PSPP - Plant Science Says *November, 2017*

Lachowiec Joins Faculty

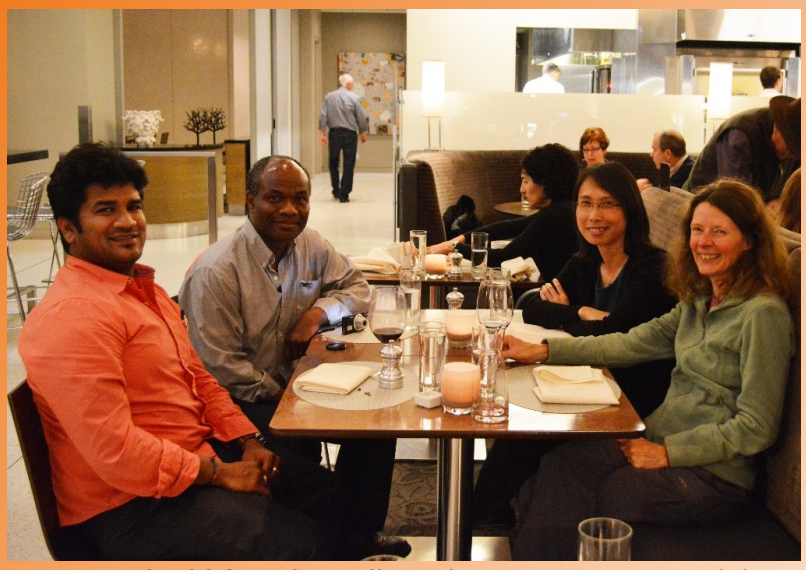
Jennifer Lachowiec is our newest faculty member as of November 1. She will be launching an interdisciplinary research program to understand the genetics of plant development using quantitative genetics and genomics.

Jennifer grew up in northwest Indiana, loving to read and swim. Her interest in genetics research stemmed from reading all the genetics books in her local library. She chose to attend the University of Wisconsin-Madison and begin her science research career, majoring in Genetics and Anthropology. For her Ph.D. studies, Jennifer joined the Molecular and Cellular Biology program at the University of Washington-Seattle. Her thesis research with the model plant *Arabidopsis thaliana* combined molecular biology and quantitative genetics to identify and understand genetic interactions underlying traits. To gain more experience in whole genome analyses, Jennifer went to the University of Michigan-Ann Arbor for a postdoctoral research fellowship. Now at Montana State University, Jennifer will develop a research program with the ultimate goal of predicting traits from the underlying genetic sequences, building approaches in model plants to apply to crops. She looks forward to working with faculty and students across the department. Jennifer is also passionate about women in science and introducing girls to math and science, especially in underserved communities. In addition to her work with science, Jennifer enjoys spending spare time bicycling, running and DIYing with her husband Zeb, and training and bird hunting with their two dogs Benny and Bambino. See more at JLlab.org.

2017 Grand Challenges Annual Meeting
By Li Huang

I was invited to attend the 2017 Bill Gates Grand Challenges Annual Meeting in Washington D.C. from October 2-6, 2017. The meeting aimed to build momentum for global collaborations to "improve the well-being and trajectory of adolescents around the world". More than 900 people from a wide range of disciplines attended the meeting. There were 26 plenary speakers including U.S. Secretary of State, Rex Tillerson, and the Co-chair of the Bill & Melinda Gates Foundation, Bill Gates. In addition, the meeting set up eight scientific track sections, such as crop research from innovation to impact, vaccines, and global health etc.

The format of the meetings was creative and promoted communication among attendees. Human nature usually causes us to stay in our comfort zones; the format of this meeting "forced" people to get out of their comfort zones. For example, on the first day, the seating was arranged so that we sat with someone we didn't know for 30 minutes, we chatted for five minutes, and then everyone



Huang with old friends Sridhar Bhavani, Evans Lagudah, and Linda Tabe.

had to use five to ten key words to tell the rest of the attendees about the research of the person they had just met. Every 30 minutes, we switched to a new person. Even though I felt uneasy at first, by the end of the meeting, I felt I knew everyone from the crop section.

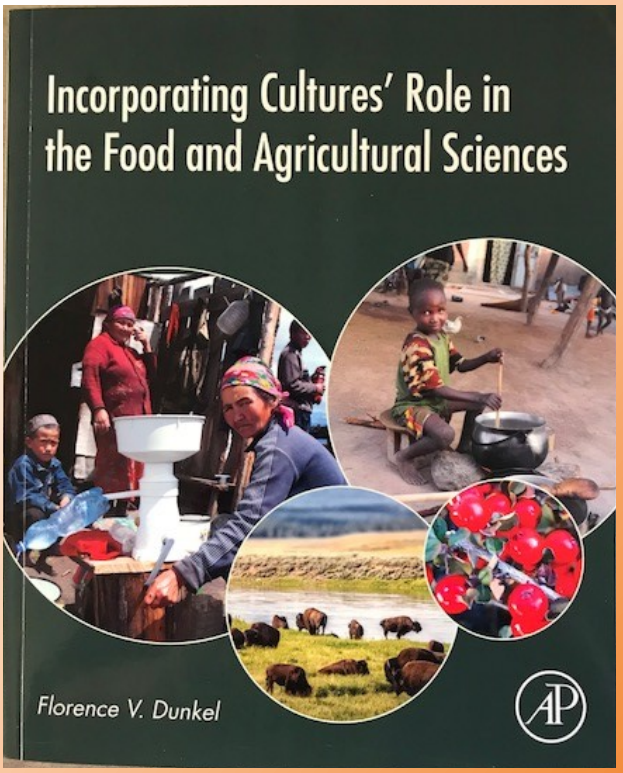
From the talks in the plenary section, I sensed that agriculture was not a high priority in funder's minds. We should keep reminding the funders that plant diseases will never disappear. If we have the correct mind set and strategy--always a step ahead of the pathogens, then we can keep all plant diseases at a manageable level.

My goals in attending this meeting were to catch up with old friends and make new friends; look for new funding opportunities (I discovered three new funding agencies including Biotechnology and Biological Sciences Research Council - BBSRC, Foundation for Food and Agriculture Research- FFAR, and Advanced Research Project Agency - ARPA; and most importantly, I wanted to be inspired. I am happy I was able to achieve all these goals.

USDA NIFA Considers Culture-Smart Agriculture
By Florence Dunkel

Program Officers from the U.S. Department of Agriculture National Institute of Food and Agriculture gathered on 24 October at the Waterfront Center in Washington D.C. to consider Dr. Florence Dunkel's main policy recommendation on Immersion from her new book *Incorporating Cultures' Role in the Food and Agricultural Sciences*. Dunkel highlighted a few case studies from her book including the required immersion program for undergraduates in all majors for the past 43-years at Morocco's premier agricultural university, l'Institute Agronomique et Veterinaire Hassan II. She compared responses to faculty with this undergrad training to faculty without immersion experiences in their effectiveness working with subsistence farmers.

Other data she drew from her book emphasized learning local traditional knowledge before providing any advice at all. She cited the USAID food storage marketing project in Rwanda in which farmers shared their knowledge of 489 mixtures of 284 landraces of the dry edible bean, *Phaseolus vulgaris,* the main source of protein and calories for 95% of the Rwandan population. This was an elegant 200 to 300 year-long field study designed to address yield, drought, and good taste in their ecologically diverse field plots!



Isis Vera, US House Ag Committee Intern; Maria Goldberg, USDA Office of Public Engagement; Dr. Susan Schram, Association of International Agriculture and Rural Development board; Dr. Florence Dunkel; Dr. Hiram Larew, PSPP affiliate faculty member and retired Director of the USDA NIFA Center for International Programs; and Vinnie Panzio, USDA Office of Public Engagement gather for lunch on the shores of the Potomac following the presentation.

The presentation concluded with her AGSC 465 Apsaalooke student, Winter Old Elk's diagram of issues related to the food desert in her community. Dunkel presented seven recommendations for USDA NIFA programs and for incorporating immersion language into the 2018 Farm Bill. She has collaborated with small-holder farmers on three continents for the past 36 years.

Also attending were folks from USAID's Feed the Future program, as well as career staff from Secretary Perdue's Office of Public Engagement, and a research fellow from the U.S. House Agriculture Committee.

Thirty minutes of discussion followed Dunkel's prepared remarks ending with positive comments from NIFA staff. In meetings with Tribal Relations and field program leaders in the Secretary's office the following day, it was suggested Dunkel return to hold workshops on the holistic process and decolonizing methodologies.

The presentation was streamed to U.S. Land Grant institutions. A link to the archived video is available from Dunkel's host, Otto Gonzales, Director of the USDA NIFA Center for International Programs. *Incorporating Cultures' Role in the Food and Agricultural Sciences* is available from Elsevier (Academic Press) online or at the MSU bookstore. A companion website accompanies the book.

Landscape Design in Poplar, Montana
By Rebekah VanWieren

This fall, students in HORT 432 Advanced Landscape Design are working with the Fort Peck Tribe's Office of Environmental Protection and the U.S. EPA on site designs for two public parks in Poplar, Montana. The partners' goals are to utilize landscape design for redeveloping vacant, under-performing properties and to demonstrate how to mimic natural systems to treat stormwater and be drought resilient.

In mid-October, we traveled to Poplar (whew – my longest trip with undergrads!) to visit the sites, meet with project partners, and facilitate a community design workshop. Even with all the technological advances in understanding places remotely, a physical site visit is invaluable when it comes to observing site-scale character and context and building trust and understanding with stakeholders. Our site visit was primarily one 12-hour work day. In the morning we toured the town, listened to presentations from the Tribe's Office of Environmental Protection, learned about Sioux American Indian cultural uses of plants from Elder Louis Red Elk, walked along the Poplar River, and visited the project sites.

Site visit at Main Street vacant lot.

Student-facilitated design workshop in Poplar, Montana.

On the sites, students measured elements like slopes, dimensions, vegetation species and structure, utility locations, and site lines. In the afternoon, students facilitated a design workshop for nearly 40 participants. The students organized and created the material and activities that were presented, and I was so proud of their professionalism and communication skills. The Tribes prepared an Indian taco feast following the workshop, which felt very celebratory after the students' hard work.

Much to the student's surprise, the day's work was not over. That evening students were given an assignment to summarize findings from the community workshop and develop initial drawings to discuss park design goals at a morning meeting before heading back to Bozeman. The students delivered on the assignment, and apparently still found time to participate in some local karaoke.

The next day, we toured the Fort Peck Interpretive Center and the dam powerhouse before the beautiful drive home through Glasgow, the Upper Missouri River Breaks, and Harlowtown. The site visit was a success although students remain a bit disappointed we did not run into Brad Pitt, as his foundation, Make It Right, planned and built phase 1 of an eco-village in Poplar – ha.

Students have been hard at work in the studio developing site design ideas that meet stakeholder needs, while also improving landscape performance and community ecosystems services. If you're interested in seeing their final design proposals, please join us for the final review on Monday, December 4, 12:00-3:00 PM in Animal Bioscience Building 145.

Landscape Design Students attend the Montana-Idaho American Society of Landscape Architects Conference
By Rebekah VanWieren

Early this October, three landscape design majors had the opportunity to attend the MT-ID ASLA biennial conference in Missoula, thanks to support from the horticultural endowment fund. This was a fantastic experience for students to interface with practitioners, landscape material representatives, and other landscape design students from University of Idaho. One student, Hailey Neutgens, shares her experience below.

"Attending the ID-MT ASLA conference in Missula a few weekends back was a great experience for me, as I am graduating in December. The conference was not only very educational but also inspiring. I had the opportunity to network and discuss projects with designers that are working in Montana

On tour of Missoula's Regional Park.

and are focusing on green infrastructure and sustainable design practices. The conference attendees were able to visit Missoula's Regional Park, which was constructed with a strong focus on SITES (www.sustainablesites.org) practices and receiving SITES certification. In many studio courses, we study and discuss these design strategies, and as a student, it was very motivating and impressive to see them utilized so close to home. PSPP, thank you once again for the horticulture endowment, it was greatly appreciated."

2017 Tri-Society International Annual Meeting
By Jason Cook

The American Society of Agronomy, Crop Science Society of America, and Soil Science Society of America hosted more than 4,000 researchers, educators, and students at the 2017 Tri-Society International Annual Meeting in Tampa, FL on Oct. 22-25 with the theme of "Managing Global Resources for a Secure Future". Montana State University was well represented by 18 faculty and graduate students from the departments of Plant Sciences and Pathology, Land Resources and Environmental Sciences, Animal and Range Sciences, and the Montana Ag Research Centers. Attendees from the Plant Science and Plant Pathology department included Breno Bicego, Hikmet Budak, Mac Burgess, Jason Cook, and Joseph Kibiwott. Dr. Budak gave a presentation entitled

Breno Bicego gave a talk entitled "Evaluation of Spring Wheat Senescence Using Multispectral Data".

Advanced plot combine made by Zurn.

Jessica Torrion and Emily Glunk enjoying turkey legs acquired at a reception.

"CRISPR/Cas9 in a complex and Polyploid Genome, Wheat" where he showed results from his lab using CRISPR/Cas9 to target two genes involved in the autophagy pathway. Dr. Budak's results suggest CRISPR/Cas9 can be easily used to edit genes in wheat protoplasts (plant cells that have their cell wall removed). Graduate student Breno Bicego also gave a talk entitled "Evaluation of Spring Wheat Senescence Using Multispectral Data" where he discussed research results acquired at the Northwest Agriculture Research Center under the advisement of Dr. Jessica Torrion. Breno discussed how they are testing the use of a fixed wing drone carrying a multispectral camera to detect senescence in spring wheat. Application for this research is to develop a more efficient method for detecting the stay-green trait in breeding programs, which has been shown to improve yield under drought conditions.

Beyond research, there were sessions that focused on work being done by USAID and the Bill and Melinda Gates Foundation to educate students and increase agricultural productivity in the developing world to enhance food security. Online education platforms have been developed to train students and agriculture personnel in the developing world such as the "Plant Breeding E-Learning in Africa" https://pbea.agron.iastate.edu/ that is hosted by Iowa State University, and the "Plant Breeding Academy in Africa" http://pba.ucdavis.edu/PBA_in_Africa/ that was developed by the University of California-Davis. Additionally, funding has supported the development of an information management system for plant breeding called the "Breeding Management System" https://www.integratedbreeding.net/breeding-management-system that helps a breeder manage data across all phases of the crop improvement cycle by helping to track trials, nurseries and seed inventories, and run statistical analyses to support breeding decisions. Another tool that has been developed is "The Breeding Program and Assessment Tool (BPAT)" http://plantbreedingassessment.org/ that assesses the management and organization of a breeding program to determine if there are ways to increase genetic gain in the program.

Lastly, the conference provided an opportunity to learn about new technology that can be used to more efficiently acquire data such as the use of drones that can be used to collect temporal data during the growing season, and advanced combines that can collect yield, test weight, moisture and grain protein content data in the field, and send the data to a computer via mobile networks for data analysis. The combines can also be set to collect sub-samples from each plot for end-use quality analysis in the lab. Efficient acquisition of field data would allow further exploitation of next generation molecular breeding applications for accelerating genetic gains. One such application was proposed by Dr. Rex Bernardo, a professor at the University of Minnesota, who wants to combine breeding value information generated by genomic selection and use CRISPR/Cas9 to induce site-specific recombination at specific locations in the genome to maximize genetic gain rather than relying on random chance alone to get a desired genetic combination. With all the new technologies and methodologies becoming available to researchers the future looks bright for managing global food security.

MAES Seminar Schedule - all in 108 PBB

Cathy Cripps
"Ectomycorrhizal Fungi in high elevation mountain systems"
11/1 - 9:00 a.m.

Jessica Rupp
"Row Crop Extension Pathology in Montana."
11/8— 9:00 a.m.

Chaofu Lu
"Genetic Engineering of Plant Oils for Industrial Applications"
11/13—9:00 a.m.

Hikmet Budak
"Cereal Genomics"
11/17—1:30 p.m.

Kevin Wanner
"Application of molecular tools for IPM of insect pests"
11/20 - 10:30 a.m.

Rebekah VanWieren
"Ecological Landscape Design in Brownfield Regeneration"
12/5 - 8:00 a.m.

Invited Talks
Hikmet Budak, "*CRISPR/Cas9 in a Complex and Polyploid Genome, Wheat*". Crop Science Society of America Meeting", 10/22/17.

Ryan Thum, "Identifying high risk genotypes of Eurasian watermilfoil", International Conference on Aquatic Invasive Species, Fort Lauderdale, FL. 10/23/17.

Grants
Mac Burgess, "Montana Hardy Fruit Nutraceutical Quality" Utah State University.

Mac Burgess, "Evaluation of Montana-grown superfood fruits: Phase II, Montana Department of Agriculture.

Kevin McPhee, "Pulse Crop Breeeding", USA Dry Pea and Lentil Council.

Mary Burrows, "Root rot mitigation in specialty crops", Montana Department of Agriculture.

Bright Agindotan, "Characterization of Pathogens Detected in Dry Peas Fields in Montana", Montana Department of Agriculture.

Mike Ivie, "Foundational Research for Specialty Crop Pollination Security? The (Wild) Bees of Montana", Montana Department of Agriculture.

Publications
Keith, B.K., E.E. Burns, B. Bothner, C.C. Carey, A.J. Mazurie, J.K. Hilmer, S. Biyiklioglu, H. Budak, and W.E. Dyer. 2017. Intensive herbicide use has selected for constitutively elevated levels of stress-responsive mRNAs and proteins in multiple herbicide resistant *Avena fatua* plants. Pest Management Science DOI 10.1002/ps.4605.

Burns, E.E., B.K. Keith, L. Talbert, and W.E. Dyer. 2017. Non-target site resistance to flucarbazone, imazamethabenz, and pinoxaden is controlled by three linked genes in *Avena fatua* L. Weed Research (In Press).

Burns, E.E., B.K. Keith, B. Bothner, and W.E. Dyer. 2017. Constitutive redox and phosphoproteome changes in multiple herbicide resistant *Avena fatua* L. are similar to those of systemic acquired resistance and systemic acquired acclimation. Journal of Plant Physiology (In Press).

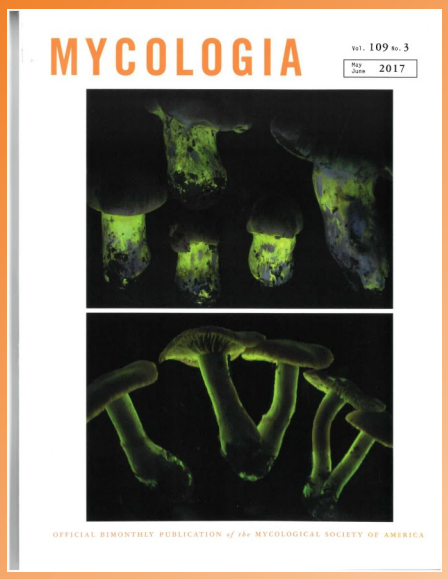
J. Nirmala, J. Saini, M. Newcomb, P. Olivera, S. Gale, D. Klindworth, El. Elias, L. Talbert, S. Chao, J. Faris, S. Xu, Y. Jin, M.N. Rouse. Discovery of a Novel Stem Rust Resistance Allele in Durum Wheat That Exhibits Differential Reactions to Ug99 Isolates. G3: Genes, Genomes, Genetics October 2017 7: 3237-3241.

P.L. Bruckner, J. Berg, K.D Kephart, R.N. Stougaard, G.P. Pradhan, P.F. Lamb, J.H. Miller, S.S. Briar, C. Chen, D.L. Nash, D.L. Holen, J.P. Cook, S. Gale, Y. Jin, J.A. Kolmer, X. Chen, G. Bai, T. D. Murray. Registration of 'Loma' Hard Red Winter. Wheat Journal of Plant Registrations Vol. 11 No. 3, p. 281-284.

J.F. Ammirati, T. Niskanen, K. Liimatainen, D. Bojantchev, U. Peintner, R. Kuhnert-Finkernagel, C. Cripps. Spring and early summer species of Cortinarius, subgenus Telamonia, section Colymbadini and / Flavobasilis, in the mountains of western North America. Mycologia 2017 May-Jun;109 (3):443-458.

Amelia C. Dolan, Casey M Delphia, Kevin M. O'Neill, Michael A. Ivie. Bumble Bees (Hymenoptera: Apidae) of Montana , Annals of the Entomological Society of America, Volume 110, Issue 2, 1 March 2017, Pages 129–144.

Cathy Cripps, cover photos, Mycologia 109:3 and Mycotaxon 132(3):July-September 2017.



A small-scale macerator and cider press

Cider and Perry Production – A Foundation
By Toby Day, Horticulture Extension Specialist

From October 9-13, Zach Miller and Katrina Mendrey from the Western Agricultural Research Center and I traveled to Mount Vernon, Washington to attend a cider and perry (beverage made from fermented pears) production class held at the WSU Mount Vernon Northwestern Research Center. This weeklong class was attended by 24 cider enthusiasts from people from as far away as Louisiana, Oklahoma, and Nebraska. It even had participants from Alberta, Canada and Chihuahua, Mexico.

Learning titration in the laboratory at the research center.

The tour of the cider apple research orchard at the Mount Vernon Research Center.

The agenda for the class included the history, background and marketing of cider; cider microbiology and chemistry, fermentation management, clarification, filtration, blending and handling. There was even an entire morning to discuss legal compliance, alcohol ethics and responsibility.

And, of course there was tasting! Otherwise called sensory science, we learned how to determine the level of sourness, bitterness, astringency, sweetness, color, mouthfeel and finish of about 17 different ciders and perries. It was fun to taste approximately four ciders per day in class (and several more in the evenings after class) to get a real sense of the diverse ways cider makers can distinguish themselves from other producers. We even had a back-blending competition using the ciders and flavors from the orchard at the research center.

Since most of our research revolves around tree fruit production, this class was well worth the time to understand the terminology and production methods of an industry that is blossoming in the state and elsewhere.

Fall Brings Eight-legged Friends to our Homes
By Laurie Kerzicnik, Extension Entomologist

Despite their negative reputation, spiders are present in all terrestrial habitats, except Antarctica, and thrive wherever insect prey and vegetation are present, from freshwater ponds to caves to elevations of over 20,000 feet. Spiders are beneficial due to their predatory nature, feeding on a variety of insect and invertebrate prey.

Cat-faced spider. Photo by Whitney Cranshaw.

During the fall in Montana, you might be lucky enough to find one of these beautiful cat-faced spiders on your porch, which catches the pesky moths, flies, and mosquitoes that are attracted to the porch lights.

Female hobo spider. Photo by Kerry Matz

Known for causing panic as a home invader, the hobo spider was introduced into Montana in the late 80's and is common from August through November. There is no conclusive evidence that hobo spider venom causes necrosis in humans and a large body of scientific research that proves it does not. Hobo spiders are not known to be naturally aggressive in their native area (Europe) or in the United States. Their nickname, aggressive house spider, comes from an errant translation of their scientific name, *Eratigena agrestis*. The Latin translation of agrestis is not aggressive, but rather "rural" or "in the fields".

Female Wolf Spider Photo by Laurie Kerzicnik

Wolf spiders occasionally enter the home and represent some of our largest spiders here in Montana. Despite their name, they don't actually hunt in "packs". But they are hunting spiders that don't build webs to catch prey. Unlike most spiders, they need to have very good eyesight to hunt down their prey in the dark.

Female black widow spider. Photo by Joe Phillips.

Sometimes known for eating her mate, the black widow is common here and can occasionally enter the home. They can typically be found in darker places, such as crawl spaces, laundry rooms, and garages. Their bite releases what is referred to as a neurotoxin, which causes a paralysis of the nervous system. Although their bites are rare, they require serious medical attention.

Even though it might seem like they are taking over your house this time of year, remember that spiders rarely bite unless threatened. Sticky traps and the vacuum are always a good way to remove spiders from the home.

Dylan and Stephanie Wed

Dylan Mangel was married to Sheyenne Rivers on September 23, 2017. They are both natives of Nebraska and their wedding was held at the River's family home near Lincoln, Nebraska. The wedding was outside and the weather was beautiful.

The bride is a graduate of Maine College of Art. She moved to Bozeman with Dylan in

the spring of 2016 where she is employed as a graphic designer for a sign company. Dylan is currently working on his Master's degree and Andreas Fischer is his advisor.

Dylan and Stephanie Mangel

The couple is happy to be married and back home in Bozeman! Congratulations to both of you!

Recipe of the Month
Sweet Potato Pecan Casserole
Recipe courtesy of Ellie Krieger for Food Network Magazine

3 1/2 pounds sweet potatoes (about 5 medium), peeled and cut into 1-inch chunks
1/3 cup honey
1 large egg
1 teaspoon ground cinnamon
1/4 teaspoon ground nutmeg
1/8 teaspoon ground ginger
Kosher salt
1 tablespoon packed dark brown sugar
1/3 cup finely chopped pecans
Preheat the oven to 350 degrees F. Mist an 8-inch square baking dish with cooking spray.

Bring a few inches of water to a boil in a pot with a large steamer basket in place. Put the sweet potatoes in the basket, cover and steam until tender, 20 to 25 minutes. Transfer the potatoes to a bowl and let cool slightly. Add the honey, egg, 1/2 teaspoon cinnamon, the nutmeg, ginger, and 1/2 teaspoon salt; whip with an electric mixer until smooth. Spread the sweet potato mixture in the prepared baking dish.

Mix the brown sugar, pecans and the remaining 1/2 teaspoon cinnamon in a bowl; sprinkle over the potatoes. Bake until hot and beginning to brown around the edges, 40 to 45 minutes.

November Birthdays

Jim Berg	4
Jack Martin	8
Tracy Hoogland	8
Yadav Ramawatar	10
Norm Weeden	12
Harvey TeSlaa	15
Paula Guastello	16
Liz Elmore	16
Jeff King	20
Ryan Thum	30

Happy Thanksgiving!