

# The IR-4 Project 50 Years of Sustained Success



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## Table of Contents

|   |    |
|---|----|
| Introduction.....                           | 4  |
| The Early Years.....                        | 5  |
| Leadership & Organizational Structure ..... | 6  |
| Funding .....                               | 13 |
| Strategic Planning .....                    | 15 |
| The Food Program.....                       | 17 |
| Ornamental Horticulture Program.....        | 27 |
| Biopesticide and Organic Support.....       | 30 |
| Animal Drug.....                            | 31 |
| Public Health Pesticide Program .....       | 31 |
| Crop Protection Industry.....               | 32 |
| The Process.....                            | 33 |
| Value & Impact .....                        | 36 |
| Hall of Fame/Other Awards.....              | 37 |
| The Future.....                             | 38 |
| Appendixes .....                            | 40 |

## **INTRODUCTION**

Celebrating a half century anniversary for any government funded program is a significant milestone, and for the IR-4 Project's its 50<sup>th</sup> year anniversary is no exception. Since 1963, the IR-4 Project has been the major factor in facilitating the registration of crop protection tools for U.S. specialty crop growers. Specialty crops are grown on limited acreage and often have a high economic value; collectively estimated at \$67 billion annually in 2011 (Clark).

Almost all food crops we consume, e.g. fruits, vegetables, nuts, herbs, and spices as well as non-food crops such as landscape plants and flowers are considered specialty crops. The pests that damage crops do not discriminate between major crops (corn, soybean, cotton, wheat/small grains, etc.) and specialty crops. Crop protection technology is often needed to prevent significant damage to the quality and yields of crops. However, the agrochemical industry often lacks the financial incentives to expand registration for their products to the specialty crops. This is due to limited sales, high crop damage liability concerns and the significant expense to develop the data to support a registration of a specialty crop. The same situation exists for minor uses on major crops. The lack of crop protection products for specialty crops and minor uses on major crops is called the "Minor Use Problem" and the IR-4 Project was formed to solve this problem for US growers.

The IR-4 Project operates as a unique partnership between the U.S. Department of Agriculture (USDA) – both the National Institute of Food and Agriculture (NIFA) (formerly called the Cooperative State Research Education and Extension Service or CSREES), and the Agricultural Research Service (ARS), the State Agricultural Experiment Stations (SAES), the U.S. Environmental Protection Agency (EPA), the agrochemical industry, commodity groups, and growers. In recent years, additional partnerships have been formed with USDA- Foreign Agricultural Service (FAS) which supports international specialty crop export activities, Animal Plant Health Inspection Service (APHIS) to work on selected invasive species, and the Department of Defense's Deployed Warfighter Protection Program to provide regulatory support for public health pesticides.

The Mission Statement for the IR-4 Project is simply to; "Facilitate Registration of Sustainable Pest Management Technology for Specialty Crops and Minor Uses". Stakeholders gain numerous benefits from the IR-4 Project's efforts, including: Growers--pest management solutions for traditional and organic farmers to maintain productivity and competitiveness; Food Processors--a dependable, safe and economic food source; Consumers--a safe, wholesome, affordable, varied, and nutritional food supply.

From a humble beginning in 1963 with only two staff members and a \$25,000 budget to a staff of 125 full time equivalent members and a budget of over \$37 million (\$19 million direct support and \$18 million indirect/in-kind support), the IR-4 Project has made a major impact on U.S. agriculture with over 26,000 specialty crop registrations.

## **THE EARLY YEARS**

In the late 1950's, as a national system for the registration of pesticides continued to develop, the SAES Directors, university extension agents, and USDA recognized the need to develop processes for registering agrochemicals for use on specialty crops and for minor uses on major crops. The project concept began in early 1960 when the University of California proposed to the National Agricultural Chemical Association (NACA) the need for registration of chemicals on minor crops. NACA supported this suggestion and asked the Director of the California Agricultural Experiment station to determine if the State Agricultural Experiment Stations could participate in this type of work (Markle, Baron and Holm 2002). The Western Agricultural Experiment Station Directors approved this idea and solicited the cooperation of other regional associations. The Experiment Station Committee on Policy (ESCOP) agreed with the principle of the program and requested a feasibility study. The study indicated that most states had a similar problem and that not only was the project feasible but highly necessary to meet a host of needs.

In 1962, the SAES Directors became extremely concerned about the legal availability of specialty crop pest management tools. A list of 548 urgently needed pest control product uses was developed. The SAES Directors requested the USDA's help to solve this Minor Use Problem and as a result the IR-4 Project was established on July 1, 1963 as an Interregional Research Project with the title: *Evaluation of Current Data and Needed Research to Determine Tolerance Limits of Chemicals for Minor Uses on Agricultural Products*. Because of the interest and concern expressed by the State of New Jersey, the National Headquarters and overall program coordination were placed on the campus of Rutgers' University, College of Agriculture (since renamed Rutgers University School of Environmental and Biological Sciences) in association with the New Jersey Agricultural Experiment Station (NJAES). The NJAES titled the project: *The Clearance of Chemicals as a Public Service*. There were synergies in placing the program in New Jersey because the NJAES was involved in other major agrochemical projects on the fate of these chemicals on the environment. Also, New Jersey, at that time, was the headquarters of many agrochemical companies.

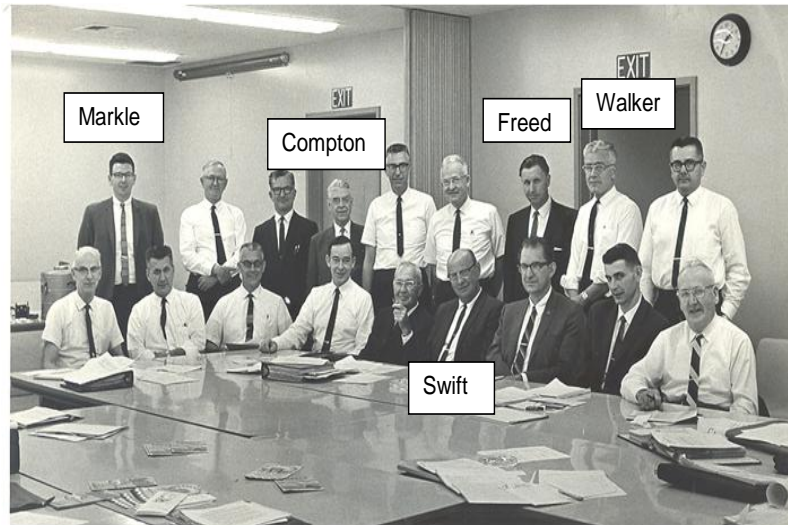
Several government agencies and industry groups endorsed the principal of the IR-4 Project and expressed interest in cooperation. They included the Food and Drug Administration, (FDA), the USDA-ARS's Pesticide Regulation Division (the precursors to the EPA's Office of Pesticide Programs), and the National Agricultural Chemicals Association (now called CropLife America or CLA).

The importance of the IR-4 Project was demonstrated early in its history when on April 13, 1966, USDA proposed to cancel all "No-Residue/Zero Residue" registrations within a five year period. IR-4 received numerous requests to help save the "older" agrochemical uses that were not being defended by registrants due to the expenses involved. IR-4 developed and facilitated a strategy with interested parties to defend uses on specialty crops where the chemical was already being defended by registrants on major crops. By the end of 1967, IR-4 obtained extensions for 38 pesticides on 129 crops.

### **LEADERSHIP & ORGANIZATIONAL STRUCTURE**

Since its inception, the IR-4 Program has operated under the guidelines for regional research as developed by the Cooperative State Research Service (CSRS) and subsequent successors. The project leadership consisted of two committees: an Administrative Advisory Committee consisting of a member from each of the four USDA agricultural

regions, and a Technical Committee consisting of a voting member representative from each participating region and appointed by the director of the SAES, an Administrative Advisor, and a CSRS representative. Subsequently, the IR-4 National Director and the Agricultural Research Service representative were added to the committee as voting members. The Technical Committee was abolished in 1997 and the Project Management Committee (PMC) was formed to take its place with similar responsibilities. Below is a Photo from the 1966 IR-4 Technical Committee Meeting at IR-4 Headquarters at Rutgers University.



The Project Management Committee (PMC) serves as the Board of Directors for the IR-4 Project. The PMC meets three times a year to develop policies and procedures, to set operational budgets within funding limitation, to review the status of ongoing programs, and to insure the program's overall goals are being met. The PMC members consist of the IR-4 Project Executive Director (formally called National Director), the four Regional Directors, the ARS Minor Use Program Director, the IR-4 Administrative Advisors (one for each of the four regions, and the USDA/ARS Administrator and the USDA-NIFA Director), the USDA-NIFA IR-4 National Program Leader and the Commodity Liaison Committee (CLC) Chair. The IR-4 Executive Director, the four Regional Directors, ARS Minor Use Program Director and the CLC Chair are voting members. The Chair for the PMC is elected from the voting members. A full roster of PMC/Technical Committee members are documented in IR-4 Project Management Committee/Technical Committee Representatives table, below.

IR-4 Project Management Committee/Technical Committee Representatives\*

**Northeast Region**

Administrative Advisor: Dan Rossi, Mark Robson, Bruce Carlton, Rod Sharp, Darrell Lund, Roger Wyse, David Brown, R. M. Hermann, G.F. Walton, W.C. Keppard, Ordway Starnes  
 Regional Director: David Soderlund, Richard Durst, Terry Spittler, John Burke, B.R. Wilson, Baily Pepper

**North Central Region**

Administrative Advisor: Doug Buhler, Gary Lemme, Kirklyn Kerr, Eldon Ortman, Roger Wyse, John Mahlstedde, J. Collenbach,  
 Regional Director: Robert Hollingworth, F. Matsumura, R. Ruppel, R. J. Sauer, P.A. Daum. J.E. Fahey, R.L. Janes, P.H. Woodley

**Southern Region**

Administrative Advisor: Mary Duryea, Neal Thompson, Vernon Perry, Howard Wilkowske,  
 Regional Director: Marty Marshall, Cheng Wei, Willis Wheeler, Neal Thompson William Eden, C.H. Van Middeltem

**Western Region**

Administrative Advisor: Mary Delany, Mike Parrella, Andre Lauchli, George Ware, I Thompson, L. Rasmussen, W.M. Dugger, D. Rolston, K.W. Hill, A.M. Boyce

Regional Director: Ron Tjeerdema, Marion Miller-Sears, T. Shibamoto, Jim Seiber, W.W. Kilgore, Virgil Freed

**ARS**

Administrative Advisor: Sally Schneider<sup>1</sup>, Nancy Ragsdale<sup>1</sup>, Richard Parry<sup>1</sup>, Ralph Ross<sup>1</sup>, E. Knipling, Terry Kinney, T.W. Edminister ( <sup>1</sup>represent ARS Administrator)

Program Director: Paul Schwartz, Kenneth Walker

**IR-4 Executive Director:** Jerry Baron, Robert Holm, Richard Guest, George Markle, Robert Kupelian, Charles Compton

**NIFA/CSREES/CSRS:** Rob Hedberg, Monte Johnson, James Parochetti, H. Teague, Kenneth Dorschner, Robert Riley, R. J. Sauer

**Commodity Liaison Committee Chair:** Rich Bonanno, Rocky Lundy, Jere Downing, Larry Elworth

\*Incumbent listed first followed by most recent

Five individuals have served as the uppermost administrative head of the IR-4 Project and are responsible to the PMC for overall coordination of the program. The Technical Committee chose Charles C. Compton, a well-known entomologist with experience in the university system and the agrochemical industry as the first National Project Leader. The other beginning employee was George Markle, who served as Compton's assistant, who later became Associate Director and Co-Director.

During the 1970's IR-4 Project Headquarters expanded from the initial staff of two to a 10-person program by the end of the decade. Compton retired in 1977 and was one of the early recipients of the IR-4 Hall of Fame Award for his many contributions. Compton was replaced by Robert Kupelian, a chemist with experience in the agrochemical industry.

Kupelian, who's tenure as the as the National Director spanned from 1978 to 1990. Kupelian was instrumental in the establishment of the National Animal Drug Program, which was initially dovetailed with the IR-4 program. For a period, Markle and Richard (Dick) Guest served as Co-Directors until Guest became sole National Director in 1990. He was instrumental in leading IR-4's response to FIFRA 88 and developing a strategy to respond to new regulatory demands of the Food Quality Protection Act of 1996 (FQPA) and encouraged IR-4's efforts to promote work with reduced risk pesticides. Guest retired in 1998. Both Dick Guest and George Markle have been inducted into the IR-4 Hall of Fame.

Robert (Bob) Holm was hired in 1998 to assume the Executive Director position after a long career in research and development management roles in the crop protection industry. He was instrumental in forging many partnership initiatives with the EPA and the agrochemical companies. This allowed IR-4 many the new opportunities to pursue new chemistries on specialty crops as part of the reduced risk strategy. After serving as the national leader for IR-4 for eight years, Holm retired in 2006 as the Executive Director. Bob Holm received the Agrow Lifetime Achievement Award based on his many contributions to agriculture, especially his IR-4 contributions. He was also inducted into the IR-4 Hall of Fame in 2006.

Following Holm as IR-4 Executive Director is Jerry Baron. Baron joined IR-4 in 1986 upon completing his degree from North Carolina State University and has worked in numerous roles within IR-4 during his 25+ year

tenure. He was instrumental in expanding and supporting IR-4's international activities and establishing IR-4's Public Health Pesticide Registration objective.

Below are Photos of IR-4's National/Executive Directors; from left to right: Dr. Charles Compton, Dr. Robert Kupelian, Dr. Richard Guest, Dr. Robert Holm and Dr. Jerry Baron.



The IR-4 Project Headquarters staff provides overall program coordination with the four regions, the USDA-ARS, the EPA, the crop protection industry, Commodity Liaison Committee and numerous other internal and external partners. This group is part of Rutgers, The State University of New Jersey and the New Jersey Agricultural Experiment Station and has been housed in various locations both on and off the Rutgers University-Cook Campus.

The IR-4 Project Regional offices and Regional "Leader" Laboratories were established in 1975 to provide IR-4 with field and laboratory research capacity. The US is divided into four regions with the IR-4 Regional Offices/Laboratories being located in and associated with the host Land-Grant Institutions. The locations are:

- Northeast Region – New York State Agricultural Experiment Station; Geneva, NY
- North Central Region - Michigan State University; East Lansing, MI
- Southern Region - University of Florida; Gainesville, FL
- Western Region - University of California; Davis, CA

All of these units operate independently, receiving separate portions of the IR-4 grant from USDA-NIFA and under the leadership of a Regional Director (PMC member). Each Regional Director is responsible for the staff budget, and programs in their region managed by Regional Field Coordinators (RFC), Regional Laboratory Coordinators (RLC), and Regional Quality Assurance Coordinators (RQAC). The roster of key regional research coordinators since the IR-4 analytical laboratories and regional offices were opened are documented in IR-4 Historical Key Regional Research Coordination Personnel table, below.

**IR-4 Historical Key Regional Research Coordination Personnel**  
(Incumbent listed first followed by most recent)

**Northeast Region**

Regional Field Coordinator: Edith Lurvey, John Martini, Paul Baker, Chand Watve  
Regional Lab Coordinator: Wlodzimierz Borejsza-Wysocki, Chris Lam, Pim Larson-Kovach, Terry Spittler  
Regional QA: Michelle Humiston, Barbara Anderson, Denise Snook,

**North Central Region**

|                               |  |
|-------------------------------|--|
| Regional Field Coordinator:   | Satoru Miyazaki, T. Dudek  |
| Regional Lab Coordinator:     | Sue Enhardt, Wayne Jiang, Dick Leavitt                                   |
| Regional QA:                  | Zhongxiao Chen, Chris Vandervoort  |
| <b><u>Southern Region</u></b> |  |
| Regional Field Coordinator:   | Michelle Samuel-Foo, Charlie Meister                                     |
| Regional Lab Coordinator:     | Wlodzimierz Borejsza-Wysocki, Jau Yoh, Promode Bardalaye, Neal Thompson  |
| Regional QA:                  | Kathleen Knight, Sam Fernando  |
| <b><u>Western Region</u></b>  |  |
| Regional Field Coordinator:   | Rebecca Sisco, Margaret Reiff, Ron Hampton, Rick Melnicoe, Harold Alford |
| Regional Lab Coordinator:     | Matt Hengel, Chuck Mourer, Jim Stokes, Tom Archer                        |
| Regional QA:                  | Martin Beran, Jim McFarland  |
| <b><u>ARS</u></b>             |  |
| GA Lab                        | Tom Hendrick, Don Wauchope, William Rhode                                |
| WA Lab                        | Todd Wixon, Ron Sell, Les McDonough                                      |
| MD Lab                        | Emile Pfeil, Al Herner, Ken Hill   |

All regions have an analytical laboratory with the exception of the Northeast Region. In 2008, the PMC made a decision to shut down one laboratory because the capacity to analyze residue samples far exceeded the funds available and IR-4's ability to produce new residue samples in its field trials. Savings from the laboratory phase-out would be reinvested in the upgrading of equipment at the remaining laboratories

The RFCs are responsible for working with stakeholders to identify needs and for assigning field residue trials at the Field Research Centers located within their regions from the projects prioritized the previous year by stakeholders at the annual Food Use Workshop. The final residue trial locations are coordinated with IR-4 Headquarters staff to ensure the studies are conducted in the appropriate EPA geo-climatic zones according to EPA guidelines. The actual field residue trials are conducted by the Field Research Directors (FRD) at research farm locations.

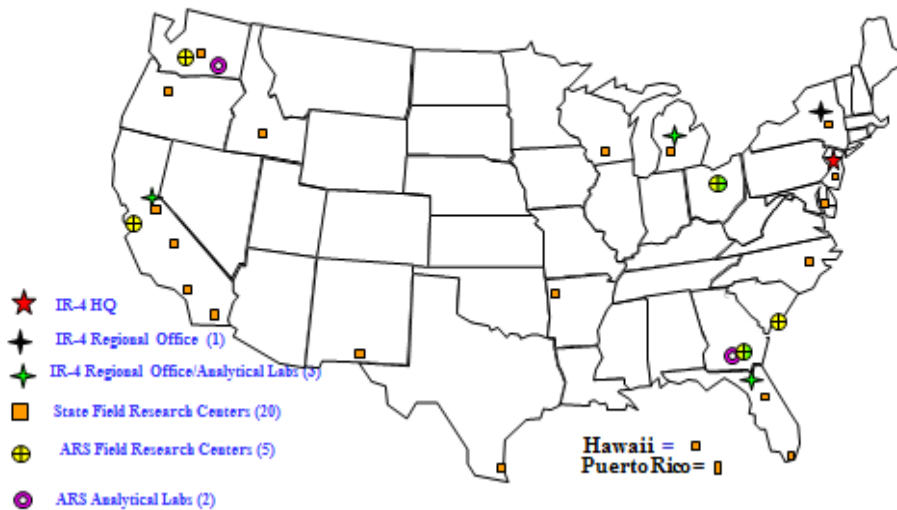
The USDA Agriculture Research Service (ARS) Minor Use Program has its own funding and it works in close coordination with the Headquarters and Regions to conduct specialty crop residue and product performance at its dedicated sites. USDA-ARS also cooperates with ornamental efficacy trials. The program has been led since 1976 by Dr. Paul Schwartz who has provided leadership and continuity not only to the ARS part of the program but also the entire program through his role in the IR-4 Technical Committee/Project Management Committee where he has served multiple terms as the Chair.

Figure 1: Diagram showing the locations of the IR-4 Food Program Infrastructure.





## IR-4 Food Program Infrastructure



The IR-4 network includes a State Liaison Representative (SLR) in every state and US territory. The SLRs are chosen by the state/territory SAES Director. This individual is asked to provide support for their state specialty crop growers by conveying their needs to the IR-4 Program. A key responsibility of SLR's is to encourage the submission of PCR's to document the pest management needs of their specialty crop growers.

A key external stakeholder group, named the Commodity Liaison Committee or CLC, was formed in 1991 to provide the program with guidance on how to best serve the specialty crop growers they represented. The CLC serves as a bridge between the specialty crop growers it represents and IR-4 to assure that the program continues to focus on important pest management problems. The CLC serve as an important stakeholder group to provide guidance and advice on ways in which the program can best serve the needs of specialty crop growers. Additionally, the CLC encourages its members, other commodity organizations and specialty crop growers to submit Project Clearance Requests (PCR's) to define pest control problems needing IR-4 support. The CLC also communicates the IR-4 mission to the broad agriculture community and provides grower level visibility on specialty crop issues. Another important role of the CLC is to support federal IR-4 funding and budget support initiatives to maintain a viable research and registration program. The historical listing of IR-4 Commodity Liaison Committee members is found in below.

### **IR-4 Commodity Liaison Committee members, 1991-2013**

|            |  |             |  |            |                             |             |
|------------|--|-------------|--|------------|-----------------------------|-------------|
| Aerts, M   | Florida Fresh Fruit and Vegetable Assoc. | 2001-       |  | Murphy, L  | Society of America Florists | 1991 - 1993 |
| Ahrens, D  | Twin Gardens Farms                       | 1992 - 1995 |  | Obenauf, G | CA Prune, Raisin, Walnut    | 1991 - 1995 |
| Allman, G  | Mint Industry Research Council           | 1991 - 1992 |  | Olszack, R | Grower                      | 1991 -2010  |
| Arney, M   | National Watermelon Board                | 2005 -      |  | Pittsz, M  | Cranberry Institute         | 2002 - 2004 |
| Balling, S | Del Monte                                | 1993 - 2000 |  | Phelps, L  | American Mushroom Institute | 2009 -      |
| Baumann, K | WI Ginseng                               | 2008        |  | Prewett, R | TX Vegetable Assoc.         | 1994 -      |
| Burger, L  | California Specialty Crops Committee     | 2008        |  | Ratto, R   | Grower                      | 1993 -      |
| Bledsoe, B | Village Farms                            | 2008-       |  | Rawlins, S | Farm Bureau                 | 1992 - 2001 |

|              |  |             |  |                |                                       |             |
|--------------|--|-------------|--|----------------|---------------------------------------|-------------|
| Bonanno, R   | Grower                                   | 1992 -      |  | Regelbrugge, C | American Nursery and Landscape Assoc. | 1992 - 2004 |
| Botts, D     | Florida Fresh Fruit and Vegetable Assoc. | 1991 - 2000 |  | Romang, R      |                                       |             |
| Buurma, B    | Grower                                   | 2005 -      |  | Schmale, L     | Society of America Florists           | 1993 -      |
| Cranney, J   | California Citrus Quality                | 2009-       |  | Schreiber, A   | Agriculture Development Group         | 2009        |
| Davenport, T | National Grape Cooperative               | 2006 - 2010 |  | Scholz, T      | USA Dry Pea & Lentil                  | 2005-       |
| Downing, J   | Cranberry Institute                      | 1991 - 1998 |  | Sharp, J       | CA Strawberry                         | 2001 - 2003 |
| Elworth, L   | PA Apple Marketing                       | 1991 - 1994 |  | Sorbello, M    | NY Potato                             | 1991 - 2000 |
| Ewart, W     | CA Citrus                                | 1991 - 2009 |  | Spencer, B     | AZ Citrus                             | 1999 - 2002 |
| Flood, B     | Del Monte                                | 2001 -      |  | Teffeau, M     | American Nursery and Landscape Assoc. | 2005 -2013  |
| Freeman, R   | Farm Bureau                              | 2005 - 2009 |  | Traino, P      | NJ Vegetable                          | 1991 - 1998 |
| George, A    | US Hops                                  | 1991 -      |  | Trinka, D      | MBG Marketing                         | 1997 -      |
| Giclas, H    | Western Growers                          | 2005 -      |  | Zellers, R     | MI Vegetable                          | 1991 - 1996 |
| Humfield, T  | Cranberry Institute                      | 2013 -      |  | Zuleger, D     | WI Potato & Vegetable Assoc.          | 1995 - 2002 |
| Jewett, V    | United Fresh Fruit & Vegetable           | 1993 - 1996 |  | Wegmeyer, T    | American Farm Bureau                  | 2010-2013   |
| Keeling, J   | National Potato Council                  | 2006        |  |                |                                       |             |
| Kesner, C    | Cherry Marketing Institute               | 1993 - 1995 |  |                |                                       |             |
| Kodet, T     | Bruce Church                             | 1991 - 1996 |  |                |                                       |             |
| Korson, P    | Cherry Marketing Institute               | 1995        |  |                |                                       |             |
| Kurtz, E     | CA Lettuce                               | 1992 - 2005 |  |                |                                       |             |
| Lister, A    | MI Cherry Committee                      | 1991 - 1993 |  |                |                                       |             |
| Lundy, R     | Mint Industry Research Council           | 1992 -      |  |                |                                       |             |
| Maurer, E    | Crop Life America                        | 2003 -      |  |                |                                       |             |
| McCloud, S   | Almond Board                             | 1991        |  |                |                                       |             |
| Melban, K    | CA Pepper                                | 2005 - 2007 |  |                |                                       |             |
| Montoian, R  | CA Grape & Tree Fruit                    | 1991        |  |                |                                       |             |

The first Chair of the CLC was Larry Elworth who represented the Pennsylvania's apple industry. The next CLC Chair was Jere Downing of the Cranberry Institute followed by Rocky Lundy, Executive Director of the Mint Industry Research Council. Lundy was passionate in keeping IR-4 on the appropriate path to help specialty crop growers find solutions for their pest management problems. His efforts with the PMC helped facilitate unprecedented expansion within the IR-4 Project. Equally important, Rocky often led fierce budget battles like the one in FY 2005 that resulted in a \$1.7 million increase after an unexpected 11<sup>th</sup> hour cut of 1.1 million in the FY 2004 budget. In 2012, Rich Bonanno, a vegetable and flower grower from MA took over the leadership of the CLC. Bonanno coordinated specialty crop grower's response to the USDA's proposed consolidation of IR-4 with five Integrated Pest Management programs to form a new program called Crop Protection. Through his efforts, many in the specialty crop community including CLC members, members of the Minor Crop Farmers Alliance, individual growers and allied industries contacted government officials and encouraged them to remove IR-4 from this consolidation plan. Below is a picture from Commodity Liaison Committee educational luncheon in Rayburn House Agriculture Building, February, 2011 with Rocky Lundy as the speaker.



## FUNDING

Government funding and support for the IR-4 Project started with the initial investment of \$25,000 by the SAES in 1963. The funding source for this investment was “off the top” funds from Hatch Act or Regional Research Funds (RRF) account. These resources were provided to Rutgers University to cover the salaries of Dr. Compton and Professor Markle. The culture of fully utilizing “in-kind” contributions and partnership was established at the very beginning of IR-4. Here, several USDA Projects provided data to assist IR-4 with its mission. The cooperating Project included:

- Northcentral Project 19 - Fundamental problems associated with the accumulation of pesticide chemicals in soil;
- Northcentral Project 33 - Pesticide residues in or on food, feed, and forage crops;
- North East Project 36 - Pesticides in or on raw agricultural commodities;
- Southern Project 22 - Pesticide residues in plant and animal products and soils;
- Western Project 45 - Pesticide residues – their nature, distribution, and persistence in plants, animals, and soils.

Funding for IR-4 through RRF increased to over \$100,000 annually by 1975. During this time, the Project had proven its value and realistic efforts were being made to expand resources. In 1975, Congress allocated funds under Public Law 89-106-Special Research Grants (SRG) to support the establishment of Regional Leader Laboratories (Regional Offices) which provided, for the first time, the opportunity for IR-4 to directly develop residue data. Field Coordinators were hired to manage the field research and analytical laboratories were established to analyze crops for residues. John Mahelstede, Associate Director at Iowa State University and IR-4 Administrative

Advisor from the Northcentral Region was instrumental in obtaining these dedicated funds for these research operations.

These new Special Research Grant (SRG) funds were provided with the oversight of USDA-Cooperative State Research Service (later renamed Cooperative State Research, Extension and Education Service-CSREES and now known as the National Institute of Food and Agriculture-NIFA). Since this first appropriation, this group has provided grants to IR-4 totaling nearly \$222.439 million.

In 1976 ARS allocated \$410,000 from its budget to initiate a minor use pesticide program. These funds were obtained thru the efforts of Waldemar Klassen, Paul Schwartz and Warren Shaw of the ARS National Program Staff. The majority of funds were given to ARS personnel at field sites and chemists at analytical laboratories to participate in IR-4 managed residue studies.

From 1975 until 1990 the SRG and RRF funding gradually increased until it reached just under \$2 million. It increased to \$3 million in 1991 and by 1995 it had nearly doubled to over \$5 million. In 1998 it went to over \$8 million and has remained around \$10-12 million from 2002 to the present. ARS funds also increased during this period from about \$2 million in the 1990's to around \$4 million.

This decade between 1980 and 1990 was very financially challenging for IR-4. During certain years, the President, in his fiscal year budget proposal, did not any recommend funding for the IR-4 Project. The IR-4 Project was in a budget category with other programs that were considered non-essential. Fortunately, due to the efforts of certain commodity associations, Congress kept IR-4 funded during their appropriation deliberations.

The crop protection industry also provides unrestricted grants that IR-4 can use where most needed such as contracted field sites that often cost more than SAES sites, laboratory, and report writing efforts as well as funding for other key programs and workshops, IR-4 was able to use the external unrestricted funding from the crop protection industry to continue programs. Since 1988, the combined contributions from the companies have exceeded \$19 million to support IR-4 activities.

Starting in 2010, IR-4 has faced some significant challenges with respect to funding and governmental reorganization. Adequate funding remains the most critical current and future challenge for IR-4. Since 2011 there have been cuts in federal government funding with the potential for more cuts in the future. The most devastating cuts occurred in 2013 in association with Budget Control Act of 2012 or The Sequester, Here, IR-4 funds were reduced by 7.6% These cuts forced IR-4 to reduce the number of new research projects that solve grower problems. Additionally, completion of some research projects was delayed, essential travel was reduced, planned laboratory equipment purchases were delayed and some personnel positions were not replaced. Complicating the funding cuts were large increases in operating expenses. These drastic cuts were occurring the same time fixed operational expenses are rapidly increasing.

In February 2012, USDA released a proposal to consolidate the IR-4 Project with several Integrated Pest Management (IPM) programs. The President's Fiscal Year 2013 funding plan called for the transfer of funds traditionally provided for IR-4 activities and five IPM programs to a new consolidated program called Crop

Protection. Many specialty crop growers and others in the minor use community had critical concerns about the impact of including IR-4 in this IPM consolidation plan. Over the years, the CLC has come to IR-4's rescue when Congress was considering cutting the annual budget. However, it was never more important than in 2012 when the CLC led by Chair, Rich Bonanno, led an initiative of nearly 100 commodity/stakeholder groups supporting the continued independence of IR-4. Broad grassroots support informed Congress and USDA of the need to keep IR-4 as a stand-alone program and fortunately, the President's proposal was not enacted.

With the diversification of IR-4's research activities, there are new sources of funding. The Department of Defense, under a cooperative agreement with USDA-ARS, funds the public health pesticide program at approximately \$250,000 annually. The USDA-Foreign Agriculture Service has funded much of IR-4's international efforts. More recently, the World Bank, through its Standards and Trade Development Facilities grants program, has provided resources for international capacity building activities. The newest funding source is USDA-APHIS which has provided resources to do research work on invasive pests. A comprehensive accounting of IR-4 funding since the beginning is found in the Total IR-4 Project Funding History – 1963 to 2013.

**Total IR-4 Project Funding History (x \$1,000)<sup>1</sup>**

| FY    | RRF   | SRG     | ARS     | Animal Drug | Global | APHIS | PHP | Industry | Misc  | Total    |
|-------|-------|---------|---------|-------------|--------|-------|-----|----------|-------|----------|
| 63-74 | 592   |         |         |             |        |       |     |          |       | \$592    |
| 75    | \$105 | \$250   |         |             |        |       |     |          |       | \$355    |
| 76    | \$110 | \$560   | \$410   |             |        |       |     |          |       | \$1,080  |
| 77    | \$135 | \$1,200 | \$910   |             |        |       |     |          |       | \$2,245  |
| 78    | \$135 | \$1,200 | \$910   |             |        |       |     |          |       | \$2,245  |
| 79    | \$150 | \$1,164 | \$910   |             |        |       |     |          |       | \$2,224  |
| 80    | \$158 | \$1,164 | \$910   |             |        |       |     |          |       | \$2,232  |
| 81    | \$176 | \$1,213 | \$910   |             |        |       |     |          |       | \$2,298  |
| 82    | \$200 | \$1,440 | \$910   | \$240       |        |       |     |          | \$35  | \$2,775  |
| 83    | \$227 | \$1,440 | \$1,100 | \$240       |        |       |     |          | \$70  | \$3,024  |
| 84    | \$254 | \$1,440 | \$1,100 | \$240       |        |       |     |          | \$58  | \$3,031  |
| 85    | \$289 | \$1,440 | \$1,100 | \$240       |        |       |     |          | \$70  | \$3,129  |
| 86    | \$320 | \$1,369 | \$1,100 | \$279       |        |       |     |          |       | \$2,935  |
| 87    | \$318 | \$1,369 | \$1,100 | \$229       |        |       |     |          | \$70  | \$3,003  |
| 88    | \$337 | \$1,369 | \$1,100 | \$229       |        |       |     | \$9      | \$35  | \$2,996  |
| 89    | \$352 | \$1,369 | \$1,100 | \$229       |        |       |     |          | \$35  | \$3,002  |
| 90    | \$347 | \$1,975 | \$1,100 | \$226       |        |       |     | \$10     | \$71  | \$3,601  |
| 91    | \$433 | \$3,000 | \$1,100 | \$450       |        |       |     | \$12     | \$40  | \$4,603  |
| 92    | \$456 | \$3,500 | \$2,100 | \$429       |        |       |     | \$92     | \$70  | \$6,218  |
| 93    | \$482 | \$3,500 | \$2,100 | \$429       |        |       |     | \$97     |       | \$6,180  |
| 94    | \$490 | \$6,373 | \$2,100 |             |        |       |     | \$291    |       | \$9,254  |
| 95    | \$490 | \$5,711 | \$2,100 |             |        |       |     | \$160    | \$50  | \$8,510  |
| 96    | \$482 | \$5,711 | \$2,100 |             |        |       |     | \$460    | \$10  | \$8,764  |
| 97    | \$514 | \$5,711 | \$2,100 |             |        |       |     | \$481    | \$10  | \$8,816  |
| 98    | \$482 | \$8,911 | \$2,100 |             |        |       |     | \$594    |       | \$12,087 |
| 99    | \$501 | \$8,990 | \$2,100 |             |        |       |     | \$303    |       | \$11,894 |
| 00    | \$482 | \$8,990 | \$2,100 |             |        |       |     | \$355    | \$60  | \$11,987 |
| 01    | \$482 | \$8,990 | \$3,100 |             |        |       |     | \$786    | \$288 | \$13,646 |

<sup>1</sup> RRF=Regional Research Funds/Hatch Funds; SRG=Minor Crop Pest Management (IR4) line under USDA-NIFA Improved Pest Control appropriations; ARS=Agriculture Research Service allocation complement IR-4 activities; Animal Drug; Global; funds mostly from USDA=Foreign Agriculture Service; APHIS-funds for invasive species research; PHP-funds for Public Health Pesticide activities through a joint grant from Department of Defense and ARS; industry- unrestricted funds to assist IR-4 in its research mission; MISC-other sources of funds

|              |                 |                  |                 |  |              |                |                |                |                 |                |                  |
|--------------|-----------------|------------------|-----------------|--|--------------|----------------|----------------|----------------|-----------------|----------------|------------------|
| 02           | \$481           | \$10,485         | \$3,600         |  |              |                |                | \$443          | \$63            | \$15,072       |                  |
| 03           | \$481           | \$10,743         | \$3,800         |  |              |                |                | \$1,040        | \$94            | \$16,158       |                  |
| 04           | \$481           | \$9,549          | \$4,000         |  |              |                |                | \$1,577        | \$189           | \$15,796       |                  |
| 05           | \$481           | \$11,142         | \$4,000         |  |              |                |                | \$1,623        | \$244           | \$17,490       |                  |
| 06           | \$481           | \$10,667         | \$4,000         |  |              |                |                | \$1,156        | \$359           | \$16,663       |                  |
| 07           | \$481           | \$10,667         | \$4,000         |  |              |                |                | \$1,485        | \$257           | \$16,890       |                  |
| 08           | \$481           | \$11,367         | \$4,000         |  | \$29         |                |                | \$1,618        | \$563           | \$18,058       |                  |
| 09           | \$481           | \$12,000         | \$4,000         |  | \$241        |                | \$250          | \$1,453        | \$234           | \$18,569       |                  |
| 10           | \$481           | \$12,180         | \$4,000         |  | \$331        |                | \$250          | \$1,022        | \$328           | \$108,342      |                  |
| 11           | \$481           | \$12,180         | \$4,000         |  | \$409        | \$155          | \$250          | \$1,022        | \$365           | \$18,862       |                  |
| 12           | \$481           | \$11,913         | \$3,900         |  | \$124        | \$567          | \$250          | \$1,149        | \$278           | \$18,663       |                  |
| 13           | \$444           | \$11,006         | \$3,570         |  | \$242        | \$591          | \$250          | \$1,299        | \$180           | \$17,452       |                  |
| <b>TOTAL</b> | <b>\$15,236</b> | <b>\$222,439</b> | <b>\$84,640</b> |  | <b>\$445</b> | <b>\$1,373</b> | <b>\$1,313</b> | <b>\$1,250</b> | <b>\$18,509</b> | <b>\$4,835</b> | <b>\$444,971</b> |

The above funding discussion refers to the direct funds IR-4 receives from government and other sources. There are significant additional contributions of “in-kind” contributions from many sources. It is estimated that for every direct dollar allocated to IR-4 there is AT-LEAST one additional dollar of in-kind support from contributions by SAES, US EPA, crop protection industry, Canada and commodity associations.

### **STRATEGIC PLANNING**

The 1989 Strategic Plan was the IR-4 Project’s first attempt to use the strategic planning process to address current challenges such as FIFRA 88 and longer term issues which included the expansion of both the Ornamentals and Biopesticide Programs. The Ornamentals Program received additional funding during this decade as did the Biopesticide Program. The plan also called for the establishment of strategically located field research centers to conduct food use residue trials according to Good Laboratory Practice (GLPs) regulations, as well as expanding the capacity of the existing SAES residue laboratories.

The 1995 to 2002 Strategic Plan reinforced the 1989 Strategic Plan’s major goals while it stressed a major shift in the program’s emphasis from supporting the re-registration of uses to “safer/reduced risk” pest control products while expanding the Biopesticide Program at the same time.

The 2001 to 2005 Strategic Plan continued to emphasize the importance of responding to the FQPA by targeting safer or reduced risk chemistries and biological pest control approaches. This was critical because specialty crop growers were faced with losing many of their older chemistries due to concerns about their acute and chronic toxicity especially to farm workers and pesticide applicators as well as environmental fate and impact on non-target organisms.

The fourth IR-4 Strategic Plan covered the years of 2006 to 2008 it was limited to only three years to synchronize future strategic plans with the USDA Project Review Process. This strategic plan expanded the scope of the original three core programs (Food Use, Ornamentals and Biopesticides) to include an initiative to pursue global harmonization of specialty crop residue levels (Maximum Residue Levels or MRLs). This new initiative was deemed important because domestic growers of specialty crops were looking to enhance export markets. However, pesticide tolerances in the US were often different from international standards. These differing standards restricted export to many foreign countries and serve as a trade barrier.

The fifth IR-4 Strategic Plan was developed largely by stakeholder suggestions during a 2008 Strategic Planning Conference. This plan put efforts into enhancing all three existing objectives. This included:

- Facilitate Identification of Pest Management Solutions to Answer Priority Grower Needs (Food Program)
- Harmonization of Maximum Residue Levels to Remove Pesticides as a Trade Barrier (Food Program)
- Invasive Species Management (Food and Ornamental Horticulture Programs)
- Registration Assistance for Products for Organic Markets (Biopesticide and Organic Support Program)

Besides reinforcing the initiatives in the previous strategic plans, the current strategic blueprint calls for a new initiative to facilitate the registration of chemistries that manage arthropod pests of medical concern which has grown into the current Public Health Pesticides (PHP) Program.

In addition to the IR-4 Project's Strategic Plan, there have been some noteworthy reports issued by the Federal government on the minor use issue. In 1991, Cooper Evans, then Special Assistant to President for Agriculture drafted a paper call "Loss of Safe Pesticides for Minor Crops: An Analysis". The Executive Summary including the following points:

- Production of fruits, vegetables and other specialty crops is in serious trouble. Consumer demand is strong. Yet US producers may lose this market opportunity unless policies are changed to assure availability of safe effective pesticides
- Minor use pesticides are endangered for economic, not safety reasons. Agrochemical companies cannot afford to develop or keep them on the market
- Clearly, funding of IR-4 has not been adequate to meet the needs of agriculture.

The Council for Agricultural Science and Technology issued a report in 1992 entitled "Pesticides: Minor Uses/Major Issues (Council for Agriculture Science and Technology Report 1992)," The conclusion of this report stated "***Solution of existing and anticipated minor crop/use pesticide related issues will require concerted and cooperative efforts by all parties including federal and state legislators and regulators, research, extension and marketing specialists, growers, and processors, manufacturers and formulators, and commodity groups. Only through the efforts of these parties can the needs of US minor crop producers be adequately addressed. Without such cooperative efforts, minor use issues will continue to escalate to the detriment of US agriculture, minor crop growers, and consumers***"

## **FOOD PROGRAM**

Since its inception 50 years ago, the IR-4 Project's main emphasis has been to support the regulatory approval of crop protection chemicals for specialty food crops and minor use on major food crops. Here the IR-4 Project has conducted residue studies and submitted over 3500 tolerance petitions to the government that have resulted in nearly

16,000 pest control clearances on specialty food crops. The pest control tools made available to U.S. specialty crop growers through IR-4 initiatives have helped growers avoid economic losses due to numerous pests and diseases. In addition, IR-4 has helped U.S. specialty crop growers produce the world's safest food with strict adherence to modern safety standards for humans and the environment.

The modern era for IR-4 started in 1975, when the USDA allocated funds to support the establishment of Regional Leader Laboratories (Regional Offices) which provided for the first time the opportunity for IR-4 to directly develop residue data. Scientific staff was hired to manage the field research and conduct residue analysis in the cooperating laboratories. .

The guidelines and requirements for the registrations of food use crop protection tools, IR-4's primary mission, have changed dramatically over the past 50 years from a rather unsophisticated (by today's standards) one administered by the USDA to the current highly complex program administered by the EPA. Additionally, a number of US pesticide laws were passed over the last 50 years that have had a dramatic impact on the way the IR-4 Program conducts business.

Up to 1973, IR-4 regulatory submissions were made to the USDA-ARS's Pesticide Registration Division. EPA was established to regulate all potential environmental pollutants in December of 1971. Under this new Federal Agency resides the Office of Pesticide Program (OPP). Within OPP, EPA has always allocated resources to specifically manage minor use submissions via the Minor Use Officer. Some of the Minor Use support personnel in the early years of EPA include, C.L. Smith, Wade Fowler, Henry Korp, Clinton Fletcher and Don Stubbs. To assist IR-4, EPA assigned one of their regulatory scientist, Drew Baker to IR-4 Headquarters in 1976. His duty was to provide advice to IR-4 research managers on studies and to do a pre-screen of regulatory submissions to ensure that all necessary information was clearly available.

In 1982, Hoyt Jamerson was selected as the EPA Minor Use Officer and his unwavering willingness to work with IR-4 to resolve regulatory issues facing petition submissions was valuable in obtaining regulatory clearances. Jamerson was presented with the IR-4 Hall of Fame Award when he retired as a result of his many contributions to the overall accomplishments to food use program.

The period after EPA's formation and until 1988 was rather uneventful. IR-4 submitted quality data, EPA reviewed the packages and in most cases new uses were approved. However, the 1988 Amendments to the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA 88), triggered a significant need for IR-4 to defend critical older chemistries. FIFRA 88 required the accelerated development of agrochemical residue data and their submission to the EPA using current (at that time) state-of-the-art analytical equipment and procedures to support the continued registration of pest control tools that were originally registered before November, 1984. This law placed tremendous data development burdens on the agrochemical industry registrants. IR-4 grower and commodity group stakeholders feared that many specialty crop and minor uses would not be defended by the registrants through this process due to the cost of developing the required new data to meet the tougher new guidelines.



Because of this concern, IR-4 developed a strategy to defend as many as 1,000 uses considered vulnerable to cancellation due to re-registration data requirements. The plan of action also received support from Congress in the form of additional resources to IR-4 to develop the necessary data. During the 10 year period after 1988, nearly two-thirds of IR-4's resources were tied up in this critical stakeholder-driven effort. The final accomplishment was that IR-4 was able to maintain the registrations of 700 uses deemed vulnerable. Other uses were not defended because the chemical registrant decided to cancel the entire chemical registration.

In 1989, EPA's Office of Compliance extended the Good Laboratory Practice (GLPs) regulations beyond laboratory toxicology studies to include field studies. IR-4 was now required to operate under the GLP regulations. This resulted in some fundamental changes in IR-4 research operations including having dedicated units for IR-4 research, standard processes in many aspects of research, the establishment of the Quality Assurance Unit (QAU), enhanced recordkeeping and identifiable study directors at IR-4 Headquarters who serve as single point of study control.

At this point, IR-4 stepped up its involvement with the crop protection industry and the National Agriculture Chemicals Association (NACA-since renamed CropLife America or CLA). Because IR-4 was a key and significant data submitter and policies and procedures undertaken in response to GLPs and FIFRA88 critically affected IR-4. IR-4 was asked to participate and serve on industry wide workgroups to help shape research practices. In this aspect, IR-4 personnel Baron and Schwartz were the primary authors of the initial crop zone maps or data regions for the US and working with NACA members were instrumental in determining the number of trials needed per crop in each region to establish a tolerance. Dr. Baron also led in the development of a standardized Field Data Notebook that still is the template of data collected in magnitude of the residue studies. IR-4 continues to maintain a presence on appropriate CropLife America committees and workgroups.

In 1993, IR-4 upgraded its GLP process with the hiring of specialized QAU staff and the implementation of the expanded IR-4 Field Data Notebook. Much of the credit for the establishment of the IR-4 QAU staff and GLP compliance measures goes to Tammy (White) Barkalow who was the first formal QAU employee and currently oversees the 12 member unit. Measures of the QAU program's successes included over 130 EPA inspections without any negative citations.

In November 2002, IR-4 management convened a Review Group to examine IR-4's GLPs and QA process. Specifically, the Review Group was charged to evaluate the structure and operations involving GLP compliance, and to offer recommendations for increased efficiencies and cost reductions. Seven recommendations were offered by the Review Group which have since been implemented and has improved the ability of IR-4.

In the mid-1990's IR-4 became aware of the crop protection industry's shift in research and discovery strategies to newer chemistries that had desirable characteristics for consumers and the environment such as low toxicity, short environmental life, and high specificity for the targeted pest with little impact on non-target plants and animals. Because of this exciting new trend, IR-4 started focusing its efforts on this lower risk approach which later became known as the IR-4 Reduced Risk Chemistry Initiative.

In 1996, Congress passed Amendments to FIFRA and the Federal Food, Drug and Cosmetic Act. These Amendments were collectively called the Food Quality Protection Act. These Amendments set a completely new, and much higher, standard for the reregistration of older agrochemicals and registration of new crop protection tools. FQPA imposed an additional 10x safety factor for children, required aggregate risk assessment which combined exposures to a single pesticide from all sources including the diet, water, and household use. (vs. earlier assessments that concentrated on dietary risks only), and cumulative risks from compounds with the same toxicity mechanism (i.e. organophosphates/OP's as a group). The Act required that nearly all of the 10,000 chemical tolerances in effect in 1996 be reassessed by 2006.

In addition to the new safety standards, there were some incentives in the FQPA language to encourage specialty crop registrations. The FQPA extended the exclusive 10-year data protection period for a registrant under FIFRA when specialty crops were added to product labels. For every three minor uses registered (within seven years of the initial registration) up to one additional year could be added to data protection rights for a maximum of three additional years. This provision to extend the exclusive marketing period has been a huge incentive for industry to register minor uses and to work with IR-4 to develop specialty crop uses for their new chemistries. Many registrants are now taking advantage of this incentive and it has also been written into Canadian law as well as European Union law.

The early years of FQPA implementation were not easy for EPA or IR-4. IR-4 went from 82 food crop clearances in 1996 to only one food crop clearance in 1997. This was due to the Agency's efforts to interpret and implement the FQPA passed by Congress in 1996. In the fall of 1998, Mr. Jim Jones, then Director of the Registration Division attended the IR-4 Food Use Workshop and worked with Bob Holm, to form the EPA/IR-4 Technical Working Group (TWG) which started meeting in 1999 with Mr. Jamerson and Dr. Daniel Kunkel as Co-Chairs. Hoyt was instrumental in that role until his retirement in 2004 when Ms. Barbara Madden assumed this role as Minor Use Officer and TWG Co-Chair.

Some of the initiatives implemented through these TWG meetings in associations with EPA's Chemical Scientific Advisory Committee (ChemSAC) included the following:

- Petition Summary templates for easier/quicker review by EPA, "Super Crop Groups" which saved IR-4 over \$1 million in laboratory and field trial expenses for Reduced Risk products (spinosad and azoxystrobin) and resulted in hundreds of new uses without generating any additional residue data.
- Screen Potential Research where EPA has agreed to pre-screened potential chemicals prior to the workshop in an attempt to help IR-4 focus on the chemicals with the clearest path towards registration. Chemicals classified as "Red Light" are not considered in the workshop, while "Yellow Light" materials are given higher scrutiny and "Green Lights" proceed without concern.

- Petition Bundling: The EPA worked with IR-4 to bundle or submit as many petitions on an individual active ingredient as possible and feasible in order to most efficiently utilize the Agencies resources for risk assessments and crop grouping opportunities.
- Reduced Risk Classification for Minor Crops: The EPA streamlined a format which IR-4 could use to propose studies to the Agency in a Reduced Risk Classification for minor/specialty crop.
- Work Share Program with California: The California Department of Pesticide Regulation (CDPR) has its own state regulatory review process to insure crop protection chemistries meet the standards set by state mandated guidelines. IR-4 helped facilitate this “Workshare Program” between the EPA and CDPR in 2000 where CDPR does regulatory reviews of selected IR-4 petitions important to California specialty crop growers with EPA granting the Federal registration, thus saving EPA valuable resources.
- Education tours for EPA scientists: IR-4 arranges a field tour of specialty crop agriculture for EPA staff each year to help them better understand how pesticides are used by growers and to make them more aware of how important these products are for production agriculture.

IR-4’s Methyl Bromide Alternatives (MBA) initiative started in 1998 and lasted to 2006. This initiative was critically important to certain specialty crop stakeholders. Methyl bromide is/was widely used by tomato, strawberry, pepper, cucurbit crops and ornamental growers as a soil fumigant to control a broad spectrum of soil diseases, nematodes, soil insects and weeds. However, methyl bromide is considered a Class 1 ozone depleting substance and is being phased out. IR-4 research, which was managed by Jack Norton and funded primarily through contributions from cooperating agrochemical companies, entailed field evaluations of alternative systems for strawberry and tomato with testing done in CA and FL by leading university researchers. In 2003, the program was expanded to peppers, eggplant, cucurbit vegetables, cut flowers, turf and ornamental bulb crops. The data developed by IR-4 helped commodity groups obtain critical use exemptions (CUE’s) to enable the continued use of methyl bromide until economical and technically viable alternatives could be registered and incorporated into grower practices. More importantly, IR-4 facilitated the support of an alternative product (dazomet) for the use on strawberries and tomatoes as a soil treatment and another product (propylene oxide/carbon dioxide) for postharvest use on stored spices, nutmeats, in-shell nuts, cocoa and cocoa beans. IR-4 helped in the registration process for a new product, MULTI GUARD PROTECT, for soil use and expanded the use of propylene oxide by label amendments to include dry fruits.

Since 2000, 70 to 80% of IR-4’s research effort has involved new pest control technologies which are considered reduced risk. This shift from a defensive FIFRA 88 program to a proactive reduced risk strategy in a few short years was accomplished through a two pronged approach consisting of partnering with the crop protection industry and educating specialty crop stakeholders. IR-4 recognized that without access to the new technologies it could not help its specialty crop growers with their control problems when the older chemistries were being greatly restricted or removed from the market entirely. IR-4 worked closely with the crop protection industry on new product

development strategies that included specialty crops in addition to their traditional major new crop focus. A key part of this strategy was using crop groups where studies on a few key representative crops allowed the product's use on many similar crops in the crop group. Also, it became clear with reduced staffing in the agrochemical industry due to mergers and reduced funding for federal and state research/extension scientists, that the public group did not always have an opportunity to test the new products. IR-4 also instituted a publication entitled "New Pest Control Products/Transition Solution List" (<http://www.ir4.rutgers.edu/FoodUse/NewProducts.cfm>) to inform all stakeholders and the general public about the options and virtues of the new technologies available to assist in the transition away from the FQPA vulnerable products.

In January, 2004 Congress passed The Pesticide Registration Improvement Act (PRIA-Fee for Service). This law has been reauthorized three times, most recently in 2012. PRIA ushered in a number of new challenges not only for EPA but also for IR-4. There were many procedural changes that not only required the agricultural chemical industry to pay millions of dollars for EPA to review their submission, some of which had been "backlogged" at EPA for several years but also required significant alternations in the way IR-4 made submissions. To ensure that IR-4's petitions were being properly handled, EPA requested that IR-4 follow new procedures that include fee waiver letters, as well as Notices of Filing and for registration packages to be submitted on behalf of the registrants. As a result IR-4 has realized significant benefits from PRIA with the main benefit being a more predictable timetable for EPA decisions. IR-4 is also provided with a PRIA fee exemption on all tolerance submissions.

IR-4's submissions fall under PRIA time lines; a 15 month EPA review period for most submissions in which a new uses is added to an existing registered pesticide. There is a 10-month timeline if the submission is considered by EPA to be a Reduced Risk use. Because of these time lines EPA has challenged IR-4 to increase efficiency by bundling as many uses as possible for each chemical, into a single petition and to routinely make no more than one submission for each active ingredient in a year.

### **CROP GROUPING**

An early initiative for IR-4 which started in 1971 by Compton and Markle involved the concept of Crop Groups. This was the development of a model that allowed extrapolation of residue data from a few representative crops to many other crops in the same group. This allowed establishment of residue tolerances for the entire group of crops based on the residues in the key crops. This really amplifies the impact of many IR-4 studies.

The first edition of "*Food and Feed Crops of the United States*" (Magness, Markle and Compton 1971) has affectionately been termed the "Greenbook" and outlined the general grouping scheme with a focus on the type of edible plant parts (i.e. fruit, seed, roots, etc.) and their uses (vegetable, feed, etc.). The first edition included over 300 crops divided into large general groups; vegetables, tree fruits, tree nuts, oil crops, spices, grasses, non-grass feed, grains, etc. Within these large groups, the specific crops were subdivided or subgrouped by like parts such as root and tuber, fruit, leaves, pods, etc. The first edition was used as the basis for the international FAO/WHO Codex Alimentarius crop groups' classifications in 1978 and by the EPA in 1983 and again in 1995 for their early crop grouping scheme.

The second edition of “Food and Feed Crops of the United States” by G.M. Markle, J.J. Baron and B.A. Schneider (Markle, Baron and Schneider 1998) continued to improve the regulatory processes with more standardization included in the scientific base. It serves as a complete source of food and feed information and the basis of a significant part of the current food safety regulatory guidelines with many specialty crops being grouped with larger consumption representative crop which are used for the crop grouping residue studies. The second edition contains over 1,000 scientific crop names along with their common and principal vernacular names and synonyms. This edition classified crops in 10 primary or large crop groups (i.e. vegetables, fruits, etc.) and 31 principal crop groups (i.e. root and tubers, citrus, berries, etc.).

The last decade has seen dramatic changes in the crop grouping approach driven mainly by the rapid development of global food crop markets and import/export activities. In 2002, IR-4 sponsored an International Crop Grouping Symposium in Arlington, VA. The report of this Symposium (CGS) proposed an expansion of the scheme in place by adding a significant number of new crops and groupings. In 2003, the IR-4/EPA Crop Grouping Working Group, under the guidance of Dr. Hong Chen and more recently, Mr. William Barney, was formed to make the proposal part of federal regulation. To assist this effort and make it more global in nature, the International Crop Grouping Consulting Committee (ICGCC) was established in 2004, representing specialty crop, regulatory, and agrochemical experts from about 40 countries. This international effort has significantly helped to promote harmonization of the U.S., Canadian and Codex crop classification systems.

The crop grouping activities have been the basis for many of IR-4 Program accomplishments over the past 50 year. Most recently, EPA and the Pest Management Regulatory Authority (PMRA) in Canada have approved nine new/enhanced crop groups. In 2007 EPA and PMRA codified changes in the Bulb Vegetables, Berries & Small Fruit groups. They also established a new Edible Fungi group. Three years later in 2010, the North American regulatory authorities modified the Fruiting Vegetables, Citrus Fruit, Pome Fruit groups and established the Oil Seed group to harmonize the two countries. Finally in 2012, there were publications of modifications to the Stone Fruit and Tree Nuts groups. In addition to the above, EPA and PMRA have accepted but not yet codified modifications to the Leafy Vegetables, Stalk, Stem & Leafy Petiole, Brassica Head & Stem groups. The formal approval is expected in the future.

Without crop groupings and representative crops from each group for residue analyses, as was the reality during the first decade of IR-4’s existence, the old paradigm of conducting a residue study for each specialty crop would still be in place. This would have resulted in less than 20% of the current specialty crop clearances over the past 40 years and probably only 10% with the new crop grouping initiatives. For each study IR-4 conducts, through crop grouping an additional 5-10 commodities can be added to product labels.

In April 2012, the Codex Committee on Pesticide Residues accepted the North American based approach for the Fruit type crops. Not only did they accept the expansion of the groups but they approved the concept of representative crops and data extrapolation. The acceptance of representative crops is the critical component of the savings from using the crop groups.

In addition to the formal crop groups, IR-4, on a case-by-case situation proposed broader extrapolations of the crop group approach. IR-4 was able to take the leadership and propose to EPA that they extend the existing data supporting the reduced risk insecticide spinosad on key crops to multiple crops and crop groups. EPA agreed with IR-4's proposal and when all the necessary data was reviewed the registration was used to support over 160 new uses. IR-4 has termed this innovative approach as "Super Crop Grouping". This approach has since been successfully used with the pesticides azoxystrobin, chlorantraniliprole, glyphosate, pyroproxifen, and spinetoram,

### **INTERNATIONAL HARMONIZATION**

IR-4's involvement with efforts to remove pesticide residues as a barrier of exports for US-grown specialty crops has been growing in importance over the last 20 years. Now it has become a common aspect of IR-4's efforts that provide expanded use of the data generated by IR-4.

In the mid-1990's, Health Canada's Pest Management Regulatory Agency (PMRA) sent a representative, Douglas Rothwell, to attend IR-4 Food Use Workshops to explore opportunities for partnership projects. Canadian specialty crop growers were also represented by the Canadian Horticultural Council and were somewhat frustrated by not being able to use the new, reduced risk chemistries being made available to US specialty crop growers. This also led to significant trade barrier issues due to a lack of MRL's for the new crop protection tools in Canada, which restricted U.S. grower exports to Canada. To address these issues, PMRA and the Canadian Horticultural Council started conducting joint residue field programs with IR-4 in 1996. Over the next 5 years, a total of 6 joint residue trials had been conducted in Canada and the first joint U.S. and Canadian residue petition for fenhexamid on caneberries was submitted to PMRA by Johannes Corley in 2001 for a joint review with the EPA.

During the period from 2000 to 2002, Bob Holm, Jerry Baron and Dan Kunkel were invited to Canada on numerous occasions to consult with PMRA and Agriculture and Agri-Food Canada (AAFC and Canada's equivalent to the USDA) on setting up a minor crop support program similar to IR-4's in Canada. The Canadian government made a major funding commitment in 2002 to its staff and resources and to AAFC to set up the Pest Management Centre (CN-PMC) along with 10 Field Research Centers to conduct the field portion of GLP residue trials and funds to conduct residue analysis. This allowed the CN-PMC Team to conduct 52 joint residue trials on 20 joint studies in 2003, compared to 6 trials during the entire period from 1996 to 2001, and resulted in much greater capacity for both the U.S. and Canadian efforts. This level of joint studies continues today and the partnership has only strengthened over the years. The recent agreement between the US President and the Canadian Prime Minister known at the Regulatory Cooperation Council, will likely further increase the amount of joint research over the coming years. The Canadians hold their annual Minor Use Workshop prioritization meetings in the spring and attend the fall IR-4 Food Use Workshops and the National Research Planning Meetings. Joint projects are developed when CN-PMC projects match the ones selected at the IR-4 Food Use Workshop. IR-4 and the AAFC PMC management attend the NAFTA Technical Working Group Meetings and help facilitate joint project reviews between the EPA and PMRA, thus avoiding duplicate review costs.

In 2004, the NAFTA Technical Working Group on Pesticides (TWG) approved the minor use joint review program that conducted joint reviews on seven chemicals in 2012. In 2007, CN-PMC started to assume the responsibilities for Study Director and Sponsor for some of the joint studies. By establishing a common MRL on a specialty crop from a particular crop protection products use, trade irritants between the two countries can be prevented before they have the potential to become a major problem for specialty crop growers on each side of the border. The U.S./Canadian specialty crop partnership has yielded valuable results for all stakeholders involved

IR-4 has also been working with EPA and Canadian authorities to implement the pesticide related areas in President Obama's initiative with Canada's Prime Minister Harper known as the Regulatory Cooperation Council (RCC). Here IR-4 has been working with partners in Canada (Pest Management Centre of Agriculture and Ag-Food Canada) to develop even more harmonized processes and data generation that will allow the US and Canadian regulatory authorities to share resources to review data to further eliminate trade barriers and technology gaps between the two countries.

Much credit for the close coordination between the CN-PMC and IR-4 can be given to Shirley Archambault, who worked in that capacity for the Canadian Horticultural Council and for the past 10 years has served as the IR-4 Coordinator for the CN-PMC. Shirley also represents Canada at U.S. crop protection industry partnership meetings. In 2009, Manjeet Sethi joined the CN-PMC as Executive Director. Under his leadership, the programs have been expanded to include more work with IR-4 and the productivity of the organization has increased.

IR-4 also regularly participates in global organizations that involve pesticide issues and commodities in trade and makes submissions to the Joint Meeting on Pesticide Residues (JMPR) which are used by the Codex Committee on Pesticide Residues to establish Codex Maximum Residue Levels for international trade. IR-4 provides support by assisting EPA, as part of the US delegations to both the CCPR and [Organization for Economic Co-operation and Development \(OECD\)](#) as well as the Working Group on Pesticides and the NAFTA Technical Working Group on Pesticides. IR-4 also plays a key role on the OECD Expert Group on Minor Uses, where a number of guidance documents have been prepared and released over the past year with regard to minor use issues. Additionally, IR-4 assists other countries, both developed and developing, as they begin to establish minor use programs and have signed MOUs with Canada, New Zealand and Brazil. The knowledge and expertise of IR-4 is occasionally sought and is highly valuable to these countries as their minor use programs evolve.

IR-4's international involvement is highlighted with the leadership role it played in the first and second Global Minor Use Summits. Both Summits were held at the United Nations Food and Agriculture Organization (FAO) Headquarters in Rome, Italy and co-organized by FAO, USDA, EPA, and IR-4. The first Summit was held in December 2007 and Chaired by Jerry Baron. The second Summit was held in February 2012 and Chaired by Dan Kunkel. Over 250 delegates attended the Summits representing over 50 industrialized and developing countries. The

First Summit outcome was Five Action items and the second Summit resulted in a five year work plan that categorized items into short, medium and long term timeframes to support and address minor use issues.

Starting in 2012, IR-4, in cooperation with USDA-Foreign Agriculture Service (FAS), has been conducting capacity building training programs in Southeast Asia, Africa and Central/South America. These programs cover all aspects of the conduct of Good Laboratory Practice in magnitude of the residue study including pesticide applications, laboratory analysis, data package development and Standard Operating Procedures. The goal of this work is develop research partners in this region who can cooperate on specific research studies when US priorities match the Asian priorities. Funds for these activities are being provided by the Standards Trade Development Facilities through the World Trade Organization.

## **ORNAMENTAL HORTICULTURE PROGRAM**

In the early to mid-1970, awareness was growing for the need to register materials for non-food uses (foliage and flowering plants in the greenhouse and out of doors; bedding plants; woody ornamentals; shade trees; and turf) because of the 1972 amendments to FIFRA. These specialty crops were also underserved, and growers and landscape maintenance personnel needed an adequate supply of registered tools to manage pests, diseases and weeds. The ornamentals industry approached T. W. Edminster (then Administrator of ARS) with the request that ARS assist with data development to register ornamental uses. He directed Dr. Schwartz to use \$500,000 of the ARS Minor Use Pesticide funds and work with IR-4 to obtain ornamental registrations.

To serve this segment of specialty crop agriculture, in 1977, the IR-4 Project added a new research objective that involved developing data to answer pest management voids in nursery and floral crops, forest seedlings, turf grass, and Christmas trees. This objective became what is now known as the Ornamentals Horticulture Program. This aspect of IR-4 involves the development and collection of crop safety and/or product performance/efficacy data to add new ornamental species and/or pests on registrations.

The first IR-4 /USDA-ARS Ornamental Workshop was held in April 1977 in St Louis, MO. The needs of the industry were condensed into 5621 distinct project requests. The Second Workshop was held later that year in December in Dallas, TX and prioritized these requests. Ray Frank, Dick Lindquist and Chuck Powell led the prioritization with legendary marathon sessions lasting late in the evenings. Below is a photo of the four “Founding Fathers” of this objective.



From left to right are Dr. Chuck Powell, Dr. Richard Lindquist, Mr. J. Ray Frank and Dr. Paul Schwartz.



The first IR-4 supported registrations were for new uses of Banrot, Glyphosate, and Ronstar was approved in 1978. In 1981, a special project was initiated to determine which products were efficacious and should be labeled to control black vine weevil. Six products were tested on 20 ornamental species. The next year marked the 5 year point of the Ornamental Program. At that point, over 8,900 different requests were received, 7,200 research trials were funded for efficacy and crop safety, 7,300 research reports were completed, and 1501 crop uses were registered based on these data.

In the early years of the Ornamental Program, it was managed by numerous part-time scientists at IR-4 Headquarters, including Dr. Joe Elson, Dr. William Biehn and Dr. Dan Kunkel. In 1993, IR-4 Headquarters, J. Ray Frank assumed responsibilities for managing the IR-4 Ornamental Program. Heavy emphasis was placed on developing crop safety data to aid in adding new crops to existing labels.

Bob Herrick became Ornamentals Manager in 2004 and succeeded in bringing about two key changes: renaming the program to Ornamental Horticulture Program and enabling dedicated funding for ornamental horticulture research projects. Cristi Palmer was hired in 2005 to replace Bob Herrick as Program Manager. She introduced a grower and extension survey to augment the project request process as means to gauge industry pest management needs without focusing on specific active ingredients. The workshop format was revised so that participants discussed and prioritized current pest, disease, and weed management need first and then discussed solutions to those needs. The status of EPA registration became the basis for setting priority levels of products included in research. About the same time, IR-4 expanded into invasive species research by accepting an invitation to participate in the Technical Advisory Committee of the USDA Interagency Task Force for Q-Biotype Whitefly (Q-TAC).

The Ornamental Horticulture Workshops started meeting every other year in 2009. Workshop participants hear presentations on ongoing projects and potential uses for existing and new products from university research and extension agents, ARS scientists, and agrochemical industry representatives. The growers, researchers and extension agents (but not agrochemical representatives) establish high priority projects for the following two year period in the weed science, plant pathology and entomology disciplines. About 50% of the work is efficacy testing to add new pests to existing registrations and the other 50% of the work is crop safety testing.

The non-food specialty crops make up over 15% of the total sales value of all production crops and 36% of all specialty crop sales. According to the 2007 Census of Agriculture, the total sales value of non-food specialty crops was \$13.7 billion (Clark 2009). To date, the IR-4 Ornamental Horticulture Program has delivered to the industry more than 16,000 crop uses for over 100 registrations. Lin Schmale of the Society of American Florists has noted:

***“IR-4 is an invaluable resource for greenhouse and nursery growers – not just in helping make sure they have access to the chemical and biocontrol tools they need to control pests and diseases, but also to support research that helps them use those tools wisely. Specialty crop growers are definitely getting double and triple benefits from the IR-4 program; because the program listens to the industry ... you hear our voices!”***

## **BIOPESTICIDE & ORGANIC SUPPORT PROGRAM**

In 1982, the IR-4 Project objectives were expanded to add research on biological based pest control agents at an early stage in their development. Previous involvement by IR-4 on these materials was at an advanced registration stage. This expansion of mission led to the formation of the Biorational Program, which was later named the Biopesticide Program and is now known as the Biopesticide and Organic Support Program

The program has had two major areas of focus: 1) Providing regulatory services/assistance to public sector scientists and small businesses in navigating the EPA registration process; and 2) Grant program funding for biopesticide research in three stages: Early, Advanced, and Demonstration. The program's name was changed to Biopesticide and Organic Support Program in 2008 as recognition of the growing organic industry which often has to rely on biopesticides for their pest control needs. With the help from an EPA Region 2 grant, IR-4 launched its Biopesticide and Organic Product Label Database in 2007 which provides stakeholders with the latest biopesticide pest control tools available searchable format by crop, pest and state.

William Biehn was the first Manager of the Biopesticide Program. Upon his retirement in 1999, Michael Braverman has assumed Management responsibilities. Over the past 31 years, the Biopesticide and Organic Support Program has been responsible numerous biopesticide product registrations. Some of the notable accomplishments over the past include the following:

- Registration of bacteriophage for the control of bacterial canker disease in commercial greenhouse tomato production;
- Registration of eight products to control mites in honeybees which have been associated with the serious problem termed Colony Collapse Disorder (CCD);
- Registration of a biofungicide extracted from giant knotweed which controls powdery mildew and other diseases and was awarded the "Best New Biopesticide" award from Agrow in 2012; and
- Registration of AF 36 to control aflatoxin (a potent natural carcinogen).

Estimating the value of the Biopesticide and Organic Support Program presented some challenges because biopesticide use is often associated with integrated pest management practices, organic farming, and use on specialty food and non-food crops. The Michigan State Center for Economic Analysis researchers point out there is no current comprehensive cost/benefit studies of biopesticides in agriculture (Miller and Leschewski 2012). However, they were able to estimate an annual GDP impact of \$155 million which appears to be a solid return on the estimated annual expenditure of \$1.5 million (both direct and in-kind funding).

## **ANIMAL DRUG PROGRAM**

In 1982, another objective, the IR-4 Animal Drug Program, was added. IR-4 was given the responsibility to develop the necessary information and data needed to facilitate the regulatory clearances by the Food and Drug Administration's Center for Veterinary Medicine (FDA/CMV) for drugs to be used to treat illnesses in minor food animal species. The need for this objective was articulated several years earlier when FDA initiated an extensive

study of the minor use of animal drugs where they identified many gaps in the availability of drugs to manage the principal diseases on these minor animal species. The gap existed because the cost of generating the necessary data to support a modification to the claims for an existing approved drug is significant and time consuming.

IR-4's involvement in animal drugs was short-lived. A USDA Peer Review Panel recommended in 1990, that the animal drug program become separate from IR-4. This recommendation was implemented in 1993 when a new USDA Program NRSP-7, was established as the stand-alone Minor Use Animal Drug Program.

### **PUBLIC HEALTH PESTICIDE PROGRAM**

The PHP Program is IR-4's newest initiative and was started in 2009 to assist in the development and registration of minor use chemistries that protect the public from vector-borne diseases like West Nile Virus and Lyme disease. In addition, the public remains at increasing risk from both the reintroduction of malaria and emergence of novel diseases spread by mosquitoes, ticks, sand-fleas and other disease vectors. This initiative has been funded by the USDA-ARS and the Department of Defense (DOD) through its Deployed Warfighter Protection Program. These two government entities have worked closely to develop new vector management products and needed IR-4's assistance with the regulatory aspects of the new uses. The program has been led from the beginning by Dr. Karl Malamud-Roam and is built on IR-4's traditional expertise in supporting small market pest management efforts and linking key researchers, commercial partners and regulators in the development of new pest control tools.

PHP Program successes were noted as early as 2011 with the first federal and state Experimental Use Permits for a series of experiments conducted by the U.S. Navy. Rutgers University and the University of Florida are using the reduced risk insecticide, pyriproxyfen, to manage Asian tiger mosquitoes in New Jersey and Florida urban areas. Also that year, a GLP residue study led to the submission to the EPA of a petition for all-crop tolerances from application of the mosquito adulticide, ethofenprox, which was a high priority product for vector control programs. IR-4 also initiated a draft white paper to document the U.S. mosquito pest problem, the products available for mosquito control, products in the pipeline, and current pest control needs.

### **CROP PROTECTION INDUSTRY**

The IR-4 Program could not exist without the cooperation of the crop protection industry which provides IR-4 access to its chemistries and biopesticides for solving specialty crop growers' pest problems. The partnership has evolved greatly over the past 50 years. Initially the companies only allowed IR-4 access to products that were already registered on major crops. Here IR-4 could develop the appropriate data (usually guideline residue data) to extend uses to new specialty crops. Starting in late 1980, IR-4 research support extended to developing needed data to allow the continued registration of important, grower identified minor use registrations. This was the major FIFRA 88 reregistration accomplishment when IR-4 "saved" 700 uses for specialty crops.

A major change in how IR-4 interacts with the companies occurred in the mid-1990s. IR-4 started working with the companies on specialty crop uses for new pesticides in advance of their first US registration. This change was largely due to some of the data extension protection incentive provided by the US government in FQPA for

companies to extend their products to specialty crops. For the first time, IR-4's data to support specialty crop uses that was bundled with the company's primary or secondary submissions.

Another major change occurred in the mid-2000 when the companies became increasingly concerned about international MRLs and the impact of pesticide residues being an artificial trade barrier. Without corresponding MRL's in importing countries, US growers could not export produce. To proactively solve this problem, IR-4 is working with companies to ensure there is adequate MRLs to allow full trade.

Over the years, IR-4 has participated in numerous unique cooperative research projects which benefit the specialty crop growers. One example occurred when DuPont representatives visited IR-4 in 2004 to discuss chlorantraniliprole, one of their new products that were still under internal development. This product had superior efficacy on *Lepidoptera* insect species with wide safety margins for human and the environment. IR-4 determined that chlorantraniliprole would be a good fit for insect pest control on specialty crops and set a goal of making this new class of chemistry available to growers as soon as possible. DuPont also shared their initial registration strategy which was global in nature. With IR-4's encouragement, DuPont disclosed information on chlorantraniliprole at the 2004 IR-4 Food Use Workshop to interested researchers, extension personnel and progressive specialty crop growers. This was DuPont's first public disclosure of this new active ingredient. Several entomologists were impressed with the information and submitted new requests to IR-4 for peaches and grapes. These requests were deemed High Priority by Workshop attendees. Canada was also interested in this new product and a joint research project was stated to complete a North American registration strategy.

IR-4 and CN-PMC expedited research and the final report was ready for submission in February 2007 to meet the agreed global submission schedule. Chlorantraniliprole was the first truly global joint review of a pest control product and included regulatory agencies from the US, Canada, Ireland, the United Kingdom, Australia, and New Zealand. After approval by the reviewing countries, the same date was used to establish Codex Maximum Residue Limits (MRL's) and in a very short period of time the product was registered in more than 60 countries.

Not only do companies provide IR-4 access to their new products but they also provide direct and in-kind resources. Specifically they provide staff to serve as IR-4 liaisons, who review PCR's, protocols and final petition submissions, attend the IR-4 Food Use and Ornamental Workshops, and set up and actively participate, along with other company product development, regulatory and business staff, in annual technical review and partnership meetings with IR-4 staff. Companies also provide analytical standards and methods, and in some years have served as the analytical lab for IR-4 studies.

The organizations that represent the conventional pesticide and biopesticide companies (CropLife America and Biopesticide Industry Alliance) provide IR-4 an opportunity to participate in many broad industry initiatives. IR-4 is an active observer on many industry committees and workgroups. These organizations look to IR-4 to be an important participant in many important processes that influence policy.

## **COMMUNICATIONS & PUBLIC RELATIONS**

IR-4's communications programs have evolved over the years to keep up with the ever changing technology. For many years, the then familiar green IR-4 Newsletter under the editorial direction of George Markle was published quarterly and consisted of a comprehensive report on program activities. When Markle retired, the PMC recognized that a full time professional was needed to carry on the program and initiate new approaches. Sandy Perry was hired as the National Outreach Specialist located with the Northcentral Region. Perry retired in 2003 and Sherrilynn Novack was hired as the IR-4 Publications Communications Coordinator located at Headquarters to facilitate more efficient coordination of the communications program throughout the program. Novack brought the idea of "branding" to IR-4's communication programs in much the same way companies do to generate recognition for their product or service. The revamped Communications Program of the past ten years with the enhanced newsletter and IR-4's website (<http://ir4.rutgers.edu> 2014), have contributed greatly to why the IR-4 Program has increased its recognition and stature both internally with key stakeholders and externally with consumers and the general public.

## **VALUE & IMPACT**

There have been several efforts over the years to put a dollar figure on the economic impact of the IR-4 Program on the U.S. economy. This is an extremely difficult value to ascertain.

One measure of the success of this program, other than the large effort over the past decade by IR-4 to provide reduced risk alternatives, to specialty crop growers is to look at the decline in use of the pre-FQPA Chemistries and the increased use of reduced risk chemistries. The California Department of Pesticide Regulation (CADPR) has studied these trends for over 10 years. From 1994 to 2006, they observed an overall decline of about 50% of the use of OP and 70% use of carbamate insecticides. The use of B2 (carcinogen classification) fungicides showed a lower decrease of 10 to 20%. However, reduced risk insecticide and fungicide chemistries showed a steady increase during this period and are now considered a central element to fruit and vegetable pest management programs. It was estimated that about 50% of the reduced risk products registered during this period were the result of the IR-4 Program. By all measures, IR-4's efforts with reduced risk chemistries has been an important factor in helping U.S. specialty crop growers to provide our and global export consumers with the world's safest food (Vircey and Hollingworth 2009).

For many years, IR-4 collected anecdotal stories from commodity organizations to estimate the impact. Starting in 1998, IR-4 collated the loss avoidance values that EPA collected in association with Section 18 Emergency Exemption requests. This "snapshot", would be able to provide an indication of how much economic damage a specific pest cost in a specific state. Because there were so many Section 18's on-going at that time, the loss avoidance values were extremely impressive, over \$20.7 billion over the last 15 years in total.

The most recent and by far the most comprehensive of these studies was published by Miller and Leschewski of the Michigan State University Center for Economic Analysis in 2012 (Miller and Leschewski 2012). They studied the impact of IR-4's output on associated employment, labor income and Gross Domestic Product (GDP). When well-established methods of measuring direct and secondary economic impacts are used to gauge the contributions of the IR-4 Project and its three primary programs, including the Food Crops, Ornamental, and Biological and Organic

Support programs in terms of sales, employment and gross domestic product is significant. Each program posits real economic benefits to growers and the economy as a whole. Specifically, growers benefit in higher yields with higher quality output, consumers benefit by higher varieties and lower costs to food and ornamental crops, and the industry benefits through better global competitiveness of U.S. output. Including all secondary impacts, the IR-4 Project is anticipated to support research and industry sales sufficient to support 104,650 U.S. jobs and bumps annual gross domestic product by \$7.2 billion.

### **IR-4 HALL OF FAME/OTHER AWARDS**

The IR-4 Hall of Fame award is the highest honor bestowed upon an individual by the IR-4 Project. Typically Hall of Fame honorees have gone well above and beyond the call of duty to serve the mission of the IR-4 Project. Only 26 individuals have been inducted into the IR-4 Hall of Fame. The members of the IR-4 Hall of Fame, along with their role in the success of the IR-4 Project are listed below.

Table 4: IR-4 Hall of Fame Members

| Name                     | Award Year  | Role                                 |
|--------------------------|-------------|--------------------------------------|
| <b>Charles Compton</b>   | <b>1987</b> | <b>National Director</b>             |
| <b>Edward Swift</b>      | <b>1987</b> | <b>CA State Liaison</b>              |
| <b>Harold Alford</b>     | <b>1989</b> | <b>Field Coordinator -West</b>       |
| <b>Thomas Archer</b>     | <b>1989</b> | <b>Laboratory Coordinator-West</b>   |
| <b>John Mahlstedde</b>   | <b>1989</b> | <b>Administrative Advisor</b>        |
| <b>Howard Wilkowske</b>  | <b>1989</b> | <b>Administrative Advisor</b>        |
| <b>Virgil Freed</b>      | <b>1990</b> | <b>Technical Committee</b>           |
| <b>Baily Pepper</b>      | <b>1990</b> | <b>Technical Committee</b>           |
| <b>John Bourke</b>       | <b>1991</b> | <b>Region Director-Northeast</b>     |
| <b>Duane Coyier</b>      | <b>1991</b> | <b>USDA-ARS Liaison</b>              |
| <b>Robert Menges</b>     | <b>1993</b> | <b>ARS Field Research</b>            |
| <b>TJ (Jack) Sheets</b>  | <b>1993</b> | <b>Satellite Laboratory Director</b> |
| <b>Ken Dorschner</b>     | <b>1994</b> | <b>CSREES Representative</b>         |
| <b>Willis Wheeler</b>    | <b>1997</b> | <b>Region Director-South</b>         |
| <b>Gene Carpenter</b>    | <b>1998</b> | <b>State Liaison Representative</b>  |
| <b>Richard Guest</b>     | <b>1999</b> | <b>National Director</b>             |
| <b>Robert Libby</b>      | <b>2000</b> | <b>National Research Coordinator</b> |
| <b>Patricia Sarica</b>   | <b>2002</b> | <b>Assistant Director</b>            |
| <b>Taka Shibamoto</b>    | <b>2002</b> | <b>Region Director-West</b>          |
| <b>George Markle</b>     | <b>2003</b> | <b>Co-National Director</b>          |
| <b>Neal Thompson</b>     | <b>2003</b> | <b>Administrative Advisor</b>        |
| <b>J. Ray Frank</b>      | <b>2003</b> | <b>Ornamental Program Manager</b>    |
| <b>Hoyt Jamerson</b>     | <b>2003</b> | <b>EPA Minor Use Officer</b>         |
| <b>Robert (Bob) Holm</b> | <b>2006</b> | <b>Executive Director</b>            |
| <b>Chuck Mouer</b>       | <b>2008</b> | <b>Laboratory Coordinator-West</b>   |
| <b>Marion Miller</b>     | <b>2013</b> | <b>Region Director-West</b>          |

In 2008, IR-4 established the National Excellence Award to recognize the highest level of meritorious service. This award is only given out once every three to four years to a limited number of highly deserving candidates. To date, IR-4 has only awarded five individuals with the National Excellence Award. The honorees are Robin Adkins, IR-4 Southern Region; Nancy Ragsdale, USDA-ARS; Marilee Ross, University of Maryland; Roger Batts, North Carolina State University; and Rebecca (Becky) Sisco, IR-4 Western Region.

IR-4 Headquarters established a new award in 2010, the SOAR award to recognize excellence in four criteria; **S**ervice, **O**utreach, **A**ltruism, and **R**esearch. This award is given on an annual basis to an individual who excels in at least three of the four criteria. To date, four individuals, John Ahrens Connecticut Agriculture Experiment Station; Lori Berger, California Specialty Crop Council; Daniel Botts, Florida Fruit and Vegetable Growers Association/Minor Crop Farmers Alliance; and Mike Benzen, North Carolina State University have received this award.

## **THE FUTURE**

IR-4 continues to perform its mandated duties, promptly and with tremendous efficiency. IR-4 has provided hundreds of commodities with their primary pest management tools and stands ready to develop new data to support the regulatory clearance of new pest management tactics. However, the environment in which we live today is much different than 1963. We fully expect many more changes over the next 50 years. IR-4, as an organization, will have to continue to evolve to allow it to continue to meet the needs of the primary stakeholders.

We predict the following that new conventional chemical pesticides and biopesticides will still be developed by the private sector to protect crops from devastating pests. The continued discovery of damaging invasive pest species, an increasing world population, and shifts in pest distribution due to climate change all point to an increased need for pest management in specialty crops in the years to come. The next generation of pest management technology will be even lower risk than the current generation of products that are classified by EPA as Reduced Risk. Pest management will continue to evolve to a broad systems approach to management of pests, resistance of pests to pesticides and residues on the finished food product. Pesticides will be used in a truly prescriptive manner. The need for IR-4 to develop residue data will remain on many crops.

There will be increasing larger need for IR-4 to develop data showing the efficacy of a pest management tactic on specific target pest. We anticipate that IR-4 will be asked to take the lead on developing a pest management systems approach for certain ultra-small acreage specialty crops.

The use of biotechnology derived pest management will become increasingly accepted by the public. Additionally, alternative pest management technology will be discovered that will be regulated by EPA, FDA, USDA or other national and international authorities. There will always be a financial threshold where private industry can no longer invest resources to develop the necessary data or collect information to support the use authorization. IR-4 will stand ready to help the “minor use” community to gain access to this new pest management technology. Furthermore, public institutions will develop technology that will require regulatory support. IR-4 will become viewed as a regulatory consultant for USDA and the land grant institutions as to help get their discoveries through the necessary regulatory steps and make this technology more desirable for licensing to investors.

IR-4 will continue to cooperate with international organizations with identification of pest management needs for specialty crops and fully cooperate with the development. We fully expect that all future pest management technology will be targeted for global registration. This will be the result of continued globalization through trade and a sharing of resources due to continued budget retractions. IR-4 will lead in the establishment of a not-for-profit foundation that will coordinate the development of a global data package for the new technology on specialty crops.

Management of pests that vector human or animal disease will become of increasing importance in the developed countries. Changes in habitat will allow pest that vector these diseases to survive and thrive. Public investment to develop or reposition pest management technology to manage the vectors is likely. The IR-4 Project will be able to utilize its expertise to assist in this area.

The management of pests that vector human or animal disease will become of increasing importance in the developed countries. Changes in habitat will allow pests that vector these diseases to survive and thrive, and increased global travel will ensure that most vector-borne diseases have the opportunity to spread worldwide. Public investment to develop or reposition pest management technology to manage the vectors is likely. The IR-4 Project will be able to utilize its expertise to assist in this increasingly important area.

Finally, imports of goods from global trading partners will serve as an entry of invasive pests into the United States. Invasive species containment and management will be of increased importance. Because of IR-4 regulatory expertise and infrastructure, governmental partners will solicit IR-4 for involvement in developing of pest management solutions.

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