



[Environment Horticulture Program Research Summaries](#)

IR-4 Environmental Horticulture Program Fiesta (Iron HEDTA) Crop Safety

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Date: Feb 27, 2020**

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Abstract

Fiesta (Iron HEDTA) is a new herbicide currently labeled for post emergence broadleaf weed control on lawns (use on rights of way or non-crop areas), turf, golf courses, parks, playgrounds, cemeteries and athletic fields. Neudorff is interested in adding environmental horticulture crops to the Fiesta label. The IR-4 Project completed 146 crop safety trials on 83 environmental horticulture plant species / genera during 2016 to 2019. In these trials, 7 plant species / genera (*Buxus* sp., *Calamagrostis acutiflora*, *Carex cherokeensis*, *Festuca glauca*, *Juniperus* spp., *Muhlenbergia capillaris* and *Taxus x media*) exhibited no or minimal transient injury after application to either dormant or actively growing plants at all 3 rates in at least 3 trials. Six species / genera (*Cotoneaster apiculatus*, *Heuchera* spp., *Hibiscus* sp., *Lagerstroemia indica*, *Ophiopogon* sp. and *Teucrium chamaedrys*), where Fiesta was applied to actively growing plants, exhibited no phytotoxicity at 1X but did have some injury at 2X and 4X rates. Twenty species / genera exhibited significant phytotoxicity at even the lowest rate; in ten of these crops, Fiesta was applied to dormant plants.

Introduction

Fiesta (Iron HEDTA) is a new herbicide currently labeled for post emergence broadleaf weed control on lawns (use on rights of way or non-crop areas), turf, golf courses, parks, playgrounds, cemeteries and athletic fields. Neudorff is interested in adding environmental horticulture crops to their label. The IR-4 Project completed 146 crop safety trials on 83 environmental horticulture plant species or genera during 2016 to 2019.

Materials and Methods

Fiesta (Iron HEDTA) was applied over-the-top twice at 6 weeks intervals to dormant or actively growing plants. The application rates were 25, 50 and 100 oz per 1000 sq ft, plus a water treated control. A minimum of four plants per three blocks or ten plants per completely randomized design were required with many researchers exceeding this minimum. Phytotoxicity was recorded on a scale of 0 to 10 (0 = no phytotoxicity; 10 = complete kill) at 1, 2, and 4 weeks after each application. For IR-4 testing, the following protocols were used: 18-013 and 19-013. In addition, Fiesta was included in the IR-4 Biopesticide & Organic Support Program protocols from 2016 through 2018. For more detailed materials and methods, please visit <https://www.ir4project.org/ehc/ehc-registration-support-research/env-hort-researcher-resources/#Protocols> to view and download the 18-013 and 19-013 protocols.

Fiesta was supplied to researchers (See list of researchers in Appendix 1) by Neudorff.

Results and Summary

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

Phytotoxicity

Fiesta (Iron HEDTA) exhibited no or minimal negative impact on 7 plant species / genera (*Buxus* sp., *Calamagrostis acutiflora*, *Carex cherokeensis*, *Festuca glauca*, *Juniperus* spp., *Muhlenbergia capillaris* and *Taxus x media*) when applied to either dormant or actively growing plants (Table 1). Six species / genera (*Cotoneaster apiculatus*, *Heuchera* spp., *Hibiscus* sp., *Lagerstroemia indica*, *Ophiopogon* sp. and *Teucrium chamaedrys*), where Fiesta was applied to actively growing plants, exhibited no phytotoxicity at 1X but did have some injury at 2X and 4X rates (Table 2). Twenty species / genera exhibited significant phytotoxicity at even the lowest rate such that it is recommend that growers not use Fiesta (Iron HEDTA); in ten of these crops, Fiesta was applied to dormant plants (Table 3). For 40 genera / species, more information is needed either because only 1 or 2 trials were conducted or because consistent results were not achieved across research sites (Table 4).

Please see Table 5 for a list of individual trial summaries on Fiesta.

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

<i>Buxus</i> sp.	<i>Muhlenbergia capillaris</i>
<i>Calamagrostis acutiflora</i>	<i>Taxus x media</i>
<i>Carex cherokeensis</i>	
<i>Festuca glauca</i>	
<i>Juniperus</i> spp.	

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

<i>Cotoneaster apiculatus</i>	<i>Hibiscus</i> sp.
<i>Heuchera</i> spp.	<i>Lagerstroemia indica</i>
	<i>Ophiopogon</i> sp.
	<i>Teucrium chamaedrys</i>

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

<i>Agapanthus</i> sp.	<i>Nerium oleander</i>
<i>Andropogon gerardii</i>	<i>Pachysandra terminalis</i>
<i>Carex</i> sp.	<i>Pennisetum setaceum</i>
<i>Euphorbia</i> sp.	<i>Physocarpus opulifolius</i>
<i>Fothergilla gardenia</i>	<i>Rhododendron</i> sp.
<i>Hosta</i> sp.	<i>Rosa</i> sp.
<i>Hylotelephium telephium</i>	<i>Sedum</i> spp.
<i>Ilex x meserveae</i>	<i>Sempervivum</i> sp.
<i>Kerria japonica</i>	<i>Thuja plicata</i>
<i>Lavandula</i> spp.	
<i>Liriope</i> spp.	

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

<i>Abies balsamea</i> ¹	<i>Hemerocallis</i> sp.	<i>Picea</i> sp. ¹
<i>Abies nordmannianna</i> ¹	<i>Hydrangea</i> sp.	<i>Pinus mugo</i> ²
<i>Acer rubrum</i>	<i>Ilex cornuta</i> ²	<i>Pinus taeda</i>
<i>Ammophila breviligulata</i> ²	<i>Ilex crenata</i>	<i>Prunus laurocerasus</i>
<i>Chamaecyparis cyoides</i> ¹	<i>Ligustrum ovalifolium</i>	<i>Rosmarinus officinalis</i>
<i>Chamaecyparis</i> sp.	<i>Ligustrum x vicaryi</i> ¹	<i>Saccharum ravennae</i>
<i>Chasmanthium latifolium</i> ²	<i>Ligustrum</i> sp. ¹	<i>Schizachyrium scoparium</i> ²
<i>Cortaderia</i> sp.	<i>Miscanthus sinensis</i> ²	<i>Spiraea japonica</i> ¹
<i>Cotoneaster</i> sp.	<i>Panicum virgatum</i>	<i>Spiraea</i> sp. ¹
<i>Cryptomeria japonica</i>	<i>Pennisetum alopecuroides</i>	<i>Thuja occidentalis</i> ²
<i>Euonymus alatus</i>	<i>Picea abies</i>	<i>Tsuga canadensis</i> ¹
<i>Euonymus fortunei</i> ¹	<i>Picea glauca</i> ¹	<i>Tsuga</i> sp. ¹
<i>Euonymus coloratus</i> ¹	<i>Picea pungens</i> ¹	<i>Viburnum</i> sp. ¹
<i>Gardenia jasminoides</i>		

¹ No injury in 1 trial.

² No injury in 2 trials.

Table 5 Detailed Summary of Crop Safety Testing with Fiesta (Iron HEDTA).

Notes: Table entries are sorted by crop Latin name. Only those trials with research reports received by 2/10/2019 are listed below.

PR#	Crop	Production Site	Researcher	State	Year	Application Type	Results
33317	Fir (Abies sp.) A. balsamea	Field Container	Aulakh	CT	2018	Over the top	No injury or growth reduction with 25, 50 and 100 oz per acre applied twice.
33317	Fir (Abies sp.) A. nordmannianna	Field Container	Moretti	OR	2018	Over the top	No injury or height reduction with 25, 50 and 100 oz per 1000 sq ft applied twice to actively growing plants.
33775	Maple, Red (Acer rubrum)	Field Container	Neal	NC	2017	Over the top	No injury with 25 oz per 1000 sq ft applied 3 times biweekly; minor injury with 50 and 100 oz but damaged leaves dropped rapidly. These results should be confirmed with additional research.
33714	Lily-Of-The-Nile (Agapanthus sp.) 'Blue Yonder'	Field Container	Wilen	CA	2016	Over the top	Moderate and unacceptable injury with 25.2 oz per 1000 sq ft and higher rates.
33749	American Beachgrass (Ammophila breviligulata)	Field Container	Senesac	NY	2017	Over the top	Application to actively growing plants 3 times biweekly. No injury or height reduction with 25, 50, and 100 oz/1000 sq ft, each rate applied at both 50 and 200 gpa.
33749	American Beachgrass (Ammophila breviligulata)	Field Container	Senesac	NY	2018	Over the top	Application to actively growing plants at 50 and 100 oz/1000 sq ft once, or at 50 oz/1000 sq ft twice at 7- or 14- day intervals, or at 50 oz/1000 sq ft once or twice at 14- day intervals following Isoxaben Pre. No injury or height reduction from all treat
33728	Big Blue Stem (Andropogon gerardii)	Field Container	Marble	FL	2019	Over the top	No injury or growth reduction with 25, 50 and 100 fl oz per 1000 sq ft applied twice.
33728	Big Blue Stem (Andropogon gerardii)	Field Container	Neal	NC	2016	Over the top	Moderate injury with dormant application of 25, 50 and 100 oz per 1000 sq ft
33728	Big Blue Stem (Andropogon gerardii)	Field Container	Senesac	NY	2019	Over the top	No injury with 8.5 and 16 gal, very minor with 24 gal per acre applied twice; no stunting.
32857	Boxwood (Buxus sp.) 'Franklin Gem'	Field Container	Persad	OH	2019	Over the top	No injury or significant growth reduction with 8.5, 17 and 34 gal per acre applied twice.
32857	Boxwood (Buxus sp.) 'Green Velvet'	Field Container	Fraelich	GA	2016	Over the top	No injury at 4.3, 8.6, 17.0 and 34.0 gal per acre applied 3 times.
32857	Boxwood (Buxus sp.) 'Green Velvet'	Field Container	Fraelich	GA	2016	Over the top	No injury or significant differences in plant growth and marketability with 4.3, 8.6, 17 and 34 gal per acre applied 3 times. Biopesticide Program - B00102-16-GA01
32857	Boxwood (Buxus sp.) 'Green Velvet'	Field Container	Moretti	OR	2019	Over the top	No significant injury or growth reduction with 25, 50 and 100 fl oz per 1000 ft applied twice.
33305	Feather Reed Grass (Calamagrostis acutiflora) 'Karl Foerster'	Field Container	Neal	NC	2016	Over the top	Minor transient injury with dormant application of 25, 50 and 100 oz per 1000 sq ft.

PR#	Crop	Production Site	Researcher	State	Year	Application Type	Results
33305	Feather Reed Grass (<i>Calamagrostis acutiflora</i>) 'Karl Forester'	Field Container	Moretti	OR	2018	Over the top	Application to dormant or actively growing plants at 50 and 100 oz/1000 sq ft once, or at 50 oz/1000 sq ft twice at 7- or 14- day intervals, or at 50 oz/1000 sq ft following a Pre herbicide once at 24 hr or twice at 24 hr and 14 days later. No injury or
33305	Feather Reed Grass (<i>Calamagrostis acutiflora</i>) 'Overdam'	Field Container	Moretti	OR	2018	Over the top	No injury or height reduction with 25, 50 and 100 oz per 1000 sq ft applied twice to actively growing plants.
33712	Sedge, Cherokee (<i>Carex cherokeensis</i>)	Field Container	Marble	FL	2019	Over the top	No injury or growth reduction with 25, 50 and 100 fl oz per 1000 sq ft applied twice.
33712	Sedge, Cherokee (<i>Carex cherokeensis</i>)	Field Container	Senesac	NY	2017	Over the top	Application to actively growing plants 3 times biweekly. No injury or height reduction with 25, 50, and 100 oz/1000 sq ft after 2 applications, slight to moderate injury after 3rd applic with good recovery. No differences between spray volumes.
33712	Sedge, Cherokee (<i>Carex cherokeensis</i>)	Field Container	Senesac	NY	2018	Over the top	Application to actively growing plants at 50 and 100 oz/1000 sq ft once, or at 50 oz/1000 sq ft twice at 7- or 14- day intervals, or at 50 oz/1000 sq ft once or twice at 14- day intervals following Isoxaben Pre. Minor injury and no height reduction from a
33727	Sedge (<i>Carex</i> sp.)	Field Container	Neal	NC	2016	Over the top	Moderate injury with dormant application of 25, 50 and 100 oz per 1000 sq ft, and fresh weight decreased with increasing with rate.
33727	Sedge (<i>Carex</i> sp.)	Field Container	Senesac	NY	2019	Over the top	Minor to moderate injury with 8.5, 16 and 24 gal per acre applied twice.
33746	Cedar (<i>Chamaecyparis</i> sp.) <i>C. cyoides</i> 'Heatherbun'	Field Container	Moretti	OR	2018	Over the top	Application to dormant or actively growing plants at 50 and 100 oz/1000 sq ft once, or at 50 oz/1000 sq ft twice at 7- or 14- day intervals, or at 50 oz/1000 sq ft following a Pre herbicide once at 24 hr or twice at 24 hr and 14 days later. No injury or
33746	Cedar (<i>Chamaecyparis</i> sp.) 'Gold Mop'	Field Container	Neal	NC	2017	Over the top	Minor injury with 25, severe with 50 and 100, oz per 1000 sq ft applied 3 times biweekly.
33303	Indian Woodoats (<i>Chasmanthium latifolium</i>)	Field Container	Wilen	CA	2018	Over the top	Acceptable injury with 25, 50 and 100 oz per acre.
33303	Indian Woodoats (<i>Chasmanthium latifolium</i>)	Field Container	Witcher	TN	2019	Over the top	No injury with 25, 50 and 100 oz per 1000 ft applied twice.
33302	Pampas Grass (<i>Cortaderia</i> sp.)	Field Container	Moretti	OR	2018	Over the top	No injury or height reduction with 25, 50 and 100 oz per 1000 sq ft applied twice to actively growing plants.
33302	Pampas Grass (<i>Cortaderia</i> sp.) 'Rosea'	Field Container	Senesac	NY	2018	Over the top	Minor to moderate injury with 25 and 50, moderate with 100, oz per 1000 sq ft applied twice; no stunting.
33735	Cotoneaster (<i>Cotoneaster</i> sp.) <i>C. apiculatus</i> 'Cranberry'	Field Container	Moretti	OR	2019	Over the top	No injury after 1st application, moderate after 2nd applic. with 25, 50 and 100 fl oz per 1000 ft; moderate growth reduction at 2X and 4X.
33735	Cotoneaster (<i>Cotoneaster</i> sp.) 'Coral Beauty'	Field Container	Wade	SC	2016	Over the top	Application to actively growing plants at 12.6, 25.2 and 50 oz/1000 sq ft 3 times biweekly. No injury with 12.6, minor with the higher rates; no height reduction from all treatments.

PR#	Crop	Production Site	Researcher	State	Year	Application Type	Results
33747	Japanese Cedar (Cryptomeria japonica) 'Black Dragon'	Field Container	Moretti	OR	2018	Over the top	Application to dormant or actively growing plants at 50 and 100 oz/1000 sq ft once, or at 50 oz/1000 sq ft twice at 7- or 14- day intervals, or at 50 oz/1000 sq ft following a Pre herbicide once at 24 hr or twice at 24 hr and 14 days later. No injury or
33747	Japanese Cedar (Cryptomeria japonica) 'Yoshino'	Field Container	Neal	NC	2017	Over the top	Minor injury with 25, severe with 50 and 100, oz per 1000 sq ft applied 3 times biweekly.
33737	Burning Bush (Euonymus alatus) 'Compactus'	Field Container	Wade	SC	2016	Over the top	Application to actively growing plants at 12.6, 25.2 and 50 oz/1000 sq ft 3 times biweekly. Minor to moderate injury increasing with rates; no height reduction from all treatments.
33738	Wintercreeper (Euonymus fortunei)	Field Container	Wade	SC	2016	Over the top	Application to actively growing plants at 12.6, 25.2 and 50 oz/1000 sq ft 3 times biweekly. No injury or height reduction from all treatments.
33738	Wintercreeper (Euonymus fortunei) E. coloratus	Field Container	Persad	OH	2019	Over the top	No injury or significant growth reduction with 8.5, 17 and 34 gal per acre applied twice.
33741	Spurge (Euphorbia sp.) E. martini 'Ascot Rainbow'	Field Container	Moretti	OR	2017	Over the top	Application to actively growing plants 3 times biweekly. Moderate to severe injury with 25, 50 and 100 oz per 1000 sq ft, each rate applied at both 40 and 180 gpa.
33741	Spurge (Euphorbia sp.) 'White Frost'	Field Container	Wilen	CA	2017	Over the top	Severe injury with 25.2, 50 and 100 oz per 1000 sq ft.
33310	Field Fescue (Festuca glauca) 'Elijah Blue'	Field Container	Moretti	OR	2018	Over the top	Application to dormant or actively growing plants at 50 and 100 oz/1000 sq ft once, or at 50 oz/1000 sq ft twice at 7- or 14- day intervals, or at 50 oz/1000 sq ft following a Pre herbicide once at 24 hr or twice at 24 hr and 14 days later. No injury or
33310	Field Fescue (Festuca glauca) 'Elijah Blue'	Field Container	Senesac	NY	2018	Over the top	Application to actively growing plants at 50 and 100 oz/1000 sq ft once, or at 50 oz/1000 sq ft twice at 7- or 14- day intervals, or at 50 oz/1000 sq ft once or twice at 14- day intervals following Isoxaben Pre. No or minor injury and no height reduction
33310	Field Fescue (Festuca glauca) 'Elijah Blue'	Field Container	Wilen	CA	2016	Over the top	Acceptable injury with 12.6, 25.2 and 50 oz per 1000 sq ft.
33310	Field Fescue (Festuca glauca) 'Elijah Blue'	Field Container	Wilen	CA	2018	Over the top	No significant injury and growth reduction with 16 oz per 1000 sq ft applied once or twice, and with 32 oz per 1000 sq ft applied once.
33742	Dwarf Fothergilla (Fothergilla gardenii) 'Mount Airy'	Field Container	Senesac	NY	2017	Over the top	Application to dormant plants 3 times biweekly. Severe injury once the plants began to leaf out in the spring with 25, 50, and 100 oz/1000 sq ft, each rate applied at both 50 and 200 gpa.
33724	Gardenia (Gardenia sp.) G. jasminoides 'Frost Proof'	Field Container	Neal	NC	2017	Over the top	Minor and moderate injury, with complete recovery, with 25 and 50 oz per 1000 sq ft; severe injury with 100 oz.
33724	Gardenia (Gardenia sp.) G. jasminoides 'Radicans'	Field Container	Neal	NC	2016	Over the top	No to minor injury (highest rate) with dormant application of 25, 50, and 100 oz per 1000 sq ft.
33719	Daylily (Hemerocallis sp.) 'Buttered Popcorn'	Field Container	Reding	OH	2019	Over the top	Some injury with complete recovery at conclusion of study with 8.5, 17 and 34 gal per acre; treated plants marketable.
33719	Daylily (Hemerocallis sp.) 'Stella del Oro'	Field Container	Neal	NC	2016	Over the top	No to minor injury (highest rate) with dormant application of 25, 50, and 100 oz per 1000 sq ft.

PR#	Crop	Production Site	Researcher	State	Year	Application Type	Results
33721	Alumroot (Heuchera sp.) 'Caramel'	Field Container	Reding	OH	2019	Over the top	Minor to moderate injury with 8.5, 17 and 34 gal per acre; severe growth reduction at 4X; treated plants not marketable.
33721	Alumroot (Heuchera sp.) H. micrantha 'Palace Purple'	Field Container	Neal	NC	2016	Over the top	No to moderate injury with dormant application of 25, 50 and 100 oz per 1000 sq ft, increasing with rate.
33736	Rosemallow (Hibiscus sp.) 'Brilliant Red'	Field Container	Wade	SC	2016	Over the top	Application to actively growing plants at 12.6, 25.2 and 50 oz/1000 sq ft 3 times biweekly. No injury with 12.6, moderate with the higher rates; minor height reduction with the higher rates.
33720	Plantain Lily (Hosta sp.) 'Royal Standard'	Field Container	Reding	OH	2019	Over the top	Moderate to severe injury with 8.5, 17 and 34 gal per acre; treated plants not marketable.
33720	Plantain Lily (Hosta sp.) x 'Minuteman'	Field Container	Neal	NC	2016	Over the top	No injury at all rates with single dormant application but minor to moderate injury with over the top application on emerging foliage (25, 50, 100 oz per 1000 sq ft).
33734	Hydrangea (Hydrangea sp.) H. macrophylla 'Endless Summer'	Field Container	Moretti	OR	2019	Over the top	Severe injury with 25, 50 and 100 fl oz per 1000 ft; no growth reduction.
33734	Hydrangea (Hydrangea sp.) H. paniculata 'Limelight'	Field Container	Witcher	TN	2019	Over the top	Severe injury with some recovery with 25, 50 and 100 oz per 1000 ft applied twice.
33734	Hydrangea (Hydrangea sp.) 'Nikko Blue'	Field Container	Wade	SC	2016	Over the top	Application to actively growing plants at 12.6, 25.2 and 50 oz/1000 sq ft 3 times biweekly. No injury with 12.6, minor with the higher rates; minor height reduction with the higher rates.
33914	Witch's Moneybags (Hylotelephium telephium)	Field Container	Derr	VA	2018	Over the top	Moderate injury (shoot weight reduction) with 25, 50 and 100 fl oz per acre applied twice.
33750	Holly, Chinese (Ilex cornuta)	Field Container	Wade	SC	2018	Over the top	Minor injury with 50 and 100 oz per 1000 sq ft; all plants marketable at end of experiment.
33750	Holly, Chinese (Ilex cornuta) 'Needlepoint'	Field Container	Neal	NC	2016	Over the top	No injury with dormant application of 25, 50 and 100 oz per 1000 sq ft.
33770	Holly, Japanese (Ilex crenata)	Field Container	Neal	NC	2017	Over the top	No injury with 25, 50 and 100 oz per 1000 sq ft applied 3 times biweekly. Plants not vigorously growing at time of treatment; additional research needed to confirm results.
33770	Holly, Japanese (Ilex crenata) 'Compacta'	Field Container	Wade	SC	2018	Over the top	Minor injury with 50 oz per 1000 sq ft, moderate stunting with 100 oz per 1000 sq ft; all plants treated with 1X rate marketable.
33751	Holly, Blue (Ilex x meserveae) 'Mesog'	Field Container	Senesac	NY	2017	Over the top	Application to dormant plants 3 times biweekly. Severe injury after 2nd applic with 25, 50, and 100 oz/1000 sq ft, each rate applied at both 50 and 200 gpa.
33312	Juniper (Juniperus sp.) J. horizontalis 'Andorra'	Field Container	Neal	NC	2016	Over the top	No injury with dormant application of 25, 50 and 100 oz per 1000 sq ft.
33312	Juniper (Juniperus sp.) J. communis 'Gold Cone'	Field Container	Moretti	OR	2018	Over the top	Application to dormant or actively growing plants at 50 and 100 oz/1000 sq ft once, or at 50 oz/1000 sq ft twice at 7- or 14- day intervals, or at 50 oz/1000 sq ft following a Pre herbicide once at 24 hr or twice at 24 hr and 14 days later. No injury or
33312	Juniper (Juniperus sp.) J. conferta 'Blue Pacific'	Field Container	Neal	NC	2017	Over the top	No injury with 25 and 50, minor with 100, oz per 1000 sq ft applied 3 times biweekly.

PR#	Crop	Production Site	Researcher	State	Year	Application Type	Results
33312	Juniper (Juniperus sp.) J. conferta 'Blue Pacific'	Field Container	Wilén	CA	2017	Over the top	Moderate but acceptable injury with 25.2, 50 and 100 oz per 1000 sq ft; no significant growth reduction.
33312	Juniper (Juniperus sp.) J. horizontalis 'Andorra'	Field Container	Neal	NC	2017	Over the top	No injury with 25 and 50, minor with 100, oz per 1000 sq ft applied 3 times biweekly.
33312	Juniper (Juniperus sp.) J. horizontalis 'Andorra'	Field Container	Wilén	CA	2018	Over the top	No significant injury with 16 oz per 1000 sq ft applied once or twice, minor with 32 oz per 1000 sq ft applied once; no significant growth reduction.
33312	Juniper (Juniperus sp.) J. horizontalis 'Prince of Wales'	Field Container	Wilén	CA	2018	Over the top	Inconclusive results because plants, including the Untreated Check, declined during the course of study.
33312	Juniper (Juniperus sp.) 'Prince of Wales'	Field Container	Senesac	NY	2017	Over the top	Application to actively growing plants 3 times biweekly. No injury or height reduction with 25, 50, and 100 oz/1000 sq ft, each rate applied at both 50 and 200 gpa.
33312	Juniper (Juniperus sp.) 'Prince of Wales'	Field Container	Senesac	NY	2018	Over the top	Application to actively growing plants at 50 and 100 oz/1000 sq ft once, or at 50 oz/1000 sq ft twice at 7- or 14- day intervals, or at 50 oz/1000 sq ft once or twice at 14- day intervals following Isoxaben Pre. No or minor injury and no height reduction
33744	Japanese Rose (Kerria japonica) 'Pleniflora'	Field Container	Senesac	NY	2017	Over the top	Application to dormant plants 3 times biweekly. Severe injury once the plants began to leaf out in the spring with 25, 50, and 100 oz/1000 sq ft, each rate applied at both 50 and 200 gpa.
33732	Crape Myrtle (Lagerstroemia indica) 'Catawba'	Field Container	Witcher	TN	2019	Over the top	Severe initial injury with some recovery with 25, 50 and 100 oz per 1000 ft applied twice.
33732	Crape Myrtle (Lagerstroemia indica) 'Natchez'	Field Container	Wade	SC	2016	Over the top	Application to actively growing plants at 12.6, 25.2 and 50 oz/1000 sq ft 3 times biweekly. Minor injury with 12.6, moderate with the higher rates; minor height reduction from all treatments.
33732	Crape Myrtle (Lagerstroemia indica) 'Plum Magic'	Field Container	Seefeldt	WA	2019	Over the top	Severe injury with 8.5, 17 and 34 gal per acre after 1 application.
33718	Lavender (Lavandula sp.) L. angustifolia x L. latifolia 'Provence'	Field Container	Moretti	OR	2017	Over the top	Application to actively growing plants 3 times biweekly. Moderate to severe injury increasing with rates (25, 50 and 100 oz per 1000 sq ft), each rate applied at both 40 and 180 gpa.
33718	Lavender (Lavandula sp.) L. stoechas 'Otto Quast'	Field Container	Wilén	CA	2016	Over the top	Minor and acceptable injury with 12.6 and 25.2, unacceptable with 50 and 100, oz per 1000 sq ft.
33718	Lavender (Lavandula sp.) 'St. Quasti'	Field Container	Wilén	CA	2017	Over the top	Moderate to severe injury and growth reduction with 25.2, 50 and 100 oz per 1000 sq ft.
33729	Privet (Ligustrum sp.) L. ovalifolium	Field Container	Senesac	NY	2019	Over the top	Minor injury with 8.5, moderate with 16 and 24 per acre applied twice; no stunting.
33729	Privet (Ligustrum sp.) L. x vicaryi 'Golden Vicary Privet'	Field Container	Moretti	OR	2018	Over the top	Application to dormant or actively growing plants at 50 and 100 oz/1000 sq ft once, or at 50 oz/1000 sq ft twice at 7- or 14- day intervals, or at 50 oz/1000 sq ft following a Pre herbicide once at 24 hr or twice at 24 hr and 14 days later. No injury fro

PR#	Crop	Production Site	Researcher	State	Year	Application Type	Results
33729	Privet (<i>Ligustrum</i> sp.) 'Wax Privet'	Field Container	Wade	SC	2016	Over the top	Application to actively growing plants at 12.6, 25.2 and 50 oz/1000 sq ft 3 times biweekly. Minor injury and no height reduction from all treatments.
33715	Lilyturf (<i>Liriope</i> sp.)	Field Container	Wade	SC	2018	Over the top	Minor injury with 50 oz per 1000 sq ft, moderate stunting with 100 oz per 1000 sq ft; all plants treated with 1X marketable at end of experiment.
33715	Lilyturf (<i>Liriope</i> sp.) <i>L. muscari</i> 'Variegata'	Field Container	Neal	NC	2016	Over the top	No to minor injury (highest rate) with dormant application of 25, 50, and 100 oz per 1000 sq ft.
33715	Lilyturf (<i>Liriope</i> sp.) <i>L. muscari</i> 'Variegata'	Field Container	Neal	NC	2017	Over the top	Severe injury with 25, 50 and 100 oz per 1000 sq ft applied 3 times biweekly.
33715	Lilyturf (<i>Liriope</i> sp.) <i>L. spicata</i> 'Silver Dragon'	Field Container	Wilen	CA	2016	Over the top	Moderate and unacceptable injury with 12.6, 25.2, 50 and 100 oz per 1000 sq ft.
33308	Silver Grass (<i>Miscanthus</i> sp.) <i>M. sinensis</i> 'Gracillimus'	Field Container	Neal	NC	2016	Over the top	Minor injury with dormant application of 25, 50 and 100 oz per 1000 sq ft.
33308	Silver Grass (<i>Miscanthus</i> sp.) <i>M. sinensis</i> 'Little Zebra'	Field Container	Witcher	TN	2019	Over the top	No injury with 25, 50 and 100 oz per 1000 ft applied twice.
33306	Muhly, Hairyaw (Muhlenbergia capillaris)	Field Container	Marble	FL	2019	Over the top	No injury or growth reduction with 25, 50 and 100 fl oz per 1000 sq ft applied twice.
33306	Muhly, Hairyaw (Muhlenbergia capillaris)	Field Container	Neal	NC	2016	Over the top	No injury with 25, 50 and 100 oz per 1000 sq ft.
33306	Muhly, Hairyaw (Muhlenbergia capillaris)	Field Container	Senesac	NY	2019	Over the top	No injury or stunting with 8.5, 16 and 24b gal per acre applied twice.
33731	Oleander, Rosebay (<i>Nerium oleander</i>) 'Cardinal Red'	Field Container	Wade	SC	2016	Over the top	Application to actively growing plants at 12.6, 25.2 and 50 oz/1000 sq ft 3 times biweekly. No injury with 12.6, minor and moderate with the higher rates; minor height reduction with the higher rates.
33731	Oleander, Rosebay (<i>Nerium oleander</i>) 'Lowfast'	Field Container	Seefeldt	WA	2019	Over the top	Moderate to severe injury increasing with rates (8.5, 17 and 34 gal per acre) applied twice.
33304	Mondo Grass; Lilyturf; Ker-Gawl (<i>Ophiopogon</i> sp.)	Field Container	Senesac	NY	2019	Over the top	Minor injury and stunting with 8.5, moderate with 16 and 24 gal per acre applied twice.
33723	Japanese Pachysandra (<i>Pachysandra terminalis</i>)	Field Container	Neal	NC	2016	Over the top	Minor to moderate injury with dormant application of 25, 50, 100 oz per 1000 sq ft.
33723	Japanese Pachysandra (<i>Pachysandra terminalis</i>)	Field Container	Senesac	NY	2019	Over the top	Moderate to severe injury increasing with rates (8.5, 16 and 24 gal per acre) applied twice.
33307	Switch Grass (<i>Panicum virgatum</i>)	Field Container	Marble	FL	2019	Over the top	No injury or significant growth reduction with 25, 50 and 100 fl oz per 1000 sq ft applied twice.
33307	Switch Grass (<i>Panicum virgatum</i>)	Field Container	Neal	NC	2016	Over the top	Minor injury with dormant application of 25, 50 and 100 oz per 1000 sq ft.
33307	Switch Grass (<i>Panicum virgatum</i>)	Field Container	Senesac	NY	2019	Over the top	Minor injury with 8.5, moderate with 16 and 24 gal per acre applied twice; no stunting.
33726	Fountaingrass (<i>Pennisetum alopecuroides</i>)	Field Container	Senesac	NY	2019	Over the top	No injury or stunting with 8.5, 16 and 24 gal per acre applied twice.

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33726	Fountaingrass (Pennisetum alopecuroides) 'Hameln'	Field Container	Neal	NC	2016	Over the top	Moderate injury with dormant application of 25, 50 and 100 oz per 1000 sq ft.
33726	Fountaingrass (Pennisetum alopecuroides) 'Hameln Dwarf'	Field Container	Moretti	OR	2019	Over the top	No significant injury or growth reduction with 25, 50 and 100 fl oz per 1000 ft applied twice.
33309	Crimson Fountain Grass (Pennisetum setaceum)	Field Container	Senesac	NY	2019	Over the top	Moderate to severe injury at 8.5, 16 and 24 gal per acre applied twice.
33743	Common Ninebark (Physocarpus opulifolius) 'Coopertina'	Field Container	Senesac	NY	2017	Over the top	Application to dormant plants 3 times biweekly. Severe injury once the plants began to leaf out in the spring with 25, 50, and 100 oz/1000 sq ft, each rate applied at both 50 and 200 gpa.
33318	Spruce (Picea sp.)	Field Container	Miller	OR	2018	Over the top	Virtually no injury with 25, 50 and 100 oz pre acre applied twice.
33318	Spruce (Picea sp.) P. abies	Field Container	Beste	MD	2018	Over the top	No significant injury or growth reduction with 25 and 50 fl oz per acre applied twice; 2 plants died with 100 fl oz per acre applied twice, no growth reduction in surviving plants.
33318	Spruce (Picea sp.) P. glauca 'Conica'	Field Container	Moretti	OR	2018	Over the top	No injury or height reduction with 25, 50 and 100 oz per 1000 sq ft applied twice to actively growing plants.
33318	Spruce (Picea sp.) P. pungens 'Majestic Blue'	Field Container	Aulakh	CT	2018	Over the top	No injury or growth reduction with 25, 50 and 100 oz per acre applied twice.
33314	Pine (Pinus sp.) P. mugo 'Enci'	Field Container	Doohan	OH	2018	Over the top	No injury or growth reduction with 25, 50 and 100 oz per acre applied twice.
33314	Pine (Pinus sp.) P. mugo 'Pumilo'	Field Container	Moretti	OR	2018	Over the top	No injury or height reduction with 25, 50 and 100 oz per 1000 sq ft applied twice to actively growing plants.
33314	Pine (Pinus sp.) P. taeda	Field Container	Fraelich	GA	2016	Over the top	No injury at 4.3 and 8.6, and slight leaf burn at 17.0 and 34.0 gal per acre applied 3 times; no significant differences in plant height or width.
32858	Pine, Loblolly (Pinus taeda)	Field Container	Fraelich	GA	2016	Over the top	No injury with 4.3 and 8.6, slight with 17 and moderate with 34 gal per acre applied 3 times; no significant differences in plant growth and marketability. Biopesticide Program - B00102-16-GA01
32858	Pine, Loblolly (Pinus taeda)	Field Container	Marble	FL	2019	Over the top	Moderate injury with 25, severe and plant death with 50 and 100 fl oz per 1000 sq ft, applied twice.
33748	Laurel Cherry (Prunus laurocerasus) 'Otto Luyken'	Field Container	Moretti	OR	2018	Over the top	Application to dormant or actively growing plants at 50 and 100 oz/1000 sq ft once, or at 50 oz/1000 sq ft twice at 7- or 14- day intervals, or at 50 oz/1000 sq ft following a Pre herbicide once at 24 hr or twice at 24 hr and 14 days later. No injury fro
33748	Laurel Cherry (Prunus laurocerasus) 'Zabeliana'	Field Container	Neal	NC	2017	Over the top	Virtually no injury with 25, 50 and 100 oz per 1000 sq ft applied 3 times biweekly. Plants not vigorously growing at time of treatment; additional research needed to confirm results.
33733	Rhododendron (Rhododendron sp.) 'Red Ruffles'	Field Container	Wade	SC	2016	Over the top	Application to actively growing plants at 12.6, 25.2 and 50 oz/1000 sq ft 3 times biweekly. No injury or height reduction from all treatments.

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33733	Rhododendron (Rhododendron sp.) Rhododendron 'cilpinese'	Field Container	Seefeldt	WA	2019	Over the top	Moderate injury with 8.5, 17 and 34 gal per acre applied twice.
33733	Rhododendron (Rhododendron sp.) 'Southern Charm'	Field Container	Wade	SC	2017	Over the top	Application to actively growing azalea plants at 12.6, 25.2 and 50 oz/1000 sq ft 3 times biweekly. Moderate to severe injury and height reduction from all treatments; treated plants unmarketable.
33745	Rose (Rosa sp.) 'Louis Philippe'	Field Container	Wade	SC	2017	Over the top	Application to actively growing plants at 12.6, 25.2 and 50 oz/1000 sq ft 3 times biweekly. Moderate to severe injury and height reduction from all treatments; treated plants unmarketable.
33745	Rose (Rosa sp.) 'Old Blush'	Field Container	Wade	SC	2017	Over the top	Application to actively growing plants at 12.6, 25.2 and 50 oz/1000 sq ft 3 times biweekly. Moderate to severe injury and height reduction from all treatments; treated plants unmarketable.
33739	Rosemary (Rosmarinus officinalis) 'Angelina'	Field Container	Moretti	OR	2017	Over the top	Application to actively growing plants 3 times biweekly. Minor injury with 25, 50 and 100 oz per 1000 sq ft, each rate applied at both 40 and 180 gpa.
33739	Rosemary (Rosmarinus officinalis) 'Blue Spires'	Field Container	Wilen	CA	2017	Over the top	Acceptable injury with 25.2, unacceptable with 50 and 100 oz per 1000 sq ft; growth reduction only with 100 oz.
33713	Ravennagrass (Saccharum ravennae)	Field Container	Senesac	NY	2017	Over the top	Application to actively growing plants 3 times biweekly. No injury or height reduction with 25, 50, and 100 oz/1000 sq ft after 2 applications, moderate injury after 3rd applic with good recovery. No differences between spray volumes.
33713	Ravennagrass (Saccharum ravennae)	Field Container	Senesac	NY	2018	Over the top	Application to actively growing plants at 50 and 100 oz/1000 sq ft once, or at 50 oz/1000 sq ft twice at 7- or 14- day intervals, or at 50 oz/1000 sq ft once or twice at 14- day intervals following Isoxaben Pre. No or minor injury and no height reduction
33311	Little Bluestem (Schizachyrium scoparium) 'Prairie Blues'	Field Container	Neal	NC	2016	Over the top	Minor transient injury with dormant application of 25, 50 and 100 oz per 1000 sq ft.
33311	Little Bluestem (Schizachyrium scoparium) 'Standing Ovation'	Field Container	Moretti	OR	2018	Over the top	Application to dormant or actively growing plants at 50 and 100 oz/1000 sq ft once, or at 50 oz/1000 sq ft twice at 7- or 14- day intervals, or at 50 oz/1000 sq ft following a Pre herbicide once at 24 hr or twice at 24 hr and 14 days later. No injury or
33311	Little Bluestem (Schizachyrium scoparium) 'The Blues'	Field Container	Wilen	CA	2018	Over the top	No significant injury and growth reduction with 16 oz per 1000 sq ft applied once or twice, and with 32 oz per 1000 sq ft applied once.
33436	Stonecrop, Moss (Sedum acre)	Field Container	Senesac	NY	2018	Over the top	Severe injury with 25, 50 and 100 oz per 1000 sq ft applied twice.
33437	Stonecrop, White (Sedum album) 'Red Ice'	Field Container	Aulakh	CT	2018	Over the top	No injury or growth reduction with 25, 50 and 100 oz per acre applied twice.
33434	Stonecrop, Kamchatka (Sedum kamtschaticus)	Field Container	Neal	NC	2016	Over the top	Moderate to severe injury with dormant application of 25, 50 and 100 oz per 1000 sq ft.
33434	Stonecrop, Kamchatka (Sedum kamtschaticus)	Field Container	Senesac	NY	2018	Over the top	Severe injury with 25, 50 and 100 oz per 1000 sq ft applied twice.

PR#	Crop	Production Site	Researcher	State	Year	Application Type	Results
33438	Stonecrop, Jenny's (Sedum rupestre) 'Angelina'	Field Container	Moretti	OR	2017	Over the top	Application to actively growing plants 3 times biweekly. Severe injury with 25, 50 and 100 oz per 1000 sq ft, each rate applied at both 40 and 180 gpa.
33438	Stonecrop, Jenny's (Sedum rupestre) 'Angelina'	Field Container	Senesac	NY	2018	Over the top	Severe injury with 25, 50 and 100 oz per 1000 sq ft applied twice.
33717	Stonecrop (Sedum sp.) 'Autumn Joy'	Field Container	Reding	OH	2019	Over the top	Moderate to severe injury with 8.5, 17 and 34 gal per acre.
33717	Stonecrop (Sedum sp.) 'Touchdown Flame'	Field Container	Wilen	CA	2016	Over the top	Moderate to severe injury with 12.6, 25.2, 50 and 100 oz per 1000 sq ft.
33716	Stonecrop, Broadleaf (Sedum spathulifolium) 'Cape Blanco'	Field Container	Wilen	CA	2016	Over the top	Severe and unacceptable injury with 12.6, 25.2, 50 and 100 oz per 1000 sq ft.
33435	Stonecrop, Two-Row/Caucasian (Sedum spurium)	Field Container	Neal	NC	2016	Over the top	Moderate to severe injury with dormant application of 25, 50 and 100 oz per 1000 sq ft.
33722	Houseleek (Sempervivum sp.)	Field Container	Neal	NC	2016	Over the top	Moderate injury with dormant application of 25, 50 and 100 oz per 1000 sq ft.
33725	Bridal-Wreath (Spiraea sp.) 'Double Play Doozie'	Field Container	Reding	OH	2019	Over the top	Minor injury and growth reduction with 8.5, 17 and 34 gal per acre; treated plants marketable.
33725	Bridal-Wreath (Spiraea sp.) S. japonica 'Goldmound'	Field Container	Neal	NC	2016	Over the top	No to minor injury (highest rate) with dormant application of 25, 50, and 100 oz per 1000 sq ft.
33315	Yew (Taxus sp.) T. media 'Densiformis'	Field Container	Moretti	OR	2018	Over the top	No injury or height reduction with 25, 50 and 100 oz per 1000 sq ft applied twice to actively growing plants.
33320	Hybrid Yew (Taxus X media) 'Densiformis'	Field Container	Doohan	OH	2018	Over the top	No injury or growth reduction with 25, 50 and 100 oz per acre applied twice.
33320	Hybrid Yew (Taxus X media) 'Hicksii'	Field Container	Moretti	OR	2018	Over the top	No injury or height reduction with 25, 50 and 100 oz per 1000 sq ft applied twice to actively growing plants.
33740	Wall Germander (Teucrium chamaedrys)	Field Container	Wilen	CA	2017	Over the top	Acceptable injury with 25.2 and 50, unacceptable with 100 oz per 1000 sq ft; growth reduction only with 100 oz.
33316	Arborvitae, American (Thuja occidentalis) 'Emerald Green'	Field Container	Moretti	OR	2018	Over the top	Application to dormant or actively growing plants at 50 and 100 oz/1000 sq ft once, or at 50 oz/1000 sq ft twice at 7- or 14- day intervals, or at 50 oz/1000 sq ft following a Pre herbicide once at 24 hr or twice at 24 hr and 14 days later. No injury or h
33316	Arborvitae, American (Thuja occidentalis) 'Emerald Green'	Field Container	Wade	SC	2016	Over the top	Application to actively growing plants at 12.6, 25.2 and 50 oz/1000 sq ft 3 times biweekly. No injury or height reduction from all treatments.
33316	Arborvitae, American (Thuja occidentalis) T. plicata 'Green Giant'	Field Container	Neal	SC	2017	Over the top	Severe injury with 25, 50 and 100 oz per 1000 sq ft applied 3 times biweekly.
33319	Hemlock (Tsuga sp.)	Field Container	Miller	WA	2018	Over the top	No injury with 25, 50 and 100 oz pre acre applied twice.
33319	Hemlock (Tsuga sp.) T. canadensis	Field Container	Witcher	TN	2018	Over the top	No injury or growth reduction with 25, 50 and 100 oz per acre applied twice.

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33730	Arrowwood (Viburnum sp.) 'Sweet Viburnum'	Field Container	Wade	SC	2016	Over the top	Application to actively growing plants at 12.6, 25.2 and 50 oz/1000 sq ft 3 times biweekly. No injury with 12.6, Minor with the higher rates; minor height reduction from all treatments.

Appendix 1: Contributing Researchers

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