Project Number: S-009

Project Title: Plant Genetic Resources Conservation and Utilization

Period Covered: 08/2012 through 8/2013

Date of this Report: September 11, 2013

Annual Meeting Dates: July 30 – July 31, 2013

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 for the past 10 years 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.

This project has grown from 811 accessions of 41 genera in 1949 to one of the largest collection of the four NPGS regional multistate projects with 92,180 accessions of 261 genera and 1,553 species in 2012. In 2012, a total of 40,465 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 1,081 orders to users in 48 states and 41 foreign countries with 15,802 accessions distributed to users in the Southern Region. 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 make this location one of the leaders in the National Plant Germplasm System.

Vigna:

Roy Pittman, Plant Genetic Resources Conservation Unit, served as the Vigna curator. Cowpea regenerations were conducted in the field and greenhouse in 2012. A total of 16 lines were increased in the greenhouse in Griffin GA, 42 lines were increased in the field at the Westbrook farm, 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 conducted for 900 cultivated peanut accessions by Noelle Barkley, Plant Genetic Resources Conservation Unit, with regenerations at locations in Tifton GA, Raleigh NC, Stillwater OK, Clovis NM, Citra FL, and Lubbock TX. Standard descriptor data was recorded for the 725 accessions regenerated. Digital scans were collected for all pods and seeds regenerated. About 270 clonal accessions of 38 *Arachis* species were maintained in the greenhouse. The U.S. peanut mini-core of 108 accessions was developed to represent the majority of the genetic diversity in the entire peanut germplasm with little redundancy. The variability in compounds such as oil and antioxidants, which are important seed quality traits, has not been previously evaluated. ARS researchers at Griffin GA, quantified the oil content and antioxidants in the peanut mini core and assessed year to year variability by evaluating the accessions over a two year period. This information will provide breeders with a range of variation in oil and antioxidants in accessions of the mini core that they can utilize to make improved selections in their breeding programs. Many of the lines in the U.S. peanut mini core were variable within each accession which can be problematic for certain types of research such as genomics work. ARS researchers at Griffin, GA, purified each accession in the mini core by eliminating rogue plants in the field and only allowing uniform plants to produce seeds. The resulting purified seeds were deposited into the germplasm collection as a separate inventory within the peanut collection to provide a consistent seed source for peanut genomics research.

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 65 accessions of different warm-season grass species were successfully regenerated and submitted to seed storage for long term preservation. Basic descriptor data and plot\flower images were collected and submitted for upload to GRIN for accessions grown in the field as well. Long-term maintenance of 411 warm-season grass clonal accessions was continued in the greenhouse with an additional 47 napiergrass accessions maintained in the field. The clonal grass collection is being reduced by removing redundant accessions, forming crossing blocks to obtain seeds from closely related clonal accessions, and removing clonal accessions that have existing seed in the collection. A total of 12 bermudagrass accessions were maintained in tissue culture. Native warm-season grasses are currently of interest to users for habitat restoration, biofuel use, or ornamental use. Reduced genetic diversity of switchgrass germplasm limits the ability of plant breeders to develop improved cultivars for bioenergy production. ARS researchers at Griffin, GA, collected a total of 27 switchgrass accessions from diverse habitats and geographic locations in Georgia, South Carolina, and North Carolina, and processed these accessions into the U.S. switchgrass collection. These collections will provide valuable germplasm needed for switchgrass breeding and research programs.

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

A total of 147 summer subtropical/tropical legumes, 22 *Hibiscus spp*., 8 winged bean, 4 guar, 8 sesame, 5 castor beans, and 25 *Corchorus olitorius* were regenerated in the field at Griffin or Byron by Brad Morris, Plant Genetic Resources Conservation Unit. An additional 25 subtropical/tropical legumes, 20 *Leuceana leucocephala* and 20 winged bean accessions were increased in St. Croix. A total of 5 photoperiod-sensitive *Neonotonia wightii* and 46 *Hibiscus* spp. accessions were regenerated in the greenhouse. A total of 120 annual clover accessions were regenerated in the field in Byron GA, and in the greenhouse at Griffin by Gary Pederson, Plant Genetic Resources Conservation Unit. Several photoperiod-sensitive legumes do not produce adequate seed numbers for distribution to researchers using traditional field or greenhouse seed regeneration procedures. Also, Chinese water chestnuts have extensive corm rot when grown in traditional flooded sand systems. ARS researchers at Griffin GA,produced high quality seed and corm production of these species by using an aeroponic system. This technique has produced adequate seed and corm numbers so that these accessions are now available for distribution and use by researchers.

Sorghum:

Gary Pederson, Plant Genetic Resources Conservation Unit, is serving as acting sorghum curator. Regeneration of sorghum accessions in St. Croix and Puerto Rico continued in coordination with ARS cooperators, Ricardo Goenaga and Alfredo Quiles. A total of 1,260 accessions were sent to St. Croix for regeneration in 2012 and seed from regenerations of 1,252 accessions have been sent to Griffin. In addition, numerous sorghum accessions need to be cleaned and/or processed into the collection including accessions from Schertz mutant accessions (505), Schertz translocation accessions (114), RIL population (127), regenerated accessions (824), A lines (130), exotic progenitors (57), other regenerations (909), and wild sorghum accessions (179).

Vegetable Crops:

Bob Jarret, Plant Genetic Resources Conservation Unit, regenerated 198 vegetable accessions including *Capsicum* spp. (55), *Citrullus* spp., (65), *Cucurbita moschata* (15), *Cucurbita argyrosperma* (12), *Acanthiosicyos* spp. (21), misc. cucurbits (5), *Ipomoea* spp. (5), and *Abelmoschus* spp. (20). A total of 753 sweetpotato accessions were maintained in tissue culture. A total of 200 pepper accessions were grown in Georgia and California for seed increase, characterization, and recording of digital images. The genetic relationships of several tetraploid varieties of sweetpotato to each other and to the cultivated hexaploid sweetpotato are largely unknown. However, these tetraploid varieties may contain genes of importance for the crop's improvement. Sequencing their plastid chloroplast genomes by ARS researchers at Griffin, GA,revealed that the tetraploid varieties were closely related to the cultivated sweetpotato and also to the diploid species *Ipomoea trifida*. All three tetraploid varieties intercrossed among themselves. This information is of use in targeting future germplasm acquisitions and suggests that these tetraploid varieties may provide a source of genes for introgression into cultivated sweetpotato via conventional or novel breeding methods.

Biochemical and Molecular Evaluations:

Ming Li Wang, Plant Genetic Resources Conservation Unit, determined seed oil content and fatty acid composition for accessions of *Macrotyloma*, *Teramnus*, *Hibiscus*, and castor species. After screening oil content, fatty acid composition and evaluationof genetic diversity for the entire US castor collection, 206 accessions have been selected for morphological observation in the field. A total of 103 accessions (10% of the entire collection) will be selected to form the US castor core collection. Accessions were identified with high oil content (peanut), high quercetin content (peanut), high leaf protein (bamboo), and sesamin content (sesame).

In collaboration with Kansas State University, 1,000 biomass sorghum accessions were genotyped by genotyping-by-sequencing (GBS) analysis. From this analysis, 280 accessions were selected. With cooperators in Kansas and Puerto Rico, these 280 sweet sorghum accessions were phenotypically evaluated in the field at two locations and 96 accessions were genotyped. Genotyping-by-sequencing (GBS) was conducted on 125 Vigna and 72 peanut accessions to evaluate genomic diversity, relationships among individuals, and develop new SNP markers. Genetic and chemical analysis of the U.S. peanut mini-core collection using SSR and including protein content, oil content, fatty acid composition, flavonoids, and resveratrol was completed from two year samples. Chemical data (oil and fatty acid composition) from two years were also collected for S population (354 progenies) and T population (248 progenies) to determine genetic, environmental effect and their interaction.

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 76,698 accessions (84.4% of the collection) including almost all available accessions of pepper, watermelon, eggplant, peanut, annual clovers, mung bean, sesame, pearl millet, and castor bean and 65-86% of all accessions of sorghum, cowpea, and warm-season grasses. 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.

Biosecurity and availability of plant genetic resources are of major concern to the U.S. agricultural research community. Preserving germplasm by maintaining accessions at two sites reduces the risk of losing valuable germplasm. A total of 89,061 accessions (96.6% of collection) have been deposited for safety back 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. Additionally, 9,679 accessions (11% of the collection) are also backed up at the Global Seed Bank in Svalbard, Norway. 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.

Most plant genetic resources in genebanks are maintained under short-term (4C) rather than long-term (-18C) storage temperatures, which increases the need for frequent seed regeneration that can reduce genetic variability. At Griffin, GA, original seed and seed of species rarely requested are maintained solely at -18 C. Other accessions are maintained as split samples with the bulk of the seed maintained at -18 C and a small distribution sample maintained at 4 C. When needed, seed will be removed from the -18 C sample to replenish the distribution sample. Currently, 19% of the accessions are maintained solely at -18 C and 74.6% of the accessions (67,806 accessions) have at least one inventory in -18C long-term storage. New storage facilities

will enable most seed of the entire collection at Griffin to be stored in long-term storage. These plant genetic resources will remain viable longer with reduced need for regeneration and better retention of genetic variability of the original sample for users.

Alabama

Legumes: Forage and Cover Crops
Current work focuses on evaluation, utilization and breeding of sunn hemp and sericea lespedeza. Auburn University and the Ala. Agric. Expt. Stn. released the sunn hemp cultivars AU Golden and AU Durbin. They were developed using germplasm for use in the continental US and other temperate climates but they can also be used in tropical environments. These cultivars 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. Evaluations are being done in cooperation with colleagues at Auburn, GA, LS, 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 for resistance to heat and drought. We have fine-tuned our evaluation process, and have been able to get repeatable results for increased tolerance to heat at both vegetative and reproductive stages. We have begun the process of evaluating advanced lines from crosses between putative heat tolerant accessions and adapted germplasm in the field, and we will continue with these populations in the growth chamber. We have concluded a study on the impact of exotic germplasm introgression on cotton yield and fiber quality traits, and manuscript preparation is in progress.

Florida

The state of Florida was very active in 2012 for plant genetic resources distribution. According to records provided by S-009, 37 different individuals requested materials from 17 different genera of plants and a total of 649 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.

Dr. Sam Hutton, University of Florida, GCREC, provided the following report from the tomato breeding program. Experiments to confirm previously-identified QTL linked to bacterial spot resistance (*Xanthomonas* spp.) from PI 114490 are underway. Confirmation experiments for a novel begomovirus resistance locus derived from LA2779 and LA1938 are being completed. Fine mapping of Ty-4 from LA1932 continues as part of a BARD grant. Fine-mapping of Sw-7 from LA1938 is also continuing. Ty-1/Ty-3 from LA1969 and LA2779, respectively, were cloned and shown to be allelic in cooperation with a lab at Wageningen, the Netherlands.

Heather Kates, University of Florida provided the following report on the use of *Cucurbita* spp. germplasm. I have included around 55 accessions of *Cucurbita* sp. grown from seeds obtained

from the S-009 germplasm bank in preliminary phylogenetic analyses to test hypotheses regarding the domestication of cultivated *Cucurbita* sp. from their wild relatives. The phylogenetic study employed a set of 5 novel genetic markers and found support for some previously proposed relationships between wild and cultivated species but also introduced a number of new relationships to examine. All seeds were grown in a greenhouse at the University of Florida and leaves were collected 10-20 days after germination and used for DNA extraction to provide template DNA for PCR of the nuclear phylogenetic markers. Plants were disposed of in organic waste after leaf collection and no plants were grown to flowering. Extracted DNA has been used for PCR, cloning and the building of genomic libraries and remaining extracted DNA is stored in a -20 freezer for future personal use or for the use of other researchers. Research was supported by the American Society of Plant Taxonomists, the University of Florida Biology Department, and the Sigma Xi Research Society.

Dr. Kevin Kenworthy, University of Florida, turf and forage breeder in Agronomy reported that a significant evaluation effort on mutagenic bahiagrass continues regarding mutagenic lines of apomictic Argentine and Wilmington bahiagrass. A significant effort continues in the breeding of St. Augustinegrass and zoysiagrass for improved turfgrass performance in Florida and reduced susceptibility to large patch. The breeding of seashore paspalum continues to progress to develop finer textured lines that are less susceptible to dollar spot. The bermudagrass program continues to breed for improved responses to the sting nematode with PI 291590 showing positive responses for further evaluation.

Dr. Karen Koch, University of Florida, maize geneticist in Environmental Horticulture reported on the activities of maize germplasm development for genomics. The maize group has released 8,000 new lines for functional genomics research in maize. The “Mus-2-Use” public resource, reverse-genetics grids to mine the UniformMu population for specific, single-gene knockout mutants (insertion sites and genes fully sequenced and mapped). Seeds and sequences accessible for all materials described above through the Maize Genetics Cooperation Stock Center and MaizeGDB.org.

Dr. Huangjun Lu, University of Florida, EREC provided the following with respect to lettuce and St. Augustinegrass breeding. The lettuce breeding program at the Everglades Research and Education Center of the University of Florida/IFAS evaluated a total of 78 germplasm lines and adapted cultivars for response to bacterial leaf spot, the most damaging disease of lettuce in Florida. Genotypes varied for response to bacterial leaf spot. There were no genotypes with high resistance but a number of genotypes showed medium resistance. An F2 population of ‘Valmaine’ × ‘Okeechobee’ segregating for resistance to banded cucumber beetles was developed and used for genetic study of resistance. Screening of 97 F2 plants with the insect indicated that resistance in ‘Valmaine’ is governed by a single dominant gene which we have designated as Bcb1. We have expanded the population size to 126 F2 plants and molecular mapping of the Bcb1 gene is underway.

The St. Augustinegrass improvement program is focused on identification of resistance to southern chinch bug in St. Augustinegrass. A total of 38 new lines derived from different cross combinations of germplasm lines were fed by southern chinch bugs in an insectarium room. Four lines were found to be resistant to the pest. Other traits such as agronomic traits and

responses to diseases are currently being evaluated to determine the suitability of these chinch bug resistant lines to be released as new cultivars to be used in Florida home lawns and landscapes. In 2011-2012, four existing methods for screening resistance to chinch bug were compared with one another for usefulness of correctly identifying resistant lines. All methods distinguished the resistant cultivars from the susceptible control. More chinch bugs survived when feeding on live plants (tube and box tests) than feeding on excised plant stolons (jar and bag tests).

Dr. Ken Quesenberry, University of Florida, forage and turf breeder in the Agronomy Department, Gainesville reports that grazing evaluation of eight selected superior F1 hybrids from *H. altissima* crosses of PI 299995 (Bigalta) and PI 364888 (Floralta) has identified four line for further testing in 2012 and in 2013 with expectation to identifying one or maybe two superior lines for potential release in 2014. Dr. Quesenberry in cooperation with Dr. Ann Blount and Dr. Kevin Kenworthy is continuing evaluations of new apomictic forage bahiagrass hybrids and of other bahiagrass accessions that may have potential as utility turfgrass. A major focus of this research is improvement of seed quality in new hybrids. Further evaluation of apomictic vs sexual mode of reproduction of these selected bahiagrasses is in progress.

Dr. Donald L. Rockwood, University of Florida, School of Forest Resources and Conservation provided the following on UF's long term effort in Eucalyptus improvement. The severe freezes of the 1980s [11] afforded exceptional opportunities to develop fast growing, freeze resilient clones, and several clone banks were established. Most of the early emphasis was on *E. grandis*, with genetic tests distributed widely across sites and climates in Florida. Based on the resulting performance, UF has patented and released five cultivars: E.nergy series *E. grandis* cultivars G1, G2, G3, G4, G5 [26], which grow well under many circumstances.

Kelley Ryan, school teacher, provided the following comment regarding the use of germplasm in her classroom. Growing in our class garden, the students are enjoying watching the different varieties of plants grow and documenting their processes of caring for them.

Dr. Barry Tillman, University of Florida, NFREC provided the following report from the UF peanut breeding program. In 2013, the UF Peanut Breeding program is evaluating 102 selections from plant introductions originating from Bolivia and derived from 48 PIs evaluated in 2012. In addition, we have 425 lines in various stages of early generation selection which originate from at least one PI.

Dr. Vance Whitacker, University of Florida, GCREC provided the following report from the UF strawberry breeding program. We have an ongoing project evaluating the 38 accessions of the Fragaria supercore collection maintained at the National Clonal Germplasm Repository (NCGR) in Corvallis, OR. We have evaluated several traits including resistance to powdery mildew, anthracnose fruit rot and anthracnose crown rot diseases as well as other traits including flowering under low chilling and tolerance to spider mites. Some intercrossing has been conducted to introgress traits of interest into breeding germplasm.

Georgia

During 2012, seventy-one different requests for plant germplasm were made to the S-009 unit by citizens of Georgia. As a result of these requests, 234 plant accessions were supplied to University scientists, USDA scientists, consultants, seed companies, gardeners, and citizens of Georgia. The most requested crops were warm-season grasses, peanut, sorghum, pepper, cowpea and watermelon.

The University of Georgia maintains strong emphasis on plant breeding and continues to expand its advanced molecular biology programs. The Institute of Plant Breeding, Genetics, and Genomics currently has 34 faculty members and 24 graduate students as well as many research scientists, and post-docs involved in various aspects of plant improvement. These programs supply new crop cultivars and associated technologies to our agricultural sector and rely heavily upon the plant materials maintained within the S-009 unit.

UGA currently has active cultivar development programs in soybean, peanut, small grains, cotton, turf grasses, forages, blueberries, pecan, grape, and numerous ornamental crops that frequently utilize the plant genetic resource collections. These cultivar development programs have released 14 cultivars in the past year (Table 1).

Research programs in crop science, horticulture, plant pathology, entomology and other disciplines continue to utilize the genetic resources of the S-009 unit in both basic and applied research projects designed to address the needs of Georgia and U.S. agriculture.
Projects currently underway involving the S-009 germplasm include:

1. Evaluation of the entire available seashore paspalum (warm-season turfgrass) collection for salt tolerance and the development of molecular markers that could be used by breeding programs to improve salt tolerance in grasses.
2. Evaluation of a large portion of the zoysiagrass collection for salt tolerance.
3. Identification of genes and pathways involved in Cucurbit disease resistance.
4. Identyfying QTLs associated with important traits in watermelon.
5. Translational genomics for enhancing disease resistance in plants, an internet-facilitated education program for training plant breeders.
6. Inheritance of *P. capsici* resistance in pepper.
7. Genetic analysis of shattering of the sorghum inflorescence.
8. Transmission genetics of *Sorghum halepense* x *S. bicolor* crosses.
9. Genome-wide association study of sorghum growth and development.
10. A few ornamental grasses are included in a butterfly, bee, and beneficial insect conservation garden at the Griffin Campus.

In summary, the S-009 unit remains a critical component of our research and cultivar development programs in Georgia.

Table 1. Cultivar Releases from UGA Breeding Programs Summer 2012-2013

‘Tift 10’	Ornamental Grass	Wayne Hanna
Tift 11, 15, 26, 40, 118	Ornamental Grasses	Wayne Hanna
‘Gulf Atlas’	Peach	Patrick Conner
‘Gulf Snow’	Peach	Patrick Conner

‘Georgia-12Y’	Peanut	William Branch
‘Treadwell’	Pecan	Darrel Sparks
‘Huffman’	Pecan	Darrel Sparks
‘Cowboy’	Perennial Peanut	Wayne Hanna
G08PR-394	Soybean Germplasm	Zenglu Li
G09PR-80	Soybean Germplasm	Zenglu Li

Guam

Plant collection, conservation and distribution:
Crotalaria juncea
Regeneration of sunnhemp (*Crotalaria juncea*) P1 561720 01 SD (IAC-1), originated from USDA/ARS/PGRCU Griffin, GA, was attempted at the University of Guam. Seeds were directly sown in the field with Guam cobbly clay soil on UOG Campus: Horticulture Laboratory at Mangilao on September 28, 2012. Because only three seedlings out of 50 seeds were obtained, seedlings were transplanted to pots for seed collection. Although flowering occurred in November 2012, a majority of pods did not contain seeds. There was a great diversity in seed morphology and size when seeds were collected. About 30 seeds collected will be replanted for further regeneration of this line.

Capsicum
Three accessions of chili peppers, PI 593566 (*C. annuum*), PI 241675 (*C. frutescens*) and PI 257051 (*C. frutescens*), were obtained from USDA/ARS/PGRCU Griffin, GA. Seedlings of PI 593566 were discarded due to the occurrence of virus disease symptoms. Healthy seedlings of PI 241675 and PI 257051 were selected to collect seeds for a future study on screening mite resistant germlines.

Tissue culture of banana and taro at Guam Department of Agriculture
Selected lines of banana (*Musa* spp.) and taro (*Colocasia*) were cloned by in-vitro culture at Guam Department of Agriculture for local distribution.

Evaluation of germplasm adaptation to Guam’s climate
Jatropha curcas
Seeds of five *Jatropha curcas* germlines were obtained from Hawaii Agricultural Research Center in 2011. The origins of those lines are one from Honduras, one from Madagascar, one from India, and two from different locations of Hawaii. Seedlings were transplanted to the field on June 5, 2012 in calcareous Guam cobbly clay soil (pH 7.3, RCB, 5 plant/plot; 2 replications). Accession Honduras matured early with the emergence of first flower buds on November 30, 2012. The first flower was observed on December 10, 2012. Observation will be continued to compare plant morphology and characteristics of seeds.

Artocarpus altilis
Clones of breadfruit (*Artocarpus altilis*) ‘Ma'afala’ were planted in the field of calcareous Guam cobbly clay soil on March 20, 2012 for evaluation of its adaptability in Guam. No flowering was observed during 2012. Investigation is in progress to investigate plant phenology and an occurrence of pest problems.

Outcomes / Impact:
Regeneration of selected lines of crops for Guam will support the increase in local farming production and diversification of agricultural crops as well as conservation of germlines. Evaluation of important tropical plant germlines will support development of sustainable agriculture in the region. The search for new germlines and commercial cultivars with heat tolerance and pest resistance will assist growers in choosing locally adapted vegetables and green manure crops to sustain their manageable farming operation in Guam.

Hawaii

USDA/ARS, Tropical Fruit & Nut Germplasm Repository, Hilo, HI
Project Plan approved and certified in March 2013 for the next five years. Provide daily care and maintenance for 30 acres of clonal field collection of approximately 1000 accessions of 13 tropical fruit and nut crops. Maintain a backup collection of 29 selected cacao, *Theobroma cacao*, accessions from Miami and Puerto Rico. Continued quarantine transfer of USDA National Plant Germplasm System (NPGS) avocado germplasm from Miami to Hilo through Fort Detrick. Twenty three (23) avocado accessions showed no visible laurel wilt symptoms and tested free for Avocado Sunblotch viroid (ASBVd) during the one year quarantine period in Hilo. These trees were transplanted into larger containers and are maintained in a screenhouse; scion wood from these accessions will be made available for research in Hawaii upon request. The unit will receive the next shipment of scions from Fort Detrick at the end of May. The Avocado CGC will consulted in establishing a core collection of about 150 accessions to represent the genetic diversity of the current 400 NPGS accessions. Nine accessions of papaya relatives including Horovitzia, Vasconcellea, Jacaratia and Jarilla were received from various cooperators nationally and internationally. Potted plants are maintained as in a screen house to protect against Papaya Ring sport Virus (PRSV). Unit plantings older than 25 years are propagated on own roots (to avoid misidentification of shoots derived from rootstocks) and replanted in different fields to ensure long term germplasm integrity and vigor, these included the guava (*Psidium*), carambola (*Averrhoa*) and breadfruit (*Artocarpus*) collections. Leaf samples of *Vasconcellea, Litchi* and *Macadamia* spp. were collected and provided to NPGS, universities and international scientists for characterization studies. Regenerated 13 non-transgenic papaya accessions in an isolated location; field planted 2 selected 'Kapoho' papaya lines in a commercial field for evaluation. Provided pineapple tissue cultures and seeds of *Vasconcellea* spp. to NPGS scientists for cryopreservation and molecular studies. Five thousand three hundred and four (5304) observations, 1318 GRIN records were documented; germplasm distributions were 28 for 191 items, and nine germplasm introduced in FY12. Assist an Australian cooperator to collect *Macadamia* samples to trace the distribution of the crop from Australia to Hawaii. Participated and presented information on a career day at the University of Hawaii Manoa campus, PBARC Open house to sons & daughters, community college student, scientists, growers, business and political stakeholders.

Kentucky

Ben Goff was hired as a Forage Legume Agronomist last fall. He will be working on forage legumes as part of livestock/pasture production, but will not conduct breeding activities.

Todd Pfeiffer continues his work on sweet sorghum breeding, with two cultivar releases planned later this year.

Tim Phillips planted a screening/increase trial to evaluate annual lespedezas (*K. stipulacea* and *K. striata*) in KY, and has conducted two cycles of selection in crimson clover for winter hardiness, seed production, and biomass yield.

Recent germplasm requests for material housed at Griffin and sent to KY in 2012 includes sorghum, cowpea, bamboo, annual lespedeza, peanut, Ipomoea, and watermelon. A total of 86 accessions were sent to KY in 2012, down from 94 accessions in 2011. The majority of requests in 2012 were from university researchers, with a few requests from private companies. The following table summarizes numbers of accessions from Griffin sent to KYduring 2009-2012:

	Recipient		
Year	University of KY	Other KY Universities	Private/other
2009	38	1	30
2010	4	25	4
2011	83	0	11
2012	66	3	17

Louisiana

Hibiscus sabdariffa germplasm seeds were screened to select early maturing hibiscus accessions for Louisiana climatic conditions. Accessions were also evaluated for horticultural characteristics. An accession from Thailand , “Thai Red” appeared to have favorable earliness in fruiting to be warranted for further evaluation for field production. This research is in support of a Ph.D. student at Southern University. Malvaceae family species are being screened for odd-chain unsaturated fatty acids in their seed oils. These fatty acids were identified in the initial accessions and additional accessions will be screened. 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). Additional cultivated *Ipomoea batatas* accessions were obtained through the quarantine system from Uruguay for use in skinning resistance research. High numbers of legumes were requested for research purposes at Louisiana State University.

Mississippi

Germplasm requested from GRIN during 2009, 2010, 2011, and 2012 were used for various research and extension activities. During this time period, 160 requests were made from the S-009 Unit by entities in Mississippi. As a result of these requests, 614 plant accessions were supplied to University scientists, USDA scientists, consultants, seed companies, gardeners, and citizens of Mississippi. The most requested crops were legumes (including peanuts), cucurbits, sweetpotato, and sorghum.

The greatest numbers of accessions were distributed to the Hancock County Extension Service. The materials were used in a series of vector and host range studies for bean pod mottle virus, which is the most significant viral pathogen of soybeans in Mississippi. These materials were

grown under greenhouse conditions and inoculated with the virus mechanically as well as by means of the principle vector, the bean leaf beetle. Materials were also used to investigate the potential for other beetles to serve as vectors of the virus. The results of this work are intended to be submitted for publishing in the near future.

Additional requests for material (pepper) were made to aid in research, specifically for cytomolecular (chromosome number determination, rDNA characterization via fluorescent in situ hybridization, genome size and base composition determination via flow cytometry) and morphological characterization of *Solanum aethiopicum.* Sorghum accession requested was used as a standard in flow cytometry analysis of various plant species.

Sweetpotato material (*Ipomea* sp.) was requested to include in our variety trials for feedstock and to determine how they would respond to alternative sustainable practices (conservation tillage).

All *Arachis* seed received from USDA germplasm center were used for a viral diseases project in Brian Baldwin's lab. They were planted in both fields (seed increase) and lab condition (greenhouse and growth chamber for virus inoculation). No viral symptoms were seen on seedlings received from USDA. Our peanut VIGS platform development project is ongoing and any publications related to the seed will bear acknowledgement indicating the source of the materials.

North Carolina

Plant introductions are critical components of plant improvement at NC State University, and programs make use of germplasm maintained in the National Plant Germplasm System (NPGS). 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. Priorities are on incorporating disease and insect resistance, abiotic stress resistance, and quality factors into improved breeding lines and cultivars. During the past year, 23 individuals received entries from the Southern Regional Plant Introduction Station, including species of sorghum, pepper, sesame, watermelon, okra, cucurbits, special purpose legumes, warm season grasses, eggplant, and Ipomoea. The Plant Breeding Center also is supporting a large group of graduate students who are studying plant breeding, many of whom are involved with plant germplasm collections.

The soybean breeder, Andrea Cardinal, left NCSU to take a position at Syngenta. The funds for the position were reverted to the state as part of a budget reduction mandate. Bayer Crop Science has agreed to fund a faculty position in soybean breeding, which should be filled in about a year. Dr. S.P. Tallury, a research assistant professor working with the wild species of peanut, took a position at Florence, SC as their peanut breeder. Funds for the position were reverted to the state.

Collections of *Arachis* cultivars and wild species are being maintained at NC State University. An attempt is being made to create a duplicate collection of the USDA *Arachis* species collection, and there are currently 428 accessions at NC State University (of the 607 accessions

in the USDA collection). In addition, the peanut program is multiplying both wild and cultivated materials for the USDA peanut curator. One hundred seventy six *Arachis* species accessions were planted in a field nursery for seed increases and more than 100 were propagated in the greenhouse and harvested. Seeds of 73 accessions were sent to Griffin, totaling 98,000 seeds. Seeds of 49 accessions also were sent to NCSU for propagation from the peanut curator and plants are being propagated in the greenhouse. There have been some issues with poor germination of the materials sent to NCSU from Griffin. We are attempting to document the numbers of wild peanut accessions being maintained at Texas A&M University, CENARGEN in Brazil, and ICRISAT to replace the lost accessions.

Peanut breeding efforts are being made to pyramid genes for disease resistances into single genotypes, investigate the inheritance of Sclerotinia blight and tomato spotted wilt virus resistances, develop drought resistant genotypes, and higher yields. Both cultivated and wild species are being utilized in the breeding program, and the most advanced breeding lines have a significant amount of wild species germplasm in their pedigrees that are thought to be supplying genes for high levels of disease resistances. Several cultivars were released and two lines, N07019JCSm (a very large-seeded normal-oleic line), and N08082olJCT (a Wynne sister line and the so-called "Bailey high oleic" that was used as a one of the eight "unique" parents in development of the CAP RIL populations are being looked by two area private companies for potential exclusive release. Two interspecific hybrid lines, SPT 06-06 and SPT 06-07, are being considered for release as germplasm as sources of extremely high levels of multiple disease resistance. In addition, a multistate project is being conducted to create 6,400 recombinant inbred lines from crosses between two cultivars and eight lines with an array of quality and disease resistance traits. Half of the materials are in the F7 generation and are being sampled for DNA and increased for seed distribution.

The soybean breeding program has two USDA scientists who are concentrating on utilizing exotic germplasm to improve drought resistance. Significant progress has been made during recent years to increase yields of non-GMO cultivars. Large projects are being conducted to increase drought resistance in the cultivated soybean and to breed for altered fatty acid profiles. Currently, there is not a state-funded soybean breeder at NC State University.

The research focus of the cotton program is developing germplasm, genetic stocks, mapping and genomic resources for enhancing the cotton productivity. Interspecific hybrids are being developed and to further breeding objectives. Cotton fiber quality and yield is being investigated by using inbred populations. Two lines with improved yield fiber quality and fusarium resistance are being released as germplasm lines.

The maize breeding program has one state-supported and two USDA scientists. Projects are currently investigating several other Latin American accessions identified in the Allelic Diversity GEM project that failed to set seed as F1 hybrid females in backcrosses with standard lines. Efforts are being made to study incompatibility factors in U.S. and Mexican maize. These factors have both historic and (potentially) economic interest. The GEM site at Iowa State, the Panzea site at Cornell, and the maize genetics site at Cornell all have data from the maize program at NC State.

The U.S. collection of cultivated and wild *Nicotiana* species is maintained at NCSU and numerous seed requests have been received by U.S. and international individuals and organizations. Accessions are no longer being sent out to individuals or companies other than those that support the NCSU tobacco breeding program. The tobacco breeding program continues to develop hybrids for both the flue-cured and burley markets with enhanced disease and virus resistances. Transcription factors in tobacco and its effects on nicotine biosynthesis are also being studied.

The Wheat Breeding program is utilizing wild species to introgress genes for scab and other diseases into the cultivated species. 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.

A turfgrass breeding program has both biotechnology and cultivar improvement components. High throughput transformation protocols were developed for switchgrass and perennial ryegrass, and useful genes were transferred into these two species. The turfgrass breeder is working to improve the sustainability by developing cultivars that require reduced inputs and that are capable of tolerating biotic and environmental stresses. Specific projects include breeding for drought tolerance in tall fescue; breeding for cold tolerance in St. Augustine grass, and bermudagrass; evaluation of St. Augustine grass germplasm for gray leaf spot resistance; evaluation of zoysiagrass germplasm for large patch resistance; and developing EMS mutants in centipede grass

The tomato breeding program at NC State University aims to improve tomato for fruit quality, disease resistance and stress tolerance by conventional and molecular breeding methods. Current emphasis is to combine resistances for early blight, late blight, fusarium wilt, bacterial wilt, tomato spotted wilt virus, tomato mosaic virus and root knot nematode. Conventional and molecular approaches are adopted to improve the tomato for fruit quality, fruit smoothness, size and color. Progress is being made to achieve these overall objectives as indicated by the release of following hybrids and breeding lines. Five hybrid grape-type tomatoes were released during the past year.

The cut flower breeding program is focusing on new cultivar evaluation, greenhouse and field production, and postharvest handling. Emphasis is being placed on zinnias and *Eucomis*. Zinnias are a popular cut flower crop grown widely throughout the U.S. and *Eucomis* is a new crop with potential for the Southeast. Efforts are being made to develop *Z. violacea* cultivars with powdery mildew resistance and cultivars of *Eucomis* with stronger flower racemes to reduce lodging.

Buddleja (butterfly bush) is being bred for compact and sterile forms with reduced or no invasive potential. Traditional cultivars are excessively vigorous and challenging to manage in a home landscape. Six advanced selections are under trial and planned for release during the coming year.

Cercis canadensis (redbud) is being bred for a series of weeping and compact forms encompassing the range of leaf variants (purple leaf, variegated leaf, golden leaf) and flower

color variants. Hybridization of eastern redbud with Texas redbud is incorporating genes for drought and heat tolerance from the Texas forms into typical eastern redbuds.

The cucumber breeding project at NC State has been working on the development of new hybrids of pickling type for use by North Carolina growers. The NCSU caneberry (blackberry and raspberry breeding program) objectives are to develop blackberry and raspberry cultivars adapted to North Carolina. In 2011, advanced selections in replicated trials were evaluated in both the field and under high tunnels. Watermelon outcrossing rate, yield stability, and hollow heart resistance are being studied. Watermelon populations with orange flesh, canary yellow flesh, small fruit, high yield, high quality, or gummy stem blight resistance are being improved for use in cultivar development. Breeding is continuing on eastern shipping cantaloupes, Sprite melons and canary melons.

Research emphasis for sweetpotatoes is to develop disease and insect resistant table-stock, processing and specialty-type sweetpotatoes with improved root quality. Efforts are being made to improve resistance to insects and pathogens by utilizing wild and/or related plant germplasm as a source of commercially important traits.

Germplasm and Cultivar Releases during the Past Year

Germplasm

Cotton: NC05AZ21 okra-leaf
Cotton: NC05-11 normal-leaf upland cotton

Peanut: SPT 06-06 peanut interspecific hybrid with high yield and disease resistance
Peanut: SPT 06-07 peanut interspecific hybrid with high yield and disease resistance

Tomato: NC 58S – TSWV line
Tomato: NC 123S– TSWV line
Tomato: NC 127S – TSWV line
Tomato: NC 132S– TSWV line

Soft red winter wheat: VA04W-433 -- Fusarium head blight–resistant (joint with VA)
Soft red winter wheat: VA04W-474 -- Fusarium head blight–resistant (joint with VA)

Cultivars

Peanut: Sullivan – large seeded Virginia type peanut with multiple disease resistances
Peanut: Wynne – large seeded Virginia type peanut with multiple disease resistances
Peanut: Titan – large seeded Virginia type peanut (joint with VA)

Tomato: Mountain Honey – Grape hybrid tomato
Tomato: Mountain Magic – large tomato with early & late blight resistance
Tomato: Mountain Vineyard – Grape hybrid tomato
Tomato: NC 4Grape – Grape tomato breeding line
Tomato: NC 5Grape – Grape tomato breeding line
Tomato: NC 6Grape – Grape tomato breeding line

Oklahoma

Plant germplasm distribution data indicate that 341 plant accessions maintained at the USDA ARS Plant Genetic Resources Conservation Unit at Griffin, GA, were distributed to organizations or individuals in Oklahoma. The accessions were distributed in 49 requests. The requested plant germplasm in 2012 included sorghum (*Sorghum bicolor*) (9 accessions), multiple *Panicum* species (*virgatum, amarum, antidotale, bergii, capillare, coloratum, decompositum, deustum, dichotomiflorum, dregeanum, hallii, lanipes, milioides, natalense, polygonatum, queenslandicum, schinzii, stapfianum, subalbidum, trichanthum*, and *turgidum*) (256 accessions), Zoysiagrass (*Zoysia* sp.) (22 accessions), sweetpotato (*Ipomoea batatas*) (27 accessions), peanuts (*Arachis hypogaea*) (15 accessions), peppers (*Capsicum annuum*) (1 accession), guar (*Cyamopsis tetragonoloba*) (7 accessions), vigna (*Vigna* spp.) (12 accessions), elusine grass (*Eleusine coracana*) (1 accession). Receivers of the plant accessions represent researchers of Oklahoma State University, USDA-ARS laboratories, Noble Foundation, local companies and individuals in the state.

Puerto Rico

Eighteen quenepa cultivars are in the eighth year of evaluation. In 2012 fruit production was poor. In Lajas, 74.1% of the trees flowered and 17.9% fruited, with an average harvest weight of 56.5 pounds per tree. In Juana Diaz only 50% of the cultivars flowered in 2012, and 14.8% fruited, with an average of 47.1 pounds per tree. Citrus germplasm collections are being maintained in screenhouses at Isabela and Rio Piedras. The rootstock evaluation of 'Tahiti' lime at Corozal and Isabela is in its third year of harvest. The highest yielding rootstock at both localities is rough lemon. An evaluation of planting date with 5 yellow fleshed sweet potatoes showed higher yields in the January planting than in September, but there was no difference in sweet potato weevil damage between the planting seasons. The FHIA 21 plantain shows a higher tolerance to black sigatoka than 'Maricongo' with no chemical fungicide application, with severity indices of 23% and 40%, respectively. Chemical fungicide treatment increased the average bunch and finger weight for both plantain clones. A pigeonpea evaluation experiment was established in November 2012 in Isabela to evaluate pod fly resistance from crosses with resistant line l-8-3-1. Small samples of seed of 63 rice accessions were increased in order to conduct a field evaluation. A field evaluation of 30 accessions with 4 replications was conducted under flooded and upland conditions. Seeds of historical vegetable cultivars were obtained and increased for field trials, including okra, cucumber, pumpkin, tomato, and eggplant. Evaluations are being conducted in a field trial at Juana Diaz with 7 tomato, 4 cucumber, and 3 pumpkin varieties. A survey for the detection of *Phytophthora* was conducted in commercial citrus orchards and at three experiment stations. Both *P. nicotianae* and *P. citricola* were identified. Studies on achachairu propagation and resistance to fruit fly are being conducted. Ten local breadfruit clones were selected, described, and propagated for field trials. USDA germplasm requests in Puerto Rico in 2012 include 10 accessions of sweetpotato, 3 pepper, 1 cowpea, 1 mung bean and 1 peanut.

South Carolina

Germplasm Distribution
A total of 2920 germplasm accessions were distributed by the Plant Genetic Resources Conservation Unit at Griffin, GA to the following individuals in South Carolina in 2012:
R. Cerney, 1 *Arachis* accession (peanut); Dr. Howard Harrison, USDA Vegetable Laboratory, Charleston, SC, 5 *Benincasa* (watermelon) and 192 *Citrullus* (watermelon) accessions; D. Gilbert, Lanherne Farms, 2 *Capsicum* spp. (pepper); W. Hucks, 1 *Capsicum* spp.; J. Quasha, 1 *Capsicum* spp.; Dr. Amnon Levi, USDA Vegetable Laboratory, Charleston, 132 *Citrullus*, accessions; M. McMillan, USDA Vegetable Laboratory, Charleston, 20 *Citrullus* accessions; Dr. Mike Jackson, USDA Vegetable Laboratory, Charleston, 276 *Ipomoea* (sweetpotato) accessions; Dr. K. Ling, USDA Vegetable Laboratory, Charleston, 1 *Ipomoea* accession; R. Schontag, 1 *Ipomoea* accession, 1 Sorghum (grain sorghum) accession, and 1 *Trifolium* (clover) accession; Dr. S. Kresovich, University of South Carolina, Columbia, SC, 667 Sorghum accessions; G. Morris, University of South Carolina, 801 Sorghum accessions; A. Patrick, University of South Carolina, 2 Sorghum accessions; D. Rhodes, University of South Carolina, 86 Sorghum accessions; Dr. T. Stefaniak, University of South Carolina, 30 Sorghum accessions; L. Fischer, 3 *Vigna* (cowpea) accessions; and Dr. W. Wechter, USDA Vegetable Laboratory, Charleston, 697 *Vigna* accessions.

Plant Breeding Changes at Clemson University
Dr. Stephen Kresovich began work at Clemson University on July 1, 2013. He is a professor in the Department of Genetics and Biochemistry and will occupy the endowed position of Coker Chair in Molecular Genetics in the School of Agricultural, Forest, and Environmental Sciences. He comes to Clemson from the University of South Carolina and will lead the Advanced Plant Technology Program based at the Clemson's Pee Dee Research and Education Center (REC), Florence, SC. Dr. Kresovich is the new South Carolina representative on the S-009 Technical Advisory Committee.

Dr. Shyam Tallury began work at the Clemson University Pee Dee REC (Florence, SC) on July 1, 2013 in peanut breeding. He comes from North Carolina State University where he worked in the peanut breeding program with Dr. Tom Isleib and Dr. Tom Stalker. He brings considerable experience in working with wild *Arachis* peanut species and introgression of disease resistance genes into cultivated peanuts.

Dr. Benjamin (Ben) Fallen began work at the Pee Dee REC (Florence, SC) on May 1, 2013 in soybean breeding. He received the Ph.D. degree from the University of Tennessee in December, 2013. While in graduate school, he worked full-time in Dr. Vince Pantalone's soybean breeding program.

Dr. Emerson Shipe, soybean breeder, retired December 31, 2012, and is working part-time with the Clemson Agricultural Experiment Station.

Tennessee

The following projects are being conducted at the University of Tennessee in which plant introductions are being utilized in research.
Biofuel Crop Alternatives:

Switchgrass
Project Title: Breeding improved synthetic varieties of Switchgrass
Personnel: Fred Allen, Professor; Virginia Sykes, Grad Research Assistant; and Hem Bhandari, Assistant Professor, Dept. of Plant Sciences, Univ. of Tennessee.
Objective: Development of improved varieties of Switchgrass
Approach: Three PIs are being intercrossed with two experimental lines and two released cultivars for the purpose of developing new synthetic varieties of switchgrass. A polycross nursery was established in spring 2007. F1 half-sib families were established in the field in 2009 and have been evaluated for yield and various agronomic traits in 2010, 2011, 2012, and 2013. Two new M.S. projects were initiated in 2012 on this set of materials and will be completed in 2014.

Row Crops:
Corn
Project Title: Cereal Breeding
Subtitle: Breeding maize lines with exotic germplasm
Personnel: Dennis West, Univ Tenn
Collaborators: Major Goodman, Matt Krakowsky, USDA and NCSU
Objective: Develop improved maize germplasm for the southern region.
Approach: Early generation lines from the Germplasm Enhancement of Maize (GEM) project, expired PVP lines, and other germplasm obtained from the North Central Regional Plant Introduction station maize collection are crossed with elite adapted lines. Progeny from crosses are advanced by traditional breeding methods, to develop new maize parental lines. In 2012 we obtained the following maize germplasm from the NPGS and have been included in our maize breeding project:

	PI/code	Cultivar
1. Lines from the GEM project;	GEMN-0229	-
	GEMS-0224	-
	GEMN-0230	-
	GEMN-0231	-
	GEMN-0232	-
	GEMS-0226	-
	GEMN-0225	-
	GEMS-0227	-
	GEMS-0228	-
2. Expired PVP lines;	562378	LH165
	564542	LH184
	559375	LH222
	562381	LH224
	565099	PHVJ4
	565106	PHJR5
	565107	PHKE6
	565111	PHV57
	565113	PHW80

Soybean

Project Title: Germplasm Resources for Enhancing Glyphosate Herbicide Resistant Soybean Seed Yield

Personnel: Vince Pantalone, Professor; Ben Fallen, Research Associate, Debbie Ellis, Research Associate, Beth Meyer, Research Associate, Chris Smallwood, Research Associate, Dept. of Plant Sciences, Univ. of Tennessee

Objective: Utilize germplasm resources to develop elite herbicide resistant soybean lines

Approach: Data were analyzed from seven environments in 2011 to evaluate field performance of glyphosate resistant line TN06-140RR (currently the released cultivar named USG 75T40). That elite line was developed by our program from crossing TN01-294RR and LG98-1445. The female parent we developed by making three backcrosses away from the Monsanto herbicide resistant source to our recurrent parent line TN93-99, which is registered germplasm line GP-280 in the USDA Germplasm Collection. The male pollen donor line is registered germplasm line GP-318 in the USDA germplasm collection and it contains two exotic pedigree sources (PI 227333 and PI 91730-1) that collectively contributed less than 10% of the genes to U.S. soybean cultivars. The opportunity to infuse new high yield genes was a major purpose of this cross.

Results: In seven environments of field testing in the Tennessee State Variety Test, our new herbicide resistant cultivar USG 75T40 produced the highest seed yield in its test, significantly greater than the commercial average by 5 Bu/A; moreover, the cultivar was also the top yielding entry in the 2 year and 3 year averages of maturity group V early Roundup Ready entries in the Tennessee State Variety Test. We also confirmed that the cultivar shows excellent resistance to soybean cyst nematode Race 2.

Project Title: Germplasm Resources for Conventional Soybean Seed Yield Improvement

Personnel: Vince Pantalone, Professor; Ben Fallen, Research Associate, Debbie Ellis, Research Associate, Beth Meyer, Research Associate, Chris Smallwood, Research Associate, Dept. of Plant Sciences, Univ. of Tennessee

Objective: Develop elite conventional soybean lines through germplasm resources

Approach: 1) A cross was made between two high yielding cultivars (5601T, CV-441 and 5002T, CV-466) that we developed and registered in the USDA germplasm collection. The progeny line TN05-5018 (relative maturity 4.9) was selected and tested over seven environments in the 2011 Tennessee State Variety Test and over 22 environments in the 2011 USDA Southern Uniform Test.

2) The cross 5601T × PI417088 was made to develop progeny line TN08-101 which was evaluated in the 2011 Southern Uniform Preliminary Test (MG IV-Late) over 12 environments.

3) A cross between two registered cultivars in the USDA Germplasm Collection (Fowler × Anand) produced progeny line TN09-008 which was evaluated in the 2011 Southern Uniform Preliminary Test (MG V) over 12 environments.

Results: 1) In the Tennessee State Variety Test, our new elite conventional soybean line TN05-5018 was the top yielding entry, exceeding the test average of conventional and herbicide resistant entries by 8 Bu/A. In the USDA Southern Uniform Test, TN05-5018 also produced the highest seed yield among all entries in the test. A request will be made to breeders next year to consider adopting this line as a new USDA check cultivar to replace 5002T.

2) In the USDA Southern Uniform Preliminary Test (MG IV-Late), line TN08-101 was the highest yielding entry in its test, exceeding the average of all entries by 5.5 Bu/A. That line contains 50% exotic parentage.

3) In the USDA Southern Uniform Preliminary Test (MG V), line TN09-008 was the highest yielding entry in its test, exceeding the average of all entries by 5.2 Bu/A. It showed excellent resistance to SCN Race 5 and moderate resistance to SCN Races 2 and 3. This line is being proposed for release as a new germplasm line for deposit to the USDA Germplasm Collection.

Project Title: Biodiesel Improvement through Elevated Oleic Acid
Personnel: Vince Pantalone, Professor; Ben Fallen, Research Associate, Carl E. Sams, and Dean A. Kopsell, Dept. of Plant Sciences, Univ. of Tennessee
Objective: To increase the monounsaturated fatty acid, oleic acid for improvement in biodiesel oxidative stability.
Approach: Sister lines of the mid-oleic registered germplasm line N98-4445A donated elevated oleic acid through crosses with glyphosate resistant versions of crosses of the registered cultivar 5601T and the registered germplasm line TN93-99 to produce new progeny lines. The lines were tested in multiple environments from eastern Virginia to West Tennessee and biodiesel properties were evaluated from extracted seed oil.
Results: The new elevated oleic acid lines had significantly better iodine value, peroxide value, and induction period, indicating better biodiesel properties and oxidative stability than the two commercial cultivars.

Niger
Project Title: Evaluation of Niger (*Guizotia abyssinica* L.) Accessions for Seed Production & Agronomic Traits
Personnel: Fred Allen, Professor and Victoria Knapp, Grad Research Assistant, Dept. of Plant Sciences, Univ. of Tennessee
Objective: Evaluate seed production potential of niger accessions, and evaluate crosses from selected parent lines for seed yield, oil and fatty acid profiles in the seed..
Approach: Fourteen niger accessions from the USDA germplasm collection were evaluated during the summer of 2012 for seed production potential and agronomic traits. Based on those evaluations crosses have been made among 6 chosen parental lines in order to determine if the feasible of selecting improved lines as new cultivars. The parental lines, F1, F2 and reciprocal backcross materials will be evaluated at two locations in TN during 2013 and 2014.
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Texas

Peanut germplasm was requested by Dr. Mark Burrow for evaluation of salt tolerance. These lines were increased and were then planted in Pecos, TX, for evaluation of salinity tolerance. This peanut germplasm evaluation is in progress. Evaluation of guar germplasm continues at Texas Tech University under the direction of Dr. Dick Auld. Guar investigations include branching habit, maturity and yield. Sorghum germplasm was evaluated at multiple locations for disease resistance, flowering, biomass production, bioenergy traits, grain production and suitability for use in breeding programs. *Panicum virgatum* is under evaluation by Dr. Xinwang Wang for biomass and cell wall composition. Seven St. Augustine turfgrass lines were used in crosses as part of a breeding program to develop turfgrass with improved drought tolerance and disease resistance. Cowpea and lablab germplasm was evaluated at Overton, TX, for forage and seed production potential.

U.S. National Cotton Germplasm Collection, USDA-ARS-SPARC
Crop Germplasm Research Unit, College Station, TX

Seed increase and descriptor evaluation
The USDA-ARS staff for The National Cotton Germplasm Collection became smaller with the early buyout retirement of long time technician Tony Bautista (Weslaco, TX). We appreciate the many dedicated years of Tony in flawlessly shipping seed to/from the Cotton Winter Nursery (CWN). The CWN is established with a cooperative agreement with Cotton Council for routine increases of the majority of cotton accessions in the Collection as well as for cooperators (e.g. cotton breeders). Janna Love has absorbed the duties of arranging shipments to the CWN in time for planting.

The annual goal of the Collection is to seed increase up to 10% of the collection each year at the CWN. We sent 777 lines to the CWN for this season, with the first 600 entirely from the obsolete cultivar subcollection (i.e. *G. hirsutum*). The last 177 are an RIL population in critical need of ample seed increase. Other cotton species were avoided because of slower maturity and the unavailability of a carryover nursery. In the overall operations we exceeded the normal plantings because of the CLCV project for which an additional 423 lines were planted at the CWN. They also consisted largely of obsolete cultivars. In College Station over 900 accessions were planted for gathering standardized descriptor data and digital images.

Thanks to financial support from Cotton Incorporated (and collaboration with Jodi Scheffler, ARS, Stoneville. MS) James and Janna were able to complete descriptor data and digital images at the CWN in 2012.

Descriptor data and images have been gathered since 2011 and progress is as follows:

CWN 2010-2011 season,	V11 (CLCV planting)	1074 accessions
College Station field,	CS11	192
CWN 2011-2012 season,	T12 (collection)	832 accessions
	V12	982
	CS12	900

This total is 3980 accessions that are considered digitally characterized. Cotton Inc. provided 2013 funding for an extended visit to the CWN to score descriptors and take pictures. However the increase restrictions on travel to Mexico essentially forced a cancellation of the trip this spring to the CWN. Many of these lines were replanted this spring (nearly 1000 accessions) in College Station so that we can stay on pace to the halfway point of a ‘digital’ characterization of the Collection. Additional camera equipment was purchased with funds from Cotton Inc. and this improved the range of digital images and the speed at which Janna can capture them in the field.

We have re-inventoried our original and increase seed lots, and where possible, started adding descriptors and digital images on unprocessed seed (‘fuzzy’) and fiber samples. For local

plantings of accessions for digital images and descriptors we try to plant out original or early increase seed lots in order to retroactively establish baselines for the collection.

Distribution and acquisition

Demand for the collection is trending upward with over 6000 accessions distributed in over 140 orders and is much higher than our five year average of 2700 accessions in 97 orders. Interest in the core set for SSR analyses, the full range of *Gossypium* species and even accessions with defined mutant alleles is increasing. Thus the maintenance of the extreme diversity of the collection and meeting the needs of the breeders remains paramount. Many orders do remain unfilled for a range of reasons (e.g., critical seed levels, not found in our collection, permit restrictions, etc.) and present new challenges to our operations and to germplasm exchanges.

Often overlooked are the numerous requests for leaf tissue of exotic species from the greenhouse plants. This saves the user time and avoids depletion of rare seed supplies. We also continue to shape orders for users according to special research interests such as molecular characterization, disease resistance, ornamental characters, seed properties, etc.

Thirty five accessions were added to the collection from expired PVP/CSR protection. Cotton Inc. also provided 2013 funding for Dr. Frelichowski to explore Puerto Rico (PR) for cotton germplasm. The addition of the latest camera equipment, GPS navigation and tagging of images, and the ease of visiting a US Territory provided for a chance to thoroughly collect and document new germplasm for the Collection and possibly create a blueprint for general cotton collection.

James Frelichowski went to PR from February 8th to 17th, 2013, to explore for wild cotton. He traveled with Dr. Louis Prom, the ARS Sorghum Pathologist at our unit in College Station, TX, because Dr. Prom regularly travels to his Sorghum plantings for joint evaluations of Sorghum diseases and germplasm resistances with collaborators of the ARS Tropical Agriculture Research Station (TARS), Mayaguez, PR. Even though there are accessions from PR in the collection, the provenance data is poorly detailed and some accessions are in critical status. This trip is intended to GPS tag sites where cotton grows, document with pictures and GPS logs where cotton is found and not found, and bring back some images of the morphological diversity of the wild cotton. Over 900 miles were traveled and most of the wild cotton was found on roadsides or margins of areas cleared naturally (tidal flats) or by man's activities. Most of the cotton was associated with vegetation typical of seashore areas or a short distance inland, often where horses are kept and never where cattle is raised. Commercial cotton plantings were not around so wild cotton persists naturally and/or becomes feral from dooryard plantings. Seventy nine cotton plants or populations were photographed and tagged with fitted GPS unit to give an excellent survey of PR. Numerous other plants or populations were sighted and marked as waypoints on a Garmin GPS because we could not stop everywhere due to time restrictions or safety or access concerns (e.g. narrow shoulders on fast highways). The southern portion of PR was much more populated with cotton than the north, but morphological diversity was seen throughout and justifies the wide search in PR for wild cotton. We are still waiting on communication from PR for permission to collect and import cottonseed from these locations. The reason the exploration was done so soon was because cotton was fully mature everywhere in PR at this time and would not begin to flower again until the end of the calendar year. A quick survey of the island was possible with just driving on roads close to the coast, but doubtless more cotton could be found

with further exploration of hotspots, and corresponding trails, and by continuing to question collaborators in PR for more detail on wild cotton growing naturally or as dooryards.

We are planning to explore for *Gossypium thurberi* in Arizona this fall and again document with GPS tagged photographs. Janna Love will hopefully take better pictures than I took in PR, because it was challenging to cover such a large area in a short time in PR. *G. thurberi* is truly wild and will provide a good model to compare with *G. hirsutum* and *G. barbadense* which have complex origins and their natural occurrence in areas per se are still debatable.

Database building
Images are continually processed for uploading to www.CottonGen.org. A meeting was held at our location in College Station, November 13th, for the primary US collaboration with expanding the descriptor and digital image database. Don Jones and representatives from four ARS locations, Texas Agrilife in Lubbock, TX (Dr. Jane Dever's research lab) and Washington State, were in attendance. We plan to meet again with collaborators this fall in conjunction with the Cotton Breeders Tour, in the Lubbock cotton growing regions.

Important issues discussed were the standardized formats for descriptor lists and digital images for all accessions of the Collection. James Frelichowski developed an excel file with standardized descriptors for field use in scoring descriptors. This will be the format for filling the collection database with descriptors and for distributing to collaborators or users of the collection. Gathering digital images in concert with the descriptors will help validate the procedures and demonstrate them to the community.

We have begun to upload images into CottonGen in order to meet milestones and to develop a platform to the cotton community for using the images. This spring Janna Love shared over 12,000 images with Cottongen, primarily collected from the accessions in the 2012 growing seasons in College Station and the CWN. Sharing earlier images will take longer because of the time involved in reformatting the file names. Cotton Incorporated also supports CottonGen and it is our collective desire to quickly make public the existing descriptor and digital image databases and to establish standards for continued digitization of the collection.

Challenges
Budget cuts have made difficult meeting current workloads and we fear a reduction in Texas A&M student labor in the next fiscal year(s). Insect outbreaks in our greenhouses have hurt our perennial collection of Gossypium and predators had to be purchased to control them. Security and financial concerns with the Mexican CWN has delayed increases and characterizations of exotic landraces in the collection. We will continue to reach out to Cotton Inc. and our collaborators to keep meeting demand for germplasm and steadily improve the databases of the collection and where possible still acquire new Gossypium germplasm.

Virgin Islands

University of Virgin Islands
Plant breeding was used to combine beneficial characteristics of sorrel varieties to develop new highly marketable types. The day neutral variety and black variety were used in reciprocal

crosses to determine the best combination. Varieties with long fruit and white fruit were also used. Because sorrel sheds pollen prior to the flower opening, it self-pollinates itself. To make the crosses, floral buds were manually opened in the early evening and the anthers removed. A paper coin envelope was placed over the emasculated flower. The crosses were made right at sunrise and tagged. The seed capsules matured in four weeks and seeds were collected and counted.

Seeds were produced on a large scale and supplied to the VI Dept. of Agriculture who grew seedlings for farmers and backyard gardeners. Over 265 small packets of seeds were also directly distributed to farmers and local gardeners upon request. Local growers have incorporated the new sorrels and the traditional late sorrel of four years ago can no longer be found. Growers have replaced the traditional sorrel with the new more productive varieties and darker red colored hybrids. Growers are also able to plant at three month intervals to ensure continuous production. Consumers buy the fresh sorrel whenever they see it available.

Sweetpotatoes were established in winter and summer to determine if photoperiod had an influence on tuberous root production. Sweetpotato cuttings from virus-free material obtained from the USDA Germplasm Repository in Griffin, GA, were grown for cuttings and distributed to 27 farmers and gardeners. Fifteen sweet potato varieties were grown and included tropical and temperate varieties. The varieties were Beauregard-14, Evangeline, Francia, Kawogo, Liberty, Mojave, Murasaki, Okinawa, Self Fertile, St Kitts, Toquecita, Wanoman, White Jewel and Yellow Sunflower. Cuttings from virus free stock plants were spaced at one foot in row and four feet between rows. Drip irrigation was used to supply water and fertilizer. Weevil traps were distributed throughout sweet potato plantings and monitored weekly. Weevils accumulating in the traps were counted and destroyed and traps reset in the field. Harvest was conducted at 120 and 150 days. A field cultivator was modified to eliminate the use of forks which stabbed the sweet potato roots. Following harvest, a taste panel evaluated the flavor of the varieties in a blind test

Impact

There has been a complete change in sorrel production in the US Virgin Islands in just four years ago. Sorrel production has increased substantially and the season has been expanded by five months due to the UVI release of new sorrel cultivars. The local consumers have increased the demand and now consumers expect fresh sorrel most of the year. The local growers have expanded their sorrel production with the new cultivars and hybrids to try and meet the increasing demand. Local growers have requested the virus-free sweetpotato varieties and 34 farmers now grow this material. They plan to follow production practices for sweetpotato to reduce the influence of weevils.

Publications

Plant Genetic Resources Conservation Unit

Austin, D., Jarret, R.L. 2013. Roots as a source of food. In: Eshel, A. and Beeckman, T., editors. Plant Roots: The Hidden Half. 4th Edition. CRC Press. Chapter 30.

Barkley, N.L., Isleib, T., Culbreath, A. 2013. Why preserve and evaluate genetic resources in peanut? Meeting Abstract. Advances in Arachis through Genomics and Biotechnology. No. 11.

Barkley, N.L., Isleib, T.G., Wang, M.L., Pittman, R.N. 2013. Genotypic effect of ahFAD2 on fatty acid seed profiles in six segregating peanut (*Arachis hypogaea* L.) populations. BioMed Central (BMC) Genetics. http://www.biomedcentral.com/1471-2156/14/62 .

Barkley, N.L., Wang, M.L. 2013. Oleic Acid: Natural variation and potential enhancement in oilseed crops. In: Silva, L, editor. Oleic Acid: Dietary Sources, Functions, and Health Benefits. Hauppauge, NY:Nova Publishers. p.29-44.

Barkley, N.L., Wang, M.L. 2012. The United States *Arachis* germplasm collection: a valuable genetic resource for mining useful traits to improve peanut quality and production. International Conference on Legume Genomics and Genetics. Hyderabad, India 10/2/2012-10/7/2012.

Barkley, N.L., Wang, M.L. 2013. Revealing gene function and genetic diversity in plants and animals via TILLING and EcoTILLING.In: Neri, C. of Advances in Genome Science Changing Views on Living Organisms. Volume 1. Oak Park, IL: Bentham Science Publishers. p.316-351.

Chamberlin, K.D., Barkley, N.L., Tillman, B. 2013. Comparing three methods used to determine the oleic/linoleic acid ratio in a single peanut seed [abstract]. In: Proceedings of the American Peanut Research and Education Society Proceedings, July 10-12, 2012, Raleigh, NC. 44:26.

Chen, C., Wang, M.L., Barkley, N.L., Dang, P.M., Holbrook Jr, C.C., Liu, L. 2013. Genetic variation of purified U.S. Peanut (*Arachis hypogaea* L.) mini-core collection.Meeting Abstract.Advances in Arachis through Genomics and Biotechnoloty. No. 13.

Chen, C.Y., Wang, M.L., Barkley, N.L., Tonnis, B.D. 2013. Effect of GxE interaction on oil content and fatty acid composition of cultivated peanuts. American Peanut Research and Education Society Abstracts. Paper No. 48.

He, G.H., Barkley, N.L., Zhao, Y.L., Yuan, M. 2013. Use of EST-SSR loci flanking regions for phylogenetic analysis of genus *Arachis*. American Peanut Research and Education Society Abstracts. Paper No. 93.

Isleib, T., Barkley, N.L. 2013. Contributions of plant introductions to the ancestry of current U.S. peanut cultivars. American Peanut Research and Education Society Abstracts. Paper No. 58.

Jarret, R.L., Levy, I.J., Potter, T.L., Cermak, S.C. 2013. Seed oil and fatty acid composition in *Capsicum* spp. Journal of Food Composition and Analysis. 30(2):102-108.

Jarret, R.L., Levy, I.J., Potter, T.L., Cermak, S.C., Merrick, L.C. 2013. Seed oil content and fatty acid composition in a genebank collection of *Cucurbita moschata* Duchesne and *C. argyrosperma* C. Huber. Plant Genetic Resources: Characterization and Utilization. 11:149-157.

Liu, J., Wang, M.L., Tonnis, B.D., Habteselassie, M., Liao, X., Huang, Q. 2012. Fungal pretreatment of switchgrass for improved saccharification and simultaneous enzyme production. Bioresource Technology. 135:39-45.

Morris, J.B., Grusak, M.A., Wang, M.L., Tonnis, B.D. 2013. Mineral, flavonoid, and fatty acid concentrations in ten diverse *Lablab purpureus* (L.) sweet accessions. In:Kuang, H., editor. Phytochemicals: Occurence in Nature, Health Effects and Antioxidant Properties. New York, NY, Nova Publishers. p. 219-224.

Morris, J.B., Wang, M.L., Grusak, M.A., Tonnis, B.D. 2013. Fatty acid, flavonol, and mineral composition variability among seven *Macrotyloma uniflorum* (Lam.) verdc. accessions. Agriculture 2013. 3(1):157-169.

Morris, J.B., Wang, M.L., Tonnis, B.D. 2013. Variability of phenotype, anthocyanin indexes, and flavonoids in accessions from a close relative of soybean, *Neontonia wightii* (Wright & Arn. J.A. Lackey) in the U.S. germplasm collection for potential use as a health forage. In: El-Shemy, Hany A., editor. Soybean Bio-Active Compounds. Rijeka,Croatia:Intech. p.375-386.

Morris, J.B., Antonious, G. 2013. Glucose, stem dry weight variation, principal component and cluster analysis for some agronomic traits among 16 regenerated *Crotalaria juncea* accessions for potential cellulosic ethanol. Journal of Environmental Science and Health. 48(3):214-218.

Wang, J., Wang, M.L., Spiertz, J., Liu, Z., Han, L., Xie, G. 2013. Genetic variation in yield and chemical composition of wide range of sorghum accessions grown in north-west China. Research on Crops (an International Journal). 14(1):95-105.

Wang, M.L., Chen, C.Y., Tonnis, B.D., Barkley, N.L., Pinnow, D.L., Pittman, R.N., Davis, J., Holbrook Jr, C.C., Stalker, H., Pederson, G.A. 2013. Oil, fatty acid, flavonoid, and resveratrol content variability in FAD2A functional SNP genotypes in the U.S. peanut mini-core collection. Journal of Agricultural and Food Chemistry. 61:2875-2882.

Wang, M.L., Chen, Z., Barkley, N.L., Morris, J.B., Pederson, G.A. 2013. Genetic and chemical evaluation of the U.S. castor germplasm collection for biodiesel production (abstract). Plant and Animal Genome Conference. Poster No.1043.

Xin, Z., Wang, M.L., Chopra, S., Wang, P. 2013. Gene Mutagensis Systems and Resources for the Saccharinae. In: Patterson, A.H., editor. Plant Genetics and Genomics: Crops and Models. New York, NY:Springer Publishing Company. 11:p. 169-185.

Florida

Cherry, R., H. Lu, A. Wright, P. Roberts, and Y. Luo. 2012. Effect of silicon on resistance of St. Augustinegrass to Southern Chinch Bugs (Hemiptera: Blissidae) and plant disease. J. Entomol. Sci. 47(1): 17-26.

Cannon, E.K., Birkett, S.M., Braun, B.L., Kodavali, S., Jennewein, D.M., Yilmaz, A., Antonescu, V., Antonescu, C., Harper, L.C., Gardiner, J.M., Schaeffer, M.L., Campbell, D.A., Andorf, C.M., Andorf, D., Lisch, D., Koch, K.E., McCarty, D.R., Quackenbush, J., Grotewold, E., Lushbough, C.M., Sen, T.Z., Lawrence, C.J. (2012). POPcorn: An online resource providing access to distributed and diverse maize project data. Int. J. Plant Genomics 2011,923035.

Guan, J.C., Koch, K.E., Suzuki, M., Wu, S., Latshaw, S., Petruff, T., Goulet, C., Klee, H.J., and McCarty, D.R. (2012). Diverse roles of strigolactone signaling in maize architecture and the uncoupling of a branching-specific subnetwork. Plant Physiol 160, 1303-1317.

Hunter, C.T., Hill Kirienko, D.R., Sylvester, A.W., Peter, G.F., McCarty, D.R., Koch, K.E. (2012). Cellulose Synthase-Like D1 is integral to normal cell division, expansion, and leaf development in maize. Plant Physiol. 158, 708-724.

Kennedy, C., T. Hasing, N. Peres and V.M. Whitaker. 2013. Evaluation of Strawberry Species and Cultivars for Powdery Mildew Resistance in Open Field and High Tunnel Production Systems in Florida. HortScience (accepted).

Kimball, J., M. Zuleta, K. Kenworthy, V. Lehman and S. Milla-Lewis. 2012. Assessment of genetic diversity in *Zoysia* species using amplified fragment length polymorphism markers. Crop Science 52: 360-370. doi:10.2135/cropsci2011.05.0252.

Kimball, J., M. Zuleta, M. Martin, K. Kenworthy, A. Chandra and S. Milla-Lewis. 2012. Assessment of molecular variation within 'Raleigh' St. Augustinegrass using amplified fragment length polymorphism markers. Hortscience 47: 839-844.

Koch, K.E., Suzuki, M., Hunter, C.T., and McCarty, D.R. UniformMu: Release of 8,000 new lines for functional genomics research in maize. MaizeGDB (www.maizegdb.org/documentation/uniformmu/)

Lu, H., and R. Cherry. 2012. New sources of Southern Chinch Bug (Hemiptera : Blissidae) resistance in St. Augustinegrass varieties. J. Entomol. Sci. 47(4):291-296.

Milla-Lewis, Susana R., M. Carolina Zuleta, George A. Van Esbroeck, Kenneth H. Quesenberry, and Kevin E. Kenworthy. 2013. Cytological and Molecular Characterization of Genetic Diversity in *Stenotaphrum*. Crop Sci. 53:296–308. doi: 10.2135/cropsci2012.04.0234.

Quesenberry, K.H., K. E. Kenworthy, W.T. Crow, P.F. Harmon, H. Lu, and S. Milla-Lewis. 2013. Lance nematode effects on rooting of two St. Augustinegrass cultivars. International Turfgrass Society Research Journal. 12:357-361.

Rockwood, D. 2012. History and Status of Eucalyptus Improvement in Florida. International Journal of Forestry Research. Volume 2012. doi:10.1155/2012/607879.

Verlaan, M.G., S.F. Hutton, R.M. Ibrahem, R. Kormelink, R.G.F. Visser, J.W. Scott, J.D. Edwards, and Y. Bai. 2013. The Tomato Yellow Leaf Curl Virus Resistance Genes Ty-1 and Ty-3 are Allelic and Code for DFDGD-class RNA-dependent RNA Polymerases. PLoS Genet 9(3): e1003399. doi:10.1371/journal.pgen.1003399.

Scully, B., R. Nagata, R. Cherry, G. Nuessly, L. Trenholm, K. Kenworthy. 2012. Registration of 'Ultimate' zoysiagrass. Journal of Plant Registrations 6: 71-74. doi:10.3198/jpr2011.04.0196crc.

Scully, B., R. Nagata, G. Nuessly, R. Beiriger, K. Kenworthy and J. Unruh. 2012. Registration of 'Hammock' centipedegrass. Journal of Plant Registrations 6: 246-251. doi:10.3198/jpr2012.02.0082crc.

Georgia

Meru G & C McGregor (2013) Genetic mapping of seed traits correlated with seed oil percentage in watermelon. HortScience in press

Prothro J, Abdel-Haleem H, Bachlava E, White V, Knapp, S & CE McGregor (2013) Quantitative trait loci associated with sex expression in an inter-subspecific watermelon population. Journal of the American Society for Horticultural Science 138(2):125–130.

McGregor CE (2012) *Citrullus lanatus* germplasm of Southern Africa. Israel Journal of Plant Sciences 60(4): 403 – 413.

Prothro J, Sandlin K, Abdel-Haleem H, Bachlava E, White V, Knapp, S & CE McGregor (2012) Mapping of seed traits in *Citrullus lanatus*. Journal of the American Society for Horticultural Science 137(6): 452–457.

Prothro J, Sandlin K, Gill R, Bachlava E, White V, Knapp, S & CE McGregor (2012) Mapping of the egusi seed trait locus (eg) and quantitative trait loci associated with seed oil percentage in watermelon. Journal of the American Society for Horticultural Science 137(5): 311–315.

Sandlin K, Prothro J, Heesacker A, Khalilian N, Okashah R, Xiang W, Bachlava E, Caldwell D, Seymour D, White V, Chan E, Tolla G, White C, Safran D, Graham E, Knapp, S & CE McGregor (2012) Comparative mapping within *Citrullus lanatus*. Theoretical and Applied Genetics 125 (8): 1603-1618.

Candole BL, Waters V, McGregor CE & PJ Conner (2012) The disease reactions of heirloom bell pepper ‘California Wonder’ to *Phytophthora capsici*. Agricultural Sciences 3: 417-424.

McGregor CE, Waters V, Nambeesan S, MacLean D, Candole BL & P Conner (2011) Genotypic and phenotypic variation among pepper accessions resistant to *Phytophthora capsici*. HortScience 46: 1235–1240.

Karen Harris-Shultz, Paul Raymer, Brian E. Scheffler, and Renée S. Arias. 2013. Development and characterization of seashore paspalum SSR markers and identification of markers potentially associated with salt tolerance. Crop Sci. In press.

Braman, S.K., P .L. Raymer, M. Harrison-Dunn and S. Nair. 2013. Antibiosis among selected Paspalum Taxa to the Fall Armyworm (Lepidoptera: Noctuidae). J. Entomol. Sci. in press.

Louisiana

LaBonte, D.R., C.A. Clark, T.P. Smith, and A.Q.Villordon. 2012. 'Orleans' Sweetpotato. HortScience 47:1817-1818

Mississippi

Zheljazkov, Valtcho, Brady A. Vick , Brian S. Baldwin , Normie Buehring, Tess Astatkie, and Billy Johnson. 2012. Effect of planting date, nitrogen rate, and hybrid on sunflower. J. Plant Nut. 35:14, 2198-2210

National Winter Canola Variety Trail. 2013. Report of Progress. Kansas State Uni. Agric. Expt. Stat. and Coop. Ext. Ser. Contribution No.

North Carolina

Andres, R.J., D.T. Bowman, K.S. Lawrence, G. Myers, P.W. Chee, E. Lubbers, V. Kuraparthy (2013) Effect of leaf shape on boll rot incidence in Upland cotton (*Gossypium hirsutum* L.). International Journal of Plant Breeding and Genetics 7:132-138.

Balota, M., S. McGrath, T.G. Isleib and S. Tallury. 2012. Transpiration response to vapor pressure deficit in field grown peanut. Peanut Sci. 39:53-61.

Balota, M., T.G. Isleib and S. Tallury. 2012. Variability for drought related traits of virginia-type peanut cultivars and advanced breeding lines. Crop Sci. 52:2702- 2713.

Balota, M.R. R.W. Mozingo, T.A. Coffelt, T.G. Isleib, B.R. Beahm, H.G. Pittman, F.S. Bryant, P.A. Copeland, C.J. Daughtrey, B.C. Kennedy, F.M. Shokes, R.D. Ashburn, D.L. Whitt, and D.A. Redd. 2011. Registration of 'Titan' peanut. J. Plant Regist. 5: 282-288.

Cai, B., B. Siminszky, J. Chappell, R.E. Dewey, and L.P. Bush. 2012. Enantioselective demethylation of nicotine as a mechanism for variable nornicotine composition in tobacco leaf. J. Biol. Chem. 287:2804-42811.

Calbrix, R., H.T. Stalker and N. Nielsen. 2012. Identification of 2S, 7S and 11S seed storage proteins of cultivated peanut. Crop Sci. 52:1676-1688.

Chandi, A., D.L. Jordan, A.C. York, S.R. Milla-Lewis, J.D. Burton, A.S. Culpepper, and J.R. Whitaker. 2012. Interference of selected Palmer Amaranth (*Amaranthus palmeri*) populations in soybean (*Glycine max*). Intl. J. of Agronomy. (DOI 10.1155/2012/168267).

Chandi, A., S.R. Milla-Lewis, D.L. Jordan, J.D. Burton, J.F. Spears, A.C. York, A.C., and J.R. Whitaker. 2012. Inheritance of evolved glyphosate resistance in a North Carolina Palmer amaranth (*Amaranthus palmieri*) biotype. Intl. J. of Agronomy. (DOI 10.1155/2012/176108).

Chen, J., C.A. Griffey, S. Liu, M.A. Saghai Maroof, J.P. Murphy, R.A. Navarro, C.H. Sneller, G. L. Brown-Guedira, and E.J. Souza. 2012. Registration of Fusarium Head Blight–Resistant Soft Red Winter Wheat Germplasm VA04W-433 and VA04W-474. J. Plant Reg. 6:1-6.

Cowger, C., L. Miranda, C. Griffey, M. Hall, J.P. Murphy, and J. Maxwell. 2012. Wheat powdery mildew, pp. 84-119. In: Disease Resistance in Wheat. I. Sharma (ed) CAB International, Wallingford, United Kingdom.

Foolad, M.R. and D.R. Panthee. 2012. Marker-assisted selection in tomato breeding. Critical Reviews in Plant Sciences, 31: 93-123.

Gardner, R.G. and D.R. Panthee. 2012. 'Mountain Magic': An early blight and late blight resistant specialty type F1 hybrid tomato. HortScience, 47: 299-300.

Gardner, R.G. and D.R. Panthee. 2012. Tomato spotted wilt virus resistant fresh-market tomato breeding lines: NC 58S, NC 123S, NC 127S and NC 132S. HortScience, 47: 531-532.

Goldstein, W.A., W. Schmidt, H. Burger, M. Messmer, L.M. Pollak, M. Smith, M. Goodman, F. Kutka, and R. Pratt. 2012. Breeding and testing field maize for organic farmers. Pp. 175-189 in Lammerts van Bueren, E.T., and J.R. Myers (Eds.), Organic Crop Breeding. Wiley.

Guo, Y., S. Khanal, S. Tang, J.E. Bowers, A.F. Heesacker, N. Khalilian, E.D. Nagy, D. Zhang, C.A. Taylor, H.T. Stalker, P. Ozias-Akins, and S.J. Knapp. 2012. Comparative mapping in intraspecific populations uncovers a high degree of macrosynteny between A- and B- genome diploid species of peanut. BMC Genomics 13:608.

Harris-Shultz, K.R., S.R. Milla-Lewis, and J.A. Brady. 2012. Transferability of SSR and RGA markers developed in *Cynodon* spp. to *Zoysia* spp. Plant Mol. Biol. Rep. 30:1264-1269.

Harris-Shultz, K.R., S.R. Milla-Lewis, M.C. Zuleta, B.M. Schwartz, W.W Hanna, and J.A. Brady. 2012. Development of SSR markers and the analysis of genetic diversity and ploidy level in a centipedegrass collection. Crop Sci. 52:360-370.

Hurlburt, B.K., D. Schmitt, T.G. Isleib, H. Cheng, C. Garvey, R.L. Koenig, and S.J. Maleki. 2011. Production of pure protein, antibodies and development of immunoassays to detect Ara h3 levels in peanut varieties. Intl. J. Food Sci. Technol. 46:1477–1484.

Joshi, B.K., R.G. Gardner, and D.R. Panthee. 2012. Diversity analysis of tomato cultivars based on coefficient of parentage and RAPD molecular markers. Journal of Crop Improvement, 26: 177-196.

Kimball, J.A., M.C. Zuleta, K.R. Harris-Shultz, K.E. Kenworthy, V.G. Lehman, and S.R. Milla-Lewis, 2012. Genetic relationships in Zoysia and the identification of putative interspecific hybrids using simple sequence repeat markers and inflorescence traits. Crop Sci. (doi: 10.2135/cropsci2012.04.0218; published online 21 Aug 2012).

Kimball, J.A., M.C. Zuleta, K.E. Kenworthy, V.G. Lehman, and S.R. Milla-Lewis. 2012. Assessment of genetic diversity in Zoysiagrass germplasm using AFLP markers. Crop Sci. 52:383-392.

Kimball, J.A., Zuleta, M.C., Martin, M., Kenworthy, K.E., Chandra, A., Milla-Lewis, S.R. 2012. Assessment of molecular variation within 'Raleigh' St. Augustinegrass using AFLP markers. HortScience 47:835-838.

Lattier, J.D., D.H. Touchell, and T.G. Ranney. 2012. In vitro regeneration and polyploidy induction of *Acer platanoides* L. 'Crimson Sentry'. HortScience 47:S17.

Lattier, J.D., D.H. Touchell, and T.G. Ranney. 2012. Micropropagation of *Acer platanoides* L. 'Crimson Sentry'. Southern Nursery Assoc. Res. Conf., 57th Annu. Rpt. 57:296-300.

Lauer, J.G., C.G.Bijl, M.A. Grusak, P.S. Baenziger, K. Boote, S. Lingle, T., Carter, S. Kaeppler, R. Boerma, G. Eizenga, P. Carter, M. Goodman, E. Nafziger, K. Kidwell, R. Mitchell, M.D. Edgerton, K. Quesenberry, and M.C. Willcox. 2012. Grand challenges for crop science. CSA News 57(6):4-12

Lauer, J.G., C.G.Bijl, M.A. Grusak, S.P. Baenziger, K. Boote, S. Lingle, T. Carter, S. Kaeppler, R. Boerma, G. Eizenga, P.Carter, M. Goodman, E. Nafziger, K. Kidwell, R. Mitchell, M.D. Edgerton, K. Quesenberry, and M.C. Willcox. 2012. The scientific grand challenges of the 21st century for the Crop Science Society of America. Crop Sci. 52:1003-1010.

Lewis, R.S., R.G. Parker, D.A. Danehower, K. Andres, A.M. Jack, D.S. Whitley, and L.P. Bush. 2012. Impact alleles at the Yellow Burley (Yb) loci and nitrogen fertilization rate on nitrogen utilization efficiency and TSNA formation in air-cured tobacco. J. Agric. Food Chem. 60:6454-6461.

Li, D., R.S. Lewis, A.M. Jack, R.E. Dewey, S.W. Bowen, and R.D. Miller. 2012. Development of CAPS and dCAPS markers for CYP82E4, CYP82E5v2, and CYP82E10 gene mutants reducing nicotine to nornicotine conversion in tobacco. Mol. Breed. 29: 589-599.

Ling, K.S.,R. Li, D.R. Panthee, and R.G. Gardner. 2013. First report of potato spindle tuber viroid naturally infecting greenhouse tomatoes in North Carolina. Plant Disease 97:148-149.

Maxwell, J.J., J.H. Lyerly, G. Srnic, J.P. Murphy, C. Cowger, R. Parks, D. Marshall, G. Brown-Guedira and L. Miranda. 2012. MlNCD1: A novel *Aegilops tauschii*- derived powdery mildew resistance gene identified in common wheat. Crop Sci. 52:1162–1170.

McCorkle, K., R.S. Lewis, and H.D. Shew. 2012. Quantifying components of resistance to *Phytophthora nicotianae* in doubled-haploid tobacco breeding lines possessing a novel source of partial resistance. Plant Dis. (In Press)

McNair, M.. A. Wilkins, and D. Werner. 2012. Wounding and chemical effects on *Drosera capensis* bud formation on leaf cuttings. J. Int. Carniv. Plt. Soc. 41:140-142.

Milla-Lewis, S.R., K.R. Harris-Shultz, M.C. Zuleta, J.A. Kimball, B.M. Schwartz, and W.W. Hanna. 2012. Use of sequence-related amplified polymorphism (SRAP) markers for comparing levels of genetic diversity in centipedegrass germplasm. Genet. Resour. Crop Ev. 59:1517-1526.

Milla-Lewis, S.R., M.C. Zuleta, G.A. Van Esbroeck, K.H. Quesenberry, and K.E. Kenworthy. 2012. Cytological and molecular characterization of genetic diversity in *Stenotaphrum*. Crop Sci. (doi: 10.2135/cropsci2012.04.0234; published online 21 Aug 2012)

Mothapo, N.V., J.M. Grossman, J.E. Maul, W. Shi, and T. Isleib. 2012. Genetic diversity of resident soil rhizobia isolated from nodules of distinct hairy vetch (*Vicia villosa* Roth) genotypes. Appl. Soil Ecol. 64: 201-213.

Nagy, E.D., Y. Guo, S. Tang, J.E. Bowers., R.A. Okashah, C.A. Taylor, D. Zang, S. Khanal, A.F. Heesacker, N. Khalilian, A.D. Farmer, N. Carrasquilla-Garcia, R. Varma Penmetsa, D. Cook, H.T. Stalker, N. Nielsen, P. Ozias-Akinsand, and S.J. Knapp. 2012. A high-density genetic map of *Arachis duranensis*, a diploid ancestor of cultivated peanut. BMC Genomics 13:469.

Oates, K.M., T.G. Ranney, and D.H. Touchell. 2012. Influence of induced polyploidy on fertility and morphology of *Rudbeckia* species and hybrids. HortScience 47:1217-1221.

Palmer, I.E., T.G. Ranney, R. Gehl, D. Touchell, and N. George. 2012. Biomass yield and nitrogen response of perennial bioenergy grasses in North Carolina. Southern Nursery Assoc. Res. Conf., 57th Annu. Rpt. 57:268-272.

Panthee, D.R., P. Perkins-Veazie, D. Randall, and A.F. Brown, A. F. 2013. Lycopene estimation in tomato lines using infra-red absorbance and tomato analyzer. International Journal of Vegetable Science 19:240-255.

Panthee, D.R. and R. Ibrahem. 2013. New molecular markers associated with Sw-5 gene conferring resistance to tomato spotted wilt virus in tomato. The Journal of Horticultural Science and Biotechnology 88:129-134.

Panthee, D.R., C.Cao, S.J. Debenport, G.R. Rodriguez, J.A. Labate, L.D. Robertson, A.P. Breksa, E. Van der Knaap, and B.B. McSpadden-Gardener. 2012. Magnitude of genotype x environment interactions affecting tomato fruit quality. HortScience, 47:721-726.

Panthee, D.R., J.A. Labate, and L.D. Robertson. 2013. Evaluation of tomato accessions for flavor and flavor contributing components. Plant Genetic Resources 11:106-113.

Parris, J.K., D.H. Touchell, T.G. Ranney, and J. Adelberg. 2012. Basal salt composition, cytokinins, and phenolic binding agents influence in vitro growth and ex vitro establishment of Magnolia 'Ann'. HortScience 47:1625-1629.

Ranney, T.G., R. Miller, R. Lewandowski, and J. Xiang. 2012. Discovery of a new diploid cytotype of *Fothergilla*. HortScience 47:S367.

Šarcević, H., J. Gunjača, A. Budimir, M. Boić, S. Bolarić, M. Bukan, R.S. Lewis, and V. Kozumplik. 2013. Long term genetic improvement and genetic diversity of Croatian flue-cured tobacco (*Nicotiana tabacum* L.) cultivars. Crop Sci. 53:112-120.

Shearer, K. and T.G. Ranney. 2013. Ploidy levels and relative genome sizes of species, hybrids, and cultivars of dogwood (*Cornus* spp.). HortScience 48:1-6.

Shearer, K., T.G. Ranney, R. Miller, and C. Towe. 2012. Pentanthera webs: Interspecific and interploid hybridization among sympatric azaleas in the southern Appalachian mountains. J. Amer. Rhododendron Soc. 66:187-197.

Sim, S., A. Van Deynze, K. Stoffel, D.S. Douches, D. Zarka, M.W. Ganal, R. Chetelat, S. Hutton, J. Scott, R. Gardner, D.R. Panthee, M. Mutschler-Chu, J. Myers, and D.M. Francis. 2012. High-density SNP genotyping of tomato (*Solanum lycopersicum* L.) reveals patterns of genetic variation due to breeding. PLoS ONE, 7:e45520.

Touchell, D.H. and T.G. Ranney. 2012. Chromosome doubling and fertility restoration in *Miscanthus* ×*giganteus*. HortScience 47:S334.

Vontimitta, V., and R.S. Lewis. 2012. Growth chamber evaluation of a *Nicotiana tabacum* 'Beinhart 1000' x 'Hicks' mapping population for QTL affecting resistance to multiple races of *Phytophthora nicotianae*. Crop Sci. 52:91-98.

Wadl, P.A., R.N. Trigiano, D.J. Werner, M.R. Pooler, and T.A. Rinehart. 2012. Simple sequence repeat markers (SSR's) from *Cercis canadensis* show wide cross-species transfer and utility in genetic studies. J.A.S.H.S. 137:189-201.

Whitley, M.L., T.G. Isleib, K.W. Hendrix, T.H. Sanders, and L.O. Dean. 2011. Environmental and varietal effects on niacin content of raw and roasted peanuts. Peanut Sci. 38: 20-25. doi: http://dx.doi.org/10.3146/PS10-9.1.

Xiao, B., K. Drake, V. Vontimitta, Z. Tong, X. Zhang, M. Li, X. Leng, and R.S. Lewis. 2013. Location of genomic regions contributing to *Phytophthora nicotianae* resistance in tobacco cultivar 'Florida 301.' Crop Sci. (In Press)

Zhang, W-J., R. E.Dewey, W. Boss, B.Q. Phillippy, and R. Qu. 2012. Enhanced *Agrobacterium*-mediated transformation efficiencies in monocot cells is associated with attenuated defense responses. Plant Mol. Biol. (published online Dec. 15, 2012; doi; 10.1007/s11103-012-9997-8).

Oklahoma

Liu, L.L., and Y.Q. Wu. 2012. Development of a genome-wide multiple duplex-SSR protocol and its applications for the identification of selfed progeny in switchgrass. BMC Genomics 13: 522, doi: 10.1186/1471-2164-13-522.

Kiniry, J.R., L.C. Anderson, M.V.V. Johnson, K.D. Behrman, M. Brakie, D. Burner, R.L. Cordsiemon, P.A. Fay, F.B. Fritschi, J.H. Houx III, C. Hawkes, T. Juenger, J. Kaiser, T.H. Keitt, J. Lloyd-Reilley, S. Maher, R. Raper, A. Scott, A. Shadow, C. West, Y.Q. Wu, and L. Zibilske. 2012. Perennial biomass grasses and the Mason-Dixon line: comparative productivity across latitudes in the southern Great Plains. Bioenergy Res. DOI 10.1007/s12155-012-9254-7.

Liu, L.L., Y.Q. Wu, Y.W. Wang, and T. Samuels. 2012. A high density SSR-based genetic linkage map of switchgrass. G3: Genes, Genomes, Genetics 2: 357-370.

Tan, C.C., Y.Q. Wu, C.M. Taliaferro, M.P. Anderson, C. Tauer, and T. Samuels. 2012. Development of simple sequence repeat markers for bermudagrass from its EST sequences and preexisting sorghum SSR markers. Molecular Breeding 29: 23-30.

Liu, L.L., and Y.Q. Wu. 2012. Identification of a self-compatible genotype and mode of inheritance in switchgrass. BioEnergy Research 5:662-668.

Puerto Rico

Román Pérez, F.M., A. González and R. Macchiavelli. 2012. Yield and growth of 'Tahiti' lime, *Citrus latifolia*, in the first two years at two localities in Puerto Rico. Annual Meeting of the Caribbean Food Crops Society, 20-26 May 2012, Cancun, Mexico.

Román Pérez, F.M., and A. González. 2012. Nuevos patrones a ser liberados en la industria de cítricas en Puerto Rico. Annual Meeting of the Puerto Rican Society for Agricultural Sciences, 2 November 2012, San Juan, Puerto Rico

South Carolina

Abd-Rabou, S., Simmons, A.M. 2012. The *Bemisia tabaci* (Hemiptera: Aleyrodidae) as a pest in Egypt. Advances in Agricultural Research in Egypt. 10:1-82.

Abd-Rabou, S., Simmons, A.M. 2012. Some cultural strategies to help manage *Bemisia tabaci* (Hemiptera: Aleyrodidae) and associated whitefly-viruses in vegetable crops. African Entomology. 20(2):371-379.

Adkins, S.T., Webster, C.G., Kousik, C.S. 2012. Development and evaluation of quanitative early monitoring techniques for Squash vein yellowing virus, the cause of watermelon vine decline. Vineline Magazine. Spring:38.

Adkins, S.T., Webster, C.G., Hassell, R., Turechek, W., Kousik, C.S. 2012. Evaluation of virus resistant rootstocks to manage watermelon vine decline and diseases caused by other potyviruses. Vineline Magazine. Fall:41.

Bjorkman, T., Davis, J.M., Farnham, M.W., Gomez, G., Griffiths, P.D., Hutton, M., Kopsell, D.A., Myers, J.R., Sams, C.E., Smith, J. 2012. A transdisciplinary approach to developing an eastern broccoli industry. HortScience. 47(9):S408-S409 (Abstract Only).

Farnham, M.W., Lester, G.E., Hassell, R. 2012. Collard, mustard and turnip greens: Effects of varieties and leaf position on concentrations of ascorbic acid, folate, B-carotene, lutein and phylloquinone. Journal of Food Composition and Analysis. 27:1-7.

Farnham, M.W. 2012. What makes those collard, turnip and mustard greens so good for you? North Carolina Vegetable Growers Association 2012 Yearbook. p. 53 (Proc.).

Felderhoff, T.J., S.C. Murray, P.E. Klein, A. Sharma, M.T. Hamblin, W. Vermerris, S. Kresovich, and W.L. Rooney. 2012. QTLs for energy-related traits in a sweet x grain RIL sorghum [*Sorghum bicolor* (L.) Moench] population. Crop Sci. 52:2040-2049.

Frett, TJ, Gasic K., Byrne, D, Clark, J., Crisosto, C. and Gradziel, T. 2012. Standardized phenotyping for peach [*Prunus persica* (L.) Batsch]. Journal of the American Pomological Society 66(4): 214-219

Frett, T.J., G. Reighard, K. Gasic and W. Okie. 2012. Mapping QTLs for red skin color in peach. HortScience 47(9):S245-246. (Abstr.).

Gasic K. 2012. Peach breeding: Focus on Biotic and Abiotic Stress Tolerance/Resistance. In: G. Reighard (ed.) Annual Peach research report for 2011, vol. XI, p. 10-18.

Gasic K and Reighard G. 2012. Evaluation of Fruit Ripening Device for Everyday Application in Peach Production. In: G. Reighard (ed.) Annual Peach research report for 2011, vol. XI, p. 19-30.

Griffiths, P.D., Farnham, M.W., Hutton, M., Davis, J.M., Morris, W., Bjorkman, T. 2012. Performance of current broccoli varieties under eastern U.S. conditions. HortScience. 47(9):S274 (Abstract Only).

Guan, W., Zhao, X., Hassell, R., Thies, J.A. 2012. Defense mechanisms involved in disease resistance of grafted vegetables. HortScience. 47(2):164-170.

Harrison Jr, H.F., Farnham, M.W. 2012. Response of broccoli and cabbage hybrid cultivars to clomazone. HortScience. 47(9):S331 (Abstract Only).

Harrison Jr, H.F., Wechter, W.P., Kousik, C.S. 2012. Inhibition of bacterial, fungal and plant growth by testa extracts of *Citrullus* genotypes. HortScience. 47:448-451.

Jackson, D.M. 2012. Evaluation of Regional Sweetpotato Genotypes for Resistance to Soil Insect Pests, 2011. Arthropod Management Tests. Volume 37, Report No. M6, Online Journal at http://www.entsoc.org/Pubs/Overview/index.

Jackson, D.M., Harrison Jr, H.F. 2013. Insect resistance in traditional and heirloom sweetpotato varieties. Journal of Economic Entomology. 106(3):1456-1462.

Jackson, D.M., Harrison Jr, H.F., Ling, K. 2012. Evaluation of heirloom sweetpotato cultivars for resistance to soil insect pests, 2010. Arthropod Management Tests. Volume 37, Report No. M5 (http://www.entsoc.org/Pubs/Overview/index).

Jackson, D.M., Harrison Jr, H.F. 2012. Evalution of advanced sweetpotato genotypes for resistance to soil insect pests, 2010. Arthropod Management Tests. Volume 37, Report No. M3, Online Journal (http://www.entsoc.org/Pubs/Overview/index).

Jackson, D.M., Harrison Jr, H.F. 2012. Evaluation of Dry-Fleshed Sweetpotato Genotypes For Resistance To Soil Insect Pests, 2010. Arthropod Management Tests. Volume 37, Report No. M4, Online Journal (http://www.entsoc.org/Pubs/Overview/index).

Jackson, D.M., Harrison Jr, H.F., Ryan-Bohac, J. 2012. Insect resistance in sweetpotato plant introduction accessions. Journal of Economic Entomology. 105:651-658.

Jackson, D.M. 2012. Resistance of National Sweetpotato Collaborator's Group Genotypes to Soil Insect Pests, Charleston, SC, 2011. National Sweetpotato Collaborators Group Progress Report. Pgs 57-58. In K. Pecota (ed).

Jackson, D.M. 2012. National Sweet Potato Collaborator Summary of Data, 2011. National Sweetpotato Collaborators Group Progress Report. Pg 52. In K. Pecota (ed).

Jackson, D.M., Ling, K., Simmons, A.M. 2012. Use of Insecticides to Control the Spread of Sweetpotato Leaf Curl Virus in Sweetpotato Fields. National Sweetpotato Collaborators Group Progress Report. Pgs 22-23. In K. Pecota (ed).

Jimenez, S., G.L. Reighard, and D.G. Bielenberg. 2012. Peach dormancy associated MADS-box gene expression during natural chilling accumulation. Acta Hort 962:161-167.

Kimber, C.T., J.A. Dahlberg, and S. Kresovich. 2012. The genepool of *Sorghum bicolor* and its improvement. In: Genetics and Genomics of the *Saccharinae*, pp. 23-42. A.H. Paterson, ed., Springer.

Kopsell, D.A., Sams, C.E., Farnham, M.W., Griffiths, P.D., Hutton, M., Davis, J.M., Morris, W. 2012. Broccoli pigment profile of six cultigens grown in five east coast locations. HortScience. 47(9):358-359 (Abstract Only).

Kousik, C.S., Adkins, S.T., Webster, C.G., Turechek, W., Roberts, P.D. 2012. Effect of SqVYV-resistant pollenizers on development and spread of watermelon vine decline in seedless watermelon. Phytopathology. 102:54-65.

Kousik, C.S., Ikerd, J.L., Thies, J.A., Harrison Jr, H.F. 2012. Evaluation of Actigard and fungicides for management of *Phytophthora* fruit rot of watermelon, 2011.. Plant Disease Management Reports. 6:V012 (Abstract only).

Kousik, C.S., Donahoo, R.S., Hassell, R. 2012. Resistance in watermelon rootstocks to crown rot caused by *Phytophthora capsici*. Crop Protection. 39:18-25.

Kousik, C.S., Ikerd, J.L., Hassell, R. 2012. Effect of grafting on resistant rootstocks on the development of *Phytophthora* fruit rot on susceptible scion, 2011. Plant Disease Management Reports. 6:V012.

Levi, A., Thies, J.A., Wechter, W.P., Kousik, C.S., Ling, K., Harrison Jr, H.F., Simmons, A.M., Reddy, U.K., Nimmakayala, P., Fei, Z. 2012. Exploiting genetic diversity in *Citrullus* spp. to enhance watermelon cultivars. Acta Horticulturae. Pp. 41-48.

Levi, A., Thies, J.A., Wechter, W.P., Harrison Jr, H.F., Simmons, A.M., Reddy, U., Nimmakayala, P., Fei, Z. 2012. High frequency oligonucleotides – targeting active gene (HFO-TAG) markers reveal wide genetic diversity among *Citrullus* spp. accessions useful for enhancing disease or pest resistance in watermelon cultivars. Genetic Resources and Crop Evolution. DOI 10.1007/s10722-012-9845-3.

Li, Z., Zhou, M., Hu, Q., Reighard, S., Yuan, S., Yuan, N., San, B., Li, D., Jia, H. and Luo, H. 2012. Manipulating expression of tonoplast transporters. In: Plant Salt Tolerance: Methods and Protocols, Methods in Molecular Biology, vol. 913, DOI 10. 1007/978-1-61779-986-0_24, Shabala, S. Cuin, TA. (eds), Springer Science+Business Media, LLC, pp359-369.

Li, R., Shan, G., Hernamdez, A.G., Wechter, W.P., Fei, Z., Ling, K. 2012. Deep sequencing of small RNAs in tomato for virus and viroid identification and strain differentiation. PLoS One. 7(5):e37127.

Ling, K., Li, R., Panthee, D.R., Gardner, R.G. 2013. First report of potato spindle tuber viroid naturally infecting greenhouse tomatoes in North Carolina. Plant Disease. 97:148.

Ling, K., Li, R., Panthee, D.R., Gardner, R.G. 2012. Identification of potato spindle tuber viroid naturally infecting greenhouse tomatoes in North Carolina and its potential in seed transmission. Tomato Disease Workshop. P.27 (Proc.).

Liu, X., G. L. Reighard, G. A. Swire-Clark, and W. V. Baird. 2012. Peach [*Prunus persica* (L.) Batsch] rootstock seedling identification by DNA-fingerprinting with microsatellite (SSR) markers. Acta Hort 962:169-175.

Loper, J.E., Hassan, K.A., Mavrodi, D., Davis, E.W., Lim, C., Shaffer, B.T., Elbourne, L.H., Stockwell, V.O., Hartney, S.L., Breakwell, K., Henkels, M.D., Tetu, S.G., Rangel, L.I., Kidarsa, T.A., Wilson, N.L., Van Mortel, J., Song, C., Blumhagen, R., Radune, D., Hostetler, J.B., Brinkac, L.M., Durkin, A., Kluepfel, D.A., Wechter, W.P., Anderson, A.J., Kim, Y., Pierson Iii, L.S., Pierson, E.A., Lindow, S.E., Raaijmakers, J.M., Weller, D.M., Thomashow, L.S., Allen, A.E., Paulsen, I.I. 2012. Comparative genomics of plant-associated *Pseudomonas* spp.: Insights into diversity and inheritance of traits involved in multitrophic interactions. PLoS Genetics. 8(7):e1002784.

Morris, G.P., P. Ramu, S.P. Deshpande, C.T. Hash, T. Shah, H.D. Upadhyaya, O. Riera-Lizarazu, P.J. Brown, C.B. Acharya, S.E. Mitchell, J. Harriman, J.C. Glaubitz, E.S. Buckler, and S. Kresovich. 2013. Population genomic and genome-wide association studies of agroclimatic traits in sorghum. Proc Natl Acad Sci USA. 110: 453-458.

Nyczepir, A.P., Kluepfel, D.A., Waldrop, V., Wechter, W.P. 2012. Soil solarization and biological control for managing *Mesocriconema xenoplax* and Short Life in a newly established peach orchard. Plant Disease. 96:1309-1314.

Ogbuji, K., McCutcheon, G.S., Simmons, A.M., Snook, M.E., Harrison, H.F., Levi, A. 2012. Partial leaf chemical profiles of a desert watermelon species (*Citrullus colocynthis*) and heirloom watermelon cultivars (*Citrullus lanatus* var. *lanatus*). HortScience. 47:580-584.

Reddy, U.K., Aryal, N., Islam-Faridi, N., Tomason, Y., Levi, A., Nimmakayala, P. 2013. Cytomolecular characterization of rRNA gene sequences among *Citrullus* species and subspecies using fluorescent in situ hybridization (FISH) technology. Genetica. 60:427-440.

Ren, Y., Zhao, H., Kou, Q., Guo, S., Zhang, H., Hou, W., Zou, X., Sun, H., Gong, G., Levi, A., Xu, Y. 2012. A high resolution genetic map anchoring scaffolds of the sequenced watermelon genome. PLoS One. 2012. 7:e29453.

Sams, C.E., Kopsell, D.A., Farnham, M.W., Griffiths, P.D., Hutton, M., Davis, J.M., Morris, W. 2012. Glucosinolate variation among six cultigens of broccoli grown in five diverse east coast locations. HortScience. 47(9):S358 (Abstract Only).

Schofield, D.A., Bull, C.T., Rubio, I., Wechter, W.P., Westwater, C., Molineux, I.J. 2012. Development of an engineered 'bioluminescent' reporter phage for the detection of bacterial blight of crucifers. Applied and Environmental Microbiology. 78:3592-3598.

Shapiro, M., El Salamouny, S., Jackson, D.M., Shepard, B. 2012. Field evaluation of a kudzu/cottonseed oil formulation on the persistence of the beet armyworm nucleopolyhedrovirus. Journal of Entomological Science. 47:197-207.

Simmons, A.M., Legaspi, J.C., Legaspi, Jr, B.C. 2012. Adult survival of *Delphastus catalinae* (Coleoptera: Coccinellidae), a predator of whiteflies (Hemiptera: Aleyrodidae), on diets of whiteflies, honeydew and honey. Environmental Entomology. 41(3):669-675.

Sukumaran, S., W. Xiang, S.R. Bean, J.F. Pedersen, S. Kresovich, M.R. Tuinstra, T.T. Tesso, M.T. Hamblin, and J. Yu. 2012. Association mapping for grain quality in a diverse sorghum collection. Plant Genome doi10.3835/plantgenome2012.07.0016.

Teng, S., Luo, H. and Wang, L. 2012. Predicting protein sumoylation sites from sequence features. Amino Acids 43:447-55.

Thies, J.A., Ariss, J., Hassell, R.L., Levi, A. 2012. Root-knot nematode resistant rootstocks for grafted watermelon. Acta Horticulturae. pp. 201-211.

Thies, J.A. 2012. Virulence of *Meloidogyne incognita* to expression of N gene in pepper. Journal of Nematology. 43(2):90-94.

Turechek, W., Webster, C.G., Kousik, C.S., Adkins, S.T. 2012. Use of latent class analysis to estimate the sensitivities and specificities of diagnostic tests for Squash vein yellowing virus in cucurbits. Phytopathology. 10:S4.122 (Abstract Only).

Wang, G., Farnham, M.W., Jeffery, E. 2012. Impact of thermal processing on sulforaphane yield from broccoli (*Brassica oleracea* L. var. *italica*). Journal of Agricultural and Food Chemistry. 60:6743-6748.

Webster, C.G., Kousik, C.S., Hassell, R., Ling, K., Turechek, W., Adkins, S.T. 2012. Virus movement within grafted watermelon plants. American Phytopathology Society. 102:S4.133 (Abstract Only).

Wechter, W.P., Kousik, C.S., Mcmillan, M.L., Farnham, M.W., Levi, A. 2012. Three improved *Citrullus lanatus* var. *citroides* lines USVL246-FR2, USVL252-FR2, and USVL335-FR2, with resistance to *Fusarium oxysporum* f. sp. *niveum* race 2. Phytopathology. 102:S4.133 (Abstract Only).

Wechter, W.P., Kousik, C.S., Mcmillan, M.L., Levi, A. 2012. Identification of resistance to *Fusarium oxysporum* f. sp. *niveum* Race 2 in *Citrullus lanatus* var. *citroides* plant introductions. HortScience. 47(3):334-338.

Yakabe, L.E., Maccree, M.M., Sudarshana, P., Mcclean, A.E., Parker, S.R., Wechter, W.P., Presting, G., Kluepfel, D.A. 2012. Novel primers for detection of genetically diverse virulent *Agrobacterium tumefaciens* bv1 strains. Journal of General Plant Pathology. DOI: 10.1007/s10327-012-0364-z.

Yang, N, Reighard, G, Ritchie, D, Okie, W and Gasic, K. 2012. Mapping QTLs controlling bacterial spot (*Xanthomonas arboricola* pv. *pruni*) resistance in peach. Tree Genetics and Genomes DOI 10.1007/s11295-012-0580-x

Yang N, Reighard G, Ritchie D and Okie W. 2012. Mapping QTLs Associated with resistance to bacterial spot (*Xanthomonas arboricola* pv. *pruni*) in Peach. HortScience 47(9):S245. (Abstr.).

Texas

Castillo, N., G. Peterson, J. Dever, D. Auld, M. Stelter, K. Ayala. 2013. Phenotyping salt tolerance responses in cotton, sorghum and castor. In Plant Abiotic Stress and Sustainable Agriculture: Translating Basic Understanding to Food Production. Keystone Symposia on Molecular and Cellular Biology. January 17-22, 2013, Taos, NM.

Ganjegunte, G.K., G. Peterson, J.D. Silva, G. Niu, and S. Miyamoto.2010. Evaluation of ameliorative effects of cellulosic bioenergy crops on soil salinity and sodicity. Proceedings of the ASA-CSSA-SSSA-GSA International Annual Meetings, CD-ROM, October 31- November 3, 2010, Long Beach, California.

Ganjegunte G. K., J. A. Clark, G. Peterson and J. A. Da Silva. 2011. Beneficial effects of cellulosic bioenergy crops on soil salinity and sodicity management. Proceedings ASA-CSSA-SSSA International Annual Meetings. CD-ROM, October 16-19, 2011. San Antonio, Texas.

Wei-Ning Cheng, Jia-Xin Lei, William L. Rooney, Tong-Xian Liu and Keyan Zhu-Salzman. 2013. High basal defense gene expression determines sorghum resistance to the whorl-feeding insect southwestern corn borer. Insect Science (2013) 00, 1–11, DOI 10.1111/1744-7917.12002

Payne S. Burks, Terry J. Felderhoff, Howard P. Viator, and William L . Rooney. 2012. The influence of hybrid maturity and planting date on sweet sorghum productivity during a harvest season. Agronomy Journal 105:263-267.

Thomas R. Stefaniak, Jeffery A. Dahlberg, Brent W. Bean, Nilesh Dighe, Edward J. Wolfrum, and William L. Rooney. 2012. Variation in biomass composition components among forage, biomass, sorghum-sudangrass, and sweet sorghum types. Crop Science 52:1949-1954.