TEXAS A&M AGRILIFE RESEARCH | EXTENSION

TEXAS A&M UNIVERSITY

TEXAS A&M PLANT BREEDING BULLETIN

March 2017

TEXAS A&M UNIVERSITY--EDUCATING AND DEVELOPING PLANT BREEDERS WORLDWIDE TO ALLEVIATE HUNGER AND POVERTY THROUGH GENETIC IMPROVEMENT OF PLANTS

PLANT BREEDING SYMPOSIUM 2017

Our graduate students held their third annual Plant Breeding Symposium on February 15-16 in the Memorial Student Center on the campus of Texas A&M. This symposium is part of the DuPont Plant Sciences Symposia Series and is primarily sponsored by DuPont Pioneer. This effort is led by our plant breeding and associated graduate students who work closely with Dr. Tabare Abadie of DuPont Pioneer. The organizing committee this year consisted of (below left to right) Ellen Roundey (PhD-Horticulture), Tessa Ries (MS-Plant Pathology & Microbiology), Francisco Gomez (PhD-Plant Breeding), Ammani Kyanam (PhD-Plant Breeding), Steve Anderson (PhD-Plant Breeding), Wardha Mustahsan (MS-Plant Breeding), Drutdaman Bhangu (PhD-Plant Breeding), and Smit Dhakal (PhD-Plant Breeding).

We are especially thankful for the guidance, encouragement, and leadership of Dr. Tabare Abadie (center below) for developing and leading the DuPont Plant Sciences Symposia Series. Our graduate students have learned and grown from this opportunity.

Dr. Tabare Abadie with organizating committee members from the Plant Breeding Symposium in 2015 (left to right) Brian Pfeiffer, Laura Masor, Tabare Abadie De Leon, Laura Ann McLoud, and Sean Carver.

At this year's symposium, three students were selected based on their submitted abstracts for keynote presentations. These students were Nolen Bentley (Horticulture; Patricia Klein chair), Brian K. Pfeiffer (Soil and Crop Sciences; Bill Rooney chair), and Mitchell Schumann (Soil and Crop Sciences; Wayne Smith chair). Their abstracts are below. I'm sure that you'll be as encouraged as I was with their science and enthusiasm for plant breeding.

Title: The Characterization of Pecan Germplasm Using Genotyping by Sequencing (GBS).

Nolan Bentley, Natalie Patterson, L.J. Grauke, Patricia Klein

Pecan (*Carya illinoinensis*) is an outcrossing, highly heterozygous, and slow to mature tree native to North America. Programs such as the USDA-ARS Pecan and Hickory Germplasm Repository are tasked with collecting and protecting this plant's germplasm and utilizing it within breeding programs. This goal necessitates the development of

genomic resources capable of characterizing genetic relationships among native accessions and interrelated cultivars in a high-throughput and cost-effective manner. This presentation describes the implementation of a genotyping by sequencing (GBS) technique to discover single nucleotide polymorphisms (SNPs) throughout the genome. This is the first reported use of this technology in pecan and represents a large step forward in the industry's ability to measure genetic relationships with high resolution. Additionally, this presentation will describe the use of these SNPs to identify cultivars, clarify historical pedigrees, perform a genome wide association study (GWAS), and develop a linkage map. These resources are intended to benefit the pecan community by improving the ability of breeders and conservationists to characterize the germplasm collection.

Title: The Contribution of Breeding to Yield Advances in Sorghum.

Brian K. Pfeiffer, Dennis Pietsch, Ronnie W. Schnell, William L. Rooney

The evaluation of genetic gain in field crops is essential to assess past and future trajectory of crop improvement. In grain sorghum [*Sorghum bicolor* (L.) Moench], total sorghum production area plateaued in the U.S. in the 1960s and experienced significant decreases in the late 1980s. At the same time, grain yield increased 0.48 t/ha annually in the U.S., but most of that progress occurred from 1950 to 1980. These trends are caused by numerous factors ranging from shifts in production environments to reduction in research and development programs. Since sorghum is produced in relatively marginal environments, sorghum breeders often focus on improving resistance to abiotic and biotic stresses to protect yield, rather than maximizing yield potential. To understand recent effects of breeding as well as the long-term genetic gain, sixty hybrids and their respective parental lines from the Texas A&M AgriLife Research Sorghum Breeding

Program were grown in five diverse environments across Texas in 2016. These hybrids represent the genetic material released from the breeding program from the 1960s until today. Over the last 55 years in the Texas A&M breeding program, yields have increased .008 t/ha annually. Days to maturity, panicle size, test weight, 500 seed weight, and grain number per panicle demonstrated significant changes while traits such as leaf angle and number of panicles per area have been constant, and plant height has decreased by 0.14 cm annually. As the data indicate, the rate of genetic gain in sorghum has been slower than in other major U.S. field crops.

Title: Identifying potential nesting of fiber quality alleles within the population structure of obsolete U.S. cotton cultivars

Mitchell Schumann, C. Wayne Smith, Alan Dabney

Population structure plays a large role in modern genome wide analytical techniques such as genome wide association studies (GWAS) and genomic selection (GS). The nesting of trait alleles within population structure can hinder the ability to detect QTLs in GWAS, and reduce prediction accuracies in GS. Being able to identify potential nesting of alleles can aid in decisions about population development, and interpretation of results in such analysis. In this study, a population was developed to represent obsolete U.S. cultivars from the U.S. National Cotton Germplasm Collection. This population was analyzed for population structure analysis using Principle Coordinate Analysis and fastStructure. Logistic Regression was used to identify markers that show an effect on population structure. Random Forest was then used to fit a multivariate model for predicting previously identified population structure. Feature selection from Random Forest model identified markers most informative for classifying population structure. Fiber quality data were then

associated to the remaining markers to determine potential nesting of fiber quality alleles within population structure.

Congratulations to Mitchell, Brian, and Nolan on their excellent research and presentations at the TAMU Plant Breeding Symposium. We look forward to their future careers as plant breeders and their future accomplishments.

Meetings of Interest

Meetings of Interest

National Association of Plant Breeders, NAPB

will hold their annual meeting at the UC Davis Activities and Recreation Center August 7 – 10, 2017. More information will be available soon at https://www.plantbreeding.org.

American Society of America, Crop Science Society of America, and Soil Science Society of America

will host more than 4,000 scientists, professionals, educators, and students at the 2017 International Annual Meeting, Managing Global Resources for Secure Future," October 22 – 25, 2017 in Tampa Florida. Additional information at

https://www.acsmeetings.org/.

Dupont Plant Sciences Symposia events for 2017.

Additional information can be found at

https://www.pioneer.com/home/site/about/research/PlantSciSymposiaSeries/.

University of Missouri, February 2
Texas A&M University, February 16
University of Minnesota Production Agriculture Symposium, Feb 22
Iowa State University, March 3
Cornell University, March 10
University of Nebraska - Lincoln, March 14
Washington State University, March 17
University of Minnesota, March 23-24
University of Saskatchewan, March 31-April 1
***Kansas State University, April 7**
University of Florida, April 13
Huazhong Agricultural University (China), April 17
University of California - Davis, April 21
University of Georgia, May 9
University of California - Berkeley, June 2
*** Event receives sponsorship support but is not officially part of the series**

Distance Plant Breeding at Texas A&M

Distance Plant Breeding at Texas A&M

Distance Plant Breeding Program and Continuing Education courses available for Spring

(https://scsdistance.tamu.edu/available-courses)

Continuing Education

Spring Courses: January 17 – May 9, 2017

To fully participate in our continuing education courses, students should have:

- **High speed internet connection and updated browsers, including Internet Explorer and either Chrome of Firefox**
- **Common plug-ins (e.g. Adobe Reader, Flash Player, Virus Protection, Java, etc.)**
- **Speakers and Webcam with microphone**
- **Skype**
- **Ability to either scan or fax course documents to the instructor**

Spring 2017

Plant Breeding Fundamentals – Full Course (3 Units) – Cost $679.65
January 17 -May 9, 2017

Introduction to the field of plant breeding for students without a plant breeding background. Includes common plant breeding terminology and introduction of concepts. Genetic improvement of crops by hybridization and selection; special breeding methods and techniques applicable to naturally self-pollinated, cross-pollinated and asexually reproduced plants.

Basic Plant Breeding - Full Course (3 Units) - Cost - $679.65
January 17-May 9, 2017

Basic Plant Breeding can be taken as an entire course (all three units) or each unit can be taken individually. For participants in our Professional Certificate in Plant Breeding and Genetics, completion of all three units is required.

Unit 3 - Breeding Cross Pollinated Crops Cost - $226.55
April 3 – May 9, 2017

Topics covered include: quantitative genetics and plant breeding, effects of selection on Hardy Weinberg Equilibrium, mating designs with cross pollinated crops, breeding methods for cross pollinated crops,

deviations from Mendelian ratios, genetic male sterility and hybrid seed production, seed certification and types of release.

Recommended textbooks are "Breeding Field Crops" by J.M. Poehlman and D.A. Sleper, and "Principles of Cultivar Development" by W.F. Fehr. A final exam will allow the participant to assess their grasp of topics covered. Participants in the Plant Breeding and Genetic Certificate Program must score 70% on the final exam for each unit.

This is a "self-paced" course and is available for viewing for a limited time. Time commitment is individual student driven. Few outside assignments are made. Students should view each lecture, review all previous lectures and be prepared to discuss any issues that are unclear. Each unit has a printable note set and most units have a set of review questions that can be used as a tool to check your comprehension and grasp of unit concepts. Feel free to contact the instructor, Dr. Wayne Smith, by e-mail (cwsmith@tamu.edu) or phone (979-845-3450) with any questions you have or if you need additional information.

Analysis of Complex Genomes – Full Course (3 Units) – Cost - $679.65

January 17-May 9, 2017

Genome structure, organization and function of model organisms and higher eukaryotes; theory and methodology of genetic and physical mapping, comparative genomics, sequencing, sequence analysis and annotation; emphasis on understanding the function of complex genomes, genome-wide expression analysis, genetic and epigenetic mechanisms; X-inactivation, imprinting, gene silencing, transposons, genome duplication and evaluation. Requires an in-depth and working knowledge of basic and advanced plant breeding concepts.

Unit 3 – Sequencing Genomes and Other Genomic Tools Cost - $226.55
April 3 – May 9, 2017

Intellectual Properties in the Plant Sciences - Full Course (3 Units) - Cost - $679.65

January 17-May 9, 2017

This course introduces the major foci of intellectual property (IP) impacting plant sciences, including: 1) traditional vs. emerging knowledge economies, 2) governing U.S. statutes and international treaties, 3) forms of IP protection, and 4) IP asset identification, valuation, capture, and deployment towards an understanding of best practices for the development of effective IP strategies and management of IP portfolios.

Unit III - Intellectual Property Transfer and Enforcement ***Cost - $226.55***
April 3 – May 9, 2017
Unit III of the Intellectual Properties in the Plant Sciences Course. Topics covered include: Intellectual Property Transfer and Enforcement, IP Case Studies, IP Portfolio, IP Strategy and Leveraging IP Value.

Introduction to Host Plant Resistance (1 Unit)
Cost - $226.55

Unit III - **Host plant resistance breeding; entomological perspectives and issues.**
April 3 – February 19, 2016

Other Academic and Continuing Education courses in plant breeding and related disciplines that will be available during other semesters include Host Plant Resistance; Crop Production; Selection Theory; Marker Assisted Selection; Genomic Analysis; Field Crop Diseases; Field Insects; Essential Nutrients in Crop Growth; and others. For more information visit https://scsdistance.tamu.edu/ or contact LeAnn Hague, Distance Education Coordinator in Soil and Crop Sciences at leann.hague@tamu.edu or (979) 845-6148.

Distance Degrees in Plant Breeding

M.S. and Ph.D. degree programs at Texas A&M.

Visit https://scsdistance.tamu.edu/plant-breeding-distance-education/ for details.

Please direct comments concerning this bulletin to Wayne Smith, cwsmith@tamu.edu or 979.845.3450.