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IR-4 Ornamental Horticulture Program
BAS 440i (Afidopyropen) Crop Safety

Authors: Cristi L. Palmer and Ely Vea
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Susan Bierbrunner

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Abstract

BAS 440i (afidopyropen) is a new insecticide being developed by BASF for the control of piercing and sucking insect pests such as aphids, whiteflies, psyllids, scales and leafhoppers. The IR-4 Project completed 80 crop safety trials on 40 ornamental horticulture plant species or genera from 2015 through 2017. In these trials, eleven genera or species exhibited minimal or no injury after foliar applications in a minimum of 3 trials for each crop; these can be added to a list of tolerant plants in the new label for this active ingredient. All trials for 29 other species or genera exhibited minimal or no injury in the limited number of trials (one or two) for each crop.

Introduction

BAS 440i (afidopyropen) is a new insecticide being developed by BASF for the control of piercing and sucking insect pests such as aphids, whiteflies, psyllids, scales and leafhoppers. The IR-4 Project completed 80 crop safety trials on 40 ornamental horticulture plant species or genera from 2015 to 2017.

Materials and Methods

BAS 440i was applied as foliar treatment mixed with NIS typically thrice (3 times) at approximately 14 days intervals. The application rates were at 7, 14 and 28 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). Phytotoxicity was rated weekly up to 6 weeks after initial application. For IR-4 testing, the following protocols were used: 15-008, 16-008, and 17-008. For more detailed materials and methods, including application rates for various products, please visit http://ir4.rutgers.edu/ornamental/OrnamentalDrafts.cfm to view and download these protocols.

BAS 440i was supplied to researchers (See list of researchers in Appendix 1) by BASF.

Results and Summary

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

Phytotoxicity

Across all crops tested, BAS 440i exhibited no or minimal negative impact on all plant species or genera. Eleven of these crops had the minimum number of 3 tests for definitive conclusion of crop safety (Table 1). No crop displayed significant injury with BAS 440i (Tables 2 and 3). There are 29 species or genera where less than 3 trials were conducted so there is not enough information available at this time (Table 4). All trials for each of these crops showed no or minimal, transitory phytotoxicity.

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

Table 1. List of BAS 440i treated crops with no or minimal transitory injury.

Aster sp.
Astilbe simplicifolia
Delphinium sp.
Dianthus sp.
Digitalis purpurea
Echinacea sp.
Hedera sp.
Hydrangea sp.
Monarda didyma
Veronica longifolia
Zinnia sp.

Table 2. List of BAS 440i treated crops with no injury at 1X but significant injury at 2X or 4X.

None

Table 3. List of BAS 440i treated crops with significant injury at 1X.

None

Table 4. List of BAS 440i treated crops where more information is needed.

Angelonia angustifolia [2]
Begonia sp. [2]
Chrysanthemum/Dendranthema sp [1]
Coleus sp. [1]
Coreopsis grandiflora [1]
Coreopsis veticillata [1]
Cornus sp.
Cotoneaster sp. [2]
Dahlia sp. [1]
Euonymus sp. [2]
Euphorbia pulcherrima [1]
Gerbera sp. [2]
Helichrysum sp. [1]
Hibiscus sp. [2]
Lagerstroemia indica [2]
Leucanthemum x superbum [1]
Ligustrum sp. [1]
Nerium oleander [2]
Paeonia sp.
Papaver orientale [1]
Picea sp.
Platanus sp. [1]
Rhododendron sp. [2]
Rosa sp. [1]
Salix caprea [1]
Sedum sp. [1]
Solidago sp.
Taxus media [1]
Viburnum sp. [1]

[1] No injury in 1 trial
[2] No injury in 2 trials

Table 5. Detailed Summary of Crop Safety Testing with BAS 440i (afidopyropen)

Notes: Table entries are sorted by crop Latin name. Only those trials with research reports received by 3/19/2018 are listed below.

PR#	Crop	Production Site	Researcher	State	Year	Application Type	Results
32409	Narrowleaf Angelonia (Angelonia angustifolia) 'Anbluim Angelface'	Field Container	Davis	MI	2016	Foliar	No injury with 7, 14 and 28 fl oz per 100 gal applied 3 times.
32409	Narrowleaf Angelonia (Angelonia angustifolia) 'Serena Purple'	Field Container	Freiberger	NJ	2015	Foliar	No injury or growth reduction with 1.5, 3.5 and 14 fl oz per 100 gal applied 4 times.
32310	Columbine (Aquilegia sp.)	Field Container	Persad	OH	2016	Foliar	No significant injury or growth reduction with 1.5, 3.5 and 14 fl oz per 100 gal + UltraPure Oil applied 3 times.
32310	Columbine (Aquilegia sp.) A. caerulea 'Origami'	Field Container	Gilrein	NY	2016	Foliar	Moderate to severe injury with 7, 14 and 28 fl oz per 100 gal; significant growth reduction at 2X and 4X.
33446	Aster (Aster sp.) Professor Kippenburg	Field Container	Davis	MI	2017	Foliar	No significant injury with 7, 14 and 28 fl oz per 100 gal applied 4 times weekly.
33446	Aster (Aster sp.) Wood's Blue	Field Container	Davis	MI	2017	Foliar	No significant injury with 7, 14 and 28 fl oz per 100 gal applied 4 times weekly.
33446	Aster (Aster sp.) Wood's Pink	Field Container	Davis	MI	2017	Foliar	No significant injury with 7, 14 and 28 fl oz per 100 gal applied 4 times weekly.
32311	False Goat's Beard (Astilbe sp.) A. simplicifolia 'Hennie Graafland'	Field Container	Davis	MI	2016	Foliar	No injury with 7, 14 and 28 fl oz per 100 gal applied 3 times.
32311	False Goat's Beard (Astilbe sp.) Fanal	Field Container	Davis	MI	2017	Foliar	No significant injury with 7, 14 and 28 fl oz per 100 gal applied 4 times weekly.
32311	False Goat's Beard (Astilbe sp.) Rheinland	Field Container	Davis	MI	2017	Foliar	No significant injury with 7, 14 and 28 fl oz per 100 gal applied 4 times weekly.
32329	Begonia (Begonia sp.) 'Ambassador Pink'	Field Container	Freiberger	NJ	2015	Foliar	No injury or growth reduction with 1.5, 3.5 and 14 fl oz per 100 gal applied 4 times.
32329	Begonia (Begonia sp.) 'Super Olympia Mix'	Field Container	Reding	OH	2016	Foliar	No injury or growth reduction with 7, 14 and 28 fl oz per 100 gal + NIS applied 3 times biweekly; all plants marketable.
32714	Chrysanthemum x rubellum (Chrysanthemum x rubellum) Dendranthema zawadskii ‘Clara Curtis’	Field Container	Klett	CO	2016	Foliar	No injury or growth reduction with 7, 14 and 28 fl oz per 100 gal applied twice at 6-week intervals.
32315	Chrysanthemum, Garden (Chrysanthemum/Dendranthema sp.) 'Regal Cheryl Purple'	Field Container	Freiberger	NJ	2015	Foliar	No injury or growth reduction with 1.5, 3.5 and 14 fl oz per 100 gal applied 4 times.
32327	Coleus, Flamenettle (Coleus sp.) 'Dark Chocolate'	Field Container	Reding	OH	2016	Foliar	No injury or growth reduction with 7, 14 and 28 fl oz per 100 gal + NIS applied 3 times biweekly; all plants marketable.
32313	Tickseed, Golden (Coreopsis tinctoria) C. verticillata 'Moonbeam'	Field Container	Wade	SC	2016	Foliar	No injury or growth reduction with 7, 14 and 28 fl oz per 100 gal + Ultra-Pure Oil applied 3 times; all plants marketable.

PR#	Crop	Production Site	Researcher	State	Year	Application Type	Results
32313	Tickseed, Golden (Coreopsis tinctoria) C. grandiflora 'Early Sunrise'	Field Container	Davis	MI	2016	Foliar	No injury with 7, 14 and 28 fl oz per 100 gal applied 3 times.
32299	Dogwood (Cornus sp.) C. alba 'Ivory Halo'	Field Container	Gilrein	NY	2016	Foliar	No injury or growth reduction with 7, 14 and 28 fl oz per 100 gal.
32299	Dogwood (Cornus sp.) C. officinalis	Field Container	Persad	OH	2016	Foliar	No significant injury or growth reduction with 7, 14 and 28 fl oz per 100 gal + UltraPure Oil applied 3 times.
32304	Cotoneaster (Cotoneaster sp.) C. adpressus 'Tom Thumb'	Field Container	Reding	OH	2016	Foliar	No injury with 7, 14 and 28 fl oz per 100 gal + NIS applied 3 times biweekly; slight growth reduction; all plants marketable.
32304	Cotoneaster (Cotoneaster sp.) 'Coral Beauty'	Field Container	Wade	SC	2016	Foliar	No injury or growth reduction with 7, 14 and 28 fl oz per 100 gal + Ultra-Pure Oil applied 3 times; all plants marketable.
32326	Dahlia (Dahlia sp.) 'Hypnotica Purple Bicolor'	Field Container	Reding	OH	2016	Foliar	No injury or growth reduction with 7, 14 and 28 fl oz per 100 gal + NIS applied 3 times biweekly; all plants marketable.
32314	Larkspur (Delphinium sp.)	Field Container	Uber	CA	2016	Foliar	No injury or growth reduction with 7, 14 and 28 fl oz per 100 gal + Capsil applied 3 times.
32314	Larkspur (Delphinium sp.) D. belladonna 'Summer Blue'	Field Container	Gilrein	NY	2016	Foliar	No injury or growth reduction with 7, 14 and 28 fl oz per 100 gal.
32314	Larkspur (Delphinium sp.) 'Summer Morning'	Field Container	Reding	OH	2016	Foliar	No injury or growth reduction with 7, 14 and 28 fl oz per 100 gal + NIS applied 3 times biweekly; all plants marketable.
32316	Pink (Dianthus sp.) 'Amazon Rose Magic'	Field Container	Freiberger	NJ	2015	Foliar	No injury or growth reduction with 1.5, 3.5 and 14 fl oz per 100 gal applied 4 times.
32316	Pink (Dianthus sp.) Dianthus gratianopolitanus ‘Firewitch’	Field Container	Klett	CO	2016	Foliar	No injury or growth reduction with 7, 14 and 28 fl oz per 100 gal applied twice at 6-week intervals.
32316	Pink (Dianthus sp.) "Super Trooper Velvet Red'	Field Container	Reding	OH	2016	Foliar	No injury or growth reduction with 7, 14 and 28 fl oz per 100 gal + NIS applied 3 times biweekly; all plants marketable.
32317	Foxglove, Purple (Digitalis purpurea) 'Camelot Rose'	Field Container	Reding	OH	2016	Foliar	No injury or growth reduction with 7, 14 and 28 fl oz per 100 gal + NIS applied 3 times biweekly; all plants marketable.
32317	Foxglove, Purple (Digitalis purpurea) Dalmatian Peach	Field Container	Davis	MI	2017	Foliar	No significant injury with 7, 14 and 28 fl oz per 100 gal applied 4 times weekly.
32317	Foxglove, Purple (Digitalis purpurea) Dalmatian Rose	Field Container	Davis	MI	2017	Foliar	No significant injury with 7, 14 and 28 fl oz per 100 gal applied 4 times weekly.
32312	Purple Coneflower (Echinacea sp.)	Field Container	Persad	OH	2016	Foliar	No injury or significant growth reduction with 1.5, 3.5 and 14 fl oz per 100 gal + UltraPure Oil applied 3 times.
32312	Purple Coneflower (Echinacea sp.)	Field Container	Uber	CA	2016	Foliar	No injury or growth reduction with 7, 14 and 28 fl oz per 100 gal + Capsil applied 3 times.
32312	Purple Coneflower (Echinacea sp.) Echinacea Supreme™ ‘Flamingo’	Field Container	Klett	CO	2016	Foliar	No injury or growth reduction with 7, 14 and 28 fl oz per 100 gal applied twice at 6-week intervals.

PR#	Crop	Production Site	Researcher	State	Year	Application Type	Results
32312	Purple Coneflower (Echinacea sp.) 'Pow Wow Wild Berry'	Field Container	Reding	OH	2016	Foliar	No injury or growth reduction with 7, 14 and 28 fl oz per 100 gal + NIS applied 3 times biweekly; all plants marketable.
32306	Spindletree (Euonymus sp.) E. fortunei 'Gold Splash'	Field Container	Reding	OH	2016	Foliar	No injury or growth reduction with 7, 14 and 28 fl oz per 100 gal + NIS applied 3 times biweekly; all plants marketable.
32306	Spindletree (Euonymus sp.) 'Wintercreeper'	Field Container	Wade	SC	2016	Foliar	No injury or growth reduction with 7, 14 and 28 fl oz per 100 gal + Ultra-Pure Oil applied 3 times; all plants marketable.
32331	Poinsettia (Euphorbia pulcherrima) Ascot Rainbow	Greenhouse	Davis	MI	2017	Foliar	No significant injury with 7, 14 and 28 fl oz per 100 gal
32331	Poinsettia (Euphorbia pulcherrima) 'Jubilee Red'	Greenhouse	Freiberger	NJ	2016	Foliar	No injury or growth or growth reduction with 7, 14 and 28 fl oz per 100 gal applied 3 times weekly.
32330	Transvaal Daisy (Gerbera sp.) 'Festival Grower Select Mix'	Field Container	Reding	OH	2016	Foliar	No injury or growth reduction with 7, 14 and 28 fl oz per 100 gal + NIS applied 3 times biweekly; all plants marketable.
32330	Transvaal Daisy (Gerbera sp.) 'Royal Premium Mix'	Field Container	Freiberger	NJ	2015	Foliar	No injury or growth reduction with 1.5, 3.5 and 14 fl oz per 100 gal applied 3 times.
32303	Ivy (Hedera sp.)	Field Container	Davis	MI	2016	Foliar	No injury with 7, 14 and 28 fl oz per 100 gal applied 3 times.
32303	Ivy (Hedera sp.) English Ivy	Field Container	Wade	SC	2016	Foliar	No injury or growth reduction with 7, 14 and 28 fl oz per 100 gal + Ultra-Pure Oil applied 3 times; all plants marketable.
32303	Ivy (Hedera sp.) H. helix	Field Container	Fraelich	GA	2016	Foliar	No injury or difference in plant growth and marketability with 7, 14 and 28 fl oz per 100 gal applied 3 times.
32318	Strawflower (Helichrysum sp.) 'Licorice'	Field Container	Reding	OH	2016	Foliar	No injury or growth reduction with 7, 14 and 28 fl oz per 100 gal + NIS applied 3 times biweekly; all plants marketable.
32319	Rosemallow (Hibiscus sp.) 'Brilliant Red'	Field Container	Wade	SC	2016	Foliar	No injury or growth reduction with 7, 14 and 28 fl oz per 100 gal + Ultra-Pure Oil applied 3 times; all plants marketable.
32319	Rosemallow (Hibiscus sp.) H. moscheutos ‘Luna Rose’	Field Container	Davis	MI	2016	Foliar	No injury with 7, 14 and 28 fl oz per 100 gal applied 3 times.
32302	Hydrangea (Hydrangea sp.) H. macrophylla	Field Container	Uber	CA	2016	Foliar	No injury or growth reduction with 7, 14 and 28 fl oz per 100 gal + Capsil applied 3 times.
32302	Hydrangea (Hydrangea sp.) 'Nikko Blue'	Field Container	Fraelich	GA	2016	Foliar	No injury with 7, 14 and 28 fl oz per 100 gal applied 3 times; moderate stunting at 4X; all plants marketable.
32302	Hydrangea (Hydrangea sp.) 'Nikko Blue'	Field Container	Wade	SC	2016	Foliar	No injury or growth reduction with 7, 14 and 28 fl oz per 100 gal + Ultra-Pure Oil applied 3 times; all plants marketable.
32302	Hydrangea (Hydrangea sp.) 'Quick Fire'	Field Container	Persad	OH	2016	Foliar	No significant injury or growth reduction with 7, 14 and 28 fl oz per 100 gal + UltraPure Oil applied 3 times.

PR#	Crop	Production Site	Researcher	State	Year	Application Type	Results
32309	Crape Myrtle (Lagerstroemia indica)	Field Container	Koivunen	CA	2016	Foliar	No injury with 7, minor injury (brown interveinal spots) with complete recovery at 14 and 28, fl oz per 100 gal + Dyne-Amic applied 3 times biweekly; no growth reduction.
32309	Crape Myrtle (Lagerstroemia indica) 'Natchez'	Field Container	Wade	SC	2016	Foliar	No injury or growth reduction with 7, 14 and 28 fl oz per 100 gal + Ultra-Pure Oil applied 3 times; all plants marketable.
33004	Daisy (Leucanthemum x superbum) 'Snow Lady'	Field Container	Davis	MI	2016	Foliar	No injury with 7, 14 and 28 fl oz per 100 gal applied 3 times.
32307	Privet (Ligustrum sp.) Wax Privet	Field Container	Wade	SC	2016	Foliar	No injury or growth reduction with 7, 14 and 28 fl oz per 100 gal + Ultra-Pure Oil applied 3 times; all plants marketable.
32323	Bee Balm, Scarlet (Monarda didyma) 'Balmy Purple'	Field Container	Reding	OH	2016	Foliar	No injury or growth reduction with 7, 14 and 28 fl oz per 100 gal + NIS applied 3 times biweekly; all plants marketable.
32323	Bee Balm, Scarlet (Monarda didyma) Blue Stocking	Field Container	Davis	MI	2017	Foliar	No significant injury with 7, 14 and 28 fl oz per 100 gal applied 4 times weekly.
32323	Bee Balm, Scarlet (Monarda didyma) Marshall's Delight	Field Container	Davis	MI	2017	Foliar	No significant injury with 7, 14 and 28 fl oz per 100 gal applied 4 times weekly.
32301	Oleander, Rosebay (Nerium oleander)	Field Container	Koivunen	CA	2016	Foliar	No injury with 7, minor injury on flower (browning at edges) with complete recovery at 14 and 28, fl oz per 100 gal + Dyne-Amic applied 3 times biweekly; no growth reduction.
32301	Oleander, Rosebay (Nerium oleander) 'Cardinal Red'	Field Container	Wade	SC	2016	Foliar	No injury or growth reduction with 7, 14 and 28 fl oz per 100 gal + Ultra-Pure Oil applied 3 times; all plants marketable.
32324	Peony (Paeonia sp.)	Field Container	Davis	MI	2017	Foliar	No significant injury with 7, 14 and 28 fl oz per 100 gal applied 4 times weekly.
32322	Oriental Poppy (Papaver orientale) Champagne Bubble Mix	Field Container	Davis	MI	2017	Foliar	No significant injury with 7 and 14, minor with complete recovery with 28 fl oz per 100 gal applied 4 times weekly.
32322	Oriental Poppy (Papaver orientale) 'Pizzicato Mix'	Field Container	Reding	OH	2016	Foliar	No injury or growth reduction with 7, 14 and 28 fl oz per 100 gal + NIS applied 3 times biweekly; all plants marketable.
32294	Spruce (Picea sp.) P. omorika 'Serbian spruce'	Field Container	Gilrein	NY	2016	Foliar	No injury or growth reduction with 7, 14 and 28 fl oz per 100 gal.
32298	Plane Tree, Sycamore (Platanus sp.)	Field Container	Koivunen	CA	2016	Foliar	No significant injury with 7, minor to moderate injury (browning of youngest leaves) with complete recovery at 14 and 28, fl oz per 100 gal + Dyne-Amic applied 3 times biweekly; no growth reduction.

PR#	Crop	Production Site	Researcher	State	Year	Application Type	Results
32293	Azalea (Rhododendron sp.)	Field Container	Wade	SC	2016	Foliar	No injury or growth reduction with 7, 14 and 28 fl oz per 100 gal + Ultra-Pure Oil applied 3 times; all plants marketable.
32293	Azalea (Rhododendron sp.) 'Pink Gumpo'	Field Container	Fraelich	GA	2016	Foliar	No injury or difference in plant growth and marketability with 7, 14 and 28 fl oz per 100 gal applied 3 times.
32296	Rose (Rosa sp.) 'Oso Easy Fragrant Spreader'	Field Container	Reding	OH	2016	Foliar	No injury or growth reduction with 7, 14 and 28 fl oz per 100 gal + NIS applied 3 times biweekly; all plants marketable.
32297	Willow (Salix sp.) S. caprea 'French Pussy'	Field Container	Reding	OH	2016	Foliar	No injury or growth reduction with 7, 14 and 28 fl oz per 100 gal + NIS applied 3 times biweekly; all plants marketable.
32325	Stonecrop (Sedum sp.) 'Angelina'	Field Container	Reding	OH	2016	Foliar	No injury or growth reduction with 7, 14 and 28 fl oz per 100 gal + NIS applied 3 times biweekly; all plants marketable.
32321	Goldenrod (Solidago sp.) S. canadensis 'Solidago Little Lemon'	Field Container	Gilrein	NY	2016	Foliar	No injury or growth reduction with 7, 14 and 28 fl oz per 100 gal.
32305	Yew (Taxus sp.) T. media 'Margarita'	Field Container	Reding	OH	2016	Foliar	No injury or growth reduction with 7, 14 and 28 fl oz per 100 gal + NIS applied 3 times biweekly; all plants marketable.
32305	Yew (Taxus sp.) T. x media ‘Hicksii	Field Container	Persad	OH	2016	Foliar	No significant injury or growth reduction with 7, 14 and 28 fl oz per 100 gal + UltraPure Oil applied 3 times.
32320	Speedwell, Brooklime (Veronica sp.) Georgia Blue	Field Container	Davis	MI	2017	Foliar	No significant injury with 7, 14 and 28 fl oz per 100 gal applied 4 times weekly.
32320	Speedwell, Brooklime (Veronica sp.) Giles van Hees	Field Container	Davis	MI	2017	Foliar	No significant injury with 7, 14 and 28 fl oz per 100 gal applied 4 times weekly.
32320	Speedwell, Brooklime (Veronica sp.) V. longifolia ‘Candied Candle’	Field Container	Davis	MI	2016	Foliar	No injury with 7, 14 and 28 fl oz per 100 gal applied 3 times.
32300	Arrowwood (Viburnum sp.)	Field Container	Wade	SC	2016	Foliar	No injury or growth reduction with 7, 14 and 28 fl oz per 100 gal + Ultra-Pure Oil applied 3 times; all plants marketable.
32410	Zinnia (Zinnia sp.) 'Magnificent Mix'	Field Container	Freiberger	NJ	2015	Foliar	No injury or growth reduction with 1.5, 3.5 and 14 fl oz per 100 gal applied 4 times.
32410	Zinnia (Zinnia sp.) 'Profusion 5 Color Mix'	Field Container	Reding	OH	2016	Foliar	No injury or growth reduction with 7, 14 and 28 fl oz per 100 gal + NIS applied 3 times biweekly; all plants marketable.
32410	Zinnia (Zinnia sp.) Z. angustifolia	Field Container	Fraelich	GA	2016	Foliar	No injury or difference in plant growth and marketability with 7, 14 and 28 fl oz per 100 gal applied 3 times.

Label Suggestions

In this report, eleven genera exhibited no or minimal injury after foliar treatments of BAS 440i (afidopyren) at 7, 14 and 28 fl oz per 100 gal. If tested crops will be listed on the label, these can be included in a future label:

Aster sp.
Astilbe simplicifolia
Delphinium sp.
Dianthus sp.
Digitalis purpurea
Echinacea sp.
Hedera sp.
Hydrangea sp.
Monarda didyma
Veronica longifolia
Zinnia sp.

Given the lack of phytotoxicity across so many different plant species and genera, it is suggested that a general statement can be placed on the label such as 'has not been demonstrated to cause damage on various ornamental plant species according to labeled use instructions. BAS 440i may be used on a wide number of crops, but must be tested on a limited portion of the crop prior to applying to the whole crop if the grower has no previous experience applying BAS 440i to that crop'.

Appendix 1: Contributing Researchers

Mr. Terry Davis	Michigan State University Dept. of Entomology 243 Natural Sciences Building East Lansing, MI 48824
Mr. Ben Fraelich	USDA-ARS P. O. Box 748 Tifton, GA 31793
Mr. Tom Freiberger	Rutgers University Cream Ridge Experiment Station 283 Rt. 539 Cream Ridge, NJ 08514
Dr. Marja Koivunen	BBS Ag Research and Consulting PO Box 390 Yolo, CA 95697
Dr. Anand Persad	The Davey Institute 1500 N, Mantua St. Kent, OH 44240
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, CA92082
Mr. Paul Wade	USDA-ARS US Vegetable Laboratory 2700 Savannah Highway Charleston SC 29414