	Field Container	Grunwald	OR	2010	Foliar	No injury or growth reduction at 0.25, 0.5, 1 and 2 oz per 100 gal applied foliar; all treated plants saleable.
27325	Coleus, Flamenettle (Coleus sp.)	Field Container	Harvey	WA	2009	Foliar	No injury at 0.5, 1 and 2 oz per 100 gal.
27325	Coleus, Flamenettle (Coleus sp.)	Field Container	Reding	OH	2008	Foliar	No injury and no significant difference in growth or marketability at 0.5, 1 and 2 oz per 100 gal
27325	Coleus, Flamenettle (Coleus sp.) 'Black Dragon'	Field Container	Grunwald	OR	2010	Drench	No injury or growth reduction at 0.125 and 0.25 oz per 100 gal applied drench; all treated plants saleable.
27325	Coleus, Flamenettle (Coleus sp.) 'Black Dragon'	Field Container	Grunwald	OR	2010	Foliar	No injury or growth reduction at 0.25, 0.5, 1 and 2 oz per 100 gal applied foliar; all treated plants saleable.
27325	Coleus, Flamenettle (Coleus sp.) 'Defiance'	Field Container	Grunwald	OR	2010	Drench	No injury or growth reduction at 0.125 and 0.25 oz per 100 gal applied drench; all treated plants saleable.
27325	Coleus, Flamenettle (Coleus sp.) 'Defiance'	Field Container	Grunwald	OR	2010	Foliar	No injury or growth reduction at 0.25, 0.5, 1 and 2 oz per 100 gal applied foliar; all treated plants saleable.
27325	Coleus, Flamenettle (Coleus sp.) 'Solar Sunrise'	Field Container	Grunwald	OR	2008	Foliar	No injury at 0.5, 1 and 2 oz per 100 gal.
29990	Tickseed (Coreopsis sp.)	Field Container	Harvey	WA	2011	Drench	No injury with 0.125 and 0.25 oz per 100 gal applied once.
29990	Tickseed (Coreopsis sp.)	Field Container	Harvey	WA	2011	Foliar	No injury with 0.25, 0.5, 1 and 2 oz per 100 gal applied 5 times.
29990	Tickseed (Coreopsis sp.)	Field Container	Wade	SC	2011	Drench	No injury or growth reduction with 0.25, 0.50, 1.0 and 2.0 oz per 100 gal applied foliar 5 times or with 0.25 and 0.5 oz applied drench once; all plants marketable.
29990	Tickseed (Coreopsis sp.)	Field Container	Wade	SC	2011	Foliar	No injury or growth reduction with 0.25, 0.50, 1.0 and 2.0 oz per 100 gal applied foliar 5 times or with 0.25 and 0.5 oz applied drench once; all plants marketable.
29990	Tickseed (Coreopsis sp.) C. grandiflora 'Sunray'	Field Container	Grunwald	OR	2011	Drench	No injury with 0.125 and 0.25 oz per 100 gal.

PR#	Crop	Production Site	Researcher	State	Year	Application Type	Results
29990	Tickseed ( <i>Coreopsis</i> sp.) 'Early Sunrise'	Field Container	Kirk	MI	2011	Drench	No injury, leaf abscission or stunting with 0.25 and 0.5 oz per 100 gal.
29990	Tickseed ( <i>Coreopsis</i> sp.) 'Early Sunrise'	Field Container	Kirk	MI	2011	Foliar	No injury or stunting with 0.25, 0.5, 1 and 2 oz per 100 gal applied 5 times.
27326	Dogwood, Flowering ( <i>Cornus florida</i> )	Field Container	Reding	OH	2008	Foliar	No injury and no significant difference in growth or marketability at 0.5, 1 and 2 oz per 100 gal
27327	Cotoneaster ( <i>Cotoneaster</i> sp.)	Field Container	Harvey	WA	2011	Drench	No injury with 0.125 and 0.25 oz per 100 gal applied once.
27327	Cotoneaster ( <i>Cotoneaster</i> sp.)	Field Container	Harvey	WA	2011	Foliar	No injury with 0.25, 0.5, 1 and 2 oz per 100 gal applied 5 times.
27327	Cotoneaster ( <i>Cotoneaster</i> sp.) C. dammeri 'Coral Beauty'	Field Container	Grunwald	OR	2010	Drench	No injury or growth reduction at 0.125 and 0.25 oz per 100 gal applied drench; all treated plants saleable.
27327	Cotoneaster ( <i>Cotoneaster</i> sp.) C. dammeri 'Coral Beauty'	Field Container	Grunwald	OR	2010	Foliar	No injury or growth reduction at 0.25, 0.5, 1 and 2 oz per 100 gal applied foliar; all treated plants saleable.
27327	Cotoneaster ( <i>Cotoneaster</i> sp.) C. dammeri 'Coral Beauty'	Field Container	Grunwald	OR	2011	Drench	No injury with 0.125 and 0.25 oz per 100 gal.
27327	Cotoneaster ( <i>Cotoneaster</i> sp.) C. microphyllus 'Coral Blue'	Field Container	Harvey	WA	2010	Drench	No injury at 0.125 and 0.25 oz per 100 gal.
27327	Cotoneaster ( <i>Cotoneaster</i> sp.) C. microphyllus 'Coral Blue'	Field Container	Harvey	WA	2010	Foliar	No injury at 0.25, 0.5, 1.0 and 2.0 oz per 100 gal.
27327	Cotoneaster ( <i>Cotoneaster</i> sp.) C. microphyllus 'Rock Spray'	Field Container	Harvey	WA	2010	Drench	No injury at 0.125 and 0.25 oz per 100 gal.
27327	Cotoneaster ( <i>Cotoneaster</i> sp.) C. microphyllus 'Rock Spray'	Field Container	Harvey	WA	2010	Foliar	No injury at 0.25, 0.5, 1.0 and 2.0 oz per 100 gal.
27330	Dahlia ( <i>Dahlia</i> sp.) 'Black Beauty'	Field Container	Grunwald	OR	2010	Drench	No injury or growth reduction at 0.125 and 0.25 oz per 100 gal applied drench; all treated plants saleable.
27330	Dahlia ( <i>Dahlia</i> sp.) 'Black Beauty'	Field Container	Grunwald	OR	2010	Foliar	No injury or growth reduction at 0.25, 0.5, 1 and 2 oz per 100 gal applied foliar; all treated plants saleable.
27330	Dahlia ( <i>Dahlia</i> sp.) D. dahlietta 'Betty'	Field Container	Grunwald	OR	2011	Drench	No injury with 0.125 and 0.25 oz per 100 gal.
27330	Dahlia ( <i>Dahlia</i> sp.) 'Figaro Mix'	Field Container	Kirk	MI	2011	Drench	No injury, leaf abscission or stunting with 0.25 and 0.5 oz per 100 gal.
27330	Dahlia ( <i>Dahlia</i> sp.) 'Figaro Mix'	Field Container	Kirk	MI	2011	Foliar	No injury or stunting with 0.25, 0.5, 1 and 2 oz per 100 gal applied 5 times; increased leaf abscission with highest rate.
27331	Pink ( <i>Dianthus</i> sp.) 'Cardinal Red'	Field Container	Grunwald	OR	2008	Foliar	No injury at 0.5, 1 and 2 oz per 100 gal
27331	Pink ( <i>Dianthus</i> sp.) D. gratianopolitanus 'Firewitch'	Field Container	Fraelich	GA	2008	Over the top	No injury or growth reduction at 0.5, 1 and 2 oz per 100 gal; all plants marketable
27331	Pink ( <i>Dianthus</i> sp.) D. gratianopolitanus 'Zing Rose'	Field Container	Reding	OH	2008	Foliar	Severe injury at 0.5, 1 and 2 oz per 100 gal
27331	Pink ( <i>Dianthus</i> sp.) 'Fire Star'	Field Container	Boydston	WA	2008	Over the top	No injury or growth reduction at 0.5, 1 and 2 oz per 100 gal

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27331	Pink (Dianthus sp.) 'Spotti'	Field Container	Boydston	WA	2008	Over the top	No injury or growth reduction at 0.5, 1 and 2 ozai per 100 gal
27332	Purple Coneflower (Echinacea sp.) E purpurea 'Magnus and 'Twilight'	Field Container	Grunwald	OR	2009	Foliar	No injury or growth reduction at 0.5, 1 and 2 oz per 100 gal; all plants saleable.
27332	Purple Coneflower (Echinacea sp.) E. purpurea 'Magnus'	Field Container	Grunwald	OR	2010	Drench	No injury or growth reduction at 0.125 and 0.25 oz per 100 gal applied drench; all treated plants saleable.
27332	Purple Coneflower (Echinacea sp.) E. purpurea 'Magnus'	Field Container	Grunwald	OR	2010	Foliar	No injury or growth reduction at 0.25, 0.5, 1 and 2 oz per 100 gal applied foliar; all treated plants saleable.
27332	Purple Coneflower (Echinacea sp.) E. purpurea 'Sunrise'	Field Container	Grunwald	OR	2010	Drench	No injury or growth reduction at 0.125 and 0.25 oz per 100 gal applied drench; all treated plants saleable.
27332	Purple Coneflower (Echinacea sp.) E. purpurea 'Sunrise'	Field Container	Grunwald	OR	2010	Foliar	No injury or growth reduction at 0.25, 0.5, 1 and 2 oz per 100 gal applied foliar; all treated plants saleable.
27333	Devil's Ivy (Epipremnum pinnatum)	Field Container	Grunwald	OR	2010	Drench	No injury or growth reduction at 0.125 and 0.25 oz per 100 gal applied drench; all treated plants saleable.
27333	Devil's Ivy (Epipremnum pinnatum)	Field Container	Grunwald	OR	2010	Foliar	No injury or growth reduction at 0.25, 0.5, 1 and 2 oz per 100 gal applied foliar; all treated plants saleable.
27333	Devil's Ivy (Epipremnum pinnatum)	Field Container	Gu	TX	2014	Foliar	No injury or growth reduction with 0.25, 0.5 and 1 oz per 100 gal applied 3 times.
27333	Devil's Ivy (Epipremnum pinnatum)	Field Container	Palmateer	FL	2015	Foliar	No injury or growth reduction with 0.25, 0.5 and 1.0 oz per 100 gal applied 5 times weekly.
27334	Spindletree (Euonymus sp.)	Field Container	Grunwald	OR	2008	Foliar	No injury at 0.5, 1 and 2 oz per 100 gal
27334	Spindletree (Euonymus sp.) E. fortunei 'Coloratus'	Field Container	Reding	OH	2008	Foliar	No injury and no significant difference in growth or marketability at 0.5, 1 and 2 oz per 100 gal
27334	Spindletree (Euonymus sp.) E. fortunei 'Colorata'	Field Container	Fraelich	GA	2008	Over the top	No injury or growth reduction at 0.5, 1 and 2 oz per 100 gal; all plants marketable
23112	Poinsettia (Euphorbia pulcherrima)	Greenhouse	Hausbeck	MI	2002	Foliar	Moderate injury with 0.5, 1.0 and 2.0 oz per 100 gal.
20281	Hardy Geranium (Geranium magniflorum) 'Johnson's Blue'	Greenhouse	Krause	OH	2002	Foliar	No injury at 1, 2, and 4 oz per acre.
20281	Hardy Geranium (Geranium magniflorum) 'Ringo'	Greenhouse	Locke	MD	2002	Foliar	No injury at 1, 2, and 4 oz per 100 gal.
27459	Transvaal Daisy (Gerbera sp.) 'Callie Light Pink'	Greenhouse	Catlin	NY	2011	Drench	Some injury (chlorosis, delayed bloom), though not significant, with 0.125 and 0.25 oz per 100 gal.
27459	Transvaal Daisy (Gerbera sp.) 'Callie Light Pink'	Greenhouse	Catlin	NY	2011	Foliar	Significant injury (chlorosis, delayed bloom) and growth reduction with 1 and 2 oz per 100 gal applied 5 times.
27459	Transvaal Daisy (Gerbera sp.) G. jamesonii	Greenhouse	Grunwald	OR	2010	Drench	No injury or growth reduction at 0.125 and 0.25 oz per 100 gal applied drench; all treated plants saleable.
27459	Transvaal Daisy (Gerbera sp.) G. jamesonii	Greenhouse	Grunwald	OR	2010	Foliar	No injury or growth reduction at 0.25, 0.5, 1 and 2 oz per 100 gal applied foliar; all treated plants saleable.
27459	Transvaal Daisy (Gerbera sp.) G. jamesonii 'White Majestic'	Greenhouse	Uber	CA	2010	Drench	No injury or growth reduction at 0.125 and 0.25 oz per 100 gal drench applied once.

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27459	Transvaal Daisy (Gerbera sp.) G. jamesonii 'White Majestic'	Greenhouse	Uber	CA	2010	Foliar	No injury or growth reduction at 0.25, 0.5, 1 and 2 oz per 100 gal foliar applied 5 times.
28140	Gladiolus (Gladiolus sp.) 'Alaska'	Field Container	Kirk	MI	2011	Drench	No injury or stunting with 0.25 and 0.5 oz per 100 gal.
28140	Gladiolus (Gladiolus sp.) 'Alaska'	Field Container	Kirk	MI	2011	Foliar	No injury with 0.25, 0.5, 1 and 2 oz per 100 gal applied 5 times; lowest rate increased plant height.
28140	Gladiolus (Gladiolus sp.) G. grandiflora	Field Container	Grunwald	OR	2010	Drench	No injury or growth reduction at 0.125 and 0.25 oz per 100 gal applied drench; all treated plants saleable.
28140	Gladiolus (Gladiolus sp.) G. grandiflora	Field Container	Grunwald	OR	2010	Foliar	No injury or growth reduction at 0.25, 0.5, 1 and 2 oz per 100 gal applied foliar; all treated plants saleable.
29991	Sunflower (Helianthus sp.)	Field Container	Grunwald	OR	2014	Foliar	No injury or growth reduction with 0.25, 0.5 and 1.0 oz per 100 gal; all plants saleable.
29991	Sunflower (Helianthus sp.)	Field Container	Harvey	WA	2011	Drench	No injury with 0.125 and 0.25 oz per 100 gal applied once.
29991	Sunflower (Helianthus sp.)	Field Container	Harvey	WA	2011	Foliar	No injury with 0.25, 0.5, 1 and 2 oz per 100 gal applied 5 times.
29991	Sunflower (Helianthus sp.) 'Table Mountain'	Field Container	Gu	TX	2014	Foliar	No injury or growth reduction with 0.25, 0.5 and 1 oz per 100 gal applied 3 times.
27338	Daylily (Hemerocallis sp.) 'Grape Velvet'	Field Container	Reding	OH	2008	Foliar	No injury and no significant difference in growth or marketability at 0.5, 1 and 2 oz per 100 gal
27338	Daylily (Hemerocallis sp.) H. hybrida 'Aquarius'	Field Container	Fraelich	GA	2008	Foliar	No injury or growth reduction at 0.5, 1 and 2 oz per 100 gal; all plants marketable.
27338	Daylily (Hemerocallis sp.) H. hybrida 'Hyperion'	Field Container	Boydston	WA	2008	Foliar	No injury or growth reduction at 0.5, 1 and 2 oz per 100 gal.
27338	Daylily (Hemerocallis sp.) H. hybrida 'Stella de Oro'	Field Container	Boydston	WA	2008	Foliar	No injury or growth reduction at 0.5, 1 and 2 oz per 100 gal.
27338	Daylily (Hemerocallis sp.) H. hybrida 'Stella De Oro'	Field Container	Fraelich	GA	2008	Foliar	No injury or growth reduction at 0.5, 1 and 2 oz per 100 gal; very slight stunting at 2X and 4X; all plants marketable
27338	Daylily (Hemerocallis sp.) 'Happy Returns'	Field Container	Grunwald	OR	2008	Foliar	No injury at 0.5, 1 and 2 oz per 100 gal.
27339	Alumroot (Heuchera sp.)	Field Container	Harvey	WA	2009	Foliar	No injury at 0.5, 1 and 2 oz per 100 gal.
27339	Alumroot (Heuchera sp.) H. micrantha 'Palace Purple'	Field Container	Grunwald	OR	2009	Foliar	No injury or growth reduction at 0.5, 1 and 2 oz per 100 gal; all plants saleable.
29998	Rosemallow (Hibiscus sp.)	Field Container	Wade	SC	2011	Drench	No injury or growth reduction with 0.25, 0.50, 1.0 and 2.0 oz per 100 gal applied foliar 5 times or with 0.25 and 0.5 oz applied drench once; all plants marketable.
29998	Rosemallow (Hibiscus sp.)	Field Container	Wade	SC	2011	Foliar	No injury or growth reduction with 0.25, 0.50, 1.0 and 2.0 oz per 100 gal applied foliar 5 times or with 0.25 and 0.5 oz applied drench once; all plants marketable.
29998	Rosemallow (Hibiscus sp.) H. syriacus 'Minfren'	Field Container	DeFrancesco	OR	2015	Foliar	No injury or growth reduction with 0.25, 0.5 and 1.0 oz per 100 gal applied 5 times weekly.

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29998	Rosemallow (Hibiscus sp.) H. trionum 'Simply Love'	Field Container	DeFrancesco	OR	2014	Foliar	No injury or growth reduction with 0.25, 0.5 and 1 oz per 100 gal applied 5 times.
29998	Rosemallow (Hibiscus sp.) 'Patio Party'	Field Container	Gu	TX	2015	Foliar	No injury or growth reduction with 0.25, 0.5 and 1 oz per 100 gal applied 3 times.
19124	Lily, Plantain (Hosta fortunei)	Field Container	Fraelich	GA	2009	Foliar	No injury or growth reduction at 0.5, 1 and 2 oz per 100 gal; all plants marketable.
19124	Lily, Plantain (Hosta fortunei)	Field Container	Harvey	WA	2009	Foliar	No injury at 0.5, 1 and 2 oz per 100 gal.
19124	Lily, Plantain (Hosta fortunei)	Field Container	Krause	OH	2000	Drench	No injury with 0.05, 0.1, and 0.2 g per liter.
19124	Lily, Plantain (Hosta fortunei) 'Aoki' and 'Francee'	Field Container	Grunwald	OR	2009	Foliar	No injury or growth reduction at 0.5, 1 and 2 oz per 100 gal; all plants saleable.
27460	Hydrangea (Hydrangea sp.)	Field Container	Harvey	WA	2011	Drench	No injury with 0.125 and 0.25 oz per 100 gal applied once.
27460	Hydrangea (Hydrangea sp.)	Field Container	Harvey	WA	2011	Foliar	No injury with 0.25, 0.5, 1 and 2 oz per 100 gal applied 5 times.
27460	Hydrangea (Hydrangea sp.)	Field Container	Wade	SC	2011	Drench	No injury or growth reduction with 0.25, 0.50, 1.0 and 2.0 oz per 100 gal applied foliar 5 times or with 0.25 and 0.5 oz applied drench once; all plants marketable.
27460	Hydrangea (Hydrangea sp.)	Field Container	Wade	SC	2011	Foliar	No injury or growth reduction with 0.25, 0.50, 1.0 and 2.0 oz per 100 gal applied foliar 5 times or with 0.25 and 0.5 oz applied drench once; all plants marketable.
27460	Hydrangea (Hydrangea sp.) 'Angel Blush'	Field Container	Harvey	WA	2010	Drench	No injury at 0.125 and 0.25, 1.0 per 100 gal.
27460	Hydrangea (Hydrangea sp.) 'Angel Blush'	Field Container	Harvey	WA	2010	Foliar	No injury at 0.25, 0.5, 1.0 and 2.0 oz per 100 gal.
27460	Hydrangea (Hydrangea sp.) H. macrophylla 'Taube'	Field Container	Grunwald	OR	2010	Drench	No injury or growth reduction at 0.125 and 0.25 oz per 100 gal applied drench; all treated plants saleable.
27460	Hydrangea (Hydrangea sp.) H. macrophylla 'Taube'	Field Container	Grunwald	OR	2010	Foliar	No injury or growth reduction at 0.25, 0.5, 1 and 2 oz per 100 gal applied foliar; all treated plants saleable.
27460	Hydrangea (Hydrangea sp.) H. macrophylla 'Taube'	Field Container	Grunwald	OR	2011	Drench	No injury with 0.125 and 0.25 oz per 100 gal.
27460	Hydrangea (Hydrangea sp.) 'Pink Delight'	Field Container	Harvey	WA	2010	Drench	No injury at 0.125 and 0.25, 1.0 per 100 gal.
27460	Hydrangea (Hydrangea sp.) 'Pink Delight'	Field Container	Harvey	WA	2010	Foliar	No injury at 0.25, 0.5, 1.0 and 2.0 oz per 100 gal.
27340	Holly, Japanese (Ilex crenata)	Field Container	Grunwald	OR	2008	Foliar	No injury at 0.5, 1 and 2 oz per 100 gal
27340	Holly, Japanese (Ilex crenata) 'Beehive'	Field Container	Reding	OH	2008	Foliar	No injury and no significant difference in growth or marketability at 0.5, 1 and 2 oz per 100 gal

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20282	Impatiens; Touch-me-not (Impatiens sp.)	Greenhouse	Krause	OH	2002	Foliar	Moderate reduction in flowering at 1, 2, and 4 oz per acre with 3 biweekly applications, but no difference was observed at the end of the experiment.
20282	Impatiens; Touch-me-not (Impatiens sp.) 'Camellia flowers Mixed Colors'	Greenhouse	Locke	MD	2002	Foliar	Moderate to severe injury increasing with rate (1, 2, 4 oz per 100 gal).
23111	Buzzy Lizzy; Impatiens, Common Garden (Impatiens walleriana)	Greenhouse	Hausbeck	MI	2002	Foliar	No injury at 0.5, 1, and 2 oz per 100 gal with 3 biweekly applications.
27461	Juniper (Juniperus sp.)	Field Container	Harvey	WA	2014	Foliar	No injury with 0.25, 0.5 and 1.0 oz per 100 gal applied 5 times.
27461	Juniper (Juniperus sp.) J. conferta 'Blue Pacific'	Field Container	Fraelich	GA	2012	Foliar	No injury or significant difference in plant growth or marketability with 0.25, 0.5 and 1 oz per 100 gal applied 5 times.
27461	Juniper (Juniperus sp.) J. procumbens 'Nana'	Field Container	Grunwald	OR	2009	Foliar	No injury or growth reduction at 0.5, 1 and 2 oz per 100 gal; all plants saleable.
30831	Lantana (Lantana sp.) L. camara 'Confetti'	Greenhouse	Grunwald	OR	2012	Drench	No injury or growth reduction with 0.125, 0.25 and 0.5 oz per 100 gal; all plants saleable.
30831	Lantana (Lantana sp.) L. camara 'Confetti'	Greenhouse	Grunwald	OR	2012	Foliar	No injury or growth reduction with 0.25, 0.5 and 1 oz per 100 gal applied 3 times; all plants saleable.
27341	Lavender (Lavandula sp.) L. angustifolia 'Purple Bouquet' and 'Buena Vista'	Field Container	Grunwald	OR	2009	Foliar	No injury or growth reduction at 0.5, 1 and 2 oz per 100 gal; all plants saleable.
27342	Lilyturf (Liriope sp.) L. muscari 'Aztec Grass'	Field Container	Fraelich	GA	2012	Over the top	No injury or significant difference in plant growth or marketability with 0.25, 0.5 and 1 oz per 100 gal applied 5 times.
21394	Apple (Malus sp.) 'Spring Snow'	Field Container	Grunwald	OR	2009	Foliar	No injury or growth reduction at 0.5, 1 and 2 oz per 100 gal; all plants saleable.
30841	Daffodil (Narcissus sp.) 'Tete-a-Tete'	Greenhouse	Freiberger	NJ	2013	Foliar	Severe injury after the final application with 0.25, 0.5 and 1 oz per 100 gal applied 5 times.
30844	Daisybush (Osteospermum sp.)	Greenhouse	Williams	IL	2013	Foliar	No injury or growth reduction with 0.125, 0.25 and 0.5 oz per 100 gal applied 3 times at monthly intervals.
30844	Daisybush (Osteospermum sp.) 'Akila'	Greenhouse	Freiberger	NJ	2014	Drench	No injury or growth reduction with 0.125, 0.25 and 0.5 oz per 100 gal.
30844	Daisybush (Osteospermum sp.) 'Akila Purple'	Greenhouse	Hausbeck	MI	2013	Drench	No injury or growth reduction with 0.125, 0.25 and 0.50 oz per 100 gal.
30844	Daisybush (Osteospermum sp.) 'Copper Purple'	Greenhouse	Grunwald	OR	2012	Drench	No injury or growth reduction with 0.125, 0.25 and 0.5 oz per 100 gal; all plants saleable.
30844	Daisybush (Osteospermum sp.) 'Copper Purple'	Greenhouse	Grunwald	OR	2012	Foliar	No injury or growth reduction with 0.25, 0.5 and 1 oz per 100 gal applied 3 times; all plants saleable.
30844	Daisybush (Osteospermum sp.) 'Margarita White'	Greenhouse	Freiberger	NJ	2013	Foliar	No injury or growth reduction with 0.25, 0.5 and 1 oz per 100 gal applied 5 times.
27344	Geranium (Pelargonium sp.)	Field Container	Harvey	WA	2009	Foliar	No injury at 0.5, 1 and 2 oz per 100 gal.



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27344	Geranium (Pelargonium sp.) P x hortorum	Field Container	Grunwald	OR	2009	Foliar	No injury or growth reduction at 0.5, 1 and 2 oz per 100 gal; all plants saleable.
27344	Geranium (Pelargonium sp.) P. hortorum	Field Container	Grunwald	OR	2008	Foliar	No injury at 0.5, 1 and 2 oz per 100 gal
27344	Geranium (Pelargonium sp.) P. peltatum	Field Container	Reding	OH	2008	Foliar	No injury and no significant difference in growth or marketability at 0.5, 1 and 2 oz per 100 gal
27344	Geranium (Pelargonium sp.) P. x hortorum	Field Container	Fraelich	GA	2009	Foliar	No injury or growth reduction at 0.5, 1 and 2 oz per 100 gal; all plants marketable.
27336	Geranium, Zonal (Pelargonium x hortorum) 'Maverick Red'	Field Container	Freiberger	NJ	2008	Foliar	No to moderate injury increasing with rate (0.5, 1.0, 2.0 oz per 100 gal), exhibited more with later applications.
27336	Geranium, Zonal (Pelargonium x hortorum) 'Orbit Red'	Field Container	Freiberger	NJ	2008	Foliar	No to moderate injury increasing with rate (0.5, 1.0, 2.0 oz per 100 gal), exhibited more with later applications.
23110	Petunia (Petunia sp.)	Greenhouse	Hausbeck	MI	2002	Foliar	No injury at 0.5, 1.0, and 2.0 oz per 100 gal.
23110	Petunia (Petunia sp.) 'Celebrity Blue Ice'	Greenhouse	Freiberger	NJ	2010	Foliar	No injury applied foliar at 0.25, 0.5, 1 and 2 oz per 100 gal.
23110	Petunia (Petunia sp.) 'Dream Red'	Greenhouse	Freiberger	NJ	2008	Foliar	No injury at 0.5, 1.0 and 2.0 oz per 100 gal.
23110	Petunia (Petunia sp.) 'Dream White'	Greenhouse	Freiberger	NJ	2010	Drench	No injury applied drench at 0.125 and 0.25 oz per 100 gal.
30578	Petunia (Petunia sp.) 'Madness'	Field Container	Grunwald	OR	2010	Drench	No injury or growth reduction at 0.125 and 0.25 oz per 100 gal applied drench; all treated plants saleable.
30578	Petunia (Petunia sp.) 'Madness'	Field Container	Grunwald	OR	2010	Foliar	No injury or growth reduction at 0.25, 0.5, 1 and 2 oz per 100 gal applied foliar; all treated plants saleable.
23110	Petunia (Petunia sp.) 'Madness Red'	Greenhouse	Freiberger	NJ	2008	Foliar	No injury at 0.5, 1.0 and 2.0 oz per 100 gal.
30578	Petunia (Petunia sp.) 'Picobella Mix'	Field Container	Grunwald	OR	2010	Drench	No injury or growth reduction at 0.125 and 0.25 oz per 100 gal applied drench; all treated plants saleable.
30578	Petunia (Petunia sp.) 'Picobella Mix'	Field Container	Grunwald	OR	2010	Foliar	No injury or growth reduction at 0.25, 0.5, 1 and 2 oz per 100 gal applied foliar; all treated plants saleable.
27347	Phlox, Carolina (Phlox carolinia) 'Creeping Blue'	Field Container	Harvey	WA	2010	Foliar	No injury at 0.25, 0.5, 1.0 and 2.0 oz per 100 gal.
27347	Phlox, Carolina (Phlox carolinia) 'Crreping Blue'	Field Container	Harvey	WA	2010	Drench	No injury at 0.125 and 0.25.
27347	Phlox, Carolina (Phlox carolinia) P. subulata 'Red Wings'	Field Container	Fraelich	GA	2009	Foliar	No injury or growth reduction at 0.5, 1 and 2 oz per 100 gal; all plants marketable.
27347	Phlox, Carolina (Phlox carolinia) P. subulata 'Red Wings'	Field Container	Harvey	WA	2010	Drench	No injury at 0.125 and 0.25.
27347	Phlox, Carolina (Phlox carolinia) P. subulata 'Red Wings'	Field Container	Harvey	WA	2010	Foliar	No injury at 0.25, 0.5, 1.0 and 2.0 oz per 100 gal.
27349	Spruce (Picea sp.) P.sitchensis and P. nidiformis	Field Container	Grunwald	OR	2009	Foliar	No injury or growth reduction at 0.5, 1 and 2 oz per 100 gal; all plants saleable.
27350	Pine (Pinus sp.) P. ponderosa	Field Container	Grunwald	OR	2008	Foliar	No injury at 0.5, 1 and 2 oz per 100 gal
27350	Pine (Pinus sp.) P. ponderosa and P. contoracontorta	Field Container	Grunwald	OR	2009	Foliar	No injury or growth reduction at 0.5, 1 and 2 oz per 100 gal; all plants saleable.

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27350	Pine ( <i>Pinus</i> sp.) <i>P. taeda</i>	Field Container	Fraelich	GA	2009	Foliar	No injury or growth reduction at 0.5, 1 and 2 oz per 100 gal; all plants marketable.
27351	Cinquefoil ( <i>Potentilla</i> sp.) <i>P. fruticosa</i> 'Mango Tango' and Goldfinger'	Field Container	Grunwald	OR	2009	Foliar	No injury or growth reduction at 0.5, 1 and 2 oz per 100 gal; all plants saleable.
30845	Fir, Douglas ( <i>Pseudotsuga menziesii</i> )	Greenhouse	Brazeo	MA	2015	Foliar	No injury or growth reduction with 0.25, 0.5 and 1 fl oz per 100 gal applied 3 times.
30845	Fir, Douglas ( <i>Pseudotsuga menziesii</i> )	Greenhouse	DeFrancesco	OR	2012	Drench	No injury or growth reduction with 0.125, 0.25 and 0.5 oz per 100 gal.
30845	Fir, Douglas ( <i>Pseudotsuga menziesii</i> )	Greenhouse	DeFrancesco	OR	2012	Foliar	No injury or growth reduction with 0.25, 0.5 and 1 oz per 100 gal applied 5 times.
30845	Fir, Douglas ( <i>Pseudotsuga menziesii</i> )	Greenhouse	Grunwald	OR	2012	Drench	No injury or growth reduction with 0.125, 0.25 and 0.5 oz per 100 gal; all plants saleable.
30845	Fir, Douglas ( <i>Pseudotsuga menziesii</i> )	Greenhouse	Grunwald	OR	2012	Foliar	No injury or growth reduction with 0.25, 0.5 and 1 oz per 100 gal applied 3 times; all plants saleable.
27792	Firethorn ( <i>Pyracantha</i> sp.) <i>P. koidzumii</i> 'Santa Cruz'	Field Container	Grunwald	OR	2010	Drench	No injury or growth reduction at 0.125 and 0.25 oz per 100 gal applied drench; all treated plants saleable.
27792	Firethorn ( <i>Pyracantha</i> sp.) <i>P. koidzumii</i> 'Santa Cruz'	Field Container	Grunwald	OR	2010	Foliar	No injury or growth reduction at 0.25, 0.5, 1 and 2 oz per 100 gal applied foliar; all treated plants saleable.
27792	Firethorn ( <i>Pyracantha</i> sp.) 'Santa Cruz'	Field Container	Uber	CA	2010	Drench	No injury or growth reduction at 0.125 and 0.25 oz per 100 gal drench applied once.
27792	Firethorn ( <i>Pyracantha</i> sp.) 'Santa Cruz'	Field Container	Uber	CA	2010	Foliar	No injury or growth reduction at 0.25, 0.5, 1 and 2 oz per 100 gal foliar applied 5 times.
27792	Firethorn ( <i>Pyracantha</i> sp.) 'Yukon'	Field Container	Harvey	WA	2010	Drench	No injury at 0.125 and 0.25 oz per 100 gal.
27792	Firethorn ( <i>Pyracantha</i> sp.) 'Yukon'	Field Container	Harvey	WA	2010	Foliar	No injury at 0.25, 0.5, 1.0 and 2.0 oz per 100 gal.
27352	Oak ( <i>Quercus</i> sp.) <i>Q. alba</i>	Field Container	Freiberger	NJ	2008	Foliar	All plants were infected with powdery mildew which complicated assessments.
27352	Oak ( <i>Quercus</i> sp.) <i>Q. garryana</i> and <i>Q. kelloggii</i>	Field Container	Grunwald	OR	2009	Foliar	No injury or growth reduction at 0.5, 1 and 2 oz per 100 gal; all plants saleable.
27352	Oak ( <i>Quercus</i> sp.) <i>Q. rubra</i>	Field Container	DeFrancesco	OR	2012	Drench	No injury but slight growth reduction with 0.125, 0.25 and 0.5 oz per 100 gal.
27352	Oak ( <i>Quercus</i> sp.) <i>Q. rubra</i>	Field Container	DeFrancesco	OR	2012	Foliar	No injury or growth reduction with 0.25, 0.5 and 1 oz per 100 gal applied 5 times.
27353	Indian Hawthorn ( <i>Rhaphiolepis indica</i> )	Field Container	Uber	CA	2015	Foliar	No injury or growth reduction with 0.25, 0.5 and 1 oz per 100 gal applied 3 times.
27353	Indian Hawthorn ( <i>Rhaphiolepis indica</i> ) 'Minor'	Field Container	Fraelich	GA	2012	Over the top	No injury or significant difference in plant growth or marketability with 0.25, 0.5 and 1 oz per 100 gal applied 5 times.
27353	Indian Hawthorn ( <i>Rhaphiolepis indica</i> ) 'Snow Caps'	Field Container	Fraelich	GA	2008	Over the top	No injury or growth reduction at 0.5, 1 and 2 oz per 100 gal; all plants marketable

PR#	Crop	Production Site	Researcher	State	Year	Application Type	Results
27354	Azalea (Rhododendron sp.) 'Lee's Dark Purple'	Field Container	Reding	OH	2008	Foliar	No injury and no significant difference in growth or marketability at 0.5, 1 and 2 oz per 100 gal
27354	Azalea (Rhododendron sp.) 'Lees Dark Purple and 'Catawbiense Boursault'	Field Container	Grunwald	OR	2009	Foliar	No injury or growth reduction at 0.5, 1 and 2 oz per 100 gal; all plants saleable.
27354	Azalea (Rhododendron sp.) 'Nova Zembla'	Field Container	Grunwald	OR	2008	Foliar	No injury at 0.5, 1 and 2 oz per 100 gal
27354	Azalea (Rhododendron sp.) 'White'	Field Container	Freiberger	NJ	2008	Foliar	No injury at 0.5, 1.0 and 2.0 oz per 100 gal.
20286	Rose (Rosa sp.) 'Crimson Meidiland'	Field Container	Boydston	WA	2008	Foliar	No injury or growth reduction at 0.5, 1 and 2 oz per 100 gal
20286	Rose (Rosa sp.) 'Joyful Jubilee'	Field Container	Boydston	WA	2008	Foliar	No injury or growth reduction at 0.5, 1 and 2 oz per 100 gal
20286	Rose (Rosa sp.) 'Nutmaka'	Field Container	Grunwald	OR	2008	Foliar	No injury at 0.5, 1 and 2 oz per 100 gal
27355	Coneflower (Rudbeckia sp.) R. fulgida 'Earlybird'	Field Container	Grunwald	OR	2010	Drench	No injury or growth reduction at 0.125 and 0.25 oz per 100 gal applied drench; all treated plants saleable.
27355	Coneflower (Rudbeckia sp.) R. fulgida 'Earlybird'	Field Container	Grunwald	OR	2010	Foliar	No injury or growth reduction at 0.25, 0.5, 1 and 2 oz per 100 gal applied foliar; all treated plants saleable.
27355	Coneflower (Rudbeckia sp.) R. fulgida 'Goldstrum'	Field Container	Grunwald	OR	2009	Foliar	No injury or growth reduction at 0.5, 1 and 2 oz per 100 gal; all plants saleable.
27355	Coneflower (Rudbeckia sp.) R. fulgida 'Goldstrum'	Field Container	Grunwald	OR	2010	Foliar	No injury or growth reduction at 0.25, 0.5, 1 and 2 oz per 100 gal applied foliar; all treated plants saleable.
27355	Coneflower (Rudbeckia sp.) R. fulgida 'Goldstrum', 'Earlybird'	Field Container	Grunwald	OR	2010	Drench	No injury or growth reduction at 0.125 and 0.25 oz per 100 gal applied drench; all treated plants saleable.
28141	Common Sage (Salvia officinalis)	Field Container	Fraelich	GA	2009	Foliar	No injury or growth reduction at 0.5, 1 and 2 oz per 100 gal; all plants marketable.
28141	Common Sage (Salvia officinalis)	Field Container	Meador	CA	2015	Foliar	No injury or growth reduction with 0.25, 0.5 and 1 oz per 100 gal applied 3 times; comparable to Heritage.
28141	Common Sage (Salvia officinalis) 'Berggarten'	Field Container	Grunwald	OR	2009	Foliar	No injury or growth reduction at 0.5, 1 and 2 oz per 100 gal; all plants saleable.
27357	Bridal-Wreath (Spiraea sp.) S. japonica 'Little Princess'	Field Container	Fraelich	GA	2008	Over the top	No injury or growth reduction at 0.5, 1 and 2 oz per 100 gal; all plants marketable
20283	American Evergreen (Syngonium podophyllum)	Greenhouse	Locke	MD	2002	Foliar	No injury at 1, 2, and 4 oz per 100 gal.
21398	Lilac (Syringa sp.) 'President Grevy'	Field Container	Grunwald	OR	2008	Foliar	No injury at 0.5, 1 and 2 oz per 100 gal
21398	Lilac (Syringa sp.) S. reticulata	Field Container	Freiberger	NJ	2008	Foliar	All plants were infected with powdery mildew which complicated assessments.
21398	Lilac (Syringa sp.) S. vulgaris 'President Greevy'	Field Container	Grunwald	OR	2010	Drench	No injury or growth reduction at 0.125 and 0.25 oz per 100 gal applied drench; all treated plants saleable.
21398	Lilac (Syringa sp.) S. vulgaris 'President Greevy'	Field Container	Grunwald	OR	2010	Foliar	No injury or growth reduction at 0.25, 0.5, 1 and 2 oz per 100 gal applied foliar; all treated plants saleable.

PR#	Crop	Production Site	Researcher	State	Year	Application Type	Results
27359	Yew ( <i>Taxus</i> sp.) <i>T. baccata</i> and <i>T. brevifolia</i>	Field Container	Grunwald	OR	2009	Foliar	No injury or growth reduction at 0.5, 1 and 2 oz per 100 gal; all plants saleable.
27360	Red Cedar, <i>Arborvitae</i> ( <i>Thuja</i> sp.)	Field Container	Grunwald	OR	2009	Foliar	No injury at 0.5, 1 and 2 oz per 100 gal.
27360	Red Cedar, <i>Arborvitae</i> ( <i>Thuja</i> sp.) <i>T. occidentalis</i>	Field Container	Grunwald	OR	2008	Foliar	No injury at 0.5, 1 and 2 oz per 100 gal
27360	Red Cedar, <i>Arborvitae</i> ( <i>Thuja</i> sp.) <i>T. occidentalis</i>	Field Container	Reding	OH	2008	Foliar	No injury and no significant difference in growth or marketability at 0.5, 1 and 2 oz per 100 gal
27463	Vervain ( <i>Verbena</i> sp.) 'Obsession Blue Eye'	Greenhouse	Freiberger	NJ	2010	Drench	No injury applied drench at 0.125 and 0.25 oz per 100 gal.
27463	Vervain ( <i>Verbena</i> sp.) 'Obsession Blue Eye'	Greenhouse	Freiberger	NJ	2010	Foliar	No injury applied foliar at 0.25, 0.5, 1 and 2 oz per 100 gal.
27463	Vervain ( <i>Verbena</i> sp.) <i>V. x hybrida</i> 'Obsession'	Greenhouse	Grunwald	OR	2010	Drench	No injury or growth reduction at 0.125 and 0.25 oz per 100 gal applied drench; all treated plants saleable.
27463	Vervain ( <i>Verbena</i> sp.) <i>V. x hybrida</i> 'Obsession'	Greenhouse	Grunwald	OR	2010	Foliar	No injury or growth reduction at 0.25, 0.5, 1 and 2 oz per 100 gal applied foliar; all treated plants saleable.
27463	Vervain ( <i>Verbena</i> sp.) <i>V. x hybrida</i> 'Obsession Red'	Greenhouse	Grunwald	OR	2011	Drench	No injury with 0.125 and 0.25 oz per 100 gal.
27363	Arrowwood ( <i>Viburnum</i> sp.) <i>V. dentatum</i>	Field Container	Grunwald	OR	2008	Foliar	No injury at 0.5, 1 and 2 oz per 100 gal
27363	Arrowwood ( <i>Viburnum</i> sp.) <i>V. dentatum</i> 'Blue Muffin'	Field Container	Reding	OH	2008	Foliar	No injury and no significant difference in growth or marketability at 0.5, 1 and 2 oz per 100 gal
27363	Arrowwood ( <i>Viburnum</i> sp.) <i>V. tinus</i> 'compatum'	Field Container	Fraelich	GA	2008	Over the top	No injury or growth reduction at 0.5, 1 and 2 oz per 100 gal; all plants marketable
27364	Periwinkle ( <i>Vinca</i> sp.) 'Bowles'	Field Container	Grunwald	OR	2008	Foliar	No injury at 0.5, 1 and 2 oz per 100 gal
27364	Periwinkle ( <i>Vinca</i> sp.) <i>V. minor</i> 'Atropurpurea' and 'Bowles'	Field Container	Boydston	WA	2008	Foliar	No injury or growth reduction at 0.5, 1 and 2 oz per 100 gal
27364	Periwinkle ( <i>Vinca</i> sp.) <i>V. minor</i> 'Bowles'	Field Container	Fraelich	GA	2008	Foliar	No injury or growth reduction at 0.5, 1 and 2 oz per 100 gal; all plants marketable
27364	Periwinkle ( <i>Vinca</i> sp.) <i>V. minor</i> 'Ralph Shugert'	Field Container	Reding	OH	2008	Foliar	No injury and no significant difference in growth or marketability at 0.5, 1 and 2 oz per 100 gal
20285	Violet ( <i>Viola</i> sp.)	Greenhouse	Hausbeck	MI	2002	Foliar	No injury at 0.5, 1.0, and 2.0 oz per 100 gal.
20285	Violet ( <i>Viola</i> sp.) 'Clear Sky Blue'	Greenhouse	Locke	MD	2002	Foliar	No injury at 1, 2, and 4 oz per 100 gal, but flower colors were lighter on the two higher rates.
20285	Violet ( <i>Viola</i> sp.) <i>V. X wittrockiana</i> 'Accord Daffodil'	Greenhouse	Linderman	OR	2002	Foliar	No injury at 1, 2, and 4 oz per acre.
29491	Zinnia ( <i>Zinnia</i> sp.)	Field Container	Wade	SC	2011	Drench	No injury or growth reduction with 0.25, 0.50, 1.0 and 2.0 oz per 100 gal applied foliar 5 times or with 0.25 and 0.5 oz applied drench once; all plants marketable.
29491	Zinnia ( <i>Zinnia</i> sp.)	Field Container	Wade	SC	2011	Foliar	No injury or growth reduction with 0.25, 0.50, 1.0 and 2.0 oz per 100 gal applied foliar 5 times or with 0.25 and 0.5 oz applied drench once; all plants marketable.

PR#	Crop	Production Site	Researcher	State	Year	Application Type	Results
29491	Zinnia (Zinnia sp.) 'Uproar Rose'	Field Container	Kirk	MI	2011	Drench	No injury, leaf abscission or stunting with 0.25 and 0.5 oz per 100 gal.
29491	Zinnia (Zinnia sp.) 'Uproar Rose'	Field Container	Kirk	MI	2011	Foliar	No injury with 0.25, 0.5, 1 and 2 oz per 100 gal applied 5 times; increased leaf abscission w/ 1 and 2 oz, slight stunting w/ lowest rate..
29491	Zinnia (Zinnia sp.) Z. elegans 'Binary Mix'	Field Container	Grunwald	OR	2011	Drench	No injury with 0.125 and 0.25 oz per 100 gal.
29491	Zinnia (Zinnia sp.) Z. marylandica 'Sahara Fire'	Field Container	Hausbeck	MI	2011	Foliar or Drench	No injury or growth reduction with 0.25, 0.50, 0.75 and 2 oz per 100 gal applied foliar 5 times or with 0.125 and 0.25 oz per 100 gal applied drench once.

## Label Suggestions

In this report, 42 species or genera exhibited minimal or no injury after foliar and/or drench treatments of acibenzolar. Of these, 40 can be added to the EPA label:

<i>Acer</i> sp.	<i>Hydrangea</i> sp.
<i>Antirrhinum majus</i>	<i>Juniperus</i> sp.
<i>Aster</i> sp.	<i>Osteospermum</i> sp.
<i>Begonia</i> sp.	<i>Petunia</i> sp.
<i>Berberis</i> sp.	<i>Phlox</i> sp.
<i>Bougainvillea</i> sp.	<i>Pinus</i> sp.
<i>Buddleia davidii</i>	<i>Pseudotsuga menziesii</i>
<i>Calibrachoa</i> sp.	<i>Pyracantha</i> sp.
<i>Camellia</i> sp.	<i>Quercus</i> sp.
<i>Chrysanthemum</i> sp.	<i>Raphiolepis indica</i>
<i>Coleus</i> sp.	<i>Salvia officinalis</i>
<i>Coreopsis</i> sp.	<i>Rhododendron</i> sp. (azalea)
<i>Cotoneaster</i> sp.	<i>Rosa</i> sp.
<i>Echinacea</i> sp.	<i>Scindapsus aureus</i>
<i>Epipremnum pinnatum</i>	<i>Thuja</i> sp.
<i>Euonymus</i> sp.	<i>Verbena</i> sp.
<i>Helianthus</i> sp.	<i>Viburnum</i> sp.
<i>Hemerocallis</i> sp.	<i>Vinca</i> sp.
<i>Hibiscus</i> sp.	<i>Viola</i> sp.
<i>Hosta</i> sp.	<i>Zinnia</i> sp.

While there was sufficient evidence of minimal or no injury for *Dianthus* sp. and *Pelargonium x hortorum*, a single trial for each crop did elicit moderate to severe injury. Further investigation on cultivar or species differences may be warranted.

## Appendix 1: Contributing Researchers

Dr. Rick Boydston	USDA-ARS IAREC Rt 2 Box 2953-A Prosser, WA 99350
Dr. Nicholas Brazee	University of Massachusetts Plant Diagnostic Laboratory 101 University Drive, Suite A7 Amherst, MA 01002
Dr. Nora Catlin	Cornell Cooperative Extension Suite 100 423 Griffing Ave Riverhead, NY 11901
Mr. Joe DeFrancesco	Oregon State University 2040 Cordley Hall Corvallis, OR 97331
Mr. Ben Fraelich	USDA-ARS CPES P.O. Box 748 Tifton, GA 31793
Mr. Tom Freiburger	Rutgers University Cream Ridge Experiment Station 283 Rt. 539 Cream Ridge, NJ 08514
Dr. Nik Grunwald	Horticultural Crops Research Lab USDA-ARS 3420 NW Orchard Ave. Corvallis, OR 97330
Dr. MengMeng Gu	Texas AgriLife Extension Service Department of Horticultural Sciences 2134 TAMU College Station, TX 77843
Mr. Paul Harvey	USDA-ARS 5230 Konnawac Pass Road Wapato, WA, 98951

Dr. Mary Hausbeck	Michigan State University Dept. of Plant Pathology 140 Plant Pathology Building East Lansing, MI 48824
Dr. Alan Henn	Mississippi State University 32 Creelman Street Mississippi State, MS 39762
Ms. Erin Hitcher	Rutgers Agricultural Research & Extension Center 121 Northville Rd Bridgeton, NJ 08302
Dr. William Kirk	Michigan State University Dept. of Plant Pathology Room 35 - Plant Biology Bldg East Lansing, MI 48824
Dr. Marja Koivunen	California State University, Chico College of Agriculture 400 West First Street Chico, CA 95929
Dr. Charles Krause ( <i>retired</i> )	USDA-ARS Application Technology Research Unit Wooster, OH 44691
Dr. Bob Linderman ( <i>retired</i> )	Horticultural Crops Research Lab USDA-ARS 3420 NW Orchard Ave. Corvallis, OR 97330
Dr. Jim Locke ( <i>retired</i> )	USDA ARS ATRU Univ of Toledo, GPRG 2801 Bancroft Street - Mail Stop #604 Toledo, OH 43606
Dr. Dustin Meador	Center for Applied Horticultural Research 3742 Blue Bird Canyon Road Vista, CA 92084
Dr. Aaron Palmateer	University of Florida Tropical Research & Education Center 18905 SW 280 Street Homestead, FL 33031



Dr. Michael Reding

USDA-ARS  
Hort Insects Lab  
1680 Madison Ave.  
Wooster, OH, 44691

Mr. Buzz Uber

Crop Inspection Service  
31130 Hilltop Drive  
Valley Center, CA 92082

Mr. Paul Wade

USDA-ARS  
US Vegetable Laboratory  
2700 Savannah Highway  
Charleston, SC, 29414

Mr. David Williams

University of Illinois  
PLS. 1201 S. Dorner  
Urbana, IL 61801