

# TEXAS A&M PLANT BREEDING BULLETIN

August 2015

**Our Mission:** Educate and develop Plant Breeders worldwide

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

**Symposium:** R/qtl, MAGIC QTL Populations and Genomic Selection in Plant Breeding  
September 2015 (see below)

**Workshop:** Genome Editing—September 2015 (see below)

Laura Masor, a MEPS major with emphasis in plant breeding, recently visited the plant breeding programs at Oregon State University. One of her goals was to initiate an “exchange” program where a plant breeding student from Texas A&M will visit the breeding programs at another LGU and we will reciprocate by hosting a plant breeding student from that university. This idea was the brain child of Dustin Herb, an MS plant breeding graduate in Dr. Bill Rooney’s program, and Laura. I hope we can make it come to fruition. Her account of her visit to OSU is below.



“In May of this year I applied for and was granted a Dudley and Angela Smith Travel Award to visit Oregon State University to tour their breeding programs. My goals of this trip were to visit at least five breeding programs and also give a presentation about the breeding programs at Texas A&M and my research to the OSU plant breeding group. Ryan Contreras, the faculty member in charge of the plant breeding seminar and Dustin Herb, a graduate student at OSU and Aggie Alum that thought up the concept of the student exchange, helped plan my visit and arrange the seminar.

From June 8<sup>th</sup> to June 12<sup>th</sup>, 2015, I toured breeding programs at Oregon State University in Corvallis, Oregon. Scott Fisk, barley program technician, Laura Helgerson, research

assistant, Dustin Herb and I met first to tour the barley program. During tours of the laboratory, greenhouse and field I learned about their projects which include creation of double haploids and facultative genotypes as well as genome wide association studies.

Dr. Jim Meyers, the small vegetables breeder and I met next. Dr. Meyers spoke to me about the various crops and projects he manages in both conventional and organic



breeding systems. In the greenhouse, Dr. Meyers showed me some of the purple varieties of tomato that he has bred, as well as his beet, broccoli, and oca evaluations. In the field he showed me his and graduate students' research in vegetables such as sweet pea, broccoli, artichoke, and squash.

Dr. Contreras breeds 18 genus of ornamentals, from *Acer* to *Vaccinium*, and during our visit I viewed many of them in the greenhouse and in the field. Dr. Contreras gave me a great overview of the needs of the ornamental industry and what he is doing through mutation and ploidy manipulation to breed plants that will help the industry meet its needs.

On day four, I met with Dr. Mehlenbacher, the hazelnut breeder. Dr. Mehlenbacher walked me through seemingly never-ending rows of hazelnut trees explaining the differences between the genotypes, which include plant habit, flowering time, sporophytic incompatibility, and most importantly, resistance to Eastern Filbert Blight. The tour was followed by sampling some of the hazelnuts to discern the differences in flavor profiles between the genotypes.

I met with Dr. Shawn Townsend the aromatic hops breeder and his graduate students Austin Fricker and Brooke Getty on my last day in Corvallis. Dr. Townsend gave me a good introduction to the crop including its uses, breeding methodology, and cultural and agronomic practices. The tour ended with a sensory evaluation of the hops cones which are an important component in beer making.



**Dr. Jenny Kling and I met later that day. In her office, Dr. Kling gave me an introduction to high oil oat, meadowfoam (*Limnanthes alba* Benth.), and flax, and discussed data illustrating her impressive breeding progress.**

**My second goal for the visit was to give a seminar consisting of an introduction to the Plant Breeding programs at Texas A&M and an overview of my research in cowpea. I spoke on Wednesday, the 10<sup>th</sup>. The seminar was attended by mix of approximately 20 professors, researchers and students.**

**My final goal was to gauge interest in starting a plant breeding student exchange program between Texas A&M and Oregon State University. The idea behind the exchange program is that a student from one university will travel to the other university to give a talk and tour some of the breeding programs, much like I did on this trip. Upon return, the student would give a seminar about the programs that they visited to their fellow students. The OSU's plant breeding students and faculty were extremely interested and excited to take part in a program of this kind. Plans are now underway for Texas A&M University to host an Oregon State student this fall. My experience at OSU suggest that this would be an outstanding learning opportunity for those plant breeding students fortunate enough to participate in the experience.**

**I'm indebted to Dr. Dudley Smith and his wife Angela for their generous gift to the Department of Soil and Crop Sciences that made this wonderful and educational experience possible."**

## **Distance Plant Breeding Program and Continuing Education courses available for 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](mailto: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 ft<sup>2</sup>, 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 N<sub>2</sub> fixations, factors influencing availability, mineralization-immobilization, nitrification, NO<sub>3</sub><sup>-</sup> movement and groundwater contamination, eutrophication, NH<sub>4</sub><sup>+</sup> fixation, NH<sub>3</sub> volatilization, denitrification, nitrification inhibitors, production of N fertilizers, acidification from NH<sub>4</sub><sup>+</sup> 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<sup>+</sup> 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 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](mailto: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](mailto:cwsmith@tamu.edu) or 979.845.3450.**

# **Symposium: The Use of R/qtl, MAGIC QTL Populations and Genomic Selection in Plant Breeding**

*Tuesday, September 1, 2015*  
*Thursday, September 3, 2015*  
1:00 – 5:30 PM  
Rudder Tower, Room 301  
401 Joe Routh Blvd.

*Friday, September 11, 2015*  
9:30 – 11:00 AM  
The AgriLife Center  
1538 John Kimbrough Blvd.

Texas A&M University, College Station, Texas

Innovative technologies must be utilized to increase crop productivity to meet the grand challenge of providing affordable food, feed, fiber, bioenergy, and greenspace for a global population of nine billion. The vast availability of genomic resources and tools is leading to a new revolution in plant and animal breeding, facilitating the ability to connect a genotype with a corresponding phenotype, especially for complex traits. This symposium will focus on three current tools being utilized by breeders to make seminal gains in plant and animal breeding: 1) R/qtl for expediting the identification of markers linked to genes and QTL of interest; 2) R/mpMap for use with multi-parent advanced generation inter-cross (MAGIC) populations in QTL mapping; and 3) Genomic Selection (GS) for the estimation of breeding values for quantitative traits through whole genome genotyping. While the focus is on plants there will be substantial overlap with tools of interest to animal breeders and geneticists.

## **Registration**

**Registration Deadline – August 20, 2015**

**Register:** <https://agriliferegister.tamu.edu/GenomicSelection>

Registration is limited to the first 200 people, so register early to reserve your place at the symposium.

## **Cost**

There is no cost to register but the registration deadline is August 20, 2015.

## **Webinar**

A webinar of presentations will be available at no charge for those unable to attend in person. On the registration page choose “Webinar Participant.” A webinar link for each day will be emailed to you prior to the conference.

## **Parking**

Visitor parking is available in the University Center Garage (UCG) located on S. Houston St. for the sessions held in Rudder Tower and in West Campus Garage for the session held in The AgriLife Center. Hourly rates apply. Maximum rate per day is \$15.

Visitor Parking Map - <http://transportmap.tamu.edu/parkingmap/tsmmap.htm?map=vis>

## Hotel

A number of hotels are available in the Bryan/College Station area for those needing overnight accommodations.

## Speakers

The program will consist of speakers who are leaders in the field of R/qlt, R/mpMap and Genomic Selection. Confirmed speakers include:

### September 1

- *Dr. Karl Broman*, Professor, Department of Biostatistics & Medical Informatics, University of Wisconsin-Madison <http://kbroman.org/>
- *Dr. Emma Huang*, Senior Research Scientist, CSIRO <https://www.linkedin.com/in/bemmahuang>
- *Dr. Thomas Juenger*, Professor, Department of Integrative Biology, University of Texas at Austin [https://sites.cns.utexas.edu/juenger\\_lab](https://sites.cns.utexas.edu/juenger_lab)

### September 3

- *Dr. Jeffrey Endelman*, Assistant Professor, Department of Horticulture, University of Wisconsin <http://potatobreeding.cals.wisc.edu/>
- *Dr. Dunia Pino Del Carpio*, Research Associate, Cornell University <https://www.linkedin.com/pub/dunia-pino-del-carpio/49/1a7/733>
- *Dr. Marnin Wolfe*, Postdoctoral Associate, Cornell University <https://www.linkedin.com/pub/marnin-wolfe/90/60b/722>

### September 11

- *Dr. Mark Cooper*, Research Director, Pioneer Hi-Bred International

## Schedule

### **Tuesday, September 1, 2015, Rudder Tower, Room 301**

1:30 PM	Welcome and Introductions
2:00 PM	Karl Broman
3:00 PM	Thomas Juenger
4:00 PM	Emma Huang
5:00 PM	Discussion
5:30 – 6:30 PM	Reception

### **Thursday, September 3, 2015 Rudder Tower, Room 301**

1:30 PM	Welcome and Introductions
2:00 – 5:00 PM	Genomic Selection Speakers
5:00 PM	Discussion
5:30 – 6:30 PM	Reception

### **Friday, September 11, 2015 The AgriLife Center**

9:30 AM	Mark Cooper
10:30 AM	Coffee and Social

## Contact Information

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## Sponsored By



# Genome Editing Workshop

**Monday, September 28, 2015**  
**8:00 AM – 1:00 PM**  
**The AgriLife Center**  
**1538 John Kimbrough Blvd.**

*Texas A&M University, College Station, Texas*

**Featuring Dr. Daniel Voytas – Professor, Director of the Center for  
Genome Engineering, University of Minnesota**

Overview of Dr. Daniel Voytas' Research  
(from <http://www.cbs.umn.edu/research/research-cbs/faculty-labs/voytas>)

The ability to modify the genome of an organism at a specific locus is an invaluable research tool and has the potential to be an amazing therapeutic tool. The Voytas Lab specializes in two types proteins that allow this kind of genome modification: Zinc Finger Nucleases (ZFNs) and Transcription Activator-Like Effector Nucleases (TALENs).

The work of the Voytas Lab focuses on the goal of modifying plant genomes for basic research and for crop improvement. Toward this goal, we work with cassava, arabidopsis thaliana, rice, tobacco, soybean, and maize with the help of many collaborators. In addition, the Voytas Lab is involved in many projects in animal systems whose goals include curing lethal genetic diseases in humans and investigating the role of specific genes in addiction. These projects in animals are only possible with the help of close collaborators.

**No Registration Cost**  
**Sponsored by the College of Agriculture and Life Sciences, Grand Challenges  
Initiative – Feeding Our World**



For more information, contact LeAnn Hague  
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