



[Environment Horticulture Program Research Summaries](#)

IR-4 Environmental Horticulture Program Tolfenpyrad Crop Safety

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Abstract

Tolfenpyrad was first registered in the United States as Hachi-Hachi 15 EC on July 28, 2010 for the control of aphids, leafhoppers, scales, thrips, whiteflies, and early instar lepidopteran larvae on environmental horticulture crops grown in greenhouses. A new formulation Hachi-Hachi 15 SC was registered on March 30, 2015, then on June 11, 2018. An expansion of this label for outdoor uses is planned. The IR-4 Project completed 194 trials on 29 ornamental plant species from 2010 through 2016 examining phytotoxicity related to foliar applications of Hachi-Hachi 15EC or Hachi-Hachi SC. In this report, 11 species or genera exhibited no or minimal injury after foliar treatments of Hachi-Hachi 15EC (tolfenpyrad) at 21, 48 and 84 fl oz per 100 gal. Three of these crops are already in the current label as crops tested for tolerance: *Chrysanthemum/Dendranthemum sp.*, *Petunia sp.*, and *Tagetes sp.* The rest can be added to the label: (*Alyssum sp.*, *Angelonia sp.*, *Antirrhinum sp.*, *Begonia sp.*, *Dahlia sp.*, *Verbena sp.*, *Viola sp.* and *Zinnia sp.*). For Hachi-Hachi SC, 20 species or genera exhibited no or minimal injury; 5 of these crops are already in the current label as crops tested for tolerance. Fifteen crops can be listed on the label (*Angelonia sp.*, *Bacopa sp.*, *Begonia sp.*, *Calibrachoa sp.*, *Dracaena sp.*, *Dahlia sp.*, *Fuschia sp.*, *Hydrangea sp.*, *Lobularia maritima*, *Pelargonium x hortorum*, *Petunia sp.*, *Rosa sp.*, *Tagetes sp.*, *Verbena sp.* and *Viola sp.*).

Introduction

Tolfenpyrad was first registered in the United States as Hachi-Hachi 15 EC on July 28, 2010 for the control of aphids, leafhoppers, scales, thrips, whiteflies, and early instar lepidopteran larvae on environmental horticulture crops grown in greenhouses. A new formulation Hachi-Hachi 15 SC was registered on March 30, 2015, then revised on June 11, 2018. An expansion of this label for outdoor uses is planned. As part of a project to screen new thrips management tools for crop safety, the IR-4 Project completed 194 trials on 29 ornamental plant species from 2010 through 2016 examining phytotoxicity related to foliar applications of Hachi-Hachi 15EC or Hachi-Hachi SC.

Materials and Methods

Hachi-Hachi 15EC and Hachi-Hachi SC were tested applied as foliar treatment typically thrice (3 times) at approximately 14 days intervals. The application rates were 21, 42, and 84 fl oz per 100 gal, plus a water treated control. A minimum of ten 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 researcher used a 0 to 5 or a 1 to 10 scale instead. Phytotoxicity was rated weekly up to 6 weeks after initial application. For IR-4 testing, the following protocols were used: 10-004, 11-016, 12-002, 13-002, 14-003, 15-008, and 16-008. For more detailed materials and methods, including application rates for various products, please visit <https://www.ir4project.org/ehc/ehc-registration-support-research/env-hort-researcher-resources/#Protocols> to view and download these protocols.

Hachi-Hachi 15EC and Hachi-Hachi SC were supplied to researchers (See list of researchers in Appendix 1) by Nichino and SePro.

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, Hachi-Hachi 15EC exhibited no or minimal negative impact (Table 1) on 11 plant genera or species, and 20 plant genera or species exhibited no or minimal transitory injury with applications of Hachi-Hachi SC (Table 5). Only Impatiens and New Guinea Impatiens displayed significant injury with both products (Tables 2, 3, 6, and 7); these are already in current Hachi-Hachi SC label as crops listed under the instruction ‘**DO NOT APPLY HACHI-HACHI SC INSECTICIDE TO**’. There are seven species or genera for Hachi-Hachi EC where less than 3 trials were conducted so there is not enough information available at this time (Table 4). For Hachi-Hachi SC there are 4 species where there is not enough information available at this time (Table 8).

Please see Table 9 for a summary of the individual trial results.

Table 1. List of Hachi-Hachi 15EC treated crops with no or minimal transitory injury.

<i>Alyssum</i> sp.	<i>Petunia</i> sp. ^{1,2}
<i>Angelonia angustifolia</i>	<i>Tagetes</i> sp. ^{1,2}
<i>Antirrhinum majus</i>	<i>Verbena</i> sp. ²
<i>Begonia</i> sp.	<i>Viola</i> sp.
<i>Chrysanthemum/Dendranthemum</i> ¹	<i>Zinnia</i> sp.
<i>Dahlia</i> sp. ²	

¹Already registered

² There may be differential responses due to cultivar.

Table 2. List of Hachi-Hachi 15EC treated crops with no injury at 1X but significant injury at 2X or 4X.

Bacopa sp. (See Gilrein 2014; slight to moderate injury on foliage)
Gerbera sp.¹ (see Gilrein 2013, foliage fine, minor injury on flower petals)

¹Already registered

Table 3. List of Hachi-Hachi 15EC treated crops with significant injury at 1X.

Impatiens sp.^{1,2} *Impatiens* sp., *New Guinea Hybrids*^{1,2}

¹Already in current Hachi-Hachi SC label as a crop listed under the instruction ‘DO NOT APPLY HACHI-HACHI SC INSECTICIDE TO’.

² There may be differential responses due to cultivar.

Table 4. List of Hachi-Hachi 15EC treated crops where more information is needed.

<i>Dianthus</i> sp.	<i>Pelargonium x hortorum</i>
<i>Fuschia</i> sp.	<i>Tagetes erecta</i>
<i>Gardenia</i> sp.	<i>Tagetes patula</i>
<i>Lobularia</i> sp.	

Table 5. List of Hachi-Hachi SC treated crops with no or minimal transitory injury.

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

¹Already registered

Table 6. List of Hachi-Hachi SC treated crops with no injury at 1X but significant injury at 2X or 4X.

None

Table 7. List of Hachi-Hachi SC treated crops with significant injury at 1X.

Impatiens sp.¹

Impatiens sp, *New Guinea Hybrids*¹

¹Already in current Hachi-Hachi SC label as a crop listed under the instruction ‘**DO NOT APPLY HACHI-HACHI SC INSECTICIDE TO**’.

Table 8. List of Hachi-Hachi SC treated crops where more information is needed.

Coreopsis sp.

Dianthus sp.

Dendrobium densiflorum

Salvia officinalis^{1, 2}

¹Already in current Hachi-Hachi SC label as a crop listed under the instruction ‘**DO NOT APPLY HACHI-HACHI SC INSECTICIDE TO**’.

² There may be differential responses due to cultivar.

Table 9 Detailed Summary of Crop Safety Testing with Hachi-Hachi 15EC and Hachi-Hachi SC

Notes: Table entries are sorted by crop Latin name. Only those trials with research reports received by 3/1/2018 are listed below.

PR#	Product (Active Ingredients)	Crop	Production Site	Researcher	State	Year	Application Type	Results
31131	Hachi-Hachi EC (Tolfenpyrad)	Madwort (Alyssum sp.) 'Clear Crystal Purple'	Field Container	Freiberger	NJ	2013	Foliar	No phytotoxicity with 21, 42 and 84 fl oz per 100 gal applied 3 times.
31131	Hachi-Hachi EC (Tolfenpyrad)	Madwort (Alyssum sp.) 'Wonderland DP Purple'	Field Container	Wade	SC	2013	Foliar	No injury or growth reduction with 21, 42 and 84 fl oz per 100 gal applied 3 times; all plants marketable.
31131	Hachi-Hachi EC (Tolfenpyrad)	Madwort (Alyssum sp.) 'Wonderland Rose'	Field Container	Davis	MI	2011	Foliar	No injury or growth reduction with 21, 42 and 84 fl oz per 100 gal applied three times.
30184	Hachi-Hachi EC (Tolfenpyrad)	Narrowleaf Angelonia (Angelonia angustifolia) 'Angel Mist Pink'	Greenhouse	Chen	LA	2011	Foliar	No injury or significant difference in plant growth and quality with 21, 42 and 84 fl oz per 100 gal applied twice.
30184	Hachi-Hachi EC (Tolfenpyrad)	Narrowleaf Angelonia (Angelonia angustifolia) 'Serena Purple'	Greenhouse	Chen	LA	2011	Foliar	No injury or significant difference in plant growth and quality with 21, 42 and 84 fl oz per 100 gal applied twice.
30184	Hachi-Hachi EC (Tolfenpyrad)	Narrowleaf Angelonia (Angelonia angustifolia) 'Sundancer Pink'	Greenhouse	Freiberger	NJ	2013	Foliar	No injury or growth reduction with 21, 42 and 84 fl oz per 100 gal mixed with surfactant applied 3 times.
30349	Hachi-Hachi EC (Tolfenpyrad)	Garden Snapdragon (Antirrhinum majus)	Field Container	Reding	OH	2013	Foliar	No injury or growth reduction with 21, 42 and 84 fl oz per 100 gal applied 3 times with NIS; all plants marketable.
30349	Hachi-Hachi EC (Tolfenpyrad)	Garden Snapdragon (Antirrhinum majus) 'Chimes Rose'	Field Container	Davis	MI	2011	Foliar	No injury or growth reduction with 21, 42 and 84 fl oz per 100 gal applied three times.
30349	Hachi-Hachi EC (Tolfenpyrad)	Garden Snapdragon (Antirrhinum majus) 'Rosey Dragon'	Field Container	Freiberger	NJ	2012	Foliar	No injury or growth reduction with 21, 42 and 84 fl oz per 100 gal applied 3 times.
30349	Hachi-Hachi EC (Tolfenpyrad)	Garden Snapdragon (Antirrhinum majus) 'Speedy Sonnet White'	Field Container	DeFrancesco	OR	2013	Foliar	No injury or growth reduction with 21, 42 and 84 fl oz per 100 gal applied 3 times.
30667	Hachi-Hachi EC (Tolfenpyrad)	Water Hyssop (Bacopa sp.)	Greenhouse	Cloyd	KS	2013	Foliar	No injury with 21, 32 and 36 fl oz per 100 gal.
30667	Hachi-Hachi EC (Tolfenpyrad)	Water Hyssop (Bacopa sp.) 'Abunda Colossal Blue'	Greenhouse	Chen	LA	2013	Foliar	No significant injury or growth reduction with 21, 42 and 84 fl oz per 100 gal applied twice.
30667	Hachi-Hachi EC (Tolfenpyrad)	Water Hyssop (Bacopa sp.) 'Abunda Colossal White'	Greenhouse	Chen	LA	2013	Foliar	No injury or growth reduction with 21, 42 and 84 fl oz per 100 gal applied twice.
30667	Hachi-Hachi EC (Tolfenpyrad)	Water Hyssop (Bacopa sp.) Sutura cordata 'Snowstorm Pink'	Greenhouse	Gilrein	NY	2013	Foliar	No injury on foliage or flowers with 21 fl oz per 100 gal applied biweekly three times; slight and moderate injury to foliage with 42 and 84 fl oz, no injury to flowers.
30667	Hachi-Hachi EC (Tolfenpyrad)	Water Hyssop (Bacopa sp.) Sutura cordata 'Snowstorm White'	Greenhouse	Gilrein	NY	2013	Foliar	No injury on foliage or flowers with 21 fl oz per 100 gal applied biweekly three times; slight and moderate injury to foliage with 42 and 84 fl oz, no injury to flowers.

30354	Hachi-Hachi EC (Tolfenpyrad)	Begonia (Begonia sp.)	Field Container	Davis	MI	2010	Foliar	Moderate, but transitory injury at 21, 42, and 84 fl oz per 100 gal.
29327	Hachi-Hachi EC (Tolfenpyrad)	Begonia (Begonia sp.) B. x semperflorens-cultorum 'Cocktail Rum'	Greenhouse	Gilrein	NY	2011	Foliar	No injury or growth reduction with 21, 42 and 84 fl oz per 100 gal.
29327	Hachi-Hachi EC (Tolfenpyrad)	Begonia (Begonia sp.) B. x semperflorens-cultorum 'Eureka GL White'	Greenhouse	Gilrein	NY	2011	Foliar	No injury or growth reduction with 21, 42 and 84 fl oz per 100 gal.
29327	Hachi-Hachi EC (Tolfenpyrad)	Begonia (Begonia sp.) 'Bada Bing Pink'	Greenhouse	Freiberger	NJ	2011	Foliar	No injury or growth reduction with 21, 42 and 84 fl oz per 100 gal + surfactant applied 3 times.
29327	Hachi-Hachi EC (Tolfenpyrad)	Begonia (Begonia sp.) 'Non-stop Orange'	Greenhouse	Freiberger	NJ	2011	Foliar	No injury or growth reduction with 21, 42 and 84 fl oz per 100 gal + surfactant applied 3 times.
30354	Hachi-Hachi EC (Tolfenpyrad)	Begonia (Begonia sp.) 'Red'	Field Container	Davis	MI	2011	Foliar	No injury with 21, 42 and 84 fl oz per 100 gal applied three times; unacceptable stunting at 4X.
30538	Hachi-Hachi EC (Tolfenpyrad)	Chrysanthemum, Garden (Chrysanthemum/Dendranthema sp.) 'Outrageous Orange'	Greenhouse	Gilrein	NY	2012	Foliar	No injury on foliage or flowers at 21, 42, and 84 fl oz per 100 gal applied biweekly 3 times.
30538	Hachi-Hachi EC (Tolfenpyrad)	Chrysanthemum, Garden (Chrysanthemum/Dendranthema sp.) 'Sly Jenna'	Greenhouse	Chen	LA	2010	Foliar	No injury or growth reduction with 21, 42 and 84 fl oz per 100 gal applied twice.
30538	Hachi-Hachi EC (Tolfenpyrad)	Chrysanthemum, Garden (Chrysanthemum/Dendranthema sp.) 'Sparkle White'	Greenhouse	Gilrein	NY	2012	Foliar	No injury on foliage or flowers at 21, 42, and 84 fl oz per 100 gal applied biweekly 3 times.
30538	Hachi-Hachi EC (Tolfenpyrad)	Chrysanthemum, Garden (Chrysanthemum/Dendranthema sp.) Tanacetum x grandiflorum	Greenhouse	Cloyd	KS	2012	Foliar	No injury with 21, 32 and 36 fl oz per 100 gal.
30370	Hachi-Hachi EC (Tolfenpyrad)	Dahlia (Dahlia sp.) 'Dahlietta Leanne'	Field Container	Chen	LA	2013	Foliar	No significant injury with 21, moderate with good recovery by 35 DAT with 42 and 84 fl oz per 100 gal applied twice; no growth reduction.
30370	Hachi-Hachi EC (Tolfenpyrad)	Dahlia (Dahlia sp.) 'Dahlietta Marissa'	Field Container	Chen	LA	2013	Foliar	No significant injury with 21, 42 and 84 fl oz per 100 gal applied twice; no growth reduction.
30370	Hachi-Hachi EC (Tolfenpyrad)	Dahlia (Dahlia sp.) 'Figaro Mix'	Field Container	Davis	MI	2011	Foliar	No injury or growth reduction with 21, 42 and 84 fl oz per 100 gal applied three times.
30370	Hachi-Hachi EC (Tolfenpyrad)	Dahlia (Dahlia sp.) 'Figaro Mix'	Field Container	Freiberger	NJ	2013	Foliar	No phytotoxicity with 21, 42 and 84 fl oz per 100 gal applied 3 times.
30598	Hachi-Hachi EC (Tolfenpyrad)	Pink (Dianthus sp.) 'Floral Lace Crimson'	Greenhouse	Freiberger	NJ	2013	Foliar	Slight injury increasing with rates (21, 42 and 84 fl oz per 100 gal) mixed with surfactant applied 3 times; some recovery at 1X and 2X; no growth reduction.
29328	Hachi-Hachi EC (Tolfenpyrad)	Fuschia; Ladies-Eardrops (Fuschia sp.) Fuschia x hybrida	Greenhouse	Cloyd	KS	2012	Foliar	No injury with 21 and 32 fl oz per 100 gal.
30599	Hachi-Hachi EC (Tolfenpyrad)	Gardenia (Gardenia sp.) G. augusta	Greenhouse	Uber	CA	2013	Foliar	No injury or growth reduction with 21, 42 and 84 fl oz per 100 gal + Capsil applied 3 times.

29329	Hachi-Hachi EC (Tolfenpyrad)	Transvaal Daisy (Gerbera sp.) 'Festival Lt. Eye Orange'	Greenhouse	Edmunds	CO	2010	Spray-to-wet	Minor flower injury (slight yellowing) at 21, 42 and 84 fl oz per 100 gal after 3rd application; application residue at higher rates.
29329	Hachi-Hachi EC (Tolfenpyrad)	Transvaal Daisy (Gerbera sp.) G. jamisonii	Greenhouse	Cloyd	KS	2013	Foliar	No injury with 21, 32 and 36 fl oz per 100 gal.
29329	Hachi-Hachi EC (Tolfenpyrad)	Transvaal Daisy (Gerbera sp.) 'Jaguar Pink'	Greenhouse	Gilrein	NY	2012	Foliar	No injury on foliage but no to minor injury to flower petals increasing with rate (21, 42, 84 fl oz per 100 gal) applied biweekly three times.
29329	Hachi-Hachi EC (Tolfenpyrad)	Transvaal Daisy (Gerbera sp.) 'Royal Red'	Greenhouse	Gilrein	NY	2012	Foliar	No injury on foliage but no to minor injury to flower petals increasing with rate (21, 42, 84 fl oz per 100 gal) applied biweekly three times.
29331	Hachi-Hachi EC (Tolfenpyrad)	Impatiens, New Guinea (Impatiens hawkeri) 'Dazzler Violet'	Greenhouse	Chen	LA	2010	Foliar	No injury or growth reduction with 8,16 and 32 oz per 100 gal applied twice.
30356	Hachi-Hachi EC (Tolfenpyrad)	Impatiens, New Guinea (Impatiens hawkeri) I. walleriana 'Stardust Red'	Field Container	Davis	MI	2011	Foliar	Severe injury and growth reduction with 21, 42 and 84 fl oz per 100 gal applied three times.
29331	Hachi-Hachi EC (Tolfenpyrad)	Impatiens, New Guinea (Impatiens hawkeri) 'Paradise Blush White'	Greenhouse	Freiberger	NJ	2011	Foliar	No injury after 1st applic. with 21, 42 and 84 fl oz per 100 gal + surfactant; slight to high injury, increasing with rates after 2nd applic; significant growth reduction with all rates.
29331	Hachi-Hachi EC (Tolfenpyrad)	Impatiens, New Guinea (Impatiens hawkeri) 'Paradise Rose Flare'	Greenhouse	Freiberger	NJ	2011	Foliar	No injury after 1st applic. with 21, 42 and 84 fl oz per 100 gal + surfactant, severe injury after 2nd applic; significant growth reduction with all rates.
29331	Hachi-Hachi EC (Tolfenpyrad)	Impatiens, New Guinea (Impatiens hawkeri) 'Patchwork Salmon'	Greenhouse	Chen	LA	2011	Foliar	Severe injury with 21, 42 and 84 fl oz per 100 gal applied twice.
29331	Hachi-Hachi EC (Tolfenpyrad)	Impatiens, New Guinea (Impatiens hawkeri) 'Sonic Lilac'	Greenhouse	Chen	LA	2011	Foliar	Severe injury with 21, 42 and 84 fl oz per 100 gal applied twice.
29331	Hachi-Hachi EC (Tolfenpyrad)	Impatiens, New Guinea (Impatiens hawkeri) 'Super Elfin Red'	Greenhouse	Chen	LA	2010	Foliar	Severe injury with 21, 42 and 84 fl oz per 100 gal applied twice.
29330	Hachi-Hachi EC (Tolfenpyrad)	Impatiens; Touch-me-not (Impatiens sp.) 'Double Camelia Mix'	Greenhouse	Freiberger	NJ	2011	Foliar	Severe injury at 4X (84 fl oz per 100 gal + surfactant) applied 3 times; not enough plants to test 1X and 2X.
29330	Hachi-Hachi EC (Tolfenpyrad)	Impatiens; Touch-me-not (Impatiens sp.) 'Extra Dwarf Tom Thumb'	Greenhouse	Freiberger	NJ	2011	Foliar	Severe injury with 21, 42 and 84 fl oz per 100 gal + surfactant applied 3 times.
30380	Hachi-Hachi EC (Tolfenpyrad)	Impatiens; Touch-me-not (Impatiens sp.) I. walleriana 'Dazzler Pink'	Field Container	Davis	MI	2010	Foliar	Significant injury at 21, 42, and 84 fl oz per 100 gal.
30380	Hachi-Hachi EC (Tolfenpyrad)	Impatiens; Touch-me-not (Impatiens sp.) 'Super Elfin Lavender'	Field Container	Wade	SC	2012	Foliar	Slight to high injury (stunting, delayed blooming) increasing with rates (21, 42 and 84 fl oz per 100 gal) applied with surfactant 3 times.
30380	Hachi-Hachi EC (Tolfenpyrad)	Impatiens; Touch-me-not (Impatiens sp.) 'Super Elfin XP Pink'	Field Container	Wade	SC	2012	Foliar	Slight to high injury (stunting, delayed blooming) increasing with rates (21, 42 and 84 fl oz per 100 gal) applied with surfactant 3 times.
31596	Hachi-Hachi EC (Tolfenpyrad)	Sweet Alyssum (Lobularia maritima) 'Clear Crystal White'	Field Container	DeFrancesco	OR	2013	Foliar	No injury with 21 and 42, moderate with 84, fl oz per 100 gal applied 3 times; moderate growth reduction.

30372	Hachi-Hachi EC (Tolfenpyrad)	Geranium, Zonal (Pelargonium x hortorum) 'Cranesbill'	Field Container	Uber	CA	2013	Foliar	Unacceptable injury to flowers, no growth reduction with 21, 42 and 84 fl oz per 100 gal + Capsil applied 3 times.
30372	Hachi-Hachi EC (Tolfenpyrad)	Geranium, Zonal (Pelargonium x hortorum) 'Orbit Pink Seed'	Field Container	Davis	MI	2011	Foliar	No injury with 21 and 42, slight with 84 fl oz per 100 gal, applied three times; no growth reduction.
30358	Hachi-Hachi EC (Tolfenpyrad)	Petunia (Petunia sp.) 'Dreams White'	Field Container	Davis	MI	2011	Foliar	No injury or growth reduction with 21, 42 and 84 fl oz per 100 gal applied three times.
29332	Hachi-Hachi EC (Tolfenpyrad)	Petunia (Petunia sp.) 'Easy Wave Rose'	Greenhouse	Chen	LA	2010	Foliar	Minor to moderate injury with complete recovery, no growth reduction with 21, 42 and 84 fl oz per 100 gal applied twice.
30358	Hachi-Hachi EC (Tolfenpyrad)	Petunia (Petunia sp.) P. x hybrida 'Prism Sunshine'	Field Container	Davis	MI	2010	Foliar	No significant injury at 21, 42, and 84 fl oz per 100 gal.
30358	Hachi-Hachi EC (Tolfenpyrad)	Petunia (Petunia sp.) 'SGL Dreams Red'	Field Container	Wade	SC	2012	Foliar	No injury or growth reduction with 21, 42 and 84 fl oz per 100 gal applied with surfactant 3 times; all plants marketable.
30358	Hachi-Hachi EC (Tolfenpyrad)	Petunia (Petunia sp.) 'SGL Dreams White'	Field Container	Wade	SC	2012	Foliar	No injury or growth reduction with 21, 42 and 84 fl oz per 100 gal applied with surfactant 3 times; all plants marketable.
29332	Hachi-Hachi EC (Tolfenpyrad)	Petunia (Petunia sp.) 'Shockwave Coconut'	Greenhouse	Freiberger	NJ	2011	Foliar	No injury or growth reduction with 21, 42 and 84 fl oz per 100 gal + surfactant applied 3 times.
29332	Hachi-Hachi EC (Tolfenpyrad)	Petunia (Petunia sp.) 'Wave Lavender'	Greenhouse	Freiberger	NJ	2011	Foliar	No injury or growth reduction with 21, 42 and 84 fl oz per 100 gal + surfactant applied 3 times.
30378	Hachi-Hachi EC (Tolfenpyrad)	Marigold (Tagetes sp.) 'Antigua Orange'	Field Container	Wade	SC	2012	Foliar	No injury or growth reduction with 21, 42 and 84 fl oz per 100 gal applied with surfactant 3 times; all plants marketable.
30378	Hachi-Hachi EC (Tolfenpyrad)	Marigold (Tagetes sp.) 'Antigua Yellow'	Field Container	Wade	SC	2012	Foliar	No injury or growth reduction with 21, 42 and 84 fl oz per 100 gal applied with surfactant 3 times; all plants marketable.
29333	Hachi-Hachi EC (Tolfenpyrad)	Marigold (Tagetes sp.) 'Marvel Orange'	Greenhouse	Freiberger	NJ	2011	Foliar	No injury or growth reduction with 21, 42 and 84 fl oz per 100 gal + surfactant applied 3 times.
29333	Hachi-Hachi EC (Tolfenpyrad)	Marigold (Tagetes sp.) 'Safari Yellow'	Greenhouse	Freiberger	NJ	2011	Foliar	No injury or growth reduction with 21, 42 and 84 fl oz per 100 gal + surfactant applied 3 times.
30378	Hachi-Hachi EC (Tolfenpyrad)	Marigold (Tagetes sp.) T. erecta 'Inca Orange'	Field Container	Davis	MI	2010	Foliar	Moderate, but transitory injury at 21, 42, and 84 fl oz per 100 gal.
30378	Hachi-Hachi EC (Tolfenpyrad)	Marigold (Tagetes sp.) T. patula 'Bonanza Yellow'	Field Container	Davis	MI	2011	Foliar	No injury or growth reduction with 21, 42 and 84 fl oz per 100 gal applied three times.
29333	Hachi-Hachi EC (Tolfenpyrad)	Marigold (Tagetes sp.) 'Taishan Orange'	Greenhouse	Chen	LA	2010	Foliar	No injury or growth reduction with 21, 42 and 84 fl oz per 100 gal applied twice.
29333	Hachi-Hachi EC (Tolfenpyrad)	Marigold (Tagetes sp.) 'Taishan Yellow'	Greenhouse	Chen	LA	2010	Foliar	No injury or growth reduction with 21, 42 and 84 fl oz per 100 gal applied twice.
29334	Hachi-Hachi EC (Tolfenpyrad)	Vervain (Verbena sp.) 'Homestead Purple'	Greenhouse	Chen	LA	2010	Foliar	No injury with 21, 42 and 84 fl oz per 100 gal applied twice.

30360	Hachi-Hachi EC (Tolfenpyrad)	Vervain (Verbena sp.) 'Obsession Pink'	Field Container	Wade	SC	2012	Foliar	No injury or growth reduction with 21, 42 and 84 fl oz per 100 gal applied with surfactant 3 times; all plants marketable.
29334	Hachi-Hachi EC (Tolfenpyrad)	Vervain (Verbena sp.) 'Quartz x O Scarlet'	Greenhouse	Edmunds	CO	2010	Spray-to-wet	No injury at 21, 42 and 84 fl oz per 100 gal; application residue at higher rates.
30360	Hachi-Hachi EC (Tolfenpyrad)	Vervain (Verbena sp.) 'Quartz XP Purple'	Field Container	Wade	SC	2012	Foliar	No injury or growth reduction with 21, 42 and 84 fl oz per 100 gal applied with surfactant 3 times; all plants marketable.
29334	Hachi-Hachi EC (Tolfenpyrad)	Vervain (Verbena sp.) 'Serenity Pink'	Greenhouse	Chen	LA	2010	Foliar	No injury with 21, 42 and 84 fl oz per 100 gal applied twice; height reduction at 4X.
29334	Hachi-Hachi EC (Tolfenpyrad)	Vervain (Verbena sp.) V. hybrida 'Obsession Blue with Eye'	Greenhouse	Gilrein	NY	2011	Foliar	Very slight injury with complete recovery, no growth reduction with 21, 42 and 84 fl oz per 100 gal.
29334	Hachi-Hachi EC (Tolfenpyrad)	Vervain (Verbena sp.) V. hybrida 'Quartz White'	Greenhouse	Gilrein	NY	2011	Foliar	Very slight injury with complete recovery, no growth reduction with 21, 42 and 84 fl oz per 100 gal.
29335	Hachi-Hachi EC (Tolfenpyrad)	Violet (Viola sp.) 'Delta Pure Orange'	Greenhouse	Freiberger	NJ	2011	Foliar	No injury or growth reduction with 21, 42 and 84 fl oz per 100 gal + surfactant applied 3 times.
29335	Hachi-Hachi EC (Tolfenpyrad)	Violet (Viola sp.) 'Delta Pure Rose'	Greenhouse	Freiberger	NJ	2011	Foliar	No injury or growth reduction with 21, 42 and 84 fl oz per 100 gal + surfactant applied 3 times.
29335	Hachi-Hachi EC (Tolfenpyrad)	Violet (Viola sp.) 'Dynamite Scarlet'	Greenhouse	Chen	LA	2010	Foliar	No injury or growth reduction with 21 fl oz per 100 gal applied twice, moderate injury with 42 and 84 fl oz.
29336	Hachi-Hachi EC (Tolfenpyrad)	Zinnia (Zinnia sp.) 'Dreamland Red'	Greenhouse	Freiberger	NJ	2011	Foliar	No injury or growth reduction with 21, 42 and 84 fl oz per 100 gal + surfactant applied 3 times.
29336	Hachi-Hachi EC (Tolfenpyrad)	Zinnia (Zinnia sp.) 'Magellan Coral'	Greenhouse	Edmunds	CO	2010	Spray-to-wet	No injury at 21, 42 and 84 fl oz per 100 gal; application residue at higher rates.
29336	Hachi-Hachi EC (Tolfenpyrad)	Zinnia (Zinnia sp.) 'Profusion Knee-high Yellow'	Greenhouse	Chen	LA	2011	Foliar	No injury or growth reduction with 21,42 and 84 fl oz per 100 gal) applied twice.
29336	Hachi-Hachi EC (Tolfenpyrad)	Zinnia (Zinnia sp.) 'Profusion Orange'	Greenhouse	Freiberger	NJ	2011	Foliar	No injury or growth reduction with 21, 42 and 84 fl oz per 100 gal + surfactant applied 3 times.
29336	Hachi-Hachi EC (Tolfenpyrad)	Zinnia (Zinnia sp.) Z. elegans 'Profusion Fire'	Greenhouse	Gilrein	NY	2011	Foliar	No injury or growth reduction with 21 and 42, slight injury (light necrotic leaf spotting) with complete recovery at 84 fl oz per 100 gal.
29336	Hachi-Hachi EC (Tolfenpyrad)	Zinnia (Zinnia sp.) Z. elegans 'Starlight Rose'	Greenhouse	Gilrein	NY	2011	Foliar	Minor injury (light necrotic leaf spotting) with complete recovery at 21, 42 and 84 fl oz per 100 gal; no growth reduction.
29336	Hachi-Hachi EC (Tolfenpyrad)	Zinnia (Zinnia sp.) 'Zahra White'	Greenhouse	Chen	LA	2011	Foliar	No injury or growth reduction with 21,42 and 84 fl oz per 100 gal) applied twice.
31132	Hachi-Hachi SC (Tolfenpyrad)	Madwort (Alyssum sp.)	Field Container	Uber	CA	2013	Foliar	No injury or growth reduction with 21, 42 and 84 fl oz per 100 gal + Capsil applied 3 times.
31132	Hachi-Hachi SC (Tolfenpyrad)	Madwort (Alyssum sp.) 'Clear Crystal Purple'	Field Container	Freiberger	NJ	2013	Foliar	No phytotoxicity with 21, 42 and 84 fl oz per 100 gal applied 3 times.

31132	Hachi-Hachi SC (Tolfenpyrad)	Madwort (Alyssum sp.) 'Wonderland Pink'	Field Container	Wade	SC	2013	Foliar	No injury or growth reduction with 21, 42 and 84 fl oz per 100 gal applied 3 times; all plants marketable.
31132	Hachi-Hachi SC (Tolfenpyrad)	Madwort (Alyssum sp.) 'Wonderland Rose'	Field Container	Davis	MI	2011	Foliar	No injury or growth reduction with 21, 42 and 84 fl oz per 100 gal applied three times.
30185	Hachi-Hachi SC (Tolfenpyrad)	Narrowleaf Angelonia (Angelonia angustifolia) 'Adessa Pink'	Greenhouse	Freiberger	NJ	2013	Foliar	No injury or growth reduction with 21, 42 and 84 fl oz per 100 gal mixed with surfactant applied 3 times.
30185	Hachi-Hachi SC (Tolfenpyrad)	Narrowleaf Angelonia (Angelonia angustifolia) 'Angel Mist Pink'	Greenhouse	Chen	LA	2011	Foliar	No injury or significant difference in plant growth and quality with 21, 42 and 84 fl oz per 100 gal applied twice.
30185	Hachi-Hachi SC (Tolfenpyrad)	Narrowleaf Angelonia (Angelonia angustifolia) 'Serena Purple'	Greenhouse	Chen	LA	2011	Foliar	No injury or significant difference in plant growth and quality with 21, 42 and 84 fl oz per 100 gal applied twice.
30350	Hachi-Hachi SC (Tolfenpyrad)	Garden Snapdragon (Antirrhinum majus)	Field Container	Reding	OH	2013	Foliar	No injury or growth reduction with 21, 42 and 84 fl oz per 100 gal applied 3 times with NIS; all plants marketable.
30350	Hachi-Hachi SC (Tolfenpyrad)	Garden Snapdragon (Antirrhinum majus) 'Chimes Rose'	Field Container	Davis	MI	2011	Foliar	No injury or growth reduction with 21, 42 and 84 fl oz per 100 gal applied three times.
30350	Hachi-Hachi SC (Tolfenpyrad)	Garden Snapdragon (Antirrhinum majus) 'Rosey Dragon'	Field Container	Freiberger	NJ	2012	Foliar	No injury or growth reduction with 21, 42 and 84 fl oz per 100 gal applied 3 times.
30350	Hachi-Hachi SC (Tolfenpyrad)	Garden Snapdragon (Antirrhinum majus) 'Speedy Sonnet White'	Field Container	DeFrancesco	OR	2013	Foliar	No injury or growth reduction with 21, 42 and 84 fl oz per 100 gal applied 3 times.
30669	Hachi-Hachi SC (Tolfenpyrad)	Water Hyssop (Bacopa sp.) 'Blutopia Blue'	Greenhouse	Freiberger	NJ	2014	Foliar	No injury or growth reduction with 21, 42 and 84 fl oz per 100 gal + NIS applied 3 times.
30669	Hachi-Hachi SC (Tolfenpyrad)	Water Hyssop (Bacopa sp.) Sutura cordata 'Snowstorm Pink'	Greenhouse	Gilrein	NY	2013	Foliar	No injury on foliage or flowers with 21, 42, and 84 fl oz per 100 gal applied biweekly three times.
30669	Hachi-Hachi SC (Tolfenpyrad)	Water Hyssop (Bacopa sp.) Sutura cordata 'Snowstorm White'	Greenhouse	Gilrein	NY	2013	Foliar	No injury on foliage or flowers with 21, 42, and 84 fl oz per 100 gal applied biweekly three times.
30355	Hachi-Hachi SC (Tolfenpyrad)	Begonia (Begonia sp.)	Field Container	Davis	MI	2010	Foliar	Slight, but transitory injury at 21, 42, and 84 fl oz per 100 gal.
29337	Hachi-Hachi SC (Tolfenpyrad)	Begonia (Begonia sp.) B. x semperflorens-cultorum 'Cocktail Rum'	Greenhouse	Gilrein	NY	2011	Foliar	No injury or growth reduction with 21, 42 and 84 fl oz per 100 gal.
29337	Hachi-Hachi SC (Tolfenpyrad)	Begonia (Begonia sp.) B. x semperflorens-cultorum 'Eureka GL White'	Greenhouse	Gilrein	NY	2011	Foliar	No injury or growth reduction with 21, 42 and 84 fl oz per 100 gal.
29337	Hachi-Hachi SC (Tolfenpyrad)	Begonia (Begonia sp.) 'Bada Bing Pink'	Greenhouse	Freiberger	NJ	2011	Foliar	No injury or growth reduction with 21, 42 and 84 fl oz per 100 gal + surfactant applied 3 times.
29337	Hachi-Hachi SC (Tolfenpyrad)	Begonia (Begonia sp.) 'Non-stop Orange'	Greenhouse	Freiberger	NJ	2011	Foliar	No injury or growth reduction with 21, 42 and 84 fl oz per 100 gal + surfactant applied 3 times.
30355	Hachi-Hachi SC (Tolfenpyrad)	Begonia (Begonia sp.) 'Red'	Field Container	Davis	MI	2011	Foliar	No injury or growth reduction with 21, 42 and 84 fl oz per 100 gal applied three times.
31697	Hachi-Hachi SC (Tolfenpyrad)	Calibrachoa (Calibrachoa sp.)	Greenhouse	Cloyd	KS	2014	Foliar	

31697	Hachi-Hachi SC (Tolfenpyrad)	Calibrachoa (Calibrachoa sp.) 'Kabloom White'	Greenhouse	Freiberger	NJ	2014	Foliar	No injury or growth reduction with 21, 42 and 84 fl oz per 100 gal applied 3 times.
31697	Hachi-Hachi SC (Tolfenpyrad)	Calibrachoa (Calibrachoa sp.) 'MiniFamous TM Compact Blue'	Greenhouse	DeFrancesco	OR	2015	Foliar	No injury or growth reduction with 21, 42 and 84 fl oz per 100 gal applied biweekly.
31697	Hachi-Hachi SC (Tolfenpyrad)	Calibrachoa (Calibrachoa sp.) 'Petcoa Supercal Neon Rose'	Greenhouse	Vafaie	TX	2015	Foliar	No injury or growth reduction with 21, 42 and 84 fl oz per 100 gal + Preference applied 3 times biweekly.
31697	Hachi-Hachi SC (Tolfenpyrad)	Calibrachoa (Calibrachoa sp.) 'Superbells Lemon Slice'	Greenhouse	Vafaie	TX	2015	Foliar	No injury or growth reduction with 21, 42 and 84 fl oz per 100 gal + Preference applied 3 times biweekly.
30539	Hachi-Hachi SC (Tolfenpyrad)	Chrysanthemum, Garden (Chrysanthemum/Dendranthema sp.) 'Jamestown'	Greenhouse	Uber	OR	2015	Foliar	No injury or growth reduction with 21, 42 and 84 fl oz per 100 gal + Capsil applied 3 times.
30539	Hachi-Hachi SC (Tolfenpyrad)	Chrysanthemum, Garden (Chrysanthemum/Dendranthema sp.) 'Outrageous Orange'	Greenhouse	Gilrein	NY	2012	Foliar	No injury on foliage or flowers at 21, 42, and 84 fl oz per 100 gal applied biweekly 3 times.
30539	Hachi-Hachi SC (Tolfenpyrad)	Chrysanthemum, Garden (Chrysanthemum/Dendranthema sp.) 'Sly Jenna'	Greenhouse	Chen	LA	2010	Foliar	No injury or growth reduction with 21, 42 and 84 fl oz per 100 gal applied twice.
30539	Hachi-Hachi SC (Tolfenpyrad)	Chrysanthemum, Garden (Chrysanthemum/Dendranthema sp.) 'Sparkle White'	Greenhouse	Gilrein	NY	2012	Foliar	No injury on foliage or flowers at 21, 42, and 84 fl oz per 100 gal applied biweekly 3 times.
31699	Hachi-Hachi SC (Tolfenpyrad)	Tickseed (Coreopsis sp.) 'Early Sunrise Yellow'	Greenhouse	Freiberger	NJ	2014	Foliar	No injury or growth reduction with 21, 42 and 84 fl oz per 100 gal applied 3 times.
30371	Hachi-Hachi SC (Tolfenpyrad)	Dahlia (Dahlia sp.) 'Dahlietta Leanne'	Field Container	Chen	LA	2013	Foliar	No significant injury with 21, 42 and 84 fl oz per 100 gal applied twice; no growth reduction.
30371	Hachi-Hachi SC (Tolfenpyrad)	Dahlia (Dahlia sp.) 'Dahlietta Marissa'	Field Container	Chen	LA	2013	Foliar	No significant injury with 21, 42 and 84 fl oz per 100 gal applied twice; no growth reduction.
30371	Hachi-Hachi SC (Tolfenpyrad)	Dahlia (Dahlia sp.) 'Figaro Mix'	Field Container	Davis	MI	2011	Foliar	No injury or growth reduction with 21, 42 and 84 fl oz per 100 gal applied three times.
30371	Hachi-Hachi SC (Tolfenpyrad)	Dahlia (Dahlia sp.) 'Figaro Mix'	Field Container	Freiberger	NJ	2013	Foliar	No phytotoxicity with 21, 42 and 84 fl oz per 100 gal applied 3 times.
31181	Hachi-Hachi SC (Tolfenpyrad)	Pineapple Orchid (Dendrobium densiflorum) Yukidian Purple	Greenhouse	Gilrein	NY	2016	Foliar	No injury or growth reduction with 21, 42 and 84 fl oz per 100 gal.
31181	Hachi-Hachi SC (Tolfenpyrad)	Pineapple Orchid (Dendrobium densiflorum) Yukidian White	Greenhouse	Gilrein	NY	2016	Foliar	No injury or growth reduction with 21, 42 and 84 fl oz per 100 gal.
30601	Hachi-Hachi SC (Tolfenpyrad)	Pink (Dianthus sp.) D. chinensis 'First Love'	Greenhouse	DeFrancesco	OR	2014	Foliar	No injury or growth reduction with 21, 42 and 84 fl oz per acre + NIS.
30601	Hachi-Hachi SC (Tolfenpyrad)	Pink (Dianthus sp.) 'Floral Lace Crimson'	Greenhouse	Freiberger	NJ	2013	Foliar	Very slight initial injury with complete recovery with 21, 42 and 84 fl oz per 100 gal mixed with surfactant applied 3 times; no growth reduction.
31704	Hachi-Hachi SC (Tolfenpyrad)	Dracaena (Dracaena sp.) Cordylene australis	Greenhouse	Gilrein	NY	2015	Foliar	No injury or reduction in plant growth or quality with 21, 42 and 84 fl oz per 100 gal applied 3 times.

31704	Hachi-Hachi SC (Tolfenpyrad)	Dracaena (Dracaena sp.) D marginata	Greenhouse	Uber	CA	2014	Foliar	No injury or growth reduction with 21, 42 and 84 fl oz per 100 gal + Capsil applied 3 times.
31704	Hachi-Hachi SC (Tolfenpyrad)	Dracaena (Dracaena sp.) D. indivisa	Greenhouse	Gilrein	NY	2014	Foliar	No injury on leaves and flowers, and no growth reduction with 21, 42 and 84 fl oz per 100 gal applied 3 times.
31704	Hachi-Hachi SC (Tolfenpyrad)	Dracaena (Dracaena sp.) 'Spikes'	Greenhouse	Freiberger	NJ	2014	Foliar	No injury or growth reduction with 21, 42 and 84 fl oz per 100 gal applied 3 times.
29338	Hachi-Hachi SC (Tolfenpyrad)	Fuschia; Ladies-Eardrops (Fuschia sp.)	Greenhouse	Cloyd	KS	2014	Foliar	
29338	Hachi-Hachi SC (Tolfenpyrad)	Fuschia; Ladies-Eardrops (Fuschia sp.) 'Dollar Princess'	Greenhouse	Freiberger	NJ	2015	Foliar	No injury or growth reduction with 21, 42 and 84 fl oz per 100 gal applied 3 times; spray residue observed on leaves at 4X.
29338	Hachi-Hachi SC (Tolfenpyrad)	Fuschia; Ladies-Eardrops (Fuschia sp.) F. magellanica 'Galadier'	Greenhouse	DeFrancesco	OR	2014	Foliar	No injury or significant growth reduction with 21, 42 and 84 fl oz per acre + NIS.
29338	Hachi-Hachi SC (Tolfenpyrad)	Fuschia; Ladies-Eardrops (Fuschia sp.) F. magellanica 'Lena'	Greenhouse	Gilrein	NY	2014	Foliar	No injury on leaves and flowers, and no growth reduction with 21, 42 and 84 fl oz per 100 gal applied 3 times.
29338	Hachi-Hachi SC (Tolfenpyrad)	Fuschia; Ladies-Eardrops (Fuschia sp.) F. magellanica 'Swingtime'	Greenhouse	Gilrein	NY	2014	Foliar	Slight injury to leaves with 21 and 42, moderate with 84 fl oz per 100 gal applied 3 times; no injury to flowers, and no growth reduction.
30602	Hachi-Hachi SC (Tolfenpyrad)	Gardenia (Gardenia sp.) G. augusta	Greenhouse	Uber	CA	2013	Foliar	No injury or growth reduction with 21, 42 and 84 fl oz per 100 gal + Capsil applied 3 times.
29339	Hachi-Hachi SC (Tolfenpyrad)	Transvaal Daisy (Gerbera sp.) 'Jaguar Pink'	Greenhouse	Gilrein	NY	2012	Foliar	No injury on foliage or flowers with 21, 42, and 84 fl oz per 100 gal applied biweekly three times.
29339	Hachi-Hachi SC (Tolfenpyrad)	Transvaal Daisy (Gerbera sp.) 'Mega Orange'	Greenhouse	Uber	CA	2015	Foliar	No injury or growth reduction with 21, 42 and 84 fl oz per 100 gal + Capsil applied 3 times biweekly.
29339	Hachi-Hachi SC (Tolfenpyrad)	Transvaal Daisy (Gerbera sp.) 'Royal Red'	Greenhouse	Gilrein	NY	2012	Foliar	No injury on foliage or flowers with 21, 42, and 84 fl oz per 100 gal applied biweekly three times.
31700	Hachi-Hachi SC (Tolfenpyrad)	Rosemallow (Hibiscus sp.) 'Mahogany Splendor'	Greenhouse	Freiberger	NJ	2015	Foliar	No injury or growth reduction with 30 fl oz per 100 gal applied 3 times.
31701	Hachi-Hachi SC (Tolfenpyrad)	Hydrangea (Hydrangea sp.)	Greenhouse	Cloyd	KS	2014	Foliar	
32546	Hachi-Hachi SC (Tolfenpyrad)	Hydrangea (Hydrangea sp.) H. macrophylla	Field Container	Uber	CA	2016	Foliar	No injury or growth reduction with 21, 42 and 84 fl oz per 100 gal + Capsil applied 3 times.
32546	Hachi-Hachi SC (Tolfenpyrad)	Hydrangea (Hydrangea sp.) H. macrophylla 'Nikko Blue'	Field Container	Fraelich	GA	2016	Foliar	No injury or difference in plant growth and marketability with 21, 42 and 84 fl oz per 100 gal applied 3 times.
32546	Hachi-Hachi SC (Tolfenpyrad)	Hydrangea (Hydrangea sp.) H. macrophylla 'Nikko Blue'	Field Container	Gilrein	NY	2014	Foliar	Slight injury on leaves and flowers with 21 and 42, moderate with 84 fl oz per 100 gal applied 3 times; no growth reduction but slight decrease in overall plant quality.
31701	Hachi-Hachi SC (Tolfenpyrad)	Hydrangea (Hydrangea sp.) H. macrophylla 'PIIHM-II'	Greenhouse	DeFrancesco	OR	2015	Foliar	No injury or growth reduction with 21, 42 and 84 fl oz per 100 gal applied biweekly.

32546	Hachi-Hachi SC (Tolfenpyrad)	Hydrangea (Hydrangea sp.) H. paniculata 'Grandiflora'	Field Container	Gilrein	NY	2014	Foliar	Slight injury on leaves and flowers with 21, 42 and 84 fl oz per 100 gal applied 3 times; no growth reduction but slight decrease in overall plant quality.
31701	Hachi-Hachi SC (Tolfenpyrad)	Hydrangea (Hydrangea sp.) 'Showstopper'	Greenhouse	Vafaie	TX	2015	Foliar	No injury or growth reduction with 21, 42 and 84 fl oz per 100 gal + Preference applied 3 times biweekly.
29340	Hachi-Hachi SC (Tolfenpyrad)	Impatiens, New Guinea (Impatiens hawkeri) 'Dazzler Violet'	Greenhouse	Chen	LA	2010	Foliar	No injury or growth reduction with 8,16 and 32 oz per 100 gal applied twice.
30357	Hachi-Hachi SC (Tolfenpyrad)	Impatiens, New Guinea (Impatiens hawkeri) I. walleriana 'Stardust Red'	Field Container	Davis	MI	2011	Foliar	Severe injury and growth reduction with 21, 42 and 84 fl oz per 100 gal applied three times.
29340	Hachi-Hachi SC (Tolfenpyrad)	Impatiens, New Guinea (Impatiens hawkeri) 'Paradise Blush White'	Greenhouse	Freiberger	NJ	2011	Foliar	No injury after 1st applic. with 21, 42 and 84 fl oz per 100 gal + surfactant, slight at 1X, moderate at 2X and 4X after 2nd applic; some growth reduction with all rates.
29340	Hachi-Hachi SC (Tolfenpyrad)	Impatiens, New Guinea (Impatiens hawkeri) 'Paradise Rose Flare'	Greenhouse	Freiberger	NJ	2011	Foliar	No injury after 1st applic. with 21, 42 and 84 fl oz per 100 gal + surfactant, severe injury after 2nd applic; significant growth reduction with all rates.
29340	Hachi-Hachi SC (Tolfenpyrad)	Impatiens, New Guinea (Impatiens hawkeri) 'Patchwork Salmon'	Greenhouse	Chen	LA	2011	Foliar	Moderate to severe injury increasing with rate (21,42 and 84 fl oz per 100 gal) applied twice.
29340	Hachi-Hachi SC (Tolfenpyrad)	Impatiens, New Guinea (Impatiens hawkeri) 'Sonic Lilac'	Greenhouse	Chen	LA	2011	Foliar	Moderate to severe injury increasing with rate (21,42 and 84 fl oz per 100 gal) applied twice.
29340	Hachi-Hachi SC (Tolfenpyrad)	Impatiens, New Guinea (Impatiens hawkeri) 'Super Elfin Red'	Greenhouse	Chen	LA	2010	Foliar	Severe injury with 21, 42 and 84 fl oz per 100 gal applied twice.
29341	Hachi-Hachi SC (Tolfenpyrad)	Impatiens; Touch-me-not (Impatiens sp.) 'Double Camelia Mix'	Greenhouse	Freiberger	NJ	2011	Foliar	Severe injury at 4X (84 fl oz per 100 gal + surfactant) applied 3 times; not enough plants to test 1X and 2X.
29341	Hachi-Hachi SC (Tolfenpyrad)	Impatiens; Touch-me-not (Impatiens sp.) Extra Dwarf Tom Thumb'	Greenhouse	Freiberger	NJ	2011	Foliar	Slight to severe injury increasing with rates (21, 42 and 84 fl oz per 100 gal + surfactant) applied 3 times.
30381	Hachi-Hachi SC (Tolfenpyrad)	Impatiens; Touch-me-not (Impatiens sp.) I. walleriana 'Dazzler Pink'	Field Container	Davis	MI	2010	Foliar	Significant injury at 21, 42, and 84 fl oz per 100 gal.
31597	Hachi-Hachi SC (Tolfenpyrad)	Sweet Alyssum (Lobularia maritima) 'Carpet of Snow'	Field Container	DeFrancesco	OR	2015	Foliar	No injury or growth reduction with 21, 42 and 84 fl oz per 100 gal applied biweekly.
31597	Hachi-Hachi SC (Tolfenpyrad)	Sweet Alyssum (Lobularia maritima) 'Clear Crystal Lavender Shades'	Field Container	Gilrein	NY	2015	Foliar	No injury or growth reduction with 21, 42 and 84 fl oz per 100 gal applied 3 times; improved plant quality.
31597	Hachi-Hachi SC (Tolfenpyrad)	Sweet Alyssum (Lobularia maritima) 'Easter Bonnet Peach'	Field Container	Gilrein	NY	2015	Foliar	No injury or growth reduction with 21, 42 and 84 fl oz per 100 gal applied 3 times; improved plant quality.
31597	Hachi-Hachi SC (Tolfenpyrad)	Sweet Alyssum (Lobularia maritima) 'Wonderland'	Field Container	Davis	MI	2014	Foliar	No injury with 21, 42 and 84 fl oz per 100 gal + Capsil applied 3 times.
30373	Hachi-Hachi SC (Tolfenpyrad)	Geranium, Zonal (Pelargonium x hortorum) 'Cranesbill'	Field Container	Uber	CA	2013	Foliar	No injury or growth reduction with 21, 42 and 84 fl oz per 100 gal + Capsil applied 3 times.

30373	Hachi-Hachi SC (Tolfenpyrad)	Geranium, Zonal (Pelargonium x hortorum) 'Orbit Pink Seed'	Field Container	Davis	MI	2011	Foliar	No injury or growth reduction with 21, 42 and 84 fl oz per 100 gal applied three times.
30373	Hachi-Hachi SC (Tolfenpyrad)	Geranium, Zonal (Pelargonium x hortorum) 'Pinto Salmon'	Field Container	Gilrein	NY	2014	Foliar	No injury on leaves and flowers, and no growth reduction with 21, 42, and 84 fl oz per 100 gal applied 3 times.
30373	Hachi-Hachi SC (Tolfenpyrad)	Geranium, Zonal (Pelargonium x hortorum) 'Pinto White'	Field Container	Gilrein	NY	2014	Foliar	No injury on leaves and flowers, and no growth reduction with 21, 42, and 84 fl oz per 100 gal applied 3 times.
30359	Hachi-Hachi SC (Tolfenpyrad)	Petunia (Petunia sp.) 'Dreams White'	Field Container	Davis	MI	2011	Foliar	No injury or growth reduction with 21, 42 and 84 fl oz per 100 gal applied three times.
29342	Hachi-Hachi SC (Tolfenpyrad)	Petunia (Petunia sp.) 'Easy Wave Rose'	Greenhouse	Chen	LA	2010	Foliar	Minor injury with complete recovery, no growth reduction with 21, 42 and 84 fl oz per 100 gal applied twice.
30359	Hachi-Hachi SC (Tolfenpyrad)	Petunia (Petunia sp.) P. x hybrida 'Prism Sunshine'	Field Container	Davis	MI	2010	Foliar	No significant injury at 21, 42, and 84 fl oz per 100 gal.
29342	Hachi-Hachi SC (Tolfenpyrad)	Petunia (Petunia sp.) 'Shockwave Coconut'	Greenhouse	Freiberger	NJ	2011	Foliar	No injury or growth reduction with 21, 42 and 84 fl oz per 100 gal + surfactant applied 3 times.
29342	Hachi-Hachi SC (Tolfenpyrad)	Petunia (Petunia sp.) 'Wave Lavender'	Greenhouse	Freiberger	NJ	2011	Foliar	No injury or growth reduction with 21, 42 and 84 fl oz per 100 gal + surfactant applied 3 times.
30603	Hachi-Hachi SC (Tolfenpyrad)	Rose (Rosa sp.)	Greenhouse	Cloyd	KS	2014	Foliar	
32425	Hachi-Hachi SC (Tolfenpyrad)	Rose (Rosa sp.) 'Double Knockout'	Field Container	Vafaie	TX	2015	Foliar	No injury or growth reduction with 21, 42 and 84 fl oz per 100 gal + Preference applied 3 times biweekly.
32425	Hachi-Hachi SC (Tolfenpyrad)	Rose (Rosa sp.) 'Easy Elegance Macy's Pride'	Field Container	Vafaie	TX	2015	Foliar	No injury or growth reduction with 21, 42 and 84 fl oz per 100 gal + Preference applied 3 times biweekly.
30603	Hachi-Hachi SC (Tolfenpyrad)	Rose (Rosa sp.) 'First Impression'	Greenhouse	Gilrein	NY	2014	Foliar	Virtually no injury on leaves and flowers, and no growth reduction with 21, 42 and 84 fl oz per 100 gal applied 3 times.
30603	Hachi-Hachi SC (Tolfenpyrad)	Rose (Rosa sp.) 'Powerhouse'	Greenhouse	Gilrein	NY	2014	Foliar	Virtually no injury on leaves and flowers, and no growth reduction with 21, 42 and 84 fl oz per 100 gal applied 3 times.
30603	Hachi-Hachi SC (Tolfenpyrad)	Rose (Rosa sp.) 'White Iceberg'	Greenhouse	Uber	CA	2014	Foliar	No injury or growth reduction with 21, 42 and 84 fl oz per 100 gal + Capsil applied 3 times.
31698	Hachi-Hachi SC (Tolfenpyrad)	Common Sage (Salvia officinalis)	Greenhouse	Cloyd	KS	2014	Foliar	
31698	Hachi-Hachi SC (Tolfenpyrad)	Common Sage (Salvia officinalis)	Greenhouse	Freiberger	NJ	2014	Foliar	No injury or growth reduction with 21, 42 and 84 fl oz per 100 gal applied 3 times.
31698	Hachi-Hachi SC (Tolfenpyrad)	Common Sage (Salvia officinalis)	Greenhouse	Uber	CA	2014	Foliar	No injury or growth reduction with 21, 42 and 84 fl oz per 100 gal + Capsil applied 3 times.
31698	Hachi-Hachi SC (Tolfenpyrad)	Common Sage (Salvia officinalis) S. splendens 'Sally'	Greenhouse	Davis	MI	2014	Foliar	Severe injury with 21, 42 and 84 fl oz per 100 gal + Capsil applied 3 times.

29343	Hachi-Hachi SC (Tolfenpyrad)	Marigold (Tagetes sp.) 'Marvel Orange'	Greenhouse	Freiberger	NJ	2011	Foliar	No injury or growth reduction with 21, 42 and 84 fl oz per 100 gal + surfactant applied 3 times.
29343	Hachi-Hachi SC (Tolfenpyrad)	Marigold (Tagetes sp.) 'Safari Yellow'	Greenhouse	Freiberger	NJ	2011	Foliar	No injury or growth reduction with 21, 42 and 84 fl oz per 100 gal + surfactant applied 3 times.
30379	Hachi-Hachi SC (Tolfenpyrad)	Marigold (Tagetes sp.) T. erecta	Field Container	Uber	CA	2013	Foliar	No injury or growth reduction with 21, 42 and 84 fl oz per 100 gal + Capsil applied 3 times.
30379	Hachi-Hachi SC (Tolfenpyrad)	Marigold (Tagetes sp.) T. erecta 'Inca Orange'	Field Container	Davis	MI	2010	Foliar	Moderate, but transitory injury at 21, 42, and 84 fl oz per 100 gal.
30379	Hachi-Hachi SC (Tolfenpyrad)	Marigold (Tagetes sp.) T. patula 'Bonanza Yellow'	Field Container	Davis	MI	2011	Foliar	No injury or growth reduction with 21, 42 and 84 fl oz per 100 gal applied three times.
29343	Hachi-Hachi SC (Tolfenpyrad)	Marigold (Tagetes sp.) 'Taishan Orange'	Greenhouse	Chen	LA	2010	Foliar	No injury or growth reduction with 21, 42 and 84 fl oz per 100 gal applied twice.
29343	Hachi-Hachi SC (Tolfenpyrad)	Marigold (Tagetes sp.) 'Taishan Yellow'	Greenhouse	Chen	LA	2010	Foliar	No injury or growth reduction with 21, 42 and 84 fl oz per 100 gal applied twice.
30379	Hachi-Hachi SC (Tolfenpyrad)	Marigold (Tagetes sp.) 'Yellow Bonanza'	Field Container	Davis	MI	2014	Foliar	No injury with 21, 42 and 84 fl oz per 100 gal + Capsil applied 3 times.
29344	Hachi-Hachi SC (Tolfenpyrad)	Vervain (Verbena sp.) 'Homestead Purple'	Greenhouse	Chen	LA	2010	Foliar	No injury with 21, 42 and 84 fl oz per 100 gal applied twice.
30361	Hachi-Hachi SC (Tolfenpyrad)	Vervain (Verbena sp.) 'Obsession Scarlet'	Field Container	Davis	MI	2013	Foliar	No injury with 21, 42 and 84 fl oz per 100 gal + Capsil applied 3 times.
29344	Hachi-Hachi SC (Tolfenpyrad)	Vervain (Verbena sp.) 'Serenity Pink'	Greenhouse	Chen	LA	2010	Foliar	No injury or growth reduction with 21, 42 and 84 fl oz per 100 gal applied twice.
29344	Hachi-Hachi SC (Tolfenpyrad)	Vervain (Verbena sp.) 'Tailing Pink'	Greenhouse	Chen	LA	2012	Foliar	No injury or growth reduction with 21, 42 and 84 fl oz per 100 gal applied twice.
29344	Hachi-Hachi SC (Tolfenpyrad)	Vervain (Verbena sp.) 'Tailing Purple'	Greenhouse	Chen	LA	2012	Foliar	No injury or growth reduction with 21, 42 and 84 fl oz per 100 gal applied twice.
29344	Hachi-Hachi SC (Tolfenpyrad)	Vervain (Verbena sp.) V. hybrida 'Obsession Blue with Eye'	Greenhouse	Gilrein	NY	2011	Foliar	No injury or growth reduction with 21, 42 and 84 fl oz per 100 gal.
29344	Hachi-Hachi SC (Tolfenpyrad)	Vervain (Verbena sp.) V. hybrida 'Quartz White'	Greenhouse	Gilrein	NY	2011	Foliar	No injury or growth reduction with 21, 42 and 84 fl oz per 100 gal.
30361	Hachi-Hachi SC (Tolfenpyrad)	Vervain (Verbena sp.) 'Veralena Red'	Field Container	DeFrancesco	OR	2013	Foliar	No injury or growth reduction with 21, 42 and 84 fl oz per 100 gal applied 3 times.
29345	Hachi-Hachi SC (Tolfenpyrad)	Violet (Viola sp.) 'Delta Pure Orange'	Greenhouse	Freiberger	NJ	2011	Foliar	No injury or growth reduction with 21, 42 and 84 fl oz per 100 gal + surfactant applied 3 times.
29345	Hachi-Hachi SC (Tolfenpyrad)	Violet (Viola sp.) 'Delta Pure Rose'	Greenhouse	Freiberger	NJ	2011	Foliar	No injury or growth reduction with 21, 42 and 84 fl oz per 100 gal + surfactant applied 3 times.
29345	Hachi-Hachi SC (Tolfenpyrad)	Violet (Viola sp.) 'Dynamite Scarlet'	Greenhouse	Chen	LA	2010	Foliar	Virtually no injury or growth reduction with 21, 42 and 84 fl oz per 100 gal applied twice.
29346	Hachi-Hachi SC (Tolfenpyrad)	Zinnia (Zinnia sp.) 'Dreamland Red'	Greenhouse	Freiberger	NJ	2011	Foliar	No injury or growth reduction with 21, 42 and 84 fl oz per 100 gal + surfactant applied 3 times.
29346	Hachi-Hachi SC (Tolfenpyrad)	Zinnia (Zinnia sp.) 'Profusion Knee-high Yellow'	Greenhouse	Chen	LA	2011	Foliar	No injury or growth reduction with 21,42 and 84 fl oz per 100 gal) applied twice.
29346	Hachi-Hachi SC (Tolfenpyrad)	Zinnia (Zinnia sp.) 'Profusion Orange'	Greenhouse	Freiberger	NJ	2011	Foliar	No injury or growth reduction with 21, 42 and 84 fl oz per 100 gal + surfactant applied 3 times.

29346	Hachi-Hachi SC (Tolfenpyrad)	Zinnia (Zinnia sp.) Z. elegans 'Profusion Fire'	Greenhouse	Gilrein	NY	2011	Foliar	No injury or growth reduction with 21, 42 and 84 fl oz per 100 gal.
29346	Hachi-Hachi SC (Tolfenpyrad)	Zinnia (Zinnia sp.) Z. elegans 'Starlight Rose'	Greenhouse	Gilrein	NY	2011	Foliar	No injury or growth reduction with 21, 42 and 84 fl oz per 100 gal.
29346	Hachi-Hachi SC (Tolfenpyrad)	Zinnia (Zinnia sp.) 'Zahra White'	Greenhouse	Chen	LA	2011	Foliar	No injury or growth reduction with 21,42 and 84 fl oz per 100 gal) applied twice.

Label Suggestions

In this report, 11 species or genera exhibited no or minimal injury after foliar treatments of Hachi-Hachi 15EC (tolfenpyrad) at 21, 48 and 84 fl oz per 100 gal. Eight of these crops can be added to the label as crops tested for tolerance: (*Alyssum* sp., *Angelonia* sp., *Antirrhinum* sp., *Begonia* sp.¹, *Dahlia* sp., *Verbena* sp.¹, *Viola* sp.¹ and *Zinnia* sp.). For Hachi-Hachi SC, 15 crops can be added to the label as crops tested for tolerance (*Angelonia* sp., *Bacopa* sp., *Begonia* sp.¹, *Calibrachoa* sp., *Dracaena* sp., *Dahlia* sp., *Fuschia* sp., *Hydrangea* sp., *Lobularia maritima*, *Pelargonium x hortorum*, *Petunia* sp., *Rosa* sp., *Tagetes* sp.¹, *Verbena* sp.¹ and *Viola* sp.¹).

¹Already in current Hachi-Hachi SC label as a crop listed with the precaution '**Temporary phytotoxicity may occur to some species**'.

Appendix 1: Contributing Researchers

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