TEXAS A&M AGRILIFE RESEARCH | EXTENSION

TEXAS A&M UNIVERSITY

TEXAS A&M PLANT BREEDING BULLETIN

October 2015

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

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

A group of 54 graduate students, faculty, and staff enjoyed a trip to RiceTec Inc. in Alvin Texas on 27 August. The group was hosted by Drs. Roy Martens and Jose Re. The morning was filled with presentations from Roy, Jose, Jianlin Wang, Rusty Bautista, and Danny Stowers. Field, lab, and greenhouse facilities tours completed the day after lunch.

Dr. Mike Thomson, Professor and Beachell Chair in International Rice in Soil and Crop Sciences, commented: "RiceTec is running a very successful hybrid rice breeding program and this trip was a fantastic opportunity for the students to see how modern plant

breeding technologies are being used in the private sector. I've found that interaction between public and private sector breeding programs can be very productive, as both groups are working towards the same goal of benefiting crop producers and consumers and there's a lot to be gained from sharing ideas in both directions. I was also impressed by the energy and enthusiasm of the graduate students who joined the trip."

RiceTec began their effort to develop hybrid rice for the U.S. market in 1988 and released their first commercial hybrid, XL6, in 2000. Today RiceTec hybrids are grown on approximately 50% of the U.S. acreage. Their hybrids are known for their high yield potential, disease resistance, and competitive head rice yield.

Roy Martens presented information about Rice Tec's plant physiology work that deals with such issues as panicle size, seed size, and the agronomics of hybrid rice production. Roy discussed kernel size uniformity, research with the number of kernels per panicle, and production practice modification to optimize the yield potential of RiceTec hybrids. A systems approach called Smartrice^{Tm} has been developed that seeks to reduce water requirement and enhance disease control in rice. Roy noted that there are no GMO hybrids in their program but that they do work with a naturally occurring mutant herbicide resistance trait known as IMI or Clearfield.

Jose Re and Jianlin Wang visited with the group about breeding and genetics at RiceTec, beginning with the unique male sterility systems in rice, Photosensitive Genetic Male Sterility (PGMS) and Temperature Genetic Male Sterility (TGMS). These are often referred to as PTGMS and a system utilizing temperature was demonstrated during one of the afternoon tours. Jose shared that RiceTec attempts to start the hybrid evaluation process each year with approximately 1000 new hybrids tested at two locations. About 400 of these are advanced to Stage 2 and are performance evaluated a second year at four locations. Stage 3 hybrids, about 100, are tested at 20 sites and the final stage the following year involves about 10 hybrids tested at 20 + sites. If all goes well, two or three experimental hybrids survives this 4-year testing cycle and moves to producer field evaluations at 60 or more locations across the Gulf Coast and Midsouth regions. One of the

unique aspects of RiceTec's program that we were not able to see because of the time of year was the use of helicopters to effect pollen movement from the male inbred line to the female inbred line for the development of F1 hybrid seed.

Rusty Bautista then visited with the group about grain quality and the engineering aspects of maintaining quality. Grain quality in rice, as most crops, depends on the final consumer. If the consumer is the American dinner table, then quality means whole or near whole kernels, whether white rice or brown rice. If the consumer is the beer industry, then grain size is irrelevant to the final product. The same can be said for some other products such as baby foods or soups. Rusty informed the group about head rice, which essentially is unbroken milled rice kernels and for which the producer receives the highest financial return, and the care that rice mills exhibit to insure maximum head rice production is obtained.

Danny Stowers from their HR department noted that RiceTec was interested in undergraduate internship students and partnering with Texas A&M relative to short term graduate internships. RiceTec has undergraduate internships in 10 areas, from breeding to HR.

The group was treated to several tours after lunch, including field, lab, greenhouse, and other facilities such as gene bank storage. The tours were informative, well planned, and the students, as well as faculty and staff, were impressed with the quality and breadth of research conducted at RiceTec.

Nolan Bentley, a plant breeding graduate student in Horticulture, noted "My research project is the development of genomic tools for use in breeding programs. It was a good experience to see which and how these tools are implemented in a commercial breeding program. My favorite part was seeing their instrumentation dealing with molecular markers, as it validated the methods I currently use."

I want to express my thanks and appreciation to Brian Pfeiffer and Laura Masor for providing leadership and making this trip a success. Appreciation is also noted for Amanda Ray, Administrative Assistant in the Teaching Office, for her efforts as well in planning and logistics. We are indebted to Roy Martens and Jose Re for their encouragement and willingness to host the group, as well as to the many others at RiceTec who took time from

their busy schedules to share their knowledge and experience with us. We hope that this was the first of many such excursions to RiceTec.

Distance Plant Breeding Program and Continuing Education courses available for Fall 2015. Courses for Spring 2016 will be listed in the November Plant Breeding Bulletin and online at https://scsdistance.tamu.edu/available-courses/.

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, comparisions 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

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 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.