

Eliminating Pesticides as a Trade Barrier

Enhancing our Safe Food Supply

Managing Pesticide Resistance

Combating Vector Borne Diseases

MAKING A DIFFERENCE

Researching Bee Safe Products

Leading Global Collaboration

Facilitating Capacity Building

Combating Invasive Species

Protecting Pollinators

Expanding Crop Groups



YEAR END
SUMMARY

2015

Dear Friends,

I am pleased to present this 2015 IR-4 Year End Summary (YES) saluting IR-4's accomplishments. The "IR-4 Process" starts with growers and processors of fruits, vegetables, herbs, ornamentals and other specialty crops who have pest management problems requesting assistance from IR-4. Those growers who have specialty use problems on larger crops may also request assistance from IR-4. An example of a specialty use request on a major crop was a recent success for rice growers needing a new bird repellent (see pg 7). Through the efforts of many, the IR-4 process ends with a new product to manage pests. IR-4 is **"Making a Difference"** for agriculture, as well as consumer access to reasonably priced, healthy food.

Recognition is due to the large network of university researchers, extension personnel, government employees and industry colleagues who participate in the process. This includes over 200 dedicated IR-4 employees and research cooperators who **"Make a Difference"** every day in their IR-4 research. It also includes our friends at USDA's National Institute of Food and Agriculture, Agriculture Research Service and Foreign Agriculture Service (FAS) who help provide resources to do this work, and the team at the US Environmental Protection Agency (EPA) who review IR-4 data submissions, as well as partners from Canada and other international cooperators who are actively involved in joint data development projects.

This is how IR-4 **"Made a Difference"** in 2015. IR-4 data supported 1,175 chemical clearances on food crops. This is the highest number of annual clearances/registrations achieved in the 53-year history of IR-4. Most of these clearances were with reduced risk chemicals and uses important for integrated pest management systems. The majority of IR-4 supported uses are expected to be added to product registrations in time for the 2016 growing season. The IR-4 Ornamental Horticulture Program continues to provide significant deliverables to its stakeholders. In 2015, IR-4 data were used to amend two herbicide labels (Freehand, Tower) to include additional crops, and two new fungicides (Mural, Segovis) were approved, allowing for more disease management options. IR-4 also achieved success in the Biopesticide and Organic Support Program. In 2015, IR-4 successfully implemented its new Biopesticide grants process where stakeholders select high priority projects for research at the IR-4 Biopesticide Workshop. One notable accomplishment in this program includes the EPA approval of HopGuard II (potassium salts of hops beta acids) to manage Varroa mites in bee hives. IR-4 staff wrote the registration package and developed the science literature reviews that were utilized in the EPA risk assessment process, which directly led to this registration. The Public Health Pesticide Program achieved some key milestones in 2015, including supporting pre-registration activities, efficacy testing, and obtaining Experimental Use Permits, for new insecticide-treated fabrics, mosquito traps, and molecular biocontrol agents.

Del Monte vegetables have been able to secure registrations for all of our primary herbicides, insecticides and fungicides either directly working with IR-4 or in cooperative collaborative efforts with IR-4 and the agrichemical industry. We reflected the value in our book —"Vegetable Insect Management" by Foster and Flood.

Brian R. Flood, Ph.D.

*Research Fellow / Pest Management – Vegetables
Del Monte Foods*

Everyone who eats has an interest in the IR-4 Project whether they know it or not. The IR-4 Project is a vital part of the country's food security system and should be considered a national strategic imperative!"

Bob Simerly,

CPAg

Agronomist, McCain Foods USA, Inc.



IR-4 is **"Making a Difference"** throughout the world. In September, IR-4 successfully hosted the first Global Minor Use Priority Setting Workshop, where over 170 participants from 30 countries decided upon three primary and six secondary research priorities. The international research for these priorities will begin in 2016. Many countries have committed to conducting this research, allowing for global product acceptance and free trade among countries.

Recently, the UN-Food and Agriculture Organization called on nations to reduce food waste, which is defined as "the decrease of food in subsequent stages of the food supply chain intended for human consumption. Food is lost or wasted throughout the supply chain, from initial production down to the final stop, household consumption (www.fao.org)". IR-4 is **"Making a Difference"** in reducing food waste by providing farmers everywhere with the safest and most current pest management technology that reduces the loss of food due to pest damage.

The Directors of the State Agricultural Experiment Stations and USDA realize IR-4 is **"Making a Difference"** and voted 49 to 1 to reauthorized IR-4 for five more years.

"Making a Difference" is difficult when IR-4 continues to face the challenge of securing adequate financial resources to sustain productive research. The impact of multiple years of flat funding and escalating costs is affecting IR-4's ability to establish new research to answer grower needs. Specifically, IR-4 conducted fewer new food use studies in 2015 (62) than it did in 2011 (85); a similar decline was observed in the ornamental horticulture program which declined from 1316 to 673 trials. Many of IR-4's partners are facing similar fiscal challenges and again, inadequate funding has had an impact. Cornell University's College of Agriculture and Life Sciences could no longer afford to cover overhead costs associated with IR-4 activities in New York State and ceased IR-4 operations at the university. Fortunately, Rutgers University and the University of Maryland were able to assume Cornell's role.

IR-4 continues to rely on the generous contributions of time and effort by members of the IR-4 Commodity Liaison Committee (CLC), Minor Crop Farmers Alliance (MCFA) and the specialty crop community to articulate the value IR-4 brings to American agriculture and food safety, as well as its contribution to economic growth. On behalf of the IR-4 Project Management Committee, I want to express heartfelt thanks to IR-4 stakeholders for their commitment and support, and guidance provided by these individuals and groups to ensure that IR-4 and the need for specialty crop/specialty use pest management technology remains "a national strategic imperative!"

All the best — Jerry



! Making a Difference for Leaf Lettuce Growers

● IR-4 “Made a Difference” by supporting the “renewal” of the registration for the herbicide pronamide (pyzamide/trade name KERB®). In 2007, EPA modified the pronamide tolerances forcing the removal of the use on leaf lettuce from the registration. The loss of KERB on the leaf lettuce registration created a huge weed management void for growers in the production of many types of leaf lettuce. Hand weeding was often the only option for leaf lettuce growers.

DowAgrosciences, submitted new data allowing EPA to reassess and reclassify pronamide to better defined the human health risk assessment. This then opened the door for adding leaf lettuce back to the label. In 2014, DowAgrosciences submitted IR-4 developed residue data, which was used to successfully establish a “new” tolerance for leaf lettuce. To the delight of growers, this much needed herbicide was approved just in time for the 2016 growing season.

*“The US Greenhouse Hydroponic vegetable industry has developed in the last 25 years. We would not exist today without the IR-4 Program. “
Mike Bledsoe
Senior Vice President Food Safety & Regulatory Affairs
Village Farms*

Making a Difference for Prickly Pear Cactus Growers!



Photo by Peter Felker

IR-4 has been receiving requests to help Prickly Pear Cactus growers for years. This is the only commercial crop in continental US that has the Crassulacean Acid Metabolism photosynthetic pathway, which is 2-3 times more efficient in converting water to dry matter than C4 grass crops like sorghum and corn. Given climate change and drought concerns, cactus could be a useful crop for the future in areas such as livestock forage and bioenergy. However, even an unusual crop like this has pest issues. Prior to 2015, the cactus crop in the US had only one insecticide registered (carbaryl) and the use was limited to 3 applications per year. This was entirely inadequate for a crop that has a yearlong frost free growing season and is attacked by two major pests, the wild cochineal insect (that produces a colorfast red dye) and a stunting disease tentatively identified as being caused by an aphid-transmitted umbravirus. IR-4 is “**Making a Difference**” for growers of Prickly Pear Cactus by its work in developing and advancing the new insecticide, Sivanto (flupyradifurone), which has low toxicity to honey bees. This product provides excellent control of these cactus pests.

Thanks to cooperative research efforts of IR-4 and Bayer CropScience, an EPA registration was obtained for Sivanto on cactus and many other crops in early 2015. However, before Bayer would fully register the product on cactus, an additional study was needed to measure the effects of Sivanto on cactus bees. Bayer came up with a novel approach of using a California Experimental Use Permit, which facilitated further study while also allowing growers to market their treated crops. This unique collaboration with Bayer, the growers, and scientists will help to refine the label and ensure that cactus bees will not be adversely affected by this use, and growers will be able to manage pests.

Making a Difference in Bee Health

IR-4 is “Making a Difference” with its latest Biopesticide & Organic Support Program success, the registration of HopGuard II. The active ingredient (potassium salts of hop beta acids) is derived from the hop plant and is the same ingredient used in flavoring beer.

By formulating the acid onto strips and placing them in beehives, the acid helps to manage the parasite known as Varroa mite, which has been implicated in colony collapse disorder. Some of the early research on this product was facilitated through US Department of Agriculture - Agricultural Research Service (USDA-ARS). The data from USDA-ARS along with information about hops in the scientific literature was submitted to EPA by IR-4 to support its registration. IR-4 also funded efficacy studies, and helped maintain the Section 18 (emergency use permits) in many states. Because this is a food grade product, it enables beekeepers to manage Varroa mite even during honey flow, when conventional pesticides are not allowed. In addition to controlling Varroa mite, HopGuard II helps to provide a new market for hops products in the Pacific North West.



“I do not know how we would survive raising vegetables without IR-4! IR-4 has been able to get us new chemicals labeled, along with better use rates and lower PHIs that we needed to keep our vegetables weed free, and insect free while keeping our bees safe, and our diseases under control.”

Bruceuurma
Buurma Farms

Arrow is pointing to the Varroa Mite on the bee.

Photo by entomology.ifas.ufl.edu



! Making a Difference in Downy Mildew Control!

Downy Mildew has been a major problem for agriculture for centuries. The disease is caused by various species of fungi including members of the genera *Pseudoperonospora*, *Bremia* and *Peronospora*. All are classified as oomycetes or water molds. These diseases have devastating effects on many plants including cucurbits (cucumber, melon, squash, pumpkin, etc.), Brassica (cabbage, broccoli, etc.), basil, onion, grapes, and numerous environmental horticulture plants including impatiens, roses, and viburnum. And some downy mildews infect both edible and non-edible related crops, such as sunflower/black-eyed susan.



Wyenandt et al. 2015. Basil Downy Mildew (*Peronospora belbahrii*): Discoveries and Challenges Relative to Its Control. *Phytopathology* 105 (7): 885-894

IR-4 is “**Making a Difference**” for specialty crop growers with residue, efficacy and crop safety screening for new pesticides and biopesticides for downy mildew in edible and non-edible crops. Basil crops have been totally decimated by basil downy mildew, effecting both basil grown for culinary and ornamental purposes. For basil downy mildew, IR-4 has conducted broad efficacy testing of biopesticides alone and in combination with conventional pesticides. Some of IR-4’s field trials included products that would be allowed to be used for organic basil production.

In August 2015, EPA approved the registration of a new active ingredient oxathiapiprolin. IR-4 provided supporting residue and efficacy data for this new tool used to fight downy mildews for which specialty crop growers are very excited. This new chemical was developed by DuPont but has been licensed to Syngenta. Syngenta has exclusive rights to foliar and soil uses on all edible and non-edible crops in North America. Oxathiapiprolin has been proven in many field trials to provide outstanding efficacy for downy mildew control, both as a preventative and through residual activity. This registration provides growers with a new mode of action fungicide. It has been shown to be highly effective at very low use rates and exhibits no cross resistance to other products.

IR-4 residue data on edible crops such as legumes, leafy vegetables, fruiting vegetables, cucurbit vegetables and ginseng were included as part of the initial submission and are now registered. There are still more registrations in the works. In December 2015, IR-4 submitted data for other Brassica leafy vegetables, raspberry, blackberry and basil. Once registered, oxathiapiprolin will be an important and foundation tool for basil growers to protect their crop.



Impatiens Downy Mildew
(*Peronospora obduscens*)
Photo by Cristi Palmer

IR-4 efficacy data on non-edible crops contributed to the first registration of oxathiapiprolin for ornamental horticulture plants grown in greenhouses, nurseries, and landscapes. Impatiens downy mildew was completely controlled with soil treatments prior to the start of symptoms. Additional crop safety studies are planned so growers can be assured of no injury across a wide variety of plants.

IR-4 is “**Making a Difference**” in studying new and emerging downy mildew diseases. In addition to studying efficacy for impatiens downy mildew, IR-4 had facilitated collaborations with a team of scientists to examine how cucurbit and impatiens downy mildew overwinter. How do they survive? Do they move to alternate non-crop plants? This team has also studied the genome of downy mildews to better understand population dynamics, develop new diagnostic tools, and determine how impatiens downy mildew could have become so devastating in a few short years.

Making a Difference in Resistance Management in Fruit and Nut Crops

In 2015, the IR-4 Biopesticide and Organic Support Program shifted its emphasis to a grower need based prioritization system. This approach has produced several encouraging results in critical pest management issues. Fireblight is a serious bacterial disease of apples and pears. The restriction against the use of antibiotics in organic production has made this problem more acute. A combination of Blossom Protect plus Buffer Protect followed by an application of FireQuencher was as effective as an antibiotic treatment. In the management of spotted wing drosophila in organic blueberry and blackberry, Veretran D and Grandevo were effective in rotation with Entrust. Promising technologies are under development for walnut and chestnut too.



Spotted Wing Drosophila monitoring trap in blackberry
(Photo by Oscar Liburd, University of Florida)

Making a Difference in Securing New Bird Repellent

IR-4 is “**Making a Difference**” by supporting minor uses on major crops. The US Environmental Protection Agency recently approved the use of anthraquinone (AV-1011) as a bird repellent to protect rice seedlings. When applied to rice seed prior to planting, it is scientifically designed to deter birds from eating rice seed before and during emergence.

Anthraquinone is a natural product found in some plants such as rhubarb. It is nontoxic, nonsystemic and is effective through plant emergence, which eliminates the need for replanting lost acres due to bird predation of planted rice seed. Birds develop a negative association between the material, light shift, and the crop, thereby safely repelling the birds.



Photo by Mike Brinkley, Arkion

“The label for AV-1011 will be extremely valuable for Louisiana rice producers as well as producers in all other southern US rice producing states. Bird depredation on seeded rice is a major problem in certain areas of all of these rice producing states. The use of AV-1011 helps establish a uniform rice stand, which facilitates many production practices including fertilization, weed and insect control, as well as timely flood establishment. All of these will help achieve maximum yields which are critical for sustainable rice production.”

Steven Linscombe
Director
LSU AgCenter
Rice Research Station





“IR-4 has shown outstanding leadership to minor use growers internationally and has been instrumental in the setup of several programmes. Relationships with IR-4 have been critical to the setup of a minor use project in New Zealand. In addition to advice on project development, the opportunity to learn about priorities and new agrichemical control options in the US, has assisted the establishment of projects in New Zealand. IR-4 has also provided invaluable leadership to international discussions and the establishment of policy on minor use, particularly at Codex. It is due largely to the commitment of IR4 that a Global Priority Setting Workshop was able to be held this year. I hope that IR4 will be able to maintain its commitment to Minor Use internationally as there is more work to be done.”

*Nikki Johnson
Project Leader
Registration of Sustainable Agrichemicals for Minor Crops Project
New Zealand*

Making a Difference Toward Global Cooperation!

In September 2015, IR-4 (along with USDA, Australia, Canada, the EU and others) **“Made a Difference”** by sponsoring the first Global Minor Use Workshop. The workshop was a first step in global research approaches to identifying solutions to solve minor use needs on fruits, vegetables and other specialty crops. From there the participants developed plans for cooperative research or data sharing.

Prior to the Workshop, a database was created through a worldwide survey, where countries shared information about their specialty crop pest issues. The database is widely available for the minor use community and registrants. Forty countries shared information about their needs for solutions to their specialty crop pest management voids.

The research projects will focus on: fruit flies on inedible peel tropical crops; downy mildew on leafy vegetables (lettuce, spinach, greens) in temperate growing climates; and aphids on lettuce grown in the greenhouse.

The US IR-4 program agreed to be the “lead country,” for the tropical project and will provide the oversight and direction for the project. A “lead country” is still being identified for the temperate and the greenhouse crop projects.

In order to coordinate and support this global research, the USDA-FAS initiated a Global Minor Use Fund with a contribution of \$500,000 and encouraged other countries and industry partners to follow suit. More information regarding the meeting can be found on the global minor use portal website at: www.gmup.org

Making a Difference in Capacity Building

IR-4 continues to **“Make a Difference”** by developing potential partners in global residue studies through the Tropical Residue Study and Capacity Development Program sponsored by USDA-FAS. In 2015, a project update meeting was held in Cambodia to develop timelines for completion of studies intended for submission to the World Health Organization’s Joint Meeting on Pesticide Residues (JMPR). Field residue research training included papaya studies in Brunei and lychee in Thailand. Studies are also ongoing in several Asian countries. In Latin America, studies are proceeding with pyriproxyfen and spinetoram on a variety of crops such as banana and pineapple. These projects are expected to be complete in 2016. The project has expanded to Africa and efficacy trials are planned in Kenya, Uganda, Tanzania, Ghana and Senegal.

IR-4 is **“Making a Difference”** by continuing its work in Egypt and Morocco.



Mango harvest during residue study in Thailand.





Making a Difference for Ornamental Horticulture Growers

Growing Ornamental Horticulture crops is an art and these beautiful plants require careful management. Often, growers group these crops in ways to achieve production efficiencies. In a greenhouse, growers might group crops that need the same light exposure or fertilizer needs; in outdoor crops, growers might group crops for more efficient water or pest management practices.



Photo by Cristi Palmer

IR-4 is **“Making a Difference”** for nursery growers by providing research data that allows for new crops to be added to herbicide product labels, which allows growers more flexibility in grouping their crops for weed management practices. Nursery growers typically apply herbicides to manage weeds prior to emergence early in the annual production cycle. Pre-emergent herbicides reduce the labor costs of hand weeding and lessen the application of post-emergent herbicides, which might cause injury to crops with accidental overspray. For several years, IR-4 has screened pre-emergent herbicides for crop safety when they are applied over crops as they are breaking dormancy and then again 6 weeks later. This is when the crops are tender and most susceptible to injury. If no injury is observed with this timing, there is less risk of injury when plants are hardier later in the season. This project has consistently provided information for new and updated labels, such as the two herbicides Freehand (pendimethalin + dimethenamid-p) and Tower (dimethenamid-p) which were amended for new crops in 2015.

“IR-4 has been and continues to be integral in helping to provide guidance in pest management options to the greenhouse, nursery, and landscape industries. Through IR-4’s focus on product registration, our industry has greater options for pest management tools that are safe for plants and pesticide resistance management.”

Jill Calabro, Ph.D.

*Science & Research Programs Director
AmericanHort/Horticultural Research
Institute*

IR-4 is **“Making a Difference”** in managing plant diseases of ornamental horticulture crops. Foliar diseases mar the beauty of ornamental horticulture plants. Diseases such as botrytis gray mold and leaf spot reduce plant quality. Over the last couple years, these two disease groups were ranked as high priority projects, and IR-4 screened several new tools for efficacy. Dovetailing with registrant research activities, IR-4 efficacy and crop safety data supported the registration of Mural (azoxystrobin + benzovindiflupyr) for botrytis, powdery mildew, and leaf spot diseases. Downy mildew diseases are problematic and can cause loss of entire crops; and they have ranked highly in the

IR-4 Grower & Extension Survey. As mentioned previously, Segovis (oxathiapiprolin) was screened by IR-4 for crop safety and impatiens downy mildew management. This information assisted in label development, allowing growers to manage downy mildews and other water mold diseases on a variety of crops.

Making a Difference in Combating Invasive Pests



Arrow points to stem damage (girdling) due to feeding by larvae of the European pepper moth, *Duponchelia fovealis* (Zeller). Photograph by Jim Bethke, Department of Entomology, University of California, Riverside.

IR-4 is “**Making a Difference**” by studying ways to prevent new insect and mite pests from coming into the US when receiving young plants grown overseas. With international production and shipment of plants, preventing potentially invasive pest species from entering and establishing in the US is a challenge. One example of international hitchhikers is the European Pepper Moth (EPM). In 2004, this pest was first discovered on begonia in San Diego County, CA. Thinking the pest was under control, growers were no longer aware of its presence. However, in 2010 the pest was found in 15 other countries in CA and many other states. This pest feeds on many ornamental horticulture and edible plants, leaving damage on roots, leaves, flowers, buds, fruits, and stems. It can survive just by feeding on decaying plant debris. It can hide in pots near the drainage openings and can easily be moved unnoticed from infested areas. IR-4 was part of a cooperative project with APHIS which studied the biology of EPM and potential ways to prevent movement of this pest and others on cuttings within the US and to provide guidance to off-shore producers to prevent future exotic hitchhikers with pre-shipment treatments.

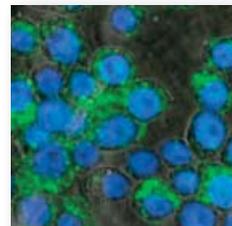
Research was conducted on several pests (thrips, mites, mealybugs) with biopesticides, natural chemistries and hot water as treatments used immediately before shipping. While several pests and products were screened with variable success, the best outcome occurred with citrus mealybug where BotaniGard (*Beauveria bassiana*) compared favorably with Safari (dinotefuran) for reducing populations completely through 2 weeks after dipping infested chrysanthemum cuttings. This project has “**Made a Difference**” by highlighting a potential avenue for managing exotic pests during shipping and highlights where new biopesticides and natural products will need to be developed for optimal and consistent efficacy.

Making a Difference in Aedes Mosquito Control!

News articles have been filled by scary stories of the Zika, Dengue and Chikungunya viruses. One known vector of these viruses is mosquitoes. IR-4 is “**Making a Difference**” by providing pest control solutions for these assailants.

Aedes aegypti (the Yellow Fever Mosquito) and *Aedes albopictus* (the Asian Tiger Mosquito) are the primary vectors of a wide swath of deadly or debilitating viruses. They are wide-spread in the US, and they are notoriously hard to control. Biting primarily during the day, they are not stopped by bed nets. They lay eggs in multiple batches in small, inconspicuous water bodies, and then live largely indoors, so they are very hard to target with either larvicides or adulticides.

But a new suite of control tools are coming, and the IR-4 Public Health Pesticides Program is helping move them from the lab to the market. Since 2009, IR-4 has provided registration support for Lethal Ovitrap – an attract-and-kill device recently registered by EPA. This device kills females *Aedes* when they enter it to lay eggs. The IR-4 PHP was also part of the Rutgers University team that developed similar devices that induce female *Aedes* to carry the pesticides on their feet and poison their



Green stain showing presence of *Wolbachia* in mosquito. (Photo courtesy of Stephen Dobson, University of Kentucky)

own offspring. IR-4 has been the registration advisor for Attractive Toxic Sugar Bait, which kills mosquitoes when they feed on it. In 2015, the Biopesticide and Organic Support Program funded efficacy studies with a bacteria which inhibits reproduction of mosquitoes carrying the Zika virus.

Finally, IR-4 is assisting with registration of a mosquito larvicide for drinking water and of a *Wolbachia* intracellular biocontrol product for use against *Aedes albopictus*.





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"IR-4 has been successful due to its unique ability to foster cooperation among stakeholders, make decisions, and carry out its core mission to provide growers of specialty crops access to pest management products. Without IR-4, the blueberry industry would have a much smaller pest control toolbox."

Dave Trinka
Director of Research
Michigan Blueberry Growers Association

