Helping Growers Find Solutions

2018 Annual Report

The IR-4 Project

ANNUAL REPORT OF THE IR-4 PROJECT[1]
January 1, 2018 - December 31, 2018

The IR-4 Project (IR-4) has functioned for decades as a national research/data development program that facilitates the regulatory approval of modern, safe and effective chemical and bio-based pesticides for use on specialty crops (fruits, vegetables, nuts, herbs, ornamentals, etc.) and minor or specialty uses on major crops (e.g. corn, cotton, soybeans, wheat, etc.). IR-4 remains relevant today because the Project provides a tangible product: registration of needed pest control products to farmers who in turn provide food processors, food retailers and the public access to quality and wholesome specialty crops.

IR-4 is needed because the registrants of pest management products often focus their product development efforts and resources on large acreage major crops where potential sales are significant. Specialty crops are minor markets; the development of pest management technology in these markets is often not a corporate objective. Without IR-4 efforts, there would be many pest management voids in/on specialty crops.

IR-4's research with food crops consists of different types of studies with different objectives. The majority of IR-4's activities involve studies that determine the amount of pesticide residue remaining in or on the crop at harvest when the crop protection product is applied in a manner that effectively manages the destructive pest. The other research on food crops is product performance; research to determine if products are safe, or non-phytotoxic to the crop and effective in controlling the target pest(s). IR-4's work with non-food, ornamental crops is primarily product performance and crop safety. In performing this research, IR-4 provides national coordination, technical guidance and other resources to develop the appropriate data to facilitate registrations.

The IR-4 Project research and regulatory activities have supported nearly 20,000 registrations of conventional pesticides and biopesticides on specialty food crops since 1963. While the number of IR-4 supported registrations in the Environmental Horticulture Program are much less than the Food Program, the impact of these registrations are equally impressive with nearly 30,000 uses on ornamental crops impacted by IR-4 research and data. Over the last 15 years, IR-4 emphasized research on products that are compatible with Integrated Pest Management Systems (IPM). This "IPM Friendly" technology includes "Reduced-Risk" pesticides, biopesticides, and products that can be used in organic farming.

IR-4 works closely with many organizations to accomplish its mission and leverage it resources. Allied organizations/ groups include[2]:

- Specialty crop growers and their commodity organizations,
- Land Grant Universities/State Agricultural Experiment Stations,
- Crop protection industry, including large and small companies that register pest management products,
- Multiple US Department of Agriculture Services and units including
    - USDA-Agriculture Research Service (ARS),
    - USDA-Foreign Agriculture Service (FAS),
    - USDA-National Institute of Food and Agriculture (NIFA),
- US Environmental Protection Agency (EPA),
- 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).

This level of partnership and cooperation is unique within a publically funded program.

The impacts of IR-4's service are broad. Obviously, farmers benefit in having legally registered crop protection products to manage pests. This helps farmers produce high quality food and ornamental crops that are demanded by consumers. IR-4's impact extends beyond farmers. Food processors and food retailers benefit in having a consistent supply of high quality produce and/or raw materials to meet consumer demand or keep their processing facilities open and operational. The public benefits through having an abundant choice of healthy vegetables, fruits, nuts and other foods available at

[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] 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

reasonable prices, as well as having ornamental horticulture plants to enhance the landscape and environment. Additionally, IR-4's efforts prevent food waste, both at the farm and consumer level. 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.

Further details about the IR-4 Project are referenced at the IR-4 Project's website: http://www.ir4project.org.

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 12,660 requests for assistance to the IR-4 Food Program. Of these, 314 are currently considered researchable projects that remain as documented needs of specialty crop growers. The others have been addressed through previous research and regulatory submissions or cannot be registered at this time. In 2018, a total of 145 new project requests were submitted to IR-4 from stakeholders. IR-4 staff added 48 requests to the IR-4 database to track the new crop group updates and International requests or other studies needed to address regulatory needs that will be bundled into future submissions to EPA. The total number of new requests added to the IR-4 tracking system during 2018 was 193 project requests.

IR-4's research priorities for 2018 were determined by IR-4 stakeholders during the September 2017 IR-4 Food Use Workshop, in Denver, CO. Based on the outcome of that workshop and other priority setting mechanisms such as upgrades to answer regional needs, IR-4 scheduled 55 new studies in 2018. An additional 13 studies were carried over from the previous year for a total of 68 research projects.

For most residue studies, IR-4 follows the EPA 860 Series Test Guidelines for pesticides and toxic substances. 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 68 residues studies in the 2018 food residue research program, there were 303 IR-4 State (land grant) field trials, 55 USDA-ARS field trials and 22 field trials provided from our Canadian (CN-PMC) partners for a grand total of 380 field trials. Thirty-six other trials were later dropped due to weather or other issues that arose requiring trials to be re-assigned. Canada also served as Sponsor and Study Director for four of these studies. The specific studies for 2018, including test chemical and crop, are shown in Attachment 2. Overall the number of field trials is the lowest reported. There has been a steady decline in the number of studies over the past years due to decreased funding as well as an increase in resources transferred into product performance and crop safety work. At the same time this decline in residue studies has helped to alleviate a backlog of analysis that developed in the IR-4 laboratories.

The majority of field trials are assigned to IR-4 or CN-PMC/Field Research Centers and sample analyses to the IR-4 Analytical Laboratories. When necessary, other cooperating facilities or contractors are utilized to ensure projects are completed in a timely manner. IR-4 makes every effort to complete the field phase of studies in one year, which is needed to meet the 30-month line goal for each study. However, weather, proper trial separation requirements and other factors can sometimes preclude IR-4 from meeting this goal.

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

The need for IR-4 to develop product performance data (efficacy and crop safety research) to support labeling of new uses for specialty crop pest management tools 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 2018, the IR-4 Food Program Product Performance team planned trials requiring nearly $400,000 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, and 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 2018 funding supported research to address needs for 46 projects, including 85 state university trials and 4 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 – "2018 Product Performance Research Program" for full details).

In addition to coordinating the 2018 performance research plan, the Food Program Product Performance team continued 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.

Integrated Solutions

In order to better service the needs of the IR-4 stakeholders, IR-4 implemented the Integrated Solutions Research Program in 2018. Integrated Solutions is a hybrid of existing Food Use, Pest Problems without Solutions (PPWS) research and elements of the traditional Biopesticide research program that also focuses on pest problems without solutions and residue mitigation.

The focus areas are to:

- Identify solutions to an existing pest management void through product screening research; this is similar to the past "Pest Problems without Solutions" projects except that biopesticides will be used to a greater extent in the screening trials, along with conventional products;
- Integrate biopesticides into conventional (non-organic) agricultural systems to help prevent development of pest resistance;
- Substitute biopesticides or short-residual reduced-risk products close to harvest to reduce the risk of MRL-violations for specialty crops targeted for export markets (residue mitigation), thus facilitating trade and reducing dietary burden; and
- Address the needs of organic production systems (however for the 2019 research program, these priorities remain in the biopesticide program, and will join Integrated Solutions at the 2019 workshop.

More so than with the other programs, the Integrated Solutions research will screen conventional products and biopesticides singularly and/or in rotation to fill pest management voids. It will also provide a greater focus on ways to manage pest resistance in conventional systems. Finally, it will also focus on residue mitigation, which is developing efficacious systems that result in reduced residues of conventional products at harvest to reduce dietary risk and facilitate international trade.

IR-4 decided to develop this Integrated Solutions program to address the ever-changing production systems. Industry and the public sector have increased development activities on a new generation of efficacious biopesticides that continues to play a more significant role in conventional (non-organic) agricultural production systems. For 2019 research, the top priorities identified were: damping-off in hemp, bacterial disease control in onions, parasitic weed control in processing

tomato, cucumber beetle control in watermelon, wireworm control in sweet potato, and verticillium wilt control in eggplant.

Submissions and Successes

Submissions. In 2018, IR-4 submitted data to EPA or to the cooperating registrant for 23 chemicals, addressing 160 specific IR-4 requests (PR#s) for assistance submitted by IR-4 stakeholders and will support hundreds of new uses based on crop group extrapolations. This was another productive year for IR-4 submissions. See Attachment 4 for a comprehensive listing of data submitted in 2018. There are currently another 100 reports signed at IR-4 and ready for submission, but are awaiting final documents from cooperating registrants or are being bundled with other studies before the submission is made 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. Again, in 2018, a large number of crop group requests were made in IR-4 submissions to reflect these efficiencies. Over half of the projects tracked in the 2018 submissions were for crop group tolerances (85 PR# of the 160 submitted). This adds many more new uses to product labels, supports new crop markets for growers and supports imports as well. Often times IR-4 realizes as many as 10 or more new uses for each residue study submitted.

Successes. IR-4 posted 918 new uses for growers in 2018, based on 208 tolerances that EPA established based on IR-4 data. EPA continues to support IR-4 in reviewing IR-4 data as it is submitted and generally meet the PRIA mandated timelines. The 918 new uses in 2018 bring the IR-4 55-year total of clearances to 19,814. A complete list of these new uses along with the new crop groups can be found in Attachment 5. In total, EPA reviewed 27 chemistries for IR-4 in 2018. This number of actions is back on par with previous years, likely due to the new minor use team being established at EPA and other factors such as several cumulative reviews being completed and the new administration being in place.

EPA continues to deal with increased scrutiny to protect consumers, farm workers and the environment, with particular attention to protecting children, pollinators, endangered species, and water. EPA's increased scrutiny of pesticide hazard/risk has required additional work by IR-4 to provide Public Interest support for these new uses and in many cases respond in the public comment process. IR-4 continues to add information from stakeholders to the IR-4 database to demonstrate the great need for these new pest control products. These products provide the much needed pest control products critical to IPM programs, resistance management and to combat new invasive pests arriving in the US.

A listing of IR-4 projects in the queue for future submission to EPA, that includes data from 164 studies that will address 283 IR-4 project requests, is provided in Attachment 6 or can be searched 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. IR-4 submissions are generally reviewed by EPA and a tolerance established within a PRIA-required 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 Feb. 27, 2018 in Davis, CA. At this meeting, the audit plan for IR-4 QA officers for the 2018 field trial season was created. For calendar year 2018, regular inspections included 20 facilities, 174 in-life audits of field trials, 61 in-life audits of residue analytical laboratory activities, 58 analytical summary report/data audits and 365 field data book audits. During the 2018 calendar year, 76 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 177 EPA GLP IR-4 facility inspections since April 27, 1997, with only one minor finding to-date. In 2018, the US EPA notified IR-4 of 5 inspections for GLP compliance and data integrity.

IR-4 continues to use the eQA (electronic) reporting system to improve efficiencies and enhance communications across the program. Over 931 inspection and audit reports were processed using the web-based system in 2018. 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 2178 sortable documents are now on the eDOCs system and readily available to IR-4 study participants.

Crop Grouping Initiative

All proposed revisions to US crop groups have been submitted to the EPA. EPA is currently working on the proposed revisions to Herb and Spice Crop Group 19 which will be separated into two new crop groups, Crop Group 25, Herb Group and Crop Group 26, Spice Group. This will promote greater use of these groups for tolerance setting purposes, both domestically and in countries that export food to the US. This is the fifth in the series of planned crop group updates. The crop group effort also continues with the Codex Committee of Pesticide Residues. Fruit, Vegetable, Grass, Nuts, Seeds and Saps and Herb and Spice Codex types have all been completed. Animal Feeds and Processed Foods will be considered at the CCPR meeting in April, 2019.

International Activities

IR-4 remains committed to assisting US specialty crop growers with their desire to export fruits and vegetables to international markets through harmonizing pesticide residues standards in specialty crops, thus reducing the use of MRLs as a technical phytosanitary trade barrier.

In North America, IR-4's cooperation with CN-PMC continues to be fruitful considering that they contributed 22 field trials to our joint program in 2018. Of the 68 studies conducted by IR-4 in 2018, four were managed by CN-PMC, where they served as Study Director and Sponsor, and they utilized a number of IR-4 field research centers to complete the NAFTA data requirements. In total, the research benefit of working on joint residue studies 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 data 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 nearly the same time. This prevents trade irritants before they happen. EPA and PMRA completed joint reviews or workshares on 8 IR-4/CN-PMC submissions, addressing 12 stakeholder requests in 2018.

Priorities resulting from the first Global Minor Use Workshops continue to make progress, and a number of studies are under consideration for fruit fly control in tropical crops, such as spinetram in Latin America. Many of the secondary priorities are also being considered, for example, the registration of flonicamid in NAFTA to address aphid control in legume crops. Anthracnose on tropical crops was raised as a priority, and IR-4 is undertaking a number of residue studies along with Costa Rica and Peru to address this need.

Many of the studies under the Global Capacity Development, Residue Data Generation Project came to completion in 2016 and 2017 and were reviewed by Codex/JMPR. 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 spinetram 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 the expertise to conduct field and laboratory pesticide residue studies under Good Laboratory Practices and to eventually provide data 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.

Projects submitted to JMPR in late 2016 included: azoxystrobin plus difenoconazole on dragon fruit, with 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 were adopted in 2018. Other projects were completed in 2016, but were scheduled for JMPR review in 2018. These include: pyriproxyfen on Papaya, with samples from the Philippines, Malaysia and Brunei; pyriproxyfen on Mango, with samples from Malaysia and Singapore; pyriproxyfen on pineapple from Panama; and pyriproxyfen on Banana with samples from Costa Rica and Guatemala. Codex MRLs for these projects are expected in 2019. Africa started their residue project with sulfoxafor on mango in 2016 and are expected to complete those studies in early 2019. Please see the summer IR-4 newsletter for a complete update regarding these projects (https://www.ir4project.org/wp-content/uploads/2018/09/vol49no3_Layout-1.pdf)

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 (*OECD*), Expert Group on Minor Uses, the Working Group on Pesticides and the Expert Group on BioPesticides; 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.

IR-4 continued to support submissions to the JMPR for 2019 review, where IR-4 supported submissions of Penthiopyrad on blueberry and caneberry, as well as supporting registrant submissions of IR-4 data.

Environmental Horticulture Program

The Environmental 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 2018, IR-4 conducted 628 environmental horticulture research trials to support registrations in the greenhouse, nursery, landscape, Christmas tree and forestry industries. Of these, 118 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 2018 field cooperators and Attachment 8 for research activities listed by project.

Table 1. Summary of IR-4's 2018 and Revised 2017 Environmental Horticulture Program Research Activities.

Category	2018			Revised 2017		
	Efficacy	Crop Safety	Total	Efficacy	Crop Safety	Total
Number of Studies (PR Numbers) with Planned Trials	118	288	406	170	327	297
Number of Trials	220	408	628	253	490	743

Submissions and Successes

During 2018, 21 data summaries were compiled based upon research reports submitted by researchers. See Attachment 9 for Abstracts from the individual reports. Acibenzolar Crop Safety, Afidopyropen Crop Safety Summary, Bacterial Disease Efficacy Summary, Beetle, Borer, Weevil & White Grub Efficacy Summary, Dimethenamid-p Crop Safety, Dithiopyr Crop Safety, Flumioxazin + Pyroxasulfone, Fluopyram Crop Safety, Fusarium Efficacy Summary, Leafminer Efficacy Summary, Mandestrobin Crop Safety, Oxyfluorfen + Prodiamine Crop Safety, Pendimethalin + Dimethenamid-p Crop Safety, Prodiamine + Isoxaben Crop Safety, Pseudomonas chloraphis Crop Safety, Pydiflumetofen + Azoxystrobin

+ Propiconazole Crop Safety, Pydiflumetofen + Fludioxanil Crop Safety Summary, Pydiflumetofen Crop Safety Summary, Rhizoctonia Efficacy Summary, SP1770 Crop Safety, and Thielaviopsis Efficacy Summary. Data from 3,467 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. 2018 Environmental Horticulture Program Research Summaries.

Region	**Number of Trials**
North Central	373
North East	526
Southern	1,028
Western	631
USDA-ARS	905
Total	3,467

During 2018, US EPA approved five new labels based partially on the efficacy data IR-4 generated: Fortress, Obtego, Picatina, Picatina Flora, and Ventigra. Three labels were registered in by California: Astun, Segovis were new, and Tower was amended.

Table 3. Environmental Horticulture Program Registration Contributions, 2018.

Category	**2018**			
	Efficacy	Crop Safety	Both	Total
New US EPA Product Registrations [a]	1	2	2	5
US EPA Label Amendments [b]	0	0	0	0
State Registrations [c]	1	1	1	3
International	0	0	0	0
Not to be Registered	0	0	0	0
Number of Trials Contributing to Registrations [d]				
North Central	-	-	-	57
North East	-	-	-	55
Southern	-	-	-	50
Western	-	-	-	59
USDA-ARS	-	-	-	137
Number of Impacted Crops [e]	2433	141	-	2574

[a] New products for the environmental horticulture industry based on data collected through IR-4 and submitted to manufacturers in previous years.

[b] Label updates on existing products for the environmental 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 environmental 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 environmental uses impacted by the IR-4 data.

[f] For some registrations, IR-4 contributed both efficacy and crop safety data.

2017 Workshop

The Environmental 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 Projects: 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 2018, the IR-4 Environmental Horticulture Program continued to facilitate research activities for two invasive species impacting the Environmental 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. Both of these projects were completed in 2018, and final summaries will be posted in 2019. The Chrysanthemum White Rust project ended during 2016 and a final summary will be posted in 2019. Key elements of each project are listed in Table 4 below.

Table 4. Invasive Species Projects during 2018

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 scientist's findings are put into practice by growers.

Subsequently, this team submitted an SCRI Coordinated Agriculture Project pre-proposal. This was ranked highly by the stakeholder review, but the full research proposal only received a High designation from the scientific review panel. A revised pre-proposal was submitted in the fall of 2018 and is awaiting review.

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 Environmental 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 second 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 and the research team began studies on the amount of systemic insecticides found in pollen and nectar of rhododendron, snapdragon, annual salvia, perennial salvia, dahlia, and knipofia. Our team 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. Our team 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 has published three scientific articles, has another accepted and in revision, has written 17 trade articles, and has given more than 20 scientific and 47 trade presentations. Ultimately, these activities will improve pollinator health and improve the sustainability and profitability of the Environmental 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 $8.7 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, and the 2018 Biopesticide Workshop in St Louis, MO.

Submissions and Successes
In 2018 IR-4 completed registration of 2 brand new active ingredients which were based on 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. In addition a new use and tolerance was established for 6BA on avocado.

The EPA approved a label amendment request to add a supplemental label for Delegate WG (Spinetoram) to reduce PHI on bushberries (Subgroup 13-07B) except lingonberry. This label change was supported by efficacy trials funded by the

Biopesticide program. Additionally, 446 labels were updated on the IR-4 Biopesticides Label Database (see http://ir4app.rutgers.edu/biopestPub/labelResult2.aspx) in 2018.

Impact

IR-4 takes great pride that its "deliverables", the registrations of pest management products for specialty crops and specialty uses on major crops, answer some very real problems facing growers. Individual growers and commodity associations continue to articulate testimonies on how IR-4 helps them feed Americans and beautify the environment. To better ascertain the impact of IR-4's research and regulatory activities, Michigan State University's Center of Economic Analysis reported 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.

IR-4 focuses its research on modern lower/reduced risk chemical pesticides and biopesticides. The strategic decision to focus with these newer products has helped ensure that growers can produce their commodities with the best available technology to manage pests while ensuring the highest degree of safety for humans and the environment. Many of the registrations are integral products in Integrated Pest Management systems.

IR-4's research and regulatory activities are keenly aware and are proactively solving many other issues facing specialty crop growers, including pest resistance to pesticides, pesticides being a barrier to trade and food waste. Though IR-4 is not solely responsible for solving these and other critical agriculture/societal issues, IR-4 efforts reduce the negative impact.

2018 Appropriations and other funding

The IR-4 Project receives funds by various Services/units within USDA, the SAES, and third party sources. Total funding received in calendar year 2018 was approximately $17,083,060. See below for details:

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 2018, 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 $2.22 million was allocated for field trials that produce the necessary residue samples and product performance data; $511,000 for ornamental trials; $387,000 for biopesticide/organic support grants, $228,000 for new analytical instruments, $372,500 for supplemental laboratory analysis and the remaining $842,500 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
$1,090,000	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.
$428,878	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 (e.g. field trials) in the US that is required by trading partners to allow domestic exports.
$17,083,060	TOTAL FUNDING	

Though not directly part of IR-4's core mission, IR-4 has been managing a USDA-Specialty Crop Research Initiative grant that studies the impact of pesticides on pollinators in ornamental horticulture production systems. This is a five-year grant totaling $6.5 million.

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 $6.0 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 activities. Over the last several years, IR-4 has established multiple working groups to seek further efficiencies, including efficiencies within the collection and reporting of data from field research sites; efficiencies in the analytical laboratories; and efficiencies in operations between IR-4's three existing research programs (Food Crops, Biopesticide/Organic Support and Environmental Horticulture).

Activities of these working groups have led to some process changes. Specifically, IR-4 has made some fundamental changes in the assignment of laboratory analysis duties. The laboratories are truly working as a single unit with a singular focus of elimination of the backlog of residue sample analysis/reporting. Great progress has been made and by the end of the calendar year, the Western Region, the Northcentral Region and USDA-ARS/Wapato laboratories had eliminated their internal backlog. The Southern Region is on track to eliminate their backlog first quarter 2019. Unfortunately, USDA-ARS/Tifton has not completed their backlog. Other process changes include Integrated Solutions and Week of Workshops which will be discussed in Future Directions.

Future Directions

As part of the above mentioned efficiency process, IR-4 explored opportunities to reduce bureaucratic burdens, provide equal or better service to stakeholders while facilitating innovation to pest management. Since the Biopesticide Program was added in 1982, IR-4 maintained three separate research programs with three separate research processes. In this time of limited resources, IR-4 internal management questioned if we could "afford" to maintain the three separate programs. After several meetings and review, a decision was made to move the biopesticide research component of the Biopesticide and Organic Support Program into the Food Program and Environmental Horticulture Program. IR-4 will maintain a regulatory support component of the Biopesticide and Organic Support Program.

The impact of moving the IR-4's research with biopesticides on ornamental crops into the Environmental Horticulture Program is minor as the Environmental Horticulture Program was already including some biopesticide products in their past and current studies. However, in the Food Program, there was significant room for innovation and process improvements, and IR-4 established its new Integrated Solutions Research Initiative.

The new Integrated Solutions Research Initiative is designed to be a hybrid of IR-4's legacy ***Pest Problems Without Solutions*** initiative and biopesticide research. The concept involves identifying a product or products that effectively manage a pest, providing growers a tool to prevent and/or manage pesticide resistant pests or a system that mitigates residues on crops at harvest. The research may be a general screening study with a number of conventional chemical pesticides and bio-based pesticides to determine which is the best available solution. It may be research where products are used in rotation with each other, or it may be research where the last application of the chemical pesticide extends the existing pre-harvest interval with another product (chemical or bio-based) filling in the niche.

The first research with Integrated Solutions is scheduled to start in 2019. IR-4 will also maintain a small footprint in doing traditional biopesticide research. The intent is to transition further with eventually with 100% of biopesticide resources transferred to Integrated Solutions.

The cornerstone of IR-4 research and regulatory efforts is an open and transparent stakeholder-driven research prioritization process to address the most important pest management voids in specialty crop agriculture. The goal is to work with the most suitable crop protection products to control the most important pests. Priority setting is absolutely necessary, as 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 majority of priorities for 2019 research in the Food Program, initial Integrated Solutions and legacy Biopesticide Research were determined at the September 20-22, 2018, workshops held in St. Louis, MO. The priority setting process utilized in the Food Program is highly refined and different from the process used in the Integrated Solutions and Biopesticide Research.

The Food Program utilized a preliminary screening of potential projects (Nomination Process) to help ensure that there is adequate time to discuss the projects of highest priority at the workshop. Projects of lesser priority are maintained in the database for possible prioritization the following year. Approximately 155 participants (growers, commodity organizations, university research and extension specialists, and representatives from EPA and the crop protection industry) attended the Food Program section of 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 2019 food program consists of 396 field trials involved in residue studies. This trial plan includes 356 trials scheduled at IR-4 Field Research Centers/other University sites, 51 field trials at ARS sites and 29 field trials conducted by Canadian partners (CN-PMC). Additionally, IR-4 is conducting 91 field trials to develop product performance data at University sites.

The priority setting process for the Integrated Solutions and Biopesticide Research is relatively the same. In both areas, there is a master list of pest management voids or pest management projects. A small number of priority projects are chosen on either consensus decision in the Integrated Solutions or voting in the Biopesticide Research. The priorities for the initial Integrated Solutions research are damping-off in hemp, bacterial disease control in onions, parasitic weed control in processing tomato, cucumber beetle control in watermelon, wireworm control in sweet potato, and verticillium wilt control in eggplant. The legacy Biopesticide Research projects for 2019 are spotted wing drosophilia on all crops, Bacteria speck/spot/canker on tomato, bioherbicide screening, downy mildew on organic basil and virus/viroids on greenhouse tomato.

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 2019 includes Non-Oomycete Root & Crown Rot Efficacy; Botrytis Efficacy; Thrips Efficacy; Foliar Feeding Beetle Efficacy; Mealybug & Scale Efficacy; Post-emergent Herbicide Efficacy (In Season); Asian Ambrosia Beetle Efficacy; Cover Crop Management for Christmas Tree Production; Liverwort Efficacy; and Snail & Slug Efficacy.

IR-4 continues to operate according to the principals outlined in its current strategic plan, ***IR-4 Project - VISION 2020.*** This plan details the IR-4 Project vision, mission, values, culture, objectives and funding needs and identifies strategic benchmarks and the goals in each program area.

Fiscal resources continue to be the most critical challenge for IR-4. Project funding remains at the same level as it was 10 years ago. Unfortunately, operational expenses have increased substantially during this period. This has triggered funding shortfalls within all IR-4 programs and operational units. IR-4's only option is to increase efficiency while reducing research/research capacity.

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 adequate resources. In March 2018, IR-4 was the subject of a Congressional Lunch and Learn. This was done to educate Congressional staff on the importance of IR-4. 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 fiscal struggles has been further complicated by the Executive Branch funding requests. In fiscal year 2018 and 2019, the President's Funding Proposal called for the elimination of the 10 USDA-ARS research programs that develop data under the IR-4 umbrella. These 10 projects account for approximately 20% of IR-4's research capacity. Fortunately, these research programs were eventually funded. However, the units are unable to replace key personnel which reduces the overall research capacity.

In addition, IR-4 faces challenges from some of their host institutions. At many Universities, overall funding is not keeping up with expenses. Some are exploring reducing or eliminating their in-kind contributions to IR-4, thus ending the state/federal partnership to resource IR-4. To offset this issue, IR-4 has requested USDA to convert its funding from a Special Research Grant that does not allow collection of administrative costs to a Specific Cooperative Agreement that will allow IR-4 to contribute 10% of funds to offset expenses.

IR-4 remains relevant, as specialty crop agriculture needs safe and effective pest management products to manage newly emerging pests and pests resistant to pesticides. IR-4 is also essential in performing robust product performance testing, developing data needed to support refined risk assessments as well as efforts to assist growers' access to lucrative international markets by reducing/eliminating pesticides as a trade barrier. The IR-4 Project is a critical component of our

nation's food security research infrastructure. An investment in IR-4 will help the agricultural sector meet the demands for high-quality food now and into the future.

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Starner, V. and S. Novack, 2018. "The Tri-State Agr. Tour – DE/PA/MD", IR-4/EPA/USDA Field Tour June 20, 2018 tour book. New Jersey Agricultural Experiment Station Publication No. P-27200-22-18, 16 pp.

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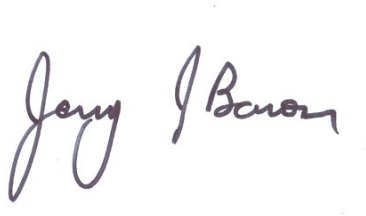
December 31, 2018

Approved by:



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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
Ms. Aline DeLucia, National Association of State Department of Agriculture
Mr. Alan DeYoung, Van Drunen Farms
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. Armando Monterroso, Brooks Tropicals
Mr. Dennis Nuxoll, Western Growers Association
Ms. Laura Phelps, American Mushroom Institute
Mr. Keith Pitts, Marrone Bio Innovations
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. Herman Waguespack, American Sugar Cane League

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. 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
Corteva Agriscience, Agr. Div. of DowDuPont
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.
Landis International
Lonza Inc.
Loveland Products
Luxembourg-Pamol, Inc.
Marrone BioInnovations, Inc.
MGK
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
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ATTACHMENT 1 Continued

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ATTACHMENT 1 Continued

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ATTACHMENT 1 Continued

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H. Sandler	MA
M. Sylvia	MA
M. VanGessel	DE

Southern Region

J. Baker	TX
R. Batts	NC
D. Carillo	FL
J. Crane	FL
S. Culpepper	GA
M. Czarnota	GA
P. Dittmar	FL
M. Long	FL
K. Jennings	NC
C. Marconi	TX
W. Mitchem	NC
M. Phillips	TX
A. Post	NC
L. Quesada	NC
D. Riley	GA
W. Robles Vazquez	PR
R. Tannenbaum	FL
D. Thomas	FL
G. Vallad	FL
D. Wright	LA

Western Region

K. Buckland	OR
Z. Cheng	HI
N. Clark	CA
C. Collins	OR
J. Coughlin	HI
K. Daane	CA
D. Ennes	CA
J. Felix	OR
S. Fennimore	CA
C. Hamilton	NM
B. Hanson	CA
J. Kam	HI
G. Koskela	OR

ATTACHMENT 1 Continued

Western Region (Continued)

G. Kyser	CA
N. Leach	CA
M. Matheron	AZ
P. Mauk	CA
W. Meeks	ID
T. Michilaides	CA
T. Miller	WA
C. Ocamb	OR
C. Oman	CO
E. Peachey	OR
W. Peng	WA
T. Perring	CA
S. Rios	CA
K. Skiles	CA
R. Smith	CA
S. Stoddard	CA
P. Sturman	OR
C. Vanderwoude	HI
D. Walsh	WA
S. Watkins	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
D. Hanscomb	NS
D. Nield	BC
G. Riddle	ON
M. Weber-Henricks	ON
R. Wismer	ON

ATTACHMENT 2
2018 Food Use Research Projects - Residue Trials*

Chemical	Crop	PR #
Abamectin	Blueberry	8361
Abamectin	Sugar Apple	7830
Azoxystrobin + Cyproconazole	Coffee	11934
Azoxystrobin + Fludioxonil + Difenoconazole	Sweet Potato (Post Harvest)	12118
Benzovindiflupyr + Difenoconazole	Beet (Garden)	12351
Bifenazate	Cucumber (GH)	8857
Bifenthrin	Coffee	11527
Cyantraniliprole (HGW86)	Basil	12403
Cyantraniliprole (HGW86)	Dill	12401
Cyantraniliprole (HGW86)	Hops	12346
Cyantraniliprole (HGW86)	Mint	12402
Cyclaniliprole	Sunflower	12264
Cyclaniliprole	Tomato (GH)	11894
Cyflumetofen	Hops	12334
Cyprodinil + Fludioxonil	Cranberry	11937
Difenoconazole + Azoxystrobin	Mango	11572
Diquat	Sweet Potato	11889
Ethalfluralin	Stevia (Future Herbs)	9871
Famoxadone + Cymoxanil	Radish	12415
Flonicamid	Caneberry	8585
Flonicamid	Pomegranate	12283
Fluazifop-P-Butyl	Radish	12543
Fluazinam	Broccoli	7091
Fluazinam	Papaya	8274
Fluazinam	Papaya	12480
Flumioxazin	Sugar Apple	11292
Fluopicolide	Grapefruit	12091
Fluopicolide	Orange	12090
Fluopyram + Pyrimethanil	Pepper (Bell & Nonbell) (GH)	11906
Fluopyram + Tebuconazole	Guava	10405
Flupyradifurone	Basil (GH)	12294
Flupyradifurone	Strawberry (GH)	11892
Flutianil	Lettuce (Head & Leaf)	12388
Flutianil	Peach	10220
Glufosinate	Banana	12050
Glufosinate	Cucumber	12019
Glufosinate	Guava	10242
Glufosinate	Lychee	10239
Glufosinate	Tomato	12021
Glufosinate	Hops	11525
Glufosinate	Pepper (Bell & Nonbell)	12022
Glufosinate	Squash (Summer)	12020
Glufosinate	Tomato	12021
Indoxacarb	Strawberry	9055
Lambda-Cyhalothrin	Mint	12347
Mandestrobin (S-2200)	Lettuce (Head & Leaf)	11027

ATTACHMENT 2 Continued

Chemical	Crop	PR #
MCPA	Clover (Seed Crop)	11994
Methoxyfenozide	Rice	11979
NA11630	Pepper (GH)	12298
NA11630	Tomato (GH)	12300
NMG787	Cantaloupe	12253
NMG787	Cucumber	12252
NMG787	Onion	12322
NMG787	Squash	12254
NMG787	Strawberry	12252
Oxathiapiprolin + Mandipropamid	Bean, Lima (Succulent)	12345
Prometryn	Leek	12131
Prometryn	Spinach	12029
Propiconazole	Ginseng	12341
Pydiflumetofen (FTH 545)	Ginseng	11912
Pydiflumetofen (FTH 545)	Hops	12342
S-Metolachlor/Metolachlor	Quinoa	12247
Spinetoram	Asparagus	11830
Spinetoram + Sulfoxaflor	Lettuce (GH)	12292
Spinosad	Mushroom (White Button)	11945
Sulfentrazone	Broccoli	10557
Sulfentrazone	Cabbage	10556
Sulfoxaflor	Pea (Dry)	12261
Tebuconazole	Avocado	7337
Tebuconazole	Avocado	11160
Tribenuron-Methyl	Bean (Dried Shelled)	11980
Uniconazole-P	Crop Group 05-16 (GH Transplant)	12027
Zeta-Cypermethrin	Cherry	12259

ATTACHMENT 3
2018 Product Performance Research Program

Research in 2018 to complete performance needs for pre-2018 residue studies:

Chemical	Crop	PR#	Comments	ARS*State university trials
indazaflam	asparagus	11429	2015 residue study	CA, MI, NJ
fomesafen	dry bulb onion	11620	2016 residue study	NY, OR
fomesafen	green onion	11857	covered by 11620 residue study	OR, SC*
afidopyropen	GH strawberry	11680	2016 residue study	GA
fluxapyroxad + pyraclostrobin	pomegranate	11754	2016 residue study	CA, CA
insecticides	prickly pear cactus	12110	PPWS (Cochineal)	CA
prometryn	spinach	12029	2017 residue study	CA, FL
glufosinate	tomato, pepper	12021 12022	2017 residue study	CA, DE
glufosinate	cantaloupe, cucumber summer squash	12018 12019 12020	2017 residue study	CA, NJ
glufosinate	avocado	10240	2017 residue study	CA, CA
rimsulfuron	olive	10184	2017 residue study	CA
difenconazole + azoxystrobin	mango	11572	2017 residue study	FL
bicyclopyrone	horseradish	11667	H+ priority from 2016 FUW	CA, CA, WI, WI
glufosinate	sweet potato	10558	H+ priority from 2016 FUW	CA, NC
sulfentrazone	broccoli	10557	H+ priority from 2016 FUW	GA
famoxadone + cymoxanil	radish	08757	new residue study needed in 2018, at least for roots	FL, MI, OH, OR
fluazinam	papaya	08274	2016 residue study	FL
cyflumetofen	peach	11761	2016 residue study	NC
cyflumetofen	plum	11762	2016 residue study	CA
			Total	1*/34

Research in 2018 for new "A" & "H" priorities from 2017 FUW/Upgrades:

Chemical	Crop	PR#	Comments	ARS*/State university trials
prometryn	leek	12131	2018 residue study	CA, FL, MI
flutianil	lettuce (field/GH)	12388	2018 residue study	AZ, FL, NY
flupyradifurone	GH basil	12294	2018 residue study	GA, WI
cyclaniliprole	sunflower	12264	2018 residue study	CA, SD
glufosinate	guava	10242	2018 residue study	FL
glufosinate	lychee	10239	2018 residue study	FL
glufosinate	banana	12050	2018 residue study	FL
flonicamid	pomegranate	12283	2018 residue study	CA, CA
cyantraniliprole	hops	12346	2018 residue study	WA
cyflumetofen	hops	12334	2018 residue study	OR, WA, WA, WI
s-metolachlor	quinoa	12247	2018 residue study	CA, OR, WA*, WA
clomazone	mustard greens	11519	2018 H+ performance priority	CA, GA*, OH, WA*
glufosinate	caneberrry	12051	2018 H+ performance priority	CA, MI, NC, WA
flutianil	rosemary	12349	2018 H+ performance priority	NY
flutianil	sage	12348	2018 H+ performance priority	NY

ATTACHMENT 3 Continued

pendimethalin	rosemary	12343	2018 H+ performance priority	3 trials done by Kemin
quizalofop	*Brassica carinata*	12335	2018 H+ performance priority	SD, SD
bifenthrin	lychee	08540	2018 H+ performance priority	FL
herbicides	hemp (industrial)	12340	PPWS research	NC, NC, WA, WA
NMG787	onion	12322	2018 upgrade priority	CA, CA, FL, GA
fluazinam	broccoli	07091	2018 upgrade priority	FL, OH, OR
cyantraniliprole	kaffir lime	12389	2018 upgrade priority	CA, CA
cyantraniliprole	curry leaves	12390	2018 upgrade priority	CA, CA
insecticides	cabbage maggot	11591	2018 upgrade priority (PPWS)	NY, OR
			Total	43

ATTACHMENT 4
2018 Submissions to EPA, Registrants, Codex, and State Departments of Agriculture

Pest Control Agent	Registrant	Type*	Date	Commodity or Crop Group	PR#
Propiconazole	SYNGEN	F	1/11/2018	Avocado	11053
				Brassica, leafy greens, subgroup 4-16B, except watercress	12438
				Vegetable, root, except sugar beet, subgroup 1B	11721
				Leaf petiole vegetable subgroup 22B	12439
				Celtuce	12441
				Florence fennel	12442
				Swiss chard	12443
				Tomato subgroup 8-10A	12440
Clofentezine	ADAMA	I	1/26/2018	Guava	09323
Abamectin	SYNGEN	I/N	02/19/2018	Carrot	10893
				Tropical and subtropical, small fruit, inedible peel, subgroup 24A	12407
				Leafy greens subgroup 4-16A	12408
				Leaf petiole subgroup 22B	12409
				Arugula	12410
				Garden cress	12411
				Upland cress	12412
				Celtuce	12413
				Florence fennel	12414
Fenpyroximate	NAI	I	02/21/2018	Banana	10008
				Leaf petiole subgroup 22B	11100
				Caneberry subgroup 13-07A	08097
				Squash/cucumber subgroup 9B	09033
				Bushberry subgroup 13-07B	11501
				Bean, succulent	11029
				Nut, tree, group 14-12	11246
				Cottonseed subgroup 20C	12461
Sulfoxaflor	DOWAGR	I	02/28/2018	Artichoke, globe	10858
				Asparagus	11321
				Bushberry subgroup 13-07B	11296
				Caneberry subgroup 13-07A	11279
				Sunflower subgroup 20B	11095
					11269
				Fruit, stone, group 12-12	12471
				Leafy greens subgroup 4-16A	12472
				Leaf petiole subgroup 22B	12473
				Nut, tree, group 14-12	12474
				Vegetable, brassica, head and stem, group 5-16, except cauliflower	12475
				Brassica, leafy greens, subgroup 4-16B, except watercress	12476
				Celtuce	12468
				Florence fennel	12469
				Kohlrabi	12470

ATTACHMENT 4 Continued

Pest Control Agent	Registrant	Type*	Date	Commodity or Crop Group	PR#
Flonicamid	ISK, FMC	I	03/01/2018	Sunflower subgroup 20B	11274 11383
Cyromazine	ADAMA	I	03/23/2018	Succulent peas (edible podded and succulent shelled)	11503
				Vegetable, tuberous and corm, subgroup 1C	12357
				Onion, bulb, subgroup 3-07A	12358
				Onion, green, subgroup 3-07B	12359
				Leafy green subgroup 4-16A	12360
				Leaf petiole vegetable subgroup 22B	12361
				Celtuce	12362
				Florence fennel	12363
				Vegetable, brassica, head and stem, group 5-16, except broccoli	12364
				Brassica, leafy greens, subgroup 4-16B	12365
				Kohlrabi	12366
				Tomato subgroup 8-10A	12367
				Pepper/eggplant subgroup 8-10B	12368
Buprofezin	NAI	I	04/11/2018	Fig	11342
				Pepper (Greenhouse-grown)	08162
				Leafy greens subgroup 4-16A, except head lettuce and radicchio	12445
				Brassica, leafy greens, subgroup 4-16B	12246
				Vegetable, brassica, head and stem, group 5-16	12247
				Leaf petiole vegetable subgroup 22B	12248
				Celtuce	12249
				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 kiwfruit, subgroup 13-07F	12457
				Nut, tree, group 14-12	12458
Pyraflufen-ethyl	NAI	H	05/07/2018	Hops	08708
				Fruit, stone, group 12-12	12079
				Nut, tree, group 14-12	12078
				Vegetable, tuberous and corm, subgroup 1C	12081
				Fruit, small, vine climbing, except fuzzy kiwifruit, subgroup 13-07F	12080
				Tropical and subtropical, small fruit, edible peel, subgroup	12082
				Cottonseed subgroup 20C	12083
Indaziflam	BAYER	H	05/11/2018	Lowbush blueberry	11412
				Fruit, tropical and tropical, edible peel, group 23	12378 11546
				Fruit, tropical and tropical, inedible peel, group 24	12379 11088 11089 11090 11692

ATTACHMENT 4 Continued

Pest Control Agent	Registrant	Type*	Date	Commodity or Crop Group	PR#
Fenhexamid	ARYSTA	F	06/08/2018	Onion, bulb, subgroup 3-07A	07149
				Onion, green, subgroup 3-07B	08243
				Kiwifruit, fuzzy	09741
				Caneberry subgroup 13-07A	10506
				Bushberry subgroup 13-07B	10507
				Fruit, stone, group 12-12, except plum, prune, fresh, postharvest	12504
				Fruit, small, vine climbing, except fuzzy kiwifruit, subgroup 13-07F	10509
				Leafy greens subgroup 4-16A, except spinach	12505
				Berry, low growing, subgroup 13-07G	10510
				Vegetable, fruiting, group 8-10, except nonbell pepper	12506
				Arugula	12507
				Garden cress	12508
				Upland cress	12509
Propamacarb	ARYLSB BAYER	F	07/09/2018	Guava	07171
				Starfruit	11571
				Leafy greens subgroup 4-16A	11499
				Vegetable, tuberous and corm, subgroup 1C	12459
				Vegetable, fruiting, group 8-10	12460 10193
Pendimethalin	BASF UPI	H	07/19/2018	Leaf petiole subgroup 22B	10746 10910
				Monard	11726
				Rosemary	12343
Etoxazole	VALENT	I	08/03/2018	Beet, sugar	11233
				Commodities within proposed Crop Group 2-18 (Leaves of Root and Tuber Vegetables)	
Acetamiprid	NISSO UPI	I	10/17/2018	Tropical and subtropical, medium to large fruit, smooth, inedible peel, subgroup 24B	11326 11602 11724
				Pepper (greenhouse)	08488
				Leafy greens subgroup 4-16A	12485
				Leaf petiole vegetable subgroup 22B	12486
				Celtuce	12487
				Florence fennel	12488
				Brassica, leafy greens, subgroup 4-16B	12489
				Vegetable, brassica, head and stem, group 5-16	12490
				Kohlrabi	12491
				Fruit, stone, group 12-12	12493
				Nut, tree, group 14-12	12494
				Rapeseed subgroup 20A	12495
				Cottonseed subgroup 20C	12496
Prohexadione calcium	BASF FINEAMA	P	10/22/2018	Corn, field Alfalfa	12024
Chlorfenapyr	BASF	I	10/24/2018	Vegetable, fruiting, group 8-10	11606 12642
				Cucumber	12356
				Basil	10087
				Chives	10088

ATTACHMENT 4 Continued

Pest Control Agent	Registrant	Type*	Date	Commodity or Crop Group	PR#
Cyazofamid	ISK	F	11/07/2018	Ginseng	11636
				Cucumber (greenhouse)	12512
				Vegetable, brassica, head and stem, group 5-16	12651
				Brassica, leafy greens, subgroup 4-16B	12652
				Leafy greens subgroup 4-16A	12653
				Kohlrabi	12654
Cyflumetofen	BASF	I	12/03/2018	Vegetable, fruiting, group 8-10	11450
					11451
				Cucumber	11452
				Fruit, stone, group 12-12	11747
					11761
					11762
				Strawberry	11890
Penoxsulam	DOWAGR	H	12/11/2018	Artichoke, globe	11282
Flutianil	LANDIS	F	12/19/2018	Hop	09190
	NAI			Vegetable, cucurbit, group 9	12657
	OATAGRIO			Cherry subgroup 12-12A	12658
				Berry, low growing, subgroup 13-07G	12659
				Fruit, small, vine climbing, except fuzzy kiwifruit, subgroup 13-07F	12660
Isoxaben	DOWAGR	H	12/20/2018	Caneberry subgroup 13-07A	10248
				Hop	11743
Afidopyropen	BASF	I	12/21/2018	Cucumber (Greenhouse)	11675
				Pepper (Greenhouse)	11676
				Tomato (Greenhouse)	11677
				Strawberry (Greenhouse)	11680

ATTACHMENT 5
2018 Tolerance Successes - Permanent Tolerances
Published in the *Federal Register*

Pest Control Agent	Registrant	Type*	Date	Commodity or Crop Group	Note	PR#	# of Uses	# of Tolerances
Difenoconazole	SYNGEN	F	01/26/2016	Brassica, leafy greens, subgroup 4-16B	1	11864	13	1
				Vegetable, brassica, head and stem, group 5-16	1	11863	0	1
				Kohlrabi	1	11922	0	1
				Fruit, small, vine climbing, except fuzzy kiwifruit, subgroup 13-07F	2	11866	5	1
				Cranberry**		10828	1	1
				Guava		10172	1	1
				Papaya		10802	1	1
Isoxaben	DOWAGR	H	02/07/2018	Apple		07603	1	1
				Bushberry subgroup 13-07B		09720 10247	19	1
				Fruit, small, vine climbing, except fuzzy kiwifruit, subgroup 13-07F	2	11257 11685	5	1
				Nut, tree, group 14-12	1	11684	26	2
Fomesafen	SYNGEN	H	02/07/2018	Berry, low growing, subgroup 13-07G, except cranberry		10282 10476	9	1
				Vegetable, tuberous and corm, subgroup 1C	2	08084	16	1
				Vegetable, legume, group 6	3	10476	10	1
Rimsulfuron	DUPONT	H	02/12/2018	Berry, low growing, except strawberry, subgroup 13-07H		07888	8	1
				Vegetable, tuberous and corm, subgroup 1C	2	11377	16	1
				Fruit, small, vine climbing, except fuzzy kiwifruit, subgroup 13-07F	2	11378	5	1
				Fruit, citrus, group 10-10	1	11379	14	1
				Fruit, pome, group 11-10	1	11380	5	1
				Fruit, stone, group 12-12	1	11381	11	1
				Nut, tree, group 14-12	1	11382	27	1
				Fescue and Ryegrass	7	10657	2	4
Kasugamycin	ARYSTA	F	03/06/2018	Cherry subgroup 12-12A		10230	5	1
				Walnut		09772	1	1
Fluopicolide	VALENT	F	03/07/2018	Basil**		10121 11658	1	2
				Bean, moth, succulent** Bean, runner, succulent** Bean, snap, succulent** Bean, wax, succulent** Bean, yardlong, succulent**		10323	5	5
				Fruit, citrus, group 10-10		11021 11022 11110	28	3
				Fruit, small, vine climbing, except fuzzy kiwifruit, subgroup 13-07F	2	11190	5	1
				Hops**		10916	1	1
				Vegetable, fruiting, crop group 8-10	1	11191	12	1

ATTACHMENT 5 Continued

Pest Control Agent	Registrant	Type*	Date	Commodity or Crop Group	Note	PR#	# of Uses	# of Tolerances
Flutianil	LANDIS NAI OATAGRIO	F	03/21/2018	Apple		09634	1	2
				Cantaloupe		09176	1	1
				Cherry		09174	1	1
				Cucumber		09718	1	1
				Squash		09177 09178 09179	11	1
				Strawberry		09188	1	1
				Grape		09175	1	1
Clethodim	ADAMA,	H	04/12/2018	Nut, tree, group 14-12		11093 11094	39	2
	ARYSTA,			Okra (revised tolerance)		10383	1	1
	VALENT			Leafy greens subgroup 4-16A	1	11959	18	1
				Brassica, leafy greens, subgroup 4-16B	1	11955 12011	13	1
				Leaf petiole vegetable subgroup 22B	1	11958	3	1
				Stalk and stem vegetable subgroup 22A	2	11957	11	1
				Onion, green, subgroup 3-07B	2	11960	6	1
				Vegetable, brassica, head and stem, group 5-16	1	11956	0	1
				Vegetable, fruiting, group 8-10, except okra		11954	0	1
Sulfentrazone	FMC	H	04/13/2018	Teff		11917	1	4
				Chia		11729	1	1
				Brassica, leafy greens, subgroup 4-16B	1	11931	13	1
				Vegetable, brassica, head and stem, group 5-16	1	11930	0	1
				Stalk and stem vegetable subgroup 22A	1	11929	11	1
				Nut, tree, group 14-12	1	11932	26	1
Clopyralid	DOWAGR	H	05/23/2018	Fruit, pome, group 11-10**	3	03624	11	1
				Radish roots		10437	1	1
				Berry, low growing, subgroup 13-07G	2	11682 12088	8	1
				Brassica, leafy greens, subgroup 4-16B Chinese broccoli Kohlrabi	1	12087	13	1
				Fruit, stone, group 12-12	1	11681	11	1
				Stalk and stem vegetable subgroup 22A	2	12085	11	1
				Vegetable, Brassica, head and stem, group 5-16	1	12086	0	1
				Vegetable, leaves of root and tuber, group 2	2	12089	13	1
Pydiflumetofen	SYNGEN	F	05/24/2018	Vegetable, cucurbit, group 9		11156 11157 11158	14	1
Acequinocyl	ARYSTA	I	06/07/2018	Guava		08600	1	1
				Tropical and subtropical, small fruit, inedible peel subgroup 24A		08602	19	1
Fluroxypyr	DOWAGR	H	06/26/2018	Teff		10807	1	4
Pyroxsulam	DOWAGR	H	07/10/2018	Teff (revised tolerances)		11940	0	4

ATTACHMENT 5 Continued

Pest Control Agent	Registrant	Type*	Date	Commodity or Crop Group	Note	PR#	# of Uses	# of Tolerances
Flonicamid	FMC ISK	I	07/23/2018	Clover	7	A9943	1	2
				Cottonseed subgroup 20C	2	12098	0	1
				Vegetable, brassica, head and stem, group 5-16	1	12099	0	1
				Brassica, leafy greens, subgroup 4-16B, except radish tops Radish, tops	1	12100 11247	13	2
				Leaf petiole vegetable subgroup 22B	1	12101	3	1
				Leafy greens subgroup 4-16A, except spinach	1	12102	18	1
				Celtuce	1	12103	0	1
				Florence fennel	1	12104	0	1
				Kohlrabi	1	12105	0	1
Florasulam	DOWAGR	H	07/25/2018	Teff		10807	1	4
Cloquintocet-mexyl	DOWAGR	HS	09/11/2018	Teff		10807	1	4
Flumioxazin	KICHEM VALENT	H	10/05/2018	Grass	7	10885	3	2
Etoxazole	VALENT	I	10/15/2018	Cherry subgroup 12-12A Peach subgroup 12-12B Plum subgroup 12-12C	1	12113	11	3
				Corn, sweet		11099	1	3
				Cottonseed subgroup 20C	2	12114	0	1
				Fruit, pome, group 11-10	1	12111	5	1
				Nut, tree, group 14-12	1	12112	26	1
Pyraclostrobin	BASF	F	10/15/2018	Brassica, leafy greens, subgroup 4-16B, except watercress	1	12120	13	1
				Celtuce	1	12121	0	1
				Fennel, Florence	1	12122	0	1
				Kohlrabi	1	12123	0	1
				Leaf petiole vegetable subgroup 22B	1	12124	3	1
				Vegetable, brassica, head and stem, group 5-16	1	12125	0	1
				Leafy greens subgroup 4-16A**	1, 6	11750	18	1
Boscalid	BASF	F	10/19/2018	Brassica, leafy greens, subgroup 4-16B, except watercress	1	12120	13	1
				Celtuce	1	12121	0	1
				Fennel, Florence	1	12122	0	1
				Kohlrabi	1, 8	12123	0	1
				Leaf petiole vegetable subgroup 22B	1	12124	3	1
				Vegetable, brassica, head and stem, group 5-16	1, 8	12125	0	1
				Pea and bean, succulent shelled, subgroup 6B		12126	1	1
				Pea and bean, dried shelled, except soybean, subgroup 6C	6	12127	3	1
				Vegetable, root, except sugar beet, subgroup 1B	6	12128	2	1
				Leafy greens subgroup 4-16A**	1, 6	11750	18	1
Pyroxasulfone	KICHEM	H	10/29/2018	Mint		10792	2	4
				Edamame**		11133	1	2
				Leaf petiole vegetable subgroup 22B**		11324	7	1
				Cottonseed subgroup 20C	2	12130	0	1
Pyroxasulfone				Grass	7	10885	3	2

ATTACHMENT 5 Continued

Pest Control Agent	Registrant	Type*	Date	Commodity or Crop Group	Note	PR#	# of Uses	# of Tolerances
Cyantraniliprole	HSB	I	11/13/2018	Coffee		10874	1	1
				Berry, low growing, except strawberry, subgroup 13-07H, except Blueberry, lowbush, and Lingonberry	2	10199	7	1
				Caneberry subgroup 13-07A**		11046 12398	5	1
				Leafy greens subgroup 4-16A	1	12391	18	1
				Leaf petiole vegetable subgroup 22B	1	12394	3	1
				Celtuce	1	12395	0	1
				Florence fennel	1	12396	0	1
				Kohlrabi	1	12397	0	1
				Vegetable, brassica, head and stem, group 5-16	1	12393	0	5
				Brassica, leafy greens, subgroup 4-16B	1	12392	13	1
Clomazone	FMC	H	12/06/2018	Bean, asparagus, dry seed		08935	1	1
				Bean, broad, dry seed			1	1
				Bean, kidney, dry seed			1	1
				Bean, lima, dry seed			1	1
				Bean, mung, dry seed			1	1
				Bean, navy, dry seed			1	1
				Bean, pinto, dry seed			1	1
				Grain lupin, dry seed			1	1
				Sweet lupin, dry seed			1	1
				White lupin, dry seed			1	1
				White sweet lupin, dry seed			1	1
				Bean, broad, succulent seed		11665	1	1
				Bean, lima, succulent seed			1	1
				Bean, wax, succulent seed			1	1
				Chickpea, dry seed			1	1
				Cilantro**			1	3
				Dill			1	4
				Vegetable, Brassica, head and stem, group 5-16	1	12224	0	1
				Broccoli, Chinese	1	12226	0	1
				Kohlrabi	1	12227	0	1
				Stalk and stem vegetable subgroup 22A, except kohlrabi	1	12228	10	1
				Cottonseed subgroup 20C	2	12225	0	1
				Cucumber**		11063	1	1
				Pumpkin**			1	1
				Squash, winter**			1	1
				Squash, summer**			9	1
				Rapeseed subgroup 20A		10839	17	1
6-Benzyladenine	VALBIO	P	12/13/2018	Avocado		10922	1	1
Mefenoxam	SYNGEN	F	12/21/2018	Cacao		11884	1	1
				Wasabi		10375	2	1
				Fruit, small, vine climbing, except grape, subgroup 13-07E	2	12295	5	1

ATTACHMENT 5 Continued

Pest Control Agent	Registrant	Type*	Date	Commodity or Crop Group	Note	PR#	# of Uses	# of Tolerances
Tolfenpyrad	NAI	I	12/21/2018	Avocado		10427	1	1
				Berry, low growing, subgroup 13-07G, except cranberry and lowbush blueberry	2	10869	6	1
				Bushberry subgroup 13-07B		10380	19	1
				Caneberry subgroup 13-07A		11263	5	1
				Celtuce	1	11975	0	1
				Cottonseed subgroup 20C	2	12097	0	1
				Florence fennel	1	11978	0	1
				Fruit, small, vine climbing, except fuzzy kiwifruit, subgroup 13-07F	2	12222	5	1
				Leaf petiole vegetable subgroup 22B	1	11973	3	1
				Leafy greens subgroup 4-16A	1	11972	18	1
				Onion, bulb, subgroup 3-07A		09551	11	1
				Onion, green, subgroup 3-07B		09657	15	1
				Vegetable, fruiting, group 8-10		10634	21	1
				Vegetable, tuberous and corm, subgroup 1C	2	12221	16	1
						Totals	918	208
*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

[7] Tolerances to support regional registrations in the Pacific Northwest only

[8] Tolerances established but these uses will not be registered at the present time.

[**] notes a Joint Review or Workshare with EPA and PMRA

Time-Limited Tolerances

Pest Control Agent	Registrant	Type*	Date	Commodity or Crop Group and Expiration Date	Note	PR#	No. of Uses	No. of Tolerances
Flonicamid	ISK/FMC	I	01/26/2016	Prickly Pear Cactus (expires 12/31/2020)		11966	1	2
						Totals	1	2
*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)
11842	2,4-D	CLOVER (SEED CROP) (18 = NONGRASS ANIMAL FEEDS GROUP)
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)
12406	ABAMECTIN	SUBGROUP 20C (20C = COTTONSEED SUBGROUP)
11867	ACEQUINOCYL	BLUEBERRY (13-07B = BUSHBERRY SUBGROUP)
12492	ACETAMIPRID	SUBGROUP 22A (22A = STALK AND STEM VEGETABLE SUBGROUP)
10214	ACETOCHLOR	BEAN & PEA (SUCCULENT) (06AB = EDIBLE PODDED AND SUCCULENT SHELLED PEA/BEAN SUBGROUPS)
10958	ACIFLUORFEN	EDAMAME (VEGETABLE SOYBEAN) (06A = EDIBLE PODDED LEGUME VEGETABLES SUBGROUP)
11695	AFIDOPYROPEN	LETTUCE (GH) (04-16A = LEAFY GREENS SUBGROUP)
12277	AMETOCTRADIN	CELTUCE (22A = STALK AND STEM VEGETABLE GROUP)
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)
11760	BENZOVINDIFLUPYR + DIFENOCONAZOLE	GINSENG (01AB = ROOT VEGETABLES SUBGROUPS)
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)
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)

ATTACHMENT 6 Continued

PR #	Chemical	Commodity (Full name)
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)
11671	CLETHODIM	CHIA (99 = MISC GROUP)
10582	CLETHODIM	GRAPE (13-07F = SMALL VINE CLIMBING SUBGROUP, ESCEPT FUZZY KIWIFRUIT)
5147	CLOPYRALID	CANEBERRY (13-071 = CANEBERRY SUBGROUP)
11600	CLOPYRALID	ONION (DRY BULB) (03-07A = ONION, BULB SUBGROUP)
11256	CLOPYRALID	STRAWBERRY (13-07G = LOW GROWING BERRY SUBGROUP)
10327	CYANTRANILIPROLE (HGW86)	LETTUCE (GH) (04-16A = LEAFY GREENS SUBGROUP)
11893	CYCLANILIPROLE	CUCUMBER (GH) (09B = SQUASH/CUCUMBER SUBGROUP)
12515	CYCLANILIPROLE	LETTUCE (GH) (04-16A = LEAFY GREENS SUBGROUP)
11891	CYCLANILIPROLE	PEPPER (GH) (08-10BC = PEPPER/NON-BELL PEPPER/EGGPLANT SUBGROUPS)
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)
8001	DIFENOCONAZOLE	GARLIC (03-07A = ONION, BULB 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)

ATTACHMENT 6 Continued

PR #	Chemical	Commodity (Full name)
11688	DIMETHOMORPH + AMETOCTRADIN	LETTUCE (GH) (04-16A = LEAFY GREENS SUBGROUP)
11302	DINOTEFURAN	APPLE (11-10 = POME FRUIT GROUP)
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)
11303	DINOTEFURAN	PEAR (11-10 = POME FRUIT GROUP)
12548	DINOTEFURAN	PEPPER (GH) (08-10BC = PEPPER/NON-BELL PEPPER/EGGPLANT SUBGROUPS)
11199	DINOTEFURAN	PLUM (12-12C = PLUM 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)
3071	DIURON	PLUM (12-12C = PLUM SUBGROUP)
12427	EMAMECTIN BENZOATE	SUBGROUP 20C (20C = COTTONSEED SUBGROUP)
10680	ETHABOXAM	BROCCOLI (05-16 = BRASSICA HEAD AND STEM VEGETABLE GROUP)
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)
8757	FAMOXADONE + CYMOXANIL	RADISH (01AB = ROOT VEGETABLES SUBGROUPS)
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)
12284	FENPYROXIMATE	CUCUMBER (GH) (09B = SQUASH/CUCUMBER SUBGROUP)
11748	FENPYROXIMATE	PEANUT (99 = MISC GROUP)
11699	FENPYROXIMATE	POMEGRANATE (24B = TROPICAL AND SUBTROPICAL, MEDIUM TO LARGE FRUIT, SMOOTH, INEDIBLE PEEL SUBGROUP)
11705	FLONICAMID	LETTUCE (GH) (04-16A = LEAFY GREENS SUBGROUP)

ATTACHMENT 6 Continued

PR #	Chemical	Commodity (Full name)
11317	FLORASULAM + FLUROXYPYR	GRASSES (SEED CROP) (17 = GRASS FORAGE, FODDER AND HAY GROUP)
11861	FLUAZIFOP-P-BUTYL	BROCCOLI (05-16 = BRASSICA HEAD AND STEM VEGETABLE 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)
8274	FLUAZINAM	PAPAYA (24B = TROPICAL AND SUBTROPICAL, MEDIUM TO LARGE FRUIT, SMOOTH, INEDIBLE PEEL SUBGROUP)
11231	FLUAZINAM	PEA (EDIBLE PODDED, SUCCULENT & DRIED SHELLED (06ABC = EDIBLE PODDED, SUCCULENT/DRIED SHELLED PEA/BEAN
10592	FLUAZINAM	TOMATO (08-10A = TOMATO SUBGROUP)
10374	FLUDIOXONIL	CELERY (GH) (22B = LEAF PETIOLE VEGETABLE SUBGROUP)
12400	FLUDIOXONIL	DRAGON FRUIT (PITAYA) (24D = TROPICAL AND SUBTROPICAL, CACTUS, INEDIBLE PEEL SUBGROUP)
12010	FLUDIOXONIL	TOMATO (GH) (08-10A = TOMATO SUBGROUP)
10908	FLUENSULFONE	BEET (SUGAR) (01AB = ROOT VEGETABLES SUBGROUPS)
11505	FLUMETSULAM	Clover (SEED CROP) (18 = NONGRASS ANIMAL FEEDS GROUP)
11132	FLUMIOXAZIN	EDAMAME (VEGETABLE SOYBEAN) (06A = EDIBLE PODDED LEGUME VEGETABLES SUBGROUP)
10686	FLUMIOXAZIN	GUAYULE (99 = MISCELLANEOUS COMMODITY)
11971	FLUOPYRAM	MINT (99 = MISC GROUP)
11318	FLUPYRADIFURONE	ASPARAGUS (22A = STALK AND STEM VEGETABLE SUBGROUP)
11712	FLUPYRADIFURONE	COFFEE (99 = MISC GROUP)
11831	FLUPYRADIFURONE	DATE (23C = TROPICAAL, PALM FRUIT, EDIBLE PEEL SUBGROUP)
11755	FLUPYRADIFURONE	GRASSES (SEED CROP) (17 = GRASS FORAGE, FODDER AND HAY GROUP)
11711	FLUPYRADIFURONE	PINEAPPLE (24C = TROPICAL AND SUBTROPICAL, MEDIUM TO LARGE FRUIT, ROUGH OR HAIRY, INEDIBLE PEEL SUBGROUP)
11725	FLUPYRADIFURONE	SESAME (20A = RAPESEED SUBGROUP)
11709	FLUPYRADIFURONE	SORGHUM (SWEET) (15-16 = CEREAL GRAINS AND CEREAL GRAINS FORAGE/FODDER/STRAW GROUPS)
11674	FLUPYRADIFURONE	SUNFLOWER (20B = SUNFLOWER SUBGROUP)
9184	FLUTIANIL (V-10118)	GREENS (MUSTARD) (04-16B = BRASSICA LEAFY GREENS SUBGROUP)
11935	FLUTRIAFOL	OLIVE (23A = TROPICAL AND SUBTROPICAL, SMALL FRUIT, EDIBLE PEEL SUBGROUP)
11754	FLUXAPYROXAD + PYRACLOSTROBIN	POMEGRANATE (24B = TROPICAL AND SUBTROPICAL, MEDIUM TO LARGE FRUIT, SMOOTH, INEDIBLE PEEL SUBGROUP)
12467	FOMESAFEN	FOLIAGE OF LEGUME VEGETABLES EXCEPT SOYBEAN (07A = FOLIAGE OF LEGUME VEGETABLES (EXCEPT SOYBEAN) SUBGROUP)
11620	FOMESAFEN	ONION (03-07AB = ONION BULB AND GREEN SUBGROUPS)
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)

ATTACHMENT 6 Continued

PR #	Chemical	Commodity (Full name)
11467	INDOXACARB	COFFEE (99 = MISC GROUP)
9521	INDOXACARB	GRASSES (SEED CROP) (17 = GRASS FORAGE, FODDER AND HAY GROUP)
11461	KASUGAMYCIN	ALMOND (14-12 = TREE NUT GROUP)
10705	KASUGAMYCIN	APRICOT (12-12C = PLUM SUBGROUP)
11137	KASUGAMYCIN	OLIVE (23A = TROPICAL AND SUBTROPICAL, SMALL FRUIT, EDIBLE PEEL SUBGROUP)
9888	KASUGAMYCIN	PEACH (12-12B = PEACH 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)
11118	LINURON	SWEET POTATO (01CD = TUBEROUS AND CORM VEGETABLES SUBGROUPS)
12478	MCPA	TEA (99 = MISC GROUP)
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)
12662	NOVALURON	CROP GROUP 05-16 (05-16 = BRASSICA HEAD AND STEM VEGETABLE GROUP)
12663	NOVALURON	KOHLRABI (22A = STALK AND STEM VEGETABLE SUBGROUP)
10956	NOVALURON	LYCHEE (24A = TROPICAL AND SUBTROPICAL, SMALL FRUIT, INEDIBLE PEEL SUBGROUP)
9777	NOVALURON	PEA (DRY) (06C = DRIED SHELLED PEA/BEAN (EXCEPT SOYBEAN) SUBGROUP)
12323	NOVALURON	PEPPER (GH) (08-10BC = PEPPER/NON-BELL PEPPER/EGGPLANT SUBGROUPS)
12661	NOVALURON	SUBGROUP 04-16B (04-16B = BRASSICA LEAFY GREENS SUBGROUP)
12664	NOVALURON	SUBGROUP 20C (20C = COTTONSEED SUBGROUP)

ATTACHMENT 6 Continued

PR #	Chemical	Commodity (Full name)
11344	NOVALURON	SUNFLOWER (20B = SUNFLOWER SUBGROUP)
11795	OXATHIAPIPROLIN	AVOCADO (24B = TROPICAL AND SUBTROPICAL, MEDIUM TO LARGE FRUIT, SMOOTH, INEDIBLE PEEL SUBGROUP)
12370	OXATHIAPIPROLIN	AVOCADO (24B = TROPICAL AND SUBTROPICAL, MEDIUM TO LARGE FRUIT, SMOOTH, INEDIBLE PEEL SUBGROUP)
11759	OXATHIAPIPROLIN	HOPS (99 = MISC GROUP)
10915	OXATHIAPIPROLIN	POMEGRANATE (24B = TROPICAL AND SUBTROPICAL, MEDIUM TO LARGE FRUIT, SMOOTH, INEDIBLE PEEL SUBGROUP)
12371	OXATHIAPIPROLIN	POMEGRANATE (24B = TROPICAL AND SUBTROPICAL, MEDIUM TO LARGE FRUIT, SMOOTH, INEDIBLE PEEL SUBGROUP)
11719	OXATHIAPIPROLIN	STRAWBERRY (13-07G = LOW GROWING BERRY SUBGROUP)
12372	OXATHIAPIPROLIN	STRAWBERRY (13-07G = LOW GROWING BERRY SUBGROUP)
3616	OXYFLUORFEN	CANEBERRY (RASPBERRY) (13-07A = CANEBERRY SUBGROUP)
9822	OXYFLUORFEN	COFFEE (99 = MISC GROUP)
6318	OXYFLUORFEN	KENAF (99 = MISC GROUP)
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)
11737	OXYTETRACYCLINE	OLIVE (23A = TROPICAL AND SUBTROPICAL, SMALL FRUIT, EDIBLE PEEL SUBGROUP)
11876	OXYTETRACYCLINE	WALNUT (14-12 = TREE NUT GROUP)
11146	PARAQUAT	SESAME (20A = RAPESEED SUBGROUP)
11255	PENDIMETHALIN	SAFFLOWER (20B = SUNFLOWER SUBGROUP)
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)
12306	PERMETHRIN	CRESS, GARDEN (04-16B = BRASSICA LEAFY GREENS SUBGROUP)
12307	PERMETHRIN	CRESS, UPLAND (04-16B = BRASSICA LEAFY GREENS SUBGROUP)
12303	PERMETHRIN	SUBGROUP 04-16A (04-16A = LEAFY GREENS SUBGROUP)
12311	PERMETHRIN	SUBGROUP 08-10C (08-10C = NON-BELL PEPPER/EGGPLANT 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)
11078	PROPICONAZOLE + CHLOROTHALONIL	TOMATO (GH) (08-10A = TOMATO SUBGROUP)
11880	PYDIFLUMETOFEN (FTH 545)	LETTUCE (GH) (04-16A = LEAFY GREENS SUBGROUP)
11879	PYDIFLUMETOFEN (FTH 545)	PEPPER (GH) (08-10BC = PEPPER/NON-BELL PEPPER/EGGPLANT SUBGROUPS)
11878	PYDIFLUMETOFEN (FTH 545)	TOMATO (GH) (08-10A = TOMATO 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)
11446	PYRIOFENONE	CUCUMBER (GH) (09B = SQUASH/CUCUMBER SUBGROUP)
11447	PYRIOFENONE	PEPPER (GH) (08-10BC = PEPPER/NON-BELL PEPPER/EGGPLANT SUBGROUPS)

ATTACHMENT 6 Continued

PR #	Chemical	Commodity (Full name)
11448	PYRIOFENONE	TOMATO (GH) (08-10A = TOMATO SUBGROUP)
12497	PYROXSULAM	RYE (15-16 = CEREAL GRAINS AND CEREAL GRAINS FORAGE/FODDER/STRAW GROUPS)
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)
10716	SEDAXANE	ONION (DRY BULB) (03-07A = ONION, BULB SUBGROUP)
2063	SETHOXYDIM	BASIL (19A = HERB SUBGROUP)
9934	SETHOXYDIM	CANEBERRY (13-07A = CANEBERRY SUBGROUP)
8345	SETHOXYDIM	VERNONIA (IRON WEED) (20B = SUNFLOWER SUBGROUP)
11325	S-METOLACHLOR/METOLACHLOR	DILL (19A = HERB SUBGROUP)
10819	S-METOLACHLOR/METOLACHLOR	ROSEMARY (19A = HERB SUBGROUP)
11895	S-METOLACHLOR/METOLACHLOR	SUBGROUP 04-16A (04-16A = LEAFY GREENS SUBGROUP)
11514	SPINETORAM	DRAGON FRUIT (PITAYA) (24D = TROPICAL AND SUBTROPICAL, CACTUS, INEDIBLE PEEL SUBGROUP)
12568	SPINOSAD	BLUEBERRY (13-07B = BUSHBERRY 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)
10290	STREPTOMYCIN	PEPPER (BELL & NONBELL) (08-10BC = PEPPER/NON-BELL PEPPER/EGGPLANT SUBGROUPS)
11727	TERBACIL	MONARDA (99 = MISC GROUP)
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)
11859	THIABENDAZOLE	SWEET POTATO (POST HARVEST) (01CD = TUBEROUS AND CORM VEGETABLES SUBGROUPS)
12499	THIFENSULFURON + TRIBENURON	RYE (15-16 = CEREAL GRAINS AND CEREAL GRAINS FORAGE/FODDER/STRAW GROUPS)
9709	THIOPHANATE METHYL	BEAN (SNAP) (06A = EDIBLE PODDEDLEGUME VEGETABLES
8614	THIOPHANATE METHYL	PEPPER (FIELD & GH) (08-10BC = PEPPER/NON-BELL PEPPER/EGGPLANT SUBGROUPS)

ATTACHMENT 6 Continued

PR #	Chemical	Commodity (Full name)
9916	TRIFLOXYSTROBIN	BEAN (SNAP) (06A = EDIBLE PODDEDLEGUME VEGETABLES
7049	TRIFLOXYSTROBIN	ONION (03-07AB = ONION BULB AND GREEN SUBGROUPS)
10765	TRIFLOXYSTROBIN + FLUOPYRAM	PAPAYA (24B = TROPICAL AND SUBTROPICAL, MEDIUM TO LARGE FRUIT, SMOOTH, INEDIBLE PEEL SUBGROUP)
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)
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)
11526	TRINEXAPAC-ETHYL	CLOVER (SEED CROP) (18 = NONGRASS ANIMAL FEEDS GROUP)
8397	ZETA-CYPERMETHRIN	BASIL (19A = HERB SUBGROUP)

ATTACHMENT 7 – 2018 ENVIRONMENTAL HORTICULTURE PROGRAM

FIELD COOPERATORS

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Dr. Janna Beckerman	IL
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Mr. Paul Wade	SC

ATTACHMENT 8 – 2018 ENVIRONMENTAL HORTICULTURE PROGRAM RESEARCH ACTIVITIES

Discipline	Project	Researchers	Crops	Products	Trials
Entomology	Afidopyropen (BAS 440I) Crop Safety *	4	6	1	6
Entomology	Borer & Beetle Efficacy *	5	3	14	36
Entomology	Cyflumetofen Crop Safety *	2	2	1	2
Entomology	Mealybug Efficacy *	2	2	7	13
Entomology	Mollusc Efficacy	2	2	3	6
Entomology	Scale Efficacy *	3	3	8	20
Entomology	SP3014 Crop Safety *	5	11	1	19
Entomology	Thrips Efficacy	2	2	6	11
Entomology	V-10433 Crop Safety *	1	12	1	12
Pathology	Azoxystrobin + Benzovindiflupyr (A18126B) Crop Safety*	2	2	1	2
Pathology	Botrytis Efficacy *	5	4	14	40
Pathology	Fluopyram (ESP 715) Crop Safety *	4	4	1	5
Pathology	Flutianil Crop Safety *	6	12	1	18
Pathology	Fluxapyroxad + Pyraclostrobin Crop Safety *	2	4	1	6
Pathology	Mandestrobin Crop Safety *	6	8	1	10
Pathology	Mono and di potassium salts of phosphorus acid + hydrogen peroxide Crop Safety *	2	2	1	3
Pathology	Nematode Efficacy	1	1	3	3
Pathology	Oxathiapiprolin Crop Safety *	1	1	1	1
Pathology	Picarbutrazox Crop Safety *	6	12	2	34
Pathology	Pseudomonas chlororaphis Crop Safety *	6	10	1	12
Pathology	Pydiflumetofen + Fludioxonil Crop Safety *	6	8	1	16
Pathology	Pydiflumetofen Crop Safety *	10	13	1	22
Pathology	Rhizoctonia Efficacy *	1	1	7	7
Pathology	SP2480 Crop Safety *	5	11	1	17
Pathology	SP2700 Crop Safety *	7	11	1	21
Pathology	Thielaviopsis Efficacy *	3	1	11	31
Weed Science	2,4-D (AMINE) Crop Safety	1	1	1	2
Weed Science	Bentazon Crop Safety	8	14	1	18
Weed Science	Cloransulam-methyl Crop Safety	1	1	1	2
Weed Science	Dimethenamid-p Crop Safety *	4	10	1	11
Weed Science	Dithiopyr Crop Safety *	4	4	1	5
Weed Science	General Weed Efficacy *	3	2	7	26
Weed Science	Glyphosate Crop Safety	1	1	1	2
Weed Science	Iron HEDTA Crop Safety *	12	30	1	54
Weed Science	Isoxaben + Dithiopyr Crop Safety *	1	5	1	7
Weed Science	Isoxaben Crop Safety *	2	4	1	5
Weed Science	Liverwort Efficacy	1	1	7	7
Weed Science	Oxadiazon Crop Safety *	3	2	1	3
Weed Science	Oxalis Efficacy *	1	1	4	4
Weed Science	Oxyfluorfen + Prodiamine Crop Safety *	10	27	1	31
Weed Science	Pendimethalin + Dimethenamid-p Crop Safety *	7	16	1	17
Weed Science	Pendimethalin Crop Safety *	6	10	1	11
Weed Science	Prodiamine + Isoxaben Crop Safety *	5	5	1	8
Weed Science	S-Metolachlor Crop Safety *	2	6	1	6
Weed Science	SP1770/SP1772 Crop Safety *	3	3	1	4
Weed Science	Spurge Efficacy *	1	1	4	4
Weed Science	Sulfentrazone + Prodiamine Crop Safety *	1	1	1	1
Weed Science	Sulfentrazone Crop Safety *	8	11	1	21
Weed Science	Tank Mix Combinations Crop Safety	1	1	1	2
Weed Science	Thifensulfuron-methyl	1	1	1	2

* National Priority Projects

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

ATTACHMENT 9 – ENVIRONMENTAL HORTICULTURE RESEARCH SUMMARIES FOR 2018

Acibenzolar Crop Safety
Acibenzolar is an active ingredient that stimulates plant defense systems. In 2002, IR-4 started testing Insimmo (acibenzolar) for safety on several ornamental horticulture crops. In 2008, IR-4 continued crop safety screening after a renewed interest in bringing this active ingredient to ornamental horticulture growers. From 2002 through 2015, the IR-4 Project completed 262 trials on 93 ornamental plant genera or species examining phytotoxicity related to foliar and/or drench applications of Insimmo. In these trials, 42 species or genera exhibited minimal or no injury after foliar applications. Based on this information, it is recommended that all but 2 of these crops be added to a list of tolerant plants when this active ingredient gains registration. While there was sufficient evidence of minimal or no injury for *Dianthus* sp. and *Pelargonium x hortorum*, a single trial for each crop did elicit moderate to severe injury. Further investigation on cultivar or species differences may be warranted

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 80 crop safety trials on 40 ornamental horticulture plant species or genera from 2015 through 2017. In these trials, eleven genera or species exhibited minimal or no injury after foliar applications in a minimum of 3 trials for each crop; these can be added to a list of tolerant plants in the new label for this active ingredient. All trials for 29 other species or genera exhibited minimal or no injury in the limited number of trials (one or two) for each crop.

Bacterial Disease Efficacy
From 2008 to 2017, 72 products were tested through the IR-4 Program as drench or foliar applications against bacterial pathogens. In addition to research collected through the IR-4 program, this summary includes a review of experiments conducted from 2005 to 2017, mainly on tree crops. Species tested included: *Agrobacterium tumefaciens, Erwinia amylovora, E. chrysanthemi, Pseudomonas cichorii, P. marginalis, P. syringae, Pseudomonas* sp.*, Xanthomonas axonopodis, Xanthomonas campestris,* and *Xanthomonas* spp. In general, all products, including the standard copper containing bactericides (Camelot, CuPRO, Cuprofix, Cuprofix MZ, Junction, Kocide, MasterCop, Phyton 27, ReZist, etc.), mancozebs (Dithane, Penncozeb, Protect) and biologicals (Cease, Regalia, Rhapsody and Serenade), provided variable efficacy on these bacterial pathogens. Several new products that are included in the IR-4 Bacterial Efficacy project looked promising based on their efficacy relative to standards. These include Acibenzolar, CG100, Citrex, HM-0736, Kasumin, Regalia, Taegro, Tanos and ZeroTol. Further research is needed to obtain additional efficacy data to recommend actions to register or amend labels for these pests.

Borers, Beetles, and White Grubs
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 2017, 67 products representing 44 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.

Dimethenamid-p Crop Safety
From 2007 to 2017, IR-4 completed 528 trials on Tower EC (dimethenamid-p). The data contained in this report was generated to register uses of dimethenamid-p on and around ornamental horticulture plants with over-the-top

applications. The dimethenamid-p rates in the testing program were 0.97, 1.94 and 3.88 pounds active ingredient per acre (lb ai per A) as the 1X, 2X and 4X rates. Tower EC had been applied to 154 plant genera or species. Of these, 63 plant species exhibited no or minimal transient injury after application at all three rates. Twenty one (21) crops exhibited no phytotoxicity at 0.97 lb ai per acre but did have some injury at 1.94 and 3.88 lb ai per acre. Nine crops – *Aquilegia sp., Catharanthus roseus, Cladrastis sp.*, *Echeveria sp.*, *Echinacea sp.*, *Epilobium canum, Muhlenbergia dubia, Teucrium chamaedrys* and *Viburnum opulus* – exhibited significant phytotoxicity at even the lowest rate.

Dimethenamid-p + Pendimethalin Crop Safety

From 2007 to 2017, IR-4 completed 637 trials on Freehand 1.75G (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 2.65, 5.3 and 10.6 pounds active ingredient per acre (lb ai per A) as the 1X, 2X and 4X rates. Freehand 1.75G had been applied to 185 plant genera or species. Of these genera and species, 73 exhibited no or minimal transient injury after application at all three rates. Thirty three (35)crops exhibited little or no phytotoxicity at 2.65 lb ai per acre, but did have some injury at 5.3 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 eight (58) 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.

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. This current label recommends directed spray as the application method for almost all crops. During 2014 to 2017, IR-4 conducted 239 trials with Dimension 2EW formulation applied as over-the-top spray on 111 species / genera, including ornamental grasses to further expand the treatable plant list in the current label. Of the researched crops and Dimension formulations, 11 crops (*Berberis thunbergii, Eragrostis curvula, Hemerocallis* sp., *Ilex crenata, Juncus effusus, Leymus arenarius, Muhlenbergia capillaris, Narcissus* sp*., Pennisetum alopecuroides, Pseudotsuga mensiezii,* and *Thuja occidentalis*) can be added for over-the-top spray at this time based on the data provided here. It is recommended the trials conducted using emulsifiable concentrate formulations be repeated with Dimension 2EW.

Flumioxazin + Pyroxasulfone (V-10233, V-10336) Crop Safety

Between 2013 and 2017, IR-4 conducted fifty-one (51) trials evaluating two formulations of flumioxazin + pyroxasulfone: V-10233 76WG (37 trials) and V-10336 61.5WG (14 trials) for crop safety. The data contained in this report was generated to register the use of this active ingredient combination with directed spray applications around ornamental horticulture plants. The rates tested were 0.35, 0.71 and 1.42 pounds active ingredient per acre (lb ai per A) as the 1X, 2X and 4X rates.

V-10336 and V-10233 were applied to 31 plant species or genera. Six species or genera (*Juglans nigra, Cornus* spp., *Pinus* spp., *Prunus* spp., *Quercus* spp. and *Salix* spp.) exhibited no or minimal transient injury in 3 trials across both formulations. One species *Cercis canadensis* exhibited moderate injury at all rates and stunting at 2X in a trial with V-10336 61.5WG. One genera (*Rhododendron* sp.) exhibited variable injury (none, minor or significant) at all rates with good recovery. Further testing is required before a conclusion can be made confirming crop safety on these crops.

ATTACHMENT 9 – Continued

Fluopyram (ESP 715, Indemnify) Crop Safety
Fluopyram (ESP 715, Indemnify) is a new fungicide being developed by Bayer for the control of nematodes, needle cast diseases powdery mildew, *Fusarium, Botrytis, Sclerotinia, Corynespora*, leaf spots and other foliar diseases. The IR-4 Project completed 14 crop safety trials on 7 ornamental horticulture plant species or genera in 2016. One genera (*Begonia* sp.) exhibited damage sufficient to recommend growers not utilize Fluopyram. Insufficient data were obtained for other species or genera for a definitive conclusion on crop safety.

Fusarium Efficacy: A Literature Review
From 2001 to 2016, numerous products representing 32 active ingredients were evaluated in greenhouse and field trials as soil drench, soil incorporation, foliar,in-furrow, drip irrigation or tuber soak applications against several *Fusarium* species causing rots (crown, stem and tuber rots) and wilt on ornamentals, and wilt and root rot on vegetables (Table 1, Table 2). *Fusarium* species tested included: *F. avenaceum, F. commune, F. oxysporum, F. solani* and *F*. sp. Most trials were conducted on *F. oxysporum* on larkspur, lisianthus and watermelon. Although there were insufficient data for definitive conclusions, several relatively new products showed promising, though inconsistent, efficacy comparable to the standards. These include Adepidyn (pydiflumetofen), Heritage (azoxystrobin), Compass (trifloxystrobin), Hurricane (fludioxonil+mefenoxam), Insignia (pyraclostrobin), Insimmo (acibenzolar), SP2169, Tourney (metconazole) and Trinity (triticonazole). BW240/RootShield Plus (*Trichoderma harzianum & T. virens*), CG100 (caprylic acid), Pageant (boscalid+pyraclostrobin), Palladium (cyprodinil+fludioxonil) and SP2550 provided no to mediocre efficacy. Proline (prothioconazole) provided consistently good control of *F. oxysporum* in watermelon trials. The established standards 3336 and Medallion generally provided inconsistent efficacy while Terraguard was effective in one trial.

Leafminer Efficacy Summary & Literature Review
From 2009 to 2015, numerous products representing 15 active ingredients were evaluated in the greenhouse to control dipteran leafminers (*Liriomyza trifolii* and other species). Nine trials were conducted on chrysanthemum, daisies and daylily. Depending upon product characteristics either foliar, drench or topdress applications were made. Although there were insufficient data for definitive conclusions, 2 relatively new products may be effective management tools: Arena provided good efficacy for *Liriomyza* spp., and Mainspring provided good efficacy for both *Liriomyza trifolii* and *Ophiomyia kwansonis*. The established standards Avid and Terraguard generally provided variable efficacy.

Mandestrobin Crop Safety
Mandestrobin is a new systemic and translaminar fungicide being developed by Syngenta for the control of Botrytis and other foliar diseases of ornamental horticulture crops. The IR-4 Project completed 18 crop safety trials on 17 ornamental horticulture plant species or genera during 2015 to 2017. In these trials, all 17 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.

Oxyfluorfen + Prodiamine) Crop Safety
From 2009 through 2017, IR-4 completed 208 trials evaluating Biathlon (oxyfluorfen + prodiamine) crop safety to crops grown in field containers. The data contained in this report were generated to register uses of oxyfluorfen + prodiamine as over-the-top applications on and around ornamental horticulture plants. The rates tested were 2.75 (1X), 5.5 (2X) and 11.0 (4X) pounds active ingredient per acre (lb ai per acre). Biathlon was applied to 99 plant species / genera. Twenty-nine species / genera exhibited no or minimal transient injury in at least 3 trials. Results are summarized at the species level, as there is some evidence that crop safety can differ at the varietal level. On the Biathlon label, *Potentilla fruticosa* appears twice: it may be used on the variety 'Abbotswood' but is not recommended on 'Goldfinger'. More data are needed to establish the actual varietal sensitivities within *Potentilla fruticosa*, and identify other species with the same difficulty. Based on the data provided here, we recommend that *Arctostaphylos* sp., *Betula nigra, Camelia japonica, Chasmantium latifolium, Dasiphora fruticosa, Dryopteris erythrosora, Gladiolus* spp, *Lantana camara, Mahonia aquifolium, Quercus rubra, Rosmarinus officinalis, Rudbeckia* spp*., Salvia nemorosa,* and *Sedum* spp. be added to the Biathlon label along with 13 additional varieties of species already listed in the label.

ATTACHMENT 9 – Continued

Prodiamine + Isoxaben Crop Safety
Prodiamine + Isoxaben (Gemini G) is a new herbicide combination being developed by Everris dba ICL Specialty Fertilizers for pre-emergent control of grasses and broadleaf weeds on ornamental horticulture crops. The IR-4 Project completed 24 crop safety trials on 15 ornamental horticulture plant species or genera in 2017. In these trials, one species (*Quercus virginiana*) exhibited no injury after over-the top applications in a minimum of 3 trials; this species can be added to a list of tolerant plants in the new label for this product. One species (*Phlox paniculata*) exhibited damage sufficient to recommend growers not utilize Gemini G as an over-the-top treatment for pre-emergent weed control.

***Pseudomonas chlororaphis* (SP2300, Zio) Crop Safety**
Pseudomonas chlororaphis (SP2300, Zio) is a new fungicide being developed by AgBiome and SePro for the control of several important diseases including Rhizoctonia, Pythium, and Phytophthora. The IR-4 Project completed 18 crop safety trials on 14 ornamental horticulture plant species or genera during 2017. In these trials, all 14 species or genera exhibited minimal or no injury in the limited number of trials (one or two) for each crop; AgBiome and SePro 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 32 crop safety trials on 22 ornamental horticulture plant species or genera during 2015 to 2017. In these trials, all 22 species or genera exhibited minimal or no injury. Two genera (*Begonia* sp. and *Petunia* sp.) exhibited minimal or no injury in 3 trials and 20 species or genera exhibited minimal or no injury in the limited number of trials (one or two) for each crop. Syngenta may consider adding these to the label.

Pydiflumetofen + Fludioxonil Crop Safety
Pydiflumetofen + Fludioxonil is a new fungicide being developed by Syngenta for the control of foliar and soil-borne diseases of ornamental horticulture crops. The IR-4 Project completed 37 crop safety trials on 24 ornamental horticulture plant species or genera during 2015 to 2017. In these trials, all 24 species or genera exhibited minimal or no injury. Two species or genera (*Lupinus* sp. and P*etunia x hybrida*) exhibited minimal or no injury in 3 trials and 22 species or genera exhibited minimal or no injury in the limited number of trials (one or two) for each crop. Syngenta may consider adding these to the label.

Pydiflumetofen + Azoxystrobin + Propiconazole Crop Safety
Pydiflumetofen + Azoxystrobin + Propiconazole was 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 39 crop safety trials on 18 ornamental horticulture plant species or genera from 2015 through 2017. In these trials, sufficient injury was observed such that future development of both formulations tested was discontinued.

Rhizoctonia Efficacy: Summary & Literature Review
From 1999 to 2016, numerous products representing 36 active ingredients were evaluated in several greenhouse experiments as soil drench, soil incorporation, foliar or soak application, and in one field trial as soil drench, against *Rhizoctonia solani*. Trials were conducted on chrysanthemum, garden impatiens, petunia, poinsettia, snapdragon, viburnum and zinnia. The relatively new registered products Affirm/Endorse/Veranda O (polyoxin D), Heritage (azoxystrobin), Medallion (fludioxonil) and Pageant Intrinsic (p*yraclostrobin + boscalid)* showed excellent efficacy. Although there were insufficient data for definitive conclusions, BAS 703/Orkestra, Compass, Disarm*,* Empress Intrinsic, Hurricane, Promax, Tourney and Trinity generally provided excellent efficacy. The biological products Actinovate, Howler, MBI-110, RootShield PLUS and SoilGard also provided good to excellent efficacy in limited number of tests. Of the established standards, Terraclor provided excellent efficacy, while 3336 generally provided inconsistent efficacy.

ATTACHMENT 9 – Continued

SP1770 Liquid Crop Safety
SP1770 Liquid is a new herbicide being developed by SePro. The IR-4 Project completed 27 crop safety trials on 19 environmental horticulture plant species or genera during 2016 to 2018. In these trials, 16 of the 19 species or genera tested exhibited significant injury in the limited number of trials (one or two) for each crop.

Thielaviopsis Efficacy: A Literature Review
From 2003 to 2017, numerous products representing 23 active ingredients were evaluated in greenhouse trials as soil drench against *Thielaviopsis basicola* causing black root rot on ornamentals. Although there were insufficient data for definitive conclusions, two new experimentals (BAS 750 - mefentrifluconazole) and A20808C showed promising efficacy comparable to the standards. Several products that are not yet labeled for *Thielaviopsis basicola* also showed promising efficacy in single trials. These include Empress Intrinsic (pyraclostrobin), Endorse/Veranda O (polyoxin D), *Mural (a*zoxystrobin + benzovindiflupyr), Tourney (metconazole) and Vital (potassium phosphite). The experimentals A19649B and *Pyraziflumid SC (pyraziflumid)* provided poor efficacy in single trials. The established standards 3336 and Terraguard generally provided excellent efficacy.

ATTACHMENT 10- Biopesticide and Organic Support Program

2018 Grant Awards

- Efficacy evaluations of biopesticides for management of spotted wing drosophila.
- Efficacy evaluations of biopesticides for organic management of fire blight in apple production.
- Efficacy evaluations of biopesticides for management of varroa mite in honeybees.
- Efficacy evaluations of biopesticides for management of *Agrobacterium rhizogens* in greenhouse tomato
- Efficacy evaluations of biopesticides for management of weeds in ornamental horticulture.
- 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. Efficacy evaluations for Biopesticide to manage black sigatoka in banana.

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Biopesticide Regulatory Support Packages Approved in 2018

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
6-Benzyladenine	Avocado	10922	PGR	Section 3	1

New Uses Supported by the Biopesticide Efficacy Program in 2018

Product	Crop	PR Number	TYPE	Registration Type	Uses
Spinetoram	Bushberries (Subgroup 13-07B) except lingonberry	B00201	Insecticide	Amendment	1

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"The IR-4 program provides an important resource for specialty crop growers to continue producing a high quality, safe food supply for our nation."
— Herman Waguespack, Research Director, ASCL