PSPP - Plant Science Says *July 2018*

The International Potato Center and World Potato Congress in Peru
By Nina Zidack

Every year at Farm Fair at our Potato Station, we ask the 4th Graders... "Do you know where potatoes were originally grown?" We are often rewarded with the correct answer which is Peru. With Peru being the origin for potatoes, I naturally could not pass up the opportunity to attend the World Potato Congress (WPC) in Cusco, Peru, which was held in late May. Through my association with Potatoes USA and the United Nations Committee on Seed Potato Standards, I was sponsored to attend the World Potato Congress in Cusco, Peru, and visit the International Potato Center (CIP) in Lima.

The United Nations Economic Commission for Europe (UNECE) delegation attended an open house at the International Potato Center at their headquarters in Lima before the WPC. There were demonstrations of the activities and research performed at CIP including preservation of genetic material, disease diagnostics and management, nutrition, and value added potato products ranging from potato chips to vodka. One of the most fascinating aspects was the observation of the vast array of potato varieties and the incredible variation in shape and color. They also maintain germplasm from wild *Solanum* relatives that potentially contain genes for traits such as disease resistance and drought and cold tolerance. Germplasm from CIP is available to potato growers throughout the world.

A sampling of the vast array of potatoes grown in Peru.

World Potato Congress

The Congress had a focus on sustainability and small farmers and had the tag line Biodiversity, Food Security, and Business. Most presentations provided a very different perspective than is generally presented in the United States where farms are significantly larger and more intensively managed. Water and nitrogen use efficiency were addressed from different regional production centers. Solid evidence was presented that changes in irrigation systems and nitrogen application timings can dramatically reduce use of both of these resources without any yield losses. Tools to assist growers in making application decisions such as remote sensing (from in-field IR cameras to satellite sensing) were described by speakers.

There was a very effective workshop on *Phytophthera infestans* led by MSU Ph.D. Ivette Acuna who serves as a potato pathologist at the Chilean Institute of Agricultural Research. This session focused on both the developed EU lateblight forecasting systems and a simple but elegant disease forecasting "wheel" that establishes fungicide recommendations based on resistance in the cultivar and number of rain days. Researchers presented evidence that *Phytopthora infestans* is developing resistance to the fungicide Fluazinam in Europe indicating that growers need to be vigilant in rotating fungicide classes to maintain useful chemistry.

A disease forecasting "wheel" that establishes fungicide recommendations based on resistance in the cultivar and number of rain days.

Field Day at INIA Andenese

The highlight of all potato activities was a visit to an experiment station in the Andean mountains located on centuries-old terraces at 12,500 ft elevation. The program included 20 separate topic demonstrations in both the field and greenhouse. The demonstrations on landraces of *Solanum* spp., varietal diversity and community selection of new lines were particularly interesting. At the station on certification of seed potatoes, it was revealed that less than 1% of seed stock in Peru comes from a formal seed system. In another station, production of pre-basic seed stock was demonstrated where cooperative groups of farmers were educated on minituber production and 16-farm units were supplied with one screen house to produce disease-free minitubers from *in vitro* microplants. Rotation crops for potato were demonstrated including Mashwa (tuber), Ocha (tuber), Olluco (tuber), Jacong tuber) Tarwe (lupin like legume).

Crops grown in rotation with Potato in Peru.

These crops are grown in a three to four year rotation with potatoes. The growing season is November to May with a fallow dry season from June to October. Although not mentioned specifically in the rotation discussion, it is clear that maize is also an important staple crop in the Andes.

Peaks and Potentials
Courtesy of MSU News Service

June 18-24 was National Pollinator Week, marking the 11th year since the United States Senate designated a week in June to address the world's declining populations of pollinators.

At MSU, the week is spent teaching fifth-, sixth-, and seventh-graders how to use science to answer questions about honey bees. The "Honey Bee Investigators: What's Killing the Bees" course is organized through MSU's Peaks and Potentials Program.

Now in its 36th year, Peaks and Potentials, organized by MSU's Academic Technology and Outreach, gives high-potential middle school students the opportunity to explore various subjects in weeklong courses led by MSU faculty.

Michelle Flenniken, Assistant Professor in the Department of Plant Sciences and Plant Pathology at Montana State University, explains how a pipette functions to Gallatin Valley middle school students.

Taught by Michelle Flenniken for the past five years, the honey bee course introduces young learners to factors causing the global phenomenon of "unsustainable annual losses of honey bees," Flenniken said.

The course includes lessons on the role of Montana's commercial beekeepers, who provide over 150,000 honey bee colonies for pollination services, including transporting their bees to the world's largest pollination event -- the pollination of California's Central Valley almond crop every February. Students learned that honey bees pollinate over 130 different agricultural plants, including numerous fruit, nut and vegetable crops that are important to human health, representing "30 percent of the average United States diet," Flenniken said. They also learn basic honey bee biology and the pathogens that play a role in colony losses, including viruses such as Deformed wing virus, Lake Sinai virus and Chronic bee paralysis virus.

"In this class, you'll be exposed to college-level genetics and virology," Flenniken told the class on Monday. "You're going to learn exactly what MSU students and scientists do to investigate the impact of pathogens on honey bee colony health and, by the end of the week, you'll have identified the pathogens in your samples obtained from different colonies."

Flenniken told the class these pathogens are likely part of the answer to what's killing honey bees.

Reder Daughenbaugh, a seventh-grader at Sacajawea Middle School in Bozeman, said his mother (Katie Daughenbaugh) works as a virologist at MSU and he wanted to see what she does every day.

"The equipment we get to use is pretty cool, and we get to learn about how science can solve real problems," he said. "It's also fun to see what my mom does up here every day."

Michelle Flenniken and Jenna Severson, MSU undergrad (far right), with this year's Peaks & Potentials class.

During the week, students worked with Flenniken and Jenna Severson, an MSU student working in Flenniken's lab who is doing research as part of the INBRE Undergraduate Scholars Program.They learned how to handle and prepare lab samples, use a pipette and analyze results. They also observed live honey bee colonies at MSU's Honey Bee Research Site and Pollinator Garden at MSU's Horticulture Farm.

"I enjoy teaching young students," Flenniken said. "They are so excited to learn and ask such great questions. I hope that if they become scientists in the future, they come back to MSU and tell me all about their discoveries and, no matter what they decide to do in the future, this course will help them appreciate scientific investigation of complex global problems."

The Agri-Food System: Moving the Needle in a more Sustainable, Healthy Direction
By Florence V. Dunkel

Montana State University and PSPP were well represented at the Association for International Agriculture and Rural Development (AIARD 2018) this year in Washington, D.C. June 3-5. AIARD is a 54-year old association of professionals with direct experience in developing countries from the U.S. and abroad.

MSU's contingent included I. Miley Gonzales, Interim Associate Provost for International Programs; Hiram Larew, retired USDA NIFA Director of the Office of International Programs; Entomology Associate Professor Florence Dunkel (PSPP); Deborah Chiolero, MSU Office of International Programs; and Badmaa Dovchin, AGSC 465R teaching assistant.

Connecting outstanding graduate and undergraduate students with national leaders in international agriculture and rural issues is one of the goals of these annual meetings held in Washington, D.C. each June. A big Bobcat thank you goes to Hiram Larew for initiating partial support for Badmaa's travel and registration to attend these meetings. Dunkel matched the funding. In addition to the meetings themselves and all the informal networking opportunities, Badmaa was able to join Larew, scholars from other universities and students selected in the Future Leaders program for a Career Conference prior to the meetings and a "session on the Hill" after the meetings. The Career Conference led by former AIARD student leaders now in international and rural agriculture positions emphasized the importance of soft skills, communicators who can work across silos, and the ability to write.

Dunkel was invited to speak at AIARD 2018 on the panel "Improving Nutrition Outcomes of the Agri-Food System: How do We Move the Needle in a More Sustainable, Healthy Direction?" Her specific presentation was entitled "Incorporating Cultural Factors." Moderating the panel was Kimberly Flowers, Center for Strategic and International Studies (CSIS) a bipartisan think tank in Washington D.C.

Other speakers were from the International Food Policy Research Institute (IFPRI), International Institute of Tropical Agriculture (IITA), Universities (both Land Grant and other public universities), Bloomberg News,

Representing MSU and PSPP at the International Agriculture meetings are (from left) Florence Dunkel, I. Miley Gonzalez, Hiram Larew, Deborah Chiolero, and Badmaa Dovchin.

Source Map, Inc, Harvest Plus, and the Foundation for Food and Agriculture Research (FFAR).

NACTA Conference and/or the Organic Ag Instructor Workshop
By Mac Burgess

From June 11-15, I visited Ames, Iowa to attend a workshop for instructors of organic agriculture followed by the annual meeting of the North American Colleges and Teachers of Agriculture (NACTA). The first event was hosted at Rieman Gardens and was organized by Dr. Randa Jabbour of the University of Wyoming. Colleagues from across the country, many of whom also teach classes in crop production and supervise student farms, met to discuss how to manage experiential learning opportunities to maximize student success and to share our stories, successes, and challenges. The highlight of this meeting was a tour of Iowa State's "Good Earth Student Farm". For the rest of the week, I attended the NACTA conference on the campus of Iowa State University and presented some of the unique approaches I use in my AGSC 356 Plant Nutrition and Soil Fertility class. Other MSU attendees included Tracy Dougher, Dustin Perry, and Rebecca Kurnick, a recent Ag Education MS graduate.

Mac Burgess at Iowa State University's student farm.

Faculty mentors of student farms from across the country assembled at Iowa State University's Good Earth Student Farm.

A recurring theme of the conference is well summarized by this combination of words often attributed to the Chinese philosopher Confucius:

I hear and I forget
I see and I remember
I do and I understand

I came away further inspired by these words of John Dewey, "We do not learn from experience, we learn from reflecting on experience." Moving forward, I'll ask students to put more effort and thought into reflecting on the experiences we give them here at MSU, and I'll be doing more reflection myself on those experiences.

TASSA 2018 Conference on Disruptive Ideas and Technologies
By Hikmet Budak

The theme of the biennial Turkish American Scientists and Scholars Association (TASSA) Conference held in Boston, Massachusetts, was "Disruptive Ideas and Technologies." Boston University Dean Lutchen shared his views on current challenges in the world such as Aging, Cancer vs Adaptive Biology, Antibiotic Resistance, Cardiovascular Diseases, Mental Health, and Food and Water Supply. He also spoke about the tools currently available for addressing these issues such as Gene Editing; Synthetic Biology, Optogenetics, and Image-guided systems.

New Employee

Hannah Shuman

Hi! My name is Hannah Shuman, and I am the new lab manager for the Lachowiec lab, where I will be working closely with Dr. Lachowiec to help organize and explore the factors surrounding genetic and environmental robustness. I recently received a B.S. from the University of Michigan, where I majored in Biomolecular Science and German. Having worked with Dr. Lachowiec during her post-doctoral work in Ann Arbor, I'm excited to work with her once again and look forward to getting to know the rest of the Plant Sciences and Plant Pathology department at MSU!

My hobbies include singing and playing the piano, hiking, skiing, and running. I love traveling and hope to be doing a lot of hiking, skiing, and exploring while in Montana. Having never lived by the mountains, I'm excited to explore!

2018 Field Days

Northwestern Agricultural Research Center, Tuesday, July 10: The field day begins at 2 p.m., with dinner following the tour. NWARC is located near Creston on State Highway 35. 406 - 755-4303.

Central Agricultural Research Center, Thursday, July 12: Registration begins at 8:30 a.m. with coffee and doughnuts. The field day starts at 9 a.m. and includes lunch. The center is located 2.5 miles west of Moccasin on U.S. Highway 87. 406-423-5421.

The MSU Arthur H. Post Agronomy Farm, Friday, July 13: The Post Farm will begin tours at 8:30 a.m. followed by lunch. The Post Farm is located eight miles west of Bozeman on U.S. Highway 191. 406-586-6819.

Eastern Agricultural Research Center, Tuesday, July 17: The field day begins at 9 a.m. and will include lunch. The center is located one mile north of Sidney on State Highway 200. 406 -433-2208.

Western Agricultural Research Center, Thursday, July 26: The field day starts at 4:30 p.m. with dinner at 5 p.m. and tours following. WARC is located at 580 Quast Lane, Corvallis. 406-961-3025.

Grants

Hikmet Budak, USDA, "Wheat Genomics Research".

Publications

CRISPR/Cas9 in plants: at play in the genome and at work for crop improvement. B Hussain, SJ Lucas, H Budak. *Briefings in Functional Genomics*, ely016, https://doi.org/10.1093/bfgp/ely016.

Exploiting Stokes and antiStokes type emission profiles of aptamerfunctionalized luminescent nanoprobes for multiplex sensing applications, M Yüce, H Kurt, B Hussain, CW OwYang, H Budak. Chemistry Select 3 (21), 5814-5823.

Patents

Gary Strobel applied to the U.S. patent office (US PTO) for a patent entitled – "Volatile Organic Compound Formulations Having Antimicrobial Activity" about 4 years ago. Early this year, the USPTO office issued a declination to the request but with the caveat that he could make a final defense of the major claims in front of the examiners at the USPTO. He, Bryan Blatt, and Scott Blackman were invited by the examiners to defend their case on May 23 in Alexandria, Va., at the USPTO. An hour was allowed for the presentation. Now as of June 27, The USPTO issued a formal allowance for the patent. This intellectual property is the concept behind the Sx electrolyte solution being sold by Ecoplanet for the treatment of cattle with scours. It is estimated that at least 25,000 animals have had the formula administered in the past two years with remarkable success. Montana is one of the states that has hugely benefited from this discovery.

Sample Submission Video
By Sarah Eilers

On June 6, emeritus faculty member Don Mathre volunteered himself and his garden for the making of a video showing the best way to submit a sample to the Schutter Diagnostic Lab. Montana PBS Production Services employees, Ben Skudlarek and Mike Suarez, filmed the piece. Chance Noffsinger, graduate student in Plant Sciences, also took part in the video as a lab technician in the Schutter Diagnostic Lab. A good quality sample and detailed information on the history of the problem is important for accurate, timely diagnosis and appropriate recommendations. The plan is to circulate the video on social media platforms along with using it during workshops and trainings.

Don Mathre taking part in a video on how to send in samples to the Schutter Diagnostic Lab.

Submission guidelines are below:

Include completed sample submission form with pertinent background information. In-depth background information will help us identify the problem or organism and is essential for timely management recommendations.

Keep samples as fresh as possible until you can ship them. Avoid exposing the sample to direct sunlight and refrigerate if possible.

*Mail packages early in the week to arrive by Friday***.** Do not mail fresh samples on a Thursday (unless using overnight mail) or Friday. Store the package in the refrigerator over the weekend and mail on Monday. We want to avoid samples sitting at the post office over the weekend.

Package samples in crush-proof containers. Never send samples in a flat paper envelope – the post office machinery causes extensive damage.

Include photographs illustrating the problem if possible. Make sure photos are in focus and include your name and contact information with sample submissions. Email the photographs to diagnostics@montana.edu.

Mailing address for all samples: Schutter Diagnostic Lab, 119 Plant BioScience Facility, P.O. Box 173150, Bozeman, MT 59717- 3150.

For additional information about sample collection and submission contact your local Extension office or the Schutter Diagnostic Lab at 406-994-5150.

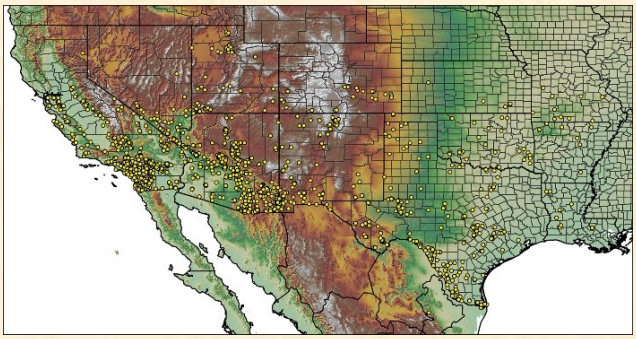
Tarantulas in Montana?
By Laurie Kerzicnik, Associate Extension Specialist

If you aren't a fan of spiders, most of them you can smash easily, wash down the tub or sink, or you can put them in a cup and release them outside. When I get spider samples from the Extension offices, they usually come in large white vials. But I received a call from Rosebud County Extension in early June and they had a spider so big that they didn't know what to put it in to send to me. I figured it was one of our larger wolf spiders. I asked her to take a picture for me, and it wasn't what I expected. It was a tarantula! The sample was finally sent to me in a large Mason jar.

Tarantulas aren't established in Montana. When I followed up with the Extension office, they said it was found at a local gas station in Forsyth. It was dead and lying in the grass in the back of the store. It was likely transported from an area where tarantulas are native. We have two genera of tarantulas in the United States,

Tarantula collected at a gas station in Forsyth, Montana.

Aphonopelma and *Brachypelma*. The tarantula was in very poor shape when it got to me, so identifying it beyond the "tarantula" family wasn't possible. It is most likely a species of *Aphonopelma*, and a map of their established range shows them in northern Utah and southern Colorado, but not in Montana.



Distribution of Aphonopelma sp. tarantulas in the US (from Hamilton et al. 2016).

Some of the largest spiders we have here in Montana are wolf spiders, *Hogna carolinensis* (17-21 mm or sometimes up to 2.25" legspan). We also have folding door spiders in the family Antrodiaetidae (6-25 mm) that were collected from flooded pitfall traps from Trout Creek, Montana. If we do get more tarantulas here in the future, they probably just "hitched a ride" from the South!

Figure 4. Folding door spider, Family Antrodiaetidae. Photo by Victor L. Berthelsdorf.

Hogna carolinensis. Photo by Richard Hoyer.

Planting the Mathre Courtyard

A big thank you to the volunteers that once again made our Mathre Courtyard beautiful! Toby Day and Dara Palmer put up the rock wall and brought in more soil to alleviate the problem of water pooling in the lower section of the Courtyard. Deanna Crow, Tom Hash (Master Gardener), Dara Palmer, and Jinling Kang did all the planting. Your efforts are greatly appreciated!

Recipe of the Month

Strawberry Pretzel Dessert

2 cups crushed pretzels
3/4 cup butter, melted
3 tablespoons white sugar
1 8 ounce package cream cheese, softened
1 cup white sugar
1 (8 ounce) container frozen whipped topping, thawed or real whipped cream
2 3 ounce packages strawberry flavored Jell-O(R)
2 cups boiling water
2 (10 ounce) packages frozen strawberries

Preheat oven to 400 degrees F (200 degrees C). Stir together crushed pretzels, melted butter and 3 tablespoons sugar; mix well and press mixture into the bottom of a 9x13 inch baking dish. Bake 8 to 10 minutes, until set. Set aside to cool.

In a large mixing bowl, cream together cream cheese and 1 cup sugar. Fold in whipped topping. Spread mixture onto cooled crust.

Dissolve gelatin in boiling water. Stir in frozen strawberries and allow to set briefly. When mixture is about the consistency of egg whites, pour and spread over cream cheese layer. Refrigerate until set.

July Birthdays

Jinling Kang	1
Mary Burrows	7
Andy Hogg	8
Jack Riesselman	9