Plant Science Says

Happy Halloween!

Volume 15, No. 9 October, 2013

Ag Fair!

Join Montana State University's College of Agriculture and the Montana Agricultural Experiment Station as they *Celebrate Agriculture!!* October 25-26. Activities include an Agricultural Economics Outlook Conference Friday morning followed by an Ag Fair, including presentation of the Outstanding Ag Leaders for 2013 in the Strand Union Building from 12:00 to 2:00 p.m. Agriculture experts from around Montana will share information and explore the latest research results. The celebration continues Saturday morning with a Blue and Gold Breakfast with President Cruzado. For more details please visit http://ag.montana.edu/excellence/agappreciation.htm or contact Susan Fraser at (406) 994-3683.

Sheep and viruses: Making Science Fun!
By Mary Burrows

Mary Burrows, Zach Miller, Fabian Menalled, and Irene Grimberg represented PSPP, LRES, CoA, Extension and the Science Math Resource Center at the Montana Science and Engineering Festival on 21 September at the Bobcat Stadium. Together, we have a number of USDA grants to investigate multitrophic pest interactions and cropping system management. This was an effort to publicize our efforts to the local community, engage K-12 students in science and engineering, and beta test some of the educational activities we're developing. We also recruited teachers to get involved in our educational objectives.

Our booth was right at the entrance to the festival, so essentially every attendee was attracted by the sheep corral, the microscopes and computers, or the blow-up viruses we brought to explain the different research we are conducting. Mark Young had used these at a Peaks and Potentials youth camp http://www.youtube.com/watch?v=tcptd4k8mlU). We had kids lining up to play in the icosahedral virus-like blow up balls. In this activity some kids were the virus and others the cell, such that the virus tried to "tag" the cell. We used this activity to model how viruses infect cells, dose responses to inoculation, and timing of infection. But I think most of the kids were just pretty pumped to have a turn, and parents were really good about watching their kids and sharing. Thankfully no one was injured, so this will likely continue as a fun activity for our group!

Kids lined up to join the game! (Yellow = healthy organelle; Blue = infectious virus; lawn = a plant cell). Photo courtesy of Mary Burrows.

Mary's daughters beta-testing the night before the festival. It turns out a small air compressor is ideal for inflation. And, Mary is very proud that her daughters enjoy playing with icosahedral virus models. Photo courtesy of Mary Burrows.

We also had a microscope set up so participants could see wheat curl mites and symptoms of *Wheat streak mosaic virus* in wheat leaves, and play a game that

represented the gradient of infected leaves in a field with respect to the location of the mites. We needed to pull up a stool for younger participants to reach the microscope! It was noticeable how little people knew about wheat production, crop management, and disease transmission; but how curious they were. Also, the interesting questions and extended conversations with participants were quite illuminating.

Finally, it was great fun seeing children and parents learning how sheep can be used to enhance the sustainability of our cropping systems. While kids where mostly interested in petting them, parents asked many questions about the feeding behavior of sheep. They were particularly excited to learn that sheep can feed on noxious weeds making it a great opportunity to teach how to identify weeds. Maybe the public does care!

Sheep provided a major attraction for visitors to our booth. Photo courtesy of Mary Burrows.

Dunkel is interviewed by Shen Chen, China Central TV correspondent, in her lab in Marsh Laboratory while the camera crew captures the to-be-translated into Chinese verbiage. Photo courtesy of Hyatt Freeman.

CCTV crew looking for grasshoppers in Dunkel's organic vegetable garden. Photo courtesy of Bob Diggs.

China Central TV Visits Dunkel Lab
By Florence Dunkel

Friday the 13th was a lucky day for China Central TV (CCTV) this September. That was the day their camera and newscast team captured six hours of interviews with Dr. Florence Dunkel and her teaching assistants, Katrina Jackson and Hyatt Freeman, in her lab and field site.

The CCTV team filmed Dunkel's cricket colony, captured male cricket songs, and female crickets laying eggs with their long ovipositors in wet sand while posing questions for their Chinese viewers on how Americans are making use of high quality insect protein. By midday, the crew was helping Dunkel collect wild grasshoppers in an organic vegetable garden, but dined on the "other" wild Montana meat—mule deer. Warm sunny mid-days are not ideal hopper hunting times.

CCTV found Dunkel because she is Editor of the Food Insects Newsletter (www.foodinsectsnewsletter.org) – for 23 years the sole source of edible insect news globally. Now, it is one of many sources documenting the current eruption of research and entrepreneurial activity in edible insects. CCTV has been the main national TV station in mainland China ever since its inception in the 1970's. Although based in Washington D.C., the September 13 film crew will air this newscast in Beijing in October with voice-over and subtitles in Chinese.

This interest of China, a country in an entire world region where edible insects are commonplace, was a surprise to Dunkel. When she thinks of edible insects and China, the good taste of their industrial side-stream, mulberry silkmoth pupae, *Bombyx mori,* comes immediately to mind.

So, Dunkel's MSU outreach and service reached a new dimension when the United Nations' Food and Agricultural Organization (FAO) based in Rome, Italy, released their 190-page report May 13, 2013, entitled *Edible Insects: Future Prospects for Food and Feed Security* #171-FAO Forestry Paper. She now has weekly interviews responding to the report's content. Canada was one of the first countries to contact Dunkel. She granted seven radio interviews from Nova Scotia to the Yukon Territories the day following release of the FAO report. By August 13, 2013, six million downloads of the report had occurred globally.

In January, 2012, Dunkel was one of 22 participants worldwide brought to Rome by FAO as expert consultants to assess the potential of insects as food and feed. FAO report #171 resulted. It contains several information boxes written by Dunkel.

As an example of the current eruption of entrepreneurial interest in this area, last week Bill Clinton and Mohammed Yunus (Nobel Peace Prize recipient) awarded the 2013 $1 million Hultz Prize for innovative ideas to business students at McGill University in Montreal, Canada for a portable cricket and grasshopper farm project!

On September 30, Dunkel presented an invited seminar at Virginia Commonwealth University-Richmond on *Food Security: The potential of insects*.

*BUG APPETIT!**

*Bug appétit! Is an MSU-generated phrase invented by entomologist Dr. Margaretha Wessel, founding director of University Studies during filming of a bug banquet in 1996 by Paramount Pictures. Dunkel was the host for the event.

Fungi Fuel in Your Tank

This week's "Science Nation" video, One day, we may fill the tank with fungi fuel!, features the work of Brent Peyton, Gary Strobel & colleagues at Montana State University.

"Science Nation" is a video series commissioned by the NSF Office of Legislative and Public Affairs. The series is distributed throughout the world, including various media outlets on the internet, the PBS Newshour website, local community TV stations in the U.S. via CMDN.tv, Voice of America for international broadcast distribution, the NSF STEM video portal Science360 – The Knowledge Network, and K-12 content producers in the U.S. and abroad. Some episodes also appear in the nationally-distributed PBS documentary series *This American Land.*

LED Greenhouse Lighting Project at the PGC

By David Baumbauer

The purple glow emanating from the teaching greenhouse at the PGC is from LED grow lamps that were recently installed as part of a pilot project to test their effectiveness and energy savings. The LumiGrow 325 LED fixtures feature a tunable design allowing users to manipulate the PAR spectrum to favor vegetative or reproductive growth. According to Assistant Director of Facilities Services, Dan Stevenson, approximately 3% of all MSU academic building electricity use is attributed to PGC greenhouse lighting. The LED lamps use 325 watts as compared to the 1000 watt Metal Halide HID lamps they replaced.

Elisa Boyd and Chester Fox measuring light levels in the teaching greenhouse. Photo courtesy of Daivd Baumbauer.

The LED pilot project was the direct result of HORT 343 – Commercial Plant Production students working on sustainability projects for the PGC. Students worked with Dan Stevenson to determine current electrical usage, potential savings and identified appropriate LED fixtures for our needs. Funding was provided by the Office of Facility Services energy conservation fund.

New Grad Students
Nar Rhanabat (Burrows)

It looked like my home town when I first came to Bozeman in April, 2013, as the mountains were covered by snow just like the Himalayas near the city I am from, Pokhara, Nepal.

I completed my Master's degree in Agricultural Science in the Tropics and Sub-tropics at the University of Hohenheim, Stuttgart, Germany. After graduation, I had the opportunity to work with Fabian Menalled, Associate Professor in Land Resources and Environmental Sciences and Mary Burrows, Associate Professor in this Department on host pathogen dynamics.

My research project is focused on the impact of agricultural practices on pathogen dynamics in dry land crops, particularly on wheat–virus-mite complex. We are doing different field and green house experiments on crops and weed hosts of mite and virus to understand their complex interaction.
My research will reveal the possible best options for agricultural practices like seedling date, using of appropriate variety, and green bridge management to mitigate the viral infection on wheat in the dry lands of Montana.

In my free time, I like to go hiking, trekking, travelling, playing volleyball, watching movies, and listening to music.

Course focus
BIOO 460 Plant Metabolism - Andreas Fischer

In terms of metabolism, plants and some other groups of eukaryotes are much more 'capable' than animals. As plants are sessile, they need strategies to survive in their given environment; they do this both through metabolic and through developmental flexibility. The focus of this class is on those metabolic 'pathways' that allow plants to thrive, literally, on water, air, a few nutrients from the soil solution, and energy from sunlight.
A large emphasis is placed on the biophysics and biochemistry of the conversion of light energy to chemical energy, and use of that energy to acquire and reduce carbon (from CO_2), nitrogen (from nitrate and ammonium) and sulfur (mostly from sulfate) – the basic reactions through which carbohydrates, amino acids and nucleic acid building blocks (nucleotides) are 'made'. This means that, while the 20 amino acids and five nucleotides needed for protein and DNA/RNA synthesis are mentioned in most introductory biology classes, BIOO 460 will teach you the metabolic principles leading to their synthesis. Additional material covered includes an integrated overview of central carbohydrate metabolism (sucrose, starch and their interconversion), an introduction to plant lipid metabolism, and an overview of the major groups of plant 'secondary metabolites' (terpenoids, alkaloids and phenolic compounds), which are important for plant interaction with other organisms.

This is mostly a lecture-style class (with lecture notes and other important materials available through D2L), but every student will present one original research article, covering a recent development in our understanding of plant metabolism, to the class. Students taking this class need a basic understanding of plant biology and a good understanding of biochemical principles; BIOO 220 ('General Botany') and BCH 380 ('Biochemistry') are therefore prerequisites. This 3-credit class is taught every other spring semester (spring 2013, spring 2015), alternating with BIOO 437 ('Plant Development'; spring 2014, spring 2016).

Montana Ag Live! Schedule
October 6
Joel Schumacher, MSU Agricultural Economist, "Financial and Estate Planning, a Must for Many Rural Montanans".

October 13
Vince Smith, MSU Economist, "Changes in the New Farm Bill.

October 20
Greg Pederson, Research Ecologist with the United State Geological Survey located at the Northern Rocky Mountain Science Center, "Climate Changes and How They Affect Agriculture."

Invited Talks
David Sands was invited to speak at the UN-FAO (Food and Agriculture Organization) in Rome, Italy, in August, in a meeting on

Perennial cereal grain production for developing countries. Numerous projects were presented on wheat, sorghum and maize with the hope that these could be developed into multiple harvest crops. Over 60 scientists were in attendance. The work at MSU was presented with the emphasis on nutritional value of cereal grains. Our two perennial crops, Timtana and Montina, selected for their high protein value and introduced successfully into the marketplace, are the only fait accompli products of perennial cereal grains on the market.

Grants
Mark Young, NSF, "Dimensions: Costs and benefits of chronic viral infections in natural ecosystems". $1,993,959.

Montana Wheat and Barley Grants
The following faculty in our Department received Montana Wheat and Barley Grants:

Tom Blake - IDENTIFYING AND DEVELOPING IMPROVED BARLEY VARIETIES FOR MONTANA

Mary Burrows - PLANT DISEASE MANAGEMENT AND EDUCATION IN MONTANA

Phil Bruckner - WINTER WHEAT BREEDING AND GENETICS

Alan Dyer - PREBREEDING FOR ROOT HEALTH IN MONTANA'S WHEAT

Mike Giroux - CREATION AND END PRODUCT QUALITY TESTING WITH NO PPO ACTIVITY

Li Huang - CREATE BROAD-SPECTRUM RESISTANCE TO BIOTROPHIC PATHOGENS IN WHEAT

Jack Martin - CHARACTER AND DEVELOPMENT OF NOVEL VARIANTS TO IMPROVE MILLING DOUGH QUALITY WHEAT

Deanna Nash - IMPROVED QUALITY OF MONTANA HARD RED AND HARD WHITE WHEATS

Jack Riessleman - "MONTANA AG LIVE!" UNDERWRITING

Jamie Sherman - MOLECULAR BREEDING PIPELINE FOR WHEAT

Luther Talbert -SPRING WHEAT BREEDING AND GENETICS

Kevin Wanner - MANAGING WIREWORM DAMAGE TO WHEAT & BARLEY-A GROWING PROBLEM IN MT

Squash-a-Rama
By David Baumbauer
Over 700 pounds of winter squash were distributed at the PGC's 2013 Squash-O-Rama on Friday, September 27th. The produce was grown by students in HORT 345 – Organic Market Gardening class and hort farm technician, Elisa Boyd.

The pictures from from the bottom up are Linnea Skoglund, Mary Burrows, Susie Siemsen, Eileen Carpenter, and Bill Grey. loading up on squash.

Phota courtesy of David Baumbauer.

Photo courtesy of David Baumbauer.

Hugelkultur – Fad or For Real?
By Toby Day, Extension Horticulture

Many in the gardening world are touting an old way of gardening called hugelkultur. Hugelkultur, a German word that roughly means "mound culture," is a method in which wood debris is used as a component in building a garden bed or mound. This method of gardening is not new, but rather an old method that has been resurrected in recent years by the permaculture movement for sustainable gardening. In the last few months I have received many inquires about this gardening method and whether the new interest is promoted by Extension.

The method in which a hugelkultur garden bed is built (most sites agree on the method) is to put down a layer of large logs (avoiding cedar and walnut that can be allelopathic) either buried in a pit to create a bed similar to traditional raised bed heights or on top of the ground to create larger "mounds." A second layer of larger branches followed by smaller branches and twigs are laid on top of the logs. These layers are then watered well. Next, all the voids and crevices are filled with twigs and organic materials such as leaf litter, kitchen scraps, and compost. Lastly, the whole thing is covered with a one to two inch layer of topsoil. There are some variations in the process depending on what Internet site you are reading, but the basic concepts are about the same – to mimic a "natural setting."

Typical Hugelkultur bed before organic matter and top soil added.


Hugelkultur bed fully covered with leaf letter and topsoil.

There are many claims that I have read online about the virtues of hugelkultur. Most claim the that hugelkultur beds will retain moisture in the large biomass (many claim you don't have to water for weeks), it will better resemble the nutrient cycle found in nature (again, many sites claiming no need for fertilizer), improve drainage, and is a good way to reuse or reclaim large woody waste that may otherwise be hauled off to the landfill. There is obviously much more to the hugelkulutr process than I have written, but much of it is anecdotal and not from unbiased and science-based websites.

This brings me to my dilemma. In Extension, we are to be unbiased and research-based. My usual litmus test for unbiased and research-based information is to see if other Extension services from around the country are supplying information on a subject. A quick search of "hugelkultur" and "extension" only brought up one fact sheet from Washington State University in Lewis County, Washington about hugelkultur, which got much of its information from the Blake Garden at UC Berkeley. Not an overwhelming endorsement for hugelkultur from Extension.

I'm divided. I think that there are some merits to the idea of hugelkultur, but I also have seen many garden techniques and products come and go. Do I have to mention square-foot gardening, lasagna gardening, or even tomatoes that grow "upside down?"

Let's face it, gardening has not changed much for generations. And, too many times, gardeners are drawn to new and interesting ideas and fads that eventually fizzle out over time. Is hugelkultur one of these fads, or is it a legitimate and easy gardening practice that the everyday gardener is going to want to take on? I think that the verdict is still out on hugelkultur.

In the mean time, I plan to implement a hugelkultur garden first hand and continue to research the new (old?) garden technique. I will report what I have found. Who knows, maybe this gardening technique will grow more in popularity and spur new research.

Recipe of the Month

Hot Spiced Cider in Coffee Maker

1/8 c packed brown sugar
1/2 t whole allspice
1 t whole cloves
1 cinnamon stick
1/4 t salt
1 pinch ground nutmeg
1 large orange, quarted with peel on
2 quarts apple cider

Place filter in coffee basket, and fill with brown sugar, allspice, cloves, cinnamon stick, salt, nutmeg, and orange wedges. Pour apple cider into coffee pot where the water usually goes. Brew, and serve hot.

October Birthdays

Florence Dunkel	10
Bob Sharrock	11
Joanna Gress	13
Jamie Sherman	20
Erin Lonergan	22
Ed Barge	24