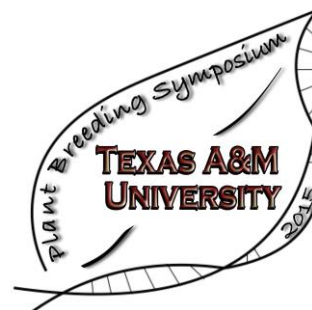


TEXAS A&M PLANT BREEDING BULLETIN

April 2015

Our Mission: Educate and develop Plant
Breeder worldwide

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



I want to take one more Plant Breeding Bulletin to thank Pioneer (especially Abadie Tabare and Pam Rullestad) for supporting the inaugural Texas A&M Plant Breeding Symposium, a DuPont Pioneer Network of Symposia Event. We also are grateful to Cotton Incorporated for providing free T-shirts to all attendees and for local support from the Department of Horticultural Sciences, the Molecular and Environmental Plant Sciences program, the Department of Biology, the Department of Soil and Crop Sciences, and Texas A&M College of Agriculture and Life Sciences for their support. The organizing committee (all graduate students) composed of Brian Pfeiffer, Laura Masor, Laura Ann McCloud, and Sean Carver deserves our thanks and applause for a fantastic job. Future committees have a “high bar” to match the professionalism established by these four future great plant breeders.

We were honored to have a “sell out” event. The MSC facility was full yet comfortable and we’re fortunate to have such facilities at Texas A&M supporting our students. Another indicator of the success of this event is that Dr. Wenwei Xu (Professor with joint appointment at Texas A&M AgriLife Research-Lubbock and Texas Tech University) brought his Advanced Plant Breeding class to the event and Dr. Tim Pannkuk brought several students from Sam Houston State University to the event. We hope to continue this tradition and reach out to students at other universities in Texas and beyond.

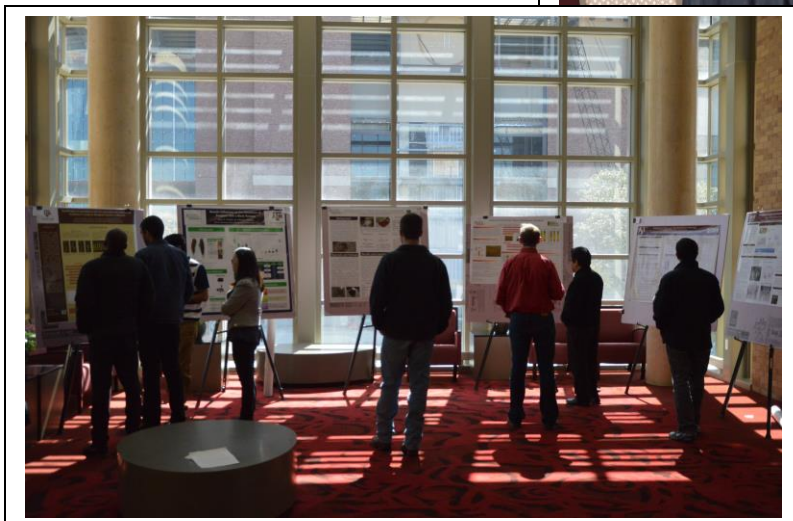
I want to share with you the titles and authors of the posters that were displayed at the symposium and draw your attention to the breadth of the plant breeding research conducted by our graduate students at Texas A&M. These folks are making outstanding contributions to our plant breeding research programs and to the science of plant breeding. I think you will agree with me that the next generation is in good hands with these young men and women. Below are the titles of all of the posters followed by the abstracts of the

three Graduate Student Symposium Poster winners. If you would like to contact and congratulate any or all of these folks then you can visit <http://soilcrop.tamu.edu> or <http://hortsciences.tamu.edu> and find their contact information.



General view of audience at Pioneer Plant Breeding Symposium (left). Student Yan Yang during presentation (above).

View of audience during the symposium (right) and viewing graduate student posters (below)



Posters displayed at the Texas A&M Plant Breeding Pioneer Symposium

Steven Anderson

Cycling of Gametes in Vitro: Proof of Concept (Development of cell cycling protocol preceding experimentation towards in vitro gametogenesis induction)

Steven L. Anderson II¹, Seth C Murray¹, and Keerti S. Rathore^{1,2}

1 Department of Soil and Crop Sciences, Texas A&M University, College Station, TX;

2 Institute for Plant Genomics and Biotechnology, Texas A&M University, College Station, TX

Brijesh Angira

Genetic Variability and Genes Conditioning Heat Tolerance in Cowpea

Brijesh Angira¹, Laura Masor^{1,2}, Dirk Hays^{1,2}, and B.B. Singh¹

1 Department of Soil and Crop Sciences, Texas A&M University, College Station, TX

2 Molecular and Environmental Plant Sciences, Texas A&M University, College Station, TX

Galal Anis

Developing new hybrids of rice to boost food security in Egypt

Anis, G.B.; H.F. El-Mowafi and A.I. El-Sherif

Henry Awika

Wax and staygreen may cosegregate to rescue seed set failure in Sorghum.

Awika Henry¹ and Dirk Hays^{1,2}

1 Department of Soil and Crop Sciences, Texas A&M University, College Station, TX

2 Molecular and Environmental Plant Sciences, Texas A&M University, College Station, TX

Nolan Bentley

Application of SSRs for determining heritage in Pecan Breeding

Nolan Bentley¹, Rory Tucker¹, LJ Grauke², and Patricia Klein¹

1 Department of Horticultural Sciences, Texas A&M University, College Station, TX

2 USDA-ARS Pecan Breeding & Genetics, 10200 FM 50, Somerville, TX

Drutdamon Bhangu

Impact of Natural Drought on Extra Long Staple and Fiber Strength Traits in South Texas

Drutdaman Singh Bhangu¹, Wayne Smith¹, and Steve Hague¹

1 Department of Soil and Crop Sciences, Texas A&M University, College Station, TX

Richard Bruton

High Throughput Phenotyping: Application of Terrestrial Laser Scanning in Wheat

Richard K. Bruton¹

1 Department of Soil and Crop Sciences, Texas A&M University, College Station, TX

Fatima Camarillo

Defining spectral radiometric indices for the high-throughput remote sensing selection of epicuticular wax accumulation for heat and drought tolerance breeding

Fatima Camarillo¹, Maria Tattaris², Dirk B. Hays¹, Matthew P. Reynolds²

1 Department of Soil and Crop Sciences, Texas A&M University, College Station, TX

2 International Maize and Wheat Improvement Center (CIMMYT), El Batan, Estado de México.

Yuanyuan Chen

Confirmation of QTLs controlling maize grain yield and plant height

Yuanyuan Chen¹, Seth Murray², Fei Wang², Steven Anderson², Justine Christman², Zoran Ilievski², Jacob Pekar², Nancy Wahl²

1 Molecular and Environmental Plant Sciences, Texas A&M University, College Station, TX

2 Department of Soil and Crop Sciences, Texas A&M University, College Station, TX

Justine Christman

Development of near infrared reflectance spectrometry (NIRS) calibrations to predict maize composition components for screening of maize breeding material

Justine L. Christman¹, Seth C. Murray¹, Jim Wilborn^{1,2}

1 Department of Soil and Crop Sciences, Texas A&M University, College Station, TX

2 Chillicothe Research Station, Texas A&M AgriLife Research and Extension, Chillicothe, TX

Alfredo Delgado

Estimation of Below Ground Biomass in Cassava by Ground Penetrating Radar

Alfredo Delgado¹, Dirk Hays¹, Michael Selvaraj², Hernan Ceballos², Fenando Calle², Luis Augusto², Alexandre Novo³

1 Molecular and Environmental Plant Sciences, Texas A&M University, College Station, TX

2 International Center for Tropical Agriculture, Cali, Colombia

3 GeoRadar Division, Ingengneria Dei Sistemi, Montreal, Canada

Smit Dhakal

Genetic Mapping of Wheat Curl Mite Resistance in TAM 112

Smit Dhakal¹, Chor Tee Tan², Shuyu Liu², Jackie Rudd², Qingwu Xue², Brock C. Blaser³, Ravindra Devkota², Charlie Rush², Maria P. Fuentealba²

1 Department of Soil and Crop Sciences, Texas A&M University, College Station, TX

2 Texas A&M AgriLife Research and Extension Center, Amarillo, Texas

3 Plant, Soil and Environmental Science, West Texas A&M University, Canyon, Texas

Kari Hugie

Identification of Robust Microsatellite Markers for Fiber Length and Strength in Gossypium spp.

Kari Hugie¹, David Fang², Ping Li², Wayne Smith¹, Hongbin Zhang¹, Steve Hague¹, and Don Jones³

1 Department of Soil and Crop Sciences, Texas A&M University, College Station, TX

2 Southern Regional Research Center, USDA-ARS, New Orleans, LA

3 Cotton Incorporated, Raleigh, NC

Ordorm Huot

The Dynamic Role of Pulse Water Stress in Plant Affects Psyllid Infestation

Ordorm Brian Huot and Cecilia Tamborindeguy

Department of Entomology, Texas A&M University, College Station, TX

Karine Kettener

Identifying marker-trait associations for Fiber Components in Sugarcane with Simple Sequence Repeat Markers

Karine Kettener¹, Natalia Spagnol Stabellini², Marcia Moreno², Itaraju Brum², Francisco Claudio da Conceicao Lopes², Thiago Benatti², Alessandro Pellegrineschi², Karine M. Oliveira², Jorge da Silva³ and Celso Luis Marino¹

1 University of São Paulo State-UNESP, Botucatu, Brazil
2 CTC, Piracicaba, Brazil,
3 Texas A&M University, Weslaco, TX

Mahanz KianiFariz

Transcriptomic analysis of cell wall related genes in high biomass energy sorghum using RNA-Seq

Mahnaz Kiani¹, Robert R. Klein², Doreen Ware³, Patricia E. Klein¹

1 Department of Horticultural Sciences, Texas A&M University, College Station, TX
2 USDA-ARS, Southern Plains Agricultural Research Center, College Station, TX
3 Cold Spring Harbor Laboratory, Cold Spring Harbor, NY

Yalin Li

Estimating the correlation and importance of load and chemical compositions in the epicuticular wax layer of wheat leaves with function and performance under stress in historic and current CIMMYT cultivars

Yalin Li¹, Xiangkun Gu¹, Suchismita Mondal², Dirk B. Hays¹

1 Department of Soil and Crop Sciences, Texas A&M University, College Station, TX
2 International Center for Wheat and Maize Improvement Center, CIMMYT, Mexico

Shuyin Liang

Characterization of 10 hybrid rose populations for heat tolerance

Shuyin Liang, Xuan Wu, David Byrne

Department of Horticultural Sciences, Texas A&M University, College Station, TX

Laura Masor

Molecular Mapping of Drought Tolerance Genes in Cowpea (*Vigna unguiculata* L. Walp)

Laura Masor^{1,2}, Brijesh Angira¹, Dirk Hays^{1,2}, and B.B. Singh¹

1 Department of Soil and Crop Sciences, Texas A&M University, College Station, TX
2 Molecular and Environmental Plant Sciences, Texas A&M University, College Station, TX

Andrea Maeda

SNP-based inferences on expression, reproductive ramifications and inheritance of the Semigamy gene of cotton (*Gossypium barbadense* L.), a rare angiosperm mutant affecting karyogamy

Andrea Maeda and David Stelly

Department of Soil and Crop Sciences, Texas A&M University, College Station, TX

Ashley Mattison

The Genetic Basis of Grain Yield in Sorghum bicolor

Ashley Mattison¹, Brock Weers¹, Bill Rooney², and John Mullet¹

1 Department of Biochemistry and Biophysics, Texas A&M University, College Station, Texas
2 Department of Soil and Crop Sciences, Texas A&M University, College Station, TX

Nikhil Patil

Identification of quantitative trait loci associated with anthracnose resistance in sorghum [Sorghum bicolor (L.) Moench]

Nikhil Patil¹, William Rooney², Delroy Collins², Millie Burrell¹, Patricia Klein¹

1 Department of Horticultural Sciences, Texas A&M University, College Station, TX
2 Department of Soil and Crop Sciences, Texas A&M University, College Station, TX

Brian Pfeiffer

Genetic Influences on the Inheritance of Sorghum With a Black Pericarp

Brian Pfeiffer, William Rooney

Department of Soil and Crop Sciences, Texas A&M University, College Station, TX

Nicholas Pugh

Heritability and QTL for Popping Characteristics in Sorghum Grain

Nicholas Ace Pugh and William Lloyd Rooney

Department of Soil and Crop Sciences, Texas A&M University, College Station, TX

Bharath Reddy

Synthetic Derived Wheat (Wild Relatives of Wheat): A Promising Platform to Improve the Grain Yield Potential

Bharath K. Reddy¹, Amir M.H. Ibrahim¹, Jackie C. Rudd², Shuyu Liu²

¹ Department of Soil and Crop Sciences, Texas A&M University, College Station, TX

² Texas A&M AgriLife Research, Amarillo, TX

Xuan Wu

Assessment of *Rosa spp.* Plant Architecture in the Field

Xuan Wu, Shuyin Liang, and Dave Byrne

Department of Horticultural Sciences, Texas A&M University, College Station, TX

Muqing Yan

Developing next-generation sequencing technology for *Rosa spp.*

Muqing Yan, Qianni Dong, David Byrne, Patricia Klein

Department of Horticultural Science, Texas A&M University, College Station, TX

Homa Zargami

Mapping QTL for salt tolerance in Cowpea (*Vigna unguiculata* L. Walp.)

Homa Zarghami, Bir.B. Singh, Dirk Hays

Department of Soil and Crop Sciences, Texas A&M University, College Station, TX

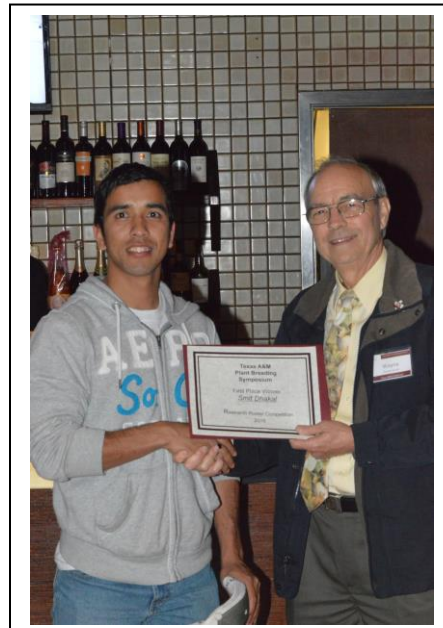
Poster winners at the Pioneer PB Symposium

First Place

Smit Dhakal

Genetic Mapping of Wheat Curl Mite Resistance in TAM 112

ABSTRACT: Viruses transmitted by wheat curl mites (*Aceria tosichella* Keifer, WCM) have been a persistent concern to farmers and researchers for at least six decades. Yield loss caused by mite-virus complexes has been reported up to 100% on field level and up to 7% state wide. Genetic control



of wheat curl mite and wheat streak mosaic virus is a viable and economically feasible way. Mite resistant wheat inhibits the reproductive capacity of the WCM. Texas A&M University developed hard red winter wheat variety TAM 112 has resistance to WCM. This study was conducted to map the WCM resistant genes in TAM 112. The experiment tested 124 F5:7 recombinant inbred lines along with TAM 112, TAM 111, and susceptible check Karl 92. For phenotypic data, all the lines were infested with WCM at the two-leaf stage and were scored on the first and second week after infestation of WCM. For genotyping data, DNA of RILs and parents were extracted and subjected to marker analysis. A total of 90,900 markers including SNPs, DArT, SSR, and STS were screened. Polymorphic marker data were utilized to construct the genetic map. From this study, in addition to the rye translocation 1AL.1RS showing resistance to the WCM collection, another WCM resistant gene in TAM 112 was mapped. The resistance gene present in TAM 112 was designated as CmcTAM112. The linkage map revealed the location of CmcTAM112 gene on the chromosome 6DS.

Kari Hugie

Identification of Robust Microsatellite Markers for Fiber Length and Strength in Cotton

ABSTRACT: *Gossypium hirsutum* (Upland cotton) accounts for the majority of cotton fiber production world-wide. The global market places value on longer and stronger fibers, mandating that U.S. breeders develop cultivars to meet this demand. One challenge that breeders face concerning the improvement of fiber quality traits is low genetic diversity among elite, agronomically acceptable genotypes of *G. hirsutum*. The use of marker-assisted selection (MAS) could help breeders access unexploited genetic diversity as well as decrease the cost of phenotyping for fiber quality traits. Linkage (bi-parental) and association mapping studies have led to the

discovery of hundreds of quantitative trait loci (QTL) for fiber length and strength, and many of these QTL detected show promise for use in MAS. However, there are few reports of public programs utilizing MAS for the improvement of fiber quality traits. Generally, there has been a lack of consistency among fiber quality QTL detected across studies, which is attributable to many different factors, including experimental error, QTL by environment interactions, and QTL by genetic background interactions. Though more recently, several association studies and meta-analyses have helped identify stable QTL



and important chromosomal regions for fiber quality traits. Identifying tightly linked markers to robust fiber quality QTL is important to the efficiency and use of MAS. The objectives of this study were to assess the effects of previously reported microsatellite markers (SSRs) for fiber length and strength in three different genetic backgrounds and identify robust and portable SSRs for use in MAS for fiber quality. Two intra-specific populations (*G. hirsutum* x *G. hirsutum*) and one inter-specific population (*G. hirsutum* x *G. tomentosum*/*G. mustelinum*) were selected for the study based on high levels of polymorphism. Within the three selected families, 285 individual F2:3 plants were genotyped for approximately 250 SSRs, hand harvested, and sent for high volume instrument (HVI) analysis of fiber quality traits. These data were used to identify robust candidate markers and evaluate their utility in MAS for fiber quality among the TAMU breeding program populations.

Drutdamon Bhangu

Impact of Natural Drought on Extra Long Staple and Fiber Strength Traits in South Texas



ABSTRACT: Extra long staple upland (ELSU) cotton phenotypes have been developed by the Cotton Improvement Lab at Texas A&M University. These and exceptional fiber bundle strength (ESU) phenotypes were evaluated in the Cotton Variety Trials at locations in South Texas that received supplemental irrigation or no irrigation in 2013 and 2014. The ELSU phenotypes produced lower UHML under drought conditions yet remained significantly livars. ELSU phenotypes had a higher stability in ght when compared with medium staple upland

cultivars. The ELSU trait will provide a genetic mechanism for the production of competitive, non-discount upland cotton even under dryland production protocols.

Continuing and Distance Education in Plant Breeding at Texas A&M

Continuing education course modules in plant breeding and genetics, and related disciplines are available from Texas A&M University to clientele interested in gaining new information in plant breeding or simply seeking refresher courses. This program is designed for individuals employed in private industry, CGIAR centers, government

agencies, non-government organizations, and other agriculture professionals who need and desire additional knowledge and training in plant breeding but who are not interested in an additional academic degree. A professional certificate can be a part of this program. No campus visit is required. Course modules available for January through May 2015 are (<https://scsdistance.tamu.edu/purchase/>):

SUMMER 2015

Introduction to Plant Breeding Fundamentals – Full Course) – Cost \$679.65

May 18 – August 28, 2015

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 18 – August 28, 2015

Unit 1 - Introduction to Basic Plant Breeding Cost - \$226.55

January 20 – February 20, 2015

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

February 23 – April 3, 2015

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

April 6 – May 13, 2015

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.

FALL 2015

Introduction to Plant Breeding Fundamentals – Cost \$679.65

August 31- December 18, 2015

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 31- December 18, 2015

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 31 – October 2, 2015

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*

October 5 – November 5, 2015

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 9 – December 18, 2015

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 31- December 18, 2015

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 31 – October 2, 2015

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

October 5 – November 5, 2015

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 9 – December 18, 2015

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 31- December 18, 2015

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 31 – October 2, 2015

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

October 5 – November 5, 2015

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 9 – December 18, 2015

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.

Soil Fertility - Full Course (3 Units) - Cost - \$679.65

August 31- December 18, 2015

Chemical and biological reactions in soils that influence nutrient availability to plants; environmental aspects associated with nutrient availability and fertilization, especially for nitrogen (N) and phosphorus (P). Topics covered include: introduction and historical background; plant essential nutrients, soil plant relations, calculations in soil fertility, soil acidity, soil nitrogen, soil phosphorus, potassium, calcium, magnesium, sulfur and the micronutrient elements.

Topic 1 – Introduction and Historical Background

Major contributions to soil chemistry and fertility. Introduction to soils and climate of Texas.

Topic 2 – Plant Essential Nutrients, Soil-Plant Relations

Plant available forms of nutrients, functions of nutrients in plants, types of soils where deficiencies might be anticipated, relative quantities required by plants.

Topic 3 – Calculations in Soil Fertility

Chemical notations, mole on a weight basis, mole on a charge basis, equivalents, ppm, concentrations of solutions, lbs/acre, kg/ha, lbs/1000 ft², etc.

Topic 4 – Soil Acidity

Measurement and causes, active and reserve acidity, effects on nutrient availability and chemical properties, influence on plant growth, correction of, exchangeable Al, Al hydroxyl polymers, effective CEC

Topic 5 – Soil Nitrogen

Reactions of N in soils, N cycle, N gains and losses, biological N₂ fixations, factors influencing availability, mineralization-immobilization, nitrification, NO₃⁻ movement and groundwater contamination, eutrophication, NH₄⁺ fixation, NH₃ volatilization, denitrification, nitrification inhibitors, production of N fertilizers, acidification from NH₄⁺ fertilizers, selection of N source potential environmental effects

Topic 6 – Soil Phosphorus

Phosphorus cycle, low uptake efficiencies – reversion in acid and alkaline soils, solubility product constants of reversion precipitates, solubility diagrams, influence of soil pH on P availability, method of application, production of P fertilizers, potential environmental consequences, eutrophication

Topic 7 – Potassium, Calcium, Magnesium

Potassium cycle, available forms, soil reactions, K⁺ fixation, mineral sources, factors influencing plant availability, fertilizer sources

Topic 8 – Sulfur and the Micronutrient Elements

Reactions of S in soils, S cycle, sources of S fertilizers, anticipated crop responses, reactions influencing availability of micronutrients in soils, pH effect chelates, extent of micronutrient deficiencies, correction of deficiencies.

Other Continuing Education courses in plant breeding and related disciplines that will be available during other semesters include Host Plant Resistance; 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 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.