Plant Science Says

Volume 16, No. 3 April, 2013

Mark Young Elected as Fellow

Mark Young elected to Fellowship in the American Society of Microbiology

Mark Young was recently elected to Fellowship in the American Academy of Microbiology. Fellows of the Academy are elected annually through a highly selective, peer-review process, based on their records of scientific achievement and original contributions that have advanced microbiology.

Mark commented, "It is always a special honor to be chosen by your colleagues when there are so many talented virologists in the country. I have been very fortunate to work with great collaborators and students at MSU and around the world over the years. It is an exciting time to do virology."

There are over 2,000 Fellows representing all subspecialties of microbiology, including basic and applied research, teaching, public health, industry, and government service. Each elected Fellow has built an exemplary career in basic and applied research, teaching, clinical and public health, industry or government service. Fellows this year came from institutions such as Harvard Medical School, Washington University School of Medicine, Seattle, Massachusetts Institute of Technology, and the University of Cambridge.

Congratulations Mark!

More on Cripps' Award

In the February issue of "Plant Science Says", we told you about Cathy Cripps winning the North American Mycological Association Award. In this issue, we would like to share with you a excerpt from the March-April 2013 issue of "The Mycophile", the Newsletter of the North American Mycological Association, concerning that award.

Cripps lauded in Mycology newsletter

"Cathy's academic research has important applications for both amateur mycology and for the well-being of people and ecosystems. She is a highly regarded expert on arctic –alpine, montane snowbank, and aspen-associated fungi, and her research has relevance for land use planning, reclamation, and fire management. Her research on Rocky Mountain alpine fungi is the most comprehensive study of fungal diversity in this ecosystem, and provides an important baseline for assessing the effects of climate change on fungi in high-elevation habitats in North America. Her research partnership on improving commercial shitake cultivation with Garden City Fungi, a Montana based grower of specialty mushrooms, was lauded by the Montana Department of Commerce as a commercialization success, showing how scientists can pair with farmers to support the vitality fof the state's agricultural economy. Few people are as passionate about their work as Cathy, or as enthusiastic about sharing their knowledge and talents with others. She has a deep respect for the fundamental work and rich history of mycology, not only the newest techniques. She is a consummate mentor and teacher who has shared her passion for fungi through summer field courses and less formal identification workshops in addition to

her formal academic mycology courses at Montana State University."

Increasing Amylose for a Healthier Durham Wheat
By Andy Hogg

Due to increased obesity rates and cases of Diabetes, there has been a trend in food manufacturing and consumption towards foods with low glycemic indices and high resistant starch content. Foods that are high in resistant starch take longer to digest and thus have a slower sugar release (good for diabetics), produce prolonged satiety (feeling of fullness), and improve overall digestive health (acts like fiber). Starch in wheat seeds is typically composed of 75% amylopectin (branched-chain starch) and 25% amylose (straight-chained starch). Amylose is a form of resistant starch due to its physical nature.

One approach to increase resistant starch a.k.a. amylose in wheat seeds is to reduce amylopectin content. To inhibit amylopectin synthesis there are several genes that could be targeted. In this paper (see end of article), we chose to focus on the starch synthase IIa (*ssIIa*) gene which is responsible for elongating amylopectin chains and directing other amylopectin synthetic enzymes to the starch granule. The enzyme produced by *ssIIa* can be found bound to purified starch granules and is called SGP-1. In durum wheat (*Triticum turgidum*), there are two homoeologous copies of this gene, which produce two unique proteins SGP-A1 and SGP-B1 (Figure 1).

We screened the National Grain Collection for lines deficient in either SGP-A1 or SGP-B1 using SDS-PAGE on proteins from purified starch granules. Out of 200+ lines only two were found to be missing SGP-A1, none were missing SGP-B1. To create a line that lacked both SGP-A1 and SGP-B1 the two SGP-A1 null lines were crossed to the cultivar "Mountrail" and then mutated with EMS to create random mutations in starch biosynthetic genes. Mutated lines were screened again using protein gels and two lines were discovered that were missing both SGP-A1 and SGP-B1 proteins, which also causes reduced binding of SGP-2

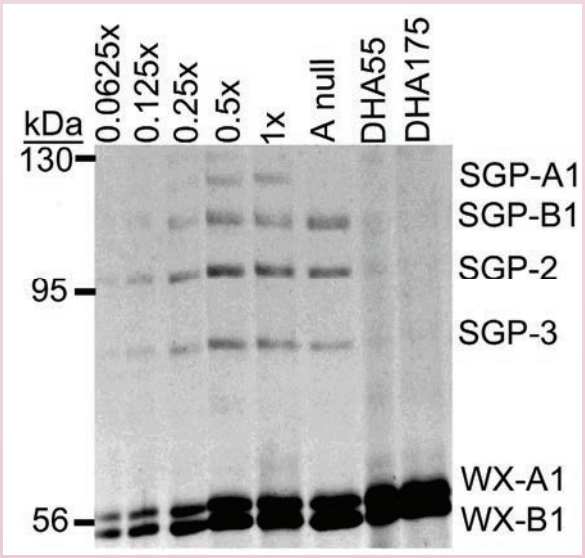

Figure 1. Starch Granule Proteins in Wheat. Lines DHA55 and 175 have mutated starch synthase IIa genes. These lines also have reduced entrapment of other starch biosynthetic proteins.

(starch branching enzyme) and 3 (starch synthase 1) (Figure 1). Both of these lines were found to have mutations in their *ssIIa-B* genes. Lines that lacked both SGP -A1 and SGP-B1 had an increased amylose content of ~40% and altered amylopectin that gelatinized at lower temperatures. The starch granules were deformed and had cracks in them (Figure 2) and overall starch content was decreased.

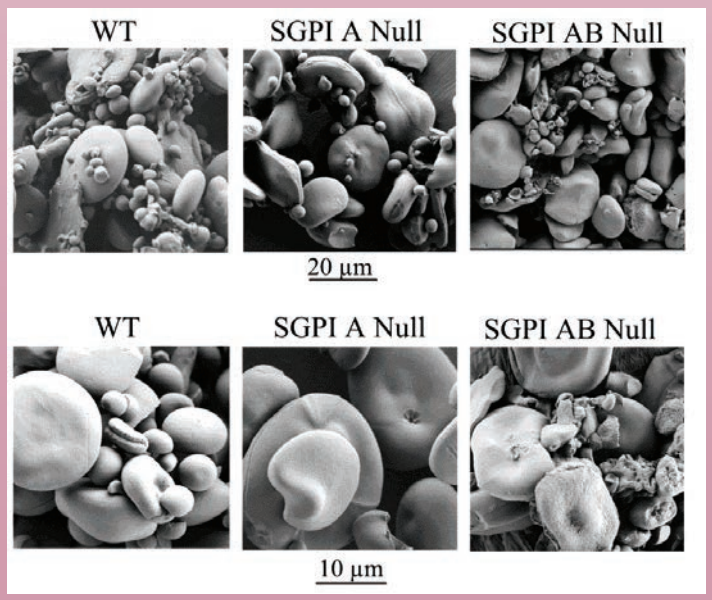

Figure 2. Starch Granule Proteins in Wheat. Lines DHA55 and 175 have mutated starch synthase IIa genes. These lines also have reduced entrapment of other starch biosynthetic proteins.

Durum wheat is primarily grown in Montana and North Dakota in the U.S. and is used almost exclusively for pasta production. On average, U.S. citizens consume approximately 20 lbs. of pasta a year. The high amylose durum wheat created here could be used to produce pasta that potentially has a lower glycemic index and increased resistant starch. As a side effect, noodles that are high in amylose are firmer in texture and resist overcooking which would also be beneficial to pasta quality as most people prefer 'al dente' pasta. Future plans for this high-amylose durum will involve assessing what effect this trait has on pasta quality as well as glycemic index testing in humans.

A.C. Hogg, K. Gause, P. Hofer, J.M. Martin, R.A. Graybosch, L.E. Hansen, M.J. Giroux, Creation of a high-amylose durum wheat through mutagenesis of starch synthase II (SSIIa), Journal of Cereal Science, Available online 31 January 2013, ISSN 0733-5210, 10.1016/j.jcs.2013.01.001.

Insect IPM for Landscape Professionals
By Linnea Skoglund

Can you tell a European paper wasp from a yellowjacket? You would be able to if you attended the recent workshop "Insect IPM for Landscape Professionals", sponsored by the MSU Urban IPM Program. The workshop was attended by 66 landscape professionals, government employees and a few master gardeners. Those with commercial pesticide applicator licenses earned CEUs and everyone earned credits toward Urban IPM certification.

Dr. Whitney Cranshaw, Extension Specialist and Professor of Entomology at Colorado State University, was our featured speaker. Whitney is a "rock star" (as Toby puts it) when it comes to urban entomology. Topics covered in the workshop included identification and biology of bees and wasps, natural enemies (predators and parasites) of insects, how to garden for insects – or not – and, finally, classes and characteristics of insecticides. The PowerPoints with Whitney's presentation can be found at http://bspm.agsci.colostate.edu/insect-information/.

The 66 participants of the Insect IPM for Landscape Professionals Workshop. Photo courtesy of Linnea Skoglund.

Dr. Whitney Cranshaw, featured speaker, giving a talk about insects that prey on other insects. Photo courtesy of Linnea Skoglund.

On the evening before the workshop, Whitney spoke to about 75 master gardeners and members of the public at the Museum of the Rockies. He gave entertaining yet informative talks about aphids and gall-forming insects and mites. The Urban IPM program was created in 2009 at the urging of the landscape and nursery industry in Montana. To date, the Program has organized six workshops that have reached over 225 professionals. One of the main areas of focus is the Certified Urban IPM Practitioner program. To become certified, 12 hours of approved education are required. We now have 114 enrolled in the program and 33 certified practitioners across the state. We also produce the Urban IPM News & Notes

(formerly the Urban IPM Newsletter), an Ag Alert- like system to disseminate topical and time-sensitive information. You can sign up at the Urban IPM website http://www.urbanipm.org.

PSPP Graduation Reception
All PSPP faculty and staff are invited to attend a Graduation Reception and Awards Ceremony honoring Spring 2013 graduates on Friday, May 3, from 3:00-5:00 pm in 108 Plant BioScience Building/Mathre Courtyard. The Awards Ceremony will begin at 4:00 p.m. Hors d'oeuvres will be served along with beer and wine.

Montana Ag Live Schedule for April
April 7
Nora Smith, Assistant Dean for the College of Agriculture, "Bright Future for MSU College of Ag Students"

April 14
Jim Knight, MSU Extension Wildlife Specialist, "Wildlife Damage Control, From Mice to Moose!"

April 21
Michel Flenniken, MSU Virologist, "Honey Bee Diseases"

April 28
Jacy Rothschiller, Montana Botanical, "Montana Women in Agriculture"

Course Focus
Tracy Dougher - HORT 310 – Turfgrass Management
HORT 310 Turfgrass Management – Catalog listing: Turfgrass propagation, fertilization, establishment, and maintenance. Recognition and adaptabilities of Northern and Southern turfgrasses used for landscape and sports use. Includes irrigation principles and basic hydraulics, establishment and fertilizer calculations, and pest management. Lab includes experimentation with establishment techniques, equipment calibration, soil testing, and turfgrass maintenance.

In the first few weeks of class, students are challenged to learn 15 grasses (of warm and cool season) commonly used as turfgrass. The additional layer of challenge in identification of turfgrasses is that the plants are never allowed to flower, thus removing a key characteristic from which to identify the grasses. For as many weeks as possible, the Turfgrass Teaching Plots housed at the Horticulture Farm become our hands-on classroom; observing the cool season turfgrasses in their native habitat and a couple of warm season grasses outside their native range; questioning and executing the techniques of soil and site preparation, sodding, and seeding; determining the maintenance required; and discovering the latest and greatest in native grass research for turfgrass applications. Students tromp over the grassy knolls of two comparative but distinct turfgrass businesses, a golf course and a sod production farm, often opening the eyes of students to the vast industry that supports what appears to be a mundane plant.

As we ramble through the (un)usual science of growing grasses, students are challenged to grow and maintain two turfgrass plots under opposing conditions, such as high and low light conditions, and record and analyze the differences in mowing, fertilizer applications, and water use. The projects are graded on aesthetics, as that is the major goal of most turfgrass products, as well as the accuracy of their records and calculations. As with real-life, these turfgrass plots are invaded by pests (pictures of pests so as to not destroy the integrity of the greenhouse) and the students must respond to the pests in a timely fashion before the pest figuratively destroys their plots. In this occasion students explore the world of turfgrass extension and the vast network of turfgrass pest identification and diagnosis specialists.

In the final analysis, students often comment on their surprise at the intricacies and vastness of knowledge required for what at first glance appears to be the backdrop of our lives.

Teaching Tips
By Tracy Dougher
Flipping the Classroom – Part I: What Started it All

Last spring (2012), I completely 'flipped' my HORT 105 Miracle Growing class. By our current and available measures, it was a success with improved student exam scores and student evaluations. Flipping, active learning, student-led, and peer teaching, are just some of the names for what the education industry is calling what I did to my classroom. I really didn't know what it was called because it was a slow (12 year) but progressive journey to that point. I share this information with you to encourage you to explore and consider changing your classroom. At the very least open up discussion about what we mean by 'teaching' and 'learning'. None of this which follows is a silver bullet to educating students; it just isn't there. Education is what I call 'squishy' or other people might call soft science. Anecdotes, rambling philosophies, and personal gut feelings abound in the literature. But I have searched for the science behind these methods and changes to justify my approach. The information is there and more is coming every day. Take this narrative with trepidation, but please think about it for just a moment.

So it begins……my second time teaching Plant Propagation was what started it all. I utilized only traditional lecture and since this was my second time teaching the course, all my slides were ready. I taught the course in the same exact way as the year before, but this group of students did not respond in the same way. My student evaluations were abysmal. Lesson #1 – the students are dynamic, my lectures are static (I'm going to have to change my lectures every year?!?). Right about that time, Pam Harris and Ralph Johnson in architecture were offering a workshop on active learning strategies….and I don't mean a 1 hour sit and listen to someone lecture 'workshop', I mean a workshop where you bring your course materials, you are held accountable for progressing through their lessons and altering your curriculum and syllabi, and you met multiple times. I could at the very least, 'do something' to improve my teaching. Whew!

From that workshop, I altered the Plant Propagation course and gave up one traditional lecture a week to try active learning. I attempted several different active learning methods, with simple group discussions based around a set of questions being the fall-back mode. However, the method that sticks out in my mind that changed my way of thinking about the classroom and the students was 'Jigsaw'.

JIGSAW – Students learn and discuss a topic in one group and then teach it to another group. This method fits well with a topic that has multiple pieces that fit together. For example, students are divided into part A, part B, and part C. After discussing their part (and I often have that group produce a written answer for credit), one student from each group (A,B,C) is sent to a new group (1,2,3). So group 1 would have one person from part A, part B, and part C and each would teach their respective part or lead the discussion on that part. During student discussions, I circulate around the room and sit briefly with each group to answer questions and clarify points. This method does require that students read the material before coming to class, fodder for discussion in my column in next month's issue!

Invited Talks

Jim Berg, "A comparison between Montana Experimental varieties to Yellowstone Check". Wheat Council Quality Meeting, Kansas City, MO. February 13, 2013.

Barry Jacobsen, "Potato Virus Y" Potato Conference, Mt. Vernon WA. February 22, 2013.

Barry Jacobsen, "Integrating seed, infurrow, and banded fungicide treatment for management of Rhizoctonia root and crown rot." Anaheim, CA. February 28, 2013.

Tom Blake, “Leveraging the Barley CAP for Barley Salinity Tolerance”. International Center for Biosaline Agriculture (ICBA), Dubai, United Arab Emirates. February 9, 2013.

Kevin Wanner, “Molecular and functional evolution of sex pheromone detection in Ostrinia moths”. ADALEP (Adaptation to a Biotic Environment in Lepidoptera) and EFOR (Functional Studies on Model Organisms) Annual Meeting, February 14-15, 2013, Paris, France.

Mike Giroux, “Enhancing Wheat Quality”, Dow Agrosciences, Indianapolis, IN. March 18, 2013.

Phil Bruckner, “Montana Winter wheat varieties”. Fort Benton, MT. Producer meeting sponsored by Taylor Aviation. February 28, 2013.

Michelle Flenniken, "Honey Bee Pathogen Detection and Discovery." Gallatin Valley Beekeeping Club. March 2, 2013.

Grants

Norm Weeden, “Breeding of High Amylose Dry Pea”. United Pulse Trading Inc., $15,000.

Mary Burrows, “A Predictive model to increase adoption of IPM of a mite-virus disease complex in wheat”. The Board of Regents of the University of Nebraska, $128,250.

Jennifer Britton, MSU Computer Fee Allocation Committee grant, $15,901.

Ed Barge (Cathy Cripps lab), “Systematics and biogeography of disjunct Rocky Mountain alpine and circumpolar arctic *Lactarius* species”. Institute of the Environment Graduate Enhancement Grant 2013. $500.

Barry Jacobsen, “Development of management techniques for Sclerotinia white mold, Blackleg, Rhizoctonia canker and Black Scurf, and storage potato pathogens important to Montana”. Montana Department of Agriculture. $23,500.

Kevin Wanner, “New Seed Treatments to Control Wireworms Infesting Seed Potatoes in Rotation with Grains”. Montana Department of Agriculture. $17,400.

Publications

Hu, W., Franklin, K.A., Sharrock, R.A., Jones, M.A., Harmer, S.L., and Lagarias, J.C.. (2013) Unanticipated regulatory roles for *Arabidopsis* phytochromes revealed by null mutant analysis. *Proc.Natl. Acad. Sci. USA.* **110** (4), 1542-1547.

A.C. Hogg, K. Gause, P. Hofer, J.M. Martin, R.A. Graybosch, L.E. Hansen, M.J. Giroux, Creation of a high-amylose durum wheat through mutagenesis of starch synthase II (SSIIa), Journal of Cereal Science, Available online 31 January 2013, ISSN 0733-5210, 10.1016/j.jcs.2013.01.001.

Perlite and Vermiculite
By Toby Day, Extension Horticulture Associate Specialist

Perlite

When planting at the MSU Plant Growth Center using Sunshine Mix, starting your vegetables at home, or even repotting your houseplants, most likely you are planting into a soilless medium that contains perlite. Perlite is the white granules that look much like Styrofoam beads in most common soilless potting mixes. It is added to the mixes because perlite helps hold water and helps with drainage and aeration in the media.

Perlite

Perlite is a volcanic glass that is mined in many countries including the United States. When it is mined, it does not have the desirable characteristics until it has been heated sufficiently. The mined perlite is heated to a temperature of 1600 degrees Fahrenheit until it “pops” like popcorn. When it pops, it can grow to over ten times its original volume and will only weigh five to eight

pounds per cubic foot (Linda Naeve, ISU Extension Coordinator). After the perlite is heated, it has a much larger surface area and also will have small cavities that will hold water (Perlite Institute). Perlite's light weight and ability to hold water while increasing drainage and aeration is why it is desired in most potting mixes today.

Perlite is also commonly used in hydroponics and for root cuttings. Other than horticulture uses, perlite is also used in construction as insulation and plasters, as filters in swimming pools, and as an abrasive in polishes and cleansers.

Vermiculite

Vermiculite is a silicate mineral (mica ore) in which the particles in potting mixes look tan to gold. Most likely you have heard of vermiculite because of the W.R. Grace Company and the issues of asbestos in Libby Montana. The Libby mine, one of the largest in the world, was and still is fraught with controversy because of the asbestos that was produced, causing health issues and even deaths in the small town. However, the EPA has noted that the vermiculite used in soilless media has very little asbestos and poses little health concerns.

Vermiculite

Like perlite, vermiculite has to be heated. When it is heated it expands and exfoliates, leaving the product that we use in soilless potting mixes. The exfoliated vermiculite adds drainage and aeration to a soilless growing media much like perlite. Most planting mixes commonly bought for home use do not contain as much vermiculite as perlite (maybe because of the perceived health risks). However, soilless media used for seed germination usually contains more vermiculite because it is better at absorbing and retaining moisture than perlite.

Vermiculite is also commonly used for storing and overwintering bulbs. It helps regulate water, prevents rot, and prevents mildew. Other than horticulture uses, vermiculite has been used for many things including insulation, acoustical panels, brake linings, fire proofing, and light-weight concrete.

Recipe of the Month

Breakfast Strata

2 slices bread, torn into bite size pieces
1/2 c diced fresh mushrooms
1/2 c chopped green bell pepper
16 oz Cheddar cheese, shredded (or less)
1/2 c chopped onion
2 c cubed ham
8 eggs
2 c milk

Grease a 9x13 inch baking dish. Layer half of the torn bread in the bottom of the dish. Sprinkle the mushrooms and green bell pepper evenly over the bread layer. Sprinkle with half of the cheese. Top with remaining bread pieces, then layer with the onion and ham. Sprinkle with remaining cheese. Whisk together eggs and milk; pour over the entire pan. Cover with aluminum foil and refrigerate for 12 to24 hours.

Bake at 350 for 35 minutes covered; remove foil and bake for 15 more minutes until evenly brown.

April Birthdays

Ryan Quire	8
John Sherwood	12
Mike Giroux	12
Toby Day	15
Matt Lavin	20
Andreas Fischer	25
Charles Hart	25
Nina Zidack	26
Rebekah VanWieren	28
Martha Peters	30