TEXAS A&M PLANT BREEDING BULLETIN

November 2014

Our Mission: **Educate and develop Plant Breeders worldwide**
Our Vision: **Alleviate hunger and poverty through genetic improvement of plants**

Our plant breeding graduates are in demand worldwide so I asked two of our recent graduates who have accepted employment outside of the United States to provide a little insight into their transition. Both George (Trey) Cutts and Eng Hwa Ng recently completed their PhD degrees in our cotton breeding programs. Trey currently is a corn breeder with the Water Efficient Maize for Africa (WEMA) program sponsored by Monsanto, Gates Foundation, CIMMYT, the African Agricultural Technology Foundation, and the African National Agricultural Research System. Eng accepted employment as a rice breeder with Pioneer and is located Los Banos, Philippines. I asked both to relate their first year experiences.

George (Trey) Cutts:

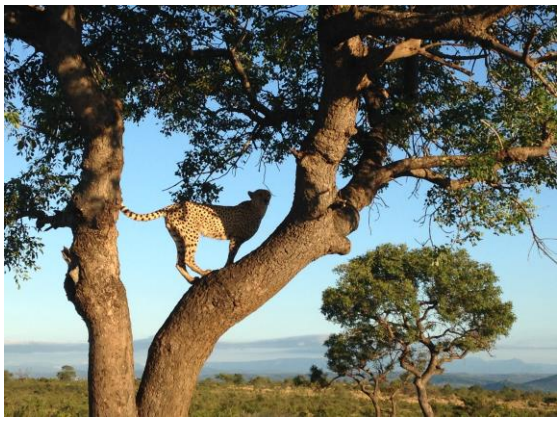
"When looking for a PhD program in 2010, I wanted a program that would strike a balance between academia and applied commercial type plant breeding, and also foster opportunities in international agriculture. That balance was found in the Plant Breeding program at Texas A&M. Conducting research in the Cotton Improvement Program under the direction of Dr. Jane Dever in Lubbock and completing graduate courses on campus in College Station under the guidance of Dr. Wayne Smith created the link between strong theory and practical application. But a very special part of my graduate tenure was the opportunities I had to visit CIMMYT in El Batán, Mexico and IRRI in Los Baños, Philippines. The need, and also the excitement, of international agricultural work created a new passion for me. I little

expected my first role to combine my desire to pursue a career in industry with making a difference in international agricultural development.

During the final stages of my degree at Texas A&M, I accepted a role based in South Africa with Monsanto as a corn breeder under the Water Efficient Maize for Africa (WEMA) project initiative. WEMA is a public-private partnership between Monsanto, The Gates Foundation, CIMMYT, the African Agricultural Technology Foundation (AATF), and the African National Agricultural Research Systems (NARS). The project aims to improve food security and rural livelihoods among smallholder farmers in Africa by developing drought-tolerant maize hybrids. Our charge is to combine conventional breeding and advanced biotechnology to deliver maize hybrids adapted to Africa that are insect-pest resistant and have added performance under drought conditions. Research is conducted in the five WEMA partner countries of South Africa, Mozambique, Tanzania, Uganda, and Kenya. My breeding role involves developing improved maize lines and hybrids with added drought-tolerance as well as overseeing hybrid testing in Southern and East Africa. With the recent rise of Maize Lethal Necrosis (MLN) in East Africa, our team has taken a sharp focus on this disease in our breeding efforts as well. A week after defending my dissertation in September 2013, I moved to the surrounds of Pretoria, South Africa and am now one year into the job.

One of my first impressions of working in an industry breeding program is the difference in speed and volume from an academic program. Whereas in graduate research there is time to contemplate and philosophize about nuances in data, in industry analysis and decisions are done at the speed of light. The tools that are available to aid in this are very exciting. Working internationally in multiple countries, the travel has also been a lifestyle change. WEMA has five countries under its geography that spans almost 3,000 miles. It has given me some excellent views. While walking plots (and not being able to take my eyes off the corn of course), I've been able to glance up at the receding glaciers of Kilimanjaro, watch sail boat fisherman on the shores of Lake Victoria, or hear village kids sing and enjoy life while their mothers labor in the fields.

Occasionally we have to keep baboons and a hippo or two out of our trials. Thank goodness I was taught the value of good experimental design at A&M, although I didn't foresee those challenges at the time. Safety is key to our culture at Monsanto, so when taking notes in Black Mamba country, snake protection is now part of my standard nursery gear.



Besides learning a new system, how to effectively manage people, and the logistics of moving seed internationally, the unique partnerships that are integral in WEMA may be responsible for my largest growth. Working with breeders in CIMMYT and in partner countries across many cultures has really broadened and deepened my view on what agriculture and plant breeding mean to the world. I have been awed by the passion in Africa for plant breeding and the endless work they do to feed a starving continent that is expected to grow to 4 billion people by the end of this century. I'm humbled to have the opportunity to be a part of it.

Eng Hwa Ng:

Eng received his Ph.D. in Plant Breeding from Texas A&M in August of 2013 and I had the pleasure of chairing his graduate committee and directing his program. Although a native of Malaysia, he received all three of his degrees from U.S. universities. Post-PhD graduation, Eng decided to pursue a career in international agriculture and currently is employed as a research scientist in the hybrid rice breeding program with Pioneer Hi-Bred in The Philippines.

According to Eng, relocating to the Philippines was a huge decision. "The hardest decision was to part with all the people whom I've known over the past ten years in the United States and venturing into a foreign country with little to no knowledge of the local environment. However, I decided to take the challenge when the opportunity presented itself as I realized that the need for improvements in agriculture in developing countries has never been greater. Rice, being a staple in many parts of the world, is in serious demand for greater research focus and breeding effort in order to meet the global demand. It has been a challenging few months for me trying to get settled in the Philippines but the experience was rather rewarding and humbling. The future for hybrid rice in this part of the world is tremendous but requires a lot of work, and I am glad to be a part of it. Texas A&M was instrumental in preparing me for this and I would like to take this opportunity to thank all my graduate committee, Dr. Smith, Dr. Hague, Dr. Cothren, and Dr. Hequet as well as former colleagues at the Cotton Improvement Lab, especially Dawn Deno."

I asked Dr. Ng to respond to some specific questions to provide current graduate students receiving this Bulletin with some additional insights into international transition.

Question: How did the company help or prepare you for the move?
Answer: Pioneer provided all of the relocation expenses, tax lawyer, immigration lawyer for my visa, assistant to look for local housing, language training (although I did not take it since everyone here speaks English), and orientation about pioneer in general and put me in touch with a lot of support personnel in Johnston (Iowa) prior to relocation.

Question: What has been your biggest challenge in learning the job?
Answer: My biggest challenge was that rice was completely new to me. Farming remains primarily self-subsistent here with little automation, even for research. However, the underlying foundation of hybrid breeding remains largely the same.

Question: How much travel do you do?
Answer: I do travel quite a bit since The Philippines is an archipelago; during the harvest season I may travel for weeks at a time.

Question: What are your objectives as a rice breeder? yield, quality, everything?
Answer: Yield is the main focus, but bacterial leaf blight, blast and tungro virus are important as well. Eating quality is part of the consideration because every region in Asia has its preferred grain type. Hybrid rice adoption for farmers differ widely as

some are still not accepting of paying for hybrid seeds. Because hybrid rice is a new crop for Pioneer, my focus here is mainly on conducting experiments on how we can breed hybrid rice more efficiently, i.e., understand GxE, heterosis levels, process improvement, use of marker technology, etc.

Question: Would you advise other Ph.D. plant breeding graduates at A&M to pursue international ag careers?
Answer: Absolutely, just applying simple practices that I learned during my time at A&M actually have a huge impact factor here. And it's rewarding to see improvements in a short amount of time despite facing all the logistical challenges.

Question: Does your station have Ph.D. scientists (or BS/MS) who are agronomists or soil scientists?
Answer: There are two Ph.D. scientists here, including myself, and six M.S. graduates holding Senior Research Associate or Research Associate positions.

Question: What about the amenities of life in the area where you live?
Answer: Amenities are adequate here in Los Banos, especially being right next to IRRI. Manila is 60 km away and it's a metropolis with almost 20 million people.

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/**):**

Basic Plant Breeding - Full Course (3 Units) - Cost - $679.65
January 20-May 13, 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.

Analysis of Complex Genomes – Full Course (3 Units) – Cost - $679.65
Genome structure, organization and function of model organisms and higher eukaryotes; theory and methodology of genetic and physical mapping, comparative genomics, sequencing, sequence analysis and annotation; emphasis on understanding the function of complex genomes, genome-wide expression analysis, genetic and epigenetic mechanisms; X-inactivation, imprinting, gene silencing, transposons, genome duplication and evaluation. Requires an in-depth and working knowledge of basic and advanced plant breeding concepts.

Unit 1 – DNA Marker Technology and Genetic Mapping *Cost - $226.55*
January 20 – February 20, 2015

Unit 2 – Recombinant DNA and Cloning *Cost - $226.55*
February 23 – April 3, 2015

Unit 3 – Sequencing Genomes and Other Genomic Tools *Cost - $226.55*
April 6 – May 13, 2015

Quantitative Genetics and Plant Breeding - Full Course (3 Units) - Cost - $679.65
Applied aspects of quantitative genetics in plant breeding; examination of methodologies to analyze quantitative variation in crop species; genetic phenomena (inbreeding, heterosis and epistasis); quantitative trait loci (QTL) mapping and marker-assisted selection (MAS); genotype by environment interaction, heritability multiple traits and selection theory with implications in plant breeding. Requires an in-depth and working knowledge of basic and advanced plant breeding concepts.

Intellectual Properties in the Plant Sciences - Full Course (3 Units) - Cost - $679.65
January 20-May 13, 2015
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*
January 20 – February 20, 2015
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*
February 23 – April 3, 2015
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*
April 6 – May 13, 2015
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.

Introduction to Host Plant Resistance (1 Units) - Cost - $226.55
January 20 – February 20, 2015
Host plant resistance programs from the standpoint of the plant breeder.

Other Continuing Education courses in plant breeding and related disciplines that will be available in the Fall 2015 and later 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.