Project Number: S-009

Project Title: Plant Genetic Resources Conservation and Utilization

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Participants: www.ars-grin.gov/ars/SoAtlantic/Griffin/pgrcu/s9report.html

Minutes: www.ars-grin.gov/ars/SoAtlantic/Griffin/pgrcu/s9report.html

Accomplishments and Impacts:

USDA – Plant Genetic Resources Conservation Unit

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

The germplasm collection at Griffin, Georgia has increased to 84,446 accessions of 244 genera and 1,437 species. In 2004, a total of 24,102 seed, tissue culture, and clonal accessions were distributed to users for their research use. All accessions were requested from the Griffin location directly by researchers and distributed in 918 orders to users in 41 states and 31 foreign countries. Genetic resources maintained at the Griffin location are in great demand by the research community and provide a valuable resource for crop improvement research. The quantity and quality of plant genetic resources maintained at Griffin makes this location one of the leaders in the National Plant Germplasm System.

Biosecurity and availability of plant genetic resources are of major concern to the U.S. agricultural research community. Backing up germplasm by maintaining accessions at two sites reduces the risk of losing valuable germplasm. In the last year, 91% of the collection is backed up at the National Center for Genetic Resource Preservation and 85% of the accessions are available for use by the research community. Backing up safely secures these plant genetic

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

Vigna:

A cowpea line was identified and released with resistance to cucumber mosaic virus (CMV) by Graves Gillaspie, Plant Genetic Resources Conservation Unit. There is little known resistance to CMV in cowpea which causes the most important disease of cowpeas in the southeastern U.S. The line, GC-86L-98, was selected and released as a breeding line. This resistant line could lead to development of cowpea cultivars with improved CMV resistance and increased yields.

Cowpea regeneration was successful with 43 lines increased in the winter, 108 lines increased in Griffin, and 51 lines increased in Puerto Rico. Digital images of flowers and seeds on all regeneration plots (284 images) and 157 lines in the cowpea core collection were prepared and submitted to Beltsville for inclusion on GRIN.

Peanut:

Roy Pittman, Plant Genetic Resources Conservation Unit, in cooperation with researchers in Georgia, Florida, and Bolivia, identified two advanced cultivated peanut lines for possible release. The lines have new sources of disease resistance for tomato spotted wilt virus, early and late leaf spot, and rust. The advanced lines under evaluation were produced by crossing Florida MDR 98 (US cultivar) x Bayo Grande (Bolivian landrace). When released, these lines will reduce fungicide use and production costs for producers.

A total of 900 cultivated peanut accessions were selected for seed increase at the Bledsoe Research Farm. Seed increases were successful for 807 cultivated peanut accessions. A total of 124 accessions of cultivated peanuts were processed through quarantine to be available for researchers. Over 500 clonal peanut accessions were maintained in the greenhouse and screenhouse.

Grasses:

The entire finger millet collection (671 accessions) was regenerated by Melanie Newman, Plant Genetic Resources Conservation Unit, and a core collection including additional descriptor data was formed. This regeneration will increase utility of the collection to researchers by providing high quality available seed, additional descriptor data, and a core collection to utilize in more rigorous studies. The core collection was formed by geographical stratification and assessed for ear shape; finger length, width, and number; grain color, surface, and uniformity; and discontinuity of spikelets on finger. Digital images were taken of all accessions in the finger millet core collection. This study raised the awareness of researchers on the importance of finger millet as a staple crop in developing countries and as a potential new crop in the United States.

Regeneration of the entire bahiagrass collection (178 accessions) was initiated at Byron, GA, in 2004 and seed harvesting initiated in 2005. Based on results from a molecular study of the bamboo collection, two contaminated plots were identified and will be renovated to remove contaminants. The entire *Paspalum* and *Cynodon* collections maintained vegetatively in the greenhouse have been converted from a one pot per accession to a four pot per accession system.

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

Amounts of four phytochemicals (daidzein, genistein, quercetin, and kaempferol) were quantified by high performance liquid chromatography (HPLC) from 36 guar accessions. Amounts of these phytochemicals were previously unknown among guar genotypes tested. Guar seed was grown and morphologically characterized by Brad Morris, Plant Genetic Resources Conservation Unit, and phytochemical amounts quantified using HPLC by Ming Li Wang, Plant Genetic Resource Conservation Unit. Guar genotypes with elevated amounts of these phytochemicals will allow the marketing of guar nutraceuticals and identify genotypes for use in breeding for increased nutraceutical concentrations.

Genetic variability of 96 guar accessions was determined using simple sequence repeat (SSR) markers and morphological data. Genetic variability to maximize utilization of guar accessions had not been determined previously in this collection. Guar accessions were grown in the greenhouse, phenotypically characterized by Brad Morris, analyzed by SSR by Ming Li Wang, and nine clades were identified from the data. Genetic variability and similarities among guar accessions were determined to improve breeding efficiency and identify potential duplicates within the collection.

Brad Morris, Plant Genetic Resources Conservation Unit, collaborated with David Knauft, University of Georgia, in evaluation of 78 accessions of *Centrosema plumieri, C. pubescens, C. virginianum, C.* species, *Chamaecrista fasciculate, Clitoria laurifolia, C. ternatea, Crotalaria verrucosa, Desmodium cuspidatum, Eriosema floribundum, Indigofera miniata, Lespedeza bicolor, L. bicolor* var. *bicolor*, *L. Cyrtobotrya, L. maximowiczii, L. thunbergii, Lotononis bainesii, Senna marilandica, S. septemtrionalis, Sesbania exasperate,* and *S. sesban* for potential use as ornamental crops for small farmers and nursery operations in the southeastern U.S.

A total of 22 self-pollinated annual clover accessions were regenerated in the greenhouse and field, and 20 cross-pollinated annual clover accessions were regenerated in cages with bees. Regeneration of 45 *Trifolium tembense*, a short-day African clover, accessions was successfully conducted in the greenhouse during the fall. Additional plantings will be made of other short-day clover species in the fall greenhouse to regenerate seed of unavailable accessions.

Sorghum:

Regeneration of sorghum accessions in St. Croix and Puerto Rico continued in coordination with the sorghum curator, John Erpelding. Over 1,100 accessions were sent to St. Croix for regeneration and seed from the first set of regenerations has arrived at Griffin. John continues to regenerate accessions of sorghum and wild sorghum species with critically low germination or seed amounts in Puerto Rico and return seed of those to Griffin.

Currently, Cleve Frank at Lubbock, TX is conducting a photoperiod sensitivity evaluation of over 8,000 sorghum accessions maintained only at Ft. Collins. Once identified in this evaluation, all accessions insensitive to photoperiod will be moved to Griffin to become part of the active collection. Accessions insensitive to photoperiod are in most demand by sorghum researchers interested in U.S. grain sorghum production.

Vegetable Crops:

Bob Jarret, Plant Genetic Resources Conservation Unit, characterized 700 accessions of the *Capsicum annuum* (chile pepper) germplasm collection via digital images and descriptors and uploaded the information onto the GRIN database. Inadequate characterization data hinders the scientific community's ability to identify appropriate plant materials for research. Since the

images were loaded, numerous researchers have supported the effort and noted how digital images aided them in selecting appropriate accessions for their chile pepper research. This effort has improved the efficiency of utilization of the collection and fostered research utilizing these genetic resources.

Regeneration of vegetable crop genetic resources has continued in order to ensure their viability and availability to the research community. More than 1,400 accessions of vegetable crops and related species were maintained in tissue culture (sweetpotato) or grown in the field for seed regeneration.

Almost the entire U.S. sweetpotato collection maintained in tissue culture has been backed up in Ft. Collins, CO. This is a major accomplishment for the last four years. In 2001, only 12% of the collection was backed up. Currently, 96% of the sweetpotato accessions are maintained in tissue culture in incubators in Ft. Collins.

Molecular Evaluations:

Simple sequence repeat (SSR) markers from wheat, rice, maize, and sorghum database were transferred for use to other grass species including finger millet, seashore paspalum, and bermudagrass by Ming Li Wang, Plant Genetic Resources Conservation Unit. DNA marker development for each individual species to be evaluated in germplasm collections can be slow and costly, while transferred markers can be rapidly and efficiently utilized. Available SSR markers from wheat, rice, maize, and sorghum were transferred to other grass species. A new approach with transferred SSR markers was utilized for plant germplasm characterization and evaluation in finger millet, seashore paspalum, and bermudagrass.

Facilities in the molecular, plant pathology, and sweetpotato tissue culture laboratories were upgraded with the purchase of a gel camera system, DNA concentrator, PCR machine, ultra-pure deionized water system, shaved ice machines, and ELISA plate washer.

Germplasm Maintenance:

In the last year, over 24,000 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. The demand for genetic resources from Griffin has grown from an average of 13,000 accessions distributed per year in the 1990s to an average of over 34,000 accessions distributed per year since 2000. The impact of this technology transfer on American agricultural sustainability and research productivity is immense, as these genetic resources are either no longer available elsewhere or no longer accessible without restriction due to rapidly changing global exchange policies.

Germination tests were conducted on over 9,100 accessions in 2004. Over 5,500 accessions were sent to Ft. Collins for new back up or replacement of other back up samples. The program continued to split seed samples of all accessions at Griffin with a small distribution sample maintained at 5 C and the bulk of each sample maintained at -18 C to maximize seed longevity. Over 7,200 accessions were put into -18 C storage. Currently, almost 58% (over 48,500 accessions) of the entire collection has at least one sample in -18 C storage.

Alabama

Legumes, Forage and Cover Crops

Current work focuses on evaluation of sunn hemp, sericea lespedeza, clovers and *Vicia* species. Sunn hemp germplasm is being used for development of cultivars for the continental US. The objective is to develop cultivars that can be used as fodder and as cover crops. 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 of the TX collection of upland cotton (*G. hirsutum*) for resistance to reniform nematode, and tolerance or resistance to heat and drought stress. The objective is to find resistance and incorporate it into adapted cotton germplasm. Evaluations are being done in cooperation with colleagues at Auburn.

Watermelon

Phylogenetic relationships of Citrullus were studied using DNA sequences from several chloroplast regions.

Arkansas

No Report

Florida

University of Florida, Institute of Food and Agricultural Sciences faculty members continue to be active users of plant genetic resources held at various locations in the USDA National Plant Germplasm System. Records provided by SRPIS show that in calendar year 2004, 418 plant introductions were distributed to 37 different individuals representing private breeders, USDA and University of Florida scientists, and the general public. These distributions represent at least 20 different plant species. Some examples of those uses are listed below.

Dr. K. H. Quesenberry, Professor of Agronomy, University of Florida, Gainesville , FL, is conducting an ongoing program of evaluation of plant germplasm for forage potential in Florida. Specifically in the past year he has received and evaluated bahiagrass (*Paspalum notatum*) plant introductions 315732, 315733, 315734, 434189, and 148996. The first three accessions were described as "Wilmington like" and have narrow leaves. They have been confirmed as tetraploid, and appear to reproduce by apomixis. Seed germination was low and only limited plants were produced, but they have been used in crosses with sexual tetraploid types for possible selection as turf types. Likewise 148996 has been crossed with sexual tetraploid types and progeny are under evaluation for potential improved forage types. Dr. Quesenberry is also evaluating native forage legume germplasm for use in mixtures with bahiagrass. A collection of 55 *Desmodium incanum* accessions (composed of 32 obtained from SRPIS, and 13 from IRFL and 10 from personal collections in Florida) were planted in bahiagrass sod in 2004 and are being evaluated for survival and spread in spring and summer 2005. Seed production and tannin content are currently being evaluated and superior accessions will be increased. An accession of *Lotononis bainesii* selected in Uruguay is also being evaluated for compatibility with bahiagrass. Seed of several *Adesmia* species including *A. bicolor, A. incana, A. latifolia, A. punctata*, and *A. securigerifolia* were received from cooperators in Uruguay and are currently under evaluation for forage potential. Preliminary results suggest that *A. bicolor* may be the best adapted to Florida conditions. Evaluations of perennial *Arachis* species are continuing. A multi-location experiment evaluating four PI

selections of *Arachis glabrata* compared to the released cultivars Florigraze and Arbrook is continuing in 2005. A decision on possible cultivar release should be made after the current growing season. Selections from an experiment evaluating PIs of *A. pintoi* were made in spring 2005 and are being propagated for an advanced evaluation experiment. Perennial *Arachis* germplasm collected in Paraguay in 2002 and 2003 is being increased and multi-location field planting are planned for 2005 and 2006.

Dr. Ann Blount, Associate Professor of Agronomy, University of Florida, North Florida REC at Marianna, FL, is continuing evaluation of *Paspalum notatum* and other *Paspalum* species. She and her students have programs underway to select for increased fall and spring growth in bahiagrass, leaf tissue tolerance to moderated frost events, and resistance to dollar spot disease. Dr. Blount has also received 44 plant introductions of *Hemarthria altissima* from SRPIS and will be evaluating these for potential wetland nutrient uptake plants. Additionally Dr. Blount has received the available collections of *Paspalum notatum* plant introductions and will be establishing a germplasm evaluation planting at the North Florida Research and Education Centers at Live Oak and at Marianna, FL.

Dr. Kevin Kenworthy, Assistant Professor of Agronomy, University of Florida, Gainesville, FL, has initiated a program of breeding and selection for improved turfgrass species. He is currently evaluating various plant introductions of zoysiagrass and bermudagrass. They will be planted in the field with other germplasm collections for evaluation. Dr. Kenworthy is cooperating with Drs. Blount and Quesenberry in selection and identification of turf type bahiagrass selections.

Dr. Jay Scott, Professor of Horticultural Sciences, University of Florida, Gulf Coast REC, Balm, FL, is using various plant introductions in his tomato improvement program. Resistance to bacterial spot race T4 has been verified in PI 114490 and PI 126932. The latter had been found to have hypersensitive resistance to race T3. Both sources are being used in breeding for resistance. The inheritance of T4 resistance is the main subject of a Ph.D. student's dissertation. Dr. Scott is looking for molecular markers linked to resistance genes in both species. Recently homozygous resistance to the local strain of the spotted wilt virus was verified in fairly advanced lines derived from LA 1938, a *L. chilense* accession. Furthermore, this source of resistance has held up against a strain that overcomes the widely used Sw-5 resistance gene. We have recently published a paper on the linkage of molecular markers to high fruit sugars from PI 270248. A second paper has been accepted on the inheritance of high sugars from this PI where F1 sugar levels are high due to heterozygous x heterozygous epistasis. A large number of PI and LA accessions are presently being screened for resistance to pepino mosaic virus in cooperation with Dr. Kai Ling of the USDA in Charleston, SC

Dr. Barry Tillman, Assistant Professor of Agronomy, University of Florida, North Florida REC at Marianna, FL, is using plant introductions in the improvement of peanut. He reports that PI 576623 is the grandparent of some breeding lines that in field testing have the highest level of tomato spotted wilt virus (TSWV) resistance that we have seen to date. At present TSWV is the most important disease of peanut in the SE USA. The current progeny lines from these crosses are not acceptable for cultivar release, but are being used as parents in crosses with the best cultivars.

Dr. Eilene Kabelka, Assistant Professor of Horticultural Sciences, University of Florida, Gainesville, FL, has used plant introduction materials in her cucurbit improvement program. She reports that the Cucurbita and Citrullus PI material obtained from S-9 during 2004 is being utilized as sources of beneficial genes for introgression into squash and watermelon,

respectively. Beneficial genes that may be obtained from this material include resistance to papaya ring spot virus, watermelon mosaic virus, zucchini yellow mosaic virus, phytophthora blight, and powdery mildew. Crossing this material with domestic squash and watermelon germplasm is being performed for the introgression of these beneficial genes into advanced material using both traditional and molecular methods. Molecular markers linked to beneficial genes from the S-9 PI material will be of direct use to public and private breeding programs and the scientific community.

Georgia

More than 50 different requests for plant germplasm were made to the S-9 unit by the citizens of Georgia during 2004. As a result of these requests, a total of 855 plant accessions were supplied to University scientists, USDA scientists, consultants, seed companies, gardeners, and numerous individuals. The most requested crops were peanut, pepper, various legumes, and bamboo.

The University of Georgia has maintained a strong emphasis on plant breeding and continues to expand its advanced molecular biology programs. These programs supply new crop cultivars and associated technologies to our agricultural sector and rely heavily upon the plant materials maintained within the S-9 unit. UGA currently has active cultivar development programs in soybean, peanut, small grains, turfgrasses, forages, blueberries, and numerous ornamental crops that frequently utilize the plant genetic resource collections. In addition, research programs in crop science, horticulture, plant pathology, entomology and other disciplines utilize the genetic resources of the S-9 unit in both basic and applied research projects designed to address the needs of Georgia agriculture. The S-9 unit remains a critical component of our research and cultivar development programs.

Guam

During 2004-2005, activities of the project in Guam included (1) field evaluation of hot peppers (*Capsicum annuum*) and large tomato (*Lycopersicum esculentum*) for tropical climate adaptation, pest resistance, and other desirable characters for consumers in Guam, (2) phenetic analysis of sweetpotato accessions and (3) continuation of germplasm collection, conservation and distribution.

Seven hot pepper accessions were evaluated in a calcareous soil for the total yield, marketable yield, and consumer preference. Three commercial cultivars originated from Taiwan yielded greater than four local lines, however Taiwan cultivars were less pungent. Thus they were not preferred by Chamorro, natives of Guam.

A new large tomato cultivar, ‘Solar Fire’ developed at the University of Florida was evaluated for adaptability to Guam’s climate in on-farm trial. For 6-week harvest period from March to mid-April, ‘Solar Fire’ (8.2 kg/plant) yielded comparably with a heat tolerant cultivar ‘Solar Set’ (9.0 kg/plant) and was superior to ‘Sun Chaser’ (7.0 kg/plant). ‘Solar Fire’ has a slightly smaller fruit (194±8 g) than ‘Solar Set’ (223±8 g), but larger than ‘Sun Chaser’ (161±5 g) (mean±SE, n=10). ‘Solar Fire’ was susceptible to bacterial spots (*Xanthomonas campestris*).

Twelve sweetpotato (*Ipomoea batatas*) accessions were studied for morphological, growth and genetic characteristics. Accessions included germlines from AVRDC (Asian Vegetable Research and Development Center) in Taiwan, Saipan, Rota and Guam. Characters included marketable yield, growth habit and characteristics of tuberous roots (color, shape, sugar content and moisture content). For genetic analysis DNAs were extracted and PCR products

were analyzed by random amplified polymorphic DNA (RAPD) fingerprinting. The phenetic analysis revealed four major clusters according to tuberous root characteristics. Accessions from Rota and Guam were closely related to each other while they were remote from accessions originated from Taiwan.

The seeds of two local vegetables, okra (*Abelmoschus esculentus*) cv. Charlie, and corn (*Zea mays*) 'Guam white corn' were distributed locally and were sent to Saipan.

Hawaii

Macadamia

Evaluation of the newest Hawaii Agricultural Experiment Station (HAES) macadamia (*Macadamia integrifolia*) selections (862, 879, 887, 896, 900, and 932) is in progress at the University of Hawaii (UH) Waiakea Research Station in Hilo and the UH Kona Research Station in Kainaliu. These selections were planted at the Kainaliu and Waiakea stations in May and July 2001 respectively, as part of a cultivar evaluation trial which includes standard HAES selections, 800 and 344. Precocity of macadamia selections is a concern since cultivars in Hawaii come into bearing at about 4 years after transplanting into the orchard, but economic yields are not realized until 6 to 7 years after transplanting. Trees in the trials have begun to bear, and observations on flowering indicate that selection 932 exhibits greater precocity compared to the standard industry cultivars, Kau (HAES 344) and Makai (HAES 800). The observations are continuing, and yield data will be collected to compare performance of the selections.

Longan

Previously we reported that soil drenches with potassium chlorate could stimulate flowering of longan (*Dimocarpus longan*) trees. To determine whether a similar response could be obtained with related oxidizing agents, experiments were conducted to determine whether oxidizing compounds containing hypochlorite (sodium hypochlorite, calcium hypochlorite) could elicit a similar flowering response in longan. Experiments were conducted on 3 to 5 year old longan trees planted in East Hawaii in rocky A'a soils commonly found near Hilo and in the Puna district. Experiments were undertaken on several cultivars including, 'Sri Chompoo', 'Biew Khiew', and 'Egami'. When 500 grams of calcium hypochlorite was applied as a drench to the soil beneath the canopy to an area extending to about 1.5 meters away from the trunk, stimulation of flowering was observed within 2 months on 'Sri Chompoo' and 'Biew Khiew' trees growing in a rocky A'a soil. In untreated 'Sri Chompoo' trees flowering began in April which coincided with the normal flowering period, but trees treated with calcium hypochlorite displayed increased flowering during February when longan flowering was very sporadic. Application of sodium hypochlorite solution (2.625 %) applied as a 7.5 liter soil drench also stimulated flowering of 'Biew Khiew', 'Egami' and 'Sri Chompoo' trees within 2 months after application. Application of muriate of potash (potassium chloride) fertilizer with sodium hypochlorite did not affect of the drench treatment, indicating that addition of potassium did not enhance the effect of hypochlorite.

Although trees appeared uninjured by the treatment, heavy feeding and foliage damage from Chinese rose beetles were often evident in the hypochlorite treated trees just prior to and at the time of flowering. These experiments showed that treatment with strong oxidizing agents such as calcium hypochlorite and sodium hypochlorite could stimulate flowering of longan trees, however, the response was reduced compared to flowering obtained after treatment with potassium chlorate. Preliminary trials with hypochlorite soil drenches to trees growing in deep

silty clay loam soils showed that trees were less responsive compared to trees growing in rocky soils. The similar response with chlorate and hypochlorite may help to elucidate the mechanism of action of these materials during flower induction of longan.

Rambutan

Previously we reported that the plant growth regulator, naphthaleneacetic acid (NAA), and the potassium salt of NAA (K+NAA) could stimulate development of male flowers on rambutan (*Nephelium lappaceum*) panicles which are comprised primarily of functionally female flowers. The treatment was effective when individual panicles were treated at a stage of development when approximately 10% of the flowers on the panicle had completed anthesis. Here we report the results of further experiments that were conducted to identify which rambutan cultivars are responsive K+NAA. Eleven rambutan cultivars were treated with 90 ppm K+NAA during the flowering season between June and September 2004. The 11 cultivars were located in four orchards on the eastern (windward) end of Hawaii Island situated on soil types ranging from rocky A'a to silty clay loam and from elevations between 75 to 250 m. Cultivars tested included 'Binjai', 'Jitlee', 'R162', 'R167', 'R9', 'R134', 'R137 Red', 'R156 Red', 'Rongrien', 'R7', and 'R156 Yellow'. Treatments consisted of 15 replications of treated and control panicles. Control panicles were sprayed with distilled water and treated panicles were sprayed to runoff with 90 ppm of K+NAA when approximately 10% of the flowers were at anthesis. Since rambutan panicles do not bloom synchronously within a tree or throughout an orchard, treatments were periodically applied to individual panicles as the flowering season progressed. As a result, treatment dates varied between panicles. Male flowers, in which anthers extended beyond the pistil, were counted and recorded. Results from these experiments indicate that all of the tested cultivars responded to 90 ppm K+NAA. Development of male flower was apparent on treated panicles 4 to 5 days after treatment. Maximum numbers of male flowers were produced at 6 to 8 days, and production ceased after about 12 days. Cultivars such as 'Rongrien' and 'Jitlee' were very responsive and consistently developed male flowers, and anthesis occurred more synchronously in these cultivars than with other cultivars. Although 'Binjai', 'R162', and 'R156 Red' were very responsive to K+NAA, low numbers of male flowers were produced, if panicles were not treated during the peak flowering period. Little or no male flowers were produced on untreated panicles for all cultivars. A few male flowers appeared without K+NAA treatment on 'R156 Yellow' and 'R134', and in particular on the 'Silengkeng' cultivar. The greater tendency for "Silengkeng' to produce numerous male flowers without NAA treatment makes it a good pollinator tree for orchards.

The ability to induce the formation of male flowers with viable pollen is important for ensuring that pollination occurs throughout an orchard. Viability of pollen grains from NAA induced male flowers was determined with a pollination medium containing 50 ppm H3BO3, 150 ppm Ca(NO3)2 4H2O, 100 ppm MgSO4 7H2O, 50 ppm KNO3 and 5% sucrose. Pollen grains from 11 cultivars were tested for viability along with pollen from naturally produced male flowers of 'Silengkeng', and pollen obtained from flowers from a male tree. Pollen from NAA induced male flowers on the 11 treated cultivars, the 'Silengkeng' pollen and pollen from the male tree successfully germinated within 15-42 hours after incubation in the germination medium. Results of the germination tests confirm that NAA induced and non-induced male flowers are capable of producing viable pollen for pollination.

The effect of multiple applications of K+NAA to individual panicles was also studied on 'Binjai' and 'Jitlee' trees. Panicles were treated at 10% anthesis with 90 ppm K+NAA and

retreated with the same concentration 8 days after the first application when approximately 50% of the flowers had opened. Data were taken every 3 days beginning on the sixth day after the first treatment. The data showed that male flower development peaked about 9 days after the first treatment was applied, and their development ceased about 7 days after the second treatment, or 15 days after the first spray application. There was a slight increase in the average number of male flowers per panicle on the twelfth day after treatment when the data were compared to data from panicles sprayed once at 10% or at 50% anthesis. These results indicate that a second application of 90 ppm K+NAA extended the duration of male flowers development by approximately 3 days. Results of these experiments show that panicles at advanced stages of development responded to K+NAA treatments but the response was lower than when treated at an earlier stage of development. Multiple applications of K+NAA were also successful at inducing the production of male flowers and extending their development by approximately 3 days.

Kentucky
No Report

Louisiana
Vigna collection (Dr. Blair Buckley, Louisiana State University Agricultural Center)

The accessions obtained represent the majority of accessions in the *Vigna* germplasm core collection. The accessions were screened for reaction to the bacterial blight pathogen *Xanthomonas axonopodis* pv. *vignicola*. Screening is complete and data is being analyzed. Ratings will be submitted to the GRIN data base and a manuscript prepared.

Medicago collection (Dr. Wink Alison, Louisiana State University Agricultural Center)

We were setting up an alfalfa variety test and requested a small amount of seed of different varieties. The test was done at the Southeast Station. It was quite beneficial to be able to obtain small quantities of seed to use in different tests.

Sorghum collection (Dr. John Veremis, USDA/ARS team at Houma, LA)

Acquire and select exotic relatives and making crosses with *Saccharum* species to improve sugarcane. I received seeds from the core collection of sorghum via Federal Express on Tuesday, February 19, 2002 from Lee Ann Chalkley after requesting from Dr. John Erpelding. Dr. Tew is the leader of our CRIS and he had suggested to me to cross Sugarcane with Sorghum. We tried to hybridize sorghum with *Erianthus* and *Saccharum*, but the crossing was not successful the past two year, because we did not get any hybrids from our attempts. However, we planned on spring of 2002 the core collection of sorghum greater than 2K and evaluated as sugarcane under our field conditions, in order to provide yield-component data to potential growers who may wish to become involved in sorghum as a crop. I still have interest in the collinearity of the grass species and would like to receive some of the ancestral species of sorghum if possible to try addition hybridizations this fall.

Clover-legume collection (Dr. Stephen Boue, Southern Regional Research Center, USDA New Orleans)

I have been working on soybean isoflavones and their effects on animal systems. I have been working with Tulane University analyzing estrogenic effects on breast cancer. We wanted

to look at other legumes other than soy as sources of isoflavones. I have not explored clover and kudzu as much as I would like, but from the literature am aware of their isoflavone composition. I appreciate the samples that were sent. We are setting up a HPLC-mass spectrometry lab and would like to start screening samples soon for unique estrogenic compounds in legumes and other plants.

Sweetpotato Collection (Drs. Don La Bonte and Chris Clark)

Clones were requested in 2004/2005 to determine genetic variability in uptake of micronutrients Fe and Zn. The goal is to enhance the levels of these micronutrients in sweetpotato to lessen nutritional deficiencies found in developing countries. Other germplasm requests are related to virus resistance research, particularly towards resistance to Sweet Potato Virus Disease.

Mississippi

The kenaf (*Hisbiscus cannabinus* L.) breeding program at Mississippi State University is selecting for altered leaf-shape and yield and anticipate a cultivar release in 2005. The USDA corn host plant resistance program is developing sources of resistance to *Aspergillus flavus* and various corn insects. A proposal for the release of a new germplasm (Mp717) with enhanced tolerance of aflatoxin has been submitted for review. The USDA Cotton Breeding program at Mississippi State University has been evaluating the use of random mating among diverse cultivars to obtain recombination among desirable yield and fiber quality traits in cotton (*Gossypium hirsutum* L.). This group also released 14 upland cotton, primitive-derived germplasm lines with improved fiber strength and 21 BC4-F4 noncommercial flowering day neutral germplasm lines of upland cotton involving *Gossypium hirsutum* L. race accessions in 2004.

North Carolina

Faculty in the Crop Science and Horticultural Science Departments at NC State University conduct research on strawberry, blueberry, brambles, tree crops, ornamentals, maize, soybean, peanut, cotton, tobacco, small grains, turfgrasses, sweet potato, cucurbits, and other crops. Priorities have concentrated on incorporating disease and insect resistance, abiotic stress resistance, and quality factors into improve breeding lines and cultivars. Plant introductions are critical components of plant improvement programs. Germplasm collections are maintained for the U.S. *Nicotiana* cultivated and species collection, *Arachis* species, South American maize germplasm, and many accessions of soybean, blueberries, sweet potato and other crop species. The following paragraphs will present a few of the research results from the past year.

In tobacco, a new burley tobacco cultivar, NC 103, was released with high levels of resistance to multiple viruses and diseases. The cultivar is high yielding and should have widespread use in the international market. Several germplasm accessions and varieties of Canadian origin were identified as possessing significantly higher percent total alkaloids at a given level of yield in tobacco. A method was developed for expediting the process of converting female parents of new tobacco hybrids to cytoplasmic male sterility. The procedure allows for complete conversion within 6 months instead of 2 ½ to 3 years. Researchers have developed new molecular markers for resistance to blue mold in tobacco and demonstrated that these markers could successfully be used to select blue mold resistant lines in marker-assisted breeding. More than 200 AFLP markers were identified for the *N. glutinosa* chromosome set

containing the TMV resistance gene N. Accessions possessing the N-gene on chromosome H may have great practical value because of decreased amounts of accompanying alien chromatin and increased potential for reducing linkage drag through the use of molecular marker assisted backcrossing. Fifteen AFLP markers were found in tobacco to be polymorphic between two near isogenic lines (NILs) for a chromosomal region that is known to influence leaf number/flowering time. These genes were previously transferred from *N. tomentosa* to chromosome B of *N. tabacum*. Phenotypic and genotypic data revealed that all polymorphic markers were linked in coupling phase with the introgressed QTL. Lastly, a gene that regulates nitrosamine formation in tobacco was identified.

In small grains, four germplasm lines with significantly more freezing tolerance than the most winter hardy oat were submitted to the Winter Hardiness Nursery: Win/Nor 1, Win/Nor 4, Win/Nor 9, and Win/Nor 10 were released. Two of the lines were hardier than any other germplasm in the nursery. A new hulless oat, cultivar NC-Hulless, was released with superior performance for the horse industry. Project leaders have associated 11 microsatellite markers with resistance to powdery mildew in selected populations of wheat. Powdery mildew is a widely distributed and destructive disease of wheat, resulting in both reduced yield and quality. Markers identified through this project may be used for marker-assisted breeding to develop resistant cultivars. Genetic marker data was provided for the 2005 Fusarium Head Blight (FHB) Uniform Nursery to all interested wheat breeders. FHB is a fungal disease occurring on all small grain crops, causing yield and quality loss. Wheat research has shown that a single gene controls resistance in each germplasm (NCD1, NCD3, NCA4, NCD7, NCAB10 and NCAG11). These genes are inherited independently except for NCA4 and NCAG11, which are closely linked. This provides a blueprint for the utilization of these resistance sources by wheat breeders in the development of new wheat varieties. Advanced generation lines of wheat from the cross of NCD1 by NCAG11 have been identified as resistant to powdery mildew in the field and to contain the molecular markers linked to each resistance gene. This represents a pyramid of the NCD1 and NCAG11 resistance genes.

The peanut breeding lines N98003 and N00090ol were proposed for cultivar release because they have very high yields; and the second line represents the first large-seeded peanut with high oleic acid content. Three new peanut cultivars were developed for the boiling market. Numerous transgenic peanut lines were developed carrying a transgene encoding the capsid protein from the 'Hawaii L' isolate of TSWV, which provides complete resistance against TSWV when tested in tobacco. A project to identify allergens in peanut has resulted in one new protein which is allergenic. Developed 14 transgenic peanut lines in peanut cv. 'Georgia Green' carrying transgene encoding ASP 1, protein that is high in four amino acids in which peanut is normally deficient.

Cotton improvement has involved both field and laboratory research to improve fiber quality. In the more basic research program, 9,239 EST sequences representing 3,420 tentative unigenes were deposited in GenBank (accession numbers C0490611-C0499850). These ESTs represented genes expressed during the secondary wall phase of cotton fiber development, and they reflect the first large scale contribution of sequences from that developmental stage.

Soybean lines were identified to have resistance to Soybean cyst nematode. Also, research determined that susceptibility to rhizobitoxine is controlled by two genes and was able to locate one in the soybean genome using molecular markers. Work has continued to develop drought-resistant germplasm and edible soybeans have been developed. Soy protein isolates also were successfully modified, both physically and chemically, to enhance their functionality. The

enhanced functionality was found in the modified soy protein prepared at neutral pH but was not found in modified soy proteins prepared at acidic pH. The fapnc mutation, or linked genes, was shown to have a negative correlation with yield in soybean. Genotypes that were homozygous for fapnc yielded 172 to 369 kg/ha less than normal or heterozygous genotypes.

Other breeding and genetics projects have resulted in release of 19 corn breeding lines that include a variety of traits that have utility for many different production requirements and conditions. Molecular characterization of maize germplasm is also in progress. Transgenic tall fescue plants were obtained that are more tolerant to water deficiency than other known tall fescue genotypes. Three promoters were identified and isolated from the rice genome, with one being a new polyubiquitin gene (rubi3) promoter including 5'UTR intron sequence. The activity of the rubi3 promoter was about half of the maize ubiquitin promoter. A total of 116 bloodroot accessions were collected in 2004. A high level of heterozygosity among bloodroot accessions has been found by AFLP and PAGE analyses. Data is being used to evaluate diversity and accession associations. The DAD30 accession of bloodroot has a unique "staghorn" leaf form, making it attractive for propagation as an ornamental. Additional cultivar releases have been made in the peach and blueberry programs.

Lastly, a proposal for a Plant Breeding Center has been submitted by the faculty to the Dean of the College of Agriculture and Life Sciences.

Personnel

Dr. Ramsey Lewis joined the Crop Science faculty as a tobacco breeder. He will work primarily with flue cured tobacco germplasm. Dr. David Danehower initiated a program to collect native plants with potentially useful secondary products. Dr. Susan Milla joined the Crop Science faculty as a Senior Researcher and she will be working with tobacco and peanut molecular markers. Dr. Gina Brown-Guedira joined the Crop Science Department as the Director of the USDA Wheat Genotyping Laboratory. This is a multi-state wheat improvement facility. Dr. George Allen joined the Crop Science Department as Director of the newly formed Plant Transformation Laboratory. This is a multi-department service laboratory for with a mission for plant improvement. Dr. Jennifer Levin, Assist. Professor of Crop Science, accepted responsibility as the curator of the national *Nicotiana* collection. The collection has about 2,000 cultivated and 200 species accessions and is being maintained by the NC State Univ. College of Agriculture and Life Sciences. Technical and operating support will be needed for proper maintenance in the future.

Oklahoma

Yinghua Huang, USDA-ARS, Field Crops Research Unit, Stillwater, OK.
Genus and common name studied: *Sorghum bicolor*
Research Purpose: Our research activities focus on identification of new sources of genetic resistance to greenbug (i.e. aphid) pest through evaluating available sorghum germplasm. Accessions received from NPGS are tested against greenbug feeding through artificial infestation in greenhouse. Once resistant sources are identified, more experiments are followed to characterize the genetic diversity of new sources and genetic mechanisms of greenbug resistance that operate in sorghum plant using conventional and genomic tools.

Twain Butler, The Samuel Roberts Noble Foundation, Inc., Ardmore, OK.
Genus and common name studied: *Strophostyles helvula* (trailing wild bean).

Research Purpose: I obtained 7 PI (215295, 215296, 599666, 601970, 601971, 603808, 603809) for seed increase and future evaluation (forage and seed yield). Future plans are to select lines with desirable maturity and agronomic characters suitable for summer reseeding legume in permanent pastures.
Genus and common name studied: *Strophostyles leiosperma* (smooth-seeded wild bean)
Research Purpose: I obtained PI 215298 for seed increase and future evaluation. Future plans are to compare this line to local ecotype collections and select line with desirable reseeding ability.

Tim Springer, Southern Plains Range Research Station, USDA-ARS, Woodward, OK.
Genus: *Schizachyrium scoparium* (Michx.) Nash; little bluestem
Research Purpose: We have planted the material in field plots and will be harvesting open-pollinated seed from it in order to develop a larger population of plants to select seed and forage production.

Puerto Rico
University of Puerto Rico

Replicated quenepa (*Melicoccus bijugatus*) field experiments consisting of 18 quenepa clones grafted on the common rootstock 'Martínez' were established in 2004 at Juana Díaz and Lajas. A replicated guava (*Psidium guajava*) planting consisting of 14 accessions was maintained and evaluated at Juana Díaz. Seventeen plantain and 26 banana clones (*Musa* sp.) were maintained in a field germplasm collection at Corozal. The banana hybrid 2390 showed more field resístance to yellow sigatoka (*Mycosphaerella musicola*) than 'Grand Nain', 'Johnson' and 'Ziv', but also had a lower fruit number per bunch and bunch weight. Field germplasm collections of 30 yam (*Dioscorea* sp.), 22 cassava (*Manihot esculenta*) and 18 sweet potato (*Ipomoea batatas*) accessions were maintained at Corozal. A field experiment of four yam (*Dioscorea alata*) cultivars was conducted. 'Diamante', 'Forastero' and 'Kabusash' had a lower incidence of infection by anthracnose and higher yields than 'Florido'. Twelve sweet cherry pepper (*Capsicum chinense*) accessions were characterized in a field planting at Lajas. Preliminary observations indicate that Selection 1 (Trompo) and Selection 7 (Chato-D) had a higher incidence of damage due to the pepper weevil (*Anthonomus eugenii* [Coleoptera: Curculionidae]), and that Selection 8 (Estrella) and Selection 10 (Selección Jorge Colón) had the lowest incidence. Citrus plantings with various rootstock/scion combinations were evaluated at Isabela, Corozal y Adjuntas, including new experimental plantings of three mandarin cultivars on five rootstocks at Isabela and Corozal. Twelve clones of "Mayagüezano" mango (*Mangifera indica*), grafted on the common rootstock 'Banilejo', were planted in 2002 and are under evaluation in a replicated field planting at Lajas. A second fresh market tomato (*Lycopersicon esculentum*) variety trial comprised of eight cultivars was conducted at Juana Díaz and Lajas. No significant differences were observed among cultivars for insect and disease incidence. 'Florida 91' had the highest total marketable yields at both locations. Virus symptoms were observed in all plants at both locations, but 'BHN 543' showed the most severe symptoms at both locations. At Juana Díaz, 'Pik Ripe 461' showed less severe virus symptoms than the other cultivars. 'Mayorbela', 'Chulo' and 'Suresweet' open pollinated maize (*Zea mays*) populations were grown in the field at Isabela and selected for superior horticultural traits, including yield and insect resístance, in a recurrent selection breeding program. Seed of two yellow dent opaque-2 maize populations was obtained from IDIAF in the Dominican Republic and were found to be well adapted to growing conditions at Isabela; seed was selected from each

population to initiate a recurrent selection program. In 2004, three researchers in Puerto Rico requested a total of 322 seed samples of Sorghum (302), Vigna (4), and Desmodium (16) from the Plant Genetic Resources Conservation Unit in Griffin, GA.

USDA, ARS, Tropical Agricultural Research Station

The sorghum germplasm collection from Mozambique was evaluated for anthracnose resistance over two growing seasons. The majority of the accessions in the collection showed resistance to the disease. A subset of germplasm from Ethiopia was screened for anthracnose resistance during the dry and wet growing seasons. The response to anthracnose infection was similar over growing seasons suggesting non-replicated large scale evaluations could be conducted to rapidly evaluate the 8,000 accessions in this collection. A subset of Malian sorghum germplasm was evaluated for anthracnose resistance in Puerto Rico and Texas in collaboration with Dr. L.K. Prom (USDA-ARS, College Station, TX). Over 70% of the accessions were observed to be resistant at both locations indicating Mali may provide a good source of anthracnose resistance. The information from this study was used to develop evaluation subsets representing specific regions of Mali for anthracnose evaluation. A subset from one region was evaluated and results suggested an association between resistance and weather patterns in the region.

For the second year, cultivars and rootstock of five tropical fruit crops with economic potential were surveyed for susceptibility to the root-feeding pests, *Phyllophaga vandinei* (Smyth) (Coleoptera: Scarabeidae), and *Diaprepes abbreviatus* (L.) (Coleoptera: Curculionidae). The fruit crops surveyed included lychee (*Litchi chinensis* Sonn.), rambutan (*Nephelium lappaceum* L.), longan (*Dimocarpus longan* Lour.), mamey sapote (*Pouteria sapota* (Jacq.) H.E. Moore and Stearn), and sapodilla (*Manilkara zapota* Van Royen). Although there do not appear to be any differences among cultivars and/or rootstock within species of these fruit crops important differences are emerging between crop species with mamey sapote supporting the most root pests and longan supporting the fewest. This is the first study of its kind and promises to reveal interesting dynamics between host choice by the adult females and the ability of larvae to survive on the roots of the plants chosen by their mothers.

Nine carambola accessions grown on an Oxisol, Ultisol and Mollisol were evaluated at Isabela, Corozal and Juana Diaz, respectively. There were no significant differences in number and weight of marketable fruits per hectare between Corozal and Isabela; average values for both locations were 249,824 fruits/ha and 29,864 kg/ha. At Juana Diaz these values were 196,254 fruits/ha and 24,339 kg/ha, respectively. There were no significant differences in weight of marketable fruit per hectare among clones B-17, Thai Knight, B-10, Sri Kembangan, and Kajang among locations. The average marketable fruit weight for these higher yielding clones was 31,457 kg/ha. Kari produced significantly longer fruits at all locations, whereas clone B-16 produced the shortest fruits. Significantly higher brix values were obtained from fruits of clone B-17 at all locations, whereas lower values were obtained from those of Arkin.

All 84 accessions in the banana (*Musa* spp.) collection were planted in the field in a replicated manner. This planting will be evaluated for phenotypic and agronomic traits; these traits as well as molecular marker (genotypic) data will be used to estimate genetic diversity in the germplasm collection.

All *Musa* spp. accessions were in-vitro regenerated from a single mother plant and will be indexed for two viruses that can occur in Puerto Rico, Banana Streak Virus (BSV) and Cucumber Mosaic Virus (CMV). The accessions have been planted and are being grown in an

insect-free greenhouse for observation of virus symptoms as well as for virus indexing with electron microscopy and serology in five months.

A collection of 20 Puerto Rican isolates of the fungus *Colletotrichum gloeosporioides,* the causal agent of mango anthracnose has been established. This collection is intended for field inoculation of mango germplasm that will be screened for disease resistance. The isolates were collected from diverse locations around the island in order to maximize genetic diversity.

Breeding populations and populations for genetic studies were generated for research on germplasm conversion, heat tolerance, and common bacterial blight in common bean (*Phaseolus vulgaris*). A large recombinant inbred line population (RIL), composed of 400 lines, was advanced two generations to F5, evaluated in the field, and DNA was extracted for molecular analysis of critical traits involved in germplasm conversion.

The regeneration of 1680 sorghum accessions with low seed viability or number was conducted at GIRU, US Virgin Islands. A total of 230 cultivated sorghum accessions and 10 wild species with germination rates below 15% were germinated in the greenhouse at Mayaguez and transplanted to the field in Isabela for seed regeneration. Also, 50 accessions of cowpea, 20 of maize (420 rows), 15 of winged bean, 5 cucurbits and 15 *Leucaena* were seed regenerated at Mayaguez and Isabela.

A total of 1785 distributions of more than 40 plant species of tropical germplasm in the form of budwood, cuttings, rhizomes, corms, seed and fruit were made available and distributed to researchers and cooperators at the local, national and international level. Additionally, many technical questions were answered by program personnel concerning agronomy, horticulture and the cultivation of crops that are the responsibility of the repository.

Over 600 sorghum panicles from accessions regenerated at St. Croix were photographed and incorporated into GRIN. Digital images of more than 200 accessions of cacao pods, plantain racemes, mamey sapote and sapodilla fruits and tropical bamboo were posted onto the GRIN database website.

New SY Hires:
Brian Irish, Horticulturist/Curator (Tropical Fruits)
David Jenkins, Research Entomologist (Tropical Fruits)

South Carolina

Germplasm Distribution

A total of 612 germplasm accessions were distributed by the Plant Genetic Resources Conservation Unit at Griffin, GA to the following individuals in South Carolina in 2004: Dr. Judy Thies, USDA Vegetable Laboratory, Charleston, SC, 33 *Citrullus* spp. (watermelon) accessions and 1 *Capsicum* (pepper) accessions; Dr. Janice Bohac, USDA Vegetable Laboratory, Charleston, SC, 65 *Ipomoea* spp. (sweet potato) accessions; Mr. Paul Berland, USDA Vegetable Laboratory, Charleston, SC, 346 *Vigna* spp. (cowpea) accessions. Dr. Amnon Levi, USDA Vegetable Laboratory, Charleston, SC, 142 *Citrullus* spp. accessions; M. Bishop, 4 *Citrullus*, 8 *Capsicum*, and 3 *Zoysia* (warm season grass) accessions; T. Bishop, Atlantis Research, Inc., 4 *Capsicum* and 1 *Solanum* (eggplant) accessions; D. Patton, 1 *Vigna* accession; D. Stanton, Stanton's Pedigreed Pepper Seed Company, 1 *Capsicum* accession; and L. Thomas, 3 *Capsicum* accessions.

Soybean

Seed of soybean (*Glycine max*) germplasm line, LG00-3372, were obtained from the developer, Dr. Randall Nelson (Curator, Soybean Germplasm Collection), USDA-ARS, Urbana, Illinois. The line was released by USDA-ARS in 2004 because of genetically diverse parentage and high seed yield performance, 2002-2003, in tests in mid-western states. It is a maturity group III line and has an indeterminate growth habit. Parentage is PI561319A x PI574477. Both PI (plant introduction) parents are originally from China. The line was crossed with two elite South Carolina glyphosate-tolerant experimental lines in 2004 with the objective of combining diverse genes for seed yield with genes in the adapted lines which provide nematode resistance and agronomic characteristics suitable for the southeastern U.S.A. F2 plants from both crosses are currently being grown at Clemson, South Carolina. Another hybridization was made with PI594651-L2, determined by researchers at the University of Georgia to have a high level of resistance to peanut root-knot nematode (*Meloidogyne arenaria*). The PI was crossed with an adapted South Carolina cultivar, Dillon, with the objective of combining an improved level of *M. arenaria* resistance with high seed yield and acceptable agronomic traits. Populations from these three crosses will be advanced to the F4 or F5 generation when experimental lines will be derived and evaluated for the specific traits under selection.

Tennessee

The following projects are being conducted at the University of Tennessee in which novel or exotic germplasm lines are being utilized in research projects.

Soybean

Effects of Root/Leaflet Orientation Trait Combinations on Water-Use Efficiency in Soybean. Fred Allen, Professor; Richard Johnson, Res. Associate, Dept. of Plant Sciences, Univ. of Tennessee

Objective: Determine the effects of combinations of fibrous root and leaflet orientation on water-use efficiency in soybeans.

Approach: Recombinant inbred lines (RIL) are being developed from a cross between a prolific rooting line, PI416.937, and a high leaflet orienting cultivar, USG 5601T. The goal is to develop isolines that have lo-orientation/normal root; lo-orientation/prolific root; hi-orientation/normal root; and hi-orientation/prolific rooting trait combinations and compare their water-use relative to seed yield. Crosses have been made and F4 through F6 populations are being evaluated in the field during the 2005 growing season.

Expanding the Genetic Diversity of Elite Soybean Germplasm. Vincent Pantalone, Associate Professor, Dept. of Plant Sciences, Univ. of Tennessee; Grover Shannon, Univ. of Missouri, Delta Station, Portageville, MO; and Randy Nelson, USDA-ARS Germplasm Currator, Univ. of Illinois, Urbana-Champaign

Objective: Develop new soybean populations with enhanced genetic diversity.

Approach: Four new cross hybridizations have being initiated by our TN program to expand diversity for applied variety development:

1) TN04 042 x S99 11986, where S99-11986 was developed from: LG87 1782(PI297515xPI290126B) x LG88 3146(PI427099xPI445830)

2) LG00 6293 x K1599, where LG00-6293 was developed from: PI 574.480 x PI 574.477

3) LG00 6293 x TN02 134RR, where LG00-6293 was developed from: PI 574.480 x PI 574.477

4) LG00 6313 x TN03 105RR, where LG00-6313 was developed from:
PI 574.480B x PI 574.477
Several populations are being grown by soybean breeders in different parts of the U.S. with the goal of selecting adapted lines for local conditions that can be used directly as potential new cultivars, or use the lines as parents in crosses in order to introgress new germplasm into breeding programs.

Corn

Cereal Breeding: Breeding maize lines with exotic germplasm. Dennis West, Univ Tennessee, and Major Goodman, NCSU
Objective: Incorporate genes from exotic maize germplasm into adapted U.S. maize germplasm.
Approach: Early generation lines from the Germplasm Enhancement of Maize (GEM) project, coordinated through the USDA Maize project at Iowa State University, are crossed with elite adapted lines. The resulting hybrids are grown regionally in the Southern U.S. to evaluate field performance. The best lines from these hybrid trials are entered in breeding programs, using traditional breeding methods, to develop new maize parental lines. In 2004 we have 891 experimental hybrids from the GEM project in yield trials in Tennessee. In addition to the yield trials we have 377 nursery rows of GEM material for inbreeding and selection.

Three accessions of teosinte were obtained from NCRPIS at Ames, Iowa in 2004. This germplasm has been planted in Knoxville and crossed with adapted corn. F1 hybrids will be backcrossed to adapted corn lines during the 2005 growing season.

Texas
No report

Virgin Islands

There are two native orchid species remaining in St. Croix; *Epidendrum ciliare* and *Psychilis macconnelliae*, both of which are on the VI endangered species list. The *Epidendrum ciliare* is an epiphitic orchid found on trees or cliffsides and requires slight shade. The *Psychilis macconnelliae* grows as a terrestrial in the Virgin Islands and prefers full sun. Current research includes media comparison studies to determine the most appropriate method for micropropagation of the plants by seed and developing acclimatization protocols for species which are more difficult to harden off than conventional hybrids. Preliminary results indicate that the *Epidendrum ciliare* germinates best on a modified Knudson-type media whereas the *Pyschilis macconnellia* prefers a modified Orchid replate/maintenance media.

Papaya strains obtained from Venezuela, Columbia and Bangladesh are being evaluated with eight selected lines grown in the US Virgin Islands. The new papaya lines are being assessed for disease tolerance, production potential and fruit quality under the semi-arid tropical conditions found in the US Virgin Islands.

Greater production of in vitro grown native orchids, through the use of specific media for the species, has reduced the cost to local growers.

Virginia

Several accessions from the USDA plant germplasm collection were used for studies of systematics and genetic diversity. Legume cover crops are under investigation for their potential in meeting nitrogen needs of various summer crops. Peanut accessions acquired from the Plant

Germplasm Conservation Unit in Griffin, GA were used in development of newly released cultivars and germplasm. These activities document the distribution and utilization of plant genetic resources, a primary objective of the regional project, the study of genetic relationships among crop plants and their wild relatives, and the release of new cultivars of crop plants, the cornerstone of agriculture.

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