

# *Plant Science Says*



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## **The Seed Lab**

### **By Bridget Westfall**

Seeds are fundamental. They represent one of the most powerful forces in nature because they ensure the reproduction of most plant species.

High quality seed lots are characterized by high viability, high vigor, a defined genotypic identity, absence of disease, and freedom from seed of other species. As a result, seed analysts must possess an array of challenging and differing skills and be familiar with a myriad of testing protocols ranging from purity and germination tests to vigor and genetic purity tests. The quantitative methods of these analyses are important. They form the basis on which judgments concerning the quality of a seed lot are made and large sums of money often exchanged. Since seed is an international commodity, it is important that seed technologists conduct and report seed test results in the same way so that values can be properly interpreted at any location in the world.

With that being said, let's jump into the world of Seed Analysts!

AOSA – Association of Official Seed Analysts

SCST – Society of Commercial Seed Technologists

ASTA – American Seed Trade Association

ISTA – International Seed Testing Association

Each year the AOSA and SCST Joint Annual Meeting brings together hundreds of seed analysts, technologists, and scientists from

both the United States and Canada with the common goal of advancing seed testing and research. This year, our meeting was held in Portland, Oregon from June 3-9, 2016. What a beautiful place that is! Bridget Westfall and Richelle O'Leary attended this year's conference as well as a couple of workshops.

Day 1 - Our first day found us participating in a Genetic Technology Workshop. It was very informational and since we just purchased a Realtime PCR machine with the Pulse Lab, it was high time we started getting some training.

Day 2 - Being the good manager, I made sure that Richelle attended the Seedling Evaluation Workshop while I visited the Japanese Gardens and the Rose Gardens of Portland - all the while building relationships with other seed analysts and rubbing elbows with the right people. Richelle said she learned a lot at the workshop and will be implementing all this new knowledge back at the lab in Bozeman. The Japanese Gardens were peaceful and the roses were beautiful. It was nearly 100 degrees that day so I did suffer a bit making all those business connections.

Day 3 - Strictly business - between the two of us, we attended the Germination and Dormancy Committee, Ethics, Conservation, Reclamation, and Tree and Shrub Committees and we were asked as representatives of Montana to attend the closed door Regulatory Committee Meeting.

Day 4 – Richelle had to fly back to Great Falls since she is working construction with her father on her months off. The morning held more committee meetings but the afternoon was an outing! We piled onto several buses and headed out to tour two large cleaning facilities, an apple orchard and gotta do it... Rogue Brewery for a Bar-b-que and as much beer as you could afford. I got one free one. Along the way, our tour guide pointed out Blueberry fields, Cherry orchards, tons of Hazelnut orchards, and commercial greenhouses. He noted that the tents along the interstate were homes to some of their very large homeless population.

The cleaning plants were very interesting, but I felt bad because they work so hard to clean that seed quickly and I'm thinking how long it takes me to do a purity analysis on it; I am a major clog in that drain! At the apple orchard, we enjoyed a short lecture, and then went back to the farm market store and had strawberry shortcake.

Since it was nearly 100 degrees we all fought the urge to push and shove to get back to the air-conditioned buses. Then we arrived at the Rogue Brewery and all of a sudden those hot angry people were happy as larks sitting there in the shade. I continued to make business connections using wit and humor. All crops and folks seemed to be thriving one way or another in Portland. It was a good day.

Day 5 - What a day! It was loaded with great meetings. Half a day was spent in the Long Range Planning Committee followed by Proficiency, Tetrazolium testing and Open Rules Discussion committees (gets pretty heated in this one). A group photo was taken and then it was time for the Awards Banquet which I might add included one of our own. Faye Jorgensen received credit for passing her test and becoming a Certified Seed Analyst for the state of Montana. Congratulations Faye!!

Day 6 – Last day. This is where the rubber meets the road. We started with the Joint AOSA/SCST voting session and business meeting. Minutes were read, we voted on rule

proposals, and there were last minute discussions and announcements like, "Ok everyone, you were given a sample of cannabis seed in your registration packet. It is illegal to cross state lines with that or take it on the plane. There is a basket at the registration table to turn them in if you so choose." I thought...hmmm what would Sherwood do? So I packed it away in my bag. No really, I left it at the registration booth! Ha!

It was a successful meeting. We learned a lot, made new friends and connections, renewed old relationships and were asked to participate in multi species testing, or referees as they are referred to in the seed world, as well as help put together a large three day workshop for next year's meeting with ISTA in Denver. Now that is an honor for Montana. It will be covering native species and flowers. ISTA calls them "Wild Species". I can't wait!!

I know I can speak for all of us here at the Montana State Seed Lab when I say that we are proud to be part of these organizations and to serve and represent the state of Montana and their seed testing needs.

**North Central Branch Entomological Society of America Annual Meeting: Urban Renewal Gardening and Novel Protein Sources in Cleveland"**  
**By Florence Dunkel**

A roomful of 100 entomology graduate students having lunch is an ideal venue for a keynote address on *Insects as Food and Feed*. Energetic, young scientists and entomo-entrepreneurs sitting at circular tables draped in white linens with ice tea in glass goblets, and munching on veggie wraps with eager looks was the scene before me.

Students of the North Central Branch of the Entomological Society of America (ESA) representing all the Big Ten schools from Minnesota to Michigan and Iowa to Kentucky are very serious when they invite



*Following her keynote for Entomology grad students, Dunkel joined panel with David George Gordon, nationally known insect chef/writer, and Megan Currie, food insect entrepreneur/rock climber who tested insects as sole nutritional source for her 45-day climb.*

a professor into their private inner sanctum luncheon. Maybe I am renegade enough to fit in with the group. Maybe I was invited because I tell stories. The first story I told was about survival of the pioneers around Salt Lake City, thanks to the Ute Native Americans and their traditional ecological knowledge of making prairie cakes after tradition mass harvests of shield-backed katydids (now called Mormon crickets). The second story hasn't yet had a happy ending. It was about the stunting of children in West Africa now linked to increased vulnerability to the usually fatal cerebral malaria in children thanks in part to pest management policies suggested by outsiders not knowing traditional children's snack foods in that part of the world are actually insects, one of the most dense packets of all essential nutrients anywhere.

What students really wanted to know in the lively Q&A following were details regarding how to start an insect farm and food factory tomorrow (soon, in other words). Inspiring. Exit survey data indicated 100% of meat eaters at the luncheon were ready to make insect-based protein part of their daily diet.

Once the luncheon presentation and Q&A concluded, the student local arrangement's chair escorted me to the older folks to open

their symposium on Insects and Human Culture with my second talk, "Life, Death, and Land Shrimp." This audience was eager, but their exit polls showed they were more skeptical than their grad students were. In the audience was the present national ESA president, Dr. May Berenbaum, and several past presidents. Dr. Berenbaum, herself an entomophob, is one of the pioneers in edible insects. Indeed the ESA North Central Branch was, along with MSU, an early pioneering center of Western culture edible insect activity.

The next day it became more clear and specific how Cleveland, Ohio will do this novel protein source conversion. Dr. Mary Gardiner, the Ohio State University associate professor of entomology took some of us away from the 3-day technical meetings to show us her 64 urban gardens on abandoned land that recently held foreclosed houses. Dr. Gardiner is testing resulting insect diversity with various management methods. We also visited two "Cadillacs" of urban gardens on condemned land by the Cuyahoga River and on land abandoned by a defunct factory in the city center. Fresh organic vegetables, fruits, and spices grown in their neighborhoods are within easy reach of the urbanites and material resource poor communities of Cleveland. No



*OSU Entomologist, Dr. Gardiner, leading this green revolution and Dr. Dunkel pause in the midst of one of Cleveland's biggest urban food gardens to reflect on role of pollinators, edible insects, and other beneficials there.*



*Horticultural renewal by Ohio City Farm is looking successful in downtown Cleveland, Ohio.*

urban desert there! That was the garden approach.

From my view on the 10<sup>th</sup> floor of the hotel where meetings were held, I could see between my window and Lake Erie a sea of opportunity for food insect factories—flat rooftops galore, perfect for modern insect farms. Cleveland is ready for invasion by those eager entomology graduate students of the North Central U.S.

### **American Society of Virology Conference By Jacob Munson-McGee and Michael Dills**

This past week we attended the 2016 American Society of Virology conference at Virginia Tech in Blacksburg, Virginia with Mark Young and Cassia Wagner. Alix Herr, Mathew Taylor, Blake Weidenheft, and Michelle Flenniken also attended from MSU. The five day meeting covered a spectrum of topics from human health to agriculture and fundamental research. Throughout the meeting, there were a number of enlightening talks on emerging technologies and applications, including a new Click-Chemistry called Click-Seq for RNA viral sequencing and characterization of recombinant

evolutionary events (Andrew Routh, University of Texas Medical Branch), and evolutionary modeling using deep mutational scanning (Jesse Bloom, Fred Hutchinson Cancer Research Center). Dr. Wiedenheft participated in the Plant Virology Symposium and presented on the applications of CRISPR technology.

The symposia sessions included some great big-picture science which helped break up the more focused workshops. Ann Palmenburg (University of Wisconsin-Madison) and Mark Denison (Vanderbilt University) gave two notable talks addressing the fundamental nature of viruses, their natural history and broader concepts of evolution.

MSU was well represented throughout the five day conference. Dr. Flenniken did a great job chairing a workshop on invertebrate viruses where she also presented some of her work with bee pathogens. Incidentally this was also the workshop where Dr. Routh showcased his new Click-Seq method. Dr. Taylor and Alix Herr contributed considerably to the Herpes virology sessions. And Dr. Young tirelessly interacted with the ASV membership.

Overall, the conference was well planned and things went smoothly. That is not to say there weren't a few technical difficulties. On the second day, Jacob presented his work on viral interactions with individual cells in hot spring communities, and managed to keep his composure when the Power Point froze before his two main slides. He covered well and his talk was nicely received.

The conference provided great opportunities for undergraduates and beginning graduate students to not only attend but also formally present. Cassia Wagner, a recent MSU graduate from our lab presented her work on discovering a novel archaeal virus from a Yellowstone hot spring in a Viral Structure workshop on Monday.

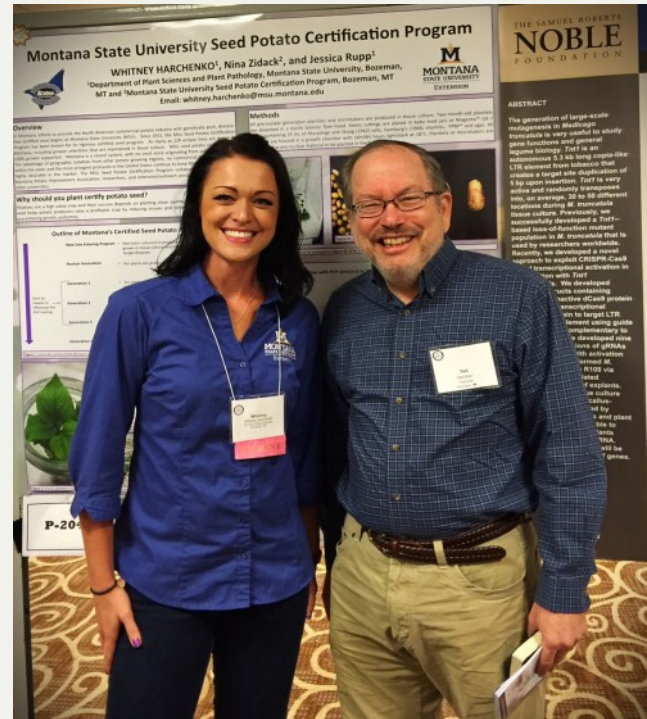
We had great time in Blacksburg and each of us took away a lot from the meeting. ASV gave us the chance to explore many of the

subfields of virology, interact with researchers from around the world, and finally learn what a Hokey is.

## **In Vitro Biology World Congress By Whitney Harchenko**

On June 11th-15th, Dr. Jessica Rupp and her Ph.D. student, Whitney Harchenko attended the World Congress on In Vitro Biology in San Diego, CA. Jessica and Whitney are members of the Society for In Vitro Biology (SIVB) as they perform tissue culture work in their laboratory. SIVB is concerned with the latest developments and state-of-the-art research in plant cell and tissue culture and biotechnology from around the globe. It was Whitney's first year attending the conference and Jessica's seventh year. Jessica was the convener for the "Application of Next Generation Sequencing Technology" plant symposium at the world congress. Whitney presented a poster on the "Montana State University Certified Seed Potato Program" to get the word out that MSU has a certified seed potato program that produces some of the cleanest and most genetically pure potato seed in the world by utilizing tissue culture techniques. Whitney will be presenting a poster on her own research project and competing in the student oral presentation competition at next year's world congress in Raleigh, North Carolina. The highlights of the SIVB world congress for Miss. Harchenko was listening to the keynote speaker Dr. William Morner, the 2014 Nobel Prize Winner in Chemistry (2014) present on "Seeing Single Molecules, from Early Spectroscopy in Solids, to Super-resolution Microscopy, to 3D Dynamics of Biomolecules in Cells," networking with people from all over the world, and meeting Tim Klein, the inventor of the gene gun. Whitney was also elected as the Society for In Vitro Biology's Student Committee Chair for the Plant Biotechnology Session for 2016-2017. Dr. Rupp has served as the Student Chair for previous World Congresses on In Vitro Biology. Jessica enjoyed attending her first

World Congress on In Vitro Biology as a professor, educating students on searching for careers, research, and networking.



*MSU Graduate Research Assistant Whitney Harchenko, standing next to Ted Klein, the inventor of the gene gun at the World Congress on In Vitro Biology in San Diego, CA*

## **Class Focus**

### **Course Focus**

### **AGSC 441 - Plant Biotechnology By Mike Giroux**

Plant Biotechnology is a senior level course taken by both junior and senior level Plant Science majors as well as graduate students. Coming in to the course, students often have a pre-conceived notion of what plant biotechnology is. Broadly defined, we have been altering plants to suit our purposes for thousands of years. More specifically defined plant biotechnology often refers to ways to make and analyze transgenic plants. Comparisons are made between "traditional" plant improvement methods and more modern methods of plant improvement. Note that this line is of course blurring over time with molecular markers being used in "traditional" plant breeding and "non-transgenic" transgenic plants being created.

This course has two components, 2 credits of

lecture and a 1 credit lab component. Several years ago, MSU began requiring defined learning outcomes for each course.

The objectives for this course are to:

- Understand the history of plant improvement from simple plant selection to modern day transgenic plants.
- Understand the process required to research, develop, and test transgenic plants.
- Aply perform a number of plant molecular biology techniques and sequence analyses.
- Demonstrate proficiency in DNA preps, PCR, and agarose gel electrophoresis.

Enrollment in the course has averaged ~15-20 students and the lectures emphasize the theories and principles behind the creation and analysis of transgenic plants. Given the importance of developing plant molecular biology techniques for plant science majors, and the scarcity of classes that offer labs, great effort is made to help each student develop proficiency in some common lab techniques. Fortunately, assistance from the department in the form of a teaching assistant has always been available for the lab portion of the course and Hannah Estabrooks, Alanna Schlosser, and Andy Hogg (it was a long time ago now for Andy) all served as excellent TAs. The techniques emphasized in lab include DNA cloning, sequence analysis, use of databases, gene expression analysis, PCR, and creation and analysis of transgenic plants. The computer lab portion of the course has grown over time and this year included assignments related to synteny and searching RNAseq expression databases using publicly available databases.

The course requires that students demonstrate proficiency (sometimes just understanding if lab skills are not their forte) in a range of methods required to manipulate plant genomes. At the end of the semester each student turns in a research paper on a topic of their choice related to the use of plant biotechnology.

Overall, it is quite an enjoyable course to teach given the high level of interest and enthusiasm exhibited by the students and the fact that it dovetails well with my research interests.

## **New Employees**

Josephine Mgbechi-Ezeri (Bright Agindotan)



I was recently hired to work in the Pulse Crops Diagnostic Lab for Bright Agindotan as a Post Doc. I was born in Ile-Ife, Osun State, Nigeria and completed my undergraduate degree in microbiology in 1999. I joined the work force at the

biotechnology laboratory of the International Institute of Tropical Agriculture (IITA) where I worked on developing a RAPD marker linked with anthracnose disease resistance in yam and then moved on to the virology lab where I continued working with yam and cassava breeders, screening and testing genotypes for resistance to virus diseases. In 2012, I obtained my master's degree in plant pathology from Olabisi Onabanjo University in Nigeria. I completed my doctoral degree in plant breeding at the Department of Horticulture at Washington State University in May, 2016. My research project was on screening and identification of quantitative trait loci underlying bacteria canker disease resistance in sweet cherry germplasm.

As far as hobbies, I love singing and cooking.

## **Invited Talks**

Mycological News—By Cathy Cripps

On June 13, I gave a talk on my new book "The Essential Guide to Rocky Mountain Mushrooms by Habitat" at the Denver Botanic Gardens to almost 100 people. The event was followed by a book signing with my co-author Vera Evenson, curator of the Sam Mitchell Fungal Herbarium at the DBG.



*Cathy and Vera consulting their own mushroom books.*

Later in the week, Vera and I were the mycologists for the Lee Barzee Memorial Foray in honor of the founder of the Pike's Peak Mycology Association who recently passed away at 92. We collected 'snowbank fungi' on Cottonwood Pass at 12,000' and garnered almost 60 species. The foray was organized by Brian Barzee, Lee's son and attended by 50 enthusiastic participants.

### **Publications**

Van Huis, A., F. Dunkel. 2016. Edible insects, a neglected and promising food source. Chapter 21, *In eds.*, S. Nadathur, J. Wanasundara, L. Scanlin. Sustainable Protein Sources. Elsevier Publ. Co. Boston, Massachusetts. Pp. 341-355.

Gary Strobel has just accepted assignments to be on the editorial boards of several new International journals including Journal of Fungi, Antibiotics, and Microorganisms

### **Grants**

Mike Ivie, UK Overseas Territories Conservation Forum, "Maximizing long-term survival prospects of Montserrat's endemic species and ecosystem-services".

Ryan Thum, Minnehaha Creek Watershed District, "Occurrence and

Distribution of Eurasian, Northern, and Hybrid Watermilfoil in Lake Minnetonka and Christmas Lake".

Ryan Thum, Montana Department of Natural Resources, "Hybrid EWM in Noxon Reservoir—Growth, spread, treatment efficacy".

### **Invited Talks**

Dunkel, F. 2016. "Food Security and Edible Insects." North Central Branch Entomological Society of America. Keynote address for student luncheon, Cleveland OH, 6 June 2016.

Dunkel, F. 2016. "Life, Death, and Land Shrimp." Annual meeting of North Central Branch of Entomological Society of America. Invited presentation in Symposium: Insects in Human Culture. Cleveland OH, 6 June 2016.

### **Health Benefits of Gardening**

#### **By Toby Day**

We all know about the benefits of growing your own garden. Money savings (although, I often disagree with the numbers as I spend way more on my garden than at the grocery store), nutritional benefits, self-reliance, knowing where your food comes from, etc. We can't get away from all the information about the benefits of growing your own garden from social media to magazines, from newspapers to TV. It's everywhere. But how about the health benefits to gardening that goes beyond the nutritional value of the food? Is there a health benefit from just gardening? Being outside? I seem to think so. You see, when I am not traveling, I spend about ½ hour to an hour in my garden each day/night. Does it put me in a better mood? Mostly. Do I physically feel better? You bet. So, I looked into the health benefits beyond the fiber and calories to see what mental and physical benefits there are to gardening. So here are a few things that I dug up (no pun intended).

#### **Stress relief**

A Dutch study found that gardening relieved stress better than reading a book. The study revealed that after gardening a positive mood

was fully restored, something that was not always the case for reading. Maybe it is just that we exclude ourselves from all of life's distractions, such as cell phones, email, or as one article I read suggests that "gardening engages us in *involuntary attention*, and effortless form of attention that we use to enjoy nature." Regardless, there is evidence that gardening puts us in a better mood, a better frame of mind.



*I am definitely a "Happier Toby" after picking all these strawberries!*

### **Heart health and reduce stroke risk**

Ok, I know it sounds lame, but gardening strengthens your heart, provides exercise and reduces chances of stroke. I hardly exercise. Running? Biking? They are not my thing. But I know that I am more physically fit due to spending an hour in the garden. One study showed that regular gardening of 2.5 hours per week (way less than I do) can reduce stroke and heart attack risks by some 30% for those over 60 years of age. Being exposed to the sun for 30 minutes per day also increases vitamin D, which can reduce risks of heart disease. We also know that to reduce the risks, exercise is important. Well, raking leaves, clearing a garden, weeding, mowing, and planting – all these activities can burn up to 400 to 600 calories per hour.

### **Muscle health and hand dexterity**

When you garden, you use almost every muscle from your back, arms, legs, thighs and hands. It is a full body workout! I often joke that I don't need to do yoga. I already do yoga when I pick strawberries (mostly, because there are very few places to put my feet in the bed, thus I often have to pick behind me). I also read about the increase in hand dexterity in our aging populations when gardening. All the pruning and weeding I do; I can see the benefits. My hands are stronger and I have much more dexterity that I do typing on a computer, that's for sure!

### **Boosted immune system**

Apparently, all the "dirt" under my fingernails, and the bits of soil that don't always get washed off the carrots can be a benefit. As it turns out, the friendly bacteria that are present in the soil can boost your immune system. Couple that with added vitamin D by just being outside can reduce colds, flus, psoriasis, allergies and even asthma. Who knew? Well, I kind of did, since I hardly ever get sick. And, I have been "playing in the mud," since I was a baby, according to my mom.

There are many more health benefits to working in our garden. Decreased dementia, depression, mental illness and overall better mental health has been reported with gardening. I have included just a few links below for you to peruse about the health benefits of gardening.

<http://hpq.sagepub.com/content/16/1/3.short>

<http://www.countryliving.com/gardening/garden-ideas/a38632/hour-gardening-health-benefits/>

<http://learn.eartheasy.com/2014/09/6-unexpected-health-benefits-of-gardening/>  
<http://www.cnn.com/2011/HEALTH/07/08/why.gardening.good/#>

### **Recipe of the Month**

Slow Cooker Stuffed Bell Peppers

6 large bell peppers

1 lb lean ground beef



1/2 c onion  
1 14 oz can diced  
tomatoes  
1 c wild rice, cooked  
2 T Worcestershire sauce  
1 t salt  
1 t pepper  
1 1/4 c shredded cheese,  
divided  
1/4 c water to put in  
bottom of slow cooker



Cut off top of each of the peppers and scrape out the seeds and membranes. Set aside. Combine ground beef, onion, diced tomatoes, rice, Worcestershire sauce, salt, pepper, and 1 cup of cheese. Stuff each bell pepper with mixture. Put water in the bottom of slow cooker.

Cook on low for 6 hours or high for 4 hours until peppers are tender and ground beef is cooked throughout.

About 15 minutes before serving, sprinkle remaining cheese and let it melt.

### **July Birthdays**

Susie Couch	2
Jinling Kang	3
Mary Burrows	7
Andy Hogg	8
Susan Siemsen	22
Alex McMenamin	24

