Plant Science Says

Volume 18, No. 8 The Department of Plant Sciences and Plant Pathology September, 2016

McPhee Joins Faculty

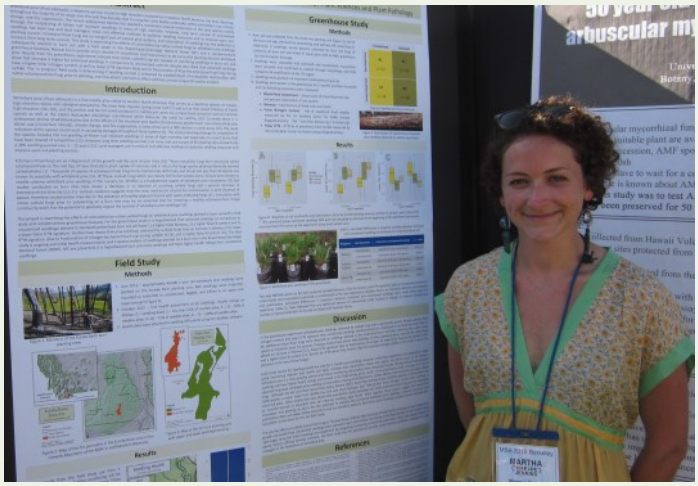
Beginning January 1, 2017, Dr. Kevin McPhee will be taking the place of Dr. Norm Weeden as the PSPP Professor of Pulse Breeding and Genetics. Kevin is currently a professor at North Dakota State University in Fargo, North Dakota. Along with his research responsibilities, it is expected that Kevin will teach Botany and Practical Genetics.

Mycological Society of America meeting Aug. 6-11, 2016
By Cathy Cripps

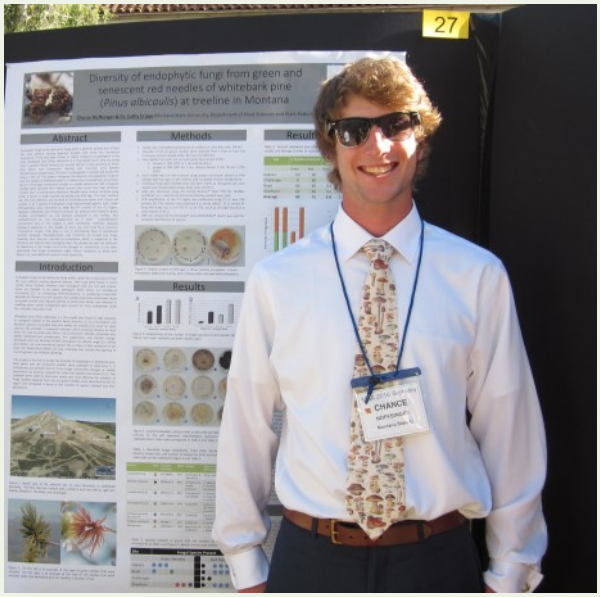
The theme of this year's MSA meeting was 'Sequencing the Environment' and the location was the small Clark Kerr Campus within the larger University of California Campus, Berkeley. It was hosted by John Taylor and Tom Bruns, both leaders in the mycological world. The California weather was so perfect and predictable that poster sessions could be held outside each afternoon. The special Karling Lecture "Thoughts on virulence, melanin and the rise of mammals' was thought provoking. Dr. Casadevall of John Hopkins let us know that pathogens are not pathogens without a host, that melanin plays a role in virulence, and that the rise of warm-blooded mammals is perhaps due to selection for organisms less affected by fungal disease. In other words, we exist because of fungi!

Other symposia and sessions covered: Dimensions of Fungal Diversity, Populations and Genomes, Fungi in the Environment (built and natural), Worlds within Leaves (endophytes) and Beetles, Underground Fungi, Mycorrhizal Fungi and Fungal Metabolites to name a few. I sat in on a long session titled 'Next Generation Sequencing Techniques' (used in large ecological studies) and heard a litany of all the problems that still need to be solved to improve interpretation of results. It helped validate my talk on 'Lessons from the Alpine: Using type specimens, sequences, and detailed morphology for species level identification'. My point is that without morphology, vouchers, cultures, or other physical evidence, we cannot reproduce results and especially particular sequences. Physical evidence tells us a fungus is functioning in an environment, sequences do not i.e. "without a voucher, it is only a sequence'. I thought I might be run out of town, but actually the talk was very well received.

Marlee (Martha) Jenkins, my master's student presented a poster on "Employing native ectomycorrhizal suilloid fungi for the restoration of whitebark pine on a burn site"----and she won First Prize at the Student Award Ceremony! Chance Noffsinger, an undergraduate in my lab won 6th place for his poster on 'Assessment of the diversity of endophytic fungi in green and red senescent needles of whitebark pine in Montana' for undergraduate submissions. Ed Barge (my past master's student and current PHD student at Oregon State), presented a spectacularly colorful



Marlee Jenkins presenting her poster entitled Employing native ectomycorrhizal suilloid fungi for the restoration of whitebark pine on a burn site"



Chance Noffsinger presenting his poster entitled "An overview of the genus Lactarius (Russulales) in the Greater Yellowstone Ecosystem"

Ed Barge, Cathy Cripps, Chance Noffsinger, and Marlee Jenkins enjoying the banquet at the Mycology Society of America meeting.

Poster entilted, "An overview of the genus *Lactarius* (Russulales) in the Greater Yellowstone Ecosystem". Former student Todd Osmundson, now assistant professor at the University of Wisconsin, LaCrosse presented his postdoc work on leaf associated fungi on a Pacific Island. Bob Antibus who took his sabbatical in my lab in 2012 attended with his wife Joanne. So, it was a nice gathering of past and present MSU students and colleagues. My students attended the forest pathology field trip to see sudden oak death in action, followed by wine and cheese at Point Reyes. The banquet and mycology auction was held at Berkeley's Faculty Club. We all made it to the meeting just before the Delta computer meltdown, which was barely fixed by the time we flew home.

Flenniken Lab – August 2016
By Michelle Flenniken

Flenniken Lab Presents Research at International Pollinator Health Meeting

The International Conference on Pollinator Biology, Health, and Policy was held at Penn State from July 17-20. Michelle Flenniken and graduate students in the Flenniken lab including: Laura Brutscher (Microbiology PhD student), Alex McMenamin (Microbiology PhD student), and Will Glenny (Ecology Masters student) presented their research on honey bee colony health, pathogen prevalence and abundance, antiviral defense mechanisms, and the discovery and characterization of the Lake Sinai virus (LSV). The LSV group is a very abundant and prevalent group of viruses that can infect multiple bee species, including Montana bumble bees (Glenny, et al. Flenniken unpublished). LSVs abundance correlates with poor colony health in some, but not all studies, therefore current research in the Flenniken lab includes better understanding of the pathogenesis of this virus group.

Top bee researchers throughout the globe attend this conference, which is held every two years, thus giving students the opportunity to interact with leaders in the

field. The keynote addresses were given by Dr. Sonny Ramaswarmy (Director of USDA-NIFA), Dr. Dennis vanEngelsdorp (University of Maryland), Dr. Taylor Ricketts (University of Vermont), Dr. Rachel Winfree (Rutgers), Dr. Amy Toth (Iowa State University), Dr. Gene Robinson (University of Illinois), and Dr. Mark Brown (University of London) on nutritional security, pollinator epidemiology, ecosystem services, nutrition and habitat, genetic regulation of social behavior, and inter- and intra-species pathogen transmission, respectively.

Overall, it was an excellent and important meeting.

<u>Southwest MT Master Gardener Group Visits Honey Bee Research Site and Pollinator Garden</u>

On August 16th, the Southwest Montana Master Gardner Group visited MSU's Honey Bee Research Site and Pollinator Garden. The group toured the garden and listened to short presentations by Michelle Flenniken and Casey Delphia on bee biology and bee research at MSU. This group was the first to experience the honey bee colonies without suiting up! A "bee curtain" was recently installed on the pavilion, using funds provided by the Gallatin Gardeners Club.

The Southwest Montana Master Gardner Group visited MSU's Honey Bee Research Site and Pollinator Garden.

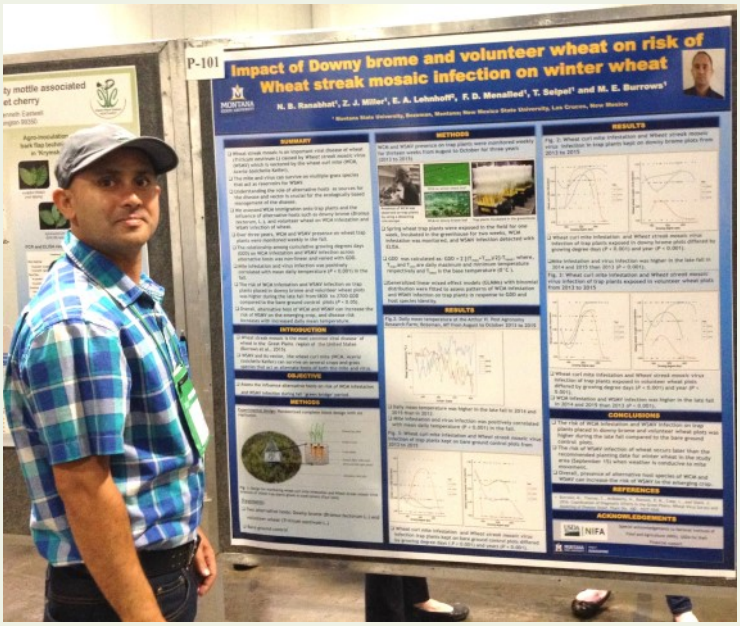
2016 AMERICAN PHYTOPATHOLOGICAL SOCIETY MEETING

By Nar Ranabhat

I attended the American Phytopathological Society (APS) annual meeting from July 30 to Aug 3 in Tampa, Florida. Drs. Barry Jacobson, Mary Burrows, Jessica Rupp, and Bright Agindotan also attended the conference. It was good to be back in Tampa's hot, humid weather.

After several workshop and committee meetings, the convention started with an official welcome that was streamed connecting APS members from around the world. As in all conventions, there was a plenary session with the theme of the talks being "Science in Practice" by scientists working on plant disease management. Plenary session II was special for most of the attendees as Temple Grandin, best-selling author, advocate for the autistic population, and Professor of Livestock Behavior and Welfare at Colorado State University, talked about how "'different kinds of minds are needed to solve problems". There were more than 200 talks about all aspects of plant pathology during technical and special sessions.

For me, it was an invaluable opportunity to present my research and to meet several professional plant pathologists. There were more than 800 poster presentations with a poster huddle time and ideas café discussing specific areas of research. I presented a poster



Nar Ranabhat presenting his poster entitled, "Impact of downy brome and volunteer wheat on risk of winter wheat infection by wheat streak mosaic virus".

entitled "Impact of downy brome and volunteer wheat on risk of winter wheat infection by wheat streak mosaic virus". It was a pleasure talking about my research project with interested people from all over the world. Additionally, we had a meeting with researchers working on our wheat-mite-virus project. The project runs the same research in six states in the Great Plains and we represent Montana. We discussed the progress and future goals of the project. Like every APS meeting, I met Nepalese plant pathologists working in different states.

Overall, the meeting was a great opportunity to meet with research scientists and employees from various agribusiness companies. Lastly, it was a nice to stay in Florida after the meeting and spend some time with my brother in-law and enjoy Key West and Miami Beach as I am from the land locked country of Nepal and live in Montana.

16th International Symposium on Microbial Ecology
By Erin Troth

Dr. Alan Dyer and I traveled to Montréal, Canada for the 16th International Symposium on Microbial Ecology. At times, we felt a bit like fish out of water as plant pathologists at an ecology conference, but the poster we presented was well-received and we had several interesting discussions with nearby presenters concerning their very diverse fields of research, from amoeba ecology in aquatic systems to gut bacteria of humans. Our own research has been focused on rhizosphere pathogen ecology, and attending an ecology conference was an opportunity we did not intend to miss. In general, the theme of the conference was the generation of novel and unique ecological stories.

In particular, a plenary session by Tom Curtis of the University of Newcastle (U.K.) emphasized the importance of generating data that is thorough, new, and fits within the structure of other research so it can be used to paint a larger view of the big picture (i.e., microbial ecology as a whole), with the eventual goal of being predictive. Curtis emphasized the eventual goal of microbial ecology as to be able to predict how systems will react under new conditions, a goal that is impossible if we cannot define what systems have done in the past.

The invited speakers covered a range of topics, from soil microbial ecology to evolution and viral ecology. My favorite talk, in particular, concerned the gut bacterial populations of Ötzi, the Iceman mummy discovered in the Ötztal Alps in 1991 and estimated to have died between 3239 and 3105 BCE. Researchers were able to sample Ötzi's gut bacteria and characterize the divergence between modern bacteria and ancient strains (*H. pylori* in particular).

Conferences historically leave Wednesday open for exploration of the host city and networking. Alan and I took the opportunity to go on a culinary tour of the Old Montréal area with several other members of ISME attending the conference. Culinary favorites in Montréal include: Smoked meats, bagels, foie gras, and a myriad of desserts, including macarons. I was particularly excited for macarons, and in spite of purchasing several to bring home with me, forgot them in my hotel and experienced the heartbreak of lost cookies. We hope to attend ISME17 in 2018 in Germany.

Palais des congrès, Montréal and site of our conference. Photo courtesy of Erin Gunnink Troth

University of Idaho Extension Horticulture In-Service Training
By Noelle Orloff

Earlier this summer, Eva Grimme, Toby Day, and I attended a horticulture training offered by University of Idaho Extension in Twin Falls, Idaho. There were about 30 participants and most were from Idaho Extension.

We had some great field tours as part of the training. I particularly enjoyed visiting the Sawtooth Botanical Garden in Hailey, Idaho, where we learned about Dr. Stephen Love's work developing native plant materials for ornamental settings (see photo). Following the excellent tour, we had the opportunity to eat dinner at the Wood River Sustainability Center, which was quite an experience.

Dr. Stephen Love speaking about developing native plant materials for ornamental settings.

When we weren't out touring and gallivanting through the Idaho countryside, we participated in some excellent classroom lectures and a few stand out as highlights. Dr. Kasia Kinser led a lively discussion about systematic approaches to diagnosing plant problems, a topic it seems all horticulture-related Extension folks can really get into- many ideas were shared during this session. We also heard from the new plant diagnostic lab director in Parma, Idaho. It was great to meet him in person, and to hear about his vision for re-invigorating the diagnostic lab in Idaho and the new technologies he could bring to the facility. Finally, we learned about specific insect and disease problems of fruit trees and ornamental plants from speakers Dr. Ed Bechinski and Mike Pace.

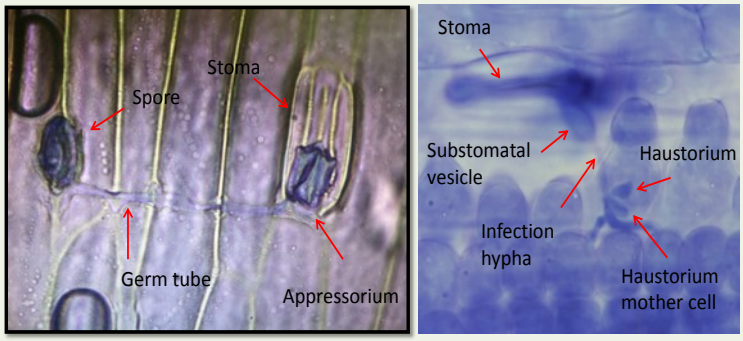
The training was a valuable experience. We learned a lot, met and connected with Extension faculty in Idaho, and were inspired with new ideas for continuing to develop horticulture training here in Montana.

Course Focus
PSPP 565/BIOM465 – Li Huang
Molecular Plant-Pathogen & Insect Interactions

PSPP565/BIOM465 is a co-listed course for graduate students and senior level undergraduate students. It is offered spring semester, even years.

The goals of this course are to teach students the molecular mechanisms by which plants and pathogens/insects interact during the process of pathogenesis or resistance, the understandings of how plants recognize relatively conserved microbial patterns to active defense, and the methods used to study and visualize intracellular interactions during pathogenesis and defense. Current information and hypotheses using different host/pathogen or host/pathogen or pest interactions as examples will be presented. Interactions between plant hosts and pathogens & pests will be illustrated from physiology,

biochemistry, molecular biology, and molecular genetics points of views.



Left: A rust spore landed on wheat leaf surface, formed a germ tube toward a stoma, produced an appressorium and penetrated through the stoma opening.

Right: After penetration, the fungus produces a sub-stomatal vesicle, then infection hypha. Haustorium mother cell is differentiated after the infection hypha encounters a mesophyll cell; a haustrorium is formed inside the mesophyll where the fungus gets nutri-ents.

New Graduate Students

Jeff King (Chaofu Lu)

My name is Kevin King and I will be working on my Master's degree as part of Dr. Chaofu Lu's lab. I will be working on the breeding of the oil seed crop Camelina. I immediately knew that I wanted to attend MSU after visiting last summer and seeing how wonderful both the school and city are. I grew up in in Southern California and it is there that I fell in love with outdoor activates including camping, biking, and fishing. I am overwhelmed by how much Bozeman, and Montana as a whole, have to offer for outdoor enthusiasts.

Since 2012, I have been working in production agriculture after earning my undergraduate degree in Crop Science and Horticulture at California State University, Chico in Northern California. I am excited about joining the PSPP department and continuing to explore the area.

Mina Botros (Li Huang)

Hello, my name is Mina Botros, I am a Ph.D. Student in Dr. Huang's laboratory, I joined her lab in January 2016. My research is on wheat using some Genetics approaches. I received my Masters two years ago in Paris, France in Plant Genetics While there, I visited ten European countries.

I can tell that Montana is a very beautiful place. I used to live in Florida with my family before joining MSU. There is a huge difference between the climate here and there. I love hiking and I am sure that I'll enjoy the snow and the beautiful landscapes. Also, I am interested in getting involved in student activities on campus. Currently I am the President of the Egyptian Club. I am looking forward to knowing everyone in our department and collaborating scientifically and socially.

Ramawatar Yadav (Jha)

Hello, I am Ramawatar Yadav, new PhD student from northern India, the country of oldest culture and religions. I am working on "Weed Biology and ecology and integrated strategies for herbicide resistance management in dryland and irrigated cropping systems of Montana" under the supervision of Dr. Prashant Jha at SARC, Huntley MT. I love travelling and camping.

I received my master's degree in Agronomy at Punjab Agricultural University, India. During my master's, I was working on Chemical Weed Management in Soybean. After degree completion, I worked a year as a Research Fellow on the project

"Integrated management of aquatic weed management in drains and water bodies in Punjab".

I am looking forward to meeting everyone and having a great time in the Department of PSPP.

Bernard Nyamesorto - Li Huang

My name is Bernard Mensah Nyamesorto and I am a new Master's student in Li Huang's lab. I was born and grew up in Battor, Ghana. I studied Agriculture (Crop Science) in the University of Ghana and obtained a BSc degree. While growing up in Ghana, teaching was more like my hobby. I started teaching from primary six. It was not surprising therefore that upon completing my undergraduate degree, I was maintained as a Teaching Assistant in the Department of Biotechnology, University of Ghana. I also played key leadership roles during my school days.

I'm excited to be joining the PSPP Department this fall to pursue a Master's degree in Plant Pathology. What excites me most is the fact that I will be working with Li Huang on a cereal crop. My first impression about Bozeman, Montana so far is that the place is less noisy which is ideal for a sound academic work.

In the future, I hope to further my study at the PhD level and become a Lecturer and a Researcher, as well as operate a specialty crop production enterprise. For now, I plan to continue enjoying all the great opportunities Montana has to offer to me and learn all I can from Dr. Huang, my advisor.

Brittany Brewer (Luther Talbert)

My name is Brittney Brewer and I am a new graduate student pursuing a Masters degree in Plant Science. I received my undergraduate degree in Crop Science from MSU Bozeman in the Spring of 2016. I am very excited to be working with Luther Talbert and others in the Spring Wheat breeding program here at MSU. During the pursuit of a Masters degree I will be placing a special emphasis on plant genetics and breeding.

Brittany Brewer

Being a Montana native and originally from the Flathead Valley, I have always taken a strong interest in the outdoors and agriculture. I am an avid fan of many outdoor activities including but not limited to hunting, fishing, hiking and camping. The many resources this beautiful state has to offer, is one of the many reasons I have chosen to continue my education here.

During my time as an undergraduate student the importance of sustainable agriculture become pivotal to my career path. Because of this in the future I would like to aid in research and crop varietal development. Developing crop varieties that can address pivotal issues such as food shortage, increasing population, water shortage and decreasing farm lands. I intend to continue my education and hope to one day become a plant breeder. However, for now, I fully intend to enjoy the journey towards a Master's degree and the opportunity to work with the many talented individuals here at MSU.

Grants

Rebekah VanWieren, Landscape Architecture Foundation, "Landscape Performance Education Grant for HORT 432 studio project working with the City of Bozeman Water Conservation Division".

Invited Talks

Rebekah VanWieren, "Landscape design principles and approaches for small-scale sites." June 21. MSU Extension.

Publications

Dunkel, F. V. and C. Payne. 2016. Introduction to edible insects, pp. 1-27. Chapter 1 in: A.T. Dossey, J.A. Morales-Ramos, and M.G. Rojas (Eds.), "Insects as sustainable food ingredients: production, processing and food applications". Academic Press, San Diego, CA, USA.

Costa-Neto, E. M. and F. V. Dunkel. 2016. Insects as Food: History, culture, and modern use around the world, pp. 29-60. Chapter 2 in: A.T. Dossey, J.A. Morales-Ramos, and M.G. Rojas (Eds.), "Insects as sustainable food ingredients: production, processing and food applications". Academic Press, San Diego, CA, USA.

Deirdre A. Prischmann-Voldseth, Erin E. Burns, Stephanie Swenson, Greta G. Gramig, "Life History and Phenology of an Endophagous Stem-Mining Herbivore (Coleoptera: Curculionidae, Hadroplontus litura) of a Clonal Weed", Annals of the Entomological Society of America.

Edward G. Barge, Cathy L. Cripps, Todd W. Osmundson, "Systematics of the ectomycorrhizal genus Lactarius in the Rocky Mountain alpine zone", Mycologia Plant Sciences & Plant Pathology.

The Buzz About Bee Viruses

In August 2016, Laura Brutscher, Alex McMenamin, and Michelle Flenniken published a PLOS Pathgens Pearl article entitled, "The buzz about honey bee viruses". PLOS Pathogens Pearl articles are open access educational articles written by scientists (see: http://collections.plos.org/s/pearls). According the their website "*PLOS Pathogens* presents an Open Access compendium of "lessons-that-last." This living collection of short, educational, and highly useful articles addresses topics of relevance and importance within the wide-ranging field of pathogens research, with insights for trainees and scientists at all career stages."

In addition to the article, Michelle was interviewed by Jose Mendez, a writer for PLOS, for their Biologue blog.
The article and blog post can be found at the following websites.
PLOS Pathogens (http://journals.plos.org/plospathogens/)
PLOS Biologue: http://blogs.plos.org/biologue/

Pollinator Health Group – new website
http://www.montana.edu/pollinators/
Also, you can find out more about the Pollinator Garden by watching this MSU video: https://youtu.be/xAlk_L_IMLY.

McMenamin A.J., Brutscher, L.M., Glenny, W., and Flenniken, M.L., Environmental factors affecting the replication and pathogenicity of bee viruses, (**2016**), *Current Opinion in Insect Science* (16):14-21.

Engel P., et al. Flenniken, M.L., Dainat, B., The bee microbiome: impact on bee health and model for evolution and ecology of host-microbe interactions, (2016), *mBio* 7(2): e02164-15.

Gary Strobel: COVER PHOTO for Volume 72, Number 2 2016: Pictured here is a small portion of Badlands National Park, South Dakota, USA. In order for badlands to form there must be alternating layers of hard and softer materials such as mudstones, clay, organic materials and sandstone. Areas such as this exist in many parts of the earth and are formed by the forces of wind and water. In Badlands National Park, the lower dark gray layer is Pierre shale (deposits from the cretaceous inland sea) dating to about 80 million years ago and the upper banded areas are of the more recent Eocene and Oligocene epochs in which mammals, in

this area, made their appearance on the earth in astonishing numbers including brontotheres, rhinoceroses, oreodonts, horses, camels, entelodonts, rabbits, rodents, and carnivores. One can only imagine how many and what kinds of microorganisms interacted with the higher organisms, the water ways, the soils and the environment as a whole during these ancient times. Suffice it to say that microbes were present, were evolving and were playing a major role in the biology and geology of the earth in those interesting days and contributed to what we now see in this beautiful scene.

A musk melon at "full slip." It should be ripe…

The bracts are opening on this artichoke. In theory, it is ripe.

"Green" tomatoes ripening in a box lined with newsprint

Is It Ripe?
By Toby Day

As we near the end of summer and threat of hard frosts, I get many inquiries about how to tell if certain fruits or vegetables are ripe. The current question I am getting is whether an apple is ripe. Well, here is the answer: Cut them open and look at the seeds. If they are brown or black, it is most likely ripe. If the seeds are white, it is not. Or, you can just taste it…

I understand that for some, it can be difficult to tell whether a fruit or vegetable is ready for the picking. Is the artichoke ready to pick or not? This is a question I had to answer for myself as I have what looks like a "ripe" artichoke. After much research, I found out you harvest just before the bracts spread open. Hmm, o.k.? Now how to cook it?

Another question I often get is, "If there is a hard frost and I pick all my green tomatoes and bring them inside, will they ripen?" The answer is likely "yes." I pick my green tomatoes and put them in boxes lined with newspaper and cover the boxes. In about two weeks, you will know which ones will ripen as they will turn color. They are not as fresh as vine ripened, but they are still "*tomatoes that I grew*."

The other question I often get this time of year is about harvesting melons and winter squash. The issue with melons and winter squash is that they often do not continue to ripen after they are harvested, unlike tomatoes. How do you know if melons are ripe? The stem should go to full slip, meaning if you turn the melon and the stem breaks off easily, it is likely ripe. There is quite a bit more to it, but that is a telltale sign. Winter squash? Well, this one is a little more difficult to explain, but if you push your fingernail into the skin of the squash and it resists your fingernail, it is likely ripe. If your fingernail easily breaks the skin of the squash, it is not.

I can't really say there is a definitive place online that tells you all the secrets to harvesting and ripeness, but I have listed a few websites below that can help you decide what to do with your garden vegetables and tree fruit this month.

http://www.almanac.com/content/ripeness-guide
http://www.harvesttotable.com/2010/06/vegetable_harvest_times/
http://www.reneesgarden.com/articles/harvest.html
http://www.rodalesorganiclife.com/garden/when-harvest

Baby News!
Hongtao and Wenchao have welcomed their second son to their family. Eric was born on Monday, August 22, at 10:31 pm and he weighed 9 pounds and was 21 inches in height. Andy, 4, loves having a little brother. Congratulations to all of you!

Recipe of the Month

Vegetarian Chili
2 T taco seasoning
2 T Worcestershire
1 onion, diced (cook until transparent)
1 orange pepper, diced
2 carrots grated
3 cans of beans
1 can of diced tomatoes
green chilies
1 cup salsa
3-4 cups corn
1 cup water
1-2 T brown sugar

Add all of these ingredients to the pot, bring to a boil and then simmer for 30 minutes. Delicious!

September Birthdays

Tracy Dougher	1
Laurie Kerzicnik	2
Irene Decker	5
Michelle Flenniken	18
Gary Strobel	23
Joseph Kibiwott	23
Bill Dyer	26
GunNam Na	27
Mark Young	27
David Baumbauer	27
Elul Kaya	29

Go to next page for photos of the Barbecue/Potluck for incoming and continuing graduate students and their advisors.

Graduate Students in PSPP, Fall 2016

Brian, Vinicius, David, Mehmet, Ram, Niranjan, Deji, Mina, Andy, Uta, Dylan, Whitney, Jeff, Paula, Brittney, Breno, Emma, Frank, Alex, Jamin, Marlee, Traci and Megan.