

TEXAS A&M PLANT BREEDING BULLETIN

October 2016

Our Mission: Educate and develop Plant Breeders worldwide

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

Plant Breeding at Texas A&M Expands into Coffee

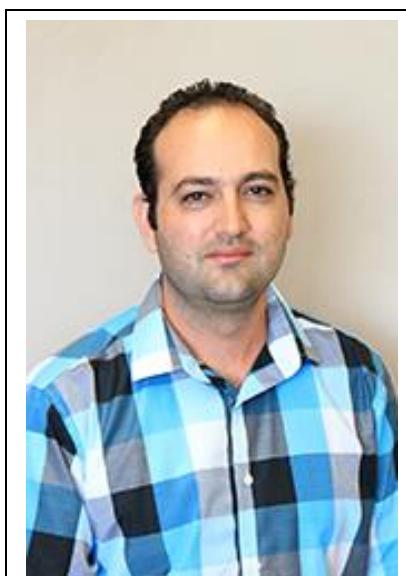
Texas AgriLife Research has initiated a new research center dedicated to world coffee.

While coffee production impacts over 100 million people globally and has a global monetary value of about \$ 170 billion, there are few well established research centers dedicated to coffee. And, while the U.S. does not produce coffee, we consume 400,000,000 cups per day. The press release from Texas A&M AgriLife Research describing this new Coffee Center is reprinted below but I also want to introduce you to Fabian Echeverria-Beirute, our first graduate student working on his doctorate with research in coffee. Fabian is co-advised by Drs. Seth Murray and Patricia Klein. Fabian came to Texas A&M's plant breeding program from the Technological Institute of Costa Rica (ITCR) where he was a professor of plant physiology and breeding in cassava. He was also the Coordinator of the Coffee Breeding Program at the Center for Coffee Research (ICAFE) from 2007 to 2014 prior to matriculating to Texas A&M to work on his doctorate.

Fabian's dissertation research deals with the most devastating disease threatening coffee production today.

There are few known resistance alleles to coffee rust, caused by the fungus *Hemileia vastatrix*, a disease that affects the leaves of the coffee plant, defoliating the plants and thus affecting photosynthetic capacity which results in reduced quality and quantity of beans produced.

Global warming is also threatening Arabica coffee that currently is produced only in higher elevations in tropical regions. Fabian's research is designed to look at the impact of hybrid vigor for rust tolerance, reproductive stress and management on production and quality. The research plot was a three-year old plantation of coffee at the Aquiares Farm in the district of Turrialba, Cartago province, Costa Rica.



So far, different quality profiles for sensory and volatile compounds were evidenced due the treatments, but especially associated with the genotype, leading to a possible metabolic interaction and regulation that may be selectable using molecular tools. If some markers are found related to stress, they may be used for future validation studies and breeding programs.

The new Coffee Research Center described below and attracting Fabian to Texas A&M are benchmarks in our continuing efforts to truly make plant breeding research and education at Texas A&M a global effort and opportunity.

New Texas A&M Center to Protect Key International Coffee Industry

September 1, 2016

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Texas A&M University administrators and researchers are stepping up efforts to protect a worldwide multibillion dollar-a-year industry.

Coffee is the main source of income for about 100 million people across the globe. The industry has a retail value estimated at \$30-32 billion for the United States alone, reaching \$170 billion worldwide, according to Dr. Craig Nessler, director of Texas A&M AgriLife Research.

However, experts have said the coffee industry is facing serious problems. Diseases, narrow genetic diversity, climate change and an ever-increasing global demand have experts predicting a difficult future for coffee producers.

“Coffee has suffered from a lack of advanced research in areas like genetics and disease resistance,” said Dr. Tim Schilling, executive director of World Coffee Research, an industry-sponsored non-profit organization that partners with scientists at Texas A&M University, College Station.

Diseases such as coffee rust, a hard-to-stop fungus that attacks and kills coffee trees, have spread across Central and South America, devastating production in the coffee-growing regions of Guatemala, Honduras, Costa Rica, Panama, El Salvador and Brazil. Guatemala declared a state of emergency in 2013 due to the havoc this disease brought to their farms. In response to these challenges, the Texas A&M University Board of Regents voted on Sept. 1 to create the premier scientific center in the world dedicated to the advancement of research and development to improve the quality and sustainability of coffee.

The Center for Coffee Research and Education, located at the university’s Norman Borlaug Institute for International Agriculture, will seek to make rapid gains in research to sustain and grow the world’s coffee supply, said Nessler.

“With the creation of the new center, one of the world’s best agricultural research institutions is adding its might to the effort to solve key issues facing one of the world’s most important crops, and those of us at World Coffee Research are honored to be working alongside the center,” Schilling said.

The center will offer researchers and students the rare opportunity to engage in fundamental research, while at the same time providing the opportunity to conduct significant parts of their research directly on location at coffee farms of producing

countries, Nessler said. It also offers the opportunity to collaborate with coffee scientists from other coffee research institutions and companies around the world.



Dr. Leo Lombardini, Professor of Horticultural Sciences and Director of the Texas A&M AgriLife Coffee Research Center, in a coffee field in Costa Rica.

“Coffee farmers are facing the challenges of increasing demand globally and decreasing land suitable for production due to climatological change. Compared to

other influential crops, relatively little research has been conducted on coffee that would support farmer resiliency to such challenges,” said Dr. Leo Lombardini, director of the center. The center will build on the extensive international development experience of the Borlaug Institute for International Agriculture and the previous research conducted by university scientists and the World Coffee Research. It will also take advantage of the WCR’s existing relationships with international research institutions and the private sector.

“The mission of the Texas A&M Center for Coffee Research and Education is to help fill the paucity of coffee research and education, and to create economic opportunities for coffee farmers worldwide,” Lombardini said.

The Inter-American Development Bank estimates that in Central America and southern Mexico up to 4 million people derive their livelihoods from the coffee industry.

“Through these efforts, we will be helping small farmers rise out of poverty and hunger, providing them with a hope and a future for themselves and their families in fulfillment of the legacy left for us by Dr. Norman Borlaug,” said Dr. Elsa Murano, director of the Borlaug Institute.

Meetings of Interest

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The annual meeting American Society of Agronomy-Crop Science Society of America-Soil Science Society of America will be held in Phoenix, AZ, 6-9 November. More information can be found at <https://www.acsmeetings.org>.

Distance Plant Breeding at Texas A&M

Distance Plant Breeding at Texas A&M

Distance Plant Breeding Program and Continuing Education courses available for Fall 2016 (<https://scsdistance.tamu.edu/available-courses>)

Continuing Education

Fall Courses: August 29 – December 16, 2016

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

- High speed internet connection and updated browsers, including Internet Explorer and either Chrome or Firefox
- Google Chrome or Mozilla 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.

Fall 2016

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

August 29 - December 16, 2016

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 29 - December 16, 2016

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 29 - September 30, 2016

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 3 - November 4, 2016

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 7 – December 16, 2016

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 29 - December 16, 2016

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 29 – September 30, 2016

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 3 – November 4, 2016

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 7 – December 16, 2016

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 29 - December 16, 2016

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 29 – September 30, 2016

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 3 – November 4, 2016

~~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 7 – December 16, 2016

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.

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.