IR-4 Project

Pest management solutions for specialty crops and specialty uses

2025 ANNUAL REPORT

Prepared by IR-4 Headquarters

ANNUAL REPORT OF THE IR-4 PROJECT
January 1, 2025 - December 31, 2025

1. Introduction

Founded by the U.S. Congress in 1963, the IR-4 Project supports specialty crop growers through its mission of securing legal access to essential pest management tools to manage insects, diseases, weeds, and other pests in production agriculture. IR-4 facilitates the registration of chemical and bio-based pesticides as well as emerging and novel pesticides for use on specialty crops such as fruits, vegetables, nuts, herbs, and ornamentals, as well as minor use cases for major commodities like corn, cotton, soybeans, and wheat. Because registrations on specialty crops and minor uses often don't provide enough profit incentive for private-sector research and development, IR-4 works to facilitate these registrations and bridge this gap. This is accomplished by generating critical data and collaborating with various specialty crop stakeholders, including government and non-government organizations (see Attachment 1: Participants in the Process). IR-4 ensures farmers have the tools they need to combat pests and produce healthy harvests. IR-4's research projects/activities include:

- Conducting U.S. Environmental Protection Agency (EPA) guideline "Magnitude of the Residue Studies." This gives EPA accurate exposure data needed to perform dietary risk assessments associated with potential product registrations.
- Product performance testing (efficacy/crop safety projects) on food and non-food ornamental crops. This provides assurances that the use of a crop protection product is safe and effective.
- Submitting proposals to the EPA and other regulatory authorities to expand crop groups/subgroups that allow data from a few representative crops to cover many crops.
- Performing Integrated Solutions Platform research projects, which explore a wide range of available crop protection tools (chemical pesticides, biopesticides and emerging technologies) to identify solutions for hard-to-manage pests, prevent or better manage pest resistance to pesticides, and mitigate pesticide residues in the final food product. Integrated Solutions Platform projects also address the management of pests in organic crop production systems.
- Assisting with the registration of biopesticides and other emerging technologies discovered/developed by public sector scientists.
- Facilitating harmonization of global pesticide regulations to assist domestic specialty crop growers' ability to export fruits, vegetables and other specialty crops to international markets.

2. Successes in 2025

Food Crop Program:
EPA publication of actions that established **3** new tolerances for **3** active ingredients. These tolerances support **3** potential new uses on food crops (Attachment 2).

This number of potential new registrations supported by IR-4 data represents a fairly significant reduction compared to previous years. A number of items contributed to the reduced number of new tolerances/uses that were published in 2025. Disruptions in items moving through EPA are typical of any change in administration, but the issue was compounded by a significant loss of staff followed by a reorganization that resulted in the loss of the Minor Use Branch. Additionally, a lengthy government shutdown in the latter half of the year also impacted EPA activities.

Environmental Horticulture Program:
At this time, IR-4 does not have an accurate assessment of new registrations achieved in 2025. This information will be obtained during the second quarter 2026 with responses to inquiries from cooperating industry registrants.

3. Registration Support Actions in 2025

Food Crop Program:

- IR-4 submitted to EPA **9** tolerance petitions and **1** non-PRIA submission of two data packages - these covered **44** unique requests (PR #s) for assistance and crop group tolerance updates (Attachment 3).
- **12** data packages containing results of an EPA Magnitude of the Residue study were completed but not submitted.
- **20** draft final reports of Magnitude of the Residue studies were submitted to IR-4's Quality Assurance Unit for Good Laboratory Practice compliance auditing.
- **32** Product Performance reports and **1** Integrated Solutions report were posted and provided to cooperating companies.

Biopesticide Regulatory Support actions and activities included:

- Biopesticide submissions were made for (1) bacteriophages of *Varroa* mites of honeybees and (2) Experimental Use Permit and tolerance petition exemption for Five Generation 2 CTV-SoD2* Constructs to suppress the symptoms of Huanglongbing (Citrus greening).
- Follow-up documentation was submitted to EPA for previous submissions for (1) attenuated Cucumber Green Mottle Mosaic Virus Strain ON-BM3 vaccine; (2) CarriCea T1 Citrus Rootstock with resistance or tolerance to Huanglongbing (citrus greening); (3) Citrus tristeza virus Expressing Spinach Defensin Protein SoD 2 in citrus fruits for resistance or tolerance to Huanglongbing (citrus greening); (4) sterile *Helicoverpa zea* moths and (5) storage stability and corrosion data were submitted as terms of registration for FourSure (a mixture of four atoxigenic strains of *Aspergillus flavus)*.
- For CarriCea T1 resistant citrus rootstock, the exemption from the requirement of a tolerance for residues of the SpCas9 protein when used as a plant-incorporated protectant was published in the Federal Register on December 16, 2025.
- For the attenuated Cucumber Green Mottle Mosaic Virus Strain ON-BM3 vaccine, the notice of receipt was published in the Federal Register on December 16, 2025.

Environmental Horticulture Program:

Thirteen research summaries were written and/or updated to support new or existing registrations, provided to registrants, and posted on the IR-4 website (see summaries in Attachment 6); **4,435** field and greenhouse trials contributed to these summaries; trials came from the following IR-4 Units:

- North Central Region: 645 trials
- Northeast Region: 615 trials
- Southern Region: 1936 trials
- Western Region: 1021 trials
- ARS cooperative sites: 192 trials
- Canadian partners: 26 trials

4. Research in 2025

Food Crop Program - Summary of Research Studies / Projects

- **37** new Magnitude of the Residue Studies (Attachment 4); **346** total field trials (309 New/37 Carryover)
- **79** Product Performance projects (Attachment 5; 28 carryover projects; 51 new projects) involving **149** efficacy/crop safety trials (53 carryover trials; 96 new trials)
- **17** field trials that contributed to **15** Integrated Solutions carryover projects
- IR-4 Quality Assurance Unit performed activities to help ensure that IR-4 remained compliant with EPA's Good Laboratory Practice Regulations; activities include:
  - 0 Protocol audits
  - 8 Facility audits

- 125 In-life Inspections of field sites
- 68 In-life Inspections of analytical laboratories
- 198 Field Databook audits
- 47 Analytical Summary Report audits
- 28 Final Report audits
- 4 Amended Report audit
- 22 Second Final Report audit
- 4 Amended Second Final Report audit

- IR-4 successfully completed **12** inspections by EPA, and QA audited **3** contributing scientist reports. The Quality Assurance unit also completed a total of 2 validation in-life inspections, 2 final report audits and 2 second final report audits for the eFDB and eQA software systems. **Eleven** people were trained to utilize the eQA/eDocs system.

Environmental Horticulture Program - Summary of Research Studies / Projects

- The Environmental Horticulture Program conducted **602** field and greenhouse trials (157 efficacy, 445 crop safety) that contributed to **21** projects (see research trial details in Attachment 7).

Comprehensive Summary - 2025 Research Trial Distribution

Cooperating Region	Food Use Residue Trials[1]	Food Use Product Performance Trials[1]	Integrated Solutions Trials[2]	Environ. Hort. Product Performance Trials
North Central Region	67 (2)	18 (3)	3	79
Northeast Region	31 (3)	12 (8)	1	76
Southern Region	69 (10)	26 (16)	4	208
Western Region	123 (20)	40 (26)	9	146
ARS Sites	41 (2)	0	0	93
Canadian Sites	15 (0)	0	0	0
TOTAL	**346 (37)**	**149**	**17**	**602**

Analytical Laboratory Status - Number of Studies

Laboratory	Awaiting Analysis	Analysis in Progress	Waiting on Storage Stability	Analysis Complete Preparing Report
Southern Region Lab	11	6	5	9
Western Region Lab	14	9	10	18

[1] Data presented as total number of trials with number in parenthesis being the number of carryover trials.
[2] Only carryover IS trials were conducted in 2025.

ARS Tifton Lab	10	1	4	4
ARS Wapato Lab[3]	0	0	0	6
Other Labs	16	1	3	16
TOTAL	**51**	**17**	**22**	**53**

5. Impacts of IR-4 Activities

The IR-4 Project delivers measurable results to both food and non-food specialty crop growers by assisting in the registration of safe, effective pest management tools. As the nation's sole publicly-funded program dedicated to generating the necessary regulatory data, IR-4 serves a unique and vital role in the U.S. agricultural landscape. IR-4's work generates many positive impacts, including:

- New pesticide registrations help producers grow high-quality food and ornamental crops while respecting the environment. This also has significant economic benefits, helping farmers remain profitable and boosting rural economies. Food processors and food retailers benefit from having a consistent supply of high-quality produce and/or raw materials to meet consumer demand and keep their processing facilities open and operational. The public benefits from having an abundant choice of healthy vegetables, fruits, nuts and other foods available at reasonable prices, as well as having ornamental horticulture plants to enhance the environment and contribute to our well-being. Specialty crops are a vital part of American dietary recommendations. IR-4's actions also prevent food waste throughout the supply chain from the farm to the consumer.
- The IR-4 Project has been a major contributor to the advancement of Integrated Pest Management (IPM) tactics through the approval of crop protection tools that give producers suitable options to manage destructive pests that disrupt advanced IPM systems.
- IR-4's Integrated Solutions Platform evaluates diverse pest management strategies and technologies that specialty crop growers can incorporate into existing crop protection programs to meet their complex needs. Goals of this work include reducing chemical residues in food, supporting organic growers, addressing pest resistance, and, in some cases, developing lower-risk solutions to unsolved pest problems.
- IR-4 continues to work with the EPA to expand and enhance US crop grouping regulations. Crop groups allow the collection of residue data on a small number of representative crops and extend the use of the exposure values to a much larger number of similar crops in the crop group or subgroup. There are huge cost savings, as crop-grouping extrapolation allows IR-4 and others in the regulated community to use resources smartly and efficiently. In 2025, no new Final Rules for US crop grouping updates were approved, although efforts are underway for the next phase of revisions. IR-4 has completed its efforts with the Codex Committee on Pesticide Residues (CCPR) to revise and expand the Codex Classification of Food and Animal Feeds.
- The Environmental Horticulture Program continues to support an industry valued at nearly $19.2 billion in annual sales (Horticulture Census, 2019, NASS). This industry is quite complex because growers cover diverse markets including flowers, bulbs, houseplants, perennials, trees, shrubs and more. These plants are grown and maintained in greenhouses, nurseries, commercial/residential landscapes, interiorscapes, Christmas tree farms and sod farms—all of which have unique pest management needs.

6. Congressional Appropriations and Other Funding

[3] ARS Wapato Lab was closed at the end of 2025. Remaining reports are being prepared elsewhere.

Summary of IR-4 Funding ($20 million)

Source	Amount	Administration	Activities covered
USDA-Minor Crop Pest Management (IR4) grant	$15.0 million	Competitive four-year grant to NC State, renewed in 2025	All core IR-4 research program and activities
USDA-ARS	$3.5 million	Contribute to and supports IR-4 research priorities	Funding of USDA-ARS scientists and activities
National Research Support Program (NRSP-4)	$0.5 million	Competitive five-year grant awarded to NC State, renewed in 2025	Salaries and research coordination activities of IR-4 Headquarters
Various industry contributions	$1.05 million	Unrestricted donations to IR-4 Project	All IR-4 Project activities and expenses

In-Kind Contributions Estimates ($20,168,127)

Estimate	Source
$2,774,800	SAES/land grant universities by hosting IR-4 field research centers, analytical laboratories and management offices throughout the United States
$2,143,327	EPA Pesticide Registration Improvement Act fee waivers
$15,000,000	Crop protection industry
$250,000	The government of Canada via joint research projects

Expenditures supported by USDA-Minor Crop Pest Management (IR4) funds[4]

Amount	Use
$5,593915	Distributed to the four IR-4 Regional offices and Headquarters for non-laboratory personnel, supplies, equipment and other core expenses
$3,127,958	Distributed to the analytical laboratories for personnel, supplies, equipment and other expenses associated with laboratory analysis.
$2,563,217	Allocated to field trials for residue studies
$1,199,448	Allocated to field trials for product performance research
$331,111	Allocated for field trials that develop data in IR-4 Integrated Solutions research

[4] All values include 11.1 % indirect costs that are shared with the various institutions involved with IR-4.

$792,085	Allocated for field trials that develop product performance data in ornamental crops
$1,125,600	Kept by NIFA to help fund their operations

Additional Expenditures Supported by Industry Contributions

Amount	Use
$356,734	Salary and Fringe
$127,085	Travel
$110,363	Meetings
$119,905	Additional Research
$24,404	Indirect/fees to cover NC State operations

7. New Requests for Assistance / Plans for the Future

Food Crop Program

- New Requests
    - 161 new requests were entered into the IR-4 food use database, of which 150 were new stakeholder requests and 11 were created by HQ for crop group tolerance revisions, referencing old PR#s, eFDB & eQA System Validations etc. The comprehensive total at the end of 2025 was 13,992.
    - The IS program received 26 new requests.
- Priority Setting
    - IR-4 stakeholders prioritized “researchable” Requests for Assistance at the 2025 Food Use Workshop and identified 36 Magnitude of the Residue Studies. One more Magnitude of Residue Studies was prioritized by IR-4 HQ/RFCs after the FUW. About 92% of these studies also require efficacy and crop safety data (33 studies out of 36 “A” priorities require product performance testing). The stakeholders also identified 8 product performance-only projects (H+ projects) and an additional 6 projects were selected by IR-4 HQ/RFCs after the FUW.
    - Eleven IS projects were selected as the highest priority for research in 2026. Two studies will be sponsored by third parties. Due to the pausing of the IS platform, the remaining 9 studies not be funded for the time being.
    - Biopesticide Regulatory Support - New biopesticide regulatory support projects, including (1) MAGNET, an insect attractant; (2) US-812, a CRISPR-edited citrus rootstock with improved resistance to Huanglongbing (citrus greening) and (3) genetically engineered (GE) New World Screwworm (NWS), developed by USDA, ARS were approved utilizing the biopesticide vetting process.
- Future Research
    - In the 2026 Food Crop Program, IR-4 will be focusing on the new research priorities, as well as some carryover projects (280 Magnitude of the Residue trials, 126 Product Performance trials, and an estimated 27 Integrated Solutions trials).

Environmental Horticulture Program

- IR-4 will conduct the planned first year of data development for priorities from the 2025 Environmental Horticulture Workshop. These research projects will be the focus of 2026:

- National Priorities - Weed Science
    - Hydrangea (not macrophylla) pre-emergent herbicide crop safety
    - Herbicide-resistant weed control in Christmas tree production; early post-emergent, semi-directed
    - Cut flower pre-emergent (transplant)
    - Perennial weed (thistle, bindweeds, nutsedges) control in cut peony
- National Priorities - Plant Pathology
    - Phytopythium Efficacy
    - Phytophthora Efficacy
    - Botrytis Efficacy
- National Priorities - Entomology
    - Thrips (parvispinus, chili and western flower) Efficacy
    - Red-headed flea beetle (1st / 2nd instar larvae) efficacy—container nursery
    - Root aphid efficacy
- Regional Priorities - Northeast Region
    - Balsam gall midge efficacy on Christmas trees
    - Bacterial leaf spot efficacy
- Regional Priorities - North Central Region
    - Powdery mildew (outdoors) efficacy
    - Lewis mite efficacy
- Regional Priorities - Western Region
    - Symphylans efficacy
    - Armored scale efficacy—woody ornamentals
- Regional Priorities - Southern Region
    - Two-spotted cotton leafhopper (cotton jassid) efficacy
    - Herbicides in container, fruit-bearing plant (pre-sale to retail) crop safety

Summary of Planned 2026 Food Program Research Trial Distribution:

Cooperating Region	Food Use Residue Trials[5]	Food Use Product Performance Trials[6]	Integrated Solutions Trials[7]	2026 Environmental Horticulture Product Performance (Crop Safety/Efficacy)
North Central Region	56 (6)	17 (2)	4	2/9
Northeast Region	22 (2)	14 (1)	3	2/9
Southern Region	57 (4)	22 (5)	7	7/17
Western Region	119 (9)	43 (22)	13	3/12
ARS Sites	28 (1)	0	0	1/1
Canadian Sites	9 (0)	0	0	0/0
TOTAL	291 (22)	96 (30)	27	15/48

[5] Data presented as total number of trials and the number of carryover trials in parenthesis.
[6] 2026 product performance trial allocations may be subject to change.
[7] These trials have been deferred by one year following the 2025 priority selection at the Milwaukee Food Use Workshop. These trial allocations may be subject to change.

PRESENTATIONS/POSTERS

Axtel, A. 2025. Biosolutions Conference and Expo. The IR-4 Project: Helping Specialty Crop Growers Address Pest Management Issues. February 18-20, 2025, Fresno, CA.

Axtel, A. 2025. Pest Management Center Priority Workshop. Advancing Crop Protection through IR-4 and AAFC-PMC Collaboration. March 24-26, 2025, Ottawa, Canada.

Axtel, A. & Moore, P. Hemp IPM Virtual Workshop. An Update on the IR-4's Efforts in Support of Hemp Growers. April 16, 2025 (virtual presentation).

Axtel, A. 2025. Annual Cumberland Shenandoah Fruit Workers Conference. An Update from the IR-4 Project. December 4, 2025, Shenandoah, WV.

Batts, R. B., J. Patel, A. Axtell, J. J. Baron, D. Carpenter, and H. Ross. 2025. IR-4 Project: Success and Benefits to Specialty Crop Growers. Proc. Northeast Weed Science Society annual meeting. Annapolis, MD, January 2025. (poster)

Batts, R.B. 2025. IR-4: Weed Control Project Updates – Food Crops. Proc. Northeast Weed Science Society annual meeting. Annapolis, MD, January 2025 (presentation).

Batts, R. B., J. Patel, A. Axtell, J. J. Baron, D. Carpenter, and H. Ross. 2025. IR-4 Project: Success and Benefits to Specialty Crop Growers. Southeast Regional Fruit & Vegetable conference, Savannah, GA Jan 2025 (poster).

Batts, R. B., J. Patel, A. Axtell, J. J. Baron, D. Carpenter, and H. Ross. 2025. IR-4 Project: Success and Benefits to Specialty Crop Growers. Proc. Weed Sci. Soc. America/Canadian Weed Science Society joint meeting. Vancouver, BC. February 2025 (poster).

Batts, R.B. 2025. IR-4: Weed Control Project Updates – Food Crops. Proc. Weed Sci. Soc. America/Canadian Weed Science Society joint meeting. Vancouver, BC. February 2025 (presentation).

Batts, R.B. 2025. Registration Support for Pest Management Tools in Specialty Crops. Guest lecture at NCSU in CS 428/CS528, Advanced Regulatory Science in Agriculture. April 2025 (presentation).

Batts, R., L. Ortega, A. Goetz, J. Overmeyer. ESA Compliance in Agricultural Regulatory: Challenges and Strategy. Panel discussion, North Carolina Biotechnology Center. October 30, 2025 (presentation).

Batts, R.B. 2025. IR-4: Weed Control Project Updates – Food Crops. Proc. North Central Weed Sci. Soc. annual meeting. Grand Rapids, MI. December 2025 (presentation).

Batts, R. B., J. Patel, P. Moore, A. Axtell, D. Carpenter, and J. Baron. 2025. IR-4 Project: Success and Benefits to Specialty Crop Growers. Proc. North Central Weed Sci. Soc. annual meeting. Grand Rapids, MI. December 2025 (poster).

Beran, M. The Joy of Presenting. National Alliance of Independent Crop Consultants, Monterey, CA. January 23, 2025.

Forder, J. To the Point….Diplomatically Clear, Concise, and Constructive Audit Writing. National Alliance of Independent Crop Consultants, Monterey, CA. January 23, 2025.

Patel, J. 2025. The IR-4 Project. Crafting Integrated Pest Management Strategies for Specialty Crops, International IPM Symposium, San Diego, CA. March 2025 (presentation).

Patel, J., Batts, R., Moore, P., Axtell, A., Ross, H. & Baron, J). 2025. The IR-4 Project. Securing Pest Management Solutions for Growers of Specialty Crops. Plant Health 2025, Honolulu, HI (poster).

Pike, T. 2025. The IR-4 Project. CropLife America Registration Committee Meeting, December 11, 2025.

Pike, T. & Marconi, C. 2025. The IR-4 Project. U.S. Environmental Protection Agency (EPA), August 25, 2025 (virtual presentation).

VanGessel, M., B. Scott, K. Vollmer, and R. Batts. 2025. Herbicide carryover trials: The search for NS. Proc. Northeast Weed Science Society annual meeting. Annapolis, MD, January 2025 (presentation).

VanGessel, M., B. Scott, K. Vollmer, and R. Batts. 2025. Reducing herbicide rotation studies: Not glamorous but important. Proc. Weed Sci. Soc. America/Canadian Weed Science Society joint meeting. Vancouver, BC. February 2025 (presentation).

PUBLICATIONS

Ceseski, A., T. Guan, R. Vulchi, R. Batts, K. Arnold, C. Baez Vega, W. Brim-DeForest. (2025). Herbicide options for cultivated wild rice (Zizania palustris) in California. *Weed Technology*. https://doi.org/10.1017/wet.2025.10067

McFall, A., Reyes-Punongbayan, R. L., & Hengel, M. (2025). Analysis of flutianil and OC56635 residues in hemp *Cannabis* matrices by LC-MS/MS. *Journal of Agricultural and Food Chemistry*. https://doi.org/10.1021/acs.jafc.4c05103

Massie, S. T., Richardson, B. J., Patel, J. S., & Gent, D. H. (2025). Evaluation of fungicides for hop powdery mildew, Toppenish, Washington, 2024. *Plant Health Progress*. https://apsjournals.apsnet.org/doi/10.1094/PHP-12-24-0145-PDMR

Miranda, J.W.A, L. M. Sosnoskie, B. D. Hanson, T. E. Besancon, S. Chaudhari, R. B. Batts, and M. L. Moretti. (2025). Differential quinclorac tolerance in grapevines depends on precipitation and edaphic factors. *Weed Technology*. https://doi.org/10.1017/wet.2025.10065.

Searer-Jones, K. (2025, March). IR-4 working behind the scenes for specialty crop growers. *Specialty Crop Grower*. https://specialtycropgrower.com/specialty-crop-grower-magazine-ir-4/

Shrestha, G., Merkle, A., Pandey, S., & Axtell, A. (2025). Evaluation of biological and synthetic insecticides for control of Lepidopteran caterpillar complex in CBD hemp, 2024. *Arthropod Management Tests*, *50*(1), tsaf032. https://doi.org/10.1093/amt/tsaf032

Sosnoskie, L.M., R. B. Batts, and T. Besancon. 2025. An evaluation of targeted spraying for reducing herbicide use in highbush blueberry. *HortTechnology*, 35:214-222. https://doi.org/10.21273/HORTTECH05555-24.

VIDEOS

[IR-4 HQ]. (2025, April 10). *Intro to the IR-4 Intranet*. https://youtu.be/hcBLKqOF3ds

December 31, 2025

Approved by:

Debbie Carpenter, Acting Executive Director
IR-4 Project, North Carolina Agriculture Research Service
North Carolina State University

Matt Hengel, Chair,
IR-4 Project Management Committee
University of California, Davis

Douglas Buhler, Chair,
IR-4 Administrative Advisers
Michigan State University

ATTACHMENT 1 – Participants in the Process

A. Commodity Liaison Committee (CLC) - This advisory group provides input to the IR-4 Project Management Committee on overall operations and program direction. Members include:

Michael Aerts, Florida Fruit and Vegetable Association
Mark Arney, National Watermelon Promotion Board
Zack Bagley, California Tomato Research Institute
Michael Bledsoe, Village Farms, L.P.
John Walt Boatright, American Farm Bureau Federation
Jennifer Clarke, California Leafy Greens Research Program
James R. Cranney, California Citrus Quality Council
Maggie Elliot, Hops Growers of America
Atticus Finger, American Sugar Cane League
William Frantz, The Cranberry Institute
Michele Grainger, NC SweetPotato Commission
Bob Jones, The Chef's Garden
Bob Kaldunski, Ginseng Board of Wisconsin
Kevin Kudsk, National Onion Association
Michael Martin, Horticulture Research Institute
Armando Monterroso, Brooks Tropicals, LLC
Pete Nelson, Cherry Marketing Institute
Keith Pitts, Bioceres Crop Solutions
Kam Quarles, National Potato Council
Amy Plato Roberts, Lallemand Plant Care
Rachel Roberts, American Mushroom Institute
Steven Salisbury, Mint Industry Research Council
Todd Scholz, USA Dry Pea & Lentil Council and CLC Chair
Jonathan Sarager, Western Growers
Alan Schreiber, Agriculture Development Group, Inc.
Laura Shumow, American Spice Trade Association
Michelle Starke, CoverCress, Inc.
Berry Tanner, National Watermelon Association
Amy Upton, Michigan Nursery & Landscape Association
Lee Van Wychen, Weed Science Society of America
Ryan Wysocki, Michigan Blueberry Commission

B. Cooperating Government Departments and Agencies

- U.S. Department of Agriculture: National Institute of Food and Agriculture (NIFA); Agricultural Research Service (ARS); Foreign Agriculture Service (FAS);
- U.S. Environmental Protection Agency (EPA)
- State of California Department of Pesticide Regulation (DPR)
- agInnovation (State Agricultural Experiment Stations/Land Grant Universities)
- Agriculture and Agri Food Canada-Pest Management Centre (Canada-PMC)
- Health Canada-Pest Management Regulatory Authority (PMRA)

C. Crop Protection Industry – Companies with products involved in IR-4's research in 2025 include:

Company	Food Residue Study	Food Crop Product Performance	Integrated Solutions	Environmental Horticulture
Adama	X	X		

Company	Food Residue Study	Food Crop Product Performance	Integrated Solutions	Environmental Horticulture
Active Cross			X	
Agbiome			X	
AgroVentures			X	
Albaugh	X	X		
Ascribe BioScience				X
AMVAC	X		X	
BASF Corporation	X	X	X	X
Bayer Crop Science	X	X	X	
Belchim Crop Protection	X	X		
Biosafe Systems				X
Bioworks				X
Certis USA			X	
Corteva Agrisciences	X	X	X	X
Drexel		X		
DSM			X	
ENVU				X
Fine Americas		X		
FMC Corporation	X	X	X	
Gowan Company	X	X	X	X
ICL Specialty Fertilizers				X
ISK Biosciences	X	X	X	X
Kemin Crop Technologies			X	X
Koppert			X	
Lallemand				X
Landis International	X	X		X

Company	Food Residue Study	Food Crop Product Performance	Integrated Solutions	Environmental Horticulture
Loveland		X		
MustGrow Biologicals			X	
NanoCrops				
Nichino America	X	X	X	
Nisso	X	X	X	X
Neudorff				X
NuFarm America	X			X
OHP				X
Plant Health Care		X	X	
Profarm				X
Rainbow Treecare Scientific				X
SAN Agrow				X
SePRO Corporation		X		X
Stepan				X
Summit Agro			X	
Syngenta Crop Protection	X	X	X	X
TDA				X
Tidal Grow AgriScience			X	
Trece			X	
TKI Novasource	X	X		
TLC Products				X
Valent Bioscience		X		X
Valent USA, LLC	X		X	

D. <u>Project Management Committee</u>

Dr. Jerry Baron*, IR-4 Project Headquarters – IR-4 Project Executive Director
Dr. Douglas Buhler, Michigan State University – Administrative Advisor, North Central Region

Dr. John Davis, University of Florida - Administrative Advisor, Southern Region
Dr. Liwei Gu*, University of Florida – Regional Director, Southern Region
Dr. Mary Hausbeck*, Michigan State University — Regional Director, North Central Region
Dr. Matt Hengel*, University of California, Davis - Regional Director, Western Region and PMC Chair
Dr. Marcel Holyoak, University of California, Davis – Administrative Advisor, Western Region
Dr. Moses Kairo, University of MD Eastern Shore - Administrative Adviser, Northeast Region
Dr. Steven Lommel, North Carolina State University –Advisor
Dr. Joseph Munyaneza, USDA-ARS - Administrative Advisor
Dr. Chris Philips, USDA-NIFA-National Program Leader for IR-4
Mr. Todd Scholz*, USA Dry Pea and Lentil-CLC Chair
Dr. Alvin Simmons*, USDA-ARS – Director Minor Use Program
Dr. Simon Zebelo*, University of MD, Eastern Shore - Regional Director, Northeast Region
*Voting member

E. IR-4 Project Headquarters (HQ)

Dr. Alice Axtell - Research Planning Manager and Integrated Solutions Platform Lead
Ms. Raven Baez - Communications Assistant
Ms. Allison Ballantyne – Senior Operations Associate
Mr. Bill Barney – Biopesticide Regulatory Manager
Dr. Jerry Baron – Executive Director
Mr. Roger Batts - Principal Weed Scientist
Ms. Susan Bierbrunner – Data Administrator
Ms. Donna Bouffard - Program Operations Coordinator
Dr. Michael Braverman – Senior Manager Associate - Biopesticide Regulatory
Mr. Jimmy Byrtus – Study Director
Dr. Debbie Carpenter – Assoc. Director for Regulatory Sciences and National Laboratory Director
Dr. Krystal Chojnacki - National Chief of Staff
Ms. Christina Dineen – Chemist and Study Director
Ms. Jane Forder – Lead Quality Assurance Auditor - Northeast and North Central Region
Ms. Shiayi Huang - Data Applications Manager
Mr. Josh Kindel - Environmental Horticulture Program Manager
Ms. Grace Lennon – Senior Regulatory Associate
Ms. Jessica Macari — Study Director
Ms. Cristina Marchesan Marconi - Registration Manager and Senior Study Director
Dr. Johanna Mazlo - National Quality Assurance Unit Manager
Mr. Philip Moore - Lead Entomologist
Mr. Scott Muir - Lead Quality Assurance Auditor - Analytical Chemistry
Ms. Sherita Normington, Senior Quality Assurance Auditor
Dr. Jaimin Patel – Principal Plant Pathologist
Mr. Josh Peterson - Quality Assurance Auditor
Mr. Thomas Pike – Submission Manager and Senior Study Director
Ms. Hannah Ross – National Information and Communications Officer
Mr. David Schnatter - Research Assistant
Dr. Van Starner – Senior Management Associate
Ms. Juliet Thompson – Research and Audit Specialist, Quality Assurance
Mr. Robert Welker - Study Director

F. Regional/ARS Field Coordinators and Staff

Dr. Kari Arnold, Regional Field Coordinator - Western Region
Ms. Megan James Hickman, Assistant Regional Field Coordinator - Northeast Region
Ms. Mika Pringle Tolson, Assistant Regional Field Coordinator - Western Region
Ms. Marylee Ross, Regional Field Coordinator – Northeast Region

Ms. Kristen Searer-Jones, Regional Field Coordinator - Southern Region
Dr. Alvin Simmons, Regional Field Coordinator- USDA-ARS
Ms. Nicole Soldan, Regional Field Coordinator - North Central Region

G. Laboratory Coordinators (Regional and ARS)

Dr. Matt Hengel, University of California, Davis – Western Region
Dr. Gail Mahnken, University of Florida – Southern Region
Ms. Tamara Snipes, USDA-ARS – Tifton, GA
Mr. T. Todd Wixson, USDA-ARS – Wapato, WA

H. Quality Assurance Unit

Mr. Martin Beran, University of California, Davis
Ms. Jane Forder, North Carolina State University
Ms. Laurel Hsieh, University of California, Davis
Ms. Kathleen Knight, University of Florida
Dr. Johanna Mazlo, North Carolina State University
Mr. Scott Muir, North Carolina State University
Ms. Sherita Normington, North Carolina State University
Mr. Josh Peterson, North Carolina State University
Ms. Juliet Thompson, North Carolina State University
Dr. Yavuz Yagiz, University of Florida

I. IR-4 Researcher & State Liaison Representatives[5]

North Central Region

State	State Liaison Rep.	Research Area
IA	S. Slack	
IL	M. Babadoost	
IN	S. Meyers	S. Meyers (P)
KS	R. Cloyd	
MI	N. Soldan	M. Hausbeck (P), (IS), (EH), T. Miles (P), N. Rothwell (P), D. Saha (EH), N. Soldan (R) (P), C. Wheeler (R)
MN	Vacant	
MO	I. Valmorbida	T. Mueth (P)
ND	B. Jenks	Q. Jia (R), T. Gauderman (R)
NE	N. Lawrence	
OH	A. Leach	L. Canas (EH), L. Horst* (R), M. Ivey (P), A. Leach (P) (IS), A. Robinson (R), F. Hand (EH), M. Reding*(EH), A. Sanabria-Velazquez (P), C. Taylor (IS), R. Yadav (P), H. Mathers (EH)
SD	G. Reicks	S. Solanki (P)

[5] R= Residue Field Trials/Food Program, P= Product Performance/Food Program, IS= Integrated Solutions, EHC= Environmental Horticulture Program, *= USDA - Agriculture Research Service Researcher

WI	D. Heider	S. Chapman (R), D. Heider (R) (P), R. Werle (P)

Northeast Region

State	State Liaison Rep.	Research Area
CT	S. Kodati	C. Krasnow (EH)
DE	D. Owens	D. Owens (P), A. Betts (P)
MA	S. Scheufele	M. Sylvia (R)
MD	D. Joseph	D. Cochran (EH), M. Hickman (R), M. Hu (P), M. Ross, (R), V. Yurchak (P)
ME	L. Calderwood	
NH	Vacant	
NJ	T. Besancon	T. Besancon (P), J. Fisher (R)
NY	L. Sosnoskie	N. Catlin (EH), D. Gilrein (EH) (P), D. Heck (P), K. Handley (R), A. Green (R), B. Nault (P), L. Sosnoskie (P), Jared Dyer (EH)
PA	G. Krawczyk	C. Brunharo (P), K. Peter (IS)
RI	Vacant	
VT	A. Hazelrigg	
WV	C. Quesada	M. Rahman (P)

Southern Region

State	State Liaison Rep.	Research Area
AL	E. Vinson	D. Held (EH)
AR	H. Wright-Smith	A. Bowden(EH), N. Burgos (P), A. Cato (P)
FL	P. Dittmar	A. Hajihassani (P), D. Carrillo (P), A. Dale (EH), P. Dittmar (P), N. Dufault (P), R. Gazis (P) (IS), S. Lahiri (P), M. Long (R), C. Marble (EH), D. Norman (EH), N. Peres (P), K. Stauderman (P), D. Sutherland (R), D. Thomas (R), G. Vallad (P), S. Zhang (P), P. Dafoe (R)
GA	S. Culpepper	B. Dutta (P), B. Fraelich* (R), (EH), E. McCarty (EH), P. Yu (EH)
KY	R. Bessin	R. Villanueva (P), C. Wilson(EH)
LA	T. Watson	D. Wright (R), D. Miller (P)
MS	A. Henn	P. Knight (EH), T. Ayankojo (P)
NC	D. Monks	R. Batts (P) , S. Frank (EH), A. Gorny (P), K. Jennings (P), R. Leon (P), L. Lopez (P) (IS), L. Lux (P), I. Meadows (EH), W. Mitchem (P), J. Neal (EH), C. Smith (R), J. Walgenbach (IS)

OK	C. Luper	
PR	W. Robles Vazquez	D. Rivera (EH), W. Robles Vazquez (R) (P)
SC	M. Cutulle	M. Cutulle (P), P. Wade* (R) (EH)
TN	M. Gireesh	K. Addesso (EH), F. Baysal-Gurel (EH) (P), A. Witcher (EH)
TX	M. Matocha	K. Cochran (R), T. Jones (R), R. Khan (EH), K. Ong (EH)
VA	D. Frank	J. Derr (EH), D. Higgins (P)(IS)

Western Region

State	**State Liaison Rep.**	**Research Area**
AK	P. Kaspari	
AZ	A. Hu	A. Hu (P)
CA	J. Adaskaveg, K. Arnold, B. Hanson, C. Nansen	J. Adaskaveg (P), B. Aegerter (P), A. Babu (P), K. Blauer (P) (IS), S. Benson* (R), N. Clark (P), O. Daugovish (P), D. Ennes (R), A. Eskalen (EH), B. Hanson (P) (IS), C. Kron (IS), N. Leach (R), P. Lazicki (IS), P. Mauk (P), I. Mokwunye (P), C. Nansen (P) (EH), J. Sidhu (P), S. Stoddard (IS), T. Turini (IS), B. Uber (EH), S. Watkins (R), B. Wheeler-Dykes (P), S. Zukoff (P), B. Turner (R)
CO	B. Tonnessen	C. Oman (R), A. Scszpaniec (IS)
GU	R. Miller	
HI	J. Kam	Z. Cheng (EH), Z. Zhang (R) (P), J. Kam (R)
ID	M. Dimase	A. Adjesiwor (IS), W. Meeks (R)
MT	Z. Miller	
NM	C. Robbins	C. Robbins (R)
NV	Vacant	
OR	D. Rendon	A. Becerra-Alvarez (P) (EH), J. Dung (P), N. Kaur (P), M. Moretti (EH) (P), L. Nackley (EH), J. Weiland* (EH), A. Rasmussen (R), M. Robinson (R), T. Hoskins (EH), N. Wiman (P)
UT	C. Ransom	
WA	D. Walsh	D. Larson* (R) (EH), R. Liu (P), W. Peng (R)
WY	C. Beiermann	

ATTACHMENT 2 – 2025 Tolerance Successes; Permanent Tolerances Published in the Federal Register

Pest Control Agent	Registrant	Type*	Date	Commodity or Crop Group	Note*	PR#	# of Uses	# of Tolerances
Fludioxonil	SYNGEN	F	02/25/2025	Cranberry		11937	1	1
Cyprodinil	SYNGEN	F	02/26/2025	Cranberry		11937	1	1
Afidopyropen	BASF	I	07/23/2025	Lettuce (GH)		11695	1	1
2025 Totals							**3**	**3**
*F=fungicide, H=herbicide, I=insecticide/acaricide, M=molluscicide, N=nematicide, P=plant growth regulator								
** Note Code 1=Update of established tolerance on old crop group or subgroup 2=Conversion of established tolerance(s) on representative commodities to a crop group or subgroup tolerance 3=Conversion of established tolerance(s) on representative commodities to a crop group or subgroup tolerance ***and*** submission of new data to complete the requirements for a crop group or subgroup 4=Individual commodity tolerance established in response to crop group revision 5=Response to EPA request for Codex harmonization 6=Revised tolerance 7=Tolerance for indirect or inadvertent residues								

ATTACHMENT 3 – 2025 Submissions to EPA, unless otherwise noted as submitted to Registrants, Codex or State Departments of Agriculture

Completed Petitions or Final Reports Submitted to EPA in 2025						
Pest Control Agent	**Registrant**	**Type***	**Date**	**Commodity or Crop Group**	**PR#**	**Reduced Risk****
Acetamiprid	NISSO, UPL NA	I	1/31/25	Dragon fruit (pitaya)	13057	
				Safflower	12032	
				Sunflower	12668	
				Vegetable, legume, bean, edible podded, subgroup 6-22A	13924	
				Vegetable, legume, bean, succulent shelled, subgroup 6-22C	13926	
				Vegetable, legume, pea, edible podded, subgroup 6-22B	13925	
				Vegetable, legume, pea, succulent shelled, subgroup 6-22D	13927	
Sulfur Dioxide	DELTA, SNOWDEN, TEDMRK, TESSARA	F	3/28/25	Fig	12404, 13183	
Cycloate***	HELMAG	H	6/19/25	Spinach	13409	
				Beet, garden	13411	
Clomazone	FMC	H	6/26/25	Dill	11640	
Benzovindiflupyr	SYNGEN	F	9/18/25	Beet, garden, leaves	12351	
				Berry, low growing, except strawberry, subgroup 13-07H	11811	
				Stevia	12532	
				Strawberry	12373	
				Vegetable, legume, pulse, bean, dried shelled, except soybean, subgroup 6-22E	14066	
				Vegetable, legume, pulse, pea, dried shelled, subgroup 6-22F	14067	
2,4-DB	ACETO, ALBAGH	H	9/26/25	Clover (seed crop)	11842	
				Guar bean	00275	

				Lentil, dry seed	08992	
Fenpropathrin	VALENT	I	10/24/25	Barley subgroup 15-22B	14068	
				Brassica, leafy greens, subgroup 4-16B	09266	
				Cherry subgroup 12-12A	11333	
				Cottonseed subgroup 20C	12775	
				Kohlrabi	12774	
				Nut, tree, group 14-12	11332	
				Peach subgroup 12-12B	11334	
				Plum subgroup 12-12C	11335	
				Tropical and subtropical, small fruit, edible peel, subgroup 23A	12776	
				Tropical and subtropical, small fruit, inedible peel, subgroup 24A	12777	
				Turnip, roots	09517	
				Vegetable, brassica, head and stem, group 5-16	12773	
				Vegetable, legume, pea, edible podded, subgroup 6-22B	14069	
				Vegetable, legume, pea, succulent shelled, subgroup 6-22D	14070	
				Vegetable, tuberous and corm, except potato, subgroup 1D	07946	
Clothianidin	VALENT	I	12/9/25	Fruit, citrus, group 10-10	10167, 10168, 10169, 13862, 13863, 13864	
Cycloate	HELMAG	H	12/17/25	Quinoa	11828	
Mefentrifluconazole	BASF	F	12/22/25	Hop, dried cones	13505	
*F=fungicide, H=herbicide, I=insecticide/acaricide, N=nematicide, P=plant growth regulator						
**"Yes" indicates that a request for reduced risk status was included by IR-4 with this submission						
***Non-PRIA submission to EPA						

ATTACHMENT 4 – 2025 Food Use Research Projects, New Residue Studies

Chemical	Crop	PR #
AZOXYSTROBIN + BENZOVINDIFLUPYR	BASIL (GH TRANSPLANT)	13866
AZOXYSTROBIN + BENZOVINDIFLUPYR	MINT (GH TRANSPLANT)	13856
BIFENTHRIN	ONION (DRY BULB)	13778
BIFENTHRIN	BASIL	13843
BROMOXYNIL	CANOLA	13854
BROMOXYNIL	PEA (DRY)	13874
BROMOXYNIL	SUNFLOWER	13875
CYANTRANILIPROLE	CLOVER (SEED CROP)	13830
FENAZAQUIN	PEPPER (GH)	12482
FENAZAQUIN	TOMATO (GH)	12484
FENAZAQUIN	STRAWBERRY (GH)	12518
FENAZAQUIN	CUCUMBER (GH)	12516
FENPYROXIMATE	FIG	13735
FLAZASULFURON	HOPS	13879
FLONICAMID	HEMP	13966
FLUAZINAM	CHERRY	13813
FLUAZINAM	ALMOND	09095
FLUAZINAM	DRAGON FRUIT (PITAYA)	13639
FLUAZINAM	CRANBERRY	13829
GLUFOSINATE	CANEBERRY	12051
GLUFOSINATE-P	SUGARCANE	13821
LINURON	PEA (EDIBLE PODDED & SUCCULENT SHELLED)	11774
LINURON	BASIL	13831
LINURON	SWEET POTATO	13832
LINURON	BEAN (DRIED SHELLED)	13833
MEFENTRIFLUCONAZOLE	LETTUCE (GH)	12703
ORTHOSULFAMURON	POMEGRANATE	13820
OXATHIAPIPROLIN	APPLE	13683

Chemical	Crop	PR #
OXATHIAPIPROLIN	PEAR	13814
PHENMEDIPHAM	SPINACH	12529
PYRIDABEN	DILL	13809
PYRIDATE	TOMATO	06529
QUINCLORAC	PEACH	12572
QUINCLORAC	PLUM	12573
QUINCLORAC	CHERRY	12574
SPIDOXAMAT	BLUEBERRY (HIGHBUSH)	13825
TERBACIL	PEACH	13847

ATTACHMENT 5 – 2025 Food Use Product Performance Research Program

Chemical	Crop	PR#	Research Trial location
1-aminocyclopropane-1-carboxylic acid (acc)	Olive	13828	CA (3)
1-aminocyclopropane-1-carboxylic acid (acc)	Cherry	13334	CA (2), MI (1)
Acetamiprid & cyantraniliprole	Dragon fruit	13057	FL (1)
Afidopyropen	Safflower	13459	CA (1)
Azoxystrobin	Mint (GH transplant)	13108	TN (1)
Azoxystrobin + benzovindiflupyr	Basil (GH transp.)	13866	FL (1), MI (1), VA (1)
Azoxystrobin + benzovindiflupyr	Mint (GH transp.)	13856	MI (1), TN (1), OH (1)
Azoxystrobin + benzovindiflupyr	Mint	13273	OR (3)
Bifenthrin	Basil	13843	CA (1)
Bifenthrin	Onion	13778	CA (1), NY (1)
Chlorantraniliprole & zeta-cypermethrin	Hemp	13000 & 13011	KY (1)
Copper hydroxide + copper oxychloride	Miracle fruit	12596	FL (1)
Difenoconazole + azoxystrobin	Avocado	13771	FL (1)
Epyrifenacil	Blueberry (hiGHbush)	13888	IN (1), NJ (1), OR (1)
Epyrifenacil	Safflower	13892	CA (3)
Epyrifenacil	Apple	13889	NY (1), PA (1), WA (1)
Ethalfluralin + clomazone	Squash	13529	CA (1), FL (1), NJ (1)
Ethephon	Ginseng	12613	WI (1)
Fenazaquin	Tomato (GH)	12484	NC (1)
Fenazaquin	Pepper (GH)	12482	NC (1)
Fenazaquin	Cucumber (GH)	12516	NY (1)
Fenazaquin	Strawberry (GH)	12518	FL (1)
Fenpyroximate	Fig	13735	CA (1)
Flazasulfuron	Hops	13879	OR (2), WA (1)
Florpyrauxifen	Pomegranate	13331	CA (1)
Fluazaindolizine	Banana	13222	PR (1)
Fluazinam	Cherry	13813	CA (2), MI (1)

Fluazinam	Almond	09095	CA (3)
Fluazinam	Stevia	13893	DE (1), FL (1), NC(1)
Fluazinam	Grapes	13905	MD (2), MI (1)
Fludioxonil + pydiflumetofen	Basil	13078	NY (1)
Fluridone	Sweetpotato	13482	NC (2), LA (1)
Fluroxypyr	Blueberry	13709	IN (1), NJ (1), OR (1)
Flutianil	Mint (GH transplant)	13869	MI (1), TN (1), VA (1)
Flutriafol	Pistachio	13664	AZ (1)
Fluxapyroxad + pyraclostrobin	Asparagus (fern)	13493	CA (1)
Fluzaindolizine	Onion (dry bulb)	12770	FL (1)
Glufosinate	Strawberry	13455	CA (1)
Indaziflam	Banana	11088	PR (3)
Indoxacarb	Clover (seed crop)	13718	OR (2)
Indoxacarb	Cacao bean	13817	HI (2)
Inpyrfluxam	Tomato (processing)	13511	CA (1)
Inpyrfluxam	Tomato	13600	FL (1), GA (1), WV (1)
Isocycloseram	Safflower	13496	CA (1)
Isocycloseram	Snap beans	12800	MD (1)
Isocycloseram	Sweet corn	12798	DE (1), MD (1), OH (1)
Linuron	Pea (edible podded & succulent shelled)	11774	NY (1), WI (1)
Linuron	Stevia	13733	NC (1)
Maleic hydrazide	Tomato (field)	13884	CA (2)
Mefenoxam	Strawberry (GH transplant)	13716	FL (1)
Mefentrifluconazole	Lettuce (GH)	12703	AZ (1), MI (1), MS (1)
Novaluron	Caneberry	13502	AR (1)
Oxathiapiprolin	Peach	13633	FL (1)
Oxathiapiprolin	Plum or french prunes	13632	CA (1)
Oxathiapiprolin	Apple	13683	CA (3)
Oxathiapiprolin	Pear	13814	CA (3)

Oxathiapiprolin + mandipropamid	Cacao bean	13635	HI (1)
PHC68949	Sweet potato	13755	NC (1)
Prohexadione calcium	Hazelnut	13880	OR (3)
Prothioconazole + fluopyram	Field pennycress (oil seed)	13929	OH (2), MO (1)
Pydiflumetofen + fludioxonil	Guava	13776	FL (1)
Pyraziflumid	Lettuce (GH)	12975	NY (1)
Pyridate	Tomato	6529	CA (1), NC (1), SC (1)
Pyroxasulfone	Carrot	13723	CA (1), NY (1)
Quinclorac	Strawberry	11611	OR (1)
Saflufenacil	Field pennycress	13522	WI (1)
S-metolachlor	Carinata	13631	NC (1)
Spidoxamat	Blueberry (highbush)	13825	CA (3)
Terbacil	Caneberry	11128	Ar (1), NC (1), OH (2), OR (1)
Terbacil	Camas	13915	OR (3)
Tiafenacil	Blueberry	13487	MI (1), NJ (1)
Tiafenacil	Cucumber	13498	FL (1)
Tolpyralate	Blueberry	13682	NC (1), NJ (1), OR (1)
Tolpyralate	Hazelnut	13679	OR (1)
Tryfloxystrobin + fluopyram	Avocado	13074	CA (2), FL (1)
Uniconazole	GH mint (multi-crop protocol with GH basil)	13530	MI (1)
Zeta-cypermethrin	Beet greens (garden)	13648	CA (1)
Zeta-cypermethrin	Dragon fruit	13305	FL (1)

Attachment 6 - 2025 Environmental Horticulture Program Research Summaries

Aphid Efficacy - In the past, IR-4 had conducted Ornamental Horticulture Surveys to poll growers, landscape care operators, researchers, extension personnel and others affiliated with the ornamental industry on needs and issues related to disease, insect, and weed management. In 2013, aphids were identified as one of the top five important insects of concern. In a literature review from 2015, there were insufficient data for definitive conclusions, many of the older registered active ingredients, including, acephate, acetamiprid, bifenthrin, chlorpyrifos, dimethoate, flonicamid, imidacloprid, lambda-cyhalothrin, malathion, pymetrozine, spirotetramat, and thiamethoxam generally provided effective control. Similarly, several relatively new products, including cyantraniliprole, pyrifluquinazon, sulfoxaflor, and tolfenpyrad were effective.

Borer & Beetle Efficacy - In the past, IR-4 had conducted Ornamental Horticulture Surveys to poll growers, landscape care operators, researchers, extension personnel and others affiliated with the ornamental industry on needs and issues related to disease, insect, and weed management. In 2013, aphids were identified as one of the top five important insects of concern. In a literature review from 2015, there were insufficient data for definitive conclusions, many of the older registered active ingredients, including, acephate, acetamiprid, bifenthrin, chlorpyrifos, dimethoate, flonicamid, imidacloprid, lambda-cyhalothrin, malathion, pymetrozine, spirotetramat, and thiamethoxam generally provided effective control. Similarly, several relatively new products, including cyantraniliprole, pyrifluquinazon, sulfoxaflor, and tolfenpyrad were effective.

Mite Efficacy - From 1999 to 2016, 34 active ingredients were tested mainly as foliar applications against several genera and species of mite pests on ornamentals and vegetables. Mite species tested included: broad mite, Polyphagotarsonemus latus, Eriophyid mites including Aceria sp., Aculops lycopersici, Aculus ligustri, Aculus schlechtendali, Epitrimerus pyri, spider mites including Tetranychus urticae, Oligonychus ilicis and Panonychus citri, and the red palm mite Raoeilla indica. Although there were insufficient data for definitive conclusions, Akari/Fujimite (fenpyroximate), Magus (fenazaquin) and Pylon (chlorfenaphyr), generally performed well on various species. Kontos/Movento/BYI 08330 (spirotetramat) looked promising on the Eriophyds Aceria sp. and Aculus ligustri and on the spider mites P. citri and T. urticae. Proclaim (emamectin benzoate) was promising on the Eriophyds Aceria sp. and Aculus ligustri and on P. latus. Mesa/Ultiflora (milbemectin) looked promising on the Eriophyds A. ligustri, Aculus schlechtendali, Epitrimerus pyri and Aculops lycopersici, and on the spider mites T. urticae. Shuttle (acequinocyl) looked promising on Southern red mite. On red palm mite, limited data indicated that Forbid/Judo (spiromesifen), Pylon, Sanmite (pyridaben), Shuttle (acequinocyl) and Sulfur/Thiolux (sulfur) performed well while Avid (abamectin), Hexagon (hexythiazox) and Tetrasan (etoxazole) were less effective. Tank-mix combination with oils generally improved mite control.

Scale & Mealybug Efficacy - Managing mealybugs and scale insects presents unique challenges. Products with contact modes of action must be applied at specific timings in order to reach the most susceptible crawler stages often targeting stems or leaf petioles not readily accessible due to dense foliage. Products with systemic modes of action may work well for certain species and not others based on application timing and whether the insect feeds within phloem or xylem. In 2003, IR-4 initiated a high priority project to determine efficacy of insecticides for mealybugs to add additional species to existing registrations and screen new active ingredients. Over time, mealybug efficacy has been re-established as high priority at subsequent workshops (2019, 2021). This research was conducted between 2004 and 2022. This summary contains outcomes from 32 experiments established to screen new active ingredients for impact on mealybugs. Across crop and mealybug species, the products with the most impact on populations include ISM-555, TriStar, Orthene, Pradia, Safari, Talus, Flagship, Rycar, A169018, Aria, Kontos, and Ventigra. MBI 205, TetraCURB Concentrate, and SP3014 also provided acceptable reductions in populations. Seven different mode of action groups are represented. There is the opportunity to include mealybugs on active ingredients that are not yet registered for mealybugs and expand currently registered labels with additional mealybug species.

Thrips Efficacy - For the last 16 years, the IR-4 Environmental Horticulture Workshop has ranked developing efficacy data on new products to manage thrips as a High Priority Project either nationally or regionally. Thrips remain an important threat for several reasons: 1) the damage thrips cause to environmental horticulture plants, decreasing the value of the infested crops; 2) the tospoviruses (tomato spotted wilt, impatiens necrotic ringspot) they can vector; 3) the newly arrived invasive species which impact at least 250 different environmental horticulture species; and 4) growers lack the ability to rotate among 3 to 4 different modes of actions to effectively manage resistance development in the thrips populations they must control to maintain economic viability. From 2005 through 2021, 78 products representing 67 different active ingredients were tested for thrips management. These products represented both biological and chemical tools. Some products were already registered, but more data were needed particularly with the newly invasive thrips species, or they were considered standards to measure the level of efficacy achieved with other materials. Other products were in development but have not yet been registered with the EPA. The five thrips species tested in the IR-4 program were Chilli Thrips (Scirtothrips dorsalis), Gladiolus Thrips (Thrips simplex), Privet Thrips (Dendothrips ornatus), Weeping Fig Thrips (Gynaikothrips uzeli), and Western Flower Thrips (Frankliniella occidentalis).

Botrytis Efficacy - At the IR-4 Environmental Horticulture Program Workshop in 2011, Botrytis Efficacy was selected as a high priority project to expand the knowledge and list of fungicides available to growers for these diseases. In addition to research collected through the IR-4 Program, this summary includes a review of experiments conducted from 1998 to 2022 on environmental horticulture crops. During this time period, numerous products representing 56 active ingredients were tested as foliar applications against several Botrytis species causing blight and gray mold on multiple environmental horticulture crops. Most products are now registered and commercially used. Almost all trials were conducted on Botrytis cinerea; however, other species tested were B. elliptica, and B. tulipae. For B. cinerea, across all crops and rates screened, Affirm, Picatina Flora, Astun, Spirato/Medallion, Mural, Tourney, Pageant Intrinsic, Decree, and Postiva provided good to excellent efficacy routinely as did two not-yet-registered tools for Botrytis management: XDE-659 and Trinity. Orkestra Intrinsic, PreStop, S2200, Broadform, and Regalia generally provided good reduction in disease; however, some variability was seen among experiments. S2200 also was variable in performance but could be registered and be part of an overall management program. For Botrytis elliptica, fewer experiments have been conducted. The best performing tools with at least 3 trials are Orchestra Intrinsic, Mural, and S2200. ZeroTol, and the copper products (Badge X2, Camelot, Phyton 27, STBX-304) generally performed poorly under the conditions of these experiments.

Fusarium Efficacy - From 2001 to 2020, numerous products representing 40 active ingredients were evaluated in greenhouse and field trials as soil drench, soil incorporation, foliar, in-furrow, drip irrigation or tuber soak applications against several Fusarium species causing rots (crown, stem and tuber rots) and wilt on environmental horticulture crops, and wilt and root rot on vegetables. Fusarium species tested included: F. avenaceum, F. commune, F. oxysporum, F. solani and F. sp. Most trials were conducted on F. oxysporum on larkspur, liriope, lisianthus and watermelon. Although there were insufficient data for definitive conclusions, several relatively new products showed promising, though inconsistent, efficacy comparable to the standards. These include Astun (isofetamid), BAS 750 (mefentriconazole), Picatina (pydiflumetofen), Heritage (azoxystrobin), Compass (trifloxystrobin), Hurricane (fludioxonil+mefenoxam), Insignia (pyraclostrobin), Insimmo (acibenzolar), MBI-121, Orkestra (fluxapyroxad + pyraclostrobin), SP2169, Tourney (metconazole) and Trinity (triticonazole)., Broadform (fluopyram + trifloxystrobin), BW240/RootShield Plus (Trichoderma harzianum & T. virens), (BWI161N), CG100 (caprylic acid), Mural, Pageant (boscalid+pyraclostrobin), Palladium (cyprodinil+fludioxonil), SP2550, SP2770 and TCX2020 provided no to mediocre efficacy. Postiva (pydiflumetofen + difenoconazole) provided excellent efficacy on F. oxysporum on various environmental horticultural crops in greenhouse experiments. Proline (prothioconazole) provided consistently good control of F. oxysporum in watermelon trials. The established standards 3336, Medallion and Terraguard generally provided inconsistent efficacy.

Bacterial Disease Efficacy - From 2008 to 2022, 83 products were tested through the IR-4 Environmental Horticulture Program as foliar or drench applications against bacterial pathogens. In addition to research collected through the IR-4 program, this summary includes a review of experiments conducted from 2005 to 2017, mainly on tree crops. Species tested included: Agrobacterium tumefaciens, Erwinia amylovora, E. chrysanthemi, Pseudomonas cichorii, P. marginalis, P. syringae, Pseudomonas sp., Xanthomonas axonopodis, Xanthomonas campestris, and Xanthomonas spp. In general, all products, including the standard copper containing bactericides (Camelot, CuPRO, Cuprofix, Cuprofix MZ, Junction, Kocide, MasterCop, Phyton 27, ReZist, etc.), mancozebs (Dithane, Penncozeb, Protect) and biologicals (Cease, Regalia, Rhapsody and Serenade), provided variable efficacy on these bacterial pathogens. Several new products that looked promising based on their efficacy relative to standards including, CG100, Citrex, HM0736, Insimmo, Postiva, Proud 3, Stargus, Taegro, Tril-21 and ZeroTol. Further research is needed to obtain additional efficacy data to recommend actions to register or amend labels for these pests.

Powdery Mildew Efficacy - Powdery mildew is a highly recognizable disease with pronounced colonies of white on foliage and, for some species, on petals. Due to the high number of spores produced, powdery mildews often develop resistance quickly to fungicides. Starting in 2012, IR-4 initiated a series of regional projects to examine new fungicides and biofungicides for powdery mildew management. In addition, we performed a literature review. Contained in the project summary are outcomes from 96 experiments conducted in greenhouses and outdoors. Specific powdery mildew pathogens included: Erysiphe azaleae, Erysiphe knautiae, Erysiphe lagerstroemia, Erysiphe lonicerae var. lonicerae, Erysiphe monardae, Erysiphe polygoni, Erysiphe pulchra, Golovinomyces cichoracearum, Golovinomyces orontii, Oidium spp., Podosphaera pannosa, and Podosphaera xanthii. Across species, the best performing products and actives included Aveylo, Bayleton, Broadform, Gatten, Heritage, Magus, Mural, NF-149 (cyflufenamid), SP2478, and XDE-659.

Phytophthora Efficacy - Root rots caused by Phytophthora species are often not noticed until foliar symptoms of wilting and stunting are observed. There are multiple species with differential sensitivities to fungicides, making them difficult to manage. Plus, they are classified as Oomycetes in the kingdom Chromista, commonly known as water molds, and can have a propensity to develop resistance to single site mode of action fungicides. Thus, Phytophthora diseases have been prioritized for research periodically at IR-4 workshops since 2003. From 2003 to 2015, 74 products representing 65 active ingredients were tested through the IR-4 Program as drench or foliar applications against eleven Phytophthora species causing root rots and stem/leaf blights in a total of 926 trials. Phytophthora species tested included: P. cactorum, P. cinnamomi, P. citricola, P. cryptogea, P. drechsleri, P. nicotianae/parasitica, P. palmivora, P. plurivora, P. ramorum, P. syringae, and P. tropicalis. For certain more prevalent and well-studied species, multiple products within several modes of action exhibited good to excellent management: P. cinnamomi, P. cryptogea, P. drechsleri, P. nicotianae, P. palmivora, P. ramorum, and P. tropicalis. For P. cactorum, none of the experiments provided separation among the treatments and controls. Control of P. cinnamomi root rot was achieved primarily with drench applications onto azaleas. When this pathogen was tested on rhododendrons, the data were either inconclusive or the products did not perform as well as on azaleas with the exception of Magellan and Fenamidone. For P. citricola, Adorn and the phosphorus acid generators provided good to great efficacy, but none of the typical oomycete fungicides were acceptable. For P. drechsleri root rot, the good to excellent efficacy was achieved with several products including BioPhos, Segway, Stature DM, and Terrazole. For P. nicotianae, consistent efficacy across crops was difficult to achieve, but the best performers included Adorn, Aliette, Alude, Biophos, Fenamidone, Insignia, Micora Segway, Stature DM, Subdue MAXX, and Vital. For P. ramorum blights, Subdue MAXX provided the most consistent control. Adorn, Fenamidone, Insignia, Segway, and Stature also provided good control. For P. plurivora, seven products provided good to excellent activity, but only two experiments have been completed so far. For P. syringae, only the phosphorous acid generators provided acceptable reduction in disease in two experiments. For P. tropicalis, the best control was achieved with Adorn and Stature. Several products have good to excellent efficacy across multiple Phytophthora species: Adorn, Disarm,

Fenstop, Micora, Orvego, Segway, Stature, and Subdue Maxx, plus certain phosphorous acid generating products.

Nutsedge & Sedge Efficacy - Nutsedges and sedges (Cyperus sp.) are difficult to manage during the production of perennial environmental horticulture crops grown in containers or in the field. During the 2006 IR-4 Environmental Horticulture Workshop, a project was prioritized to screen for efficacious products to manage sedge and nutsedge in container or field grown environmental horticulture crops. Between 2007 and 2023, IR4 evaluated a diverse group of products for pre- and post-emergent control of several sedges and nutsedges. During this time, IR-4 sponsored 84 research trials on 28 products or product formulations with 20 actives to manage sedges and nutsedge. Most research was conducted with pre-emergent herbicides. The most effective options across these studies where IR-4 has at least 3 experiments include Pennant Magnum, SedgeHammer, Tower, and V-10142 for yellow nutsedge management. However, the IR-4 dataset is limited, and several products tested show promise for managing annual sedges, rice flatsedge, purple nutsedge or compressed sedge.

Spurge Efficacy - Nursery growers have had a longstanding battle to control weeds in environmental horticulture crops. Spurge (Chamaesyce maculata), is one of the most difficult weeds to control in container grown ornamentals. It grows aggressively in containers and can outcompete ornamental crops for water, nutrients, and light. Several chemical tools are available for preemergent control. However, there remains a need for effective control of emerged weed seedlings. At the 2007 Environmental Horticulture Workshop, IR-4 initiated a study to determine whether preemergent herbicides could provide efficacy for spurge, and other weeds, up to the 2-4 leaf stage. Research was conducted from 2008 through 2019. This report is a brief summary of available data from 18 experiments received through the IR-4 Environmental Horticulture Program. Early postemergence applications of Casoron, Certainty, Gallery, Marengo/Indaziflam, Pendulum, SP 1770, Tower and V-10142 provided significant control of emerged spurge. These findings benefit growers by identifying select preemergence herbicides which control specific weeds at early emergence stages in container grown ornamental horticulture crops.

Attachment 7 - 2025 Environmental Horticulture Program Research Activities

Discipline	Project	Researchers	Crops	Products	Trials
Entomology	European Corn Borer Efficacy	1	1	5	1
	Nantucket Pine Tip Moth Efficacy	1	1	5	1
	NER Regional Root Aphid/Aphid Efficacy	2	2	8	2
	New Pest Products Crop Safety - Foliar	17	29	10	82
	New Pest Products Crop Safety - Soil	12	13	7	39
	Scale Efficacy	3	5	11	3
	Thrips Efficacy	2	1	10	2
	WSR Regional Lygus Efficacy	1	1	10	1
Plant Pathology	Boxwood Foliar Disease Efficacy	2	1	10	2
	Cylindracarpon in Conifers Efficacy	1	1	6	1
	NCR/WSR Regional Botrytis Efficacy	1	1	10	1
	New Disease Products Crop Safety - Foliar	15	29	12	96
	New Disease Products Crop Safety - Soil	9	17	7	30
	Phytophthora Efficacy	3	1	7	3
	Pythium & Phytopythium Efficacy	1	1	7	1
	SOR Regional Vascular Streak Dieback Efficacy	1	1	9	1
Weed Science	NCR Regional Equisetum Efficacy	2	N/A	5	2
	Postemergent Herbicide Crop Safety	1	1	2	2
	Preemergent Herbicide Crop Safety for Container Production	15	39	17	128
	Preemergent Crop Safety for Field Production	8	27	4	44
	SOR Regional Pollinator Plant Herbicide Crop Safety	7	6	6	24

For a detailed list of research activities visit https://www.ir4project.org/ehc/.