TEXAS A&M AGRILIFE RESEARCH | EXTENSION

TEXAS A&M UNIVERSITY

TEXAS A&M PLANT BREEDING BULLETIN

April 2019

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

Joel Arce will receive his M.S. degree in plant breeding in May 2019. He completed his graduate degree under the guidance of Dr. Jane Dever at the Texas A&M AgriLife Research and Extension Center at Lubbock, TX through our Distance Plant Breeding Program while working full time as a technician with Dr. Dever. Joel's research dealt with preparing cotton seeds for planting by mechanically removing the short fibers that remain attached to the seeds after ginning. His abstract is below.

Delinting cottonseeds, which is removing short fuzz fiber called linters to prepare seeds for mechanical planting, is a practice commonly used by cotton breeding programs. The predominant method of delinting cottonseeds is acid delinting, which can be dangerous and produces toxic effluent, the disposal of which is costly. Mechanical delinting could be an environmentally safe and effective alternative to acid

delinting. A prototype for commercial delinting developed by the USDA-ARS Cotton Production and Processing Research Unit in Lubbock, TX, was used to explore advantages and disadvantages of using a mechanical delinter for small breeder samples. Delinting time, seed carryover between samples, incidence of seed-borne disease, seed size effects and sample size effects were evaluated and compared to acid delinting. Different cantilever brush configurations were tested for efficiencies by processing separate small samples. Seed quality and germination percentage for mechanical and acid delinted samples were compared. Modifications to the cantilever brush system and to the drum decreased delinting time and increased ease of sample processing compared to the original prototype. Small improvements in the reduction of seed carryover and in seed-borne disease incidence were observed, but these areas still need improvement. Mechanically delinted seeds averaged 87 percent germination compared to 89 percent for acid delinted seeds in 2016. In 2017, mechanically delinted seeds planted in a field environment averaged 85 percent emergence when a packed drum treatment was used and 76 percent emergence when a finished drum treatment was used.

Joel enjoys travel, collecting antique tools, and spending time with his wife and children. Congratulations Joel on your research and upcoming graduation.

Publications by Plant Breeding Faculty

First Quarter, 2019

Burrow: Gangurde, Sunil S., Rakesh Kumar, Arun K Pandey, Mark Burow, Haydee E Laza, Spurthi N Nayak, Baozhu Guo, Boshou Liao, Ramesh S Bhat, Naga Madhuri, S Hemalatha, Hari K Sudini, Pasupuleti Janila, Putta Latha, Hasan Khan, Babu N Motagi, T Radhakrishnan, Naveen Puppala, Rajeev K Varshney, Manish K Pandey. 2019. Climate-Smart Groundnuts for Achieving High Productivity and Improved Quality: Current Status, Challenges, and Opportunities. ***In: Genomic Designing of Climate-Smart Oilseed Crops***. Springer, Cham.

Dever: Kelly, Carol M, Juliana Osorio-Marin, Neha Kothari, Steve Hague, Jane K Dever. 2019. Genetic improvement in cotton fiber elongation can impact yarn quality. ***Industrial Crops and Products*** 129:1-9.

Dever: Mauget, Steven, Mauricio Ulloa, and Jane Dever. 2019. Planting Date Effects on Cotton Lint Yield and Fiber Quality in the U.S. Southern High Plains. ***Agriculture*** 9(4): 82

Hays: Delgado, Alfredo, Alexandre Novo, and Dirk B. Hays. 2019. Data Acquisition Methodologies Utilizing Ground Penetrating Radar for Cassava (Manihot esculenta Crantz) Root Architecture. G***eosciences*** 2019 9: 171

Ibrahim: Jamil, Muhammad, Aamir Ali, Alvina Gul, Abdul Ghafoor, Abdul Aziz Napar, Amir M. H. Ibrahim, Naima Huma Naveed, Nasim Ahmad Yasin, and Abdul Mujeeb-Kazi. 2019. Genomic-wide association studies of seven agronomic traits under two sowing conditions in bread wheat. ***BMC Plant Biology*** 2019 19:149

Ibrahim: Olanrewaju, Sarah , Nithya Rajan, Amir M. H. Ibrahim, Jackie C. Rudd, Shuyu Liu, Ruixiu Sui, Kirk E. Jessup, and Qingwu Xue. 2019.

Using aerial imagery and digital photography to monitor growth and yield in winter wheat. *International Journal of Remote Sensing*. https://doi.org/10.1080/01431161.2019.1597303

Klein: Patil, Nikhil Y., N Ace Pugh, Robert R Klein, Hector S Martinez, Raul S Martinez, Raul Rodriguez-Herrera, William L Rooney, Patricia E Klein. 2019. Heritability and quantitative trait loci of composition and structural characteristics in sorghum grain. *J Crop Improvement* 33: 1-24.

Klein: Bentley, Nolan, L.J. Grauke, Patricia Klein. 2019. Genotyping by sequencing (GBS) and SNP marker analysis of diverse accessions of pecan (Carya illinoinensis). *Tree Genetics & Genomes* 15:8

Klein: Yan, M., DH Byrne, PE Klein, WE van de Weg, J Yang, L Cai. 2019. Black spot partial resistance in diploid roses: QTL discovery and linkage map creation. *Acta Horticulturae* 1232:135-141.

Liu: Thapa, Sushil, Qingwu Xue, Kirk E Jessup, Jackie C Rudd, Shuyu Liu, Thomas H Marek, Ravindra N Devkota, Jason A Baker, Shannon Baker. 2019. Yield determination in winter wheat under different water regimes. *Field Crops Res*. 233:80-87.

Magill: Ahn, E, LK Prom, G Odvody, C Magill. 2019.Defense responses against the sorghum anthracnose pathogen in leaf blade and midrib tissue of johnsongrass and sorghum. *Physiological and Molecular Plant Pathology* 106: 81-86.

Magill: Radwan, GL, LK Prom, G Odvody, CW Magill. 2019. Mating type *a* locus alleles and genomic polymorphism in *Sporisorium reilianum*: comparison of sorghum isolates to those from maize. *Australasian Plant Pathology* 48: 119-129.

Magill: Prom, LK, E Ahn, T Isakeit, C Magill/ 2019. GWAS analysis of sorghum association panel lines identifies SNPs associated with disease response to Texas isolates of *Colletotrichum sublineola*. *Theoretical and Applied Genetics* 132:1389-1396.

Murray: Zhang, M, Y Cui, YH Liu, W Xu, SH Sze, SC Murray, S Xu, HB Zhang. 2019 Accurate prediction of maize grain yield using its contributing genes for gene-based breeding. ***Genomics***

Murray: Wahl, NJ, SC Murray, HB Zhang, M Zhang, CM Dickens, TS Isakeit. 2019. Maize Kernel Development Stage the Primary Factor in Differential Gene Expression in Response to Two Methods of Field Inoculation with Aspergillus flavus. ***BioRxiv***

Murray: Murray, Seth C, Kerry Mayfield, Jacob Pekar, Patrick Brown, Aaron Lorenz, Tom Isakeit, Gary Odvody, Wenwei Xu, Javier Betran. 2019. Tx741, Tx777, Tx779, Tx780, and Tx782 Inbred Maize Lines for Yield and Southern United States Stress Adaptation. ***Journal of Plant Registrations***:

Rathore: Singh, Shivom, Bhupendra Kumar, Neha Sharma, and Kajal S. Rathore. 2019. Organic farming: challenge for chemical pollution in aquatic ecosystems. ***In***: Handbook of Research on the Adverse Effects of Pesticide Pollution in Aquatic Ecosystems. IGI Global.

Rooney: Boerman, NA, KB Hlavinka, W Zhu, AR Dabney, GL Hodnett, WL Rooney. 2019. Efficacy of the chemical ***trifluoromethanesulfonamide*** as a male gametocide in field-grown sorghum [***Sorghum bicolor*** (L.) Moench]. ***Euphytica*** 215: 96

Rooney: Malambo, L, SC Popescu, DW Horne, NA Pugh, WL Rooney. 2019. Automated detection and measurement of individual sorghum panicles using density-based clustering of terrestrial lidar data. ***ISPRS Journal of Photogrammetry and Remote Sensing*** 149:1-13.

Rooney: Teferra, TF, DB Amoako, WL Rooney, JM Awika. 2019. Qualitative assessment of 'highly digestible'protein mutation in hard endosperm sorghum and its functional properties. ***Food chemistry*** 271:561-569

Rooney: Cuevas, HE, RA Fermin-Pérez, LK Prom, EA Cooper, S Bean, WL Rooney. 2019. Genome-Wide Association Mapping of Grain Mold

Resistance in the US Sorghum Association Panel. *The Plant Genome* 12 (1).

Rooney: Casto, A, AJ Mattison, SN Olson, M Thakran, WL Rooney, JL Mullet. 2019.Maturity2, a novel regulator of flowering time in Sorghum bicolor, increases expression of SbPRR37 and SbCO in long days delaying flowering. BioRxiv: 535484

Septiningsih: Baltazar, Miriam D, John Carlos I Ignacio, Michael J Thomson, Abdelbagi M Ismail, Merlyn S Mendioro, Endang M Septiningsih. 2019. QTL mapping for tolerance to anaerobic germination in rice from IR64 and the aus landrace Kharsu 80A. *Breeding Science*: 18159

Stelly: Stelly, DM. 2019. Aneuploid mapping inpolyploids. *In. Encyclopedia of Plant and Crop Science*, pp 37-42.

Xu: Zhao, Jin, Qingwu Xue, Baozhen Hao, Thomas H Marek, Kirk E Jessup, Wenwei Xu, Brent W Bean, Paul D Colaizzi. 2019. Yield determination of maize hybrids under limited irrigation. *Journal of Crop Improvement:* 1-18

Xu: Zhang, HB, Meiping Zhang, Yanru Cui, Yun-Hua Liu, Wenwei Xu, Sing-Hoi Sze, Seth Murray, and Shizhong Xu. Accurate prediction of maize grain yield using its contributing genes for gene-based breeding. *Genomics* https://doi.org/10.1016/j.ygeno.2019.02.

Xu: Hao, Baozhen, Qingwu Xue, Thomas H Marek, Kirk E Jessup, Jacob D. Becker, Xiaobo Hou, Wenwei Xu, Edsel D. Bynum, Brent W Bean, Paul D. Colaizzi, Terry A Howell. 2019. Grain Yield, Evapotranspiration, and Water Use Efficiency of Maize Hybrids Differing in Drought Tolerance*. Irrigation Science* 37:25-34

Meetings of Interest

National Association of Plant Breeders, NAPB will hold their annual meeting at the University of Georgia, August 25-29, 2019. More information will be available soon at https://www.plantbreeding.org.

American Society of Agronomy-Crop Science Society of America-Soil Science Society of America will hold their annual meeting November 10 – 13, 2019 in San Antonio, Texas. More information available at https://www.acsmeetings.org/.

Distance Plant Breeding at Texas

A&M – Continuing Education

Available Courses

Summer Courses: May 28 – August 12, 2019

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**

Summer 2019

Plant Breeding Fundamentals – Full Course (3 Units) – Cost $679.65
May 28 – August 12, 2019

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
May 28 – August 12, 2019

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 1 - Introduction to Basic Plant Breeding Cost - $226.55

May 28 – June 21, 2019

Introduction to Basic Plant Breeding provides a review of plant reproduction, genetic variation, gene banks, germplasm preservation, gene segregation, the power of selection and its role in plant breeding, and an introduction to intellectual property and its role in the life of a plant breeder. This unit is designed to prepare the participant to explore the genetics and methodologies employed by plant breeders of self and cross pollinated crop species in units two and three of Basic Plant Breeding.

Unit 2 - Breeding Self Pollinated Crops Cost - $226.55
June 24 – July 19, 2019

The frequency of any specific heterozygous locus will be reduced by 50% for every generation of selfing, resulting in a mixture of homozygous lines within any natural population. Phenotypic selection within heterozygous generations will lead to homozygous or near homozygous germplasm lines or cultivars under self-pollination. This unit is designed to communicate plant breeding methodologies that take advantage of the genetic consequences of natural or forced self-pollination in agronomic crops. Topics will include: [1] the basics of segregation, [2] breeding methodologies, [3] the grain sorghum conversion program-an example of backcrossing in a different direction, [4] review of a commercial soybean cultivar development program, and [5] a review of the types of genetic releases from Texas A&M AgriLife Research.

Unit 3 - Breeding Cross Pollinated Crops Cost - $226.55
July 22 – August 16, 2019

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.

Fall Courses: August 27 – December 14, 2018

Fall 2019

Plant Breeding Fundamentals – Full Course (3 Units) – Cost $679.65

August 26 - December 11, 2019

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

August 26 - December 11, 2019

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 1 - Introduction to Basic Plant Breeding Cost - $226.55
August 26 – September 27, 2019

Introduction to Basic Plant Breeding provides a review of plant reproduction, genetic variation, gene banks, germplasm preservation, gene segregation, the power of selection and its role in plant breeding, and an introduction to intellectual property and its role in the life of a plant breeder. This unit is designed to prepare the participant to explore the genetics and methodologies employed by plant breeders of self and cross pollinated crop species in units two and three of Basic Plant Breeding.

Unit 2 - Breeding Self Pollinated Crops Cost - $226.55
September 30 – November 1, 2019

The frequency of any specific heterozygous locus will be reduced by 50% for every generation of selfing, resulting in a mixture of homozygous lines within any natural population. Phenotypic selection within heterozygous generations will lead to homozygous or near homozygous germplasm lines or cultivars under self-pollination. This unit is designed to communicate plant breeding methodologies that take advantage of the genetic consequences of natural or forced self-pollination in agronomic crops. Topics will include: [1] the basics of segregation, [2] breeding methodologies, [3] the grain sorghum conversion program-an example of backcrossing in a different direction, [4] review of a commercial soybean cultivar development program, and [5] a review of the types of genetic releases from Texas A&M AgriLife Research.

Unit 3 - Breeding Cross Pollinated Crops Cost - $226.55

November 4 – December 11, 2019

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.

Advanced Plant Breeding - Full Course (3 Units) - Cost - $679.65

August 26 - December 11, 2019

Expectations of genetic improvement for different plant breeding methods; relative efficiency for crops of different reproductive mechanisms; genetic variances, covariances and genotype-environment interaction components of variance used in planning selection procedures. Advanced 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 1 - Advanced Genetic Principles in Plant Breeding

August 26 – September 27, 2019

Topics covered include: Hardy Weinberg, means and variances, covariances and heritability, mating designs, genetic diversity.

Cost - $226.55

Unit 2 - Selection: Theory and Practice in Advanced Plant Breeding

September 30 – November 1, 2019

Topics covered include: recurrent selection, inbred line selection and testcrossing, selection environments, indirect selection, multiple trait selection, QTL MAS, heterosis and hybrid prediction.

Cost - $226.55

Unit 3 - Statistical Tools in Advanced Plant Breeding
November 4 – December 11, 2019
Topics covered include: statistical concepts review, expected mean squares and combined analysis, GxE interactions and stability analysis, polyploidy.
Cost - $226.55

Experimental Designs in Agronomic Research - Full Course (3 Units) - Cost - $679.65

August 26 - December 11, 2019

Teaches fundamental principles and procedures of experimental designs in agricultural sciences. Emphasis includes factorial designs, predicting outputs, use of covariance, and balanced and unbalanced experimental designs as related to common agricultural research projects under field, greenhouse or growth chamber culture. Students will become familiarized with computer programming of common statistical software. Experimental Designs in Agronomic Research 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 1 - Factorial Experimental Designs in Agronomic Research
August 26 – September 27, 2019
Topics covered include: Fundamentals of agricultural research methodology and methodology, basic statistical concepts for testing of hypothesis, introduction to simple computer statistical software programs and applications, complete randomized design, randomized complete block design, and Latin square design.
Cost - $226.55

Unit 2 - Factorial and Unbalanced Designs in Agronomic Research
September 30 – November 1, 2019
Topics covered include: Split-plot and split-split plot designs, nested designs, variance analyses, interactions with years and locations, comparisons of paired and grouped mean, estimation of missing values, the general linear model, and planned incomplete block design.
Cost - $226.55

Unit 3 - Correlation, Regression, Covariance, and Biplot Analysis in Agronomic Research
November 4 – December 11, 2019
Topics covered include: Correlation, regression, path coefficient analysis, covariance analysis, nearest neighbor analysis, augmented designs and moving means and analysis, database management, biplot analyses.
Cost - $226.55

This is a "self-paced" course and is available for viewing for a limited time. Time commitment is individual student driven. 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 voiced over PowerPoint video lectures.

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

August 26 - December 11, 2019

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 I - Introduction to Intellectual Property, International Treaties and Patents Cost - $226.55

August 26 – September 27, 2019

Unit I of the Intellectual Properties in the Plant Sciences Course. Topics covered include: IP Culture and the Knowledge Economy, Traditional Knowledge vs. Biopiracy, Sui generis Systems, International Treaties, Overview of Patentability, Utility Patents, and Plant Variety Patents.

Unit II - Intellectual Property Documentation Cost - $226.55

September 30 – November 1, 2019

Unit II of the Intellectual Properties in the Plant Sciences Course. Topics covered include: Trademarks, Copyrights, & Trade Secrets; USPTO; Inventorship, Ownership, Compensation, IP Training; Confidential Information; IP Audit; IP Value; Competitive Intelligence; Cyberspace – IP and IT Cooperation.

Unit III - Intellectual Property Transfer and Enforcement Cost - $226.55

November 4 – December 11, 2019

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.

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 Plant Breeding at Texas A&M Graduate Degrees

Distance Plant Breeding at Texas A&M Graduate Degrees

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.