IR-4 and Growers

Partners in Agriculture

2017 Annual Report

The IR-4 Project

ANNUAL REPORT OF THE IR-4 PROJECT[1]
January 1, 2017 - December 31, 2017

The IR-4 Project (IR-4) continues to provide a valuable service to farmers, food processors and the public by facilitating the registration of safe and effective pest management products for horticultural crops (also known as specialty crops that includes fruits, vegetables, nuts, herbs, ornamentals, etc.) and minor or specialty uses on major crops (e.g. corn, cotton, soybeans, wheat, etc.). IR-4 was established in 1963 and still is relevant today because it solves the "Minor Use Problem" while adding value to specialty crop agriculture.

The Minor Use Problem exists because registrants of pest management products focus their product development efforts on large acreage major crops where the potential sales are significant. Specialty crops are minor markets and the development of pest management technology in these markets is not an objective of the private sector. This often leads to many pest management voids in/on specialty crops. IR-4's role in solving the Minor Use Problem involves developing the data needed by the US Environmental Protection Agency (EPA) and/or registrants to register conventional chemical pesticides as well as biopesticides[2] on these important crops. Data developed through IR-4 research includes guideline Magnitude of the (pesticide) Residue and/or product performance data.

IR-4 focuses its resources on providing specialty crop farmers legal access to essential pest management products that protect their crops from destructive pests while reducing food waste. Without regulatory approval of safe and effective pest management products, specialty crops would suffer significant yield and quality losses. IR-4 provides national coordination, technical guidance and research to develop the appropriate data to facilitate registrations.

The IR-4 Project efforts have supported over 48,000 registrations of conventional pesticides and biopesticides on specialty food crops and ornamental horticulture crops in its 54-year history. IR-4 focuses its efforts on technology that is the cornerstone of, or compatible with, Integrated Pest Management Systems (IPM). Technology often includes "Reduced-Risk" pesticides, biopesticides, and products that can be used in organic farming.

IR-4's service extends beyond farmers in facilitating registrations to manage pests and reduce food waste. Food processors benefit in having a consistent supply of high quality raw materials to keep their operations efficient. The public benefits through having an abundant choice of healthy vegetables, fruits, nuts and other foods available at reasonable prices, as well as ornamental horticulture plants to enhance the landscape and environment we live in. IR-4 is a critical constituent of the U.S. government's tactical sciences that contribute to domestic food security as well as a resource to combat invasive pest species and bioterrorism. The economic value of IR-4 is significant - Michigan State University's Center for Economic Analysis recently completed an economic analysis of IR-4 and concluded that "IR-4's Partnership with Agriculture has contributed to 95,261 jobs with a total labor income of $5.6 billion, and annual contributions to gross domestic product totaling about $9.4 billion". A great deal of these contributions go a long way to benefit healthy economies and well-being of rural communities.

IR-4 has achieved this success and value because it cooperates with many partners to accomplish its mission. Resources are leveraged to their fullest potential. Some of the major partners/cooperators include:

- Specialty crop growers and their commodity organizations
- Land Grant Universities and their State Agricultural Experiment Stations
- Crop protection industry, including large and small companies that register pest management products
- Multiple government Departments/Services/units[3] including:
    - USDA-Agriculture Research Service (ARS)
    - USDA-Animal and Plant Health Inspection Service (APHIS)
    - USDA-Foreign Agriculture Service (FAS)

[1] IR-4 Project, or Inter-Regional Research Project Number Four, is authorized by the Directors of the State Agricultural Experiment Station Directors as National Research Support Program Number Four (NRSP-4)

[2] IR-4's research was further expanded in 1982 to include support for microbial and biochemical pesticide products (biopesticides)

[3] These and other Cooperating Agencies, principal leaders of the project, technical managers and IR-4 State and Federal Liaison Representatives are shown in Attachment 1

- USDA-National Institute of Food and Agriculture (NIFA)
- US Environmental Protection Agency (EPA)
- Department of Defense-Deployed Warfighter Protection Program (DWFP)
- California's Department of Pesticide Regulation (CA-DPR)
- Canada's Pest Management Regulatory Agency (PMRA) and the Pest Management Centre in Agriculture and Agri-Food Canada (CN-PMC).

Further details about the IR-4 Project can be found at the IR-4 Project's website: http://ir4.rutgers.edu.

Food Program

The IR-4 Project remains committed to its original objective to provide regulatory approval of safe and effective plant protection products to assist in the production of food crops and give specialty crop growers the tools they need to grow a healthy crop and be successful and competitive in local, regional, national and international markets.

Research Activities – Food Residue

Since 1963, IR-4 stakeholders have submitted 12,466 requests for assistance to the IR-4 Food Program. Of these, 355 are considered researchable projects that remain as documented needs of specialty crop growers. The other requests have either been addressed through previous research and regulatory submissions or cannot be registered at this time. The total number of new project requests added to the IR-4 tracking system during 2017 was 370. Of these, 107 new project requests were submitted to IR-4 from domestic stakeholders and international cooperators, 179 were created to track new crop group updates/submissions and 84 were used to facilitate the transfer of old data to off-site archives.

IR-4's research priorities for 2017 were determined by IR-4 stakeholders during the September 2016 IR-4 Food Use Workshop in Orlando, FL. Based on the outcome of that workshop and other priority setting mechanisms, such as upgrading projects to answer important regional needs, IR-4 scheduled 60 new studies in 2017. An additional 16 studies were carried over from the previous year's research for 76 total residue studies.

For most Magnitude of the Residue studies, IR-4 follows the EPA's Office of Pesticide Program Series 860 Test Guidelines. In most cases, the test chemical is applied in the field in a manner that simulates the proposed grower use of the pesticide on the target crop. When the crop is at the appropriate stage, samples of the crop are collected and shipped to the analytical laboratory where the amount of test chemical remaining in or on the crop is determined. Field and laboratory data from this research are then compiled in a regulatory package and utilized to request a pesticide tolerance, also known as a maximum residue limit (MRL).

In support of the 76 residue studies in the 2017 food residue research program, there were 364 IR-4 State (land grant) field trials, 72 USDA-ARS field trials and 32 field trials provided from our Canadian (CN-PMC) partners for a grand total of 468 field trials. Canada also served as Sponsor and Study Director for three of these studies. The specific studies for 2017, including test chemical and crop, are shown in Attachment 2.

The majority of resulting residue samples are analyzed at the dedicated IR-4 analytical laboratories[4]. When necessary, other cooperating facilities or contractors are utilized to ensure projects are completed in a timely manner. In 2017, IR-4 set aside approximately $300,000 to have certain sample sets analyzed by Contract Research Laboratories. IR-4 makes every effort to complete the lab portion of studies in one year in order to meet the 30-month timeline goal for each study. However, weather, proper trial separation requirements and other factors can sometimes preclude IR-4 from meeting this goal.

[4] Laboratories at University of California-Davis, University of Florida, Michigan State University, USDA-ARS at Tifton, GA and USDA-ARS at Wapato, WA

Research Activities – Product Performance (formerly Efficacy and Crop Safety [E/CS])

The need for IR-4 to develop Food Program product performance data (efficacy and crop safety research) to support labeling of new uses for specialty crop pest management continues to be an important priority in the IR-4 Project's annual research plan. In many cases, the data are required by registrants prior to actively marketing the new uses, especially in states like California where these data are needed as part of the registration package. For 2017, the IR-4 Food Program Product Performance team planned trials requiring nearly $45,000 in funding to support product performance research. This research focused primarily on five research areas:

- projects where data are needed to support past residue research, but more performance data are needed before the cooperative registrant would allow registration, often times to address liability concerns
- projects supporting on-going residue research
- projects where data are needed before registrants approve IR-4 conducting residue research
- projects to address highest priority national and regional performance needs
- projects to identify possible products to control pests where tools currently are not available (Pest Problem Without Solution, or "PPWS").

The 2017 funding supported research to address needs for 52 projects, including 102 state university trials and 2 ARS trials. In addition, CN-PMC planned to conduct several performance trials supporting a number of joint projects. Data from all these performance trials are to support new uses in the US, which will benefit specialty crop stakeholders (see Attachment 3 – "2017 Product Performance Research Program" for full details).

In addition to coordinating the 2017 performance research plan, the Food Program Product Performance team continued to implement process improvements that have improved the monitoring and tracking of this expanding segment of the Food Use Program. The improved performance trial protocol format has been successfully implemented. The team continues to work closely year-round with registrants and researchers to understand the quantity and scope of data requirements, and to ascertain the status of research results. They have also compiled as much detail as possible on each performance protocol prior to the annual National Research Planning meeting so that more informed trial placement and funding decisions can be made for the next year's program.

Submissions and Successes

Submissions. This was another productive year for IR-4 submissions. In 2017, IR-4 submitted data to EPA or to the cooperating registrant for 28 chemicals, addressing 194 specific IR-4 requests for assistance. Included in these submissions was one package submitted to cooperating registrants to support an expansion of the registration. See Attachment 4 for a comprehensive listing of data IR-4 submitted for registration in 2017. Additionally, there are currently another 99 reports signed at IR-4 and ready for submission but are awaiting final submission documents (EPA forms, labels etc.) or are being bundled with other studies before making the submission to EPA.

The IR-4 Food Use Program continuously strives to work smarter and more efficiently to deliver new plant protection products for specialty crop growers. For example, over half of the projects tracked in the 2017 submissions, were for crop group tolerances (121 of the 194 project requests submitted). Utilizing crop groups continues to add many more new uses to product labels and supports new crop markets for growers.

Successes. IR-4 posted 534 new uses for growers in 2017, based on 65 tolerances that EPA established utilizing IR-4 data. A complete list of these new uses along with the new crop groups are presented in Attachment 5. EPA continues to support IR-4 in reviewing IR-4 data as it is submitted and generally meet the PRIA mandated timelines. In total, EPA reviewed 14 chemistries in 15 actions for IR-4 in 2017. The number of actions is down slightly from previous years, but this may be due to some cumulative assessments as well as delays associated with the change of administration. The 534 new uses in 2017 bring the IR-4 54-year total of clearances with conventional pesticides on food crops to 18,896.

EPA continues to closely scrutinize data to ensure that any new regulatory approval protect consumers, farm workers and the environment, with particular attention to protecting children, pollinators, endangered species, and water. This increased scrutiny of pesticide hazard/risk assessments has required additional work by IR-4 to provide more comprehensive Public Interest (benefit) support for these new uses and in many cases respond in the public comment process, to a much greater degree than in the past. IR-4 continues to add information from stakeholders to the IR-4 database that demonstrates the great need of new pest control products. As noted on the IR-4 database, these products provide the much needed pest control, and are critical components of IPM programs and resistance management.

A listing of IR-4 projects in the queue for future submission to EPA, that include data from 140 studies that will address 320 IR-4 project requests, are provided in Attachment 6 or can be viewed on the IR-4 website at: http://ir4app.rutgers.edu/Ir4FoodPub/timelineSch.aspx. EPA posts their Multi-Year work plan, which includes IR-4 submissions pending at EPA, at: http://www.epa.gov/pesticide-registration/multi-year-workplan-conventional-pesticide-registration. EPA generally reviews IR-4 submissions and establishes tolerances within a legislative mandated 15-month review timeline. IR-4 continues to support EPA's goal of encouraging the use of pesticides that pose less risk to human health and the environment compared to existing alternatives and IR-4 continues to make requests of EPA for many of our submissions to be classified as Reduced Risk.

Regulatory Compliance

Good Laboratory Practice Standards (GLP's as noted in Chapter 40, *Code of Federal Regulations*, Part 160) compliance is paramount to the quality and success of the IR-4 Project's Food Program residue data. Key components of compliance include the activities of the IR-4 Project's Quality Assurance Unit (QAU). The QAU continues to provide monitoring and support to cooperating scientists throughout the US. Audits of facilities and ongoing field and laboratory procedures provide assurance that IR-4's data are of the highest quality and ensure acceptance by EPA, the crop protection industry, and international regulatory authorities.

The Annual IR-4 QA Planning Meeting was held March 2-3, 2017 in Orlando, FL. At this meeting, the audit plan for the IR-4 QA officers for the 2017 field trial season was created. For calendar year 2017, regular inspections included 18 facilities, 151 in-life audits of field trials, 34 in-life audits of residue analytical laboratory activities, 34 analytical summary report/data audits and 420 field data book audits. During the 2017 calendar year, 54 final reports and amended reports were audited.

IR-4 facilities continue meeting the high standards demanded under GLP requirements. IR-4 has participated in a total of 172 EPA GLP IR-4 facility inspections since April 27, 1997, with only one minor finding to-date. In 2017, the US EPA notified IR-4 of 10 inspections for GLP compliance and data integrity, including IR-4 Headquarters.

IR-4 continues to use the eQA (electronic) reporting system to improve efficiencies and enhance communications across the program. Over 992 inspection and audit reports were processed using the web-based system in 2017. The electronic system was expanded in 2017 to include a document management system (eDOCs). This document management system is used to post protocols/changes, analytical methods and certificates of analysis for GLP test materials. To-date some 1045 sortable documents are now on the eDOCs system and readily available to IR-4 study participants.

Crop Grouping Initiative

IR-4 continues to expand and enhance crop groups and sub-groups. IR-4 assisted the EPA with analysis of the previously submitted proposals for Crop Group 15 Cereal Grains; Crop Group 16 Forage, Fodder and Straw of Cereal Grains; and Crop Group 18 Nongrass Animal Feeds Group. In addition, US EPA ChemSAC has reviewed and approved the revised Herb and Spice crop groups, Root and Tuber, Leaves of Root and Tuber Vegetable and Legume Vegetables and Foliage of Legume Vegetable groups. The proposed rule for comment of a number of the revised crop groups is expected to be published in the Federal Register in 2018. The effort to update crop groups continues with the Codex Committee of Pesticide Residues as well. Codex commodities of plant origin Type 02 (Vegetables) and Type 03 (Grasses) were completed during the 2017 Codex Committee of Pesticide Residues meeting in Beijing, China.

International Activities:

IR-4 remains committed to assisting US specialty crop growers with their desire to expand their markets by exporting fruits and vegetables to international destinations. IR-4 data is often a key component in efforts to harmonize pesticide residue standards for specialty crops and to reduce the use of MRLs as a technical phytosanitary trade barrier.

In North America, IR-4's cooperation with CN-PMC continues to be mutually beneficial; in 2017 CN-PMC contributed 32 field trials to the joint US/Canada minor use program. CN-PMC managed and served as Study Director and Sponsor for 3 of the 76 studies in 2017. These three studies utilized a number of IR-4 field research centers to complete the NAFTA data requirements. CN-PMC also analyzed samples from all of these field locations. In total, the research benefit in the IR-4 residue program for working with CN-PMC saves IR-4 an estimated $500,000 per year. In addition, the CN-PMC program continues to provide significant contributions to IR-4 efficacy and crop safety research and shares

ornamental efficacy and crop safety with IR-4. There also continues to be a good exchange of personnel, with CN-PMC participating in various IR-4 meetings and vice versa.

The joint review process by EPA and Canada's Pest Management Regulatory Agency also benefits IR-4 stakeholders by saving resources on both sides of the border; only one agency is responsible for reviewing the residue data. More importantly, both agencies are establishing MRLs at the same level, at the same time. This prevents trade irritants before they happen. EPA and PMRA completed joint reviews or workshares on 6 IR-4/CN-PMC submissions that addressed 14 stakeholder requests in 2017.

IR-4 continues to work with other nations to answer priorities captured at the first Global Minor Use Workshop. Under IR-4's lead, progress is being made with products such as spinosad or spinetoram to manage fruit fly in tropical crops in Latin America. While several of these uses are already registered in the US, the tolerances were granted through extrapolation. Generating residue data for these uses will ensure long-term support of the uses. Many of the secondary priorities are also being considered; for example, the 2017 registration of flonicamid in NAFTA to address aphid control in legume crops was cited as an important need. Anthracnose on tropical crops was also raised as a priority, and IR-4 undertook a number of residue studies in 2016 and 2017 to address this need and other countries are considering support as well.

The Canadian Agriculture and Agri-Food Canada Pest Management Centre hosted the Third Global Minor Use Summit in Montreal, Quebec, Canada from October 1-4, 2017. The USDA-FAS, CN-PMC and IR-4 served as co-sponsors. The Summit provided a venue for experts to discuss these issues and identify ways to harmonize pesticide regulations, with a goal to reduce duplication and cost of efforts in developing and reviewing regulatory submissions for minor uses. This Summit saw some strong progress in several areas and the group agreed to focus work on the following themes over the next five years:

- Increase cooperation by creating minor use champions from different regions of the world;
- Actively promote the adoption of procedures to establish global maximum residue limits (the amount of pesticide that can be safely left on crops);
- Work towards a globally acceptable definition of "minor crops";
- Find consensus on crop grouping and representative crops (crops that are similar enough that they can be treated the same, i.e. onions and leeks);
- Develop a white paper on capacity building to meet regulatory data requirements.

Another area of success in 2017, was that many of the studies under the Global Capacity Development/Residue Data Generation Project came to completion in 2016 and were reviewed by JMPR/Codex in 2017. Coordinated by USDA-FAS, this project's objective was to enhance capacity of participating nations in Asia, Africa and Latin America to meet pesticide-related requirements based on international (Codex) standards. This goal is being achieved by collaborative residue data generation projects on low risk products, such as pyriproxyfen and spinetoram on tropical fruits, that incorporate all technical aspects of these studies and is expected to provide broader national residue monitoring as well. The focus of IR-4's contributions has been on developing expertise in the area of GLP field and laboratory pesticide residue studies that can be provided to local authorities and Codex for product registration. All three of the regions participating in this project have received Standards Trade Development Facility (STDF) and USDA-FAS funding, which provides support for IR-4's contributions to the project as well.

The projects submitted in late 2016 involved: azoxystrobin plus difenoconazole on dragon fruit that included samples from Indonesia and Vietnam; spinetoram on lychee and mango with samples from Thailand; and spinetoram on avocado from Columbia. These projects were reviewed by JMPR in September of 2017 and final Codex MRLs are expected in 2018. Other projects were completed in 2016, but were scheduled for JMPR review in 2018, therefore, they were submitted in 2017. These include pyriproxyfen on papaya with samples from the Philippines, Malaysia and Brunei; pyriproxyfen on mango that included samples from Malaysia and Singapore; pyriproxyfen on pineapple from Panama; and pyriproxyfen on banana with samples from Costa Rica and Guatemala. Africa started their residue project with sulfoxaflor on mango in 2016 and completed the field portions in 2017. The samples are awaiting analysis.

At the request of EPA, IR-4 personnel continue to be included as part of the US delegations to the: Codex Committee on Pesticide Residues (CCPR); the Organization for Economic Co-operation and Development's Expert Group on Minor Uses and the Working Group on Pesticides; and the NAFTA Technical Working Group on Pesticides. IR-4 plays a key

role in these activities by supporting global standards and incentives that support minor uses. These include global recognition of crop grouping and extrapolation as well as promoting MRLs on specialty commodities. IR-4 also assists other countries, both developed and developing, as they begin to establish minor use programs, especially with New Zealand, Brazil, Costa Rica and Colombia. The knowledge and expertise of IR-4 is often sought after and is highly valuable to these countries as their minor use programs evolve and become established.

IR-4 continued to support submissions to the JMPR for 2017 review, including captan on ginseng, potassium phosphite (tree nuts and citrus) and flonicamid on legume vegetables as well as the global tropical fruit submissions noted above.

Ornamental Horticulture Program

The Ornamental Horticulture Program continues to support an industry valued at nearly $19.2 billion in annual sales (Horticulture Census, 2014, NASS). This industry is quite complex because growers cover many 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.

Research Activities

In 2017, IR-4 conducted 673 ornamental horticulture research trials to support registrations in the greenhouse, nursery, landscape, Christmas tree and forestry industries. Of these, 231 were efficacy trials designed to compare different products to manage damaging insects, plant diseases and weeds and to measure the impact of growth regulators; the remaining trials were conducted to determine the level of phytotoxicity to crops with herbicides used to manage common weeds in and around nurseries. Please see Table 1 for a summary of research activities and Attachment 7 for a complete listing of 2017 field cooperators and Attachment 8 for research activities listed by project.

Table 1. Summary of IR-4's 2017 and Revised 2016 Ornamental Horticulture Program Research Activities.

Category	2017			Revised 2016		
	Efficacy	Crop Safety	Total	Efficacy	Crop Safety	Total
Number of Studies (PR Numbers) with Planned Trials	148	298	446	226	355	581
Number of Trials	231	442	673	255	507	782

Submissions and Successes

During 2017, 21 data summaries were compiled based upon research reports submitted by researchers. See Attachment 9 for Abstracts from the individual reports. The summary reports includes: Afidopyropen Crop Safety Summary, Arthropod Shipping and European Pepper Moth APHIS Project Summary, Beetle, Borer, Weevil & White Grub Efficacy Summary, Benzovindiflupyr + Azoxystrobin Crop Safety, Botrytis Efficacy Summary, Dithiopyr Crop Safety, Downy Mildew Efficacy Summary, Fluensulfone Crop Safety, Fluxapyroxad + Pyraclostrobin Crop Safety, Isoxaben Crop Safety, Metconazole Crop Safety, Nematode Literature Review, Oxathiapiprolin Crop Safety, Oxyfluorfen + Prodiamine Crop Safety, Pendimethalin + Dimethenamid-p Crop Safety, Pendimethalin Crop Safety, Powdery Mildew Efficacy Summary, Pydiflumetofen + Fludioxanil Crop Safety Summary, Pydiflumetofen Crop Safety Summary, Scale and Mealybug Efficacy, and Thrips Efficacy Summary. Data from 4,112 trials contributed to the writing of these reports. Table 2 lists the number of trials by IR-4 Region that were used in the data summaries.

Table 2. 2016 Ornamental Horticulture Program Research Summaries.

Region	Number of Trials
North Central	571
North East	611
Southern	1,224
Western	724
USDA-ARS	962
Total	4,192

During 2017, US EPA approved one new label based partially on the efficacy data IR-4 generated: a new formulation and label for F9110 from FMC. Orkestra Intrinsic (boscalid + pyraclostrobin) was registered by California. Two of the five products not to be registered were related to crop safety trials exhibiting injury. The other three were dropped by the new registrant during the acquisition process.

Table 3. Ornamental Horticulture Program Registration Contributions, 2017.

Category	**2017**		
	Efficacy	Crop Safety	Total
New US EPA Product Registrations [a]	1	0	1
US EPA Label Amendments [b]	0	0	0
State Registrations [c]	1	0	1
International	0	0	0
Not to be Registered	3	2	5
Number of Trials Contributing to Registrations [d]	27	0	27
North Central	9	1	10
North East	13	2	15
Southern	8	0	8
Western	19	0	19
USDA-ARS	29	15	44
Number of Impacted Crops [e]	804	0	804

[a] New products for the ornamental horticulture industry based on data collected through IR-4 and submitted to manufacturers in previous years.
[b] Label updates on existing products for the ornamental horticulture industry based on data collected through IR-4 and submitted to manufacturers in previous years.
[c] State registrations and special local needs registrations on federally registered products for the ornamental horticulture industry based on data collected through IR-4 and submitted to manufacturers in previous years.
[d] The total number of trials where data was utilized for registrations.
[e] The number of impacted crops is an estimate of the total plant species grown commercially for ornamental uses impacted by the IR-4 data.
[f] For some registrations, IR-4 contributed both efficacy and crop safety data.

2017 Workshop

The Ornamental Horticulture Workshop was held in San Diego, CA, in October 2017 to establish priorities for the 2018 and 2019 biennial research cycle. In this workshop, IR-4 combined discussing the ornamental horticulture program priorities with discussion of potential ornamental horticulture projects in the Biopesticide Program. Similar to past workshops, registrant representatives presented new active ingredients and highlighted opportunities for existing products. Then the results of the Grower & Extension Survey were presented, and we discussed the pros and cons for conducting efficacy or crop safety research on 34 current and potential new projects across entomology, pathology and weed science. To have these discussions flow smoothly, IR-4 staff updated Project Sheets that summarized the need, research and registrations to date, and 15 Product Lists outlining the key features of tools currently available for certain diseases and pests. The 31 project sheets were created to cover recently studied projects and potential new projects based on the annual Grower & Extension Survey and newly received project requests. Also, new projects for each discipline were raised as potential research avenues during the workshop. After the relative merits of each project were captured on poster-size paper and fastened to the walls, a Sticker Caucus was held so that workshop attendees could vote for the research projects IR-4 should undertake during 2018 – 2019. During the second morning of the workshop, the outcomes for each discipline were projected, and the research priorities were finalized after further conversations.

Priorities from the 2017 Workshop include:

- Entomology Projects: Foliar Feeding Beetle Efficacy, Coleopteran Borers, New Product Crop Safety.
- Pathology Projects: Botrytis Efficacy, Non-Oomycete Root Disease Efficacy, New Product Crop Safety.
- Weed Science: Pre-Emergent Herbicide Crop Safety, Post-Emergent Herbicide Crop Safety, Post-Emergent Herbicide Efficacy. Regional Pprojects: Thrips Efficacy, Snail & Slug Efficacy, Nematode Efficacy, Liverwort Efficacy, Cover Crop Management for Christmas Tree Production, and Cut Flower Herbicide Crop Safety.

Invasive Species Research Activities

During 2017, the IR-4 Ornamental Horticulture Program continued to facilitate research activities for two invasive species impacting the Ornamental Horticulture Industry: Boxwood Blight Biology and Management, and Impatiens Downy Mildew Biology and Management. Each project was funded under USDA-APHIS Farm Bill Section 10201/10007 and encompassed key objectives to manage exotic invasive species by studying aspects of pathogen or pest biology and management tools (conventional or biopesticide as appropriate to the target organism) on plants to enable growers to better implement mitigation strategies. The Arthropod Management Project finished during 2015, and the final summary report of research results was posted to the IR-4 website in 2017. The Chrysanthemum White Rust project ended during 2016 but a final summary will be posted in 2018. Key elements of each project are listed in Table 4 below.

Table 4. Invasive Species Projects during 2017

Project Topic	Collaborating Researchers	Research Objectives	Duration
Boxwood Blight	Sharon Douglas, Connecticut Agriculture Experiment Station Robert Marra, CAES Jim LaMondia, CAES Margery Daughtrey, Cornell University Nina Shishkoff, USDA-ARS- Fort Detrick JoAnne Crouch, USDA-ARS, Beltsville Mike Benson, NC State University Marc Cubeta, NC State University Kelly Ivors, NC State University Chuan Hong, Virginia Tech Anton Baudoin, Virginia Tech Norm Dart, Virginia Department of Ag. & Consumer Services Len Coop, Oregon State University Anne Gould, Rutgers University Brad Hillman, Rutgers University	Fungicide screening and mitigation strategies Cultural control potentials including use of heat treatments Effect of sanitizers on conidia and mycelia Impact of fungicides on microsclerotium development Screening of potential biopesticides for microslerotium inactivation Development of isothermic LAMP detection assay Boxwood species and cultivar screen for resistance *Calonectria pseudonaviculata* host range (*Pachysandra* and *Sarcoccoca*) Development of infections under field conditions *Calonectria pseudonaviculata* population genetics Development of epidemiology model based on U.S. temperature and moisture conditions	2011 – 2018
Impatiens Downy Mildew	Margery Daughtrey, Cornell University Mary Hasubeck, Michigan State University Aaron Palmateer, University of Florida JoAnne Crouch, USDA-ARS, Beltsville Nina Shishkoff, USDA-ARS, Fort Detrick Lena Quesada, NC State University Ann Gould, Rutgers University	Overwintering of *Plasmopora obducens* oospores Fungicide screening and rotational strategies Sporangia and oospore development and epidemiology *Plasmopora obducens* population genetics Development of genetic tools for downy mildews including Impatiens Downy Mildew, Cucurbit Downy Mildew, Hops Downy Mildew, Basil Downy Mildew	2012 - 2018

As an offshoot from the APHIS impatiens downy mildew project, IR-4 submitted and received a competitive USDA-NIFA Specialty Crop Research Initiative (SCRI) planning grant to identify knowledge gaps for downy mildews of environmental horticulture crops and to better understand how scientists findings are put into practice by growers. To achieve these goals IR-4 developed a survey for growers and held a workshop with members of the research and stakeholder communities. The survey asked growers about downy mildews (DMs) within their operations and how they handled outbreaks. The workshop included presentations and discussions on topics related to the biology, genetics, management and economic impact of downy mildew diseases and how best to convey complex topics to audiences with diverse language and education backgrounds. IR-4 then developed and posted a white paper that outlined the knowledge and outreach gaps (see details below) and the resulting potential short and long term objectives. This white paper provides a research and outreach roadmap to address DMs for the benefit of growers and consumers, and it will help to frame the issues for policy makers and granting agencies.

Pollinator Protection Activities

Protecting pollinators has risen to a high level of public concern and is affecting decision making at many levels, from individual consumers to the federal government representatives. This SCRI research project is expected to provide crucial, science-based information for grower decision making and provide opportunities for the ornamental horticulture industry

to contribute to improved pollinator health by growing plants under best production practices, thereby increasing pollinator forage quality and quantity in rural and urban landscapes.

This research project team is comprised of entomologists and agricultural economist from Clemson University, Connecticut Agriculture Experiment Station, Cornell University, Michigan State University, Penn State University, University of California, University of Florida and University of Kentucky.

During the first year, IR-4 in cooperation with several universities established test garden plots of common annuals and perennials and then collected/counted the number of visiting pollinators. IR-4 has now begun studies on the amount of systemic insecticides found in pollen and nectar of rhododendron and sunflower plots and has also established plots for geraltdon wax flower, salvia, and snapdragon. IR-4 has started compiling the available efficacy and toxicology information for alternative treatment options, and have developed a grower survey to understand the economic and social impacts related to neonicotinoid use or lack thereof. IR-4 has also developed the consumer online and eye tracking survey tools to assess consumer willingness to pay and preferences related to grower production practices. The team contributed to the Horticultural Research Institute's Best Management Practices document and wrote more than 10 articles and gave 39 presentations. Ultimately, these activities will improve pollinator health and improve the sustainability and profitability of the ornamental horticulture and beekeeping industries.

Biopesticide and Organic Support Program

The IR-4 Biopesticide and Organic Support Program has the goal of facilitating the registration of crop protection products classified by EPA as Biopesticides. The program provides registration assistance to university and USDA researchers as well as to small biopesticide companies with regulatory advice and petition preparation assistance. The program also does considerable work on product performance.

Research Activities

Since its inception in 1982, the IR-4 biopesticide research program has provided competitive grant funding of projects, amounting to over $8.4 million to researchers (see http://ir4app.rutgers.edu/biopestPub/grantFundedProj.aspx for report summaries). In 2014, IR-4 decided to transition its biopesticide program from a "Request for Application" program that supported Early, Advanced and Demonstration stage research to a priority setting workshop with actively engaged stakeholders who choose the most critical needs for biopesticides, and IR-4 responds by directing research to these priorities.

IR-4 held its first Biopesticide Priority Setting Workshop in September 2014 in association with the Food Use Workshop in Atlanta, GA. The workshop was established to actively engage stakeholders and encourage submission of known pest management voids that could potentially be answered by biopesticide technology. Continued stakeholder input occurred at the 2016 Biopesticide Workshop in Orlando, Florida. Based on the priorities established at the 2016 workshop, in 2017, IR-4 funded 13 studies with 31 different researchers. These studies were conducted by different universities on fruits, vegetables, honeybees, and ornamentals. Among the high profile invasive pests, the biopesticide program has supported projects involving Spotted Wing Drosophila, American Chestnut Blight, and Fire Blight management in organic pome fruit. See Attachment 10 and http://ir4app.rutgers.edu/biopestPub/pnnProjects.aspx for the specific research projects and research cooperators.

Due to feedback gathered from the preceding Biopesticide Workshops, the workshop interval is now changed to every other year to allow researchers more time to compile important information and understand efficacy results and needs going forward. The next workshop will take place September 20-21, 2018 in St. Louis, MO.

Submissions and Successes

In 2017, IR-4 submitted a registration packages to EPA for PMV-01 for the management of Pepino Mosaic Virus in tomato and for *Metschnikowia fructicola* for the management of diseases in the Small fruit vine climbing subgroup, except fuzzy kiwifruit (Crop Group 13-07F). IR-4 also submitted a number of additional studies to the EPA to support the pending request for *Pseudomonas fluorescens* ACK55.

The EPA approved the bioinsecticide PFR-97 label amendment request to add management of flies in mushroom houses. Other amendments include the addition of basil, cabbage, potato, and apple to the Stargus (*Bacillus amyloliquefaciens F727*) label. Regulatory support focused on control of *Phytophthora infestans* and *Erythroseptica* in potato with the

biofungicide previously known as MBI-110. These label changes were also supported by efficacy trials funded by the Biopesticide program.

The Public Health Pesticides Program

The IR-4 Public Health Pesticide (PHP) Program's objective is to focus on registrations of pesticide products that protect the public from vector-borne diseases (e.g. Dengue or Zika virus, Lyme disease, malaria, etc.) and from the nuisance and economic costs caused by mosquitoes, ticks, and other arthropod public health pests. Vector control uses of pesticides are statutorily recognized as "minor uses", and it is widely recognized that public support for their development and registration is in the public interest. The PHP Program provides regulatory support for new vector control materials, products, and use patterns. In addition, the Program maintains a unique database of existing vector control tools and potential PHP's; collaborates with industry, the user community, and regulators on developing strategies to retain products in the vector control toolbox in the face of new regulatory requirements; and participates in efforts to encourage innovation and streamline the path to registration and market. In 2017, the program made one submission to EPA to convert the use of permethrin disinfections of aircraft products that is currently under an EPA Section 18 emergency use to a full Section 3 registration, final approval is expected in June of 2018.

Primary funding for the IR-4 PHP Program is provided by the Deployed Warfighter Protection Program (DWFP) of the U.S. Department of Defense (DoD) and by USDA-ARS. IR-4 serves as a regulatory consultant and representative for many of the new materials and methods developed by DWFP-funded researchers, as well as other military and USDA medical and veterinary entomology programs. Unfortunately, due to other priorities, DoD and USDA-ARS management did not renew their cooperative agreement with IR-4. At this time, IR-4 has suspend operations with the Public Health Pesticide objective.

Impact

This document captures the successes, accomplishments and deliverables of the IR-4 Project in its core program areas. IR-4 remains a highly accountable and responsive organization that directly answers the articulated needs of its stakeholders. It should be further noted that the majority of IR-4's research efforts is with products that are compatible with Integrated Pest Management systems, and have low toxicity and hazard or degrade rapidly after use. The goal of IR-4 is to give safe and effective pest management tools to farmers so they can maximize yields of quality fruits, vegetables and nuts, and the many other specialty crops that are important constituents of a consistent supply of nutritious food available to the public at an affordable price. The same culture applies to ornamental horticulture crops. What IR-4 delivers to society continues to be extremely important and necessary.

In December, Michigan State University's Center of Economic Analysis released an updated study on the economic impact of IR-4 Project's activities in the Food, Ornamental Horticulture and Biopesticide and Organic Support programs. According to the report, ***"the estimated total effects of the IR-4 Project includes supporting an estimated 95,261 jobs with total labor income of $5.6 billion and annual contributions to gross domestic product totaling about $9.4 billion. These impacts represent best estimates of ongoing contributions to the U.S. economy, largely through crop agricultural productivity and damage mitigation via pest management."*** See http://ir4.rutgers.edu/Other/IR4%202017%20Impact%20Final.pdf for a full report of the IR-4 economic impact study.

2017 Appropriations and other funding

The IR-4 Project receives funds by various units within USDA in partnership with the SAES as well as others. Funding is broken down into two main buckets, "Core Programs" and "Enhanced Mission". Total funding received in calendar year 2017 in these two areas was approximately $17,910,552. See below for details:

Core Programs

Amount	Source	Comment
$11.913,000	Congressional Appropriation via Special Research Grant administrated by USDA-NIFA	Support operations within the Food, Ornamental Horticulture and Biopesticide and Organic Support programs. In 2017, approximately $7.353 million was distributed to the four IR-4 Regional offices and Headquarters for personnel, supplies, equipment; laboratory analysis and other core expenses. Slightly over $2.30 million was allocated for field trials that produce the necessary residue samples and product performance data; $505,000 for ornamental trials; $390,000 for biopesticide/organic support grants, $228,000 for new analytical instruments, $300,000 for supplemental laboratory analysis and the remaining $834,000 was mandatory NIFA holdback
$481,182	State Agriculture Experimental Station Directors (NRSP-4)	Multi-State Research Funds/NRSP-4 grant. NRSP-4 funds directly pay salaries for IR-4 HQ management who provide overall leadership and coordination of the IR-4 Project's on-going research efforts.
$3,170,000	Congressional Appropriation via USDA-Agriculture Research Service	Funds support salary and other expenses for USDA-ARS personnel involved with high priority research within IR-4's Food and Ornamental Horticulture programs. Participating ARS scientists are given specific research assignments that fully complement and do not duplicate the on-going research at the SAES
$15,564,182	**TOTAL FUNDING**	CORE PROGRAMS

Enhanced Missions

Amount	Source	Comment
$30,000	**Department of Defense/USDA-Agricultural Research Service**	Cooperative agreement between IR-4 and USDA-ARS based on allocation through Deployed Warfighter Protection Program. Funding is provided exclusively for the Public Health Pesticide Registration Support Program and pays for personnel costs, travel and subcontracts to research groups who conduct priority research projects. Agreement expired in September 2017.
$579,000	**USDA-Foreign Agriculture Service and other global partners**	Resources to support activities that promote global pesticide regulatory harmonization and remove barriers to US specialty crop exports. This includes funds for capacity building training programs in Asia, Africa and Latin America and Technical Assistance for Specialty Crops grant to develop additional data (eg. field trials) in the US that is required by trading partners to allow domestic exports.
$2,899,975	**USDA-NIFA SCRI**	Competitive research grants to determine research and extension gaps for downy mildew diseases in environmental horticulture crops ($50,000) and to study pollinator protection in ornamental horticulture ($2,894,975, over two years) with emphasis on data gaps for risk assessment of systemic insecticides applied to ornamental horticulture crops.
$1,737,370	**Industry support**	Unrestricted funds-the crop protection industry and some grower groups/commodity associations also contribute direct financial resources as well as significant in-kind resources. IR-4 used these resources to supplement USDA funds, specifically: additional research activities, additional IR-4 HQ operations, priority setting/research planning workshops, EPA training tour, and related meetings.
$5,246,345	**TOTAL FUNDING**	ENHANCED MISSIONS

IR-4 also receives in-kind contributions from multiple sources including:

- SAES/land grant universities by hosting IR-4 field research centers, analytical laboratories and management offices throughout the United States (estimated at nearly $6 million annually)
- EPA Pesticide Registration Improvement Act fee waivers average approx. $6.0 million/annually.
- Crop protection industry (their in-kind contributions are estimated to be a 1:1 match).
- The government of Canada also makes significant in-kind contributions (>$750,000).

The IR-4 Project remains prudent with the use of resources while it continues to search for opportunities to gain efficiencies in all aspects of its research and regulatory affairs. Over the last several years, there have been substantial process improvements that allow IR-4 to get the most out of the funding. Specifically, in May of 2016, IR-4 established a panel to perform an independent organizational assessment of IR-4's operations. The Panel recommended that the IR-4 Project maintain its basic structure and engage in a thorough review of many of its processes to determine if any modification could lead to operational efficiencies and financial savings.

In response to the recommendation, IR-4 has established three ad-hoc working groups to start the examination of processes. The first group is exploring the opportunities for efficiencies within the collection and reporting data from the field research sites, the second group is looking at efficiencies in the analytical laboratories and the third group is seeking efficiencies in operations between IR-4's three existing research programs (Food Crops, Biopesticide/Organic Support and Ornamental Horticulture). Activities of these three workgroups continue. Certain process changes have been proposed and/or implemented that should lead to additional efficiencies. For example, specific process changes have led to the IR-4 Analytical Laboratories significantly reducing their backlog of uncompleted residue analysis. A major change planned for 2019 includes having all existing research program priority-setting workshops in a single week at a single venue.

Future Directions

IR-4 facilitates a stakeholder-driven research prioritization process to set direction for addressing the most important pest management voids in specialty crop agriculture. The goal is to work with crop protection products that are best suited to manage/control those pests. This is necessary because IR-4 does not have adequate resources to answer all documented pest management needs in specialty crops. This project prioritization process provides IR-4 clear guidance on resource allocation. The processes in the Food, Ornamental Horticulture and Biopesticide and Organic Support Programs are somewhat different and detailed below.

Food Program

The majority of priorities for 2018 research in the Food Program were determined at the September 20-21, 2017, Food Use Workshop held in Denver, Colorado. Because of the large number of "needs" and the limited resources to answer these needs, IR-4 facilitates an internet-based process prior to the workshop where stakeholders identify and nominate projects for consideration at the workshop. Only projects identified by at least one stakeholder during the on-line process as "A Priority" are discussed at the workshop.

Approximately 155 participants (growers, commodity organizations, university research and extension specialists, and representatives from EPA and the crop protection industry) attended the workshop where they deliberated and developed consensus on the most important chemical/crop research projects. At a minimum, assessments are based on the following criteria:

1. Availability and efficacy of alternative pest management tools (including ongoing projects for the same need);
2. Pest damage potential of target pest(s);
3. Performance and crop safety of the chemical tool in managing the target pest(s);
4. Compatibility of the proposed chemical candidate with Integrated Pest Management and safety to pollinators;
5. Uses currently covered by Section 18 emergency exemptions and;
6. Harmonization implications due to lack of international MRLs.

Recognizing certain high priority needs that are regionally based or certain high priority needs that might be missed at the workshop, IR-4 has a secondary process where stakeholders can write a comprehensive justification document to upgrade a particular project. This upgrade process serves as a safety net to ensure that IR-4 remains responsive to the specialty crop growers and their pest management needs.

Based on priorities established at the IR-4 Food Use Workshop and the upgrade process, the 2018 food program consists of 396 field trials involved in residue studies. This trial plan includes 322 trials to be conducted at IR-4 Field Research Centers/other University sites, 53 field trials at ARS sites and 21 field trials conducted by Canadian partners (CN-PMC). Additionally, IR-4 is conducting 82 field trials to develop product performance data. The majority of these trials are at University sites with four being conducted at ARS sites.

The next Food Use Workshop to identify 2019 research priorities is scheduled for September 20-21, 2018, in St. Louis, MO.

Ornamental Horticulture Program

The Ornamental Horticulture Program also utilizes a priority-setting workshop to establish priorities. Workshops are scheduled every two years to support multi-year research plans. Research priorities balance crop safety and efficacy testing for new active ingredients and expanded current registrations for new and important pest species.

In 2017, IR-4 convened an Ornamental Horticulture Priority Setting Workshop on October 17-19, 2017 in San Diego, CA. This workshop established priorities for IR-4's 2018 and 2019 Ornamental Horticulture research. Planned work in 2018 includes insecticide efficacy testing with Foliar Feeding Beetles, Coleopteran Borers (Ambrosia Beetles), and Scale/Mealybug. Fungicide efficacy testing against Botrytis and Non-Oomycete fungi. Herbicide testing includes crop safety studies for in-season "Pre-emergent" and "Post-emergent" uses, and efficacy testing for post-emergence applications. IR-4 is also planning funding insecticide/miticide crop safety testing as well as regional priorities which include efficacy research on Thrips, Snail and Slugs, nematode, and liverwort, as well as crop safety on cut flowers and ground covers for Christmas trees.

Biopesticide and Organic Support Program

The priority setting for the Biopesticide and Organic Support Program/Food Crops was held on September 21, 2016 in Orlando, FL. During the workshop, there were discussions concerning the outcome of the 2015/2016 projects including if any of the results looked promising enough to fund for a 2nd/3rd year. Projects for 2018 include:

- Varroa mite / honey bees
- Phorid fly management/ mushroom
- Spotted wing drosophila/ All crops
- Pepper weevil / GH Pepper
- Fire blight (Erwinia amylovora) Organic / Apples
- Black rot (Xanthamonas) / Organic brassica
- Weeds/ All crops
- Stem gall wasp / Blueberry
- Spotted wing drosophila / Organic fruit
- Agrobacterium rhizogens / Tomato, cucumber GH
- Downy mildew / Organic spinach
- Pythium, Cylindrocarpon / Conifer seedlings
- Black sigatoka / banana

Except for a single priority in the ornamental horticulture area, the priorities established at the 2016 Biopesticide and Organic Support Workshop will continue and cover IR-4's 2018-field research efforts.

IR-4 continues to focus its efforts in concert with the strategic plan, ***IR-4 Project - VISION 2020.*** This plan details the IR-4 Project background, vision, mission, values, culture, objectives and funding needs and identifies strategic benchmarks and the goals in each program area. See the IR-4 website for details of the strategic plan.

Specialty crop growers/minor use stakeholders continue to face significant challenges and costs in managing critical pests that attack and damage their crops. This has led to a greater need for IR-4 resulting from:

- Consolidations within the crop protection industry;
- Many new damaging invasive pests;
- Existing products less effective due to pest resistance;
- Companies are requiring additional data needed to support refined risk assessments;
- Domestic specialty crop growers want access to international markets, additional data is needed to meet these requirements; and
- Companies need/require robust crop safety and product performance testing on specialty crops before they will register the use.

Adequate funding remains as IR-4's most critical challenge. IR-4 funding from government sources in 2017 was lower than in 2009, aside from cost associate with inflation, etc. The impact of multiple years of flat funding and escalating costs is affecting IR-4's ability to maintain research levels needed to address grower demands. More troubling was the proposal in the fiscal year 2018 Executive Budget that eliminated 10 USDA-ARS research programs, all of which develop data under the IR-4 umbrella. These 10 projects account for approximately 20% of IR-4's research capacity.

In response to these funding challenges, the IR-4 Commodity Liaison Committee continues to advocate for IR-4 to decision makers within the Federal government about the importance of IR-4 and the need to provide adequately resources. The Commodity Liaison Committee has been very successful in raising awareness of IR-4 and the resource

issues. Unfortunately, due to multiple years of Continuing Resolutions and Omnibus Appropriations laws, the efforts by the Commodity Liaison Committee have not yielded a funding increase.

IR-4 has participated in the USDA led effort to establish a Tactical Science initiative/funding stream in the Federal government. The concept behind the Tactical Sciences is for likeminded organizations that provide a service to protect our domestic food supply come together with a single strong collation of programs dedicated to protect agriculture and food. It is envisioned, through this Tactical Science initiative, that Congress provide increased funding to protect our food supply.

In addition to the above, IR-4 faces additional fiscal challenge with our host land-grant universities. IR-4 is unique since IR-4's federal grants do not allow host institutions to charge indirect costs. This prohibition of indirect costs has often left the host institutions with a mandatory cost of funding administrative costs associated with the IR-4 grant. In 2015, Cornell University terminated their activities with IR-4 because it's College of Agriculture and Life Sciences were no longer able to pay a mandatory 18% cost to the University. IR-4 administrators remain fearful that other institutions will duplicate the decision made at Cornell University.

IR-4 continues to keep a close watch on the potential loss of cooperating research institutions. We are currently in discussions on how IR-4 can proactively manage this situation through a change in IR-4 authorizing language and allow the host institutions to charge a nominal amount of service fees.

In spite of these fiscal challenges, IR-4 continues to do its job. IR-4 has a record of accomplishment delivering tangible results, including over 48,000 registrations for food and non-food crops over the 54-year history of the Project. As noted previously in this document referencing the Michigan State University Center of Economic Analysis report of The Economic Impact of the IR-4 Project and Programs, IR-4 has huge economic benefit. The report goes further to conclude: ***These impacts (IR-4 contribution $9.4 billion to the annual gross domestic product) represent best estimates of ongoing contributions to the U.S. economy, largely through crop agricultural productivity and damage mitigation via pest management. Relative to core federal funding of $15.6 million dollars, this represents a high return to public investment"***. The bottom line, the IR-4 Project is a critical component of our nation's food security research infrastructure. An investment in IR-4 will help the agriculture sector meet the demands for high-quality food now and into the future.

PUBLICATIONS/PRESENTATIONS

Archambault, S. and D. Kunkel. 3rd Global Minor Use Summit Program Booklet, Filling the Tool Box for Growers: Developing Strategies for Specialty Crop and Minor Use Programs and Harmonization, Montreal, Quebec, Canada October 1-4, 2017.

Arsenovic, M., J. Baron, D. Kunkel and R. Batts. 2017. The IR-4 Project: Update on Weed Control Projects (Food Uses). The Northeastern Plant, Pest, and Soils Conference, Philadelphia, PA, Abstract.

Cowles, R.S., C.L. Palmer. J. Bethke, J.-H. Chong, B. Eitzer, D. Potter, D. Smitley, and N. Thayaril. 2017. Systemic insecticide risk assessment for pollinators in ornamental horticulture crops. American Chemical Society Meeting. August 2017.

Dorschner, K., D. Kunkel and M. Braverman. Sustainable Management of Arthropod Pests of Tomato, 1st Edition, **Editors:** Waqas Wakil, Gerald Brust and Thomas Perring . Chapter 17. Agricultural pesticide registration in the United States. **Published:** 17th November 2017

Kumar, V., C.L. Palmer, C. L. McKenzie, L. S. Osborne. 2017. Whitefly (*Bemisia tabaci*) Management Program for Ornamental Plants. EDIS ENY-989. Department of Entomology and Nematology, UF/IFAS Extension. April 2017.

Kunkel, D.L., Jerry Baron, Michael Braverman, Jason Sandahl, and Edith Lurvey. 2017. The IR-4 Program and International Cooperation to Address Pest Control Needs for Specialty Crop Growers by Establishing Pesticide MRLs. LAPRW Sixth Congress, Abstract # SS-01

Kunkel, D.L., M. Braverman, and J.J. Baron. 2017. UTILIZING GLOBAL RESOURCES TO REGISTER NEW PEST CONTROL PRODUCTS ON SPECIALTY CROPS. Proc. NEWSS, Vol. 71, p.76.

Kunkel, D. Americas Pesticide Workshop: Exploring trade and regulatory issues**,** Dr. Daniel Kunkel, Associate Director, Food and International Programs, IR-4 Project Headquarters, Rutgers State University of New Jersey – The IR-4 Program and International Cooperation to Address Pest Control Needs for Specialty Crop Growers, March 6, 2017 Location: Quito, Ecuador

McKenzie, C. L. Osborne, V. Kumar, R. Oetting, C.L. Palmer. 2017. The importance of understanding Bemisia tabaci cryptic species identification (i.e. biotypes) and how this can impact IRM programs. Presentation at Entomological Society of America Annual Meeting Denver, CO.

Novack, S. IR-4 Newsletter Winter 2017 Vol. 48 No, 1 No.P-27200-17-01

Novack, S. IR-4 Newsletter Spring 2017 Vol. 48 No, 2 No.P-27200-17-02

Novack, S. IR-4 Newsletter Summer 2017 Vol. 48 No, 3 No.P-27200-17-03

Novack, S. IR-4 Newsletter Fall 2017 Vol. 48 No, 4 No.P-27200-17-04

Palmer, C.L. J.A. Bethke, J.-H. Chong, D.O. Gilrein, D. R. Smitley. 2017. Presentation at Entomological Society of America Annual Meeting Denver, CO.

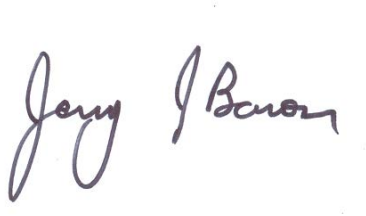
Palmer, C.L. Practical Implications for Current and Future Research Activities. Presentation at Second National Conference on Protecting Pollinators in Urban Landscapes. October 2017.

Palmer, C.L., E. Vea, J. Baron, and E. Lurvey. 2017. IR-4 Ornamental Horticulture Program: 2016 research highlights and 2017 priorities. Northeastern Plant, Pest, and Soils Conference. January 2017.

Starner, V. and S. Novack, 2017. "A Taste of Agriculture on the Delmarva Peninsula", IR-4/EPA/USDA Field Tour June 21, 2017 tour book. New Jersey Agricultural Experiment Station Publication No. P-27200-22-17, 16 pp.

December 31, 2017

Approved by:



J.J. Baron, Executive Director
IR-4 Project, NJ Agricultural Experiment Station
Rutgers, The State University of New Jersey

John Wise, Chair,
IR-4 Project Management Committee
Michigan State University

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

ATTACHMENT 1

Participants in the Process

These are the primary customers for IR-4 Project services. A concerted effort is always made to seek input from growers/commodity group representatives for establishing research priority setting policies. The **IR-4 Commodity Liaison Committee (CLC)** provides input to the IR-4 Project Management Committee on overall operations and program direction. They are often effective communicators to Congress on the importance of the IR-4 Project and its deliverables to specialty crop agriculture in the United States. Members include:

Dr. Michael Aerts, Florida Fruit and Vegetable Association
Mr. Tim Alberts*, Kemin Industries
Mr. Mark Arney, Nat'l Watermelon Promotion Board
Mr. Kirk Baumann, Ginseng Board of Wisconsin
Dr. Lori Berger, Ag Business Resources
Dr. Michael Bledsoe, Village Farms, L.P. and CLC Chair
Mr. Bruce Buurma, Buurma Farms Inc.
Dr. Jill Calabro, AmericanHort
Mr. James R. Cranney, California Citrus Quality Council
Mr. Alan DeYoung, Van Drunen Farms
Ms. Amy Gandhi* Kemin Industries
Ms. Ann E. George, Washington Hop Commission
Mr. Hank Giclas, Western Growers
Mr. Drew Gruenburg, Society of American Florists
Mr. Terry Humfeld, Cranberry Institute
Mr. John Keeling, National Potato Council
Mr. Phil Korson, Cherry Marketing Institute
Mr. Allen Mize, Del Monte, USA
Mr. Armando Monterraso, Brooks Tropicals
Mr. Dennis Nuxoll, Western Growers Association (alternative)
Mr. Keith Pitts, Marrone Bio Innovations
Mr. Ray Ratto, Ratto Brothers
Mr. Ben Sacher, Western Growers Association
Mr. Steven Salisbury, Mint Industry Research Council
Mr. Paul Schlegel, American Farm Bureau Federation
Mr. Todd Scholz, USA Dry Pea & Lentil Council
Dr. Alan Schreiber, Agriculture Development Group, Inc.
Mr. Mark Seetin, U.S. Apple Association
Mr. Bob Simerly, National Onion Association
Mr. Berry Tanner, National Watermelon Association (alternative)
Mr. Dave Trinka, MBG Marketing
Mr. Dennis Tristao, J.G. Boswell Company
Mr. Ron Williams, The Coca-Cola Company
*Partial year

Cooperating Government Departments and Agencies

Agriculture and Agri Food Canada-Pest Management Centre (CN-PMC)
Health Canada-Pest Management Regulatory Authority (PMRA)
State Agricultural Experiment Stations/Land Grant Universities (SAES)
State of California Department of Pesticide Regulation (DPR)
U.S. Department of Agriculture, National Institute of Food and Agriculture (NIFA)
U.S. Department of Agriculture, Agricultural Research Service (ARS)
U.S. Department of Agriculture, Foreign Agriculture Service (FAS)
U.S. Department of Agriculture, Animal and Plant Health Inspection Service (APHIS)
U.S. Department of Defense, Deployed Warfighter Protection Program (DWFP)
U.S. Environmental Protection Agency (EPA)

ATTACHMENT 1 Continued

Crop Protection Industry

ADAMA
AgBio Development Inc.
Agrimar
AgroSource Inc.
Albaugh, Inc.
Amvac Chemical Corporation
Arkion Life Sciences
Arysta LifeScience North America Corp.
BASF Corporation
Bayer CropScience USA
Bayer Environmental Science
Belchim Crop Protection
BetaTec
BioBest
Bio HumaNetics
BioProdex
BioSafe Systems
Bioworks
CAI Limited
Certis USA
Dow AgroSciences
DuPont Agricultural Products
Engage Agro
Everris
Fine Americas
FMC Corporation
Gowan Company
Hacco, Inc.
Isagro, USA
ISK Biosciences
Janssen Pharmaceutica
K-I Chemical USA Inc.
MGK
Landis International
Lonza Inc.
Loveland Products
Luxembourg-Pamol, Inc.
Marrone BioInnovations, Inc.
Monsanto Company
Natural Industries
Neudorff
Nichino America, Inc.
Nisso America, Inc.
Novozymes, Inc.
Nufarm Americas, Inc.
Oat Agrio
OHP
Pace 49, Inc.
SePro Corporation
Sipcam Advan
Summerdale, Inc.
Syngenta Crop Protection Inc.
Syngenta Flowers
TDA
TKI Novasource
UPI
Valent Biosciences
Valent USA, LLC
Westbridge Agricultural Products
Willowood USA

IR-4 PARTICIPANTS

Project Management Committee (PMC):

Dr. Jerry Baron, IR-4 Project Headquarters – IR-4 Project Executive Director
Dr. Michael Bledsoe, Village Farms, Inc and CLC Chair
Dr. Douglas Buhler, Michigan State University – Administrative Advisor, North Central Region
Dr. Jackie Burns, University of Florida – Administrative Advisor, Southern Region
Dr. Liwei Gu, University of Florida – Regional Director, Southern Region.
Dr. Rob Hedberg, USDA-NIFA - National Program Leader
Dr. Matt Hengel, University of California, Davis - Regional Director, Western Region
Dr. Bradley Hillman, Rutgers University – Administrative Advisor, Northeast Region
Dr. Joseph Munyaneza, USDA-ARS - Administrative Advisor
Dr. Daniel Rossi, Rutgers University **–** Regional Director, Northeast Region
Dr. Alvin Simmons USDA-ARS – Interim Director Minor Use Program
Dr. Ronald Tjeerdema, University of California, Davis - Administrative Advisor, Western Region
Dr. John Wise, Michigan State University – Regional Director, North Central Region, and PMC Chair

ATTACHMENT 1 Continued

IR-4 Project Headquarters (HQ)

IR-4 Headquarters is located at the 500 College Road East, Suite 201W, Princeton, NJ 08540; (732) 932-9575

Dr. Marija Arsenovic – Manager, Weed Science Activities/Study Director
Ms. Tammy Barkalow – Assistant Director, Quality Assurance
Mr. Bill Barney – Manager, Crop Grouping/Study Director
Dr. Jerry Baron – Executive Director
Ms. Susan Bierbrunner – Data Manager and Administrative Support
Dr. Michael Braverman – Manager, Biopesticides and Organic Support Program
Ms. Uta Burke – Administrative Support
Dr. Debbie Carpenter – Assistant Director, Registrations
Ms. Krista Coleman – Program Assistant: Organic Support, Food and Crop Grouping
Ms. Diane D'Angelo – Quality Assurance*
Dr. Keith Dorschner – Manager, Entomology Activities/Study Director
Ms. Cheryl Ferrazoli – Administrative Support
Ms. Jane Forder – Quality Assurance
Ms. Kathryn Homa – Manager, Plant Pathology Activities/ Study Director
Ms. Shiayi Huang - Database Developer
Ms. Carolyn Jolly – Study Director/Research Coordinator
Dr. Daniel Kunkel – Associate Director, Food & International Programs
Ms. Grace Lennon – Study Director/Research Coordinator
Mr. Raymond Leonard – Study Director/Research Coordinator*
Dr. Karl Malamud-Roam – Manager, Public Health Pesticides Program*
Ms. Sherri Nagahiro – Business Manager
Ms. Sherri Novack – Manager, Communications and Outreach
Dr. Cristi Palmer – Manager, Ornamental Horticulture Program
Mr. Kenneth Samoil – Study Director/Research Coordinator
Ms. Karen Sims – Administrative Support
Dr. Van Starner – Assistant Director, Research Planning & Outreach
Ms. Juliet Thompson – Administrative Support
Dr. Ely Vea – Assistant, Ornamental Horticulture Program

Field Coordinators (Regional and ARS)

Dr. Michael Horak, University of California, Davis – Western Region*
Dr. Satoru Miyazaki, Michigan State University – North Central Region
Ms. Marylee Ross, University of Maryland – Northeast Region
Dr. Michelle Samuel-Foo, University of Florida – Southern Region
Dr. Alvin Simmons, USDA-ARS – ARS Office of Minor Use Pesticides
Ms. Rebecca Sisco, University of California, Davis – Western Region*

Laboratory Coordinators (Regional and ARS)

Dr. Wlodzimierz (Wlodek) Borejsza-Wysocki, University of Florida – Southern Region
Dr. Sue Erhardt, Michigan State University – North Central Region
Mr. Thomas Hendricks, USDA-ARS – Tifton, GA
Dr. Matt Hengel, University of California, Davis – Western Region
Mr. T. Todd Wixson, USDA-ARS – Wapato, WA

*Partial year

ATTACHMENT 1 Continued

Regional Quality Assurance Unit Coordinators

Dr. Martin Beran, University of California, Davis – Western Region
Dr. Zhongxiao (Michael) Chen, Michigan State University – North Central Region
Ms. Jane Forder, Rutgers University – Northeast Region
Ms. Kathleen Knight, University of Florida – Southern Region

Additional Technical Staff

Mr. Stephen Flanagan – Assistant Regional Field Coordinator, Western Region
Dr. Derek Killilea – Quality Assurance Consultant
Ms. Lisa Latham – Quality Assurance, North Central Region
Ms. Mary Lynn – Quality Assurance Consultant
Ms. Eileen Nelson - Quality Assurance Participant, University of Wisconsin
Ms. Sherita Normington – Associate Quality Assurance, Western Region
Ms. Lisa Smith – Quality Assurance, USDA-ARS Tifton Analytical Lab
Ms. Mika Pringle Tolson – Field Program Assistant, Western Region
Dr. Yavuz Yagiz – Analytical Quality Assurance, Southern Region

State and Federal IR-4 Liaisons Representatives

Northcentral Region

Dr. S. Clay	SD
Dr. R. Cloyd	KS
Dr. D. Doohan	OH
Dr. D. Egel	IN
Dr. R. Groves	WI
Dr. R. Hartzler	IA
Dr. D. Heider	WI
Dr. S. Kamble	NE
Dr. V. Krischik	MN
VACANT	MI
Dr. M. Reding	USDA-ARS
VACANT	IL
Dr. M. Williams	USDA-ARS
Dr. R. Zollinger	ND
VACANT	MO

Northeast Region

Dr. J. Aulakh	CT
Dr. T. Besancon	NJ
Dr. E. Beste	MD
Ms. H. Faubert	RI
Dr. D. Frank	WV
Dr. A. Hazelrigg	VT
Dr. G. Krawczyk	PA
Dr. B. Kunkel	DE
Dr. B. Nault	NY
Ms. M. Ross	MD
Ms. C. Smith	NH
Dr. R. Wick	MA
Dr. D. Yarborough	ME

ATTACHMENT 1 Continued

Southern Region

Dr.	R.	Bessin	KY
Dr.	N.	Burgos	AR
Dr.	S.	Culpepper	GA
Ms.	A.	Fulcher	TN
Dr.	A.	Henn	MS
Dr.	C.	Hollier	LA
Mr.	C.	Luper	OK
Mr.	M.	Matocha	TX
Dr.	D.	Monks	NC
Dr.	A.	Newby	AL
Dr.	W.	Robles Vasquez	PR
Dr.	M.	Samuel-Foo	FL
Dr.	A.	Simmons	USDA-ARS
Dr.	M.	Weaver	VA

Western Region

Dr.	M.	Burrows	MT
Mr.	J.	Davison	NV
Mr.	C.	Hamilton	NM
Dr.	R.	Hirnyck	ID
Dr.	M.	Horak*	CA
Dr.	P.	Kaspari	AK
Dr.	M.	Kawate	HI
Dr.	S.	Nissen	CO
Dr.	G.	O'Neill	OR
Dr.	J.	Palumbo	AZ
Dr.	C.	Ransom	UT
Ms.	R.	Sisco*	CA
Dr.	B.	Stump	WY
Dr.	D.	Walsh	WA

Regional Field Research Directors –Food Program

Northcentral Region

S. Chapman	WI
S. Clay	SD
N. Cloud	IA
D. Doohan	OH
M. Hausbeck	MI
D. Heider	WI
K. Howatt	ND
B. Jenks	ND
A. Schilder	MI
A. Van Woerkom	MI
B. Zandstra	MI

Northeastern Region

T. Besancon	NJ
J. Fisher	NJ
T. Freiberger	NJ
C. Hoepting	NY
B. Nault	NY

*Partial Year

ATTACHMENT 1 Continued

Northeastern Region (Continued)

S. Palmer	NY
M. Rahman	WV
M. Ross	MD
H. Sandler	MA
M. VanGessel	DE

Southern Region

M. Abney	GA
R. Batts	NC
R. Bessin	KY
N. Boyd	FL
N. Burgos	AR
C. Cahoon	VA
J. Crane	FL
S. Culpepper	GA
M. Czarnota	GA
P. Dittmar	FL
J. Gore	MS
T. Horn	MS
A. Jacobson	AL
K. Jennings	NC
C. Marconi	TX
X. Martini	FL
W. Mitchem	NC
N. Peres	FL
L. Quesada	NC
D. Riley	GA
W. Robles Vazquez	PR
J. Rose	TX
T. Rountree	VA
M. Shankle	MS
H. Smith	FL
R. Srinivasan	GA
L. Steckel	TN
R. Tannenbaum	FL
G. Vallad	FL

Western Region

M. Bolda	CA
J. Coughlin	HI
O. Daugovish	CA
J. DeFrancesco	OR
D. Ennes	CA
J. Felix	OR
S. Fennimore	CA
C. Hamilton	NM
B. Hanson	CA
G. Holmes	CA
S. Joseph	CA
J. Kam	HI
M. Kawate	HI
G. Koskela	OR
G. Kund	CA

ATTACHMENT 1 Continued

Western Region (Continued)

G. Kyser	CA
N. Leach	CA
M. Lewis	CA
C. Mallory-Smith	OR
W. Meeks	ID
T. Michilaides	CA
E. Peachey	OR
W. Peng	WA
T. Perring	CA
S. Rios	CA
S. Salisbury	OR
K. Skiles	CA
R. Smith	CA
S. Stoddard	CA
P. Sturman	OR
B. Turner	CA
C. Vanderwoude	HI
B. Viales	CA
D. Walsh	WA
T. Walters	WA
S. Watkins	CA
R. Wilson	CA

ARS

S. Benzen	CA
B. Fraelich	GA
R. Goenaga	PR
J. Harvey	WA
L. Horst	OH
P. Wade	SC

Canada

M. Clodius	BC
D. Cloutier	QC
J. MacDonald	BC
H. Peill	NS
G. Riddle	ON
M. Weber-Henricks	ON
R. Wismer	ON

ATTACHMENT 2
2017 Food Use Research Projects - Residue Trials*

Chemical	Crop	PR #
Acequinocyl	Blueberry	11867
Acetochlor	Bean & Pea (Succulent)	B10214
Afidopyropen	Strawberry (GH)	11680
Azoxystrobin + Cyproconazole	Coffee	11934
Bicyclopyrone	Onion (Dry Bulb)	11619
Bicyclopyrone	Onion (Green)	11829
Bifenthrin	Safflower	11068
Buprofezin	Blueberry	11983
Cyclaniliprole	Artichoke (Globe)	11952
Cyflumetofen	Cherry	11747
Cyflumetofen	Peach	11761
Cyflumetofen	Strawberry (GH)	11890
Cyprodinil + Fludioxonil	Sugar Apple	7119
Difenoconazole	Parsley	11902
Difenoconazole + Azoxystrobin	Mango	11572
Diquat	Sweet Potato	11889
Diquat	Sunflower	12064
Ethaboxam	Cabbage	11870
Ethaboxam	Greens (Mustard)	11877
Fenpyroximate	Pomegranate	11699
Flonicamid	Blueberry	11969
Flonicamid	Corn (Sweet)	11970
Flonicamid	Prickly Pear Cactus	11966
Fluazifop-P-Butyl	Broccoli	11861
Fluazinam	Papaya	8274
Flumioxazin	Cranberry	11962
Flumioxazin	Lychee	11290
Flumioxazin	Sugar Apple	11292
Fluopicolide	Grapefruit	12091
Fluopicolide	Orange	12090
Fluopyram	Mint (Future Herbs)	11971
Fluopyram + Tebuconazole	Guava	10405
Flupyradifurone	Coffee	11712
Flupyradifurone	Date	11831
Fluridone	Sweet Potato	11775
Flutriafol	Olive	11935
Glufosinate	Avocado	10240
Glufosinate	Cantaloupe	12018
Glufosinate	Cucumber	12019
Glufosinate	Fig	11547
Glufosinate	Grasses (Seed Crop)	11535
Glufosinate	Grasses (Seed Crop)	12109
Glufosinate	Hops	11525
Glufosinate	Pepper (Bell & Nonbell)	12022
Glufosinate	Squash (Summer)	12020
Glufosinate	Tomato	12021
Halosulfuron	Stevia (Future Herbs)	12049

Chemical	Crop	PR #
Indoxacarb	Coffee	11467
Indoxacarb	Sunflower	11707
ISM-555	Onion	11986
ISM-555	Peanut	11985
Isofetamid	Ginseng	12000
Mandestrobin (S-2200)	Lettuce (Head & Leaf)	11027
MCPA	Clover (Seed Crop)	11994
Methoxyfenozide	Rice	11979
Nitrapyrin	Grapefruit	12094
Nitrapyrin	Orange	12093
Novaluron	Pea (Edible Podded & Succulent Shelled)	9778
Oxathiapiprolin	Strawberry	11719
Oxytetracycline	Walnut	11876
Prometryn	Broccoli	12035
Prometryn	Cabbage	12034
Prometryn	Pepper (Bell & Nonbell)	12036
Prometryn	Spinach	12029
Pronamide	Grasses (Pasture)	12061
Propiconazole	Pea (Dry)	11963
Pydiflumetofen (FTH 545)	Caneberry	11794
Rimsulfuron	Olive	10184
Spinetoram + Sulfoxaflor	Cucumber (GH)	11926
Spinetoram + Sulfoxaflor	Pepper (Bell & Nonbell)	11944
Spinetoram + Sulfoxaflor	Tomato (GH)	11919
Sulfoxaflor	Prickly Pear Cactus	11964
Tribenuron-Methyl	Bean (Dried Shelled)	11980
Tribenuron-Methyl	Pea (Dry)	11981
Tribenuron-Methyl	Pea (Dry)	12245
Trifloxystrobin + Fluopyram	Papaya	10765
Uniconazole-P	Greens (Mustard) (GH Transplant)	12026

ATTACHMENT 3
2017 Product Performance Research Program

Research in 2017 to complete performance needs for pre-2017 residue studies:

Chemical	Crop	PR#	Comments	State university trials
cyflumetofen	GH tomato	11450	2015 residue study	CA, FL, GA, WI
cyflumetofen	GH pepper	11451	2015 residue study	CA, FL, GA, WI
indazaflam	asparagus	11429	2015 residue study	CA, MI, NJ
clopyralid	dry bulb onion	11600	2015 residue study	FL, MI, NY, OH
fluridone	sweet potato	11775	2016 residue study	DE, NC
fomesafen	dry bulb onion	11620	2016 residue study	GA, NY, OR
fomesafen	green onion	11857	covered by 11620 residue study	CA, OR, SC*
afidopyropen	GH tomato	11677	2016 residue study	CA, CA
afidopyropen	GH pepper	11676	2016 residue study	CA, CA
afidopyropen	GH cucumber	11675	2016 residue study	GA
cyflumetofen	cherry	11747	2016 residue study	CA, OR, WA*
cyflumetofen	peach	11761	2016 residue study	CA, CA
cyflumetofen	plum	11762	2016 residue study	CA, OR
afidopyropen	GH strawberry	11680	2016 residue study	CA
linuron	mint	11773	2016 residue study	OR, WA
flupyradifurone	sesame	11725	2016 residue study	CA, CA
flupyradifurone	coffee	11712	2016 residue study	HI
flupyradifurone	pineapple	11711	2016 residue study	PR
flupyradifurone	grasses (seed)	11755	2016 residue study	OR
fluxapyroxad + pyraclostrobin	pomegranate	11754	2016 residue study	CA, FL
flupyradifurone	date	11831	2016 residue study	CA
			Total	42

Research in 2017 for continuing PPWS (Pest Problem Without Solution) studies:

Chemical	Crop	PR#	Comments	State university trials
Fungicides	sweet potato	11848	*Rhizopus* root rot control	NC
			Total	1

Research in 2017 to complet high-priority pre-2017 Regional performance needs:

Chemical	Crop	PR#	Comments	State university trials
valifenalate	basil	10296	need new tools for resistance management	MI
			Total	1

Research in 2017 for performance needs for new 2017 residue studies:

Chemical	Crop	PR#	Comments	State university trials
isofetamid	ginseng	12000	2017 residue study	WI
diquat	sweet potato	11889	2017 residue study	CA, NC
prometryn	spinach	12029	2017 residue study	CA
prometryn	Chinese napa cabbage	12034	2017 residue study	CA

glufosinate	tomato	12021	2017 residue study	CA, FL, VA
glufosinate	pepper	12022	2017 residue study	CA, FL, VA
glufosinate	canteloupe	12018	2017 residue study	CA, FL, NJ
glufosinate	cucumber	12019	2017 residue study	CA, DE, FL
glufosinate	summer squash	12020	2017 residue study	CA, FL, NJ
pydiflumetofen	caneberry	11794	2017 residue study	CA, MI, WA, WV
cyflumetofen	GH strawberry	11890	2017 residue study	CA
rimsulfuron	olive	10184	2017 residue study	CA
glufosinate	avocado	10240	2017 residue study	CA, CA, PR
flumioxazin	sugar apple	11292	2017 residue study	PR
prometryn	broccoli	12035	2017 residue study; performance covered in other project	----
prometryn	pepper	12036	2017 residue study; performance covered in other peoject	---
difenconazole	mango	11572	2017 residue study	FL, PR
halosulfuron	stevia	12049	2017 residue study	CA, GA, NC
ISM-555	onion	11986	2017 residue study	CA, FL, NY, WI
diquat	sunflower	12064	2017 residue study	ND, SD
pyroxasulfone	sesame	11951	2017 residue study	AR, CA
			Total	43

Research in 2017 for new high-priority Regional performance needs:

Chemical	Crop	PR#	Comments	State university trials
bicyclopyrone	horseradish	11667	H+ priority from 2016 FUW	WI
insecticides	sweet potato	11938	PPWS (soil insects) - H+ priority from 2016 FUW	GA, KY
glufosinate	sweet potato	10558	H+ priority from 2016 FUW	CA, CA, MS, NC, VA
sulfentrazone	broccoli	10557	H+ priority from 2016 FUW	FL, NC
pyroxasulfone	dry pea	12023	H+ priority from 2016 FUW	AR, TN
fluazinam	strawberry	11920	H+ priority from 2016 FUW	CA, FL
metaflumizone	tropical fruits	11915	H+ priority from 2016 FUW	HI, HI
pendimethalin	monarda	11726	H+ priority from 2016 FUW (Kemin Industries trials)	---
sulfoxaflor	prickly pear cactus	11964	H+ priority from Upgrade	CA
			Total	17

ATTACHMENT 4
2017 Submissions to EPA, Registrants, Codex, and State Departments of Agriculture

Pest Control Agent	Type*	Date	Commodity or Crop Group	PR#
Fluroxypyr	H	02/03/2017	Teff	10807
Pyroxsulam	H	02/03/2017	Teff	10807
Fluorasulam	H	02/03/2017	Teff	10807
Flonicamid **	I	02/03/2017	Clover	A9943
			Vegetable, brassica, head and stem, group 5-16	12099
			Brassica, leafy greens, subgroup 4-16B	12100
			Cottonseed subgroup 20C	12098
			Leaf petiole vegetable subgroup 22B	12101
			Leafy greens subgroup 4-16A, except spinach	12012
			Celtuce	12103
			Florence fennel	12104
			Kohlrabi	12105
Etoxazole	I	02/07/2017	Sweet corn	11099
			Fruit, pome, group 11-10	12111
			Nut, tree, group 14-12	12112
			Fruit, stone, group 12-12	12113
			Cottonseed subgroup 20C	12114
Flumioxazin	H	03/24/2017	Grasses (tolerances for regional registration only-Pacific Northwest	10885
Pyroxasulfone	H	03/24/2017	Grasses (tolerances for regional registration only-Pacific Northwest	10885
			Mint	10792
			Edamame (vegetable soybean)	11133
Boscalid	F	03/24/2017	Brassica, leafy greens, subgroup 4-16B	12120
			Celtuce	12121
			Fennel, Florence	12122
			Kohlrabi	12123
			Leaf petiole vegetable subgroup 22B	12124
			Vegetable, brassica, head and stem, group 5-16	12125
			Pea and bean, dried shelled, except soybean, subgroup 6C	12126
			Pea and bean, succulent shelled, subgroup 6B	12127
			Vegetable, root, except sugar beet, subgroup 1B	12128
			Vegetable, cucurbit, group 9	08849 08878
			Vegetable, fruiting, group 8-10	08876 11751
			Leafy greens subgroup 4-16A	11750
Pyraclostrobin	F	03/24/2017	Brassica, leafy greens, subgroup 4-16B	12120
			Celtuce	12121
			Fennel, Florence	12122
			Kohlrabi	12123
			Leaf petiole vegetable subgroup 22B	12124
			Vegetable, brassica, head and stem, group 5-16	12125
			Tropical and subtropical, medium to large fruit, smooth, inedible peel, subgroup 24B	12129

Pest Control Agent	Type*	Date	Commodity or Crop Group	PR#
			Vegetable, cucurbit, group 9	08849
				08878
			Vegetable, fruiting, group 8-10	08876
				11751
			Leafy greens subgroup 4-16A	11750
Famoxadone	F	05/02/2017	Carrot	08875
			Ginseng	A10812
			Mango	10677
			Brassica, leafy greens, subgroup 4-16B	08759
			Bean, succulent	07262
			Leafy greens subgroup 4-16A	12230
			Leaf petiole vegetable subgroup 22B	12231
			Vegetable, tuberous and corm, subgroup 1C	12232
			Vegetable, fruiting, group 8-10	12233
			Arugula	12234
			Upland cress	12235
			Garden cress	12236
			Celtuce	11237
			Florence fennel	11238
Cymoxanil	F	05/02/2017	Carrot	08875
			Ginseng	A10812
			Mango	10677
			Brassica, leafy greens, subgroup 4-16B	08759
			Bean, succulent	07262
			Leafy greens subgroup 4-16A	12230
			Leaf petiole vegetable subgroup 22B	12231
			Vegetable, tuberous and corm, subgroup 1C	12232
			Vegetable, fruiting, group 8-10	12233
			Arugula	12234
			Upland cress	12235
			Garden cress	12236
			Celtuce	11237
			Florence fennel	11238
Acequinocyl**	I	05/12/2017	Guava	08600
			Lychee	08602
Trifluralin	H	05/15/2017	Rosemary	10820
Clomazone	H	05/18/2017	Cilantro + Coriander	11092
			Dill	11091
			Vegetable, cucurbit, group 9	11063
			Rapeseed subgroup 20A	10839
			Vegetable, brassica, head and stem, group 5-16	12224
			Cottonseed subgroup 20C	12225
			Broccoli, Chinese	12226
			Kohlrabi	12227
			Stalk and stem vegetable subgroup 22A, except kohlrabi	12228
			Bean, dry + Bean, succulent	11665
Pyroxasulfone	H	06/08/2017	Leaf petiole vegetable subgroup 22B	11324
			Cottonseed subgroup 20C	12130
S-Metolachlor	H	06/19/2017	Vegetable, leaves of root and tuber, group 2, except sugar beet	10480
				11697
			Stevia	09872

Pest Control Agent	Type*	Date	Commodity or Crop Group	PR#
			Swiss chard	10673
			Vegetable, brassica, head and stem, group 5-16	11897
			Brassica, leafy greens, subgroup 4-16B, except Chinese broccoli	11896
			Stalk and stem vegetable subgroup 22A, except celtuce, Florence fennel, and kohlrabi	11900
			Leaf petiole vegetable subgroup 22B	11901
			Cottonseed subgroup 20C	11899
			Celtuce	12132
			Florence fennel	12133
			Kohlrabi	12134
			Chinese broccoli	12135
Bentazon	H	06/22/2017	Pea (dry)	11510
Mefenoxam	F	08/02/2017	Wasabi	10375
			Cacao	11884
			Fruit, small, vine climbing, except grape, subgroup 13-07E	12295
Tolfenpyrad	I	08/11/2017	Avocado	10427
			Vegetable, fruiting, group 8-10	10634
			Vegetable, tuberous and corm, subgroup 1C	12221
			Onion, bulb, subgroup 3-07A	09657
			Onion, green, subgroup 3-07B	09551
			Caneberry subgroup 13-07A	11263
			Bushberry subgroup 13-07B	10380
			Fruit, small, vine climbing, except fuzzy kiwifruit, subgroup 13-07F	12222
			Berry, low growing, subgroup 13-07G, except cranberry and blueberry, lowbush	10869
			Vegetable, cucurbit, group 9	10842
			Cottonseed subgroup 20C	12097
			Leafy greens subgroup 4-16A	11972
			Leaf petiole subgroup 22B	11973
			Arugula	11974
			Celtuce	11975
			Garden cress	11976
			Upland cress	11977
			Florence fennel	11978
Penthiopyrad**	F	09/14/2017	Caneberry subgroup 13-07A	10695
			Bushberry subgroup 13-07B	10694
			Vegetable, brassica, head and stem, group 5-16	12324
			Brassica, leafy greens, subgroup 4-16B	12325
			Oilseed group 20	12326
			Fruit, stone, group 12-12	12327
			Nut, tree, group 14-12	12328
			Leafy greens subgroup 4-16A	12329
			Leaf petiole vegetable subgroup 22B	12330
			Celtuce	12331
			Florence fennel	12332
			Kohlrabi	12333
Mandipropamid**	F	10/04/2017	Fruit, citrus, group 10-10	11138
				11139
				11140

Pest Control Agent	Type*	Date	Commodity or Crop Group	PR#
			Bean, succulent	12380
			Vegetable, brassica, head and stem, group 5-16	12381
			Leafy greens subgroup 4-16A	12382
			Brassica, leafy greens, subgroup 4-16B	12383
			Leaf petiole vegetable subgroup 22B	12384
			Celtuce	12385
			Florence fennel	12386
			Kohlrabi	12387
Cyantraniliprole	I	10/25/2017	Coffee	10874
			Strawberry	10328
			Berry, low growing, except strawberry, subgroup 13-07H, except blueberry, lowbush and lingonberry	10199
			Caneberry subgroup 13-07A	11046
				12398
			Leafy greens subgroup 4-16A	12391
			Leaf petiole vegetable subgroup 22B	12394
			Celtuce	12395
			Florence fennel	12396
			Kohlrabi	12397
			Vegetable, brassica, head and stem, group 5-16	12393
			Brassica, leafy greens, subgroup 4-16B	12392
Zinc Phosphide	R	11/17/2017	Grasses (tolerances for regional registration only-Pacific Northwest	09736
			Vegetable, tuberous and corm, subgroup 1C	12265
			Fruit, small, vine climbing, except fuzzy kiwifruit, subgroup 13-07F	12266
Emamectin Benzoate	I	11/22/2017	Herb subgroup 19A	07137
				07138
			Cherry subgroup 12-12A	10685
			Artichoke, globe	10863
			Fruit, pome, group 11-10	12428
			Nut, tree, group 14-12	12429
			Vegetable, brassica, head and stem, group 5-16	12430
			Brassica, leafy greens, subgroup 4-16B	12431
			Kohlrabi	12432
			Leafy greens subgroup 4-16A	12433
			Leaf petiole vegetable subgroup 22B	12434
			Fennel, florence	12435
			Celtuce	12436
			Vegetable, fruiting, group 8-10	12437
Nitrapyrin	NI	11/28/2017	Vegetable, bulb, group 3-07	11309
			Vegetable, leafy, group 4-16	A2658
				A2659
				A2660
			Vegetable, brassica, head and stem, group 5-16	A2022
				A2188
			Leaf petiole vegetable subgroup 22B	A2024
			Fruit, citrus, group 10-10	11314
				11315
				11316
Spinetoram***	I	11/14/2017	Grape	11413
Tebuconazole	F	12/07/2017	Watercress	A6481
			Tomato (Greenhouse)	10134

Pest Control Agent	Type*	Date	Commodity or Crop Group	PR#
			Brassica, leafy greens, subgroup 4-16B, except watercress	12417
			Cottonseed subgroup 20C	12418
			Fruit, pome, group 11-10	12419
			Fruit, stone, group 12-12, except cherry	12420
			Fruit, small, vine climbing, except fuzzy kiwifruit, subgroup 13-07F	12421
			Tropical and subtropical, small fruit, inedible peel, subgroup 24A	12422
			Nut, tree, group 14-12	12423
			Sunflower subgroup 20B	12424
Pronamide	H	12/22/2017	Berry, low growing, except strawberry, subgroup 13-07H	A3152
			Fruit, stone, group 12-12	12462
			Fruit, pome, group 11-10	12463
			Caneberry subgroup 13-07A	12464
			Bushberry subgroup 13-07B	12465
			Fruit, small, vine climbing, except fuzzy kiwifruit, subgroup 13-07F	12466
Buprofezin**	I	12/22/2017	Fig	11342
			Pepper (Greenhouse)	08162
			Leafy greens subgroup 4-16A, except head lettuce and radicchio	12445
			Brassica, leafy greens, subgroup 4-16B	12446 11453
			Vegetable, brassica, head and stem, group 5-16	12447
			Leaf petiole vegetable subgroup 22B	12448
			Celtuce	12449
			Florence fennel	12450
			Kohlrabi	12451
			Tropical and subtropical, small fruit, edible peel, subgroup 23A	12452
			Tropical and subtropical, small fruit, inedible peel, subgroup 24A	12453
			Cottonseed subgroup 20C	12454
			Fruit, citrus, group 10-10	12455
			Fruit, stone, group 12-12, except apricot and peach	12456
			Fruit, small, vine climbing, except fuzzy kiwifruit, subgroup 13-07F	12457
			Nut, tree, group 14-12	12458

*F=fungicide, H=herbicide, I=insecticide/acaricide, M=molluscide, N=nematicide, P=plant growth regulator

** Reduced Risk requests

*** Data submitted to MFG for label expasion.

ATTACHMENT 5
2017 Tolerance Successes - Permanent Tolerances
Published in the *Federal Register*

Pest Control Agent	Type*	Date	Commodity or Crop Group	Note	PR#	No. of Uses	No. of Tolerances
Acequinocyl	I	01/18/2017	Avocado		09218	1	1
			Bean (dry)**		08675	22	1
			Cherry subgroup 12-12A	2	11800	3	1
			Fruit, citrus, group 10-10	1	11801	14	1
			Fruit, pome, group 11-10	1	11802	5	1
			Nut, tree, group 14-12	1	11803	26	1
			Vegetable, fruiting, group 8-10	1	11804	11	1
			Vegetable, cucurbit, group 9**	3	08608	10	1
			Tea		11706	1	1
Cyantraniliprole	I	03/22/2017	Vegetable, root, except sugar beet, subgroup 1B		10364 10641 10731	18	1
Pyroxasulfone	H	04/18/2017	Sunflower subgroup 20B**		10932	14	1
Flonicamid	I	05/11/2017	Tomato subgroup 8-10A	6	10999	0	1
			Pepper/Eggplant subgroup 8-10B**	6	10999	0	1
Spirotetramat	I	06/14/2017	Carrot		10788	1	1
			Fruit, stone, group 12-12	1	11455	11	1
			Nut, tree, group 14-12	1	11456	27	1
Indaziflam	H	07/05/2017	Bushberry subgroup 13-07B**		10882	19	1
			Caneberry subgroup 13-07A**		10909	5	1
			Coffee		10654	1	1
			Hop**		11071	1	1
			Fruit, small, vine climbing, except fuzzy kiwifruit, subgroup 13-07F	2	11655	5	1
			Fruit, stone, group 12-12	1	11654	11	1
			Nut, tree, group 14-12	1	11656	26	1
			Fruit, tropical and subtropical, small fruit, edible peel, subgroup 23A	2	11868	55	1
Flonicamid	I	07/07/2017	Vegetable, legume, edible podded, subgroup 6A**		10472 10474	12	1
			Pea and bean, succulent shelled, subgroup 6B**		10472 10474	12	1
			Pea and bean, drid shelled, except soybean, subgroup 6C**		10473 10475	24	1
Fenamidone	F	07/28/2017	Basil**		10120 10925	1	2
			Celtuce		11819	0	1
			Cilantro			0	0
			Cottonseed subgroup 20C		11820	0	1
			Florence fennel		11818	0	1
			Kohlrabi		11817	0	1
			Leaf petiole vegetable subgroup 22B		11816	3	1
			Leafy vegetable group 4-16		11814 11815	35	1
			Vegetable, brassica, head and stem, group 5-16		11813	0	1

Pest Control Agent	Type*	Date	Commodity or Crop Group	Note	PR#	No. of Uses	No. of Tolerances
Ethaboxam	F	08/03/2017	Ginseng		10682	1	1
			Pepper/eggplant 8-10B		10650	10	1
			Vegetable, cucurbit, group 9		10649	14	1
					10651		
					10652		
			Vegetable, tuberous and corm, subgroup 1C		11113	17	1
Oxathiapiprolin	F	09/27/2017	Cacao bean		11883	1	1
Fluazifop-P-Butyl	H	09/27/2017	Bushberry subgroup 13-07B		02083	19	1
			Caneberry subgroup 13-07A		03947	5	1
					02681		
			Lettuce, head and leaf**		02072	2	1
			Onion, green		03405	9	1
			Onion, bulb, subgroup 3-07A	2	11362	3	1
			Fruit, small, vine climbing, except fuzzy kiwifruit, sugroup 13-07F	2	11365	5	1
			Rhubarb		02404	1	1
			Strawberry		02085	1	1
			Vegetable, tuberous and corm, except potato, subgroup 1D	2	02328	15	1
					02402		
			Fescue, forage and hay		09825	1	2
Benzovindiflupyr	F	11/14/2017	Onion, bulb, subgroup 3-07A **		11129	11	1
					11130		
			Onion, green, subgroup 3-07B**			15	1
Ethofumesate	H	12/04/2017	Sugar beet	6	11126	1	2
Quinclorac	H	12/04/2017	Asparagus		08295	1	1
			Bushberry subgroup 13-07B		10435	19	1
			Caneberry subgroup 13-07A		10436	5	1
Prometryn	H	12/04/2017	Sesame		11178	1	1
			Leaf petiole vegetable subgroup 22B	1	11987	3	1
			Florence fennel		11988	0	1
			Celtuce		11989	0	1
			Swiss chard		11990	0	1
			Cottonseed subgroup 20C	2	11991	0	1
					Totals	534	65

*F=fungicide, H=herbicide, I=insecticide/acaricide, M=molluscide, N=nematicide, P=plant growth regulator

[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 *and*
submission of new data to complete the requirements for a crop group or subgroup

[4] Response to EPA request for Codex harmonization

[5] Tolerance for indirect or inadvertent residues

[6] Revised tolerance

Time-Limited Tolerances

Pest Control Agent	Type*	Date	Commodity or Crop Group and Expiration Date	Note	PR#	No. of Uses	No. of Tolerances
Flupyradifurone	I	03/10/2017	Sorghum, sweet (12/31/2019)		11709	1	2
Oxytetracycline	B	03/10/2017	Fruit, citrus, group 10-10 (12/31/2019)		11469 11470 11766 11767	28	1
Triclopyr	H	06/08/2017	Sugarcane (12/31/2020)		12084	1	1
Tolfenpyrad	I	10/10/2017	Onion, dry bulb (12/31/2020)		09657	3	1
Clothianidin	I	12/04/2017	Fruit, citrus, group 10-10 (12/31/2020)		10167 10168 10169	28	1
					Totals	61	6
*F=fungicide, H=herbicide, I=insecticide/acaricide, M=molluscide, N=nematicide, P=plant growth regulator							

ATTACHMENT 6
Pending Food Program Submissions to EPA

PR #	Chemical	Commodity (Full name)
7732	2,4-D	STRAWBERRY (ANNUAL) (13-07G = LOW GROWING BERRY SUBGROUP)
275	2,4-DB	GUAR (06C = DRIED SHELLED PEA/BEAN (EXCEPT SOYBEAN) SUBGROUP)
8992	2,4-DB	LENTIL (06C = DRIED SHELLED PEA/BEAN (EXCEPT SOYBEAN) SUBGROUP)
12410	ABAMECTIN	ARUGULA (04-16B = BRASSICA LEAFY GREENS SUBGROUP)
10893	ABAMECTIN	CARROT (01AB = ROOT VEGETABLES SUBGROUPS)
12413	ABAMECTIN	CELTUCE (22A = STALK AND STEM VEGETABLE SUBGROUP)
12411	ABAMECTIN	CRESS, GARDEN (04-16B = BRASSICA LEAFY GREENS SUBGROUP)
12412	ABAMECTIN	CRESS, UPLAND (04-16B = BRASSICA LEAFY GREENS SUBGROUP)
12414	ABAMECTIN	FENNEL, FLORENCE (22A = STALK AND STEM VEGETABLE SUBGROUP)
12408	ABAMECTIN	SUBGROUP 04-16A (04-16A = LEAFY GREENS SUBGROUP)
12406	ABAMECTIN	SUBGROUP 20C (20C = COTTONSEED SUBGROUP)
12409	ABAMECTIN	SUBGROUP 22B (22B = LEAF PETIOLE VEGETABLE SUBGROUP)
12407	ABAMECTIN	SUBGROUP 24A (24A = TROPICAL AND SUBTROPICAL, SMALL FRUIT, INEDIBLE PEEL SUBGROUP)
11326	ACETAMIPRID	AVOCADO (24B = TROPICAL AND SUBTROPICAL, MEDIUM TO LARGE FRUIT, SMOOTH, INEDIBLE PEEL SUBGROUP)
10214	ACETOCHLOR	BEAN & PEA (SUCCULENT) (06AB = EDIBLE PODDED AND SUCCULENT SHELLED PEA/BEAN SUBGROUPS)
6300	ACIFLUORFEN	BEAN, LIMA (SUCCULENT & DRIED SHELLED) (06BC = SUCCULENT/DRIED SHELLED PEA/BEAN SUBGROUPS)
10958	ACIFLUORFEN	EDAMAME (VEGETABLE SOYBEAN) (06A = EDIBLE PODDED LEGUME VEGETABLES SUBGROUP)
6301	ACIFLUORFEN	PEA (SOUTHERN) (06C = DRIED SHELLED PEA/BEAN (EXCEPT SOYBEAN) SUBGROUP)
12277	AMETOCTRADIN	CELTUCE (22A = STALK AND STEM VEGETABLE SUBGROUP)
12282	AMETOCTRADIN	CROP GROUP 05-16 (05-16 = BRASSICA HEAD AND STEM VEGETABLE GROUP)
12278	AMETOCTRADIN	FENNEL, FLORENCE (22A = STALK AND STEM VEGETABLE SUBGROUP)
12280	AMETOCTRADIN	KOHLRABI (22A = STALK AND STEM VEGETABLE SUBGROUP)
12276	AMETOCTRADIN	SUBGROUP 04-16B (04-16B = BRASSICA LEAFY GREENS SUBGROUP)
12279	AMETOCTRADIN	SUBGROUP 13-07F (13-07F = SMALL FRUIT VINE CLIMBING SUBGROUP, EXCEPT FUZZY KIWIFRUIT)
12281	AMETOCTRADIN	SUBGROUP 22B (22B = LEAF PETIOLE VEGETABLE SUBGROUP)
9613	ANTHRAQUINONE	CORN (FIELD) (15-16 = CEREAL GRAINS AND CEREAL GRAINS FORAGE/FODDER/STRAW GROUPS)
3735	ATRAZINE	SORGHUM (SWEET) (15-16 = CEREAL GRAINS AND CEREAL GRAINS FORAGE/FODDER/STRAW GROUPS)
8052	AVG	CHERRY (12-12A = CHERRY SUBGROUP)
11055	AZOXYSTROBIN	BLUEBERRY (13-07B = BUSHBERRY SUBGROUP)
9026	BETA-CYFLUTHRIN	FLAX (20A = RAPESEED SUBGROUP)
10002	BIFENAZATE	BANANA (24B = TROPICAL AND SUBTROPICAL, MEDIUM TO LARGE FRUIT, SMOOTH, INEDIBLE PEEL SUBGROUP)
11465	BIFENAZATE	CROP GROUP 14-12 (14-12 = TREE NUT GROUP)
11462	BIFENAZATE	SUBGROUP 12-12A (12-12A = CHERRY SUBGROUP)
11463	BIFENAZATE	SUBGROUP 12-12B (12-12B = PEACH SUBGROUP)
11464	BIFENAZATE	SUBGROUP 12-12C (12-12C = PLUM SUBGROUP)

PR #	Chemical	Commodity (Full name)
11872	BIFENAZATE	SUBGROUP 20C (20C = COTTONSEED SUBGROUP)
11873	BIFENAZATE	SUBGROUP 24A (24A = TROPICAL AND SUBTROPICAL, SMALL FRUIT, INEDIBLE PEEL SUBGROUP)
11165	BIFENTHRIN	GRAPEFRUIT (10-10C = GRAPEFRUIT SUBGROUP)
11164	BIFENTHRIN	LEMON (10-10B = LEMON/LIME SUBGROUP)
11166	BIFENTHRIN	ORANGE (10-10A = ORANGE SUBGROUP)
9338	BROMOXYNIL	MILLET (15-16 = CEREAL GRAINS AND CEREAL GRAINS FORAGE/FODDER/STRAW GROUPS)
10087	CHLORFENAPYR	BASIL & CHIVES (GH) (19A = HERB SUBGROUP)
11062	CHLORFENAPYR	CROP GROUP 08-10 (GH) (08-10 = FRUITING VEGETABLE GROUP)
9215	CHLORFENAPYR	CUCUMBER (GH) (09B = SQUASH/CUCUMBER SUBGROUP)
12356	CHLORFENAPYR	CUCUMBER (GH) (09B = SQUASH/CUCUMBER SUBGROUP)
11606	CHLORFENAPYR	TOMATO (GH) (SMALL) (08-10A = TOMATO SUBGROUP)
10367	CHLOROTHALONIL	ALMOND (14-12 = TREE NUT GROUP)
391	CHLOROTHALONIL	BEET (GARDEN) (01AB = ROOT VEGETABLES SUBGROUPS)
10859	CHLOROTHALONIL	CHERRY, SOUR (12-12A = CHERRY SUBGROUP)
11846	CHLOROTHALONIL	CRANBERRY (13-07H = LOW GROWING BERRY SUBGROUP, EXCEPT STRAWBERRY)
10164	CHLOROTHALONIL	GRAPEFRUIT (10-10C = GRAPEFRUIT SUBGROUP)
5423	CHLOROTHALONIL	GREENS (MUSTARD) (04-16B = BRASSICA LEAFY GREENS SUBGROUP)
10100	CHLOROTHALONIL	GUAVA (23B = TROPICAL AND SUBTROPICAL, MEDIUM TO LARGE FRUIT, EDIBLE PEEL SUBGROUP)
10165	CHLOROTHALONIL	LEMON (10-10B = LEMON/LIME SUBGROUP)
147	CHLOROTHALONIL	LETTUCE (HEAD & LEAF) (04-16A = LEAFY GREENS SUBGROUP)
6420	CHLOROTHALONIL	LYCHEE (24A = TROPICAL AND SUBTROPICAL, SMALL FRUIT, INEDIBLE PEEL SUBGROUP)
10163	CHLOROTHALONIL	ORANGE (10-10A = ORANGE SUBGROUP)
148	CHLOROTHALONIL	RADISH (01AB = ROOT VEGETABLES SUBGROUPS)
397	CHLOROTHALONIL	SPINACH (04-16A = LEAFY GREENS SUBGROUP)
3721	CHLOROTHALONIL	SUGAR APPLE (24C = TROPICAL AND SUBTROPICAL, MEDIUM TO LARGE FRUIT, ROUGH OR HAIRY, INEDIBLE PEEL SUBGROUP)
9323	CLOFENTEZINE	GUAVA (23B = TROPICAL AND SUBTROPICAL, MEDIUM TO LARGE FRUIT, EDIBLE PEEL SUBGROUP)
10327	CYANTRANILIPROLE (HGW86)	LETTUCE (GH) (04-16A = LEAFY GREENS SUBGROUP)
11636	CYAZOFAMID	GINSENG (01AB = ROOT VEGETABLES SUBGROUPS)
11893	CYCLANILIPROLE	CUCUMBER (GH) (09B = SQUASH/CUCUMBER SUBGROUP)
11891	CYCLANILIPROLE	PEPPER (GH) (08-10BC = PEPPER/NON-BELL PEPPER/EGGPLANT SUBGROUPS)
11452	CYFLUMETOFEN	CUCUMBER (GH) (09B = SQUASH/CUCUMBER SUBGROUP)
11451	CYFLUMETOFEN	PEPPER (GH) (08-10BC = PEPPER/NON-BELL PEPPER/EGGPLANT SUBGROUPS)
11762	CYFLUMETOFEN	PLUM (12-12C = PLUM SUBGROUP)
11450	CYFLUMETOFEN	TOMATO (GH) (08-10A = TOMATO SUBGROUP)
12362	CYROMAZINE	CELTUCE (22A = STALK AND STEM VEGETABLE SUBGROUP)
12364	CYROMAZINE	CROP GROUP 05-16 (05-16 = BRASSICA HEAD AND STEM VEGETABLE GROUP)
12369	CYROMAZINE	CROP GROUP 21 (21 = EDIBLE FUNGI GROUP)
12363	CYROMAZINE	FENNEL, FLORENCE (22A = STALK AND STEM VEGETABLE SUBGROUP)
12366	CYROMAZINE	KOHLRABI (22A = STALK AND STEM VEGETABLE SUBGROUP)
11503	CYROMAZINE	PEA (EDIBLE PODDED & SUCCULENT SHELLED) (06AB = EDIBLE PODDED AND SUCCULENT SHELLED PEA/BEAN SUBGROUPS)

PR #	Chemical	Commodity (Full name)
12357	CYROMAZINE	SUBGROUP 01C (01C = TUBEROUS AND CORM VEGETABLES SUBGROUP)
12358	CYROMAZINE	SUBGROUP 03-07A (03-07A = ONION, BULB SUBGROUP)
12359	CYROMAZINE	SUBGROUP 03-07B (03-07B = ONION, GREEN SUBGROUP)
12360	CYROMAZINE	SUBGROUP 04-16A (04-16A = LEAFY GREENS SUBGROUP)
12365	CYROMAZINE	SUBGROUP 04-16B (04-16B = BRASSICA LEAFY GREENS SUBGROUP)
12367	CYROMAZINE	SUBGROUP 08-10A (08-10A = TOMATO SUBGROUP)
12368	CYROMAZINE	SUBGROUP 08-10B (08-10B = PEPPER/EGGPLANT SUBGROUP)
12361	CYROMAZINE	SUBGROUP 22B (22B = LEAF PETIOLE VEGETABLE SUBGROUP)
1548	DCPA	ASPARAGUS (22A = STALK AND STEM VEGETABLE SUBGROUP)
8332	DCPA	CARROT (01AB = ROOT VEGETABLES SUBGROUPS)
11433	DCPA	CROP GROUP 03-07 (03-07 = BULB VEGETABLE GROUP)
10245	DCPA	PRICKLY PEAR CACTUS (24D = TROPICAL AND SUBTROPICAL, CACTUS, INEDIBLE PEEL SUBGROUP)
11434	DCPA	SUBGROUP 09A (09A = MELON SUBGROUP)
11435	DCPA	SUBGROUP 13-07G (13-07G = LOW GROWING BERRY SUBGROUP)
12268	DIMETHOMORPH	CELTUCE (22A = STALK AND STEM VEGETABLE SUBGROUP)
12273	DIMETHOMORPH	CROP GROUP 05-16 (05-16 = BRASSICA HEAD AND STEM VEGETABLE GROUP)
12274	DIMETHOMORPH	CROP GROUP 08-10 (08-10 = FRUITING VEGETABLE GROUP)
12269	DIMETHOMORPH	FENNEL, FLORENCE (22A = STALK AND STEM VEGETABLE SUBGROUP)
12271	DIMETHOMORPH	KOHLRABI (22A = STALK AND STEM VEGETABLE SUBGROUP)
12275	DIMETHOMORPH	SUBGROUP 01C (01C = TUBEROUS AND CORM VEGETABLES SUBGROUP)
12270	DIMETHOMORPH	SUBGROUP 13-07F (13-07F = SMALL FRUIT VINE CLIMBING SUBGROUP, EXCEPT FUZZY KIWIFRUIT)
12267	DIMETHOMORPH	SUBGROUP 13-07G (13-07G = LOW GROWING BERRY SUBGROUP)
12272	DIMETHOMORPH	SUBGROUP 22B (22B = LEAF PETIOLE VEGETABLE SUBGROUP)
11689	DIMETHOMORPH + AMETOCTRADIN	CUCUMBER (GH) (09B = SQUASH/CUCUMBER SUBGROUP)
11688	DIMETHOMORPH + AMETOCTRADIN	LETTUCE (GH) (04-16A = LEAFY GREENS SUBGROUP)
8595	DINOTEFURAN	BASIL (19A = HERB SUBGROUP)
11305	DINOTEFURAN	CHERRY (12-12A = CHERRY SUBGROUP)
10998	DINOTEFURAN	CUCUMBER (GH) (09B = SQUASH/CUCUMBER SUBGROUP)
11304	DINOTEFURAN	PEACH (12-12B = PEACH SUBGROUP)
10816	DIQUAT	AVOCADO (24B = TROPICAL AND SUBTROPICAL, MEDIUM TO LARGE FRUIT, SMOOTH, INEDIBLE PEEL SUBGROUP)
10818	DIQUAT	BANANA (24B = TROPICAL AND SUBTROPICAL, MEDIUM TO LARGE FRUIT, SMOOTH, INEDIBLE PEEL SUBGROUP)
10817	DIQUAT	GUAVA (23B = TROPICAL AND SUBTROPICAL, MEDIUM TO LARGE FRUIT, EDIBLE PEEL SUBGROUP)
10815	DIQUAT	LYCHEE (24A = TROPICAL AND SUBTROPICAL, SMALL FRUIT, INEDIBLE PEEL SUBGROUP)
10766	DIQUAT	ONION (DRY BULB) (03-07A = ONION, BULB SUBGROUP)
10669	DIQUAT	PEPPER (BELL & NONBELL) (08-10BC = PEPPER/NON-BELL PEPPER/EGGPLANT SUBGROUPS)
10814	DIQUAT	SUGAR APPLE (24C = TROPICAL AND SUBTROPICAL, MEDIUM TO LARGE FRUIT, ROUGH OR HAIRY, INEDIBLE PEEL SUBGROUP)
10668	DIQUAT	TOMATO (08-10A = TOMATO SUBGROUP)
9737	DIQUAT	WATERCRESS (04-16B = BRASSICA LEAFY GREENS SUBGROUP)
2399	DIURON	CHERRY (12-12A = CHERRY SUBGROUP)

PR #	Chemical	Commodity (Full name)
3071	DIURON	PLUM (12-12C = PLUM SUBGROUP)
12427	EMAMECTIN BENZOATE	SUBGROUP 20C (20C = COTTONSEED SUBGROUP)
10115	ETHEPHON	FIG (23B = TROPICAL AND SUBTROPICAL, MEDIUM TO LARGE FRUIT, EDIBLE PEEL SUBGROUP)
10049	ETHOPROP	MINT (FUTURE: HERBS) (99 = MISCELLANEOUS COMMODITY)
4124	ETHYLENE	PINEAPPLE (24C = TROPICAL AND SUBTROPICAL, MEDIUM TO LARGE FRUIT, ROUGH OR HAIRY, INEDIBLE PEEL SUBGROUP)
11233	ETOXAZOLE	BEET (SUGAR) (01AB = ROOT VEGETABLES SUBGROUPS)
8757	FAMOXADONE + CYMOXANIL	RADISH (01AB = ROOT VEGETABLES SUBGROUPS)
9741	FENHEXAMID	KIWIFRUIT (PREHARVEST) (13-07E = SMALL FRUIT VINE CLIMBING SUBGROUP, EXCEPT GRAPE)
7149	FENHEXAMID	ONION (03-07AB = ONION BULB AND GREEN SUBGROUPS)
8243	FENHEXAMID	ONION (GH TRANSPLANT) (03-07AB = ONION BULB AND GREEN SUBGROUPS)
10506	FENHEXAMID	SUBGROUP 13-07A (13-07A = CANEBERRY SUBGROUP)
10507	FENHEXAMID	SUBGROUP 13-07B (13-07B = BUSHBERRY SUBGROUP)
10508	FENHEXAMID	SUBGROUP 13-07E (13-07E = SMALL FRUIT VINE CLIMBING SUBGROUP, EXCEPT GRAPE)
10509	FENHEXAMID	SUBGROUP 13-07F (13-07F = SMALL FRUIT VINE CLIMBING SUBGROUP, EXCEPT FUZZY KIWIFRUIT)
10510	FENHEXAMID	SUBGROUP 13-07G (13-07G = LOW GROWING BERRY SUBGROUP)
11332	FENPROPATHRIN	CROP GROUP 14-12 (14-12 = TREE NUT GROUP)
9266	FENPROPATHRIN	GREENS (MUSTARD) (04-16B = BRASSICA LEAFY GREENS SUBGROUP)
11333	FENPROPATHRIN	SUBGROUP 12-12A (12-12A = CHERRY SUBGROUP)
11334	FENPROPATHRIN	SUBGROUP 12-12B (12-12B = PEACH SUBGROUP)
11335	FENPROPATHRIN	SUBGROUP 12-12C (12-12C = PLUM SUBGROUP)
7946	FENPROPATHRIN	SWEET POTATO (01CD = TUBEROUS AND CORM VEGETABLES SUBGROUPS)
9517	FENPROPATHRIN	TURNIP (ROOTS) (01AB = ROOT VEGETABLES SUBGROUPS)
10008	FENPYROXIMATE	BANANA (24B = TROPICAL AND SUBTROPICAL, MEDIUM TO LARGE FRUIT, SMOOTH, INEDIBLE PEEL SUBGROUP)
11029	FENPYROXIMATE	BEAN (SUCCULENT SHELLED) (06B = SUCCULENT SHELLED PEA/BEAN SUBGROUP)
11501	FENPYROXIMATE	BLUEBERRY (13-07B = BUSHBERRY SUBGROUP)
8097	FENPYROXIMATE	CANEBERRY (13-07A = CANEBERRY SUBGROUP)
11100	FENPYROXIMATE	CELERY (22B = LEAF PETIOLE VEGETABLE SUBGROUP)
11246	FENPYROXIMATE	CROP GROUP 14-12 (14-12 = TREE NUT GROUP)
9033	FENPYROXIMATE	SQUASH (SUMMER) (09B = SQUASH/CUCUMBER SUBGROUP)
12461	FENPYROXIMATE	SUBGROUP 20C (20C = COTTONSEED SUBGROUP)
11705	FLONICAMID	LETTUCE (GH) (04-16A = LEAFY GREENS SUBGROUP)
11383	FLONICAMID	SUNFLOWER (20B = SUNFLOWER SUBGROUP)
11317	FLORASULAM + FLUROXYPYR	GRASSES (SEED CROP) (17 = GRASS FORAGE, FODDER AND HAY GROUP)
11862	FLUAZIFOP-P-BUTYL	CABBAGE (05-16 = BRASSICA HEAD AND STEM VEGETABLE GROUP)
2336	FLUAZIFOP-P-BUTYL	CELERY (22B = LEAF PETIOLE VEGETABLE SUBGROUP)
2087	FLUAZIFOP-P-BUTYL	CHIVES (03-07B = ONION, GREEN SUBGROUP)
11363	FLUAZIFOP-P-BUTYL	CROP GROUP 10-10 (10-10 = CITRUS FRUIT GROUP)
11364	FLUAZIFOP-P-BUTYL	CROP GROUP 12-12 (12-12 = STONE FRUIT GROUP)
2076	FLUAZIFOP-P-BUTYL	GREENS (MUSTARD) (04-16B = BRASSICA LEAFY GREENS SUBGROUP)
11265	FLUAZIFOP-P-BUTYL	PAPAYA (24B = TROPICAL AND SUBTROPICAL, MEDIUM TO LARGE FRUIT, SMOOTH, INEDIBLE PEEL SUBGROUP)

PR #	Chemical	Commodity (Full name)
11231	FLUAZINAM	PEA (EDIBLE PODDED, SUCCULENT & DRIED SH (06ABC = EDIBLE PODDED, SUCCULENT/DRIED SHELLED PEA/BEAN SUBGROUPS)
10374	FLUDIOXONIL	CELERY (GH) (22B = LEAF PETIOLE VEGETABLE SUBGROUP)
12010	FLUDIOXONIL	TOMATO (GH) (08-10A = TOMATO SUBGROUP)
10908	FLUENSULFONE	BEET (SUGAR) (01AB = ROOT VEGETABLES SUBGROUPS)
11132	FLUMIOXAZIN	EDAMAME (VEGETABLE SOYBEAN) (06A = EDIBLE PODDED LEGUME VEGETABLES SUBGROUP)
10686	FLUMIOXAZIN	GUAYULE (99 = MISCELLANEOUS COMMODITY)
12467	FOMESAFEN	FOLIAGE OF LEGUME VEGETABLES EXCEPT SOYB (07A = FOLIAGE OF LEGUME VEGETABLES (EXCEPT SOYBEAN) SUBGROUP)
11650	GLYPHOSATE	CROP GROUP 12-12 (12-12 = STONE FRUIT GROUP)
11651	GLYPHOSATE	CROP GROUP 14-12 (14-12 = TREE NUT GROUP)
8056	GLYPHOSATE	ONION (DRY BULB) (03-07A = ONION, BULB SUBGROUP)
10285	GLYPHOSATE	PEPPER (CHILI) (08-10BC = PEPPER/NON-BELL PEPPER/EGGPLANT SUBGROUPS)
9494	IMAZALIL	MUSHROOM (WHITE BUTTON) (21 = EDIBLE FUNGI GROUP)
7669	IMIDACLOPRID	BLUEBERRY (HIGH BUSH) (13-07B = BUSHBERRY SUBGROUP)
11412	INDAZIFLAM	BLUEBERRY (LOWBUSH) (13-07BGH = BUSHBERRY AND LOW GROWING BERRY SUBGROUPS)
12378	INDAZIFLAM	TROPICAL & SUBTROPICAL FRUITS, EDIBLE PE (23 = TROPICAL AND SUBTROPICAL FRUIT, EDIBLE PEEL GROUP)
12379	INDAZIFLAM	TROPICAL & SUBTROPICAL FRUITS, INEDIBLE (24 = TROPICAL AND SUBTROPICAL FRUIT, INEDIBLE PEEL GROUP)
11467	INDOXACARB	COFFEE (99 = MISCELLANEOUS COMMODITY)
9521	INDOXACARB	GRASSES (SEED CROP) (17 = GRASS FORAGE, FODDER AND HAY GROUP)
10248	ISOXABEN	CANEBERRY (13-07A = CANEBERRY SUBGROUP)
11743	ISOXABEN	HOPS (99 = MISCELLANEOUS COMMODITY)
10705	KASUGAMYCIN	APRICOT (12-12C = PLUM SUBGROUP)
8742	LAMBDA-CYHALOTHRIN	ASPARAGUS (FERN) (22A = STALK AND STEM VEGETABLE SUBGROUP)
10255	LAMBDA-CYHALOTHRIN	BROCCOLI RAAB (04-16B = BRASSICA LEAFY GREENS SUBGROUP)
10343	LAMBDA-CYHALOTHRIN	BULB VEGETABLES SUBGROUP 03-07A (03-07A = ONION, BULB SUBGROUP)
9390	LAMBDA-CYHALOTHRIN	CARROT (01AB = ROOT VEGETABLES SUBGROUPS)
9926	LAMBDA-CYHALOTHRIN	GREENS (MUSTARD) (04-16B = BRASSICA LEAFY GREENS SUBGROUP)
9430	LAMBDA-CYHALOTHRIN	MILLET, PEARL (15-16 = CEREAL GRAINS AND CEREAL GRAINS FORAGE/FODDER/STRAW GROUPS)
9852	LAMBDA-CYHALOTHRIN	OKRA (08-10BC = PEPPER/NON-BELL PEPPER/EGGPLANT SUBGROUPS)
9381	LAMBDA-CYHALOTHRIN	RADISH (01AB = ROOT VEGETABLES SUBGROUPS)
8850	LAMBDA-CYHALOTHRIN	RICE, WILD (15-16 = CEREAL GRAINS AND CEREAL GRAINS FORAGE/FODDER/STRAW GROUPS)
9380	LAMBDA-CYHALOTHRIN	RUTABAGA (01AB = ROOT VEGETABLES SUBGROUPS)
10344	LAMBDA-CYHALOTHRIN	TEA (99 = MISCELLANEOUS COMMODITY)
9379	LAMBDA-CYHALOTHRIN	TURNIP (ROOTS) (01AB = ROOT VEGETABLES SUBGROUPS)
10540	LAMBDA-CYHALOTHRIN + THIAMETHOXAM	AVOCADO (24B = TROPICAL AND SUBTROPICAL, MEDIUM TO LARGE FRUIT, SMOOTH, INEDIBLE PEEL SUBGROUP)
6684	LAMBDA-CYHALOTHRIN + THIAMETHOXAM	GUAVA (23B = TROPICAL AND SUBTROPICAL, MEDIUM TO LARGE FRUIT, EDIBLE PEEL SUBGROUP)
10221	LINURON	BASIL (19A = HERB SUBGROUP)
11508	LINURON	BEAN (DRIED SHELLED) (06C = DRIED SHELLED PEA/BEAN (EXCEPT SOYBEAN) SUBGROUP)

PR #	Chemical	Commodity (Full name)
11118	LINURON	SWEET POTATO (01CD = TUBEROUS AND CORM VEGETABLES SUBGROUPS)
1703	MEFENOXAM	CUCUMBER (GH) (09B = SQUASH/CUCUMBER SUBGROUP)
11376	MESOTRIONE	CROP GROUP 13-07 (13-07 = BERRY AND SMALL FRUIT GROUP)
6388	METRIBUZIN	PEA (EDIBLE PODDED & SUCCULENT SHELLED) (06AB = EDIBLE PODDED AND SUCCULENT SHELLED PEA/BEAN SUBGROUPS)
10671	METRIBUZIN	POTATO (01C = TUBEROUS AND CORM VEGETABLES SUBGROUP)
3524	NAA	ALMOND (14-12 = TREE NUT GROUP)
3523	NAA	PLUM (12-12C = PLUM SUBGROUP)
3525	NAA	WALNUT (14-12 = TREE NUT GROUP)
10956	NOVALURON	LYCHEE (24A = TROPICAL AND SUBTROPICAL, SMALL FRUIT, INEDIBLE PEEL SUBGROUP)
11795	OXATHIAPIPROLIN	AVOCADO (24B = TROPICAL AND SUBTROPICAL, MEDIUM TO LARGE FRUIT, SMOOTH, INEDIBLE PEEL SUBGROUP)
10915	OXATHIAPIPROLIN	POMEGRANATE (24B = TROPICAL AND SUBTROPICAL, MEDIUM TO LARGE FRUIT, SMOOTH, INEDIBLE PEEL SUBGROUP)
11719	OXATHIAPIPROLIN	STRAWBERRY (13-07G = LOW GROWING BERRY SUBGROUP)
3616	OXYFLUORFEN	CANEBERRY (RASPBERRY) (13-07A = CANEBERRY SUBGROUP)
9822	OXYFLUORFEN	COFFEE (99 = MISCELLANEOUS COMMODITY)
6318	OXYFLUORFEN	KENAF (99 = MISCELLANEOUS COMMODITY)
3574	OXYFLUORFEN	ONION (GREEN) (03-07B = ONION, GREEN SUBGROUP)
3573	OXYFLUORFEN	SHALLOT (03-07AB = ONION BULB AND GREEN SUBGROUPS)
9352	OXYFLUORFEN	STRAWBERRY (TRANSPLANTS) (13-07G = LOW GROWING BERRY SUBGROUP)
7377	OXYFLUORFEN	TI PALM (PEACH PALM) (23C = TROPICAL AND SUBTROPICAL, PALM FRUIT, EDIBLE PEEL SUBGROUP)
4132	OXYFLUORFEN	TOMATO (08-10A = TOMATO SUBGROUP)
11146	PARAQUAT	SESAME (20A = RAPESEED SUBGROUP)
11255	PENDIMETHALIN	SAFFLOWER (20B = SUNFLOWER SUBGROUP)
11282	PENOXSULAM +	ARTICHOKE (GLOBE) (99 = MISCELLANEOUS COMMODITY)
11307	PENTHIOPYRAD	BANANA (24B = TROPICAL AND SUBTROPICAL, MEDIUM TO LARGE FRUIT, SMOOTH, INEDIBLE PEEL SUBGROUP)
11444	PENTHIOPYRAD	LETTUCE (GH) (04-16A = LEAFY GREENS SUBGROUP)
12305	PERMETHRIN	ARUGULA (04-16B = BRASSICA LEAFY GREENS SUBGROUP)
12308	PERMETHRIN	CELTUCE (22A = STALK AND STEM VEGETABLE SUBGROUP)
12306	PERMETHRIN	CRESS, GARDEN (04-16B = BRASSICA LEAFY GREENS SUBGROUP)
12307	PERMETHRIN	CRESS, UPLAND (04-16B = BRASSICA LEAFY GREENS SUBGROUP)
12312	PERMETHRIN	CROP GROUP 11-10 (11-10 = POME FRUIT GROUP)
12309	PERMETHRIN	FENNEL, FLORENCE (22A = STALK AND STEM VEGETABLE SUBGROUP)
1953	PERMETHRIN	GRAPE (13-07F = SMALL FRUIT VINE CLIMBING SUBGROUP, EXCEPT FUZZY KIWIFRUIT)
12301	PERMETHRIN	SUBGROUP 01C (01C = TUBEROUS AND CORM VEGETABLES SUBGROUP)
12302	PERMETHRIN	SUBGROUP 03-07A (03-07A = ONION, BULB SUBGROUP)
12303	PERMETHRIN	SUBGROUP 04-16A (04-16A = LEAFY GREENS SUBGROUP)
12310	PERMETHRIN	SUBGROUP 08-10A (08-10A = TOMATO SUBGROUP)
12311	PERMETHRIN	SUBGROUP 08-10C (08-10C = NON-BELL PEPPER/EGGPLANT SUBGROUP)
12313	PERMETHRIN	SUBGROUP 12-12A (12-12A = CHERRY SUBGROUP)
12314	PERMETHRIN	SUBGROUP 12-12B (12-12B = PEACH SUBGROUP)
12315	PERMETHRIN	SUBGROUP 13-07E (13-07E = SMALL FRUIT VINE CLIMBING SUBGROUP, EXCEPT GRAPE)

PR #	Chemical	Commodity (Full name)
12304	PERMETHRIN	SUBGROUP 22B (22B = LEAF PETIOLE VEGETABLE SUBGROUP)
10840	PERMETHRIN	TEA (99 = MISCELLANEOUS COMMODITY)
11885	POTASSIUM PHOSPHITE	CANEBERRY (13-07A = CANEBERRY SUBGROUP)
11717	PROPAMOCARB-HCL	BROCCOLI (05-16 = BRASSICA HEAD AND STEM VEGETABLE GROUP)
11847	PROPAMOCARB-HCL	CABBAGE (05-16 = BRASSICA HEAD AND STEM VEGETABLE GROUP)
12460	PROPAMOCARB-HCL	CROP GROUP 08-10 (08-10 = FRUITING VEGETABLE GROUP)
7171	PROPAMOCARB-HCL	GUAVA (23B = TROPICAL AND SUBTROPICAL, MEDIUM TO LARGE FRUIT, EDIBLE PEEL SUBGROUP)
11499	PROPAMOCARB-HCL	SPINACH (04-16A = LEAFY GREENS SUBGROUP)
12459	PROPAMOCARB-HCL	SUBGROUP 01C (01C = TUBEROUS AND CORM VEGETABLES SUBGROUP)
11078	PROPICONAZOLE + CHLOROTHALONIL	TOMATO (GH) (08-10A = TOMATO SUBGROUP)
11763	PYDIFLUMETOFEN (FTH 545)	BLUEBERRY (13-07B = BUSHBERRY SUBGROUP)
11879	PYDIFLUMETOFEN (FTH 545)	PEPPER (GH) (08-10BC = PEPPER/NON-BELL PEPPER/EGGPLANT SUBGROUPS)
11159	PYDIFLUMETOFEN (FTH 545)	STRAWBERRY (13-07G = LOW GROWING BERRY SUBGROUP)
7968	PYMETROZINE	CUCUMBER (GH) (09B = SQUASH/CUCUMBER SUBGROUP)
11445	PYMETROZINE	LETTUCE (GH) (04-16A = LEAFY GREENS SUBGROUP)
7969	PYMETROZINE	TOMATO (GH) (08-10A = TOMATO SUBGROUP)
12079	PYRAFLUFEN-ETHYL	CROP GROUP 12-12 (12-12 = STONE FRUIT GROUP)
12078	PYRAFLUFEN-ETHYL	CROP GROUP 14-12 (14-12 = TREE NUT GROUP)
8708	PYRAFLUFEN-ETHYL	HOPS (99 = MISCELLANEOUS COMMODITY)
12081	PYRAFLUFEN-ETHYL	SUBGROUP 01C (01C = TUBEROUS AND CORM VEGETABLES SUBGROUP)
12080	PYRAFLUFEN-ETHYL	SUBGROUP 13-07F (13-07F = SMALL FRUIT VINE CLIMBING SUBGROUP, EXCEPT FUZZY KIWIFRUIT)
12083	PYRAFLUFEN-ETHYL	SUBGROUP 20C (20C = COTTONSEED SUBGROUP)
12082	PYRAFLUFEN-ETHYL	SUBGROUP 23A (23A = TROPICAL AND SUBTROPICAL, SMALL FRUIT, EDIBLE PEEL SUBGROUP)
10793	PYRIFLUQUINAZON	CUCUMBER (GH) (09B = SQUASH/CUCUMBER SUBGROUP)
11446	PYRIOFENONE	CUCUMBER (GH) (09B = SQUASH/CUCUMBER SUBGROUP)
11447	PYRIOFENONE	PEPPER (GH) (08-10BC = PEPPER/NON-BELL PEPPER/EGGPLANT SUBGROUPS)
11448	PYRIOFENONE	TOMATO (GH) (08-10A = TOMATO SUBGROUP)
10033	QUIZALOFOP	APPLE (11-10 = POME FRUIT GROUP)
10036	QUIZALOFOP	CHERRY (12-12A = CHERRY SUBGROUP)
10031	QUIZALOFOP	GRAPE (13-07F = SMALL FRUIT VINE CLIMBING SUBGROUP, EXCEPT FUZZY KIWIFRUIT)
10034	QUIZALOFOP	PEACH (12-12B = PEACH SUBGROUP)
10032	QUIZALOFOP	PEAR (11-10 = POME FRUIT GROUP)
10035	QUIZALOFOP	PLUM (12-12C = PLUM SUBGROUP)
10606	RIMSULFURON	POMEGRANATE (24B = TROPICAL AND SUBTROPICAL, MEDIUM TO LARGE FRUIT, SMOOTH, INEDIBLE PEEL SUBGROUP)
11875	RIMSULFURON	SUBGROUP 08-10A (08-10A = TOMATO SUBGROUP)
11079	SAFLUFENACIL	CANEBERRY (13-07A = CANEBERRY SUBGROUP)
11557	SAFLUFENACIL	FIG (23B = TROPICAL AND SUBTROPICAL, MEDIUM TO LARGE FRUIT, EDIBLE PEEL SUBGROUP)
11841	SAFLUFENACIL	FIG (23B = TROPICAL AND SUBTROPICAL, MEDIUM TO LARGE FRUIT, EDIBLE PEEL SUBGROUP)
2063	SETHOXYDIM	BASIL (19A = HERB SUBGROUP)
9934	SETHOXYDIM	CANEBERRY (13-07A = CANEBERRY SUBGROUP)

PR #	Chemical	Commodity (Full name)
8345	SETHOXYDIM	VERNONIA (IRON WEED) (20B = SUNFLOWER SUBGROUP)
11325	S-	DILL (19A = HERB SUBGROUP)
10819	S-	ROSEMARY (19A = HERB SUBGROUP)
11895	S-	SUBGROUP 04-16A (04-16A = LEAFY GREENS SUBGROUP)
11898	S-	TREE NUTS (14-12 = TREE NUT GROUP)
11514	SPINETORAM	DRAGON FRUIT (PITAYA) (24D = TROPICAL AND SUBTROPICAL, CACTUS, INEDIBLE PEEL SUBGROUP)
9971	SPIROMESIFEN	CANTALOUPE (09A = MELON SUBGROUP)
9970	SPIROMESIFEN	CUCUMBER (09B = SQUASH/CUCUMBER SUBGROUP)
10800	SPIROMESIFEN	FRUITING VEGETABLES (08-10 = FRUITING VEGETABLE GROUP)
9842	SPIROMESIFEN	GRASSES (17 = GRASS FORAGE, FODDER AND HAY GROUP)
9290	SPIROMESIFEN	OKRA (08-10BC = PEPPER/NON-BELL PEPPER/EGGPLANT SUBGROUPS)
9972	SPIROMESIFEN	SQUASH (SUMMER) (09B = SQUASH/CUCUMBER SUBGROUP)
10551	SPIROMESIFEN	WATERCRESS (04-16B = BRASSICA LEAFY GREENS SUBGROUP)
10858	SULFOXAFLOR	ARTICHOKE (GLOBE) (99 = MISCELLANEOUS COMMODITY)
11321	SULFOXAFLOR	ASPARAGUS (22A = STALK AND STEM VEGETABLE SUBGROUP)
11296	SULFOXAFLOR	BLUEBERRY (HIGH BUSH) (13-07B = BUSHBERRY SUBGROUP)
11279	SULFOXAFLOR	CANEBERRY (13-07A = CANEBERRY SUBGROUP)
12468	SULFOXAFLOR	CELTUCE (22A = STALK AND STEM VEGETABLE SUBGROUP)
12475	SULFOXAFLOR	CROP GROUP 05-16 (05-16 = BRASSICA HEAD AND STEM VEGETABLE GROUP)
12471	SULFOXAFLOR	CROP GROUP 12-12 (12-12 = STONE FRUIT GROUP)
12474	SULFOXAFLOR	CROP GROUP 14-12 (14-12 = TREE NUT GROUP)
12469	SULFOXAFLOR	FENNEL, FLORENCE (22A = STALK AND STEM VEGETABLE SUBGROUP)
12470	SULFOXAFLOR	KOHLRABI (22A = STALK AND STEM VEGETABLE SUBGROUP)
12472	SULFOXAFLOR	SUBGROUP 04-16A (04-16A = LEAFY GREENS SUBGROUP)
12476	SULFOXAFLOR	SUBGROUP 04-16B (04-16B = BRASSICA LEAFY GREENS SUBGROUP)
12473	SULFOXAFLOR	SUBGROUP 22B (22B = LEAF PETIOLE VEGETABLE SUBGROUP)
11095	SULFOXAFLOR	SUNFLOWER (20B = SUNFLOWER SUBGROUP)
11727	TERBACIL	MONARDA (FUTURE: HERBS) (99 = MISCELLANEOUS COMMODITY)
11235	TERBACIL	OREGANO (19A = HERB SUBGROUP)
9017	TERBACIL	PEACH (12-12B = PEACH SUBGROUP)
8959	TERBACIL	STRAWBERRY (ANNUAL) (13-07G = LOW GROWING BERRY SUBGROUP)
11310	THIABENDAZOLE	CLOVER (SEED CROP) (18 = NONGRASS ANIMAL FEEDS GROUP)
11585	THIABENDAZOLE	GREENS (MUSTARD) (SEED TRT) (04-16B = BRASSICA LEAFY GREENS SUBGROUP)
9709	THIOPHANATE METHYL	BEAN (SNAP) (06A = EDIBLE PODDED LEGUME VEGETABLES SUBGROUP)
8614	THIOPHANATE METHYL	PEPPER (FIELD & GH) (08-10BC = PEPPER/NON-BELL PEPPER/EGGPLANT SUBGROUPS)
11644	TRIFLURALIN	CARDOON (22B = LEAF PETIOLE VEGETABLE SUBGROUP)
11645	TRIFLURALIN	CELERY, CHINESE (22B = LEAF PETIOLE VEGETABLE SUBGROUP)
11628	TRIFLURALIN	CROP GROUP 03-07 (03-07 = BULB VEGETABLE GROUP)
11629	TRIFLURALIN	CROP GROUP 08-10 (08-10 = FRUITING VEGETABLE GROUP)
11630	TRIFLURALIN	CROP GROUP 10-10 (10-10 = CITRUS FRUIT GROUP)
11631	TRIFLURALIN	CROP GROUP 12-12 (12-12 = STONE FRUIT GROUP)
11633	TRIFLURALIN	CROP GROUP 14-12 (14-12 = TREE NUT GROUP)
11646	TRIFLURALIN	FUKI (22B = LEAF PETIOLE VEGETABLE SUBGROUP)
11647	TRIFLURALIN	RHUBARB (22B = LEAF PETIOLE VEGETABLE SUBGROUP)
11147	TRIFLURALIN	SESAME (20A = RAPESEED SUBGROUP)

PR #	Chemical	Commodity (Full name)
11632	TRIFLURALIN	SUBGROUP 13-07F (13-07F = SMALL FRUIT VINE CLIMBING SUBGROUP, EXCEPT FUZZY KIWIFRUIT)
11648	TRIFLURALIN	UDO (22B = LEAF PETIOLE VEGETABLE SUBGROUP)
11649	TRIFLURALIN	ZUIKI (22B = LEAF PETIOLE VEGETABLE SUBGROUP)
8397	ZETA-CYPERMETHRIN	BASIL (19A = HERB SUBGROUP)

ATTACHMENT 7 – 2017 ORNAMENTAL HORTICULTURE PROGRAM

FIELD COOPERATORS

NORTHCENTRAL REGION

Dr. Diana Cochran	IA
Mr. Terry Davis	MI
Dr. Francesca Hand	OH
Dr. Mary Hausbeck	MI
Ms. Erica Hotchkiss	MI
Dr. Chengsong Hu	OH
Dr. Hannah Mathers	OH
Dr. Anand Persad	OH
Dr. Cliff Sadof	IN
Dr. John Siefer	OH

NORTHEAST REGION

Dr. Jatinder Aulakh	CT
Dr. Ed Beste	MD
Dr. Nicholas Brazee	MA
Dr. Nora Catlin	NY
Dr. Dan Gilrein	NY
Dr. Brian Kunkel	DE
Dr. Angela Madeiras	MA
Dr. Andy Senesac	NY

SOUTHERN REGION

Dr. Karla Addesso	TN
Dr. Fulya Baysal-Gurel	TN
Dr. Kris Braman	GA
Dr. JC Chong	SC
Dr. Adam Dale	FL
Dr. Jeffrey Derr	VA
Dr. Steve Frank	NC
Dr. Charles Gilliam	AL
Dr. Mengmeng Gu	TX

SOUTHERN REGION (continued)

Dr. Chris Marble	FL
Dr. Inga Meadows	NC
Dr. Joe Neal	NC
Dr. Dave Norman	FL
Dr. Kevin Ong	TX
Dr. Erfan Vafaie	TX
Dr. Williams-Woodward	GA
Dr. Anthony Witcher	TN

WESTERN REGION

Dr. Gary Chastagner	WA
Dr. Zhiqiang Cheng	HI
Dr. Cai-Zhong Jiang	CA
Dr. James Klett	CO
Dr. Dustin Meador	CA
Dr. Tim Miller	WA
Mr. Lloyd Nackley	OR
Dr. Christian Nansen	CA
Dr. Luisa Santamaria	OR
Dr. Buzz Uber	CA
Dr. Cheryl Wilen	CA

USDA-ARS

Mr. Ben Fraelich	GA
Mr. Tom Freiberger	NJ
Dr. Nik Grunwald	OR
Mr. John Harvey	WA
Dr. Mike Reding	OH
Mr. Paul Wade	SC

ATTACHMENT 8 – 2017 ORNAMENTAL HORTICULTURE PROGRAM

RESEARCH ACTIVITIES

Discipline	Project	Researchers	Crops	Products	Trials
Entomology	Afidopyropen (BAS 440I) Crop Safety *	6	19	1	29
Entomology	Borer & Beetle Efficacy *	8	3	16	40
Entomology	BYI-2960 Crop Safety *	1	1	1	1
Entomology	Cyflumetofen Crop Safety *	3	6	1	9
Entomology	Scale Efficacy	1	1	1	1
Entomology	Thrips Efficacy *	7	4	8	25
Pathology	A14658C Crop Safety *	1	1	1	1
Pathology	Algal Leaf Spot Efficacy	1	2	11	11
Pathology	Azoxystrobin + Benzovindiflupyr (A18126B) Crop Safety *	4	8	1	11
Pathology	Bacterial Efficacy *	2	1	10	20
Pathology	Botrytis Efficacy *	7	5	21	85
Pathology	Cyflufenamid Crop Safety *	3	5	1	7
Pathology	Fluopyram (ESP 715) Crop Safety *	4	13	1	22
Pathology	Fluxapyroxad + Pyraclostrobin Crop Safety *	10	14	1	20
Pathology	Mandestrobin Crop Safety *	5	8	1	10
Pathology	Metconazole Crop Safety *	2	2	1	2
Pathology	Mono and di potassium salts of phosphorus acid + hydrogen peroxide Crop Safety *	5	5	1	8
Pathology	Oxathiapiprolin Crop Safety *	4	2	1	4
Pathology	Powdery Mildew Efficacy	1	1	6	12
Pathology	Pseudomonas chlororaphis Crop Safety *	5	14	1	22
Pathology	Pydiflumetofen + Azoxystrobin + Propiconazole Crop Safety *	4	18	1	28
Pathology	Pydiflumetofen + Fludioxonil Crop Safety *	9	11	1	25
Pathology	Pydiflumetofen Crop Safety *	8	15	1	25
Pathology	TDA01 Crop Safety *	3	8	2	10
Pathology	Triticonazole Crop Safety *	1	1	1	1
Weed Science	Dimethenamid-p Crop Safety *	7	9	1	10
Weed Science	Dithiopyr Crop Safety *	11	13	1	21
Weed Science	Flumioxazin + Pyroxasulfone Crop Safety	5	9	1	11
Weed Science	General Weed Efficacy	1	1	7	17
Weed Science	Isoxaben Crop Safety *	5	10	1	10
Weed Science	Oxyfluorfen + Oryzalin Crop Safety	1	1	1	1
Weed Science	Oxyfluorfen + Prodiamine Crop Safety *	17	42	1	68
Weed Science	Pendimethalin + Dimethenamid-p Crop Safety *	11	19	1	31
Weed Science	Pendimethalin Crop Safety *	4	6	1	9
Weed Science	Prodiamine + Isoxaben Crop Safety	10	15	1	45
Weed Science	SP1770/SP1772 Crop Safety *	9	9	1	18
Weed Science	Spurge Efficacy	1	1	5	5
Weed Science	Sulfentrazone + Prodiamine Crop Safety *	2	2	1	2
Weed Science	Trifluralin + Isoxaben Crop Safety *	1	5	1	7

* National Priority Projects

For a detailed list of research activities visit ir4.rutgers.edu.

ATTACHMENT 9 – ORNAMENTAL HORTICULTURE RESEARCH SUMMARIES FOR 2017

Afidopyropen Crop Safety

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 50 crop safety trials on 35 ornamental horticulture plant species or genera during 2015 and 2016. In these trials, two genera (*Hedera* sp. and *Zinnia* sp.) 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 thirty-three other species or genera exhibited minimal or no injury in the limited number of trials (one or two) for each crop; BASF can consider adding these to the label.

Arthropod Shipping and European Pepper Moth APHIS Project Summary

The project entitled "Developing sustainable methods for controlling invasive pests on ornamental plant cuttings" had 6 objectives (Table 1) with two primary goals of studying the newly introduced Duponchelia fovealis and to examine methodologies to reduce interstate and international shipment of invasive species using model crop-pest systems. An unstated objective was to disseminate the newly gathered information to stakeholders via technical literature and presentations to growers. Our research team determined the minimal and maximum temperature thresholds for D. fovealis development with the optimal temperature being 32.2ºC. The current D. fovealis population within San Diego county was surveyed over time demonstrating multiple generations per year. In examining hot water immersion treatments as a potential means of disinfestation, rooted chrysanthemum cuttings exhibited higher heat tolerance than unrooted cuttings and subsequent growing conditions can impact growth and market readiness. Poinsettia cuttings were not able to tolerate the same temperatures as chrysanthemums. For pre-shipment efficacy on cuttings, aphid, mite and thrips populations were reduced by dips into natural products but not consistently to the level required to eliminate interstate or international shipping of these pests. For actual shipping, citrus mealybug populations were also reduced with dip treatments generally providing better control than spray treatments. BotaniGard and Safari reduced mealybug populations to virtually zero by approximately 2 weeks after application. With silverleaf whitefly, none of the natural products sufficiently reduced populations after shipping to warrant their use as regulatory pre-shipment treatments.

Beetle, Borer, Weevil & White Grub Efficacy

Collectively, managing coleopteran insects can be challenging because the adult and larval stages may both cause damage and sometimes occur on different hosts or on different plant parts. While organophosphates, pyrethroids, and neonicotinoids can provide good to excellent control of coleopteran insects, not all products work equally well in all situations. Treatments for borers are very different than treatments targeting white grubs. Developing newer classes of chemistry are important to reduce the environmental consequences and to minimize the development of resistance. Starting with the 2004 Annual Workshop, screening a number of products to manage coleopteran insects became one of the high priority projects for entomology. From 2005 through 2016, 66 products representing 43 different active ingredients were tested for management of adult and larval stages of coleopteran insects. In addition, 10 products representing 10 active ingredients were evaluated for lepidopteran clearwing borers in 2008 and 2009. These products represented both biological and chemical tools. Some products were already registered but more data were needed 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. While a number of coleopteran and lepidopteran species were tested, only enough experiments were able to be completed on the coleopteran species black vine weevil, Japanese beetle, oriental beetle, Sri Lankan weevil, and viburnum leaf beetles to recommend actions to register or amend labels for these pests.

Benzovindiflupyr + Azoxystrobin Crop Safety

In 2013, as part of the crop safety screening for new active ingredients and recently registered fungicides, IR-4 started testing Mural WDG (benzovindiflupyr + azoxystrobin) for safety on several ornamental horticulture crops. During 2013 to 2017, the IR-4 Project completed 78 trials on 27 ornamental plant genera or species examining phytotoxicity related to foliar and/or drench applications. In these trials, no injury was observed on any species or genera. If a list of tested plants is placed on the Mural WDG label, 15 of the IR-4 screened plants can be added to the EPA label based on having 3 or more completed trials: *Aquilegia* sp., *Buddleia davidii, Buxus* sp., *Calibrachoa* sp.,

Camellia sp., *Dianthus* sp., *Helianthus* sp., *Heuchera* sp., *Juniperus* sp., *Lamium* sp., *Lavandula* sp., *Monarda* sp., *Osteospermum* sp., *Rhaphiolepis* sp., and *Scindapsus aureus.*

Botrytis Efficacy

At the IR-4 Ornamental 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 2015 on ornamental horticulture crops. During this time period, numerous products representing 42 active ingredients were tested as foliar applications against several Botrytis species causing blight and gray mold on ornamentals. Most products are registered and commercially used. Almost all trials were conducted on *Botrytis cinerea*; other species tested were *B. elliptica*, *B. paeoniae* and *B. tulipae*. Although there were insufficient IR-4 data for definitive conclusions, four relatively new products that are included in this research project project, Orkestra Intrinsic, Mural, NUP 09092, and S2200 looked effective, while Proud 3 and SP2770 looked ineffective. Data on other relatively new products (F9110, MBI-110, Regalia, SP2773, Torque, Tourney, Trinity, ZeroTol) were limited to provide some conclusions. Of the registered products, Daconil, Decree, Heritage, Insignia, Pageant and Palladium generally provided excellent efficacy; Chipco 26019 and Veranda O provided good efficacy and Disarm provided mediocre efficacy. ZeroTol, and the copper products (Badge X2, Camelot, Phyton 27, STBX-304) generally performed poorly.

Dithiopyr Crop Safety

Dimension was initially registered in 1992 for ornamental horticulture uses. This initial label contained an extensive list of ornamental horticulture plants in landscapes where Dimension could be used without causing phytotoxicity. From 1992 through 2004, IR-4 conducted 68 trials on 42 species / genera, including several different fern species grown in field containers, to contribute crop safety data for dithiopyr formulations. In 2006, the new Dimension 2EW label contained registered uses for field container and in ground nursery production, the first dithiopyr product to have these use sites. A revised label was published in 2015 adding more crop species to the label. During 2014 to 2016, IR-4 conducted 206 trials with Dimension 2EW formulation on 108 species / genera, including ornamental grasses to further expand the treatable plant list in the current label. Of the researched crops and Dimension formulations, only four crops (*Hemerocallis* sp., *Muhlenbergia capillaris*, *Pennisetum alopecuroides* and *Pseudotsuga mensiezii*) can be added at this time based on the data provided here. It is recommended the trials conducted using emulsifiable concentrate formulations be repeated with Dimension 2EW.

Downy Mildew Efficacy

In 2008, IR-4 initiated a high priority project to determine efficacy of several fungicides on downy mildew pathogens so data can be obtained to support current and future registrations. This research was conducted in 2008 and in 2009. Subsequently, Impatiens Downy Mildew (IDM) emerged, and studies on this disease sponsored in part by USDA-APHIS occurred from 2013 through to 2016. In addition to research collected from 12 studies through the IR-4 program from 2008 to 2016, this summary includes a review of 38 experiments conducted from 2000 to 2014 on ornamental horticulture crops. During this time period, numerous products representing 41 active ingredients were tested as foliar or drench applications against several species causing downy mildew on ornamentals. Most products are registered and commercially used. Most tests were conducted on *Plasmopara obducens* (impatiens downy mildew); other species tested included *Peronospora lamii* (lamium downy mildew), *Peronospora* sp.(coleus downy mildew), *Peronospora sparsa* (rose downy mildew), *Peronospora statices* (limonium downy mildew), *Peronospora antirrhini* (snapdragon downy mildew),and *Plasmopara viburni* (viburnum downy mildew). Although there were insufficient data for definitive conclusions, five relatively new products provided efficacy. Adorn (V-10161) was effective for impatiens initially, lamium and snapdragon downy mildews. Orvego (BAS 651F) provided good to excellent control of coleus, impatiens, lamium and snapdragon downy mildews. Micora (NOA 446510) provided good to excellent control of coleus, impatiens, lamium and snapdragon downy mildews. Regalia exhibited excellent control of impatiens downy mildew, and good control of lamium, snapdragon and viburnum downy mildews at the higher rate. Segovis applied as a drench provided excellent control of impatiens downy mildew.

Basil downy mildew, caused by *Peronospora belbahrii*, has become a major problem in the production of basil in the United States since it was first reported in south Florida in 2007. We reviewed 31 available trials published in Plant Disease Management Reports to check efficacy of experimental and registered fungicides on basil downy mildew.

Generally, Revus (mandipropamid), Quadris/Amistar (azoxystrobin), and Reason (fenamidone) applied as sprays, and Ridomil Gold (mefenoxam) drench or spray provided good to excellent efficacy. Efficacy of Ranman (cyazofamid) spray was variable. Two new products Zorvec/QGU42 (oxathiopiprolin) and Zampro/BAS 651 (ametoctradin + dimethomorph also provided excellent efficacy. The phosphorus acid fungicides (including Agri-Fos, K-Phite, Nutri-Phyte, Phostrol, Prophyt) and the products for organic production, including biofungicides (Actinovate, Companion, Double Nickel, Regalia,Serenade, Sonata), and copper fungicides (Badge X2, Cueva, Kocide, Nordox, Nu-Cop) generally provided poor efficacy.

Fluensulfone Crop Safety

Fluensulfone was registered as Nimitz Pro G in the United States in 2016 for nematode control in turf. Between 2012 and 2014, the IR-4 Project completed 13 trials on 8 ornamental horticulture plant species or genera examining phytotoxicity related to soil drench applications of fluensulfone (MCW-2 480EC). In these trials, one genus (*Petunia* sp.) exhibited minimal or no injury after drench applications. Based on this information, it is recommended that this genus be added to the list of tolerant plants on a future fluensulfone label for uses on ornamental horticulture crops.

Fluxapyroxad + Pyraclostrobin Crop Safety

The IR-4 Project screens new active ingredients for potential deleterious impacts to aid growers in selection of appropriate disease management tools for their crops. From 2014 to 2017, IR-4 completed 68 trials on 29 ornamental plant species examining phytotoxicity related to foliar applications of Orkestra (fluxapyroxad + pyraclostrobin). During 2016 and 2017, an additional 8 trials were conducted using drench application on 7 crops. In these trials, 13 species or genera exhibited minimal or no injury after foliar applications in a minimum of 3 trials for each crop. Nine of these are already on the current label for this active ingredient; the other four (*Aquilegia* sp, *Hemerocallis* sp., *Picea* sp. and *Pinus* sp.) can be added to a list of tolerant plants in the current label. Only two plant species (*Cornus florida* and *Impatiens hawkeri*) exhibited significant injury in one study. All trials for fifteen other species or genera exhibited no or minimal injury in the limited number of trials (one or two) for each crop. Six of these are already in the current label; BASF can consider adding the other nine to the label. Drench application caused no phytotoxicity on all crops tested.

Isoxaben Crop Safety

Gallery 75DF (isoxaben) was initially registered in 1992 for ornamental horticulture uses. This initial label contained an extensive list of ornamental horticulture crops where Gallery could be used without causing phytotoxicity. It also included a short list of crops where Gallery applications were not recommended. Between 1992 and 2013, IR-4 examined 98 crop species / genera to expand this label to other crops, including several different fern species grown in field containers. Of these, 24 crop species exhibited no or minimal transient injury with 20 already placed on the Gallery label. Eight crops exhibited injury in this research: *Astilbe* sp., *Athyrium filix-femina, Buddleia davidii, Dendranthema x morifolium, Digitalis purpurea, Echinacea purpurea, Stachys byzantine,* and *Thymus* sp..A new formulation, Gallery SC, was tested between 2014 and 2016 to determine crop safety on 34 species / genera in 57 trials. Of these, two species, *Chasmanthium latifolium* and *Sorghastrum nutans*, exhibited no or minimal transient injury; *C. latifolium* is already in the Gallery SC label.

Metconazole Crop Safety

Metconazole was registered as Tourney50WDG in the United States in 2007 as a turf fungicide. In 2010, uses for ornamental horticulture plants in greenhouse, nurseries, and landscapes were added. The commercial label contains a list of 49 woody ornamental plants exhibiting no or minimal injury. However, because metconazole is in the triazole class it could cause symptoms similar to plant growth regulators and additional testing is warranted on additional herbaceous and woody ornamental species. Between 2010 and 2016, the IR-4 Project completed 166 trials on 41 ornamental plant species examining phytotoxicity related to foliar applications of Tourney. In these trials, 22 species or genera exhibited minimal or no injury after foliar applications. Of these, 14 are already on the Tourney label; *Buxus* sp., *Calibrachoa* sp., *Chamaerops humilis*, *Hemerocallis* sp., *Hydrangea* sp., *Lantana* sp., *Liriope* sp. and *Verbena* sp. are the eight crops not yet listed. Based on this information, it is recommended that these be added to the list of tolerant plants on the Tourney 50WDG label. Four crops exhibited stunting: begonia, impatiens, pansy and zinnia.

ATTACHMENT 9 – Continued

Nematode Efficacy

Foliar nematodes cause huge damage not only in food crops but also on popular ornamental horticulture plants. This summary includes research from nematode efficacy experiments on ornamental horticulture crops during 1999 to 2017. The 36 products tested either as soil or foliar treatments were from different mode-of-action groups and included 26 chemicals, 9 plant oils, and 1 bacterial biopesticide. Products with good efficacy included: abamectin, acephate, clothianidin, dimethoate, insecticidal soap, isofenphos, methiocarb, neem oil, oregano oil, oxamyl and lambda-cyhalothrin. Active ingredients with excellent efficacy included: ammonia hydroxide, Burkholderia cepacia, chlofenapyr, cinnamon + clove + thyme oils (32% + 8% + 15%), diazinon, ethoprophos, grapefruit seed extract, imidacloprid, peroxyacetic acid, potassium permanganate, sodium dichloroisocyanurate, sodium hypochlorite, and trichlofon.

Oxathiapiprolin Crop Safety

Oxathiapiprolin was registered as Segovis in the United States in 2017 for disease control on ornamental horticulture plants in greenhouse and nurseries. The commercial label contains a general list of 17 crop groups that cover virtually all ornamental crops. During 2015 and 2016, the IR-4 Project completed 19 trials on 18 ornamental plant species or genera examining phytotoxicity related to drench applications of Segovis. In these trials, all species or genera exhibited minimal or no injury after drench applications. These results confirm the crop safety for Segovis.

Oxyfluorfen + Prodiamine Crop Safety

From 2007 to 2016, IR-4 completed 620 trials on Freehand G (BAS 659 G; dimethenamid-p + pendimethalin). The data contained in this report was generated to register uses of dimethenamid-p + pendimethalin on and around ornamental horticulture plants with broadcast applications, including over the top of established plants. The Freehand rates in this testing program were 2.64, 4.3 and 10.6 pounds active ingredient per acre (lb ai per A) as the 1X, 2X and 4X rates. Freehand G had been applied to 179 plant genera or species. Of these genera and species, 71 exhibited no or minimal transient injury after application at all three rates. Thirty three (33) crops exhibited little or no phytotoxicity at 2.64 lb ai per acre, but did have some injury at 4.3 and/or10.6 lb ai per acre, or showed injury after the second application. Twenty two (22) genera or species exhibited damage sufficient to recommend growers not utilize Freehand G as an over-the-top treatment for pre-emergent weed control. Of the fifty six (56) crops that still need additional information, there are twelve (12) genera or species in which three or more trials do not show significant injury, but one or more additional trials shows some sort of notable injury, necessitating additional research. Additional trials are also indicated to establish species or cultivar sensitivities.

Pendimethalin + Dimethenamid-p Crop Safety

From 2007 to 2016, IR-4 completed 620 trials on Freehand G (BAS 659 G; dimethenamid-p + pendimethalin).The data contained in this report was generated to register uses of dimethenamid-p + pendimethalin on and around ornamental horticulture plants with broadcast applications, including over the top of established plants. The Freehand rates in this testing program were 2.64, 4.3 and 10.6 pounds active ingredient per acre (lb ai per A) as the 1X, 2X and 2X rates. Freehand G had been applied to 179 plant genera or species. Of these genera and species, 71 exhibited no or minimal transient injury after application at all three rates. Thirty three (33) crops exhibited little or no phytotoxicity at 2.64 lb ai per acre, but did have some injury at 4.3 and/or10.6 lb ai per acre, or showed injury after the second application. Twenty two (22) genera or species exhibited damage sufficient to recommend growers not utilize Freehand G as an over-the-top treatment for pre-emergent weed control. Of the fifty six (56) crops that still need additional information, there are twelve (12) genera or species in which three or more trials do not show significant injury, but one or more additional trials shows some sort of notable injury, necessitating additional research. Additional trials are also indicated to establish species or cultivar sensitivities.

Pendimethalin Crop Safety

Pendimethalin has been registered in the United States since 1994 for uses in and around ornamental plants in production nurseries and in landscapes. Between 1981 and 2008, the IR-4 Project has conducted over 469 trials using two granular formulations (Corral 2.68G and Pendulum 2G), two liquid formulations (Pendulum AquaCap and Prowl 4E) and a wettable dry granular formulation (Pendulum WDG). Between 2014 and 2016, 62 trials were conducted on ornamental grasses to determine crop safety of the Pendulum 2G formulation. This summary is an update of the first summary across all the available data generated through IR-4 since screenings began in 1981.

ATTACHMENT 9 – Continued

Eighty-two plant species or genera exhibited no or minimal, transitory phytotoxicity to over the top applications of Corral 2.68G and Pendulum 2G formulations. Of these, 19 species or genera are not on the current Pendulum 2G label. Thirty-seven plant species or genera exhibited no or minimal transitory phytotoxicity to applications of Pendulum AquaCap and Pendulum WDG formulations. All these ornamentals are currently listed on the Pendulum AquaCap label. One species (*Stachys byzantina*) exhibited phytotoxicity at 2 lb ai per acre and higher rates. Twenty plant species or genera exhibited no or minimal transitory phytotoxicity to applications of Prowl 4E. Of these, one (*Paeonia* sp.) is not currently listed on the label.

Powdery Mildew Efficacy

In this review of literature published from 1999 to 2016, 99 products representing 57 active ingredients were screened in greenhouse and field experiments against several species causing powdery mildew on ornamentals. These pathogens included: *Erysiphe azaleae*, *Erysiphe knautiae*, *Erysiphe lagerstroemia*, *Erysiphe lonicerae var. lonicerae*, *Erysiphe monardae*, *Erysiphe polygoni*, *Erysiphe pulchra*, *Golovinomyces cichoracearum*, *Oidium* spp., *Podosphaera pannosa*, and *Podosphaera xanthii*. The established products like 3336, Banner MAXX, Compass, Eagle, Heritage, Insignia, Pageant, Pipron, and Terraguard generally provided consistent efficacy. Although there were insufficient data for definitive conclusions, several new products included in the IR-4 efficacy experiments looked promising. These include IKI-309, Mural, NF-149, and Orkestra. Other products in this research - F9110, Mettle, Milstop, Regalia and ZeroTol - provided generally inconsistent results. Milsana was ineffective in IR-4-sponsered research. Other new products that looked promising include Picatina and other pydiflumetofen products (Picatina Flora and Picatina Gold). Further research is needed to obtain additional efficacy data to recommend actions to register or amend labels for these pests.

Pydiflumetofen + Fludioxonil Crop Safety

Pydiflumetofen + Fludioxonil is a new fungicide being developed by Syngenta for the control of foliar and soil-borne diseases oh ornamental horticulture crops. The IR-4 Project completed 19 crop safety trials on 18 ornamental horticulture plant species or genera during 2015 and 2016. In these trials, all 18 species or genera exhibited minimal or no injury in the limited number of trials (one or two) for each crop; Syngenta can consider adding these to the label.

Pydiflumetofen Crop Safety

Pydiflumetofen is a new fungicide being developed by Syngenta for the control of leaf spots (*Septoria*, *Cercospora*, *Alternaria*, *Venturia*), powdery mildew, *Fusarium*, *Botrytis*, *Sclerotinia*, *Corynespora*, and other foliar diseases. The IR-4 Project completed 19 crop safety trials on 18 ornamental horticulture plant species or genera during 2015 and 2016. In these trials, all 18 species or genera exhibited minimal or no injury in the limited number of trials (one or two) for each crop; Syngenta can consider adding these to the label.

Scale and Mealybug Efficacy

Managing scale and mealybug 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. 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 several insecticides on several scale and mealybug species so data can be obtained to add appropriate species to existing registrations. This research was conducted between 2004 and 2015.This report is a brief summary of available data from eighty-two experiments received through the IR-4 Ornamental Horticulture Program.

Several neonicotinoids (Aloft SC/Celero 16WSG, Flagship 0.22G/25WP, Safari 2G/20SG/Transtect 70WSP, and TriStar 30SG/70WSP), insect growth regulators (Distance and Talus 40SC/70DF), and other products were tested against scales and mealybugs. All products tested generally provided excellent control of elongate hemlock scale, cryptomeria scale, gloomy scale, citrus mealybug and Mexican mealybug, generally mediocre to excellent control of false oleander scale, Fletcher scale, Florida wax scale, magnolia scale, and poor control of armored scale. For other species, efficacy levels varied with the active ingredient and method/timing of application.

All products tested on citrus mealybug and Mexican mealybug, including Aria, Flagship, Safari, Talus, and TriStar, generally provided good to excellent control of these species. A experiment on Madeira mealybug showed excellent control when TriStar was mixed with Capsil surfactant, and poor control without Capsil. Rycar, Safari and Talus provided good to excellent control of this species, while A16901B provided mediocre control when applied as drench but good when applied as foliar treatment. Phormium mealybug control was good to excellent with all neonicotinoids tested – Flagship, Safari and TriStar. Good to excellent control of Rhizoecus root mealybug was obtained with A16901B, Aria, Kontos, MBI-203, MBI-205 and Safari in single experiments.

Three recently registered products (Mainspring, Rycar and XXpire), and three new experimentals (BAS 440, BYI-2960 and IKI-3106) looked promising on several species based on their efficacy relative to standards. Further research is needed to obtain additional efficacy data to recommend actions to register or amend labels for these pests.

Thrips Efficacy

For the last 10 years, the IR-4 Ornamental Horticulture Workshop has ranked developing efficacy data on new products to manage thrips as a High Priority Project. Thrips remain an important threat for several reasons: 1) the damage thrips cause to ornamental 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 ornamental 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 2017, 81 products representing 53 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*).

ATTACHMENT 10- Biopesticide and Organic Support Program

2017 Grant Awards

- Efficacy evaluations of biopesticides for management of spotted wing drosophila.
- Efficacy evaluations of biopesticides for organic management of spotted wing drosophila.
- Efficacy evaluations of biopesticides for organic management of fire blight in apple production.
- Development of hypovirulent strains of chestnut blight for topical applications in chestnut.
- Efficacy evaluations of biopesticides for management of varroa mite in honey bees.
- Efficacy evaluations of biopesticides for management of *Agrobacterium rhizogens* in greenhouse tomato and cucumber.
- Efficacy evaluations of biopesticides for management of downy mildew in organic spinach.
- Efficacy evaluations of biopesticides for management of weeds in ornamental horticulture.
- Efficacy evaluations of biopesticides for management of weeds in sweet potato.
- Efficacy evaluations of biopesticides for management of phorid fly in mushrooms.
- Efficacy evaluations of biopesticides for management of pepper weevil in greenhouse peppers.
- Efficacy evaluations of biopesticides for organic management of black rot (*Xanthamonas*) in brassica.
- Efficacy evaluations of biopesticides for management of stem gall wasp in blueberries.
- Residue mitigation evaluations of biopesticides for management of aphid, cherry fruitworm, midge, root weevil, scale, and spotted wing drosophila in blueberries.
- Efficacy evaluations of biopesticides for management of *Pythium* and *Cylindrocarpon* in conifer seedlings.

Research Cooperators

NORTHCENTRAL REGION

George Sundin	MI
Dennis Fulbright	MI
Sally Miller	OH
Chris Taylor	OH
John Wise	MI
Rufus Isaacs	MI

NORTHEAST REGION

Cesar Rodriguez-Saona	NJ
Thierry Besancon	NJ
Mark VanGessel	DE
Kari Peter	PA
Jim Steffel	PA
Nina Jenkins	PA
Andrew Senesac	NY
Dennis vanEngelsdorp	MD

WESTERN REGION

Alan Schreiber	WA
Mark Bolda	CA
Ken Johnson	OR
Marcelo Moretti	OR

WESTERN REGION (continued)

Anna Leon	OR
Mark Triebwasser	OR
David Granatstein	WA
Tianna DuPont	WA
Nabil Khadduri	WA
Gary Chastanger	WA
Marianne Elliot	WA
Elina Niño	CA
Cheryl Wilen	CA
Charlee Kelly	CA

SOUTHERN REGION

Oscar Liburd	FL
Lambert Kanga	FL
Dakshina Seal	FL
Nicholas Dufault	FL
Katie Jennings	NC
Joe Neal	NC

USDA-ARS

Ben Fraelich	GA
Paul Wade	SC
Steven Klosterman	CA

Biopesticide Regulatory Support Packages Approved in 2017

Product	Crop	PR Number	TYPE	Registration Type	Uses
PMV-01	Tomato	1052B	Virucide	Section 3	1
Metschnikowia fructicola	13-07F. Small vine fruit, except fuzzy kiwifruit	1051B	Fungicide	Section 3	7

New Uses Supported by the Biopesticide Efficacy Program in 2017

Product	Crop	PR Number	TYPE	Registration Type	Uses
Isaria fumosorosea apopka Strain 97	Mushroom	0273B	Insecticide	Amendment	1
Bacillus amyloliquefaciens	Basil	1044B, 1031B	Fungicide	Amendment	1
Bacillus amyloliquefaciens	Cabbage	1044B, 1031B	Fungicide	Amendment	1
Bacillus amyloliquefaciens	Potato	1044B, 1031B	Fungicide	Amendment	1
Bacillus amyloliquefaciens	Apple	1044B, 1031B	Fungicide	Amendment	1

Contact Us

IR-4 Headquarters, Rutgers University
500 College Rd. E. Suite 201 W.
Princeton, NJ 08540
732.932.9575
Fax: 609.514.2612

IR-4 Executive Director
Dr. Jerry Baron
732.932.9575 x 4605
Cell: 908.627.4213
jbaron@njaes.rutgers.edu

Food Use & International Programs Associate Director
Dr. Dan Kunkel
732.932.9575 x 4616
daniel.kunkel@rutgers.edu

Biopesticides & Organic Support Program Manager
Dr. Michael Braverman
732.932.9575 x 4610
mbrave@njaes.rutgers.edu

Ornamental Horticulture Manager
Dr. Cristi Palmer
732.932.9575 x 4629
clpalmer@njaes.rutgers.edu

Northeast Regional Field Coordinator
Ms. Marylee Ross
University of Maryland / Lower Eastern Shore Research and Education Center
27664 Nanticoke Rd.
Salisbury, MD, 21801
Phone: 410-742-8788 ext. 310
Fax: 410-742-1922
mross@umd.edu
Working with CT, DE, MA, MD, ME, NH, NJ, NY, PA, RI, WV, and VT.

North Central Regional Field Coordinator
Dr. John Wise
Michigan State University
Dept of Entomology;
Integ Plant Sys Ctr
578 Wilson Rd.,
Room 206
East Lansing, MI, 48824
Phone: 517-432-2668
Fax: 517-353-5598
wisejohn@msu.edu
Working with IA, IL, IN, KS, MI, MN, MO, ND, NE, OH, SD, and WI.

Southern Regional Field Coordinator
Roger B Batts
North Carolina State University
NCSU IR-4 Field Research Center
NCSU Campus Box 7654
Raleigh, NC, 27695-7654
Phone: 919-515-1668
Fax: 919-513-7226
roger_batts@ncsu.edu
Working with AL, AR, FL, GA, KY, LA, MS, NC, OK, PR, SC, TN, TX, and VA.

Western Regional Field Coordinator
Dr. Michael Horak
4218 Meyer Hall
University of California Davis
Davis, CA, 95616
Phone: 530-752-7634
mjhorak@ucdavis.edu
Working with AK, American Samoa, AZ, CA, CO, Federated States of Micronesia, Guam, HI, ID, MT, NV, NM, Northern Marianas, OR, UT, WA, and WY.

USDA-ARS
Dr. Alvin Simmons
USDA-ARS
US Vegetable Laboratory
2700 Savannah Highway
Charleston, SC, 29414
Phone: 843-402-5307
Fax: 843-573-4715
alvin.simmons@ars.usda.gov

This material is based upon work that is supported by the National Institute of Food and Agriculture, US Department of Agriculture, under award number 2015-34383-23710 with substantial cooperation and support from the State Agricultural Experiment Stations, USDA-ARS and USDA-FAS. In accordance with Federal Law and US Department of Agriculture policy, this institution is prohibited from discriminating on the basis of race, color, national origin, sex, age or disability.