

TEXAS A&M PLANT BREEDING BULLETIN -- February 2013

Our Mission: Educate and develop Plant Breeders worldwide.

Our Vision: Alleviate hunger and poverty through genetic improvement of plants.

Dr. Seth C. Murray is an Assistant Professor of Corn Breeding and Quantitative Genetics in the Department of Soil and Crop Sciences. Seth credits Wes Jackson's "Becoming Native to This Place" as the driving force behind his decision to become an academic plant breeder. He received his B.S. in Crop and Soil Sciences at Michigan State University in 2001 where he worked in a sugarbeet genomics and breeding lab and co-founded a student organic farm. He received his Ph.D. at Cornell University in 2008 where he worked on quantitative trait locus (QTL) and association mapping in sweet sorghum. He joined Texas A&M in 2008 as one of two corn breeders in the department, and actively collaborates with counterpart Dr. Wenwei Xu at the Texas A&M AgriLife Research and Extension Center in Lubbock. Seth noted that his overarching objective as a plant breeder is to "improve the quality and sustainability (both environmental and economic) of life on earth by developing plants that fit better into the natural world and produce more economic product with fewer inputs." Towards this objective he balances a portfolio of projects dealing with applied breeding, i.e., cultivars that will be released to companies and growers, and more basic science and molecular quantitative genetic projects, e.g., genetic mapping and simulation studies. He also structures his program to include short term projects that are led by graduate students for rapid results and publications, medium term



projects such as aflatoxin resistance, and long term projects such as perennialism, bioenergy, and breeding for new uses.

Dr. Murray's applied breeding program goals are the result of stakeholder input, primarily the Texas Corn Producers Board, a commodity group who has been supportive of the program. These goals include Texas adaptation, yield improvement, aflatoxin resistance, and heat and drought tolerance. Seth noted that "ultimately we strive to deliver



improved germplasm for Texas and make germplasm and research findings available to the world." He builds on the success of predecessors in the corn breeding program, notably Dr. Javier Betran and Dr. Kerry Mayfield, who developed a large and diverse breeding base of corn germplasm bred in Texas

for these unique traits and conditions. Dr. Murray noted that a major limiting factor to corn production in Texas and the southern United States, as well as much of the developing world, is chronic preharvest aflatoxin accumulation caused by the fungus *Aspergillus flavus*. The pathogen itself rarely causes economic yield loss but the toxins that it produces, referred to as aflatoxin, are known to cause liver cancer and potentially death. Chronic exposure to aflatoxin in both humans and livestock can lead to impaired growth and other adverse health effects. Because of these factors, the U.S. Food and Drug Administration has issued limits on the amount of aflatoxin that can be present in corn: less than 20 ng/g in human food and less than 300 ng/g for certain livestock feed. While these limits, combined with extensive testing, have minimized the presence of aflatoxin in the U.S. food stream, the limits also produce significant economic losses to affected producers since they are forced to destroy their crops or sell them at a significant loss. The exact economic loss to producers from aflatoxin contamination of corn is unknown. However, crop insurance payments to Texas producers alone for mycotoxins were \$18 million in 2008 and direct losses across the U.S. have been estimated at \$200 million per year.

Currently there are no known sources of complete resistance to *A. flavus* or aflatoxin accumulation in corn but heritable variation exists. Texas A&M AgriLife recently developed and released four germplasm lines of corn with significant levels of either

resistance to the fungus or to the production of aflatoxin. Tx772 was released in 2004 and Tx736, Tx739, and Tx740 germplasm lines were released from Dr. Murray's corn breeding program, (Mayfield, K. et al. 2012. *Journal of Plant Registrations* 6:88-94).

These three lines were field tested as lines per se and as testcross hybrids with introduced inoculation in multi-environmental trials. In these trials, Tx735, Tx739, and Tx740 maize germplasm lines and hybrids exhibited between 30 and 73% lower aflatoxin content than



commercial checks, but yield was lower also. Better yielding lines that maintain resistance are being developed. Similarly, Dr. Murray's program completed a large association mapping study for aflatoxin and drought that is providing evidence and mechanisms for further meeting this challenging problem.

In addition to yellow corn, Dr. Murray, along with his graduate students and collaborators, are involved in a number of other corn projects such as increasing the antioxidant value of corn for health and consumer appeal. In a paper recently

accepted in *Crop Science*, student Adam Mahan used a multi-environmental diallel design to demonstrate that red, blue, and purple lines from Seth's program have



greater antioxidant values than currently available. Antioxidant values were highly heritability, suggesting that breeders can expect to make significant progress in selection programs.

Dr. Murray is currently an associate editor for *Crop Science*, and has served as associate editor for the *Journal of Plant Registrations*. He serves on the Executive Committee of the National Association of Plant Breeders, and serves as chair or vice-chair for a number of regional and national scientific meetings. In addition to his research and service, Seth teaches SCSC 642, Quantitative Genetics and Plant Breeding, directs the Department's weekly seminar, and directs graduate students. He has served or currently serves as chair / co-chair of 11 graduate students and serves as committee member for

another 15 graduate students. Seth's hobbies include: designing/welding/woodworking to build his own furniture, beer brewing, spending time with his wife Andrea, and bread making, which we all appreciate around Christmas time.

Reminder: NAPB Annual Meeting, 2-5 June 2013 in Tampa, FL

Visit <http://www.plantbreeding.org/napb/Meetings/pbccmeeting2013.html> for information on the seventh annual meeting of The National Association of Plant Breeders. The annual meeting is an opportunity for breeders and allied scientists to stay updated on recent innovations in plant science and to discuss public policy issues relevant to plant breeding. The meeting also provides an important venue for graduate students to present their research, meet with potential employers, and become acquainted with plant breeding graduate students from other universities. This year's meeting will be hosted by the University of Florida.

For information about the Plant Breeding Distance M.S. and Ph.D. Program contact:

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eLearning at Texas A&M University: <http://elearning.tamu.edu>

Office of Graduate Studies: <http://ogs.tamu.edu>

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