

Annual Meeting of WERA-1017: Coordination of Integrated Pest Management Research and Extension/Educational Programs for the Western States and Pacific Basin Territories

Meeting date: 7th to 8th July, 2014

Meeting Location: Bozeman, Montana

Minutes

Attendees

Don W Morishita, University of Idaho, don@uidaho.edu

Carrie Foss, Washington State University, cfoss@wsu.edu

Sally O'Neal, Washington State University, soneal@tricity.wsu.edu

Ronda Hirnyck, University of Idaho, rhirnyck@uidaho.edu

Robert L Schlub, University of Guam, rlschlub@uguam.uog.edu

Cheryl Wilen, University of California, cawilen@ucanr.edu

James J Farrar, University of California, jjfarrar@ucdavis.edu

Virgil Dupuis, Salish Kootenai College, virgil_dupuis@skc.edu

Marion S. Murray, Utah State University, marion.murray@usu.edu

Tunyalee Martin, University of California, tlamartin@ucanr.edu

Tessa R. Grasswitz, New Mexico State University, tgrasswi@nmsu.edu

Arnold Hara, University of Hawaii, arnold@hawaii.edu

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Joy L Paterson, University of Nevada, patersonj@unce.unr.edu

Alfred J Fournier, University of Arizona, fournier@cals.arizona.edu

Deb Young, Colorado State University, deborah.young@colostate.edu

Mary Burrows, Montana State University, mburrows@montana.edu

Tom Holtzer, Colorado State University, Thomas.Holtzer@ColoState.edu

Matt Baur, University of California, mebaur@ucanr.edu

Marty Draper, NIFA, mdraper@nifa.usda.gov

Bob Nowierski, NIFA, rnowierski@nifa.usda.gov

Monday, July 7th

8:30-8:50 Introduction to MSU College of Ag and Plant Sciences Dept-**John Sherwood**
8:50-9:00 **Business orientation and welcome-Mary Burrows**
9:00-9:30 **WERA-1017 administrative business - Tom Holtzer, Colorado State Univ.**

We are in our middle year of a 5-year run. We get reviewed at the end of the first 2 ½ years. Tom has to write a report. His responses have to be based on annual reports from the group. Some of the reports is good and some is not so good. Tom gave some examples of reports. There is a very serious need in USDA for accountability and outcomes, and our reports matter.

Tom said that we don't have very many people with Agricultural Experiment Station appointments on the committee. This is a great place for IPM Coordinators to get together with AES scientists. In his report, he emphasizes that more AES participation would be good.

Future report writing and objectives:

- increase participant skills, knowledge, and awareness

- increase relevance of federal and regulatory RFA's
- enhance collaboration
- improve coordination of IPM programs

Impacts

- Improved communication and collaboration among IPM researchers
- Sharing of ideas and strategies to develop sustainable alternatives

Overview of ESCOP-Experiment Station's Committee on Science Roadmap from

Mike Harrington

USDA-REE

Sonny Ramaswamy-NIFA director

Deputy Directors-Mike Fitzner

Priorities for USDA-no real changes

Budget has declined due to inflation

NIFA Appropriations

2013 Budget, Fiscal Cliff

Budget Battles, 2015 and beyond. Mike's forecast-no fiscal cliff coming. House and senate cannot agree on anything. Impact reporting-multi-state projects required. Why worry about reporting? It comes down to preserving the system as we know it. It is summarized in a great handout.

9:30-10:00

WIPM Center & WRIPM Grant Program updates, Jim Farrar, UC ANR

Jim looked at all the different ways the center has used IPM-who is downloading slider, current signature program, recent signature program, state IPM coordinator, advisory and steering committee, 2013 center grants. Several states downloading and connecting. They are doing well in helping to connect western IPM groups. Carla Thomas moved offices and returned to WPDN in December. Matt Baur became the Associate Director in May. Crop Protection Pest Management an applied research and development program with extension implications. The three goals of RCP are the following: improve cost benefit analysis when IPM practices are adopted, reduce human health risks, minimize environmental impacts. **Handout:** want to develop a report documenting various impact studies that are done. On the first page there is an outline. Next four pages are resources that are found so far. Marion, Peter, and Al's data are I there. This documents the impact of IPM in the western region. Jim is asking for help with information from the three priority areas-doesn't have to be peer-reviewed publications. For time frame, Jim wants a draft by September for the Regional IPM center director's meeting. Bob Schlub suggested taking two or three liens from each state report that they do. Jim said that would be fine as long as it is documented evidence of some kind. Bob said it would be easy to send lines from the Western SARE report. Rhonda asked if the surveys need to be statistically analyzed, and Jim said that they don't.

The seven priorities of RCP are the following:

- Development and adoption off IPM
- Intra regional IPM collaboration aand cooperation

- Intra regional IPM collaboration and cooperation
- IPM info networks
- IPM partnerships
- IPM Signature food security programs
- Evaluation of IPM

Jim said that he could talk about the concept of IPM Signature food security programs in the call for proposals, as that was one point to be addressed. Each program will be required to do this. At what point does it become signature? Jim's understanding is that the "signature" means it has multi state application to other regions or potential to reach other regions. One example is the Pollinator meeting.

Grant types-Last year we changed our grant types-project initiation, work groups, outreach and implementation, IPM planning documents (broad category, PSMP's, surveys, impacts). They are not funding research because they don't have funding for it. "Special issues" involve grants that need to happen more quickly. One example is the coconut rhino beetle in Micronesia, which supported some training. Jim showed a map that Matt Baur put together which showed the distribution of dollars for western IPM grants. He also showed a center grants projects pie chart. Bob would like the pie chart separated to show the Pacific Islands. Another pie chart was shown for the number of grant dollars given to each state.

2014 Center Grants

- Weeds in Chile pepper NMS\
- Pear Psylla-WSU
- Bed bug work group
- Managing white flies
- Spray-drift pesticide application

Jim showed a map of the main collaborators

Special projects. Query-driven data. A publicly accessible list for ectoparasites was created. The coconut rhino beetle is one example.

Communication. There is a monthly newsletter, IPM Western blog, press releases, and website?? Jim needs information from state IPM coordinators to share on the website.

Evaluation of IPM implementation. Crop pest losses. Emphasize the evaluation in center grants RFA. This needs to be supported with an online toolkit to assess IPM outcomes and impacts. The connection needs to be made back to EPA. There are impacts to doing that. Matt was thinking Jim was going to mention the working with IR4 to develop a pesticide registration program. In the draft, we can document this with a list of different attributes of pesticides in an IPM program.

Tom Comment. This group and Jim's center are joined at the hip. Both must have a strong role. This needs to be made transparent and seamless and is good for funding. We need to encourage these linkages to be strong.

10:00-10:30 **USDA NIFA and E-IPM Program updates (*via phone*), Dr. Marty Draper, National Program Leader**

Marty asked if all states were represented. Alaska and Wyoming did not come to the meeting, and Marty said to try to remind them to participate.

NIFA-all applications are in with a handful of glitches. He wanted to say thank you because 40% of applications were in one day before the deadline. Thanks for the quality of applications. They all look really good. Things are going to be pretty similar. They are in review and the panel will be meeting soon. We are looking at September 1 as start dates. If asking for a revised budget, it will need to be turned around very quickly. It might actually affect your ability to be funded. The panel pretty much has to get 80% of a year's work done in one month. You might get some frustrated messages from the panel because they are under a lot of pressure, but please try to be understanding.

If we see an increase in the 2015 budget, we might not have the ability to change the amount given in the awards. There are rumors that there might be an increase in 2016's budget. He doesn't see anything happening for 2015. If the authority changes or the program is moved, you will have to recompete for funds.

406 discussion-If it moves out of 406, where would it go? Marty said Smith level. The only problem is that we have indirect costs that we didn't have before. Tom asked if they would give more money for indirect costs. Marty said maybe, but there isn't the opportunity to throw it into a pot.

New match requirements-more direction on new matching requirement (by Congress) starting October 1. Even if you get your award before Oct 1, the 2nd year of funding could be subjected to that. Land grant institutions are exempt. Will we have to have any matching requirements in the revision? Marty will know in about 9 months. Al discussed rumors of additional funding and asked if it would get funneled to centers and EIP awards. Marty said that it could all possibly be applied to ARDT, but that is just his guess. It could be in the 2016 budget. Arnold missed the deadline and asked if he would have an opportunity next year to apply. Marty said maybe if there is additional funding and thought it could be an appropriate use of funds. Virgil mentioned the 406 money and wondered if there would still be tribal eligibility. Marty said this could be problematic and not sure what effect this would have. It would be an unfortunate outcome of moving back to Smith Lever 3D.

Number of proposals-there were 49 EIP proposals requesting way more money than what is available.

10:30-10:45 Break

10:45-11:15 **What happened to the RIPM Program? Bob Nowierski-*via phone***

Awarding ARDP money amounts-RFA came out about 1 month ago. Deadline was June 19th. This will all be presented in a single RFA.

ARDP-annually. EIP and regional centers are multi year. Al asked if total funds are anticipated for ARDP or if there would be a decrease. Bob thought there might be a slight increase. Announcements will be made in September. There were 68 applications total.

AFRI Panels-Bob said if you have an interest in serving on any AFRI panels, Bob would be happy to accommodate you. Bob S. asked how the projects are evaluated, and bob said they are considered in the same pool together. It is balanced with institution, gender, ethnicity, and rank of the reviewer. It is a diverse panel to avoid biases. 17 people are on the review panel.

11:15-11:30 **Developing an IPM Roadmap for Western Tribal communities-Virgil Dupuis-Salish Kootenai College**

Virgil discussed the Native IPM working group that he is part of. He has been working with the management of noxious weeds for thirty years while working with tribes, biological control, and the rearing/release of insects. He is now trying to form a working group of tribal colleges and universities. He is the executive director and heading up an IPM working advisory group. He is sending a survey out in late Aug/Sep to evaluate complex problems with 500 tribes and just getting started.

EPA-funded programs. There are 40 programs across the nation. There is little regulations, record keeping, and evaluation.

Tribes are also very diverse operators. They are operating on tight budgets. Many tribes are more and more concerned about invasives.

There are also jurisdictional issues, but they are generally able to work out situations without enforcement needing to step in. Tribal colleges should be trained to look for noxious weeds on the ground.

Virgil's plan is to increase knowledge about IPM. $\frac{3}{4}$ colleges have some levels of gardening. There is a need for information exchange. He would like to get all emails. He will send out a short list of questions to ask for views of the tribal lands within the state, how you view pest issues in your tribal areas, and success stories. Working with Native groups is difficult. They found medusa head this winter and will be doing treatments in the fall. They are losing weed control money because they don't have anyone to run it. Tribal artifacts are being repatriated back to tribes, and they don't know how to handle it.

11:30-12:00 **Discussion-New Requirements in the Crop Protection and Pest Management RFA (Regional Project Directors Workshop Requirement)-Jim Farrar**

ARDP and EIP-project director workshop. There are items in the RFA that are supposed to help facilitate getting this organized. RIPM project directors used to come to this meeting. NIFA thinks it is a good idea for groups in crop protection programs to get together. We are supposed to have a project director workshop. Jim is not sure what this would look like but is not sure that a presentation-based

workshop would be helpful. An additional day could be added to the WERA meeting for this. Jim needs feedback on how to coordinate this. If you get EIPM money, you are expected to attend this in addition to the ARDP meeting. In the EIPM RFA, you are expected to use travel money from the EIPM grant. All thought there was great logic in doing this with the WERA meeting because you can add to existing travel. This would add about 7 or 8 people to the existing project coordinator workshop. The objective is to have greater regional coordination and cooperation of IPM. This is for all funded individuals for ARDP and EIPM. We have to report that we are collaborating and having an impact with our stakeholders. We need to have facilitated discussions to delineate impacts, maybe 15 minutes for each project to make them work for their time. Carla has gotten into a form from NPDN, which can provide immediate information. Come to the meeting with some basic questions. Both ARDP and EIPM have to participate.

12:00-1:00 Lunch (Boxed lunches-miscellaneous sandwiches)

1:00-3:00 State IPM reports-in order, 20 min each (ID, WA, Guam, CA, UT, NM)

1:00-1:20 ID-(not recorded)

1:20-1:40 WA-Sally O’Neal and Carrie Foss

Deficit irrigation is used to concentrate flavors in wine grapes. They are researching deficit irrigation on the pest complex. They are developing a hop pest management strategic plan. They are also doing spotted wing drosophila monitoring and outreach with sweet cherries. They published rangeland beef cattle results. They talked about doing a field ID guide that is photo driven. Carrie Foss is doing education about IPM and bed bugs. University of Washington did a video and assessed their program. They are doing a curriculum project, carrying on a lot of efforts. It is an IPM curriculum for 3-5 grade students and has a lot of potential.

1:40-2:00 Guam-Bob Schlub

They have active faculty that work with coral. He feels that we need to look beyond the surface and need to look into the water. He has hosted farmer-based workshops. Bob thinks workshops get a lot more people involved and likes to let the farmers speak. Bob thinks communications needs to be developed. There is a decline of ironwood trees. They have IPM problems multiplied by four, having problems with ganoderma, termites, all related to the environment. They also have problems with funding and new pests coming in. They have a new gall wasp.

2:00-2:20 CA-Cheryl Bishop and Tunyalee

They have 9 full-time IPM advisors. They are looking for an urban/structural IPM person. They are recruiting for a person in the fall in LA. They have a director and 4 associate directors and 5 people doing computer work. 1.8 people are dedicated to urban IPM. They also have a pesticide safety group. At Davis, they have a collector of info and development of materials. They will develop a strategic plan for the next 5 years. They have lots of blogs, such as “southern IPM activities” and how to inspect for bed bugs. There are advantages to using

electronic applications because you can use google analytics to gauge how long and how they are using it. They are no longer going to produce the IPM compendium books.

Tunyalee said that they are using 99 technology for web pages. They are moving stuff into databases and adding an evaluation component and surveying users of the website. They want to use technology where a survey will pop up when you go onto the site. People might not attend a meeting unless they get credit or hours for it.

2:20-2:40 UT-Marrion Murray

The IPM coordinator for the state is Diane Alston. They have an arthropod diagnostician for urban pests and outreach. Their listserv has 14,000 subscribers that are small growers to homeowners. They have a host of sites that monitor for pests. People volunteer to provide info. People can get info from stations for pest monitoring. They send out surveys to evaluate on pesticide use and what they are learning. 134% have increased their monitoring of pests. Growers depend on extension. Advisory service is free. They are doing applied research projects, such as onion thrips (Diane). Three to four weed species are hosts for onion thrips. Also, they are doing cherry fruit fly research and IPM in organic peaches. They are producing a tree fruit production guide-\$16 is the cost they came up with to retrieve their costs. They will update these every other year. Surveys have indicated that more are using reduced-risk pesticides. IPM in schools was mandated in 2013.

2:40-3:00 NM-Tessa Grasswitz

New Mexico is doing an organic pest management program. Organic conferences are the largest in the state. They increased baseline knowledge of IPM. They have diagnostic programs for 100 insect and pathogen IDs and weeds. For invasives, they found SWD in 2013 near Albuquerque. They have a good monitoring system in place. Blackberries and raspberries are major crops. They developed a small farm IPM working group in 2010 with 2014 being the last year. For pesticides, Jane Pierce is working on *Trypanosoma cruzi*. 61% of the insects she is catching have a high infection of Chagas disease, which used to be 3% in the 30's and 50's. They have had three consecutive years of drought. They have Diarapta beetles attacking saltcedar (4 different species). They also have 2 stink bugs. They lay eggs on rangelands around Albuquerque. They had a grasshopper swarm that registered as a "storm" on the radar. They have been doing lots of outreach and extension. They have a recommended list of plants for native pollinators. They have a contract for school IPM programs, as regular spraying has gone on. They have been looking at the onset of tillage and irrigation and its effect on weeds. Bob Wood "ask the bugman" is antipesticide.

3:00-3:15

Reporting Comments-Tom Holtzer

Reports have been good. For putting the report together, it is drawn out of your state reports. When these are done well, it is easy to extract. Tom passed out a handout. Last year's state reports weren't written well. It helps if you can sort the following: Number of refereed journals, extension publications, feature articles, etc.

3:15-5:15

For impacts, add to it and any involving impact.
State IPM reports, continued

3:15-3:35 HI-Arnold Hara

They have the coqui frog. A 113° treatment will disinfest. It has killed over 3000 frogs. They have a problem with incoming produce from OR and WA and Christmas trees. For vegetables, they have been focusing on spray calibration and spray coverage. They also have the diamondback moth and the macadamia felt tip coccid from Australia. They are doing an exploration of natural enemies in Australia. They have fruit flies. They have a Master Gardener's program.

3:35-3:55 OR-Len Coop

They have a state law for IPM implementation. They will have a state IPM coordinator. They have developed remote sensing for conservation biocontrol-pests.org. Len discussed signature area funds that are available. If you have a nice solid need, you can come to Len for help. Len showed pest event maps for the SWD, gypsy moth, and said they have 102 models in the system. From the AFRI grant, he has developed hourly-driven models and is continuing to support underserved needs with different forecasts. Paul Jepson reports that all of the growers allow data of pheromone traps to be broadcasted. The entire growing community is showing and sharing pest data. This has resulted in OP use, probably due to mating disruption.

3:55-4:15 NV-Joy Paterson

They do community IPM and two people handle most of it. It is in high demand and has been reprinted three times in 1 year. They work closely with Master Gardeners, and they are the first line of defense. They recently updated a pesticide manual and put it in their IPM programs for the 1st time. They are printing and giving it out for free. They work with hoophouse growers for use in Reno and Vegas markets. Agriculture is a small percentage of total state's income, but a huge percentage of certain counties. They just updated a 15-yr. biocontrol manual. They are pushing for weed management. Honeybee IPM-considered a small operation if it is less than 50 hives and the hives stay in NV and large if it goes from CA-NV without much regulation. The varroa mite has been a problem in hives and they are now having major bee issues. They have four experimental bee hives.

4:15-4:35 AZ-Al Fournier

Al had a handout. His current IPM program includes agronomics, vegetables, school IPM. They produced a book through the IPM Center. He is proud of it and has seen a lot of use. You can go to lulu.com, and it can be printed on demand. The goal is for this to go to pest control advisors and people in the field. Tim Vanderboot, a graduate student, is working off of a RIPM grant with natural enemies. Did field work to ID predator/pest rates to determine whitefly thresholds. It has good IPM potential. They have had three workshops with PCAs. He hopes to see a reasonable adoption of these. He also has a field crops team. They have a vegetable IPM update, which targets Yuma producers. They are hiring a new assistant in extension for the community IPM team. They are trying to enhance interest in IPM in general. They have a team dedicated to IPM assessment for impacts. Wayne and Al have shifted teams to get data entered. He

evaluates the number of attendees, number of CEU's rewarded, grant affiliation field, team field (i.e. vegetables). This is a very basic format. The numbers on his handout say a lot about impacts. They have had a resurgence of the brown stink bug and also have a SCBG for the lettuce fig.

4:35-4:55 CO-Deb Young

So many people are retiring and need to fill extension positions. They are looking to fill two plant pathologist positions. It is exciting to see new people coming into extension. They have programs with Ag, Forest and Range, Gardens and Landscape, and School IPM. Deb was wondering if there was another way to share information online, concerning EAB. A Wiggio account is kind of like FB but doesn't have to be approved. It is like a listserv with bonuses. It is a good thing to use if a program is being evaluated. For marijuana, CDA and WA are working together to come up with a product that can be approved for marijuana pest management.

4:55-5:15 MT-Mary Burrows

MSU is looking for a VP of Agriculture. She is also hiring a pulse pathologist with good communication skills in addition to diagnostic and molecular skills. Mary is basically the "new Barry". Jane Mangold is the weed range specialist. She is working on early detection and rapid response. She also working on a project to train real estate agents on weeds. Fabian Menalled is the head of organic production and weeds in agriculture. Kate Fuller is our new Ag Economist. Emily Glunk is the new Forage Extension Specialist. Laurie Kerzicnik started last October as the new Insect Diagnostician in Schutter and Eva Grimme joined Schutter 5-6 weeks ago as the new Plant Pathologist. We are trying to renovate the Urban IPM program, which started in 2008. There have been 25-28 participants. Extension has funded these latter two positions 100%. Mary has received money from the state from impact statements. We will be doing follow up calls this fall for evaluation of samples. We work closely with Toby Day, who is the Horticulture Specialist and Master Gardener Coordinator.

5:15-5:30

Elect new Vice Chair

Boise will host the next meeting after SLC.

Arizona State Report WERA 1017

July 30, 2014

Agronomic Crops IPM Team

- Published Natural Enemies Guide:
 - Brown L.M., P.C. Ellsworth, G. Hughes, S. Bundy, P. Porter, V. Barlow, S.E. Naranjo, D. Kerns, A.M. Mostafa, A.J. Fournier. 2013. Natural Enemies of the Southwest: A field guide to the arthropod natural enemies of southwestern field crops. Book. University of Arizona Cooperative Extension. Publication no. AZ1607 71.
Available at: lulu.com, \$22.95, ranked 427 in sales, liked by 104 people
- Integrating natural enemy counts into whitefly management decisions in cotton. WRIPM & WIPMC grants. Ph.D. student Tim Vandervoet involved in large-scale field confirmations, PCA workshops and statewide outreach campaign. New publications:
 - Vandervoet, T., P.C. Ellsworth, L.M. Brown, S.E. Naranjo. 2014. Making Whitefly and Natural Enemy Counts. Field Crops IPM Short. University of Arizona Cooperative Extension. <http://ag.arizona.edu/crops/cotton/files/PredatorToPreyRatios.pdf>
 - Brown L.M., A.M. Mostafa, T. Vandervoet, A.J. Fournier, P.C. Ellsworth, S.E. Naranjo. 2014. Minute Bug with Enormous Impacts on Insect Pests. Field Crops IPM Short. University of Arizona Cooperative Extension. <http://ag.arizona.edu/crops/cotton/files/OriusRatio.pdf>
- 45 Field Crops IPM Shorts including 11 in Spanish, 8 videos, since 2011 http://ag.arizona.edu/crops/cotton/agronomic_ipm.html
- Continued intensive reduced risk cotton IPM program in Mexicali, Mexico, reaching hundreds of growers and consultants and reducing pesticide risk (see *Impacts*)

Vegetable IPM Team

- In the past year, delivered 26 Veg IPM updates accessed by over 450 local end-users and redistributed to 20,000 through farm press and related media <http://ag.arizona.edu/crops/vegetables/advisories/advisories.html>
- Several new vegetable IPM videos <http://ag.arizona.edu/crops/vegetables/videos.html>
- Organized on-farm research demonstrations with grower cooperators
- Delivered workshops and trainings, including major contributions to the annual Southwest Ag Summit attended by over 800 growers, PCAs and agriculture industry professionals <http://swagsummit.com/>

Community IPM Team

- **Hired new Assistant in Extension, Shaku Nair, starting July 1 2013**
- Continued trans-disciplinary “School IPM Inside and Out” Extension program
- Implemented pilot IPM programs in 6 schools (5 districts) in metro Phoenix and Tucson
- Engaged with County Agents & conducted workshops to reach outlying school districts
- Produced 15 monthly newsletters, Extension publications, videos
- EPA School IPM grant: “Stop School Pests” training and certification program; “big check” media event at Metro Tech High School; “IPM Hero” awards
- Nair WIPMC grant: Handbook of Pests in Community Environments

- Public Health Pests IPM: Assistant in Extension, Shujuan (Lucy) Li

IPM Assessment Team

- APMC Pesticide use database: >23 years of data; >595,000 use reports; ~ 1 million applications; >2,000 products >120 different crops
- Crop Pest Losses & Impact Assessment Signature Program: IPM impacts in cotton, lettuce and melons (AZ & low desert region of CA); expansion to other crops & locations
- ipmPRiME analysis of historical lettuce pesticide use: In collaboration with Jepson & Guzy (OSU, IPPC). Initial analysis complete (*Impacts, fig. 4*), detailed work ongoing.

Pesticide Safety Education Program

- We recently hired new Assistant in Extension for Pesticide Safety Education, Dr. Mike Wierda who began work in mid-July. Mike's position is partially supported through a PSEP-IMI grant and a major focus will be to work with a broad group of Arizona stakeholders to develop a business plan for establishing a sustainable and effective Pesticide Safety Education Program for Arizona.

Recent Publications

Extension Publications

Brown L.M., P.C. Ellsworth, G. Hughes, S. Bundy, V. Pat Porter Barlow, S.E. Naranjo, D. Kerns, A.M. Mostafa, A.J. Fournier. 2013. Natural Enemies of the Southwest: A field guide to the arthropod natural enemies of southwestern field crops. Book. University of Arizona Cooperative Extension. Publication no. AZ1607 71.

Brown L.M., A.M. Mostafa, T.. Vandervoet, A.J. Fournier, P.C. Ellsworth, S.E. Naranjo. 2014. Minute Bug with Enormous Impacts on Insect Pests. Field Crops IPM Short. University of Arizona Cooperative Extension. <http://ag.arizona.edu/crops/cotton/files/OriusRatio.pdf>

Brown P.W. 2014. Medium Term Weather Forecasts. Extension Report. University of Arizona Cooperative Extension.

Ellsworth P.C., L.M. Brown. 2013. Landscape Influences on Lygus Bugs in Western Cotton Plant Management Network. Webinar recorded. Plant Management Network. <http://www.plantmanagementnetwork.org/edcenter/seminars/Cotton/LygusBugs/>

Ellsworth P.C., L.M. Brown. 2013. Stink bugs in cotton alfalfa and other Arizona crops. ArizonaAg Blog Entry. University of Arizona Cooperative Extension. <http://arizonaag.com/2013/07/17/stink-bugs-in-cotton-alfalfa-and-other-arizona-crops/>

Ellsworth P.C., L.M. Brown. 2013. Frequently Asked Questions: Brown Stink Bugs. ArizonaAg Blog Entry. University of Arizona Cooperative Extension. <http://arizonaag.com/2013/07/02/frequently-asked-questions-brown-stink-bugs/>

Gouge D.H., S. Li, T.. Stock, S.. Bryks, C.. Foss, A.. Romero, D.J.. Young, A.. Code. 2014. Bed Bugs. Publication no.

az1625 <http://extension.arizona.edu/sites/extension.arizona.edu/files/pubs/az1625.pdf>

Kopec D.M., J.J. Gilbert, M. Pessaraki, E. Sanchez, D.A. Kilmer. 2013. Fairway overseeding trials 20122013. Cactus Clippings: Cactus and Pine GCSA Newsletter. Cactus and Pine GCSA. No. JulySeptember 68. <http://www2.cybergolf.com/sites/images/1177/Cactus-Clippings-2013-Jul-Sep.pdf>

Li S., D.H. Gouge, A.J. Fournier, S. Nair, P.B. Baker, C. Olson. 2013. Mosquitoes. Publication no. az1221 <http://ag.arizona.edu/pubs/insects/az1221.pdf>

Li S., D.H. Gouge, A.J. Fournier, U.K. Schuch, P.B. Baker, K. Umeda, D.M. Kopec. 2013. Summer Pest Proofing School Integrated Pest Management IPM Newsletter July 2013. Newsletter. University of Arizona Arizona Pest Management Center. <http://cals.arizona.edu/apmc/westernschoolIPM.html>

Li S., D.H. Gouge, S. Nair, A.J. Fournier, U.K. Schuch, P.B. Baker, K. Umeda, D.M. Kopec. 2013. Rodents Management Part II School Integrated Pest Management IPM Newsletter December 2013. Newsletter. University of Arizona Arizona Pest Management Center. <http://cals.arizona.edu/apmc/docs/2013DecemberAZSchoolIPMNewsletter.pdf>

Li S., D.H. Gouge, S. Nair, A.J. Fournier, U.K. Schuch, P.B. Baker, K. Umeda, D.M. Kopec. 2013. Rodents Management Part I School Integrated Pest Management IPM Newsletter November 2013. Newsletter. University of Arizona Arizona Pest Management Center. <http://cals.arizona.edu/apmc/docs/2013NovemberAZSchoolIPMNewsletter.pdf>

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ANNUAL IPM REPORT¹ FOR COLORADO

July 8, 2014

Bozeman, Montana

Submitted by Deborah Young, CSU

The **Colorado Center for Sustainable Integrated Pest Management** focuses on pests that damage or interfere with desirable plants in agricultural fields, orchards, landscapes and natural areas; damage homes or other structures; or pose an environmental health risk.

ADMINISTRATION

In cooperation with the College of Agricultural Sciences, the Center has a new website



<http://ipm.agsci.colostate.edu/>. Two-minute videos of CSU IPM faculty are being developed and posted on the website. Other websites include the Plant Diagnostic Clinic Facebook page, YouTube channels for school IPM and the Plant Diagnostic Clinic, Colorado Environmental Pesticide Education Program (CEPEP), the Healthy Communities website, and eXtension Urban IPM. The Department of Bioagricultural Sciences and Pest

Management at Colorado State University conducts two advisory committee meetings annually.

AGRICULTURE (Schwartz, Cranshaw, Nissen, Peairs, Westra, Ode)

Research:

- White mold (*Sclerotinia sclerotiorum*) resistance in dry bean
- Epidemiology of Iris yellow spot virus (IYSV) and onion thrips
- Thrips-resistant vegetable cultivars
- Herbicide resistance in weed species
- *Drosophila suzukii* (a new pest affecting state food crops)
- Brown wheat mite growth rates on 14 noncultivated grasses
 - No development occurred on the warm season grasses tested, while intrinsic rates of increase on several cool season species were similar to those observed on winter wheat.

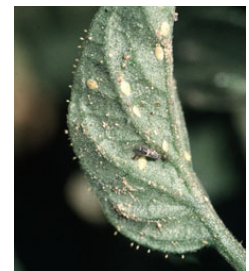
¹ WERA-1017: Coordination of IPM Research and Extension/Educational Programs in the Western States & Pacific Basin Territories

- Ecological interactions involved in the competitive displacement of *Cotesia glomerata* by *C. rubecula*, two imported biological control agents of the imported cabbageworm *Pieris rapae*, a serious pest of cruciferous crops worldwide
- Incidence and expansion of wheat stem sawfly damage to winter wheat
 - Fields infested with larvae, out of 100 surveyed, increased from 14 to 36% from 2012 to 2013.
- Biological control of Russian wheat aphid
 - Exclusion cage studies in the early 1990s indicated little biological control; these studies were repeated from 2009 to 2011. Reductions in Russian wheat abundance at Zadoks 45 growth stage average 67%, over seven site-years, with a range of 0 to 97%. Observed predator and parasitoids were predominantly native species.
- Seasonal life history and habits of a newly established population of apple maggot
- *Phyllotreta cruciferae*, an invasive flea beetle affecting crucifers, and displacement of the native *P. pusilla*



Extension/Outreach:

- “Onion Health Management and Production”, a capstone resource for the IPM PIPE (pest identification platform for extension and education <http://www.ipmpipe.org/>)
- Four new fact sheets on insects affecting fruit/vegetable crops
- Field days, workshops, collaborations with grower organizations, and timely information on new and emerging pests, such as potato/tomato psyllids



FORESTS & RANGE (Nissen, Norton, Brown, Jacobi, Beck, Gaines)

Research:

- Invasive species management and development of successional weed management systems for key invasive weed species (yellow toadflax, cheatgrass, leafy spurge, white top, diffuse knapweed)
- Plant invasions and restoration in prairie, steppe and montane system
- Forest issues, including exotic pest movement on firewood, mountain pine beetle and wildfires, the effect of magnesium chloride and trees, and dwarf mistletoe and fire fuels

Extension/Outreach:

- Demonstration plot and workshops on integrated weed management of leafy spurge
- Workshops, YouTube videos and fact sheets on Emerald Ash Borer
- Invasive Weed Master program -- course curriculum and educational materials

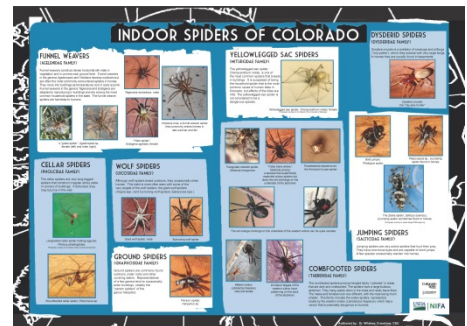
SCHOOLS & HOMES (Young, Cranshaw, Camper, Blunt, Davis)

Research:

- Interviews of participating school districts to identify accepted IPM practices
 - 90% of participating school districts are using snap traps instead of bait; 50% have replaced or installed new door sweeps; 70% have increased attention to sanitation; and 30% use sticky traps to monitor for pests.
- Key stakeholder interviews to determine community readiness for IPM adoption in schools in Colorado and Utah
 - 50, one-on-one phone interviews with key staff were analyzed based on job title and by school district to understand school personnel skills and knowledge of IPM.

Extension/Outreach:

- 4 posters of common arthropods in and around homes
- 12 new/updated fact sheets used for both school and housing (with Utah State University)
- Fact sheets in Spanish (10)
- Surveys of household infesting flies
- A guide for identifying and managing weeds in schoolyards & landscapes
- Quarterly meetings of the Colorado Coalition for School IPM
- Workshops to Colorado Pest Control Association, school grounds, retail staff in hardware/garden stores
- New videos, on the school IPM and Plant Clinic YouTube channels
- Monthly Healthy Schools newsletter (380 recipients)
- Presentations on school and housing IPM to more than 1000 individuals
 - Audiences included school districts, University of Colorado Hospital Asthma Foundation, Colorado Environmental Health Association, school nurses, City of Fort Collins, Entomology Society of America, and National Healthy Homes Conference.



GARDENS, LAWNS & LANDSCAPES (Cranshaw, Blunt, Camper, Young, Jacobi)

Extension/Outreach:

- Advanced ornamental pest diagnostics workshops -- in Colorado, Wyoming, New Mexico and Utah
 - External evaluations of training courses demonstrate a substantial increase in skills and knowledge.
- New educational materials and diagnostic training to address the discovery of emerald ash borer (EAB) in Boulder in September 2013

- how to identify the various wood boring insects of ash
- lilac/ash borer
- EAB management options
- a questions/answers sheet
- a map establishing EAB Risk Zones in Colorado
- Diagnoses of insect and disease problems
 - In 2013, the clinics (campus and Jefferson County) processed 1,468 samples.
- Training and support of Colorado Master Gardeners (CMG)
 - Annually, 1,600 CMG volunteers serving in 36 county/area based programs donate \$1.4 million in volunteer time.

COLORADO ENVIRONMENTAL PESTICIDE EDUCATION PROGRAM (*Walker*)

Research:

- Survey & Effectiveness of Pesticide Application Equipment Cleanout Methods, with the CSU Department of Chemistry, funded by the High Intermountain Center for Agricultural Health & Safety
 - The survey results (608 respondents) provided information on pesticide applicator practices and identified areas where behavioral interventions can be made to improve safety and protect the environment. The second phase of the study involved collecting samples from actual pesticide application equipment cleanouts (46 participants). Results provided information on how to improve cleanout efficiencies.

Extension/Outreach:

- Initial certification, through study guide manual sales and precertification workshops, to 1180 private applicators and 1559 commercial applicators
- Recertification training to 321 private pesticide applicators through Extension workshops and 1673 commercial applicators through organization meetings and Extension workshops
- Assistance to over 125 non-certified individuals (homeowners, parents, etc.) seeking information about pesticides through email and phone calls

Project WERA-1017: Coordination of IPM Research and Extension/Educational Programs in the
Western States & Pacific Basin Territories

ANNUAL REPORT FOR STATE: HAWAI'I

Submitted by: Arnold H. Hara, Coordinator, University of Hawai'i Extension IPM Program
Submitted: July 2014

Objectives of WERA-1017:

1. Increase participants' skills, knowledge, and awareness of regional/national IPM issues, systems, and strategies.
2. Enhance collaboration, sharing of ideas, and hence creation of regional outputs such as multi-state grants and shared outreach materials.
3. Improve coordination of IPM programs that address on-going, emerging and other critical pest and related environmental issues.

The University of Hawai'i Extension IPM Coordination and Support (UH EIPM CS) Program provides support for IPM education and technology transfer in two emphasis areas that were identified by extension personnel and stakeholders for their potential to generate the most IPM adoption, subsequent impact on reduction of risks to human health and the environment, and to be especially applicable to other areas of the Pacific Basin: IPM Training for Consumers/Urban Environments and IPM Implementation for Specialty Crops.

Accomplishments and Activities of the Hawai'i IPM Program

- The IPM Coordinator and staff participated in several training sessions for Master Gardeners and provided hands-on displays at community events to bring awareness to IPM in urban environments:
 - "Alien Invaders of the Worst Kind", Training for Master Gardeners (Mar. 4, 2014)
 - "Alien Invaders of the Worst Kind - A Systems Approach to Pest Management" (March 27, 2014, Kamuela, HI)
 - "Pest Alerts: Little Fire Ants, Coconut Rhinoceros Beetle, Coqui Frogs", "Sending Pest-free Flowers to the Mainland", Big Island Association of Nurserymen Annual Plant Sale and Educational Displays (April 26-27, 2014, Hilo, HI)
 - "Hawaii's Little Fire Ant Crisis", a community group, (April 13, 2014; Hilo, HI)
- Training for 2014 Master Gardeners (14) in Hilo (Hawaii) was completed in April (Andrew Kawabata) with curriculum that also included "Varietal selections to minimize disease and insect problems", "Insect and disease identification on various edible and

ornamental crops”, “Soil fertility and plant nutrition to promote healthy plantings”, “Fruit fly IPM”.

- The IPM Coordinator and staff participated in several seminars for growers with insect pest management presentations: (>400 attendees). Presentations can be viewed at <http://www.ctahr.hawaii.edu/haraa/grower.asp>
 - “Maintaining our Ornamental Export Markets”, Sustainable and Organic Agriculture Program’s Extension and Research Update (September 25, 2013, Honolulu, O`ahu).
 - “Common Pests: ‘Green’ Solutions”, Hawaii Export Nursery Association Horticultural Conference (July 26, 2013, Kohala, Hawai`i)
 - “Insect Pests”, Landscape Conference (August 6, 2013, Lihu`e, Kaua`i)
 - “Coconut Rhinoceros Beetle, A Major Threat to Hawaii’s Coconut and Palm Trees”, (March 25, 2014, Kahului, Maui)
 - “Old, New, and Expected Landscape Pests in Hawaii”, Maui Association of Landscape Professionals (March 25, 2014, Kahului, Maui)
- Several posters were prepared by extension agent Jari Sugano and colleagues for Integrated Pest Management, including “Pest Identification: Common Pests”, “Pest Identification: Common Diseases”, “Prevention Strategies”, “Control Strategies”, “Chemical Modes of Action”, “Reduced Risk Products”, and “Beneficial Insects and Insectary Plants”.
- Hawai`i nurseries shipping ornamental potted plants out-of-state continued to be encouraged to use hot water on plants for disinfestation of coqui frogs (*Eleutherodactylus coqui*), nettle caterpillar (*Darna pallivitta*), and little fire ants (*Wasmannia auropunctata*) as part of a systems approach to quarantine pest management. Hawai`i Department of Agriculture inspectors and staff monitor hot water treatments by nurseries in Hawai`i County.
- Extension Agents Jari Sugano (O`ahu County) and Randall Hamasaki (Hawai`i County) planned and implemented the following workshops, field days, and programs to promote IPM adoption by commercial and home garden growers of vegetables in the state:
 - Educational workshops targeting Chinese, Thai, and Laotian basil growers (J Sugano, translators available): “Farmers Resource Workshop: Chemical Sprayer Calibration and Chemical Mixing Demonstration (April 6, 2013, Kahuku, O`ahu; August 22, 2013, Kunia, O`ahu; September 5, 2012, Lihu`e, Kaua`i)
 - “Waianae Basil Growers Top Issues of 2013”, (October 5, 2013, Wai`anae, O`ahu)
 - “Diamondback Moth Insecticide Resistance Management Program” (J Sugano, R Hamasaki): “2013 Insecticide Rotation Calendar”, DBM field sampling and laboratory resistance screening (October 2013)

- “Spray Coverage and Calibration” (J Sugano, R Hamasaki) (June 13, 2013, Kula, Maui)
 - Train-the-Trainer session “1/128th spray calibration method”, Sustainable and Organic Agriculture Program’s Extension and Research Update (September 25, 2013, Honolulu, O`ahu).
 - “Farm Doctor Program” (R Hamasaki)
 - Hawaii Papaya Industry Association Annual Conference. Hilo, Hawaii. September 30, 2013 (J Sugano)
 - “Easy as 1-2-3” Fruit Fly Suppression Program (R. Hamasaki, J Sugano), Continuing Grower Education, <http://www.fruitfly.hawaii.edu/>
- In addition to educational sessions on safe use of pesticides, review of common basil pests in Hawaii, pesticides registered for use on basil in Hawaii, Hawaii Department of Agriculture pesticide inspection process, and the Hawaii Department of Health commodity sampling program, basil grower workshops also focused on soliciting ideas on how best to continue servicing and partnering with basil farmers, and establishing buy in to continue participation in future UH educational activities.
 - Farm visits were coordinated with translators to work with many Chinese growers on a one-on-one or small group basis on issues such as crop production, pesticide education, pesticide comprehension, and personal protection equipment. J. Sugano’s team effectively communicated with new and existing stakeholders on the best management practices in managing new and existing pathogens to vegetable crops.
 - The Diamondback Moth (DBM, *Plutella xylostella*) Insecticide Resistance Management Program was developed by UH CTAHR for growers to effectively manage DBM by rotating insecticide chemistries on an areawide basis. Extension agents worked with the crucifer growers in their counties to provide grower education and conduct periodic field sampling for laboratory resistance screening. At workshops, crucifer growers learned how to identify the various stages of the DBM life cycle, its distribution, host plants, and damage symptoms. Growers also learned about host-plant resistance, factors that affect insecticide resistance, including spray concentration and coverage, and effective pesticides available. Based on resistance screening in October 2013, adjustments were made to the DBM insecticide rotation.
 - Educational workshops were conducted to stress the importance of properly applying chemicals to edible and non edible crops. Worker protection standards and personal protection equipment were discussed to ensure farm employees are knowledgeable about a safe working environment.

- J Sugano developed publications that simplified spray equipment calibration using the 1/128th spray calibration method for both booms and hand-held spray guns for better pesticide spray coverage and accuracy. Lay terms and photos were used to communicate the concepts and step procedures to farm employees with varying levels of English proficiency. A video “Calibrating a Mist Blower Using the 1/128th Method” is available on-line at <http://www.ctahr.hawaii.edu/SustainAg/news/index.html#video> (Hana`ai newsletter, Sustainable and Organic Agriculture Program).
- Feedback from vegetable farmers in Hawai'i county indicated an emerging weed problem. Extension agent R Hamasaki submitted samples that were identified as yellow nutsedge, then proceeded with a workshop and demonstration for affected farms. Information on the weed's biology and chemical and cultural management strategies were covered by the Weed Specialist. A video of the workshop was posted on-line for accessibility by others encountering this weed.
- Since 2005, macadamia felted coccid (MFC) has been plaguing the macadamia nut industry in Hawaii. R. Hamasaki and a UH Entomology Specialist provided information to growers on using horticultural oils in combination with existing biological controls. Some of the oils are compatible with certified organic production and are mild on natural enemies that help to reduce MFC populations.
- The “Easy as 1-2-3” Fruit Fly Suppression in Hawaii program promotes an environmentally friendly, cost effective technology that, when used in an “area-wide” approach, can increase economic benefits to growers, the community and the state of Hawaii through expanded opportunities in diversified agriculture. Participants signed on as cooperators and were trained in using the program's three-pronged approach (field sanitation, an effective protein bait, and trapping) to manage fruit flies in apples, avocado, banana, cantaloupe, cherry, coffee, cucumber, eggplant, fig, grape, grapefruit, gourd, jaboticaba, lemon, lychee, mango, mountain apple, nectarine, orange, papaya, peach, pepper, persimmon, pomegranate, plum, pumpkin, sapote, starfruit, sour sop, squash, tangelo, tangerine, and tomato.

Impacts

- Workshop evaluations of “Alien Invaders of the Worst Kind” presentations conducted for program development and improvement were summarized (response scale: 1= Poor, 2=Fair, 3=Good, and 4=Excellent), with mean value of 4. Average rating by participants was “4”, with perceptions of increased knowledge and understanding of the topics presented (100%). Participants felt the methods conveyed in this presentation were appropriate (100%) and would assist them to better manage risk from insect and other

pests (100%). Evaluations showed participants picked up 3 to 4 (14%), 5 to 9 (43%), or 10 or more strategies (43%) that could be applicable to their risk management operations. Future workshops were requested on more pest and disease control (100%), crop insurance (67%), new varieties, crops and products (100%), record keeping (83%), fertilization (100%), and marketing and adding value (71%). The presentation “Hawaii’s Little Fire Ant Crisis” resulted in 12 confirmation samples (7 at the event, 5 during follow-up telephone and walk-in visits). The attendees also discussed cooperating as a group to monitor, purchase product, and treat for little fire ants.

- In the past year, nearly 96,000 potted plants (estimated \$4.7 million) were hot water-showered, and nearly all 49 species and cultivars tolerated the heat well; 2,968 coqui frogs (adults, juveniles, egg clutches) and numerous arthropods, slugs, snails, and lizards were killed and removed by the treatment. Use of hot water on potted ornamental plants continues to be validated as a practical, cost-effective IPM strategy available to large-scale commercial growers, on preventing potential pest interceptions by receiving ports in the US and Guam.
- In collaboration with the University of Hawai'i, John A. Burns School of Medicine (JABSOM), extension agent Glenn Teves, Hawaii Department of Agriculture pesticide educators, agricultural chemical representatives, and the Local Immigrant Farmer Education (LIFE) program, Jari Sugano and her team worked with a group of Wai`anae basil farmers to address priority crop production and human safety issues. As a result of intensive training and recognition of government and private sector resources, these farmers were able to control armyworm damage to their crops safely by selecting appropriate products, learning to decipher pesticide labels, and applying according to label with proper personal protection equipment.
- Workshop participants developed the “2013 Insecticide Rotation Calendar” for O`ahu and Hawai'i counties based on bioassay results. Crucifer crop growers applied pesticides in a coordinated, area-wide basis, rotating insecticides from 6 mode of action groups to reduce the risk of selecting for resistance in DBM populations. Bioassays conducted in October 2013 showed no evidence of insecticide resistance selection in Hawaii county, indicating that the program is preserving the effectiveness of insecticides and enabling growers to achieve their yield goals. Approximately 50% of acres in brassica production (7 farms) are participating in this area-wide program on O`ahu, and approximately 457 acres in Hawaii county (7 farms).
- By placing a portable piece of clear plastic on a plowed and irrigated field and increasing the depth of solar heat penetration, rhizomes of weeds are encouraged to sprout, making them more susceptible to control measures. Vegetable crop growers implementing this

strategy and also properly calibrating their spray equipment have decreased frequency of herbicide applications and volume of herbicides applied.

- In September 2013, a Train-the-Trainer educational event was conducted in coordination with the Sustainable and Organic Agriculture Program (SOAP) and Western SARE program. Nearly 30 extension educators attended and obtained hands-on training on the application of the 1/128th spray calibration method, a fast, easy way to compute the gallon-per-acre rate (GPA), to pass onto their respective clientele.
- As part of the Risk Management Hawaii (RMH) project, the "Farm Doctor" program (R. Hamasaki) meets the needs of a varied clientele base. Beginning farmers with little experience and often times no agricultural background or training Beginning farmers often inquired about general crop culture, information and resource materials, and sources of agricultural credit, while established farmers requested assistance with pest identification and management. A total of 188 direct (face to face) interactions such as through farm/office visit consultations and 430 indirect interactions such as through email and telephone consultations were conducted. An additional 2,140 contacts were made via email blasts. Although this is often a reactive, one-on-one approach, there is a good chance of learning and adoption because a client in dire need is in a very "teachable moment" and receptive to outreach efforts.
- Thirty cooperators representing 172 acres practiced the "Easy as 1-2-3" Fruit Fly Suppression in Hawaii program during the past year. As a result of training, the participants were able to make informed decisions for managing fruit flies in their farm or garden. These practices resulted in decreased pest infestation and crop damage levels. Many participants have adopted these practices over several years..

Publications

1. Research Publications

Hara, A.H., S.K. Cabral, and K.L. Aoki. 2013. Foliar and drench applications of insecticides against root mealybugs in containerized rhapsis palms, 2010. *Arthropod. Manage. Test* 38 (G21)

Hara, A.H., S.K. Cabral, and K.L. Aoki. 2013. Efficacy of s-methoprene ant baits to control the little fire ant, 2011. *Arthropod Manage. Test* 38 (L1).

2. Extension bulletins, Newsletter articles / Technical reports

Hara, A.H., S.K. Cabral, R.Y. Niino-DuPonte, and J.M. Miyashiro. 2014 (rev Mar 2014). Little fire ant products available for homeowner use. University of Hawaii at Manoa, CTAHR,

Honolulu, HI.

<http://www.ctahr.hawaii.edu/haraa/HomeownerLFAAttractancyrev030314CES.pdf>

Hara, A.H., S.K. Cabral, R.Y. Niino-DuPonte, and J.M. Miyashiro. 2014 (rev May 2014). Little fire ant products available for landscape, golf course and nursery use. University of Hawaii at Manoa, CTAHR, Honolulu, HI.

http://www.ctahr.hawaii.edu/haraa/rev%20Nursery_Landscape_LFA_Pesticides_5__2014CES.pdf

Uyeda, J., J. Sugano, S. Fukuda, M. Kawate, R. Shimabuku, and K.-H. Wang. 2013. Sprayer calibration using the 1/128th method for boom spray systems. CTAHR Cooperative Extension Service PRRE-8. <http://www.ctahr.hawaii.edu/oc/freepubs/pdf/PRRE-8.pdf>

Uyeda, J., J. Sugano, S. Fukuda, M. Kawate, R. Shimabuku, and K.-H. Wang. 2013. Sprayer calibration using the 1/128th method for handheld spray gun systems. CTAHR Cooperative Extension Service PRRE-7. <http://www.ctahr.hawaii.edu/oc/freepubs/pdf/PRRE-7.pdf>

IDAHO EXTENSION IPM 2014

Edward John Bechinski, Extension IPM Coordinator

Ronda E. Hirnyck, Idaho Pest Management Center Director and Extension Pesticide Coordinator

University of Idaho

WERA 1017 Bozeman MT 7-8 July 2014

Our FY13 NIFA E-IPM award provided funding for Extension programming by University of Idaho faculty teams in three emphasis areas.

EMPHASIS #1: IPM TRAINING FOR CONSUMERS/URBAN ENVIRONMENTS

Our desired outcome is improved pest management practices in home yards and gardens among Idahoans statewide. Results from our 2011-2012 statewide homeowner surveys provide the necessary baseline data for 5-year follow-up surveys during 2016-2017 to quantify changes in IPM adoption. Programming during 2014 involved four activities with emphasis on enhancing the IPM knowledge and skills of our statewide Extension County educators and their county Master Gardeners.

Idaho Green Thumbs How-To's Home Landscape Fact Sheets Project

The University of Idaho Extension Faculty Team in Commercial and Consumer Horticulture identified 50 topics as priorities for delivery as single-page, on-line and printed fact sheets. We created a new standardized publication series format -- the *Idaho Green Thumbs How-To's* fact sheets -- and have written and posted on-line 6 titles, four of which deal with management of diseases, insects or weeds. We anticipate two more *Green-Thumbs* during summer 2014. We have contracted with University of Idaho Educational Communications to translate these into Spanish. Experience suggests we will reach thousands of homeowners in Idaho and the Pacific Northwest; two of our on-line *Homeowner IPM Guides* bulletin series (funded through our FY09 and FY10 NIFA E-IPM awards) are the #1 and #4 most-accessed publications in the Extension catalog with 85,000 unique IP downloads annually.

In-Service IPM Workshops for Extension Faculty and Master Gardeners

Thirty-two County Extension Educators from Idaho, Montana, Utah and Wyoming participated in our 26-27 June 2014 *In-Service Workshop*. Speakers included Extension and Research faculty in Entomology, Plant Pathology and Pest Diagnostics from Colorado State University and Montana State University as well as from the University of Idaho who delivered 90-minute workshops supplemented with a field trip. Pre:post tests to quantify short-term Logic Model outcomes showed that whereas >50% participants ranked their pre-workshop knowledge of pest identification, biology and management as “*some-to-poor*” (with <3% ranking their knowledge as “*excellent*”), 75% self-ranked their post-workshop knowledge as “*excellent-to-good*.” Participants received an IPM “tool-kit” of reference texts, specimen curation supplies, and a Mini-Digital Microscope.

One hundred thirty-five Master Gardeners and affiliated staff and students from Idaho, Montana and Wyoming participated in our 27-28 June 2014 *Master Gardener State Convention* convened at the Horticulture Gardens and adjoining greenhouses and orchards of Brigham Young University – Idaho. Faculty from the University of Idaho, Montana State University and Colorado State University offered fifteen concurrent 50-minute hands-on small-group workshops; IPM subject-matter included plant disease diagnosis, IPM for landscape insects, and insect biocontrol.

IPM Curriculum for Master Gardeners

Bechinski is developing a peer-reviewed IPM curriculum for Master Gardeners that will consist of twelve 1-hour subject-matter modules allocated as four-units *Safe and Effective Pesticide Use in Yards and Gardens*, four-units *Entomology*, and four-units *Managing Insects Frequently Encountered in Yards and Gardens*. Training will be available in two formats: (1) on-line, independent-study lessons using Adobe Captivate and posted to the national eXtension site, and (2) PowerPoint pptx file format for live delivery by a local presenter. We completed elements of this work (SEE Idaho Master Gardener Pesticide Policy

at eXtension Campus Courses <http://campus.extension.org/enrol/index.php?id=926>). To date, 145 Master Gardeners across Idaho have completed this initial on-line training module.

Bechinski delivered during 2014 36 contact-hours of on-site IPM workshops attended by 303 Idaho Master Gardeners volunteers and County Extension educators. Subject-matter focus was pest identification, biology and management options, with an emphasis on biological control and “least-toxic” biorational pesticides. Workshops combined PowerPoint shows supplemented by hands-on examination of specimens. We are equipped with 25 portable, battery-powered stereoscopes through our FY12 NIFA E-IPM award to support these workshops

Videos for Master Gardener Education

Work is in progress on a 1-hour video to supplement live on-site Master Gardener IPM education. Subject-matter is “*How to succeed at biological control*” so as to accompany the 2014 in-press extension handbook *Pacific Northwest Natural Enemies Manual* funded with our FY12 NIFA E-IPM award.

EMPHASIS #2: IPM IMPLEMENTATION FOR SPECIALTY CROPS

Our desired outcomes are two-fold: (1) to increase farmer profitability via pest alerts and interactive IPM decision tools that identify economically optimal aphid:virus management strategies for dry peas in the Palouse agronomic region of northern Idaho and adjoining eastern Washington state, and (2) mitigate adverse environmental impacts of current aphid:virus control practices (esp. impacts on natural enemies) by replacing dimethoate insecticide applied as three seasonal foliar sprays with reduced-hazard seed-treatments of imidacloprid or thiamethoxam.

We are operating a network of aphid pan-traps strategically located at 20 commercial dry pea fields in a three-county area and are using ELISA and PCR to determine the virus status (pea enation mosaic virus and bean leaf roll virus) of colonizing pea aphids and dry pea crops. We deliver to growers and their advisors on-line pest forecasts, real-time status reports, and IPM decision tools at our *Aphid Tracker* website (www.ag.uidaho.edu/aphidtracker). IPM decision tools take the format of interactive crop enterprise budgets that allow growers to use values from their own farms to estimate the cost-effectiveness of imidacloprid and thiamethoxam insecticidal seed-treatments and foliar insecticides (dimethoate and alternatives to dimethoate) when virulent or non-virulent aphids occur.

EMPHASIS #3: IPM EDUCATION FOR IDAHO PESTICIDE APPLICATORS

Our desired outcome is improved pest management practices among state-certified commercial agricultural and horticultural pesticide applicators, especially practices that minimize potential harm to groundwater and surface waters.

We are working with Mr. Sherm Takatori, Program Manager for Pesticide Licensing and Certification at our state lead agency, the Idaho State Department of Agriculture, to revise and update a study manual widely used by Idahoans preparing for initial pesticide applicator certification exams -- *Agricultural Weed Management Principles* (published 1993). This manual is a Washington State University publication and so justifiably has a Washington-centric focus that sometimes is inappropriate for Idaho. Topics now considered critical to pest management -- such as pesticide resistance management, environmental fate and stewardship (including use of risk assessment tools) – are not covered in the detail they warrant in this 20-year old manual. We emphasized these topics at four regional Pre-Licensing Training Workshops organized by Hirnyck and Takatori during 2014. These 3-day workshops delivered IPM training to approximately 200 pre-license private and commercial pesticide applicators.

ADDITIONAL IPM WORK PROJECTS AT UNIVERSITY OF IDAHO:

1. Water Quality and Nutrient Management Topic Team:

Conservation Innovation Grant (CIG) with Idaho NRCS to develop and test crop specific IPM checklists in a targeted watershed. The Lower Boise River watershed is listed as an impaired stream segment and NRCS has designated it as one of the areas for the National Water Quality Initiative. Project is still ongoing. No impacts measured, at this time.

2. Potato Topic Team:

Extension potato team is developing a proposal to develop a multi-disciplinary project to deal with soil health. The ultimate goal will be to decrease the use of soil fumigants. The proposal was just submitted.

3. Sugar Beets and Minor Crops Topic Team:

- a. Multi-million dollar project: REACCH, Regional Approaches to Climate Change. The project is a multi-state project to focus on integrated relationship among cropping systems, pests and beneficial organisms, weather and climate modeling, greenhouse gas emissions, social and economic interests, and curriculum development. www.REACCHpna.org
- b. Extension minor crop research and extension projects on developing use of drip irrigation to manage water use, pests, and reduce transport of pesticides to water bodies. Impact Statement at: http://www.extension.uidaho.edu/impacts/Pdf_13/17-13jneufeld-onion.pdf
- c. Effects of fertilizer rate, irrigation and crop residue on diseases, insects and weed control in sugar beets.

Don W. Morishita, W. Howard Neibling, and Erik J. Wenninger

University of Idaho, Kimberly R&E Center

Professor, Weed Science; Associate Professor, Irrigation Engineering; Assistant Professor, Entomology

The first year of a two year interdisciplinary study was initiated in April 2013 at the University of Idaho Kimberly Research and Extension Center. The primary objectives of the study are to examine the effects of nitrogen fertilizer application rate, irrigation amounts, and crop residue level on: 1) moisture content and temperature within the soil profile; 2) emergence and stand establishment of sugar beet crop; 3) abundance of insect pests and severity of associated crop damage; 4) abundance and richness of natural enemy arthropod fauna; 5) onset, development, and severity of Rhizomania; 6) weed emergence, control, and interference with the crop; and 7) root yield, sugar content, and estimated recoverable sucrose.

Three tillage treatments were established to achieve the desired crop residue levels: conventional tillage (CT), strip tillage (ST), and no tillage or direct seeding (DS). Individual tillage plots were 264 ft wide (144 rows) by 30 ft long. Three irrigation levels were established after seedling establishment. The irrigation rates were based on sugar beet evapotranspiration (ET) and were: 50, 100 and 150% of ET. Each irrigation treatment was applied across all three tillage treatments in each rep. An individual irrigation treatment was 88 ft wide (48 rows) by 90 ft long. In this study tillage treatments and irrigation treatments are main effects. Four nitrogen fertility rates based on The Amalgamated Sugar Company's recommended nitrogen rate for conventionally tilled sugar beets. In addition to the recommended rate, which is 1x, three other rates were applied 0.5x, 0.75x, and 1.25x) within each irrigation and tillage treatment. Each fertilizer rate sub-plot was 22 ft (12 rows) by 30 ft long.

Sugar beet stand counts were taken five times beginning shortly after the first beets emerged on May 14 and ended June 12. On every counting date, stand was equal between the CT and ST and in most cases significantly higher than DS. On May 29, which was roughly the peak of emergence, crop stand averaged 180, 185 and 160 plants per 100 feet of row in the CT, ST and DS, respectively. The DS tillage treatment stand was statistically lower than the other two tillage treatments. By the last stand counts taken June 12,

there was a significant tillage by irrigation by nitrogen fertilizer rate interaction. Essentially though, the biggest difference was due to the tillage treatment.

Insects. Among the pestiferous arthropods found in the plots, leafminers and sugar beet root aphids were abundant enough to sample and make meaningful comparisons among treatments. Leafminer eggs and larvae were sampled across all of the 100% ET plots on May 31 and June 12. No significant leafminer responses were observed in regard to fertility treatments; however, leafminers responded to tillage treatments. On May 31, more eggs per plant were found in the CT plots relative to the ST and DS plots, which did not differ from each other; no differences in leafminer eggs were observed among tillage treatments on June 12. On both dates, more leafminer larvae were observed in CT plots than in ST and DS plots, which did not differ from each other.

Sugar beet root aphids were sampled across all 50% ET plots by digging eight beets per plot and assessing infestations using an established rating scale. Root aphid ratings did not differ significantly in regard to either tillage or fertility treatment.

Plant disease. Random *Aphanomyces* and *Rhizoctonia* diseased plants were found throughout the study site, but there was no correlation with tillage, irrigation or nitrogen fertilizer rates.

Weed seedling emergence. Weed seedling emergence counts were taken four times, June 3, June 19, July 3 and July 17 within fixed 2.7 ft² (0.25 m²) areas in each plot. Weed counts were taken before each time the sugar beets were sprayed for weed control and two more times at two week intervals after the last application of glyphosate + dimethenamid-P at 0.75 lb ae/A (0.84 kg ae/ha) and 0.84 lb ai/A (0.95 kg ai/ha), respectively. No differences were observed in weed populations between the tillage treatments, irrigation treatments or fertilizer treatments. This would indicate that weed emergence is not any different between tillage systems.

Yield response. Analysis of the data showed that ERS yield in the CT and ST treatments (10,196 and 10,203 lb/A) were significantly higher than the DS treatment which averaged 9,202 lb/A. However, there was a significant tillage by irrigation rate interaction for root yield (Table). Interestingly, root yield was equal between DS at the 100% ET rate and the CT or ST treatments at 100% ET. However, at 150% ET, the DS yield was significantly lower than CT or ST and statistically equal to CT or ST at the 50% ET rate. Sugar beet stand was likely the biggest factor affecting DS root and sugar yields. If we can improve crop stand in the DS, root and sugar yields could potentially equal CT and ST yield.

Table. Sugar beet root yield in response to tillage and irrigation rate.

Tillage	Irrigation rate	Root yield
	% of ET	ton/A
Conventional tillage	50	38 d
Direct-seed	50	35 ef
Strip tillage	50	39 cde
Conventional tillage	100	43 a
Direct-seed	100	39 abcd
Strip tillage	100	42 ab
Conventional tillage	150	43 a
Direct-seed	150	34 f
Strip tillage	150	42 abc

IMPACTS: Information from this project was presented to 110 growers, crop consultants, crop advisors and other agricultural professionals at a field in June 2013. Overall response to this has been favorable and many growers have expressed interest in direct seeded sugar beets.

PUBLICATIONS:

Morishita, D.W., W.H. Neibling, E.J. Wenninger, O.T. Neher and K. Belmont. 2014. First year report on the effects of fertilizer rate, irrigation and crop residue on diseases, insects and weed control in sugar beets. The Sugarbeet. p. 26-27.

Montana's Annual report for WERA-1017

Mary Burrows, Montana IPM Coordinator, Bozeman, MT; 406-994-7766; mburrows@montana.edu
Objectives of WERA-1017:

1. Increase participants' skills, knowledge, and awareness of regional/national IPM issues, systems, and strategies.
2. Enhance collaboration, sharing of ideas, and hence creation of regional outputs such as multi-state grants and shared outreach materials.
3. Improve coordination of IPM programs that address on-going, emerging and other critical pest and related environmental issues.

The Montana State University IPM Program has chosen areas of emphasis that were identified by our stakeholder advisory committee as high priority, and match the skill sets of our staff. In the 2013-2014 EIPM cycle, those were: IPM Implementation in Agronomic Crops; Animal Agriculture (Bees); Communities; and Specialty Crops. Secondary areas of emphasis included Pest Diagnostic Facilities and Education for Pesticide Applicators

Accomplishments and Activities, 2013-2014

- The former IPM Coordinator, Barry Jacobsen, has been replaced by Mary Burrows. Dr. Burrows accepted the nomination to vice chair for WERA-1017 in 2013-2014, and will serve as chair in 2014-2015.
- New staff include Dr. Laurie Kerzicnik (Oct 2013), insect diagnostician and Dr. Eva Grimme, plant disease diagnostician (May 2014). Both work in the Schutter Diagnostic Laboratory
- The Schutter Diagnostic Laboratory received state funding for the first time in its history during the 2013-2014 legislative biennium. This funding has been added to the Extension base budget.
- A team has been hired to help provide external evaluation of the MSU IPM program. Their work will begin in September, 2014
- The plant identification diagnostician identified 547 plants in 2013, and more than 280 samples and counting in 2014. More than thirty of the submissions were state-listed noxious weeds. All clients are sent reports on how to manage weeds using IPM strategies. In addition to plant identification, the diagnostician assesses plants for herbicide injury, averaging more than 60 per year. Assessments include a consultation with client on whether they followed the herbicide label, advice on how to do so, or a recommendation for a different herbicide or different control method. Of increasing concern is vegetables submitted to the lab that are injured due to plant growth regulators herbicides from contaminated compost. The diagnostician is collaborating with the herbicide Compliance and Enforcement Officer at the Montana Department of Agriculture who has observed a sharp increase in 2014 in the prevalence of plant growth regulator contaminated compost. Discussions are underway to develop an educational campaign in 2015 to have gardeners conduct bioassays on new soil or compost before adding it to their garden.
- IPM specialists Fabian Menalled, Mary Burrows, Jane Mangold, Hilary Parkinson and Health and Human Services Specialist Selena Ahmed are developing a mental model to assess the communication gap between researchers, consultants and producers. Research in ecological weed management is extensive, but researchers struggle to convince producers to use this information when they make decisions. The group has collected more than 200 surveys from organic and conventional producers and researchers and consultants across the state and will continue to do so into the fall. The mental model will dissect and cluster the language obtained in the surveys to elucidate differences in what researchers and producers value and how they make decisions, thereby improving research, and methods and strategies to improve communication between researchers and producers to further implementation of integrated pest management practices.

Impacts:

- Performed over 1830 diagnoses on 1630 disease, insect and plant identification samples.
- Estimated economic impact per client was \$523, with an estimated total impact of \$900,000 to SDL clients on 3.6 million acres.
- One client stated the impact was in the '100s of thousands.' One wheat grower did not spray a fungicide and saved \$700k with no perceived yield loss due to disease.
- Failures of Priaxor fungicide were noted on Ascochyta blight of chickpea in 2013. An isolate from a grower in northern Montana was subsequently found resistant to Headline, a component of Priaxor. Advice from MSU Extension Plant Pathologist Mary Burrows to spray the crop with Proline saved the chickpea crop for several growers.
- In Dr. Kerzicnik's first week on the job, she identified a sap beetle, *Brachypeplus basalis* submitted by a curious commercial beekeeper. This beetle has been identified 3 times in the US, always associated with bees. The implications of this finding are unknown, but educational efforts will be conducted in cooperation with APHIS-PPQ and the Montana Department of Agriculture.
- Twenty nine plant identification samples were submitted to determine if they were toxic to livestock (cattle, horses and a mule) five of which were toxic, enabling producers to prevent further illnesses.
- Ten plant identification samples were submitted to determine if they were edible to humans, four of which were toxic, thereby preventing the potential consumers from becoming very ill.
- Medusahead (*Tainiatherum caput-medusae*) and garlic mustard (*Alliaria petiolata*) were identified, both first records in Montana of highly invasive weeds. Identification enabled early detection and rapid response, preventing further spread of these new invaders, which have cost other states millions in control costs or lost livestock forage production.
- Diagnosis was used to settle a legal issue between neighbors.
- Many clients reported avoiding pesticide treatments to landscapes and crops or were able to save important landscape trees worth several thousand dollars.
- 88% of clients rated services as "highly valuable"
- 81% of clients felt they made better management decisions due to clinic services.
- Research performed by an undergraduate has been submitted for publication and resulted in the recommendation that pulse growers use Stamina seed treatment as part of an integrated management strategy for Ascochyta blight in pea and lentil.
- Undergraduate who trained for 3 years in lab became an inspector with the state department of agriculture after graduation.
- Graduate student published two first reports of diseases in Montana, one of concern to the expansion of garlic cultivation in Montana and the other a powdery mildew on a widely grown ornamental, caragana.
- In 2013, Schutter Lab identified medusahead (*Tainiatherum caput-medusae*) in Sanders County, and garlic mustard (*Alliaria petiolata*) in Daniels County, both first records in Montana of highly invasive weeds. A management plan is in place for medusahead to prevent further spread, and the garlic mustard was eradicated. In 2014, Schutter lab identified two rush skeletonweed plants, one of which is a new county record. This plant is one of two 'priority 1A' plants on the Montana Noxious Weed List, meaning weeds are not present or in very limited populations and eradication is a top management goal.
- More than 30 plants were submitted to determine if they were toxic to livestock, seven of which were. Twelve were submitted by clients who planned to eat the plant, but wanted to verify it was safe. Five of those plants would have made the consumers very ill. In the most recent case, poison hemlock was submitted for identification. The client saw the highly dissected carrot-like foliage and the white taproot and hoped it was a wild carrot. All parts of this plant are extremely poisonous, but the root is particularly deadly.

Outputs (Publications and Presentations):

Referred publications:

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2. Burrows, M., C. Thomas, N. McRoberts, L. Coop, J. Stack, T. Blunt, G. Franc, D. Ito, K. Kinzer, J. Olson, J. O'Mara, J. Price, C. Rush, C. Tande, A. Timmerman. 2014. Distribution of wheat viruses in the Great Plains region, 2008-2010 and modeling of symptom onset. *Plant Dis.* (in prep).
3. Miller, Z., F. Menalled, M. Moffet, D. Ito, M. Burrows. 2014. Impacts of crop variety and time of inoculation on the susceptibility and tolerance of winter wheat to *Wheat streak mosaic virus*. *Plant Dis.* 98: 1060-1065.
4. Burrows, M., L. Neuman, L. Skoglund. 2014. Evaluation of seed treatment fungicides for management of *Ascochyta* blight in lentil, 2012. *Plant Disease Management Reports.* 8:ST005.
5. Moffet, M, M. Burrows, P. Bruckner, J. Berg. 2013. Evaluation of fungicides for control of stem rust in Montana, 2012. *Plant Disease Management Reports.* 7:CF035.
6. Ehlert, K.A., J.M. Mangold, and R.E. Engel. 2014. Integrating the herbicide imazapic and the fungal pathogen *Pyrenophora semeniperda* to control *Bromus tectorum*. *Weed Research.* *In press.*
7. Mangold, J., H. Parkinson, C. Duncan, P. Rice, E. Davis, and F. Menalled. 2013. Controlling downy brome (*Bromus tectorum*) with imazapic on Montana rangeland. *Invasive Plant Science and Management* 6:554-558.
8. Mangold, J. and A. Lansverk. 2013. Testing control options for *Tragopogon dubius* on Conservation Reserve Program lands. *Weed Technology* 27:509-514.
9. Orloff, N., Z.J. Miller, F.D. Menalled, M.E. Burrows, and J.M. Mangold. 2013. Joint impacts of biological and environmental stressors on *Bromus tectorum* growth. *Weed Research* 53:192-200.
1. Orloff, L.N., J.M. Mangold, and F.D. Menalled. 2013. Role of size and nitrogen in competition between annual and perennial grasses. *Invasive Plant Science and Management* 6:87-98.
2. Taylor, R.V., M.L. Pokorny, J. Mangold, and N. Rudd. 2013. Can a combination of grazing, herbicides, and seeding facilitate succession in old fields? *Ecological Restoration* 31:141-143.
3. Miller, Z; F. Menalled, U.M. Sainju, A.W. Lenssen, and P.G. Hatfield. *Accepted with minor editions.* Effects of targeted sheep grazing and diversifying crop rotation on spring wheat yields and weed pressure. *Agronomy Journal.*
4. Miller, Z., F. Menalled, D. Ito**, M. Moffet, and M. Burrows. *In Press.* Impacts of crop variety and time of inoculation on the susceptibility and tolerance of winter wheat to *Wheat streak mosaic virus*. *Plant Disease.*
5. Liebman, M., Z. Miller, C. Williams, P.R. Westerman, P.M. Dixon, A. Heggenstaller, A.S. Davis, F.D. Menalled, and D.N. Sundberg. 2014. Fates of *Setaria faberi* and *Abutilon theophrasti* seeds in three crop rotation systems. *Weed Research* 54:293-306.
6. Mangold, J., H. Parkinson, C. Duncan, P. Rice, E. Davis, and F. Menalled. 2013. Controlling downy brome (*Bromus tectorum*) with imazapic on Montana rangeland. *Invasive Plant Science and Management* 6:554-558.
7. Lehnhoff, E. and F. Menalled. 2013. Impacts of Tamarix-mediated soil changes on restoration plant growth. *Applied Vegetation Science* 16:438-447.
8. Lehnhoff, E. , B. K. Keith, W. E. Dyer, R. K. Peterson, and F. Menalled. 2013. Characterization of multiple herbicide resistance in wild oat (*Avena fatua*) and its impacts on physiology, germinability, and seed production. *Agronomy Journal* 105:854-862.
9. Orloff, N., Z.J. Miller, F.D. Menalled, M.E. Burrows, and J.M. Mangold. 2013. Joint impacts of biological and environmental stressors on *Bromus tectorum* growth. *Weed Research* 53:192-200.
10. Lehnhoff, E. , B. Keith, W. Dyer, and F. Menalled. 2013. Does multiple herbicide resistance modify crop-weed competitive interactions? Impact of biotic and abiotic stresses on multiple herbicide resistant wild oat (*Avena fatua*) in competition with wheat (*Triticum aestivum*). *PLoS ONE* 8(5):
11. Davis P., B. Maxwell, and F. Menalled. 2013. Impact of growing conditions on the competitive ability of *Camelina sativa* (L.) Crants (*Camelina*). *Canadian Journal of Plant Sciences* 93: 243-247.
12. Miller, Z., M. Burrows, and F. Menalled. 2013. Winter annual grassy weeds increase disease induced overwinter mortality in fall-sown cereals. *Weed Research* 53:102-109.

13. Orloff, N., J. Mangold, and F. Menalled. 2013. Role of size and nitrogen in competition between annual and perennial grasses. *Invasive Plant Science and Management* 6:87:-98.
14. Lonergan, E., and Skoglund, L. G. 2013. First report of *Embellisia allii* causing skin blotch and bulb canker on garlic in Montana. Online. *Plant Health Progress* doi:10.1094/PHP-2013-0924-01-BR.
15. Lonergan, E., and Skoglund, L. G. 2013. First report of powdery mildew (*Microsphaera palczewskii*) on Siberian peashrub (*Caragana arborescens*) in Montana. Online. *Plant Health Progress* doi:10.1094/PHP-2013-0327-01-BR.

Abstracts:

1. Burrows, M. Z.J. Miller, N. Ranabhat, D. Delaney-Falcon, and F. Menalled. 2014. Estimating Impacts of Grassy Weed Species on Risk of Cereal Viruses. WSSA-CWSS Joint Meeting, Vancouver, Canada.
2. Burrows, M., Z. Miller, F. Menalled. 2013. Estimating susceptibility to Wheat streak mosaic virus infection in non-crop grasses. American Phytopathological Society Meeting, Austin, TX. August 10-14.
3. Miller, Z., M. Burrows, F. Menalled. 2013. Effects of nitrogen fertilization on risks and impacts of wheat streak mosaic disease. American Phytopathological Society Meeting, Austin, TX. August 10-14.
4. Ranabhat, N., D. Delaney-Falcon, F. Menalled, M. Burrows and Z. Miller. 2013. Effects of inoculation method on host plant susceptibility to WSMV infection. NCB-ESA. Rapid City, SD. June 16-19. Poster DR-41.
5. Pol, C., Z. Miller and M. Burrows. 2013. Chemical and biological control of the wheat curl mite (*Aceria tosichella*). NCB-ESA. Rapid City, SD. June 16-19. Poster DR-42.

Extension publications:

1. M. Burrows, F. Menalled, and D. Weaver. 2013. 2014 Wheat Pest Calendar. (printed by Montana Wheat and Barley Committee).
 - a. McVay, K., M. Burrows, F. Menalled, C. Jones, K. Wanner, R. O'Neill. 2013. Montana Cool-Season Pulse Production Guide. MSU Extension Publications. EB0210.
2. J. Mangold, H. Parkinson, and M. Lavin. 2014. Grass Identification Basics. MT201402. Montana State University Extension, Bozeman, MT.
<http://msuextension.org/publications/AgandNaturalResources/MT201402AG.pdf>
3. Goodwin, K., J. Mangold, and C. Tharp. 2013. Herbicides and noxious weeds: Answers to frequently asked questions. EB0214. Montana State University Extension, Bozeman, MT.
<http://msuextension.org/publications/AgandNaturalResources/EB0214.pdf>
4. Mangold, J. and H. Parkinson. 2013. Plant Identification Basics. MT201304. Montana State University Extension, Bozeman, MT.
<http://msuextension.org/publications/AgandNaturalResources/MT201304AG.pdf>
5. Tharp, C.I. & A. Sigler. Pesticide Performance and Water Quality. MSU Extension Service
6. MontGuide: MT201305AG.
7. Kerzicnik LM, T Day. 2014. Japanese Beetle. Montguide MT201404AG. Montana State University Extension.
8. Tilt, W., M. Lavin, J. Mangold, H. Parkinson, K. Gibson. 2014. Montana Grasses App by High Country Apps. Version 3.12.
9. Mangold, J and H Parkinson. 2014. Grass Identification Basics, MontGuide 201402AG.
10. Orloff, N and J. Mangold. 2014. Watch out for Medusahead, EB0218.
11. Mangold, J and H Parkinson. 2013. Plant Identification Basics, MontGuide201304AG.
12. Parkinson, H., J. Mangold and F. Menalled. 2013. Weed Seedling Identification Guide for Montana and the Northern Great Plains, EB0215.
13. Monthly Weed Posts, produced by the Mangold lab cover identification of new high priority weed species, new research, and identification of Montana's noxious weeds; the publication reaches

more than 350 subscribers in Montana and surrounding states. Hawkweed (January 2013); Hawkweed Nomenclature and ID (February 2013); Dyer's Woad (March 2013); Controlling Cheatgrass with Imazapic (April 2013); "New" Invaders (May 2013); Knotweed Distribution (June 2013); Narrowleaf Hawksbeard (July 2013); Ventenata (August 2013); Going my way? Weed seeds as hitchhikers (September 2013); Plant Identification (October 2013); A bee's eye view' (November 2013); A Brief Peak at some Weed Research in Montana (December 2013); Medusahead (January 2014); Black henbane (February 2014); Genotyping Rush Skeletonweed (March 2014); Grass Identification (April 2014); Poison Hemlock (May 2014); Bulbous bluegrass (June 2014); Weed Spread and climate change: The Story of Dalmatian Toadflax (July 2014); Native and Exotic Thistles: Who's Jeckyl, who's hide? (August 2014)

14. Master Gardener Q&A, Big Sky Small Acres, Spring 2013
15. Master Gardener Q&A, Big Sky Small Acres, Summer 2013
16. Featured Landowner – Emmett May Grows Giant Atlantic Pumpkins, Big Sky Small Acres, Fall 2013
17. Master Gardener Q&A, Big Sky Small Acres, Fall 2013
18. Master Gardener Q&A, big Sky Small Acres, Winter 2013

Invited seminars:

1. 2014. Wheat streak mosaic virus: Research, Extension, and Education. Pacific Division American Phytopathological Society meeting. Bozeman, MT.
2. 2013. Innovation in research and extension in Wheat IPM. Northcentral Region Entomological Society of America meeting. Rapid City, SD.
3. 2014. Principles of restoration. North American Invasive Plant Short Course. Webinar from North Platte, NE. 23 January.
- 4.
5. 2013. Invasive plants in Montana. Montana Chapter of the Society for Conservation Biology. Bozeman, MT. 7 November.
- 6.
7. 2013. Cheatgrass management. Society for Range Management-International Mountain Section Fall Meeting, Medicine Hat, AB, Canada. 25 October.
- 8.
9. 2013. Cheatgrass research and Extension across Montana. 2013. Montana Extension Advisory Committee fall meeting. Bozeman, MT. 4 October.
- 10.
11. 2013. Managing and restoring rangelands and grasslands. North American Invasive Plant Ecology and Management Short Course. North Platte, NE. 25-27 June.
- 12.
13. 2013. Developing ecological principles for weed management: From MT to IA and beyond! Iowa Weed Commissioners Invasive Species Conference. Ames, IA. 7 March.

New Grants, 2013-2014:

1. M. Burrows and F. Menalled. 2013-2014. Improving the web presence of the MSU IPM Program. Subcontract from Tommy Bass. \$6,000.
2. M. Burrows. 2013-2014. AgroEmergency Preparedness Education. Subcontract from Tommy Bass. \$3,853.
3. M. Burrows. 2013-2014. Plant disease management and education in Montana. Montana Wheat and Barley Committee. \$39,614.
4. M. Burrows, L. Skoglund, J. Pasche, M. Wunsch. 2014-2015. Evaluation of the Ascochyta/Mycosphaerella Pathogen Complex in Chickpeas, Peas and Lentils for Resistance to QoI and DMI Fungicides. \$20,000

5. M. Burrows, L. Skoglund, J. Mangold. 2013-2014. Great Plains Diagnostic Network Montana Plan of Work. Subcontract from KSU. \$20,000
6. B. Jacobsen, M. Burrows, F. Menalled, K. Wanner, J. Mangold. 2013-2014. Implementing an IPM program for Montana. USDA-EIPM. \$86,000.
7. M. Burrows. 2013-2015. Schutter Diagnostic Laboratory. Montana Legislature added to MSU Extension base budget. \$250,000.
8. M. Burrows. 2013. Plum Pox virus testing. MDA. \$3750.
9. M. Burrows. 2014. Pulse Crop Diagnostic Laboratory. APHIS-10201 Farm Bill. \$150,000
10. M. Burrows and J. Pasche. 2014-2015. Fungicide resistance monitoring for *Ascochyta* blight in Montana and other pulse-growing states. Northern Pulse Growers Association. \$3500.
11. M. Burrows. Fungicide use in wheat and on-farm participatory research in Montana. Montana Wheat and Barley Committee. \$35,988
12. Grimberg, M. Burrows, F. Menalled. 2014-2015. Pathways to college. MSU's Native American Recruitment & Retention Initiative. \$17,000
13. M. Burrows. 2014-2015. Great Plains Diagnostic Network Montana Plan of Work. Subcontract from KSU. \$27,000.
14. M. Burrows. 2014-2017. Detection of fungicide resistant *Ascochyta* blight. Specialty Crop Block Grant Program, Montana. \$99,710.
15. E. Lehnhoff, J. Mangold, F. Menalled, Z. Miller, L. Rew, and T. Seipel. 2014-2015. Montana Department of Agriculture Noxious Weed Trust Fund. Mitigating the impacts of cheatgrass in a changing climate. \$30,000.
16. J. Mangold and N. Orloff. 2014-2015. Montana Department of Agriculture Noxious Weed Trust Fund. Predicting plant community response to weed control. \$27,000.
17. J. Mangold. 2014-2015. Montana Department of Agriculture Noxious Weed Trust Fund.
18. Montana's noxious weeds mobile app. \$11,150.
19. J. Mangold. 2014-2015. Montana Department of Agriculture Noxious Weed Trust Fund.
20. Montana noxious weed education campaign. \$75,000.
21. J. Mangold. 2014-2015. Montana Department of Agriculture Noxious Weed Trust Fund. Tall buttercup ecology and integrated management: phase 2. \$31,000.
22. J. Mangold. 2014-2015. Montana Department of Agriculture Noxious Weed Trust Fund. \$28,827.
23. J. Mosley, J. Mangold, R. Frost. 2013-2015. Western Region Integrated Pest Management Center. Integrating biocontrol insects and cattle grazing to suppress spotted knapweed. \$77,762.
24. J. Mangold. 2013-2014. Montana Department of Agriculture Noxious Weed Trust Fund. Montana noxious weed education campaign. \$75,000
25. Menalled F. W., Dyer, and E Davis. 2013-2014. Control of glyphosate resistant kochia
26. in fallow with soil active herbicides. Montana Wheat and Barley Committee. \$28,510.
27. Davis, E. and F. Menalled. 2014-2015. Evaluation of burndown efficacy and pre-emergences grass and broadleaf control in pulse crops. Northern Pulse Growers Association. \$11,425.
28. Menalled, Orloff, Miller, Barroso, Mangold. 2014-2015. A meta-analysis of previous Canada thistle (*Cirsium arvense*) control and management studies. Organic Advisory and Education Council (OAEC). \$4,000.
29. Menalled, Orloff, Miller, Barroso, Mangold. 2014-2015. A meta-analysis of previous field bindweed (*Convolvulus arvensis*) control and management studies. Organic Advisory and Education Council (OAEC). \$4,000.
30. C. Tharp. 2013-2014. Montana Pesticide Safety Education Program. USDA-PSEP. \$10,000.
31. T. Bass and C. Tharp. 2013-2014. Safe and secure pesticide storage; terrorism and pesticides. MT Department of Military Affairs. \$5,000.
32. C. Tharp. 2014-2017. Montana Pesticide Education Program Sustainability Initiative. Crop Life America. \$74,629
33. C. Tharp. 2013-2014. MSU/MDA PSEP interagency agreement. Montana Department of Agriculture. \$15,000.
34. K. Wanner. 2014-2018. Elucidating the Molecular Mechanisms of Pheromone and Odor Signaling in Olfactory Neurons. USDA-NIFA Foundational. \$399,858.

35. K. Wanner. 2013-2014. Managing wireworm damage to wheat and barley, a growing problem in Montana. \$29,546.

Awards:

- 2014 Mangold. Montana Weed Control Association Presidential Award
- 2013 Mangold. Western Society of Weed Science Outstanding Weed Scientist Early Career – Public Sector.
- Burrows. 2014 Researcher Excellence Award, Northern Pulse Growers Association
- Day Received the 2013 Distinguished Staff Award through the College of Agriculture
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Presentations

Montana Ag Live: Day, 9; Mangold, 8; Burrows, 14, Kerzicnik, 1; Montana PBS, 10,000 attendees/appearance

1. Kerzicnik LM. Identification of insects. April 21, 2014. Gallatin Master Gardeners, Level 1. Museum of the Rockies, Bozeman, MT.
2. Kerzicnik LM. Insects and diseases of woody ornamentals. March 15, 2014. Wyoming Farmer's Market and Master Gardener Annual Conference. Sheridan, WY.
3. Kerzicnik LM. Insect pest management in greenhouses. March 6, 2014. Greenhouse Pest Workshop. Bozeman, MT.
4. Kerzicnik LM. Identification of insects. February 18, 2014. Polson Master Gardeners, Level 1. Polson, MT.
5. Herbicide resistance - news and update. Crop and Pest Management School. Bozeman, MT. January 3, 2013 (27 contact hours)
6. Management decision in agricultural systems. Crop and Pest Management School. Bozeman, MT. January 3, 2013 (60 contact hours)
7. Herbicide resistance - news and update. Cabin Fever. Havre, MT. January 3, 2013 (60 contact hours)
8. Cheatgrass biology, ecology and management. MABA. Great Falls, MT. January 31, 2013 (115 contact hours)
9. Weed science at MSU. MSUE New agents orientation. Bozeman, MT. February 19, 2013 (10 contact hours)
10. Wild oat and kochia herbicide resistance. 2013 Crop School. Three Fork, MT. February 27, 2013 (67 contact hours)
11. Herbicide resistance - news and update. 2013 Private Applicator Workshop. Augusta, MT. March 22, 2013 (13 contact hours)
12. Glyphosate resistance kochia in Montana. MSUE new agent orientation. Bozeman MT. April 4, 2013 (37 contact hours)
13. Herbicide resistance - news and update. Private Applicator Workshop. Helena, MT. May 3, 2013 (30 contact hours)
14. Montana's crops. Farm fair. Belgrade, MT. May 8, 2013 (100 contact hours)
15. Targeted grazing to manage weeds. Farmers Union tour. Bozeman MT. June 9, 2013 (25 contact hours)
16. Welcome and introduction to the field day. MSU field day. Bozeman, MT. June 27, 2013 (30 contact hours)
17. Managing herbicide resistance and targeted grazing. MSU field day. Bozeman, MT. June 27, 2013 (50 contact hours)
18. Grazing small acres farms. MOA and Townes Harvest Field. Bozeman, MT. June 19, 2013 (25 contact hours)
19. Q&A. Framers Market. Bozeman, MT. July 31, 2013. (4 contact hours)

20. Sheep and viruses: making science fun! Montana Science and Engineering Festival. Bozeman, MT. September 28, 2013 (20 contact hours)
21. Herbicide resistance - news and update. Noxious Weed Management Certification Program. Bozeman MT. October 2, 2013 (16 contact hours)
22. Ecological principles in agroecosystems. 2013 MAE Conference. Belgrade, MT. October 18, 2013 (12 contact hours)
23. Climate change and impacts. MSUE 2013 Extension annual conference. Bozeman MT. October 23, 2013 (50 contact hours)
24. Sustainable agriculture. Science Olympiads. Bozeman MT. November 26, 2013 (25 contact hours)
25. Weed I.D. and Management Decision Tools. 2013 IPM Technology Forum. Bozeman MT. December 5, 2013 (41 contact hours)
26. Introduction to the MSU weed extension and research program. MSUE New agents orientation. Bozeman MT (10 contact hours)
27. Integrating crop and livestock in organic systems. Montana Organic Association. Kalispell, MT. December 13, 2013 (60 contact hours)
28. Current and future challenges to manage cheatgrass. Crop and Pest Management School. Bozeman, MT. January 2, 2014 (40 contact hours)
29. Herbicide resistance in kochia and other weeds, status and strategies for control. NDSU Extension Service Workshop. Williston, ND. February 4, 2014 (125 contact hours)
30. eOrganic Q&A. National eXtension Conference. Sacramento, CA. March 24, 2014 (25 contact hours)
31. Montana's crops. Farm fair. Belgrade, MT. May 7, 2014 (100 contact hours)
32. Welcome and introduction to the field day. MSU field day. Bozeman, MT. July 8, 2014 (30 contact hours)
33. Managing herbicide resistance. MSU field day. Bozeman, MT. July 8, 2014 (50 contact hours)
34. Integrated management of annual grasses. MSU field day. Bozeman, MT. 8 July, 2014 (30 contact hours)
35. Integrating crop and livestock in organic systems. MOA field day. Big Sandy, MT. July 11, 2014 (40 contact hours)
36. Burrows. 1/3/2013. On-farm research. 80 attendees. Bozeman, MT.
37. Burrows. 1/23/2013. Disease update. 20 attendees. Townsend, MT.
38. Burrows. 1/31/2013. Aster yellows in grain. 75 attendees. Great Falls, MT.
39. Burrows. 2/13/2013. Pulse crop diseases. 270 attendees. Conrad, MT.
40. Burrows. 2/27/2013. Introduction to Plant Disease. 75 attendees. Helena, MT.
41. Burrows. 5/6/2013. Diagnostic lab. 35 attendees. Bozeman, MT.
42. Burrows. 5/7/2013. Montana Crops. 400 attendees. Belgrade, MT.
43. Burrows. 6/7/2013. Montana Farm Bureau Tour of Clinic. 60 attendees. Bozeman, MT.
44. Burrows. 6/12/2013. Plant Disease. 15 attendees. Medicine Lake, MT.
45. Burrows. 6/12/2013. Plant Disease. 5 attendees. Plentywood, MT.
46. Burrows. 6/13/2013. Plant Disease. 10 attendees. Malta, MT.
47. Burrows. 6/14/2013. Plant Disease. 20 attendees. Sunburst, MT.
48. Burrows. 6/14/2013. Plant Disease. 12 attendees. Conrad, MT.
49. Burrows. 6/19/2013. Schutter Diagnostic Lab and Pulse crops. 20 attendees. Bozeman, MT.
50. Burrows. 6/25/2013. Pulse crop diseases and sample submission activity. 100 attendees. Lewistown, MT.
51. Burrows. 6/26/2013. Plant Disease during field day. 250 attendees. Havre, MT.
52. Burrows. 6/27/2013. Plant disease training. 12 attendees. Havre, MT.
53. Burrows. 7/9/2013. Plant Disease. 150 attendees. Mocassin, MT.
54. Burrows. 7/10/2013. Plant Disease. 150 attendees. Conrad, MT.
55. Burrows. 8/5/2013. Advanced Plant Disease Diagnosis for field crops. 16 attendees. Bozeman, MT.
56. Burrows. 8/7/2013. Cereal disease update. 50 attendees. Huntley, MT.
57. Burrows. 10/7/2013. Plant disease identification and doing research on your farm or land. 23 attendees. Ronan, MT.

58. Burrows. 10/7/2013. Plant disease identification and doing research on your farm or land. 23 attendees. Kalispell, MT.
59. Burrows. 10/8/2013. Plant disease identification and doing research on your farm or land. 19 attendees. Plains, MT.
60. Burrows. 10/8/2013. Plant disease identification and doing research on your farm or land. 9 attendees. Superior, MT.
61. Burrows. 10/9/2013. Plant disease identification and doing research on your farm or land. 50 attendees. Missoula, MT.
62. Burrows. 10/9/2013. Plant disease identification and doing research on your farm or land. 35 attendees. Hamilton, MT.
63. Burrows. 12/17/2013. Fungicide resistance in pulse crops. 260 attendees. Great Falls, MT.
64. Burrows. 12/5/2013. How to effectively and efficiently identify your pest with digital diagnosis. 75 attendees. Bozeman, MT.
65. Burrows. 3/22/2013. Disease management for Pulse Crops. 14 attendees. Bozeman, MT.
66. Burrows. 7/18/2013. Field crops disease and viruses. 8 attendees. Bozeman, MT.
67. Burrows. 10/29/2013. Vector transmission of plant pathogens. 6 attendees. Bozeman, MT.
68. Burrows. 10/31/2013. Introduction to Epidemiology. 6 attendees. Bozeman, MT.
69. Burrows. 6/17/2013. Wheat streak mosaic virus and the wheat curl mite: recent progress in research, extension, and education. 50 attendees. Rapid City, SD.
70. Burrows. 9/21/2013. Biology and management of mite-transmitted cereal viruses. 3000 attendees. Bozeman, MT.
71. Burrows. 10/25/2013. Wheat viruses and Schutter D-lab. 100 attendees. Bozeman, MT.
72. Burrows. 1/13/2014. Economics of fungicide use in dryland winter wheat and testing it on your farm. 10 attendees. Denton, MT.
73. Burrows. 1/13/2014. Economics of fungicide use in dryland winter wheat and testing it on your farm. 25 attendees. Fort Benton, MT.
74. Burrows. 1/14/2014. Economics of fungicide use in dryland winter wheat and testing it on your farm. 45 attendees. Chester, MT.
75. Burrows. 1/14/2014. Economics of fungicide use in dryland winter wheat and testing it on your farm. 25 attendees. Shelby, MT.
76. Burrows. 1/15/2014. Economics of fungicide use in dryland winter wheat and testing it on your farm. 23 attendees. Cut Bank, MT.
77. Burrows. 1/15/2014. Economics of fungicide use in dryland winter wheat and testing it on your farm. 30 attendees. Conrad, MT.
78. Burrows. 1/30/2014. Disease management with fungicides. 75 attendees. Great Falls, MT.
79. Burrows. 2/19/2014. Plant disease issues due to hail damage in 2013; Fungicide use and testing it on your farm. 102 attendees. Three Forks, MT.
80. Burrows. 2/21/2014. Plant disease threats 2014; Fungicide use and testing it on your farm. 60 attendees. Kalispell, MT.
81. Burrows. 2/28/2014. Disease management with fungicides and testing it on your farm. 28 attendees. Malta, MT.
82. Burrows. 6/4/2014. Agronomy update, Co agents. 12 attendees. Moccasin, MT.
83. Burrows. 5/8/2014. Montana Crops. 350 attendees. Belgrade, MT.
84. Burrows. 7/24/2014. Plant diseases in cereals and pulse crops. 100 attendees. Sidney, MT.
85. Burrows. 7/9/2014. Wheat streak mosaic virus Research, Extension, and Education. 100 attendees. Bozeman, MT.

Agricultural alerts (785 subscribers):

1. Impatiens Downy Mildew Webinar 1/15/2013
2. Cropland disease. Pulse crop disease information resources. (8 March, 2013) 3/8/2013
3. Webinar on 'Analyzing Winter Wheat Survival' from NDSU. 3/14/2013
4. Cropland disease. Think about long term disease control when planning rotations with pulse crops 3/21/2013

5. winter wheat webinar link in attachment 3/26/2013
6. 2013 Train the Trainer Update for Pesticide Educators. 4/1/2013
7. Bed Bug Awareness Week. 4/23/2013
8. Alfalfa Seed Chalcid: Timely Management Starts in Early Spring 4/24/2013
9. Some grasshoppers are active in winter and early spring 4/26/2013
10. Cutworms Active in Yellowstone County 4/26/2013
11. Spring tips to preparing various types of pesticide application equipment. 5/2/2013
12. Survey for Wireworm Damage 5/14/2013
13. Pea Leaf Weevils are Active 5/14/2013
14. Freeze damage common across state. 5/15/2013
15. Crop and Weed Field Day 5/20/2013
16. We got some rain! Should I spray a fungicide on wheat? 5/21/2013
17. Insect chewing damage to wheat reported in western Montana: Scouting recommended
6/3/2013
18. Hort. Farm - Towne's Harvest Field Day 6/6/2013
19. Downy mildew (*Peronospora trifoliorum*) of Alfalfa reported from Broadwater County (6 June
2013) 6/6/2013
20. Horticulture Farm and Towne's Harvest Garden Field Day 6/12/2013
21. Ascochyta blight of pea found in Sheridan Co 6/12/2013
22. Potential stripe rust found in Hill County 6/18/2013
23. Stripe rust confirmed in Flathead and Hill counties on spring and winter wheat 6/19/2013
24. Yellow crops more common right now due to heavy rains (19 June, 2013) 6/19/2013
25. Mechanism of Glyphosate-Resistance in Kochia from Montana (19 June 2013) 6/19/2013
26. MSU has received reports of current cereal leaf beetle activity in small grains 6/20/2013
27. Stripe rust considered widespread in the triangle 6/24/2013
28. Bee Kill Reminds Applicators to Read and Follow the Product Label. 7/1/2013
29. Advice on stripe rust from WA 7/1/2013
30. High Incidence of Orange Wheat Blossom Midge in Pondera and Flathead Counties, MT (1 July
2013) 7/1/2013
31. Observations on wheat and pulse crops in the triangle. (2 July, 2013) 7/2/2013
32. Tilt fungicide receives approval for 7 day PHI 7/8/2013
33. Safflower: Alternaria Blight and Rust (9 July 2013) 7/9/2013
34. Control of Roundup-Resistant Kochia in Montana (9 July 2013) 7/9/2013
35. Sugarbeets- Cercospora Leaf Spot and Powdery Mildew (9 July 2013) 7/9/2013
36. Alfalfa Downy Mildew in Phillips County (12 July 2013) 7/12/2013
37. 2013 Pest Management Tour offers credit opportunities. 7/15/2013
38. Added Insect Pest on Canola in Montana? 7/15/2013
39. Diagnosing head problems in wheat 7/16/2013
40. First Time Pulse Growers – Harvest Guidelines (17 July 2013) 7/17/2013
41. Possible fungicide failures against ascochyta in Chickpea. 7/17/2013
42. Clarification on Tilt special label 7/19/2013
43. Monitor for small grain aphids 7/26/2013
44. Insect Update, Winter Wheat 8/30/2013
45. Disease risk this fall in winter wheat 9/24/2013
46. Fall stripe rust management in winter wheat. 9/27/2013
47. Last Chance Private Applicator Credit Opportunities offered in North-Western Montana.
10/30/2013
48. Schutter Diagnostic Lab Impact Survey (6 November 2013) 11/6/2013
49. 2014 Crop and Pest Management School 11/18/2013
50. IPM Technology Forum offered in Bozeman, MT. 11/18/2013
51. Grain Storage Workshop on Dec.3rd 11/19/2013
52. Insect Diagnostician Joins Schutter Diagnostic Lab 11/19/2013
53. College of Ag Dean Listening sessions scheduled 12/2/2013
54. Credits for the 2014 Crop and Pest Management School 12/10/2013
55. Initial Commercial/Government Applicator Trainings across Montana 12/12/2013
56. Invasive grass medusahead found in Montana 1/3/2014

57. New Special Registration for Repelling Sand Hill Cranes Approved in Montana 1/24/2014
58. Brown Marmorated Stink Bug Webinar 2/7/2014
59. EPA Announces Final Plan for Certification of Pesticide Applicators within Indian Country
3/9/2014
60. Seed treatments for pulse crops. 3/19/2014
61. Three Tips for Preparing Pesticide Equipment 4/9/2014
62. Snow mold in winter wheat and other diseases you may encounter this spring in wheat
4/10/2014
63. Managing Pea Leaf Weevils 4/13/2014
64. Seed Treatments for Wireworm Control 4/20/2014
65. Army Cutworms Active in Teton County 4/22/2014
66. URBAN IPM: Reports of Woolly Apple Aphids (24 April, 2014) 4/24/2014
67. Wheat fungicide table finalized. 5/5/2014
68. Montana Grasses App 5/7/2014
69. New app for pest control from NDSU 5/7/2014
70. Wheat streak mosaic virus and active wheat curl mites in Chouteau County 5/9/2014
71. URBAN IPM: Chilling Injury to Ornamentals (9 May 2014) 5/9/2014
72. Potential for WSMV epidemics in areas that were hail damaged last fall 5/12/2014
73. Pesticide Program Focused on Applying Pesticides on Tribal Land. 5/13/2014
74. Monitor for Cutworms 5/16/2014
75. Urban IPM: Gall wasps and woodpecker damage on bur oak 5/20/2014
76. Pea leaf weevil activity reported from Hill County 5/22/2014
77. A heads up on Fusarium head blight in wheat and barley 5/30/2014
78. Stripe rust confirmed in Big Horn County 5/30/2014
79. CROPS AND WEED FIELD DAY AT THE MSU POST RESEARCH FARM 6/2/2014
80. Field Day - July 8 6/2/2014
81. More information on head blight management in cereal crops 6/5/2014
82. Stripe rust confirmed in Chouteau Co 6/10/2014
83. cereal leaf beetles active 6/17/2014
84. Orange Wheat Blossom Midge Adults beginning to emerge in Lake and Flathead Counties
6/18/2014
85. "White head" syndrome in small grains 6/20/2014
86. Freeze, hail damage, nutrient deficiency, physiological spotting, and powdery mildew in cereals.
6/20/2014
87. Stripe rust widespread in the triangle 6/25/2014
88. Adult Wheat Midges Active in Spring Wheat Fields 6/29/2014
89. Cereal cyst nematode concerns in Montana –Alan Dyer 7/18/2014
90. Ascochyta blight identified in chickpea in northern Montana. 7/18/2014

Newsletters:

Monthly Weed Post <http://www.msuextension.org/invasiveplantsMangold/extensionsub.html>
 Biannual IPM Newsletter <http://pesticides.montana.edu/News/Bulletins/>
 Quarterly Urban IPM Newsletter <http://urbanipm.org/>

2013 Montana Master Gardener Statistics:

Counties that Participated	26
Reservations that Participated	2
Master Gardener students taught:	616
White/Caucasian	548
Black/African American	3
Hispanic/Latino	21
Asian/Pacific Islander	4

American Indian/Alaska Native	40
Average class size:	22
Total number of student hours taught:	13,480
Total Number of contacts:	11,813
White/Caucasian	10596
Black/African American	70
Hispanic/Latino	366
Asian/Pacific Islander	82
American Indian/Alaska Native	768
Total volunteer hour value:	\$284,410 (12,846 volunteer hours X \$22.14/hr)

Level 1 Master Gardeners

Level 1 Master Gardeners:	616
Number of Level 1 Master Gardeners certified	156
Level 1 volunteer hours:	4,165
Level 1 contacts:	5,983
Value to Level 1 Master Gardener volunteers	\$92,213 (4,165 X \$22.14/hr)

Level 2 Master Gardeners

Level 2 Master Gardeners:	121
Number of Level 2 Master Gardeners certified	35
Level 2 volunteer hours:	4316
Level 2 contacts:	2350
Value to Level 2 Master Gardener volunteers	\$95,556 (4316 X \$22.14/hr)

Level 3 Master Gardeners

Level 3 Master Gardeners:	30
Number of Level 3 Master Gardeners certified	8
Level 1 volunteer hours:	4,365
Level 3 contacts:	3480
Value to Level 1 Master Gardener volunteers	\$96,641 (4,365 X \$22.14/hr)

Project WERA-1017: Coordination of IPM Research and Extension/Educational Programs in the
Western States & Pacific Basin Territories

ANNUAL REPORT FOR UTAH

Submitted by: Marion Murray and Diane Alston, Utah State University
Submitted: August 2014

Work under WERA Objectives

1. *Increase participants' skills, knowledge, and awareness of regional/national IPM issues, systems, and strategies.*

2. *Increase relevance of federal and regional IPM RFAs, programs, and policies to better align them with regional stakeholder needs.*

3. *Enhance collaboration, sharing of ideas, and hence creations of regional outputs.*

Utah State University, Colorado State University, and University of Idaho collaborate to write and maintain the Intermountain Tree Fruit Production Guide and companion website, intermountainfruit.org. The guide is unique in that it presents reduced risk/organic products separate from conventional, and focuses on monitoring, cultural practices and using thresholds.

4. *Improve coordination of IPM programs that address on-going, emerging, and other critical pest and related environmental issues.*

Impacts under WERA Outcomes

1. *Participants will form a functioning and responsive network, with access to shared expertise, improved grantsmanship and administration, and program development.*

Utah State University IPM benefits from the work done by larger states on invasive insects, and is now forming a multi-state working group for the invasive, brown marmorated stink bug.

2. *WERA-1017 priorities, reflecting our stakeholder identified needs, will appear in regional and national IPM RFAs, programs and policies.*

3. *WERA-1017 will serve as a forum from which new collaborations emerge among its members and their stakeholders.*

4. *State IPM programs will better address regional pest and environmental issues, have access to other state programs and opportunities to participate in coordinated, multi-state efforts.*

Because of WERA-1017, Utah State University is involved in a multi-state project outlining whole farm approaches to managing onion thrips and IYSV, including weed management, edge treatments, fertilization, irrigation, and use of predators and chemicals.

General State Report

The overarching goal of the Utah IPM Program at Utah State University is to increase the use of sustainable pest management practices in schools and on agricultural, and urban lands in a way that provides economic benefit and human and environmental protection. In 2013, the Program's education and applied research activities have resulted in changed human practices that reflect good stewardship and economic sustainability. Combined survey results from subscribers of the IPM Pest Advisories, commercial fruit growers, and IPM workshop attendees show improvements, as compared to 2008, in IPM implementation, including increased pest monitoring (134%), increased use of non-chemical control options (34%), increased adoption of safe pesticides and biocontrol options (1,400%), and decreased use of toxic pesticides (45%). These changes in behaviors will result in reduced pesticide impacts on humans, pollinators, soil and water.

SPECIALTY CROP IPM

The IPM Pest Advisory service consists of newsletters and an online decision aid tool called Utah TRAPs (Timing Resource and Alert for Pests, climate.usurf.usu.edu/traps). During 2013, we delivered 15 fruit and vegetable newsletters to a subscriber base of 14,400 (up 17% from 2012). The information provided in the newsletters comes from statewide weather station data and weekly insect trapping and pest monitoring in up to 20 locations.

We developed several new additions for the TRAPs website, including a redesigned interface; faster processing; a login-based pest alert text/email message system; an interactive map; addition of 2 orchard weather stations; 3 new pest models; a "one-stop" pest summary page; and video tutorials.

Subscribers of the advisory service are surveyed every other year, with the next survey scheduled for fall 2014. Surveys from 2008, 2010, and 2012 have shown that the advisories have been very beneficial to growers and homeowners in the state and have advanced the use of IPM. We have seen the following improvements since 2008:

- pest monitoring has increased by 134%
- the use of pheromone traps has increased by 16%
- avoidance of spraying during bloom has increased by 41%
- adoption of reduced risk and biocontrol products has increased by 1,400%
- use of organophosphate and pyrethroid products has decreased by 45%

Most subscribers (86%) use the advisories as their sole source of pest management information, and 99% reported that they would retain their subscription.

The IPM Program coordinated and conducted 4 applied research projects in 2013. Results of applied research have led to increases in IPM practices, cost savings, and/or reductions in pesticide use, and results include:

- peach twig borer mating disruption dispensers (Checkmate, Suterra) hung in mid-June provided the same protection and lower cost than when hung at biofix, saving growers up to \$70/acre
- four common perennial and biennial weeds in onion agricultural landscapes have been identified as key overwintering hosts for onion thrips and iris yellow spot virus; targeted weed removal can save onion growers an average of 15% crop loss, a savings of \$1010 per acre
- positioning a systemic insecticide as the first cover spray in an insecticide program for western cherry fruit fly prevented 5-10% crop loss, a savings of \$300-600 per acre for tart cherries and \$185-370 per acre for sweet cherries in Utah
- use of birdsfoot trefoil as a cover crop in peach orchards provided an average of 35% of the crop's nitrogen requirements and enhanced arthropod biodiversity for a value of more than \$100 per acre

The Intermountain Tree Fruit Production Guide was updated for the 2013 season, with authors from USU, Colorado State University, and University of Idaho. The guide is unique in that it presents reduced risk/organic products separate from conventional, and focuses on monitoring, cultural practices and using thresholds. We surveyed recipients of the tree fruit production guide and found that 60% increased their level of monitoring, 48% used the "organic/reduced risk" recommendations, 73% learned more about pest biology, and 72% said they are more likely to adopt recommended IPM practices.

A 2011 survey of Utah vegetable growers revealed that a comprehensive guide was one of the most needed tools for them to be successful. In spring 2014, a comprehensive vegetable guide was published, written by 8 USU authors representing 4 disciplines. It contains 7 chapters and focuses on onion, sweet corn, and solanaceous crops (utahpests.usu.edu/ipm/htm/vegetables). The guide will be evaluated via a pre-stamped written survey included with each copy. Over the next several years, it will be expanded to include additional crops and input from neighboring states.

SCHOOL IPM

As a result of the hard work by the Utah School IPM Coalition (comprised of representatives from various district school boards, pesticide applicators, and USU), the Utah Legislature passed the "School Rule" in August 2013, mandating IPM in all Utah schools. As a result, the focus of the Utah IPM Program is to help schools quickly transition to IPM to meet this new mandate. The Program held over 30 training sessions for 18 school districts, and additional training sessions for Utah Health Department employees who will be enforcing the new law. In addition, 10 schools were assessed to determine pest levels and areas where improvements could be made. A school IPM website (utahpests.usu.edu/schoolIPM) was developed, and includes 20 fact sheets in English and Spanish. The Utah Plant Pest Diagnostic Lab arthropod diagnostician spends 10% of his time on School IPM activities.

CONSUMER/URBAN IPM

In 2013, the IPM Program produced 7 IPM advisories in turf and ornamentals to a subscriber base of 10,600. The Program gave 40 talks and produced 4 how-to videos and 8 fact sheets. Twelve existing fact sheets were translated into Spanish. The IPM website was updated, and the commodity content (fruit, vegetable, landscape, field crops IPM) was expanded to include easy to understand information on pest management with thumbnails of diagnostic digital images. Optimal distribution of pest management information such as this has resulted in increased knowledge of our clientele, seen by the decreased number of inquiries on when/what to spray and general pest identification.

Publications 2013

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