TEXAS A&M PLANT BREEDING BULLETIN

March 2015

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

LeAnn Hague, Distance Education Coordinator, developed the following poster information that highlights four of our distance plant breeding students. One of the students is a full time employee of Texas AgriLife Research located in Stephenville, TX, one is a full time employee with the Missouri Agriculture Experiment Station in Portageville, MO, Vishal Saitwal is a breeder in India, and Koti Konda also is a breeder in India. I think that you will enjoy reading about these outstanding students who have the opportunity to achieve their professional goals because of our Distance Plant Breeding Program.

POSTER: Plant Breeding Distance Education: Worldwide Research Degrees

As the global population increases, providing food, fiber, fuel, greenspace, and housing to meet growing demand has become a significant challenge. The Department of Soil and Crop Sciences and the Department of Horticultural Sciences at Texas A&M University are committed to meeting this challenge by training future plant breeders. These efforts have been expanded through a Distance Education Program in Plant Breeding offering a wide range of opportunities for students located around the world. The plant breeding distance education program offers online Masters and Ph.D. degrees in Plant Breeding as well as a robust continuing education program for agriculture professionals seeking further plant breeding education but who are not interested in a degree program. The degree programs are unique in that distance students conduct thesis and dissertation research at their location under the supervision of a distance co-chair, while drawing on the expertise of TAMU plant breeding faculty as their on-campus co-chair and committee members. This program is modeled from the successful record these departments have of training graduate students located across the state at Texas AgriLife Research and Extension Centers and opens up an array of opportunities for distance students to tailor their educational experience to be fully online or to include time on campus.

Program Features: [1] MS Non-Thesis Option, MS Thesis Option, and Ph.D. degrees available, [2] Thesis and dissertation research conducted at student's location under supervision of distance co-chair, [3] Twelve courses in plant breeding or related plant sciences offered fully online by the Soil and Crop Sciences Department, [3] Additional online courses available through other TAMU departments, [4] 100% distance program with additional opportunities for students to spend time on campus, [5] Online continuing education courses available for plant breeding professionals not seeking a degree.

Matthew Rhine
Distance PHD Student
Malden, Missouri

Committee Chair: Dr. Wayne Smith; Professor and Associate Head, Cotton Breeder, Department of Soil and Crop Sciences, Texas A&M University

Distance Co-Chair: Dr. Grover Shannon; Professor and Soybean Breeder, University of Missouri – Delta Center

Dissertation Project: Improvement of soybean breeding across various soil types.

Project Impact: The aim of this project is to give breeders a better idea of which genetic traits should be tailored to specific soil types and which traits translate across environments. Selections are being made from several breeding populations and replicated across three soil types. Identification of Genetic x Environment (soil type) interactions could impact production practices on millions of acres in the U.S. for this major agricultural commodity.

Student Profile: Matthew is Research Associate at the University of Missouri Fisher Delta Research Center working on the improvement of cropping systems such as rice, corn, soybeans, wheat, sorghum, and cotton. He had been looking for a way to get a Ph.D. in plant breeding for several years before joining the distance program in 2013. However, working full time and having a family made it tough to find a program that would fit his needs. Matthew says that his local co-chair keeps his research flowing smoothly while he has regular Skype and phone conferences with his on-campus committee to make sure everyone is on board with the research being conducted. He has taken advantage of time at annual professional meetings to meet with his on-campus committee in person to discuss research and coursework. According to Matthew, the program is a "perfect fit" for his situation. He would like to transition from general crop research into a crop specific breeding program once his degree is complete.

Vishal Saitwal
Distance PHD Student
Aurangabad, India

Committee Chair: Dr. Wayne Smith; Professor and Associate Head, Cotton Breeder, Department of Soil and Crop Sciences, Texas A&M University

Distance Co-Chair: Dr. R.S. Mahala, Research Director at Dupont Pioneer

Dissertation Project: Genotypic and phenotypic potential for F_1 growth habit in upland cotton for mechanized harvest

Project Impact: India is the second leading country in upland cotton production but its yield per unit land area is well below the global average. India is the only country where the vast majority of its production is from hybrid seeds and almost 100% of its massive crop is hand harvested. As India's cotton production becomes more mechanized, breeders must radically modify the plant's phenology from a tall, spreading plant suited for multiple hand harvests per year to a compact, highly productive plant type suited to machine harvest. Vishal's work will be cutting edge in identifying germplasm pools with appropriate genetic combining ability for this transformation. His efforts in genotyping the plant material used in his study will provide the foundation for genomic selection for the needed traits as India continues its quest for improved yields per acre and to free additional land for food production.

Unique Program Attributes: Vishal's experience illustrates the flexibility of the plant breeding distance program to provide opportunities for custom designed educational programs that meet a wide range of needs. He spent three semesters on campus and returned to India at the end of the Fall 2014 semester to complete his program via distance education and resume his employment with DuPont Pioneer. Part of his research will be conducted in the U.S. and part in India. Vishal said, "It was a wonderful experience to be on campus to attend courses by eminent professors, discuss assignments with colleagues, have first hand experience of field trials, and attend national level professional meetings. It

has definitely helped me to understand recent advancements in plant breeding, develop contacts, and share my own experiences."

Student Profile: Before joining the Ph.D. program at Texas A&M, Vishal worked as a Cotton Research Associate at Dupont Pioneer for five years. He was involved in a breeding program focusing on high yielding varieties of Bt cotton. He resumed his employment with Dupont Pioneer upon his return to India. The long term goal is to develop Vishal as a Team Leader so he can contribute to the expanding cotton breeding program through the technical knowledge he will gain during his Ph.D. studies at TAMU.

Johnny Cason
Distance PHD Student
Stephenville, Texas

Committee Chair: Dr. Bill Rooney; Professor and Sorghum Breeder, Department of Soil and Crop Sciences, Texas A&M University

Distance Co-Chair: Dr. Charles Simpson; Professor Emeritus, Texas Agrilife Research

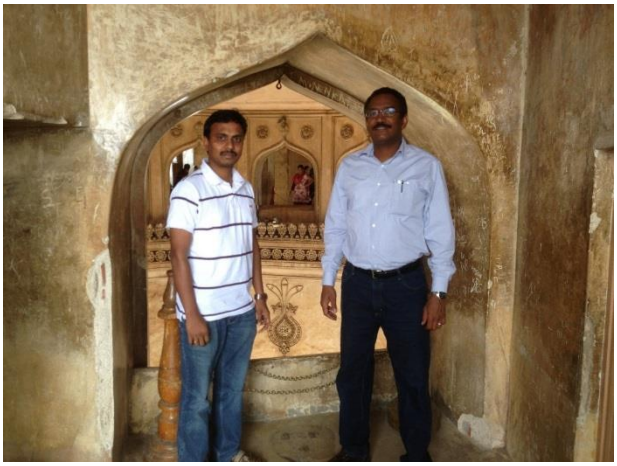
Dissertation Project: Identification of drought tolerant species in the Peanut Germplasm Collection and development of an introgression pathway to move genes from the identified species to the cultivated

Project Impact: Johnny Cason has been a valuable component of the wild peanut collection during the career of Dr. Charles Simpson at the Texas A&M Research and Extension Center in Stephenville, TX. Johnny has experienced first hand that the collection of wild, uncultivated and economically unproductive peanut plants from the Center of Diversity of this crop in Brazil can lead to cultivars with added valuable traits. Texas A&M AgriLife Research produced the first

nematode resistant cultivar ever developed globally by crossing commercial type peanut with one of these wild, unproductive accessions. Johnny's efforts in identifying drought tolerance in the Peanut Germplasm Collection could mean that Texas peanut producers could one day produce more peanuts with less supplemental irrigation, conserving millions of gallons of fresh water for future use in agricultural production for human needs as well as freeing millions of gallons of fresh water for human use.

Student Profile: As a Research Associate with Texas A&M AgriLife Research in Stephenville, Johnny is involved with the Peanut Breeding Program at the research center. He assists with the current Texas A&M peanut variety development program through planting, data collection, care, maintenance and harvest of statewide variety trials. Pursuing his Ph.D. is part of his professional development that he hopes will provide opportunities for advancement. He would like to continue to use the germplasm collection to introgress traits from wild peanut species into the cultivated peanut and to stay involved with peanut variety development.

Koti Konda
Distance PHD Student
Hyderabad, India



Committee Chair: Dr. Amir Ibrahim; Professor and Wheat Breeder, Department of Soil and Crop Sciences, Texas A&M University

Distance Co-Chair: Dr. Yog Raj; Rice Breeder, Bayer CropScience

Dissertation Project: Genetic analysis of Indica Rice (*Oryza sativa, L.*) genotypes for hybrid (F_1) seed production traits and Brown Plant Hopper (BPH) resistance to identify commercially viable restorer parental lines.

Project Impact: Brown Plant Hopper is a devastating pest in rice, and it can be difficult to control under heavy infestation. Host plant resistance to this pest could result in improved integrated pest management strategies in India and other countries where rice is a primary food source for millions. Furthermore, this project aims to identify suitable genetics to produce hybrid seed under ever changing environmental conditions by ensuring stable

planting seed quality that will impact total production of this major food source across the globe.

Student Profile: Koti is a Rice Discovery Breeder at Bayer CropScience in India. He leads rice native trait discovery breeding projects, develops and implements breeding processes using molecular markers, and is responsible for rice germplasm enhancement for hybrid parental line development. Koti enrolled in the distance program because it allowed him to remain employed while completing an advanced degree. All research field trials are being conducted in India and genotyping data are generated in Gent, Belgium at the centralized Bayer CropScience Facilities.

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 May through December are (https://scsdistance.tamu.edu/purchase/):

Continuing Education Available Courses
Summer Courses: May 18 – August 28, 2015

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

- High speed internet connection and updated browsers, including Internet Explorer and either Chrome of 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

Summer 2015

Plant Breeding Fundamentals – Full Course (3 Units) – 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

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*
May 18 – June 19, 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*
June 22- July 24, 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*
July 27 - August 28, 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.

Continuing Education Available Courses
Fall Courses: August 31 – December 18, 2015

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

- High speed internet connection and updated browsers, including Internet Explorer and either Chrome of 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 2015

Plant Breeding Fundamentals – Full Course (3 Units) – 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, 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

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). Topic 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 grown, 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, NO-3 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.

For more information about these and other available courses 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.