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Project Title: Plant Genetic Resources Conservation and Utilization

Period Covered: 08/2009 through 8/2010

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Annual Meeting Dates: July 27, 2010

Participants: www.ars.usda.gov/Main/docs.htm?docid=9514

Minutes: www.ars.usda.gov/Main/docs.htm?docid=9514

Accomplishments and Impacts:

USDA – Plant Genetic Resources Conservation Unit

Plant genetic resources collected or obtained from throughout the world are valuable sources of genetic diversity for use in agronomic and horticultural crop improvement programs in the U.S. This project forms part of a comprehensive nationwide program, National Plant Germplasm System, to preserve plant genetic resources for use today and for use by future generations. The primary objectives of this project are 1). To conserve genetic resources and associated information for a broad spectrum of crops and related species; 2). To develop and apply new or improved evaluation procedures and marker-based approaches to assess diversity of genetic resources in the collections and evaluate materials for useful traits; and 3). To transfer technology to researchers and plant breeders in the Southern Region and worldwide in the form of plant genetic resources and associated information. Seed and clonal genetic resources acquired, maintained, characterized, evaluated, documented, and distributed by this project will provide researchers with a broad range of clearly-identified crop genetic diversity to utilize. This broad genetic diversity enables research programs to efficiently produce new cultivars, develop new knowledge, discover value-added uses, and preserve food security for the general public.

The germplasm collection at Griffin, Georgia has increased to 90,668 accessions of 255 genera and 1,546 species. In 2009, a total of 40,449 seed, tissue culture, and clonal accessions were distributed to researchers and educators at universities, private companies, agricultural and medical research foundations, seed conservatories, federal agencies, farmer-owned cooperatives, and foreign universities and companies. All accessions were requested from the Griffin location directly by researchers and distributed in 899 orders to users in all 50 states and 38 foreign countries. Genetic resources maintained at the Griffin location are in great demand by the research community and provide a valuable resource for crop improvement research. The quantity and quality of plant genetic resources maintained at Griffin makes this location one of the leaders in the National Plant Germplasm System.

Biosecurity and availability of plant genetic resources are of major concern to the U.S. agricultural research community. Backing up germplasm by maintaining accessions at two sites reduces the risk of losing valuable germplasm. In the last year, 96.3% of the collection is backed up at the National Center for Genetic Resource Preservation, Ft. Collins, CO and 87.9% of the accessions are available for use by the research community. Backing up safely secures these

plant genetic resources for future use by researchers and good availability provides users with a wide array of currently available germplasm.

Vigna:

Gary Pederson, Plant Genetic Resources Conservation Unit, served as acting Vigna curator. Cowpea regeneration was conducted in the field and greenhouse by James Chalkley in 2009. A total of 40 lines were increased in the greenhouse in Griffin, 47 lines were increased in the field, and 52 lines were increased in Puerto Rico. Digital images of seeds and flowers were taken on regeneration plants. These images are posted on GRIN for use by breeders and other researchers.

Peanut:

Seed increases were obtained for 275 cultivated peanut accessions by Roy Pittman, Plant Genetic Resources Conservation Unit, grown for regeneration at three locations in Georgia and Florida. Over 370 clonal peanut accessions were maintained in the greenhouse. A genotyping assay using a real-time polymerase chain reaction was developed to detect alleles relating to the high oleic acid trait in peanuts. This assay enables breeders to test seed or leaf tissue in initial crosses without using chemical analysis of ground up seeds. Development of this rapid assay will help identify key genotypes linked to important agronomic traits, improve breeding efficiency by eliminating undesirable plants, and expedite the process of developing improved peanut cultivars by decreasing the time and effort to characterize all of the generated progeny.

Grasses:

The warm-season grass germplasm collection was improved over the past year by Melanie Harrison-Dunn, Plant Genetic Resources Conservation Unit mainly through acquisition, regeneration, and characterization efforts. A total of 46 switchgrass (*Panicum virgatum*) accessions were collected from 19 counties in northern Florida in September 2009. Newly collected switchgrass accessions were tested for germination, regenerated, characterized genotypically using simple sequence repeat (SSR) markers, and ploidy levels. This effort will provide well characterized lowland switchgrass germplasm to plant breeders for incorporation into bioenergy feedstock development programs furthering the endeavor towards U.S. energy independence.

A total of 103 accessions representing 56 species of warm-season grasses were successfully regenerated. Descriptor data was collected and uploaded to GRIN for 96 accessions of bamboo for nine descriptors. Flower image data was collected and added to GRIN for the warm-season grass clonal collection including bermuda, centipede, St. Augustine, seashore paspalum and zoysia grasses. The clonal collection of 398 accessions was maintained and ten accessions transferred to tissue culture.

Clovers, New Crops, Misc. Legumes, and Misc. Crops:

A total of 346 misc. legumes, new crops, and other misc. crops were regenerated at Griffin by Brad Morris, Plant Genetic Resources Conservation Unit. A total of 15 self-pollinated and 10 cross-pollinated annual clover accessions were regenerated in the field in Byron, GA, and 17 self-pollinated annual clover accessions were regeneration in the greenhouse by Gary Pederson, Plant Genetic Resources Conservation Unit.

Optimum regeneration techniques are unknown for several legume species. Improved regeneration techniques were developed for two legume species. Twelve photoperiod sensitive *Hibiscus sabdariffa* accessions were successfully regenerated in a greenhouse during the offseason (November – June). Six perennial *Bituminaria bituminosa* accessions overwintered and produced quality fruits and seed during the second year of growth. Quality seed of these legumes are now available for scientists to use in their research projects.

Little information is available regarding fatty acid variability in the U.S. *Lablab purpureus* collection. Significant variation for several fatty acids was found in seven *Lablab purpureus* accessions. These accessions can now be used by breeders and scientists in the development of new products containing these fatty acids.

Cellulosic ethanol is expected to play a large role in biofuels, however cellulose and biomass variation is unknown among the U.S. sunn hemp (*Crotalaria juncea*) collection. Glucose is a primary constituent in cellulose and was found to vary among these 16 sunn hemp accessions. Significant variation was observed among accessions for biomass, apical dominance, branching, open flowers, plant height, earliness, and seed production. Several sunn hemp accessions were identified as parental species for use in breeding programs for cultivar development.

Sorghum:

Regeneration of sorghum accessions in St. Croix and Puerto Rico continued in coordination with the sorghum curator, John Erpelding. In March 2010, John took a new job with ARS in Stoneville, MS. Gary Pederson is currently serving as acting sorghum curator and regeneration of sorghum accessions in St. Croix is continuing with ARS cooperators there. A total of 1,456 accessions were sent to St. Croix for regeneration in 2009 and seed from regenerations of 1,429 accessions has been sent to Griffin. John Erpelding also received 224 quarantine sorghum accessions for regeneration and returned seed of 169 accessions to Griffin. In addition, other sorghum seed from past regenerations that had been maintained in Puerto Rico was shipped to Griffin for incorporation into the sorghum germplasm collection.

Vegetable Crops:

Bob Jarret, Plant Genetic Resources Conservation Unit, regenerated 70 accessions of the *Capsicum* spp. (chile pepper) germplasm collection in the field and greenhouse, and characterized an additional 300 accessions grown in the field. Also, 8 accessions of cucurbits were regenerated. More than 750 accessions of sweetpotato were maintained in tissue culture.

The sensory attributes (chemical composition) of vegetables can be an important factor in determining consumer acceptance and demand. The occurrence and concentration of capsaicin and capsiate in Capsicum spp. was determined. Capsaicin confers the pungency (heat) associated with hot peppers and capsiate is a related compound. The levels of capsaicin and capsiate ranged from 0 (not present) to >1500 ug and >600 ug/g FW, respectively. Capsiate was present in most of the tested chile pepper accessions. This information will be of benefit to those developing pepper lines or varieties enhanced for either of these compounds.

Molecular and Analytical Evaluations:

Ming Li Wang, Noelle Barkley, and others, Plant Genetic Resources Conservation Unit, developed a genotyping assay using a real-time polymerase chain reaction to detect alleles relating to the high oleic acid trait in peanuts. This assay enables breeders to test seed or leaf

tissue in initial crosses without using chemical analysis of ground up seeds. Development of this rapid assay will help identify key genotypes linked to important agronomic traits, improve breeding efficiency by eliminating undesirable plants, and expedite the process of developing improved peanut cultivars by decreasing the time and effort to characterize all of the generated progeny.

In collaboration with National Peanut Research Laboratory (USDA-ARS), a total of 84 DNA markers have been used for genotyping the U.S. peanut mini-core collection. Seeds from two years of the mini-core collection have been analyzed for flavonoids, resveratrol, fatty acids and oil content. Data for morphological traits (including disease resistance, botanical descriptors and pod-market type) have been collected for two years. The data for association analysis is in progress and results will be reported.

Okra (*Abelmoschus* spp.) is an oil seed crop that is known to produce oil yields with chemical properties similar to those of cotton seed. More than 1,200 accessions of various okra species were evaluated for total oil content using nuclear magnetic resonance (NMR). Data indicated that total oil content varied from approximately 4% to >21% and that it was loosely correlated with seed weight. This information will enable researchers to select okra accessions with potential for use as an oil seed crop.

Oil content for biodiesel production among the castor bean accessions in the U.S. collection is unknown. Significant variation in oil content (ranging from 37 to 61%) was found in 1,033 castor bean accessions. Selected castor bean accessions with high oil content can now be used in variety development for use as a biodiesel crop.

Germplasm Maintenance:

Prior to 2002, seed samples of over 84,000 accessions of plant genetic resources maintained at the Griffin location had not been tested for germination and the quality of seed distributed to researchers was not known. A concentrated effort was made to conduct germination tests on this large collection. Currently germination tests have been completed for over 60,000 accessions including almost all accessions of pepper, watermelon, eggplant, mung bean, sesame, pearl millet, and castor bean and 41-84% of all accessions of sorghum, okra, annual clovers, peanuts, and misc. legumes. This germination testing enables curators to properly identify accessions with poor quality seed that need to be regenerated resulting in better quality seed being distributed to researchers upon request.

In 2009, a total of 3,125 accessions were sent for safety back up to Ft. Collins and 1,130 accessions were sent to the new global safety backup vaults at Svalbard, Norway. Several repatriation requests were sent in 2009 including 1,247 accessions to the National Seed Bank of Mexico; 95 *Vigna* accessions to the National Institute of Agriculture Biotechnology, South Korea; and 50 *Trifolium* spp. accessions to Tunisia. The program continued to split seed samples of all accessions at Griffin with a small distribution sample maintained at 5 C and the bulk of each sample maintained at -18 C to maximize seed longevity. Currently, over 70% (over 62,500 accessions) of the entire collection has at least one sample in -18 C storage.

Alabama

Legumes: Forage and Cover Crops

Current work focuses on evaluation, utilization and breeding of sunn hemp and sericea lespedeza species. Sunn hemp germplasm is being used for development of cultivars for the continental

US. The objective is to develop cultivars that can be used as fodder and as cover crops. Sericea lespedeza is being evaluated for control of gastrointestinal parasites in ruminants and for condensed tannin content. A new low-growing sericea lespedeza will be evaluated for road-side use. Evaluations are being done in cooperation with colleagues at Auburn, GA, LA, AR, and USDA at several locations.

Upland cotton
Current work focuses on evaluation, utilization and breeding of upland cotton. Cotton accessions continue to be evaluated to resistance to reniform nematode, but we have not been able to find adequate resistance in materials we have evaluated. We also continue to evaluate accessions for resistance to heat and drought, and have begun the introgression of some putative heat tolerant accessions into adapted germplasm for further study. We are also conducting a study on the impact of exotic germplasm introgression on cotton yield and fiber quality traits.

Florida

The state of Florida remained active in 2009 for plant genetic resources distribution. According to records provided by S-9, 28 different individuals requested materials from 25 different genera of plants and a total of 510 unique PIs distributed. Affiliation of individuals obtaining materials included University of Florida scientists, USDA scientists, private research organizations, private citizens, and public schools. Most individuals who responded to a request for information indicated a high level of satisfaction with materials provided and appreciation for the availability of the germplasm. Listed below are reports submitted by cooperators.

Ms. Bunmi Aina, PhD graduate student, Department of Agronomy, Gainesville, who is working with Dr. Ken Quesenberry, provide this report on her use of wild perennial *Arachis* spp. During the past year we obtained seeds of following *Arachis paraguayensis* material from the Plant Genetics Resource Conservation Unit at Griffin, GA: PIs 262842, 468155, 468176, 468180, 468362, 468365, 468370, 604836, and 604837. We have successfully utilized this germplasm for developing in vitro tissue culture regeneration protocols, studying morphogenic pathways in *Arachis* species. Additionally, we were able to induce tetraploidy in diploid *Arachis papraguariensis* through the use of the antimitotic agent colchicine. The plantlets derived from the experiments were established on the field and are being evaluated for resistance to early and late leaf spot disease.

Dr. Ann Blount, NFREC, Marianna, FL provided this report regarding her use of plant genetic resources in the past year.
Bahiagrass evaluation: Bahiagrass (*Paspalum notatum*) germplasm evaluation continues in Florida with approximately 50 plant introductions from NPGS-GRIN, Australia, Uruguay and Argentina in multi-year and multi-location trials. Several species have been identified as having superior winter growth and better seasonal forage distribution compared to bahiagrass (i.e. *P. cromyorhizon, P. guaraniticum, P. nicorae*). Evaluation includes winter survival, frost tolerance, forage yield, forage quality, seasonal forage distribution, turf characteristics, seed production aspects, and persistence under clipping. NPGS-GRIN germplasm in this evaluation includes *P. nicorae* - PIs 202044, 209983, 276248, 276249, 283020, 284171, 304004, 310131, 404469, 404471, 404859, 462273, 477103, 490363, 490364, 508818, 508819, 508820, 508821; *P.*

quadrifarium - 404880, 404881, 404882, 462302, 462295, 462298, 508942, 508947; *P. guaraniticum* – 404449. Several plant introductions have persisted at droughty sites, particularly at Live Oak and Brooksville, FL. These lines have been planted at Marianna in plots to increase seed production for the next level of field trial evaluation.
Hemarthria evaluation: Plant introductions of *Hemarthria* were planted under non-irrigated conditions at the North Florida Research and Education Center at Marianna, FL and include: PIs 299039, 299993, 299994, 299995, 349750, 349751, 349752, 349754, 349796, 364861, 364863, 364865, 364868, 364869, 364871, 364874, 364875, 364876, 364877, 364878, 364881, 364882, 364884, 364885, 364890, 364891, 365145, 379613, 383331, 409751, 410128, 410129, 410131, 410132, 410133, 410134, 410137, 410138, 410139, 410140, 413186, 508606. BYDV has been documented on the limpograss PIs at the Marianna site.
Gamagrass evaluation: Twenty eight Florida gamagrass (*Tripsacum dactyloides*) selections collected by NRCS and forage breeders at University of Florida are under evaluation at the NFREC. These include NRCS nos. 9055975, 9056065, 9056073, 9059196, 9059199, 9059203, 9059215, 9059232,9059254, 9059267, 9059269, 9059272, 9059280, 9059281,9059282, 9059283, 9059285, 9059286, 9059287, 9059290, 9059294, 9059338, and NFREC ecotypes Joe Budd, Rancher, Pine Acres, Woodruff Dam, Marianna and Savannah. New NRCS gamagrass experimental lines were established at the NFREC-Marianna in 2008-2009 and seed increases of these have been made annually. Additionally, NRCS 9059266 was planted in 2009 and 2010 in seed increase plots at the NFREC-Marianna site.
Aristida stricta collection: A southeastern collection of wiregrass (GA, FL and AL) is being planted at the NFREC-Marianna as part of a cooperative arrangement with Northwest Water Management District-FL, NPGS-Griffin, NRCS-PMC-Brooksville and NFREC-Marianna to collect and evaluate populations of wiregrass and submit new germplasm to NPGS-GRIN.
Arachis glabrata evaluation: Approximately 100 perennial peanut PI cuttings were obtained from Roy Pittman, USDA-ARS at Griffin in 2009. These plant introductions were established in the field/greenhouse in 2009-2010. Evaluation of these PIs will include winter survival, frost tolerance, foliage yield, seasonal foliage growth, turf or forage classification, flowering aspects, shade tolerance, and persistence under clipping.

Mr. Scott Burns, graduate student in the Agronomy Department, working with Dr. Maria Gallo reports that he obtained the peanut cultivar JL-24 from the S-9 Griffin seed bank. This is an Indian cultivar not readily available in the U.S. He is increasing the seed for eventual use in Agrobacterium-mediated transformation experiments in common peanut.

Dr. Carlene Chase, Horticultural Science Department, provided this report on her use of sunn hemp (*Crotalaria juncea*). In spring 2008 a group consisting of researchers from the University of Florida in Gainesville, USDA-ARS in Griffin GA, and University of Puerto in Mayaguez began work on the Southern Region SARE grant “Selecting a Sunn Hemp Cover Crop Genotype for Weed Suppression and Seed Production - LS08-205”. Seed of 16 accessions were obtained from S-9 and grown at each location in 2008 and repeated in 2009. Limited adoption of sunn hemp as a cover crop in the U.S. is primarily due to the irregular supply and high cost of imported seed. Seed production in the continental United States would provide a more consistent supply of lower cost seed while also providing growers with a new seed crop. Improved availability and affordability of sunn hemp might encourage its utilization by growers in their cropping systems for weed and pest suppression, soil stability, and nitrogen and biomass

accumulation. The 16 accessions were evaluated in 2008 and 2009 at Rosie's Organic Farm in Gainesville, Florida to assess their vegetative and reproductive characteristics and potential for seed production in Florida. The experimental design was a split plot with planting dates (May, June, and July) assigned to the main plots, which were arranged in a randomized complete block design with four replications. The sixteen accessions were randomly assigned to the sub-plots. Data were collected on plant height, leaf area, number of leaves, number of branches, plant weights, days to first open flower, and seed production. Field observations suggested that accessions could be separated into two distinct groups based on size and daylength sensitivity. Analysis of the vegetative and reproductive data provided evidence for one group of short-day accessions and one group of day-neutral accessions. The short-day accessions were taller, with higher shoot biomass, later branching and flowering than the day-neutral accessions, and produced little or no seed. The day-neutral accessions flowered early and produced viable seed in summer. Of these accessions, PI 314239 and PI 322377 produced the most seed, demonstrating potential for use for seed production in Florida. These accessions had the lowest shoot biomass, making them less desirable as a cover crop. Future work will focus on developing day-neutral cultivars of sunn hemp that retain the cover crop attributes of the commercially available short-day sunn hemp varieties, but are capable of producing seed in Florida.

Dr. Fred Gmitter, citrus breeder, UF/IFAS, Citrus Research and Education Center, Lake Alfred, FL reports that he used pollen from several citrus breeding parents, provided by the NCGR for Citrus/Dates, Riverside, CA. These parents included tetraploid Hudson grapefruit and seedless Kishu mandarin. In addition, he also obtained seeds of a citrus relative, *Murraya paniculata*, for research to develop transformation techniques for Murraya to produce a potentially psyllid-deadly trap crop plant, in efforts to manage the citrus disease Huanglongbing.

Dr. Kevin Kenworthy, turf and forage breeder, Agronomy Department, Gainesville, provided this report. Common bermudagrass (*Cynodon dactylon* [L.] Pers.) germplasm accessions (PI numbers 289922, 290868, 290872, 290895, 291590) were evaluated in 2009 for their response to the sting nematode (*Belonolaimus longicaudatus*). The two PIs, 290868 and 290895, had the most favorable responses to the sting nematode when comparing root lengths between inoculated and uninoculated pots and the nematode counts in inoculated pots did not increase for the duration of the study (3 months) on these accessions. These results indicate that the nematodes had difficulty reproducing on these accessions. Investigations continue for two vegetative accessions of *Cynodon radiatus* (PIs 289613 and 292570) for their turf potential.
Dr. Ken Quesenberry, forage breeder, Agronomy Department, Gainesville, provided this report on use of plant genetic resources in his forage improvement program. We continue to evaluate the species *Arachis glabrata, A. paraguayensis, Hemarthria altissima, Trifolium pratense, T. repens*, and *Paspalum notatum*. During 2009, we initiated cultivar planting material increases of two *A. glabrata* germplasms (Arblick and Ecoturf - originally assigned PI numbers 262839 and PI 262840, respectively, but assigned new PI numbers 658528 and 658529, respectively upon formal germplasm release), and two *A. glabrata* cultivars (UF Tito and UF Peace – originally PIs 262826 and an accession that originally was labeled PI 262839, but then shown by molecular profile to be different and assigned the new PI number 658214 in the formal release document). Field evaluations of new *A. glabrata* introductions from Paraguay (GRIF numbers 15054, 15058, 15062, 15067, 15068, 15072, 15075, 15212, 15214, 15216, 15221, 15223, 15227 are in progress with first harvest season completed in 2009 and continuing in 2010. In 2009 the eight selected

superior F1 hybrids from *H. altissima* crosses of PI 299995 (Bigalta) and PI 364888 (Floralta) were planted vegetatively into an experiment to determine plant response to grazing defoliation. Grazing was initiated on this experiment in spring 2010. Our red clover improvement program released a new mid-dormant RKN resistant cultivar 'Barduro' that is in preliminary certified seed production with limited availability for producers in fall 2010. This cultivar was developed from an initial population consisting of 50% 'Southern Belle', 15% 'Kenstar', 15% 'Cinnamon', 15% 'Scarlet', 5% creeping rooted PI materials. A PVP application is being submitted and a PI number will be assigned. In white clover, certified seed of a new RKN resistant cultivar, Ocoee, should be available in fall 2010. In conjunction with Dr. Ann Blount, Riata, a new Pensacola type bahiagrass with improved late fall and early spring DM yields was released and certified seed is available in summer 2010. We are continuing evaluation of a group of new tetraploid apomictic bahiagrass hybrids produced by crosses with Argentine (PI 148996)and Tifton 7 as male parents and recent releases of sexual tetraploid germplasm (PIs 619631 and 619632) and sexual tetraploids produced from Tifton 9 as female parents. Preliminary results show superior early spring DM yields compared to Argentine. Evaluation of seed production potential suggests some problems with fungal contamination in the breeder seed increases.
Dr. Vance Whitaker, Assistant Professor and Strawberry breeder, UF/IFAS, Gulf Coast, REC, Wimauma, FL 33598, began his employment with Florida in 2009 and provided this report of his use of germplasm. In fall 2009 the UF IFAS strawberry breeding program obtained 38 wild strawberry accessions from the National Clonal Germplasm Repository (NCGR) in Corvallis, Oregon. These accessions of *Fragaria virginiana* and *Fragaria chiloensis* (the octoploid progenitors of cultivated strawberry, *Fragaria x ananassa*) had been collected in the wild from their native ranges across North and South America. Flowering patterns as well as plant and fruit characteristics were evaluated in the greenhouse. Some data on disease resistance and fruiting traits were already available from other breeding programs. These species are fully interfertile with each other and with cultivated strawberry, allowing us to construct crosses with the most promising clones. Progenies from these crosses will be evaluated in fall 2010.

Mr. Larry Yarger, Agricultural Consultant, ECHO, 17391 Durrance Road, North Ft. Myers, FL 33917 provided this report on international outreach use of germplasm by this NGO. Last fall (6/09) I requested 6 accessions of *Eleocharis dulcis*, Chinese water chestnut. These were refrigerated until May when they were planted out in demonstration and observation beds. Here at ECHO we are interested in learning what we can about nutritious crops of the world to be able to transfer such information to development practitioners working overseas. One area of interest is in perennial vegetables. *Eleocharis dulcis* has a number of benefits for tropical and subtropical farmers, and we were looking for accessions that might become germplasm for the occasional overseas request for such propagules. Moreover, *E. dulcis* has become an additional crop of which students and interns can learn the importance, culture and uses before tackling such overseas. Unfortunately, of the six accessions, only one has survived, PI 276260 from Hong Kong. I intend to increase it to where it can be a suitable demonstration planting, as well as an abundant source of food for future ECHO training programs.

Georgia

Thirty separate requests for plant germplasm were made to the S-9 unit by the citizens of Georgia during 2009. As a result of these requests, a total of 723 plant accessions were supplied

to University scientists, USDA scientists, consultants, seed companies, gardeners, and individuals. The most requested crops were sorghum, castor, watermelon, peanut, paspalum and peppers.

The University of Georgia has maintained a strong emphasis on plant breeding and continues to expand its advanced molecular biology programs. The Institute of Plant Breeding, Genetics, and Genomics (IPBGG), officially established at UGA in 2008, has 20 faculty members and six affiliated members. IPBGG faculty are actively engaged in training graduate students who may receive M.S. or PhD. degrees in Plant Breeding, Genetics, and Genomics. Faculty research is focused on the development of new crop varieties and basic research on the genetics and understanding of crop traits important to agriculture and human kind. The Institute's philosophy is that modern plant breeding should be integrated with modern genomics and biotechnology to achieve maximum efficiency.

Georgia plant breeding programs supply new crop cultivars and associated technologies to our agricultural sector and rely heavily upon the plant materials maintained within the S-9 unit. UGA currently has active cultivar development programs in soybean, peanut, small grains, cotton, turf grass, forages, blueberry, pecan, fruits, vegetables, and numerous ornamental crops that frequently utilize the plant genetic resource collections. In addition, research programs in crop science, horticulture, plant pathology, entomology, and other disciplines utilize the genetic resources of the S-9 unit in both basic and applied research projects designed to address the needs of Georgia agriculture. The S-9 unit remains a critical component of our research and cultivar development programs.

Guam

Plant collection, conservation and distribution:
University of Guam continued to maintain local lines of sweetpotato [*Ipomoea batatas* (L.) Lam.] and chili pepper (*Capsicum annuum* L.). Sunnhemp (*Crotalaria juncea* L.) originally from Taiwan was grown to collect seeds for future field evaluation with other lines. A chili pepper was collected locally as a new entry to our accessions and field observations are in progress.

Seeds of *Jatropha curcas* L. and *Calophyllum inophyllum* L. are being collected for a research project on the evaluation of potential biodiesel oil production in Guam. A local line of pumpkin (*Cucurbita maxima* Duchesne) was planted for seed collection at the Guam Agricultural Experiment Station Yigo Farm.

Evaluation of germplasm adaptation to Guam's climate:
Lettuce cultivar trial 2009:
Nine leafy lettuce (*Lactuca sativa* L.) cultivars were evaluated at the Guam Agricultural Experiment Station Yigo Farm. Cultivars included Magenta, Nevada, Vulcan, Tropicana, Cherokee, Ermosa, Adriana, Red Sail and Mottistone. Seeds were sown on 7/6/09 in seed propagation trays, and seedlings were transplanted on 8/13/10 to the field. Complete randomized design (CRD) was used with four replications. Within a plot, nine plants were planted in a row at 25 cm (10 inch.) apart and the distance among adjacent rows was 90 cm (ca. 3 ft.). The field

was irrigated using a drip irrigation system. Fertilizers applied were P2O5 (150 lb/A) as a pre-plant on 8/12/10, and N (150 lb/A) and K2O (150 lb/A) in two split-applications through irrigation lines during the season. Leaves were harvested on 9/24/09 to compare dry biomass of cultivars after drying in a drying oven at 60°C to constant weight. The composite of five plants were harvested to make a sample of each plot. Before harvest, all plants of each plot were examined for the presence of either disease or insect damage.

The field trial revealed that two red cultivars, Vulcan and Red Sail, and a green cultivar, Tropicana, were promising lines during the rainy season in Guam. Two butterhead type cultivars, Adriana and Ermosa, and green summer crisp type, Nevada, had more than 70% of the plants infected with a leaf spot disease. Red leaf cultivars including Red Sail, Vulcan, Cherokee and Magenta, a red speckled cultivar Mottistone, and a green cultivar Tropicana had less damaged plants than other green cultivars.

Table 1. Dry biomass of leaves and % plants damaged by insects and/or diseases per plot of lettuce cultivars grown in Guam cobbly soil at Yigo, Guam[X]. Harvest date: 9/24/09.

Cultivar	Dry biomass (g/plant)	% Plants with damages[Y]
Vulcan	1.57 a	14.4 c
Red Sail	1.31 ab	0.0 c
Tropicana	1.14 abc	38.4 bc
Adriana	0.97 abc	100.0 a
Magenta	0.83 abc	39.2 bc
Ermosa	0.79 bc	72.8 ab
Cherokee	0.71 bc	36.2 bc
Nevada	0.54 c	83.3 ab
Mottistone	0.40 c	1.0 c

[X]Mean of four replications is presented for each column and means followed by a common letter are not significantly different at the 5 % level. Mean separation was performed by Tukey HSD.
[y]The percentage of plants damaged by insects and diseases/plot was analyzed after arcsine transformation, arcsine SQRT(x). The original data are presented in this Table.

Yardlong bean trial report 2009:
A two-year field trial of five yardlong-bean cultivars, *Vigna unguiculata* (L.) Walp. ssp. *sesquipedalis* (L.) Verdc., in three different soils, Pulantat clay soil, Akina silty clay soil and Guam cobbly clay loam soil in Guam was summarized for dissemination of the results. Four cultivars, Green Arrow, Green Pod Kaohsiung, KY Bush, and Milady, and a germline obtained from a local farm, 'Local Selection,' were tested. The study indicated that season, location and cultivar affected pod yield. The cultivar Green Pod Kaohsiung grown in Pulantat clay soil during the dry season had the highest pod yield. 'Local Selection' was one of high yielders in all sites in both dry and rainy seasons. Nodulation was observed at all locations with the least

number of nodules found in a calcareous alkaline Guam cobbly clay loam soil. 'Local Selection' had the most nodules at acidic Akina silty clay soil. There was no correlation between the number of nodules found in roots and pod yield. The study indicated that yield potential of yardlong bean would be improved by selection of planting season, location, and cultivar.

Hawaii

Germplasm Requests and Utilization
Germplasm requested in 2009 included *Dactyloctenium, Ipomea batatas, Megathyrsus*, and *Pennisetum*.
Dactyloctenium australe (sweet smother grass) seeds were received for evaluation as a shade tolerant ground cover in macadamia orchards by the University of Hawaii (UH) and two commercial macadamia growers. Seeds germinated within 1-2 weeks and are being maintained in flats. In Australia *Dactyloctenium* has been successfully used as a ground cover in macadamia orchards with a 5.2 m hedge height and a 2m alley width. Plantlets of 86 sweet potato varieties were received by a UH cooperative extension agent and will be evaluated for their productivity, insect and disease tolerance and commercial potential. *Pennisetum purpureum* and *Megathyrsus maximus* accessions are being evaluated at the UH with wild accessions from Hawaii for biofuels production in different environments. Analysis of germplasm with molecular markers revealed significant genetic diversity, which has been confirmed in agronomic trials. Diverse germplasm will be utilized in a crop improvement breeding program to develop high quality feedstocks for diverse environments with minimal inputs.

Macadamia integrifolia
Collaborative research with Dr. Lisa Keith, USDA-ARS Plant Pathologist, has determined the cause of macadamia quick decline (MQD), a problem which has been responsible for death of a large number of mature macadamia trees in Hawaii. The research was conducted on the University of Hawaii Waiakea Agricultural Research Station in an orchard planted with the 'Ikaika' (HAES 333) cultivar. The research at this site was critical since previous work showed that this cultivar is highly susceptible to MQD, particularly in orchards along the eastern coast of Hawaii island near Hilo. Koch's postulates for MQD were completed with organisms isolated from declining trees, and artificial inoculations of field grown trees with prospective pathogens were conducted to duplicate the entire disease syndrome. MQD trees yielded *Phytophthora*, a fungal pathogen common in wet growing areas. The fungus causing MQD was identified as *Phytophthora tropicalis*. Branches inoculated with *Phytophthora* become infected and displayed all of the symptoms associated with MQD (sap bleeding, appearance of Nectria, ambrosia beetle powder posts followed by browning and death of the leaves). Re-isolation from the infected branch yielded *P. tropicalis* proving Koch's postulates. This is the first report of *P. tropicalis* being isolated from macadamia trunks and confirms that *P. tropicalis* is the primary causal agent of MQD, and is associated with trunk bleeding, ambrosia beetles and the saprophytic fungus *Nectria*. With this information fungicide treatments effective against *Phytophthora* were evaluated.
MQD experiments to evaluate fungicide treatments were conducted at the UH Waiakea Research Station on the 'Ikaika' cultivar. Fosphite® (JH Biotech Inc. Ventura, CA; active ingredient: 53% mono and di potassium salts of phosphorous acid), a fungicide that targets *Phytophthora*, was injected into 12 trees with MQD symptoms between January 07 and August 07 using the

"Arborjet" system which forcibly injects the fungicide into the trunk. This method utilizes compressed air and a leak proof proprietary plug to actively micro-infuse the tree with the fungicide. The fungicide was applied at the label rate (15 ml/5 cm of trunk diameter at breast height). In 5 of the trees, trunk injection treatments were done after soil drench treatments to the base of the tree had been previously applied. Trunk injections were applied after it appeared that drenches were not effective in arresting progression of the MQD disease. Health of treated trees was monitored to January 2010.
The median length of time 10 untreated trees survived after MQD was detected on the trunk was 7.0 months. Of the 12 trees injected with Fosphite, all except one tree survived beyond 14.9 months after MQD symptoms were initially detected on the trunk. The treated tree that survived for 14.9 months, was initially treated with drench treatments followed by the injection, but it survived nearly 2 times longer than the median survival time for untreated trees. It is important to implement injection treatments soon after MQD symptoms are detected to halt further development of the disease in the trunk. In 3 of the injected trees, MQD symptoms did not return. These results show that trunk injections with Fosphite fungicide can be effective in preventing or delaying return of MQD symptoms if trees are treated when signs of MQD are first observed.

Dimocarpus longan
A study to monitor longan (cv. Biew Kiew) fruit growth, fruit quality, and the pattern of moisture and nutrient accumulation during fruit development was initiated. Nutrient compositions of leaves and fruits are being monitored during fruit growth to develop nutrient management guidelines for this cultivar. In the phenology study longan fruits exhibited a sigmoid growth pattern and matured about 24 weeks after anthesis when total soluble solids (brix) content reached its maximum (19.2%). Fruit weight increased most rapidly between 12 and 24 weeks after anthesis; moisture accumulation was also greatest between 12 and 24 weeks and accounted for 73 to 77% of the final weight of mature fruits. Although fruit weight increased slightly after 24 weeks, fruit quality decreased due to a reduction in soluble solids and increased seed germination.

Nephelium lappaceum
A heavy infestation of armored scales on rambutan trees was discovered by the project leader on leaves and fruits at the University of Hawaii Waiakea Agricultural Research Station. Subsequently, commercial growers in the principal rambutan growing area of Hawaii island discovered similar scale infestations in their orchards. Samples were submitted to the UH CTAHR Agricultural Diagnostic Center for identification, and the infestation at the Waiakea Station surveyed for evidence of bio-control activity. The rambutan scale (*Aulacaspis alisiana*) was confirmed as the cause of the scale outbreak on rambutan trees. Although first reported in Hawaii in 1989, the scale was not considered a serious problem and was not widespread until the recent outbreak. Infestations are very characteristic, because the scales which are white, pencil shaped and about 0.5 mm in length, aggregate in clusters and appear aligned in a single direction. Controlling the infestation is critical since scales are quarantine pests, and rambutan fruits with infestations are rejected for export to the US mainland. A presentation to growers and its impact on fruit export was made to enable growers to identify the pest. Growers were also alerted that a number of bio-control insects were found feeding on the infestations, and that chemical control options are available with buprofezin, which is registered for scale control in rambutan, longan

and lychee. The impact on export is problematic, since fruits with visible surface infestations of live or dead scales will be rejected for export to the US mainland.

Kentucky

Todd Pfeiffer continues to work on sweet sorghum breeding, but much less now that he is the chairman of the Department of Plant and Soil Sciences at the University of Kentucky. Mike Barrett has picked up his sweet sorghum biomass research project. Sadly, Dr. Morris Bitzer passed away from a sudden illness in the spring. He has been an avid advocate of sweet sorghum and had retired from a grain crops extension position at U.K.

Tim Phillips has planted a trial to evaluate the winter hardiness in KY of some warm-season grasses in the S9 collection, as well as a breeding nursery for several native warm-season grasses. In 2009, I obtained some finger millet accessions and a few other African species to investigate performance of C4 gluten-free grain crops. Many of the switchgrass accessions in a selection nursery appear to have become infected with a virus. Other than the grasses I requested, germplasm sent to KY in 2009 includes sorghum, pepper, watermelon, clovers, peanut, Ipomoea, and vinca. In 2009, more university researchers requested accessions than private companies or individuals, with three institutions housing these researchers (University of Kentucky, Kentucky State University, and Kentucky Wesleyan University). A total of 69 accessions from Griffin were shipped to KY in 2009

The following table summarizes numbers of accessions from Griffin sent to Kentucky during 2005-2009:

	Recipient		
Year	University of KY	KY State University	Private/other
2005	57	21	13
2006	52	6	5
2007	387	6	25
2008	18	2	25
2009	38	1	30

Louisiana

Germplasm from the bamboo collection is routinely evaluated by a nursery in Louisiana for commercial landscape applications. More accessions of *Phyllostachys edulis*, *Phyllostachys vivax*, *Bambusa multiplex*, and *Bambusa textilis* are needed in the collection. Sweetpotato accessions were requested to identify sources of resistance to Sweet Potato Leaf Curl Virus. Research on *Ipomoea* accessions include evolutionary ecology, molecular evolution and population genetics of genes involved in flower color, as well as the phylogenetic systematics of morning glories (species of the tribe *Ipomoeae*). *Hibiscus* accessions were requested to identify fatty acid profiles (as methyl esters) of repository plants to help confirm the identity of peaks observed in related *Gossypium* (cotton) samples. Legumes were examined for induced flavonoids/isoflavonoids (phytoalexins) in legumes for anticancer and antiobesity activities.

Research has expanded to other legumes. Certain species of *Teramnus* make a phytoalexin called glyceollins that is produced in soybean and has anticancer activity.

North Carolina

Faculty in the Crop Science and Horticultural Science Departments at NC State University conduct research on strawberry, blueberry, brambles, tree crops, ornamentals, maize, soybean, peanut, cotton, tobacco, small grains, turfgrasses, sweet potato, cucurbits, and other crops. NCSU is hiring a soybean breeder to replace Dr. Joe Burton when he retires within the coming year. Priorities are on incorporating disease and insect resistance, abiotic stress resistance, and quality factors into improved breeding lines and cultivars. Plant introductions are critical components of plant improvement programs, and NCSU scientists make use of germplasm maintained in the National Plant Germplasm System (NPGS). During the past year, 32 individuals received 459 entries that were been introduced to NC from the Southern Regional Plant Introduction Station, including 6 cultivated peanut, 212 *Arachis* species, 13 sorghum, 1 cowpea, 92 sweetpotato, 2 eggplant, 10 peppers, 3 clover, 2 *Cucurbit* spp., 2 watermelon and 116 warm-season grasses.

The U.S. collection of cultivated and wild *Nicotiana* species is maintained at NCSU and numerous seed requests are filled annually both to U.S. and international individuals and organizations. Collections of *Arachis* cultivars and species, South American maize germplasm, and many accessions of soybean, blueberries, sweet potato and other crop species are maintained by the plant breeding faculty. The *Arachis* species accessions introduced were grown in the greenhouse for seed increases and seeds will be returned to the plant introduction station during the coming year and considerable efforts were made to proof the *Arachis* species entries in GRIN.

The Eastern Regional Small Grains Genotyping Laboratory at NCSU is involved in use of markers to characterize germplasm and deployment of genes/QTL by marker-assisted selection. In addition, the Plant Breeding Center is supporting a large group of plant breeding graduate students, many of whom are involved with plant germplasm collections.

During the past year, both germplasm lines and cultivars have been released by the NC Agricultural Research Service. Germplasm released by the NCSU breeding projects, 2008-2009. Included in the releases are the following:

Maize inbreds

- NC512
- NC 514
- NC 516
- NC518
- NC520
- NC522
- NC524

Oat

- NC03-2421, an inbred line for cultivation

- NC02-833, an inbred line for cultivation

Pickling cucumber

- Inbred NC-74 germplasm release
- NC-Danbury cultivar release (dwarf-determinate monoecious habit, high yield, early maturity, high fruit quality, and with multiple disease resistances)

Redbud

- Merlot, a cultivated clone with purple leaf color and semi-upright growth habit
- Ruby Falls, a cultivated clone with purple leaf color and weeping growth habit
- Whitewater, a cultivated clone with variegated leaf color and weeping growth habit

Soybean

- N8101, a small-seeded soybean cultivar
- N6202 germplasm line with high protein, favorable yield potential, and large seed

Summersweet (*Clethra alnifolia*)

- Crystalina, a cultivated ornamental clone

Sweetpotato

- NCORNSP-011MNLC an ornamental clone
- NCORNSP-012EMLC an ornamental clone

Switchgrass

- Colony, an improved, highly yielding population.

Tomato

- Mountain Merit, a large-fruited tomato cultivar
- Plum Regal, a fresh-market plum tomato cultivar
- Inbred line NC 946 germplasm
- Inbred line NC1 CELBR germplasm an early blight and late blight resistant fresh market tomato breeding line
- Inbred line NC 2 CELBR, an early blight and late blight resistant fresh market tomato breeding line

Wheat

- Cape Fear, a soft red winter wheat cultivar
- NC Yadkin, a soft red winter wheat cultivar
- KS11WGGRC52-J, leaf rust and stripe rust resistant hard red winter wheat germplasm
- KS11WGGRC52-O, leaf rust and stripe rust resistant hard red winter wheat germplasm
- KS11WGGRC53-J, leaf rust resistant hard red winter wheat germplasm
- KS11WGGRC53-O, leaf rust resistant hard red winter wheat germplasm

Oklahoma

Plant germplasm distribution records received from S-9 indicate that 352 plant accessions maintained at the Plant Genetic Resources Conservation Unit at Griffin, GA were distributed to organizations or individuals in Oklahoma the last year, from August 2009 through July 2010. The accessions were distributed in 21 respective requests. Respective annual plant germplasm distribution numbers for 2005, 2006, 2007, and 2008 were 597, 169, 295 and 431. The requested plant species in 2009 include sorghum (*Sorghum bicolor*) (214), sweetpotato (*Ipomoea batatas*) (81), Guar (*Cyamopsis* sp.) (33), squash (*Cucurbita* spp.), Okra (*Abelmoschus* sp.), vigna (*Vigna* spp.), switchgrass (*Panicum virgatum*) and Miscanthus (*Miscanthus* sp.) and other

warm-season grasses, and legumes. Receivers of the plant accessions represent researchers of Oklahoma State University, the Noble Foundation, USDA-ARS laboratories, and individual Oklahomans.

Puerto Rico

Eighteen quenepa (*Melicoccus bijugatus*) cultivars are in the fifth year of evaluation at Juana Díaz and Lajas. At Juana Díaz and Lajas, respectively, 48% and 22% of the trees fruited in 2009. Horticultural traits and fruit quality parameters (pH, TSS, acid, and TSS/acid ratio) were measured on the mandarin cultivars 'Encore', 'Murcott' and 'Fallglo' on five rootstocks in Corozal. The mandarin experiment at Isabela was eliminated due to high incidence of citrus greening disease. At Isabela, a citrus germplasm collection was established in the screenhouse and citrus rootstocks are being propagated for new experiments to be established at Corozal and Adjuntas. Five hybrid and five open-pollinated Cubanelle-type pepper cultivars were evaluated from February to May. The best commercial yields were obtained by hybrids 'Aruba', 'Key West' and 'HMX 6640'. Among the open-pollinated cultivars, the best performers were 'Aconcagua' and 'Marconi Red'. Twelve "Mayaguezano-type" mango clones on 'Banilejo' dwarfing rootstock are being evaluated in the field at Lajas. A field planting of 14 guava accessions is being evaluated at Juana Díaz. 'Estela' hybrid tannier production was evaluated using planting material of different source and size. Marketable yield was increased by 27% when planting material from main corm sections was used, compared with crowns. The size of planting material has no effect in the marketable yield of tannier. 'Cuerno de Arce' plantain was evaluated with and without a chicken manure soil amendment. An increase in average bunch weight of 18% and a reduction of 32 days from planting to fruiting was observed with the addition of chicken manure. One hundred half-sib lines of 'Suresweet' sweet corn are being evaluated in a replicated performance trial. After the second cycle of mass selection has been completed, a manuscript will be prepared for the formal release of this sweet corn variety as 'Suresweet 10'. Seed of 'Suresweet' is currently available for sale at Isabela. During January 2009, flowering was induced in 'Cabezona' pineapple clones HT1-N, HT2-N, I-A, I-B and I-C. Fruits were harvested in June 2009. Clones HT1-N, HT2-N and I-B showed the best fruit characteristics (size, weight and brix). Germplasm requests in Puerto Rico in 2009 include 221 *Citrullus* sp., 1 *Praecitrullus* sp., and 16 *Crotalaria* sp.

South Carolina

Germplasm Distribution
A total of 925 germplasm accessions were distributed by the Plant Genetic Resources Conservation Unit at Griffin, GA to the following individuals in South Carolina in 2009: Dr. R. Fery, USDA Vegetable Laboratory, Charleston, SC, 477 *Vigna* (cowpea) accessions; T. Johnson, 6 *Arachis* (peanut) accessions; Dr. C. Kousik, USDA Vegetable Laboratory, Charleston, SC, 26 *Citrullus* (watermelon) accessions; Dr. Amnon Levi, USDA Vegetable Laboratory, Charleston, SC, 142 *Citrullus*, 13 *Praecitrullus* (watermelon), 14 gourd, 7 *Luffa*, and 23 *Cucurbit* spp. accessions; Dr. C. Kole, Clemson University, 1 *Solanum* (eggplant) 2 *Momordica* (gourd), 3 *Cymbopogon* (lemon grass), and 4 *Catharanthus* accessions; Dr. Judy Thies, USDA Vegetable Laboratory, Charleston, SC, 2 *Cucurbita* accessions; Dr. W. Wechter, USDA Vegetable Laboratory, Charleston, SC, *35 Ipomoea* (sweetpotato) and 141 *Citrullus* accessions: Dr. H.

Harrison, USDA Vegetable Laboratory, Charleston, SC, 2 *Ipomoea* accessions; Dr. K. Ling, Vegetable Laboratory, Charleston, SC, 2 *Solanum* and 1 *Catharanthus* accessions; Dr. M. Jackson, USDA Vegetable Laboratory, Charleston, SC, 7 *Ipomoea* accessions; J. Mullins, 2 *Trifolium* (clover) accessions; L. Reep, 1 *Vigna* accession; Dr. M. Shepherd, Clemson University, 1 *Sesamum* (sesame) accession; D. Sheriff, 12 *Capsicum* (pepper) accessions; and B. Stewart, 1 *Abelmoschus* (Okra) accession.

Soybean Germplasm Utilization and Evaluation
Soybean Breeding: In 2009, twenty-one elite lines and/or cultivars from the Clemson University soybean breeding program were tested in a greenhouse to determine their suitability as hosts for reniform nematode, *Rotylenchulus reniformis*. Five pots containing plants of each genotype were inoculated with 1600 nematodes per pot. The test was conducted by Dr. R.T. Robbins at the University of Arkansas. Elite lines SC06-687, SC05-642, SC01-803, and SC03-9093 had reproductive indices lower than the reniform resistant breeding line, SC02-208.
Soybean Rust Disease: Soybean rust (SBR) was first identified in the United States in November, 2004. The disease is caused by *Phakopsora pachyrhizi* and can cause severe yield losses under optimal temperature and humidity conditions. Plant introductions (PIs) are being evaluated to identify resistant genotypes. Under the direction of Dr. David Walker, USDA-ARS, researchers collaborated in 2009 to evaluate USDA germplasm accessions for SBR resistance in seven locations in the southern U.S. The objective is to identify and confirm PIs that exhibit resistance to rust isolates in multiple locations in order to provide soybean breeders with guidance in choosing parents for crosses made to develop rust-resistant soybean cultivars with competitive yields. Ninety-one genotypes across maturity groups III through IX were planted at Blackville, S.C. August 18, 2009, in three replications. Portable lights were used to extend photoperiod and vegetative growth until SBR development which usually occurs in late August or September in South Carolina. Rust symptoms were first observed on known susceptible genotypes in mid October. Ten leaflets were collected from plants in each plot from November 5 to November 20. Leaflets were examined under a microscope for the presence of rust and rated for disease severity and sporulation by Dr. John Mueller, Clemson University. Data were summarized and submitted to Dr. Walker to be combined with data from other U.S. locations. A manuscript summarizing results of the PI screening effort has been accepted by Crop Science.

Texas

Switchgrass research is in progress at Weslaco, TX using two PI lines (PI422016 and PI431575). Currently, we are in the process of evaluating drought/cold tolerance of sugarcane and other wild grass species. The two switchgrass accessions, PI422016 and PI431575, will be included in the list of our germplasm to test since switchgrass is considered as one of the best biomass feedstock producers. Molecular marker profiles of those two switchgrass accessions will be compared with those of sugarcane and other wild grass species. Four accessions of *Pennisetum purpureum* (PI 316421, 410305, 410306, 410307) are in biomass production evaluations near College Station, TX.

The Texas A&M Sorghum Improvement Program requests approximately 2,000 sorghum accessions annually. We screen these lines for agronomic potential and any other desirable traits that we may find. We then bring the selections into our breeding program for crossing and to

create segregating populations for selection. Four of the introductions requested will be evaluated for phenotype and crossed to other exotic varieties to study malting and brewing quality in sorghum. The remaining introductions will provide diversity in the sorghum breeding program for several different traits. Some will be crossed to elite adapted lines to develop new breeding populations for selection.

Three sorghum lines requested by Dr. Cleve Franks are currently being grown at Taft and Plainview for seed increases. In 2011 these lines will be planted in three screening locations across the southern U.S. and northeast Mexico for line evaluation and the following diseases recorded: head smut, downy mildew and anthracnose. Agronomic traits will also be recorded, including height, days to flower and grain color. Lines that exhibit disease resistance will be used to make topcross hybrids and screened again for disease reactions and fertility reaction in a hybrid. Resistant lines, if any, will then be used in breeding programs at Taft and Plainview.

Nineteen PI's of Big Hop clover (*Trifolium campestre*) were evaluated for adaptation to northeast Texas. During the growing season PI's were rated for freeze damage, power mildew, flowering, growth, and maturity. Seed were collected from Big Hop and two of the most productive PI's for further evaluation next fall. Crimson clover, lablab and cowpea accessions are being evaluated and used as parents in the Texas AgriLife Research (Texas A&M Univ. System) forage legume breeding program.

Peanut germplasm materials requested this past year were used to re-establish the lines in our germplasm collection at Stephenville and for use in making crosses to improve our cultivated varieties after we get the seeds/plants increased to a safe level for storage.

The USDA/NRCS Plant Materials Center in Kingsville, Texas received collections in 2009 of Illinois bundleflower (*Desmanthus illinoensis*), purple bushbean (*Macroptilium atropurpureum*), poorman's friend (*Stylosanthes viscosa*) and sunn hemp (*Crotolaria juncea*) from the USDA ARS (S-009). We received 27 accessions of purple bushbean and 9 accessions of Illinois bundleflower. We are evaluating these two perennial leguminous species for potential rotational crops with sorghum and cotton. Evaluation of their soil nitrogen accumulations, forage quantity and quality and potential biodiesel seed oil production will be conducted. We have planted all of the accessions out into the field and are currently evaluating adaptation to south Texas environmental conditions. We received 5 accessions of *Stylosanthes viscosa*. We have planted all of the accessions out into the field and are currently evaluating adaptation to south Texas environmental conditions. We received 16 accessions of sunn hemp (*Crotolaria juncea*). We plan to evaluate the provided accessions of sunn hemp for adaptation and seed production in south Texas. Accessions of Aleppo chilies are in evaluations for seed and pepper production in Texas.

Virginia

Germplasm from S-009 was acquired in Virginia both by academics for research purposes and from the public for trials in farms and gardens. Backyard gardeners conducted trials of eggplant, pepper, watermelon and cultivated peanut. Researchers at Virginia State University evaluated several new oilseeds (*Brassica* sp.) and legume crops (Sunn hemp, Guar, Lablab) for potential

production. Another study at Virginia State University was conducted to test the market for niche and ethnic crops, e.g., jute seed and jute leaf that was test marketed in farmer's markets around Richmond where it was received favorably by the Middle Eastern community and others aware of its culinary uses. Additional work will be conducted on two *Solanum* spp, four cowpea lines and Cleome, to test demand among local communities of African origin. *Crotalaria brevidens* (Sunn hemp) was studied for its potential as a biomass crop with the conclusion that it can fit well into short-rotation sustainable vegetable production systems in the Southeast. Peanut, pepper and watermelon accessions were used in research at the Universidad Nacional de Cuyo in Argentina in a differential host test to identify the race of nematodes (*Meloidogyne* spp.) and in hybrid development among solanaceous species. These activities document the distribution and utilization of plant genetic resources, a primary objective of the regional project, in Virginia.

Virgin Islands

Sorrel was planted in November to determine the production potential of a late planted sorrel. Twenty varieties were evaluated which included local varieties as well as from the USDA Plant Genetic Resources Conservation Unit in Griffin, GA. Sorrel plots were established as on-farm trials in three locations. Late planting of Sorrel in November provided harvest in February through March. This extends the production potential of this crop from the traditional December through January. The late winter production was at a time when demand is great for the product which results in a higher market price for the farmer. Branch angle was variable among accessions with upright branching more favorable for harvest. Breeding has been initiated to develop day neutral lines with large dark red calyxes.

Eleven virus-free varieties of sweetpotato were obtained in vitro from the USDA Germplasm Repository at Griffin and micropropagated to generate plants for field trials. Sweetpotatoes were established in the field at three month intervals. The virus-free sweetpotatoes grew vigorously. Two varieties developed excessive vines. Four varieties had better tuberous root quality than locally grown varieties that farmers are using to increase production.

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