The IR-4 Project

Pest Management Solutions for
Specialty Crops and Specialty Uses

Newsletter

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Report Shows The IR-4 Project is an Excellent Return On Investment

— by Steven R. Miller, Ph.D. Director: MSU Center for Economic Analysis

The Michigan State University Center for Economic Analysis (MSU/CEA) has updated their estimates of the economic significance of the IR-4 Project. Their findings show that the IR-4 Project supports over 95,000 U.S. jobs and contributes about $9.4 billion to annual gross domestic product – a measure of national income.

MSU/CEA has undertaken multiple economic studies of agricultural pest management programs from a perspective of agricultural producers and from policy perspectives to better understand the roles of pesticides and pest management practices in efficient agricultural practices. These studies, and others, show that access to effective pest management tools is a key source of agricultural productivity growth experienced throughout the 20th century and is vital to cost-effective and sustainable agriculture. However, a lot has changed since the introduction of inorganic pesticides to agriculture in the 1940s. Researchers began to recognize that many early-developed pesticides had unintended consequences to health and environment, leading to regulatory changes designed to mitigate harmful impacts of agricultural pesticide use. These regulations required that pesticide uses be approved by the Environmental Protection Agency (EPA), and validated through extensive laboratory and field-testing. These regulations, while contributing to food safety and improved environmental outcomes, distort economic incentives for bringing pesticides to market.

This distortion falls most heavily on minor uses of pesticides, because these uses do not promise sales sufficient to cover the cost of laboratory and field testing necessary to achieve EPA registration. Since using pesticides on crops or in manners not prescribed on the label is prohibited, specialty crop growers and others seeking minor uses of existing pesticides are often locked out of pest management solutions available to major crop growers.

Through three program areas and associated activities, the IR-4 Project seeks to rectify this asymmetric access to pest management options as well as

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Inside...

Executive Director Notes

Dear Friends,
Wait a minute; what happened to 2017? I remember when I was younger, a mentor said to me; "Just wait until you get to your 50s; it is scary how fast time moves," I realize now what he meant.

As we transition into the 2018 research season, the IR-4 team is trying to balance many high priorities. We have the typical year-end reporting requirements. Spoiler alert - some of IR-4's key accomplishments in 2017 include:

- 534 new food crop registrations on specialty crops/minor uses,
- 2 new ornamental horticulture pesticide registrations impacting more than 800 crop uses
- Support and facilitation of EPA approval of new uses on 9 crops with 3 active ingredients in the Biopesticide & Organic Support Program

Unfortunately, not everything ended up as positive. IR-4 has suspended its Public Health Pesticide research program that supported new tools to manage mosquitoes, ticks, and other arthropod pests that transmit disease to humans and animals, because funding was eliminated. We thank Dr. Karl Malamud–Roam for his efforts and wish him all the best for the future.

IR-4 is in the process of finalizing its research plans for 2018. We expect the 2018 research program to be about the same size as in 2017. IR-4 at one point was considering a significant cutback in new research based on the proposed elimination of 10 research sites within USDA-Agriculture Research Service (ARS) that cooperates with IR-4. Collectively, these 10 research projects account for between 20% to 25% of IR-4's research capacity. The IR-4 Commodity Liaison Committee (CLC) reached out to the ARS Administrator expressing concerns with the proposed cuts and expressed support for full funding of these 10 ARS research projects. This, combined with Congressional funding proposals with significantly fewer cuts gave IR-4 the encouragement to proceed with a full research program in 2018.

One of the highlights of my responsibilities is to represent IR-4 at conferences, workshops, symposiums and other public events. Over the next several months, I will be extremely busy sharing positive information about IR-4. I have agreed to make presentations at events with the EPA Office of Pesticide Programs, NJ Vegetable Growers Association, USDA-Pesticide Data Program annual meeting, and the American Association of Pest Control Officials. IR-4 was selected to present a "Lunch and Learn" symposium hosted by the National Coalition for Food and Agriculture Research. Several CLC representatives and I will provide an overview of IR-4 to staff of the US Senate and House of Representatives on March 12th. Also on the calendar is an IR-4 display booth at the 9th International IPM Symposium on March 19-22 in Baltimore, MD, and talks at IR-4 Northeast and Western Regional Meetings in April. In addition to the above, I have also committed to speak at the California Specialty Crops-MRL Workshop in May and National Association of County Agriculture Agents "Super Symposium" in August. If you are attending any of these events, please come over and say hello.

Before the end of last year, IR-4 was recognized when 17 senior government officials issued a joint statement at the 11th World Trade Organization Ministerial Conference acknowledging the productive work of IR-4 within the Standards and Trade Development Facility to build knowledge and capacity for developing countries in the area of pesticide maximum residue levels.This was the icing on the cake after IR-4 successfully co-hosted the Third Global Minor Use Summit with our friends and partners with USDA-Foreign Agriculture Service and the Canadian Pest Management Centre.

I want to bring to your attention a report that was recently completed by the Michigan State University Center for Economic Analysis studying the economic impact of the IR-4 Project. The report stated "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. Relative to core federal funding of $15.6 million dollars, this represents a high return on public investment." We hope to use these numbers to state our case that IR-4 is important and a good investment of public resources. For a full copy of the report, see http://bit.ly/IR4IMPACT.

That's all for now, all the best — Jerry

enhance the pest management solutions for agricultural uses. The programs span Food Crops, Ornamental Horticulture and the Biopesticides & Organic Support. Our study estimated pesticide purchases for these minor uses, pesticides' share of the value of crop production, and the IR-4 Project's contribution to making these pesticides available for minor uses for food and horticulture growers. It made similar calculations for estimating the IR-4 Project's contribution through their work on biopesticides and supporting organic growers. These estimates allows MSU/CEA to evaluate the contribution of the IR-4 Project to agricultural production and pesticide purchases for agricultural uses. Using estimates of the impact of pesticides to yields and output (value of final production), the study also estimated the contribution of the IR-4 Project to agricultural production. The resulting estimates of agricultural and agrichemical production provide the basis for estimating contributions through economic multiplier effects. Multiplier effects are secondary transactions that ripple throughout the economy as initial revenues are re-spent in the economy, giving rise to other rounds of expenditures. These secondary transactions represent a central tenet of economic theory that initial transactions spawn a cycle of secondary transactions as dollars recirculate throughout the economy.

The approach applied to estimate economics of the IR-4 Project was to account for all of the value generated by registered pesticide uses that are available to growers because of the IR-4 Project. Accordingly, the study found that about 50 percent of existing minor use registrations were garnered through research conducted by the IR-4 Project. MSU/CEA does not claim those registrations would not exist in the absence of the IR-4 Project, nor does it conjecture how growers would alter their operations in the absence of such pest management tools. Rather, applied expected yield enhancements from pesticide use to the existing level of usage. In this, the resulting estimates show the contribution of the IR-4 Project to current economic activity, but do not suggest this activity would suddenly disappear in the absence of the IR-4 Project. It is too difficult to conjecture 50 some years of evolution in the agro-food and fiber value chains from what is grown and how it is grown to consumers' choices of the mix of agricultural products consumed. That is, the alternative marketplace, in the absence of the IR-4 Project cannot be established for comparison.

While the IR-4 Project's core budget in 2016 was $15.5 million, we found that the IR-4 Project contributes over $9.4 billion to annual gross domestic product and supports around 95,000 jobs in agriculture and related industries. The largest component of these impacts is the Food Crops Programs, as this represents the largest market value of agricultural production utilizing pesticides facilitated by the IR-4 Project. In total, the contribution to this sector tops $7.1 billion. However, compared to MSU/CEA's 2012 estimates, the contribution has decreased because of falling commodity prices. The Biopesticide & Organic Support Program contributions spans well beyond specialty crops and supports an estimated $1.6 billion to annual gross domestic product. This is followed by the Ornamental Horticulture Program's estimated contributions of just under $600 million. Other sources of contribution are spelled out in the report, which can be found on the IR-4 Project website at www.ir4.rutgers.edu.

The strikingly large effects reported in the MSU study are largely attributed to two effects. First, the grower benefits of minor use registrations continue to be realized for many years. Those past registrations continue to contribute to agricultural productivity as the IR-4 Project turns its attention to address new threats to producers, such that for any given year, growers benefit from all past registrations garnered by the IR-4 Project. Second, while minor uses may not promise agrichemical producers sufficient returns to encourage them to pursue such registrations, such uses are common for high-value, specialty crops. Therefore, the potential grower gains from minor use registrations may greatly exceed the private gains to agrichemical producers. This analysis captures those broader gains in the final estimates. Based on these estimates, the IR-4 Program plays an important role in assuring consumers have access to a wide mix of agricultural and food products at reasonable prices.

Efficacy Work at IR-4

— by Jerry Baron, IR-4 Executive Director

Quick quiz...What is IR-4's primary role with specialty crops/specialty uses?

A. Develop data to support EPA establishment of pesticide tolerances.
B. Help farmers market food to consumers in the US and international countries.
C. Facilitate registrations of pest management technology to allow growers to manage pests.
D. Make sure that the grocery stores have plenty of fruits and vegetables.

Please note, there is not an option "E" – All of the above.

And the answer is..... "C".

My guess is that many of you chose "A". This answer is correct but it only covers one aspect of the IR-4 Food Use Program. It ignores IR-4's involvement in many other areas, including efforts to develop crop safety and efficacy data (collectively called product performance) in the Ornamental Horticulture and the Biopesticide/Organic Support Programs. It also ignores IR-4's increased efforts to develop product performance data for food crops. So let's dig deeper into IR-4's Product Performance research.

In the early days of IR-4, researcher's primary focus was to support pesticide tolerances on specialty food crops through the development of residue data. Others, including many applied researchers at the Land Grant Universities and USDA-Agriculture Research Service were active in screening technology to manage pests. These public sector scientists would come to IR-4 with the necessary efficacy and crop safety data that proved a proposed use was safe and effective. The data would be shared with the company and if they concurred with a proposed use, IR-4 was given the approval to develop residue data.

IR-4's first major transition into product performance data development was when the IR-4 Project added the Ornamental Horticulture Program in 1977. The data requirements for environmental horticulture crops are different. US Environmental Protection Agency (EPA) does not require pesticide residue data on these non-food crops. IR-4 data development efforts in the core Ornamental Horticulture Program have been and continue to be the development of efficacy and crop safety data.

As IR-4 expanded into biopesticides in 1982, it also expanded its product performance data development efforts. Initially, IR-4 funded numerous small projects to explore feasibility of biopesticide products in managing target pests. IR-4 solicited mini-grant applications for public sector scientists to test the efficacy of new biopesticide technology. IR-4 expanded this effort and began funding mini-grants to test the performance of biopesticide products that were further advanced in the regulatory process. IR-4, collaborating with EPA's Pesticide Environmental Stewardship Program also funded grants supporting large biopesticide trials to demonstrate to the growers/farmers that biopesticides, when used appropriately, could be a useful technology in pest management programs.

IR-4's minimal involvement with the development of product performance data in the Food Program during this phase was logical. Many of the companies had their own research programs that performed the necessary studies to protect the company from crop damage liability that met EPA data requirements.* Companies often funded public sector researchers and other times they did the work internally with their own team of scientists.

In the early 2000's. IR-4 started noticing a fundamental shift in the product performance environment. Applied scientists at public institutions were retiring and their positions were not being replaced. New scientists were often required to focus their research in novel areas and pesticide product screening was deemed as service work and not scholarly. During this same period there was consolidation of the crop protection industry, fewer companies, reduced applied research infrastructure and less external funding for product performance research that did not match the company's main priorities.

The net result of the company consolidations and retirement of applied researchers at public institutions was industry requiring more preliminary product performance data before they would approve IR-4 residue studies. IR-4 had a dilemma; there were no funds to develop data to prove to the company the use was safe and effective, and without this product performance data the companies would not support the uses. Growers were also starting to experience different pest pressures;

pests that were controlled in the past by broad-spectrum products were no longer controlled. There were fewer scientists in the public sector who could do the screening with the new generation of reduced risk products.

IR-4 recognized this need for product performance data and took action to fill the void. The IR-4 Project Management Committee made a strategic decision to set aside a portion of Food Program resources to fund product performance research. Today, approximately 18% of IR-4 Food Program field research funds are used to develop product performance data.

All three programs (Food, Ornamental Horticulture and Biopesticide & Organic Support) product performance activities follow the same general process: 1) establishment of research priorities by stakeholders at a workshop, 2) development of research protocols giving research cooperators specific directions to implement experiments, 3) data collection, and 4) report development and submission of data to cooperating companies. Each of the programs have nuisances and intricacies in their respective programs, however, there are more similarities within the programs than there are differences. In fact, in many ways the process for the Ornamental Horticulture Program and the Biopesticide & Organic Support Program are identical.

In order to further harmonize the process and activities across IR-4 Programs, two IR-4 committees have been established. There is the Product Performance Team (PPT) at IR-4 Headquarters that consists of individuals involved with the Food Program Product Performance Data Development and includes representatives from the Ornamental Horticulture and Biopesticide & Organic Programs. Some of the deliverables of the Food Program committee involve producing a common protocol format for product performance data, and a common reporting format, as well as looking into process improvement in transferring the data to the cooperating company and providing timely results assessment. This group has also streamlined priority setting at the Food Use Workshop and project selections during the IR-4 National Research Planning Meeting.

The Project Management Committee also established an ad hoc committee consisting of the managers of the three IR-4 Core Programs. The mission of this committee is to examine the existing process of product performance data development between the Programs and explore ways to gain efficiencies and synergies. The goal is to take the best characteristics of each of the Program processes and determine if changes can be made to make it easier for stakeholders. For example, it has been proposed that all three Programs hold their respective priority-setting workshop the same week at the same venue to capture savings.

Both committees continue to strive for greater efficiencies in order to preserve existing research capacity. We expect this to be an on-going effort that over time will continue to move systems to a single IR-4 Product Performance system.

**EPA requires the companies to have adequate product performance data supporting crop uses. Data is only submitted when requested by EPA.*

Food Use Program Efficacy Work

–by Stephen Flanagan, IR-4 WSR Assistant Regional Field Coordinator

The lion's share of Food Use Program research work centers around residue trials, but the research landscape has shifted to include more efficacy and crop safety research. Historically, our extension specialists and university collaborators have generated the efficacy data that drove projects to the Food Use Workshop and put these projects into motion.

So, what caused the change? Most of us who have been playing the ag research game for a few years can point to several factors. There are fewer primary investigators at land grant universities running applied programs, and industry consolidation has resulted in fewer companies along with an attendant reduction in sponsored field studies. Liability concerns have also increased with manufacturers.

Do these changes in our universities and industry cooperators change the need for efficacy work? If we want high quality projects that are focused on the right product for the right problem which will serve a grower's needs, the answer is clearly no. That no translates into more IR-4 resources directly funding both exploratory and ongoing project efficacy work. On a national level, funding has increased from roughly $100K for 17 projects in 2014, to over $400K/year in 2017 and in 2018

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Biopesticide Efficacy Trials F

— by Michael Braverman, IR-4 Biopesticide & Organic Support Manager and Krist

In 2017, the IR-4 Biopesticide and Organic Support Program funded a number of efficacy studies across the US. Three of the most promising projects are summarized below.

Managing Fire Blight Organically on Apples:

Fire blight is a bacterial disease that affects several species of trees and shrubs, most notably pome fruits. The bacterium (*Erwinia amylovora*) invades blossoms and shoots on trees and infects almost all tissue types. Infected branches often serve as the reservoir of bacteria in subsequent seasons. Infected leaves bend inwards towards the stem, release infectious exudates, wilt, and die. Death of blossoms, leaves and shoots, results in low fruit yields and smaller fruits. Apple produce losses in the United States alone cost farmers millions

Fire blight. Credit: Kari Peter

annually. Growers have been looking for alternatives to antibiotics and copper to treat this disease, as resistance has increased. A solution to this problem is imperative for conventional and organic growers. Also antibiotics have not been allowed in organic production since 2014.

This has been a long-standing issue, first addressed in the IR-4 Biopesticide and Organic Support Program in the year 2000. Grant funded projects continued intermittently through 2014, when the system switched to a Priority Need Funded approach to focus more on stakeholder input. Farmers continued to search for answers to this need, as indicated at the 2014 Biopesticide Workshop and subsequent workshops. Studies concerning fire blight in organic apple production have continued in this system from 2015 to 2017. Overall, these studies indicate that some options may exist; Cueva® (a copper-based product), Fire Quencher (phage), Blossom Protect™ (*Aureobasidium pullulans*) Buffer Protect (citric acid), and Serenade Opti® (*Bacillus subtillus*) are the most promising treatments. The latest results come from Drs. George Sundin, Kenneth Johnson, Kari Peter, David Granatstein, and Tianna DuPont.

Dr. Sundin of Michigan State University found that Blossom Protect and Buffer Protect provided a level of control for blossom blight that was statistically similar to Cueva, Previsto and Serenade Optimum. Shoot blight control in this experiment was statistically similar to Cueva, Previsto™, Serenade Opti and FireWall™ (a Streptomycin standard antibiotic), probably because shoot blight infection was low. Dr. Johnson of Oregon State University noted that programs with Blossom Protect and Buffer Protect followed by VP20 (mineral based) Previsto (copper hydroxide) or Serenade Optimum, then Lime Sulfur provided very good levels of control. In regard to other materials, the phages (Fire Quencher and Omnilytics) provided good suppression of fire blight, likely due to the applications being so close to inoculation.

Dr. Peter of Penn State University indicated that Blossom Protect and copper formulations provided the greatest control of blossom blight. Consistent with past trials, Blossom Protect resulted in 40% control. Copper seemed to be an antagonist when combined with biopesticides. Fire Quencher, however, did not perform well in her trial which was likely due to the high disease pressure.

Drs. Granatstein and DuPont of Washington State University found that Blossom Protect combined with VP20, VP20 alone, and Blossom Protect with VP20 and Cueva/Serenade performed statistically as well as the standard conventional Oxytetracycline treatment. Yet, they did not perform as well as the Streptomycin standard.

Results from these ongoing trials have provided insight for treatments outside of antibiotics. Further, they allow options that do not rely solely on copper-based products. There is hope that the continued development of bacterial and phage based products will provide answers to this very frustrating fire blight problem.

Using SPLAT™ to Attract and Kill Spotted Wing Drosophila:

Spotted wing drosophila (SWD) is an invasive insect from Asia that causes damage in berries, grapes, and some stone fruits. It is a fairly

HOOK SWD splattered on a leaflet, used to attract and k insect. Credit: Cesar Rodrig

Professor Osca University of Fl blueberries with spotted wing dr infestation. Cre Liburd.

Funded by The IR-4 Project

a Coleman, Research Assistant *(See additional article by these authors on page 11)*

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recent pest, first detected in 2008 in California. The reason that this pest is particularly bothersome is the female fruit fly's serrated ovipositor. Unlike other drosophila species, this ovipositor allows for egg laying in unbroken fruit. The resulting maggot infested fruit leads to large economic losses for farmers. For both organic and conventional growers, efficacious materials need to be available while fruit is ripe and ripening.

The IR-4 Biopesticide and Organic Support Program has been funding research on spotted wing drosophila in berries since 2013. The project truly came into focus at the 2014 Biopesticide Workshop, where it was recognized as a top need in the field by IR-4 stakeholders. In 2015 and 2016, trials revealed that a combination of biopesticides Grandevo® (*C. subtsugae*) and Entrust®(spinosad) provided the best form of control. In 2017, the projects spread from including biopesticides in a conventional regime to control of SWD in organic fruit. This lead to both on-farm organic demonstrations, and an interest in SPLAT attract and kill technology in the conventional field.

The SPLAT product consists of a food-based lure in a gel matrix, and a toxicant. Dr. Oscar Liburd of the University of Florida conducted a trial using this product on a conventional berry farm. In his findings, the number of females per trap were significantly lower with SPLAT treatments at 7 and 14 day intervals compared to the no SPLAT treatment, though there were no significant differences with males per trap. Also, there were no differences concerning emergence of SWD, which was low. When considering Grandevo versus a grower standard of malathion however, there were significantly greater numbers of SWD per trap with Grandevo. While malathion can be used in conventional production, Grandevo can also be used in organic production. In Dr. Liburd's studies, the addition of pesticides did not further reduce SWD numbers in traps or fruit over the SPLAT alone.

Dr. John Wise from Michigan State University conducted a SPLAT study as well. In his findings, combining pesticides Delegate® (spinetoram) and Grandevo significantly reduced SWD infestations. The combination of Grandevo and SPLAT did not statistically improve performance over either material alone.

According to Rutgers University's Dr. Cesar Rodriguez-Saona, SPLAT can provide alternative means of control for managing SWD in small fruit operations. In his 2017 trial, there was very little infestation after the attract and kill HOOK SWD combined with complete cover sprays. Further trials discerning appropriate frequency of application could prevent huge losses for farmers.

As seen, we are still in the early stages of gathering information on SPLAT for SWD, yet the results are promising for reducing the impact of this invasive insect over time. Additional larger scale work is needed.

Managing Phorid Flies on Mushroom:

Phorid Flies (*Megaselia halterata*) are common in mushroom houses because they are an obligate fungal feeders. This means that they are only able to survive on a fungal mycelia, such as mushrooms. In addition, they are a vector of Green Mold (*Trichoderma aggressivum*) which is a major disease problem in mushroom production. The need for biopesticides arises because most pyrethroid materials used to control flies are not as effective on phorid flies as they are on sciarid flies. There is a need for fly management in organic production as well.

Three trials were funded in 2017. The researchers of these studies include: Charlee Kelly of Monterey Mushrooms, Nina Jenkins of Penn State University, and Jim Steffel from LabServices, Hamburg, PA. Based on the limited research we received from Charlee Kelly, JMS Stylet-oil® combined with alcohol and sprayed on the walls and on mushroom beds significantly reduced phorid flies compared to an untreated control.

Penn State's Mushroom Research Center. Credit: Penn State College of Agricultural Sciences.

Orn. Hort. Efficacy

— by Cristi Palmer, IR-4 Orn. Hort. Manager

In the Ornamental Horticulture Program, developing efficacy and crop safety data is the way we facilitate registrations for this segment of specialty crop growers. Over time, we have sponsored research on numerous pathogens, pests and even a few weeds. We have also gathered crop safety data for many products. Below are short vignettes on three multi - year projects, their importance and benefits for growers.

Gray mold

The fungus *Botrytis cinerea* and closely related other *Botrytis* species cause the disease gray mold. This disease impacts more than 200 ornamental horticulture crops. As it infects plant tissues, *Botrytis* releases enzymes to dissolve plant cells causing necrotic (brown) spots and lesions that can eventually destroy plant leaves and flowers. Often plants will abscise (shed) severely infected leaves or flower petals. *Botrytis* diseases are called gray molds because massive numbers of gray conidia (spores) form above the surface of infected plant tissues on thin long stalks called conidiophores. Botrytis is typically a problem when temperatures are cool and relative humidity is high. Under most growing situations, *Botrytis* will not reach epidemic proportions, but it can cause spotting or localized damage which lowers the quality of plants during production. However, when plants are placed in cool conditions for temperature or storage, *Botrytis* can be devastating with severe crop loss.

Periodically since 1982, IR-4 has studied new tools for managing gray mold both during production and during cold storage. Much of these efforts have been ongoing since 2014, where more than 250 trials have been completed with 7 new products being registered with 6 different mode of action groups for improved resistance management options.

Petunias are often affected by gray mold and thrips. Credit: Cristi Palmer

Botrytis efficacy continues to be a national priority project and our 2018/2019 research is twofold: management during production and screening options for management during cold storage and display of cut flowers.

Thrips

Thrips are tiny little insects (about 1 mm in length) that feed on plants by scraping leaf and flower surfaces and sucking up the juice. There are about 180 different thrips species, but only a small subset are economic pests. For ornamental horticulture, key pests are western flower thrips (*Frankliniella occidentalis*), chili thrips (*Scirtothrips dorsalis*), and a handful of others such as onion thrips and *Echinothrips sp.* In addition to causing feeding damage, thrips also can vector viral diseases such as impatiens necrotic spot virus and other tospoviruses. Managing thrips can be challenging because most species tend to seek sheltered areas like the base of flower petals and they reproduce very quickly.

IR-4 has considered studying new products for managing thrips a high priority project since 2005. More than 450 trials have been completed, leading to 15 new or updated products in nine mode-of-action groups. This provides the ability for growers to have a robust rotation program incorporating biocontrol agents, biopesticides, and designer chemistry to manage thrips populations and the viruses they can transmit.

Weeds

For weed management, most of IR-4's efforts have been to expand the knowledge base for which products are okay to use with an ever expanding list of crops. Research has focused on over-the-top applications of preemergent herbicides, or those used before weeds have germinated and started growing. This has led to the registration of 22 new or expanded herbicide labels since 2000.

For 2018 and 2019, IR-4 efforts are expanding to high priority projects related to postemergent herbicides, or those herbicides which are effective after weeds have germinated and have started growing around the crop. Over-the-top or directed applications depending on the herbicide will be studied, as well as how well postemergent herbicides work for some common weeds found in nursery container production. While efficacy is well understood for weeds growing directly in soil production systems, herbicide efficacy is not as well characterized for weeds in containers, such as oxalis, spurge and northern willowherb. Results from this work may broaden the options for growers dealing with these weeds.

Northern willowherb. Credit: Andy Senesac

Food Program Efficacy

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supporting 92 different projects.

Back in 2013, IR-4 sponsored 6 efficacy trials in the Western Region. In 2017, that number was 47 and 2018 is on track to support 40 studies. These trials range from exploratory work for Little Fire Ant control in Hawaii, herbicide safety on stevia and quinoa, and fungicide trials for radish foliar diseases. Some of this work is specifically focused on western problems (Little Fire Ant in Hawaii) but other projects like foliar diseases on radish have national focus.

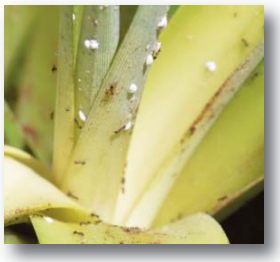
For a national project like radish diseases, Kathryn Homa develops an efficacy protocol in consultation with regional experts and trials are conducted in multiple states. For regional projects like Cochineal Scale control on prickly pear cactus, Keith Dorschner develops an efficacy protocol targeting the specific regional pest/crop challenge. Herbicide projects like Rely® (glufosinate) on fruiting vegetables and sweet potatoes were spear- headed by Roger Batts with similar national protocols written to address these national projects.

There is a direct line between developing efficacy data for a residue project and an eventual label. Three western examples of this sequence are Pristine® fungicide for white mold on endive, Movento® insecticide for Mealybug control on pineapple, and Spartan® herbicide on tomatoes. The exact sequence of dance steps between efficacy data, regulatory data, and the eventual regulatory submission and a successful label are unique for each project. Some projects have a fairly direct path while others take a more circuitous route.

On the circuitous route our experience with Pristine (pyraclostrobin + boscalid) fungicide on endive was something of an epic quest. There is one endive producer in California whose disease control program was based on the soon-to-be-cancelled use of Ronilan back in 2002. A project with Pristine was prioritized and initiated for 2003 and Michael Davis from UC Davis initiated efficacy trials. Both the residue trials and efficacy trials had to be repeated in 2009 and 2012 to refine the use rates and ensure that the commodity residues were accurate utilizing grower equipment. The end result was a supplemental use label for Pristine on endive that arrived in 2013 to support this remarkable California specialty crop. Although the road had some curves and dips, the final destination was a success.

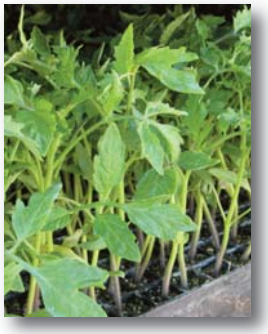
Untreated (Left) versus Treated (Right) endive plants from California Endive. Credit: Stephen Flanagan

Out in Hawaii the Movento (spirotetramat) use on pineapple for mealybug was an express lane project. Grey and Pink Mealybugs are vectors of the yield reducing Pineapple Mealybug Wilt Virus. Mike Kawate from the University of Hawaii was funded to conduct efficacy work in 2008 and the residue work was initiated in 2011. The use for Movento on pineapple was approved and labeled for grower use in 2013. Hawaii pineapple production has decreased significantly in recent years, but this significant pest complex now has an effective control tool via IR-4's research efforts.



Mealybugs tended by ants on pineapple in Hawaii. Credit: Julie Coughlin

The labeling of Spartan (sulfentrazone) on tomatoes was a project with efficacy and residue work spread throughout the United States. Starting in 1999 and through to 2008 efficacy cooperators submitted data or were funded to generate efficacy data in California, Michigan, Georgia and Ontario, Canada. A national residue project was initiated in 2004, and an approved label for transplant tomatoes arrived in 2012. One key factor in this study was figuring out how to use sulfentrazone safely on transplanted tomatoes rather than direct seeded fields. The need for sulfentrazone was driven by nutsedge control and the crop safety data confirmed its suitability for transplant rather than direct seeded production. This coordination of efficacy and residue work translated into a registered and safe use of this effective herbicide for US tomato growers.



Transplant tomato plants ready for field planting, California. Credit: Stephen Flanagan

The Food Use Program has always conducted efficacy work to support potential or ongoing residue projects. The industry and university changes that require IR-4 to sharpen its focus on generating supporting efficacy data are likely to continue into the future.

Thank You, Ray Ratto!

Recently, Ray Ratto retired from his company and resigned from his duties with the IR-4 Commodity Liaison Committee (CLC).

Ray first became involved with IR-4 in 1980, when he approached IR-4 with an herbicide request. From there he became a founding member of the IR-4 CLC in 1991. Ray has always gone to bat to help IR-4. He estimates he visited Congress on our behalf about 25 times.

When asked what he plans to do in retirement Ray replied, "Hang out with Theresa and do Flying Samaritan and Angel flight trips." In case you didn't know, Ray got involved with these projects about 20 years ago. He explained these organizations in an email to share with you all.

"I was asked by a friend at the airport if I had time to take a flight for an eye clinic to San Felipe, Baja, MX. They were one plane short and needed another pilot. I'm also somewhat fluent in Spanish so I was able to act as an interpreter during the clinic. Since then, I've been flying down to these clinics two to three times a year. We usually have 5-7 planes go down on each trip. Our chapter performs eye, ear, nose, throat and baby health clinics. We will have up to 200 people waiting in line before the clinic starts to get their eyes checked and receive glasses if needed for no charge. My specialty is using the auto-refractor. I get a preliminary read of the persons eye before they go in to see the eye doctor. The doctor will spend a few minutes with each person and by 2:00 to 3:00 in the afternoon will see up to 250 people. San Felipe is a very poor fishing village on the Northwest corner of the Sea of Cortez and it's a very good feeling when you can help these people."

Ray is planning on joining IR-4 in Washington for the joint CLC/PMC meeting in March. IR-4 wishes you the best Ray and THANK YOU for all you have done for the program!

IR-4 Executive Director, Jerry Baron (left) with Ray Ratto in one of his warehouses on his farm.

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IR-4 Biopesticide Program Supports Products Receiving Agrow Awards

IR-4 decreases barriers and cost burdens in the regulatory process with the EPA in order to better assist biopesticide registrants. The resulting products are not only important to niche markets, but across the United States. To demonstrate, the registrations enabled by IR-4 have received Agrow Awards three times in the span of a decade. The Agrow Awards recognize crop protection companies as well as the companies supplying to the agriculture industry. This recognition of IR-4 sponsored registrations is confirmation of the investment made in such unique and important products.

LifeGard™ is the most recent IR-4 assisted product to receive a 2017 Best New Biological Product Agrow Award. In 2016, the EPA approved this Certis USA product. The active ingredient, *Bacillus mycoides* isolate J (BmJ), has been the subject of efficacy work by the IR-4 Project for several years. *Bacillus mycoides* are commonly used to inhibit the growth of harmful bacteria and fungi. Efficacy trials for this active ingredient were funded in 1997, under the IR-4 grant program. The project focused on the development of a biological control product based on *Bacillus mycoides* for control of Cercospora leaf spot of sugar beets. The positive outcomes lead to further testing from 2004 to 2011. LifeGard continues to be funded in IR-4 efficacy projects, such as organic management of black rot in brassica and downy mildew of spinach in 2017. In 2017, LifeGard was awarded "Best New Biological Product." It was recognized as the first biopesticide that works by inducing resistance to fungi and viruses, with no direct antagonism.

IR-4 funded an efficacy trial for BioProdex's SolviNix (Tobacco Mild Green Mosaic Virus) in 2011. This project was focused on the ability of the product to control the invasive tropical soda apple (*Solanum viarum*) in the Southeast. At the time, a petition to register SolviNix was already under EPA review. In 2015, SolviNix won the Agrow Award for "Best New Biopesticide" due to being the world's first bioherbicide containing a plant virus as the active ingredient. As such, the product was noted to control its target in a highly specific and rapid manner known as a hypersensitive response. IR-4 submitted the registration package for SolvinNix to EPA resulting in the registration.

Regalia Biofungicide began its journey at IR-4 as Milsana in 1999. It was evaluated in many field trials for control of pathogens such as powdery mildew and botrytis on a variety of fruits, vegetables, and ornamentals. The IR-4 Project prepared the data package and submitted the tolerance petition to the Biopesticides and Pollution Prevention Division of EPA and registration was approved in 2005. The registration was transferred to Marrone Bio Innovations who further developed the product under the current trade name, Regalia. Through numerous IR-4 trials and researchers, Regalia exhibited a wide range of efficacy against various diseases. Regalia Biofungicide was recognized by the Agrow Awards in 2010 for its successful introduction and impact on the market. This product won the "Best New Biopesticide" category for its induced systemic resistance and synergistic effects with conventional fungicides. Regalia continues to be funded in IR-4 efficacy projects, such as organic control of downy mildew on basil and spinach in 2015 and 2016 respectively.

Out of the products IR-4 has enabled to achieve EPA registration, a significant number have gone on to achieve recognition for their value in the agricultural world. IR-4 has supported these awarded products through registration and efficacy testing, allowing for their acceptance and wide use today. IR-4 will continue to aide in procuring registrations for such exceptionally useful products.

Tolerance Successes Nov. - Jan.

Federal Register: Nov.r 14, 2017

Benzovindiflupyr Trade Name: Aprovia, Elatus **Crops:** Bulb onion subgroup 3-07A, Green onion subgroup 3-07B **PR#:** 11129, 11130

Federal Register: Dec. 4, 2017

Ethofumesate Trade Name: Willowood Ethofumesate **Crops:** Sugar Beet **PR#:** 11126

Quinclorac Trade Name: Quinclorac **Crops:** Asparagus, Bushberry subgroup 13-07B, Caneberry subgroup 13-07A **PR#:** 08295, 10435, 10436

Prometryn Trade Name: Caparol **Crops:** Sesame, Leaf petiole vegetable subgroup 22B, Florence fennel, Celtuce, Swiss chard, Cottonseed subgroup 20C **PR#:** 11178, 11987, 11988, 11989, 11990, 11991

Federal Register: Jan. 26, 2018

Difenoconazole Trade Name: Inspire, Quadris **Crops:** Guava, Papaya, Cranberry, Head and stem brassica vegetable group 5-16, Brassica leafy greens subgroup 4-16B, Small vine climbing fruit except fuzzy kiwifruit subgroup 13-07F, Kohlrabi **PR#:** 10172, 10802, 10828, 11863, 11864, 11866, 11922

New Study Director

HQ Welcomes New Study Director

Thomas Pike has joined the team at HQ as the new Assistant Coordinator in entomology. In this position, Tom will oversee certain national activities for the IR-4 Project to gain regulatory approval of crop protection technology on fruits, vegetables, nuts, herbs and other specialty food crops. His specific duties will be to manage studies, assemble research data, and write and submit regulatory packages suitable for submission to worldwide regulatory agencies and assist registrants with product labeling.

Tom comes to IR-4 with 10 years of research experience including conducting laboratory and field research with Dr. George Hamilton at Rutgers University, on the biology and management of brown marmorated stink bug. At the University of Maryland, he continued his work with the brown marmorated stink bug under Dr. Paula Shrewsbury, looking at the use of fungi as a form of biological control.

He has worked for the Middlesex County, NJ, Mosquito Commission and was more recently a research associate at Sanaria, a biotechnology company developing vaccines protective against malaria. There he was responsible for rearing aseptic and non-aseptic mosquitoes according to Good Manufacturing Practices and performed experiments to improve mosquito production and parasite yield.

Tom received an MS in Entomology from the University of Maryland and a BS in Marine Science (Marine Biology) with a minor in Entomology from Rutgers University.

He can be reached at 732.932.9575 x 4628 and tpike@njaes.rutgers.edu.

Welcome Tom.

The IR-4 Project

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