Project Number: S-009

Project Title: Plant Genetic Resources Conservation and Utilization

Period Covered: 08/2001 through 8/2002

Date of This Report: March 17, 2003

Annual Meeting Dates: August 6, 2002

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

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

Accomplishments and Impacts:

USDA - Plant Genetic Resources Conservation Unit

Plant genetic resources collected from throughout the world are a valuable source of genetic diversity for the improvement of agricultural and horticultural crops grown in the U.S. This germplasm will be used now and in the future to develop improved plant materials with resistance to diseases or insects, improved crop quality, greater yields, alternate uses, and new chemical traits. The germplasm collection at the Plant Genetic Resources Conservation Unit contains 82,416 accessions representing 1,429 species and 245 genera. This collection is one of the largest working collections of seed and clonal accessions in the entire U.S. National Plant Germplasm System.

Vigna: Worked on the characterization of an unknown disease found in Crotalaria growing in the regeneration plots at Griffin. This disease agent causes collapse and death in *Nicotiana benthamiana* and attempts have been made to identify via ELISA, RT-PCR, host range studies, and electron microscopy. Work had been done to attempt to gain enough knowledge of the biology of the pathogen to be able to inoculate *N. benthamiana* plants without the plants being killed. Thus far, there have been no consistent results.

Research has been completed with the study of relatedness of subspecies of *Vigna unguiculata* using AFLP and SSR markers. A manuscript has been prepared and submitted for entry into ARIS so that it can be submitted for publication.

Regenerations were conducted again this year with 200 lines planted in the plots in Griffin, 50 lines at Isabela, and about 50 lines in the greenhouses at Griffin. Of the lines in the field at Griffin 121 matured and produced seed with another five lines from last seed maturing in the greenhouse. One line did not grow in Isabela so there were seeds from 49 lines. The winter growout in the greenhouse at Griffin produced seed of 47 lines.

The usual descriptor data were collected for those accessions in the regeneration plots in the field in Griffin and in Puerto Rico as well as in the greenhouse. In addition, digital images were collected of flowers, pods, and leaf shapes.

Tests were run on developing a method for screening cowpeas for resistance to cucumber mosaic virus in the greenhouse. These were only moderately successful since the followup tests

of the greenhouse results were marred by the presence of either a new strain of CMV or another similar virus that caused infections in accessions previously noted as resistant. Then, work was started to test a possible association of several SSR markers with resistance to CMV to determine if these possible markers can be used in association with the biological results for screening.

The major impact of the pathology and the cowpea germplasm research in progress has been the discovery of possible DNA markers for cucumber mosaic virus resistance in cowpea. This could be a breakthrough in the screening of cowpea lines for resistance. The other item of impact for the future is the collection of digital descriptors for cowpeas in the collection. This will be of major importance for scientists to be better able to use the collection.

Peanut: Using information in GRIN, approximately 800 cultivated accessions were selected for increase at Byron, Georgia. Approximately 200 quarantine peanut germplasm lines were increased and tested in a timely matter for use by University and private industry. Most of the material was from ICRISAT and cultivated; the balance was material from the Paraguay collection trip.

Coordinated peanut research on AFLP markers on wild peanut germplasm as no polymorphism were found in cultivated peanuts; polymorphisms were found for wild peanuts. Started a joint SSR discovery project with Dr. Guohao He at Tuskegee University (HBLC). Approximately 400 SSR's have been looked at and about 50 have been found to be polymorphic in cultivated peanuts.

Continued the National Peanut Check-off Board on Tomato Spotted Wilt Virus Resistance research project for the second year. Continued Check-off Board research on Tomato Spotted Wilt Virus Resistance using molecular techniques to identify resistance. Continued research funded by the GACC for Peanuts for mid generation selection of breeding of cultivated material for disease and pest resistance.

Active member of team which collected 65 accessions of peanut germplasm (mainly wild germplasm for forage use) in Paraguay.

Updated and new descriptor and image information was made available to scientists on GRIN. Barcode label and note taking system was used which reduced descriptor time and resulted in more accurate information. Requested quarantine peanuts by scientists was processed in a timely matter. New wild peanuts was obtained through collection in Paraguay which will impact legume forage production in the Southeastern United States.

Represented USDA in discussion with University of Florida Forage Group headed by Ann Blount to discuss the discovery of Peanut Stunt Virus in perennial peanut in north Florida and what needs to be done to identify the how wide spread the virus is in forage peanuts. The finding of Peanut Stunt Virus in the perennial peanut is a first report of the virus in rhizomatous peanuts which might have significant impact in the production of forage in north Florida and Georgia.

Clovers, Grasses, New Crops, Misc. Legumes and Misc. Crops: Several gaps were corrected in GRIN including reduction of seed distributed for sesame, kenaf, velvetbean, and jackbean due to self pollinating reproduction and/or low seed production. Attempted 398 regenerations at the Westbrook farm for castor, grasses, legumes, kenaf, miscellaneous crops, and sesame plus an additional 27 castor accessions regenerated by a collaborator, Rick Graves, Castor Oil, Inc., Plainview, TX; 19 velvetbean accessions regenerated by collaborator, Howard Harrison, USDA,

ARS, Charleston, SC; and 38 guar accessions regenerated by collaborator, Kim Moore, AgResearch Consultants, Inc., Ashburn, GA. The current tally includes 179 successful regenerations thus far from the Westbrook farm. Several are either perennial, late season production or low in vigor with low germination percentages and low flower production.

Acquisitions of various accessions were received including 1 *Macroptilium gibbosifolium*, 1 castor (*Ricinus communis*) germplasm (TTU-LRC) developed from crosses made between PI 257654 and Hale and between 258368 and Hale. Hale is high yielding, dwarf, high ricin content in the seed and developed by Dick Auld, Texas Tech University.

Reviewed descriptor modifications for *Lesquerella, Limnanthes*, and *Echinacea*. Reviewed and distributed 2,968 legumes, miscellaneous crops, grasses, and new crops to researchers throughout the world for studies regarding agronomic, phytochemical, biological control, forage, genetics, herbarium, aid, wildlife, teaching aids, evolution, taxonomy, physiology, archaeology, biodegradation, ornamental, display, tannin biosynthesis, edible vaccine development in forage crops, nutraceutical and pharmaceutical crop development, local farmer testing, pest control, nitrogen fixation, alternative crops, medicinal crop demos, vegetative propagation, new variety development, cytogenetics, saline tolerance, and tissue culture. Special-purpose legume, new, miscellaneous, and grass genetic resources, information, and reprints distributed to scientists worldwide provided not only quality seed but also pertinent information to adequately ascertain usefulness of specific species for alternative uses such as nutraceuticals, pharmaceuticals, and pesticidals while providing valuable information and proof for updating core collections especially for subterranean clover.

Conducted successful seed increases in the field of 21 of 35 cross-pollinated clover accessions in cages with bees. Conducted successful seed increases of 45 of 50 self-pollinated clover accessions in the greenhouse. Attempted fall regeneration of short-day African clovers most of which were killed by early cold temperatures.

Sorghum

Coordinated plan for regeneration of sorghum accessions with John Erpelding, sorghum curator. Seed was received from 2002 growout and germinations were conducted on all accessions received. Samples with poor germination (<50%) were identified and selected for planting in 2003. Selected over 2,000 sorghum accessions that were sent to St. Croix this fall/winter to be planted for seed regeneration in 2003. Presently, all sorghum accessions with known germinations between 20-50% have been sent to St. Croix for regeneration.

Developed a timeline for improvement in maintenance of the sorghum germplasm collection and presented this timeline to the Sorghum CGC at the Feb. 2002 meeting. The plan documented in the timeline was accepted by the committee with no changes.

In response to requests from the sorghum industry, a high priority was placed on processing seed of photo-sensitive sorghum in early spring 2002 so that seed could be shipped to two locations for summer growouts in 2002. Normal seed handling priorities would have delayed seed shipment until next year. Seed processing was completed on all 3,640 sorghum accessions increased last year by industry cooperators. Seed of these 3,640 accessions were shipped to Kansas and Texas for evaluations by the sorghum industry. The Grain Sorghum Symposium was held in Kansas in Sept. 2002. Participants toured the Kansas evaluation of 3,640 accessions and sorghum researchers were able to use this evaluation to select accessions to incorporate into their research program.

Vegetable Crops: All sweetpotato germplasm was maintained in vitro, propagules were distributed on request, and new material was added to the collection. Approximately two-hundred genotypes have been backed up in vitro at Fort Collins. Genotypes are provided to Fort Collins as these are scheduled for their periodic reculture (maintenance). No problems with culture contamination or damage in transit have been encountered. We anticipate completing the back up in June - July 2003. However, as Fort Collins does not actively maintain the backup, the backing up process will continue indefinitely.

Several hundred Expressed Sequence Tags (ESTs) were analyzed, annotated, and uploaded into GenBank.

One-hundred-fifty accessions of *Citrullus* spp. were increased in the field or greenhouse. All valid requests for seed were filled promptly. *Cucurbita moschata* genetic resources were maintained and increased in the field. Seed of 8 *Ipomoea* spp. were increased. Seed of fifty accessions of *Capsicum* sp. were increased in Griffin and an additional 30 accessions were increased in collaboration with NMSU. Seed of 8 accessions of misc. cucurbits were increasedin Griffin. Seed regeneration was conducted using 10 accessions of *Abelmoschus*.

The *Capsicum* core collection (approximately 400 accessions) was grown in Griffin, GA and characterized for 40 morphological descriptors. All accessions in the *Capsicum* core collection were photo-documented. Digital photographs were edited and have been uploaded into the GRIN database. Four hundred thirty (430) digital images of Capsicum and about 10 images of various other accessions (flowers of *Cucurbita* spp., *Ipomoea* spp., etc.) were prepared and uploaded into GRIN.

Germplasm Maintenance

Continued to build the germination program as a high priority in the Unit. Following resignation of the first germination technician, another technician was hired and a third germinator was purchased. Germinations were completed for over 4405 sorghum accessions and 445 accessions of other crops.

A number of additional ideas submitted during the brainstorming session in 2001 were adopted this year including the purchase of shade shelters for field operations in Griffin and Byron, purchase of a Gator for the Griffin field crew, pictures of field operations and photo-documenting of germplasm, and purchase backup generator for the sweetpotato collection.

Continued program to split samples of all 82,000 accessions maintained at Griffin with 2,137 accessions split this year. Small distribution sample will be maintained in 5 C and bulk of sample will be maintained at -18 C to maximize longevity of viable seed and minimize need for regeneration. Initiated hiring of an additional technician to increase the number of accessions that will be split each year.

With seed storage manager, Lee Ann Chalkley, planned a step-by-step process to improve the seed processing facility. Six new work stations were purchased and are currently being installed. Old ductwork was removed from the seed processing area, replaced with wallboard, and entire area painted. A new air handling system was purchased and will be installed shortly.

Alabama

Legumes:

Assessed genetic diversity of the red clover core subset held by the USDA Plant Genetic

Resources and of cultivated red clover. Results indicated that red clover genetic diversity is high even when compared to other outcrossing crops. PI 235867 was found to be much different from the rest of the 40 accessions of the core subset tested in this study. These results and field observations of these plants by N. Taylor and R. Smith being suggested that PI 235867 was a different species. N. Taylor (Univ. Kentucky) classified this accession as a *T. alexandrinum* L. Thus, this study provided an immediate benefit to the USDA-NPGS clientele by helping to eliminating an undesirable population from the collection.

Genetic linkage information is of practical significance in that it can be used as a tool to increase selection efficiency. Information on inheritance of isozymes and linkage maps in red clover is limited. A linkage study between isozyme loci and the morphological traits was conducted. This study serves as a first step toward the construction of a linkage map in red clover. Use of germplasm resource in the breeding program has resulted in the release of improved legume cultivars for use as forage and/or ground cover.

Watermelon:

PCR-RFLP analysis of chloroplast DNA of a wide collection of *Citrullus lanatus* var. *lanatus* cultivars and Plant Introductions , *C. lanatus* var. *citroides* , *C. colocynthis*, and *Praecitrulllus fistulosus* accessions have been used to detect variation within and between genera and to study the distribution of the variation across different regions of the chloroplast genome. Seeds of more than 50 PI accessions were obtained from the PI Station at Griffin, Georgia. The main objective of this research is to gain an understanding of the domestication patterns of the cultivated watermelon and evolution of the species in the Cucurbitaceae family.

Germplasm from disease resistant watermelon plant introductions is used for genome mapping studies and identification of resistance genes. Different molecular marker techniques are being used to screen fungal disease resistant and susceptible watermelon plants for DNA polymorphism. Main focus is on the development of detailed linkage maps to provide fundamental tools for improvement of this crop.

Florida

Forage breeding programs at the University of Florida utilize significant amounts of plant genetic resources. In the past year several faculty members have obtained forage cultivars and advanced breeding lines for cultivar evaluation research at varied locations. This program coordinated by the Souther Forage Breeders Workgroup and distributed through SRPIS provided an extremely valuable service to forage breeders throughout the USA.

Dr. K. H. Quesenberry has cooperated with Dr. Pittman at SRPIS to obtain *Arachis pintoi* germplasm from CIAT, Cali, Columbia during 2001 - 2002. Ten accessions were obtained as seed material in fall 2001 and an additional group of about 25 lines obtained as vegetative material in summer 2002 are currently being evaluated at SRPIS to confirm absence of plant viruses before release to Dr. Quesenberry.

Dr. M. J. Williams participated cooperatively with Dr. Roy Pittman in May of 2002 in an Arachis germplasm collection expedition to Paraguay, focused primarily on perennial Arachis species. The effort was very successful and materials collected are currently being screened in quarantine at Griffin before released to scientist cooperators for evaluation.

Dr Dan Grobet reports that the University of Florida peanut breeding program located at Marianna continues to evaluate and utilize plant introductions in the breeding program. New

crosses were made with PI 521296 in 2002 and with PIs 540866, 497358, and 512249 (2001) - mostly for resistance to TSWV and late leafspot. In 2001 field tests, 21 PIs were evaluated for late leafspot and TSWV resistance. An additional 40 PIs were evaluated for TSWV resistance (sprayed). Promising parental material was identified. A new variety released in 2002 named Hull has multiple disease resistance (late leafspot, white mold, TSWV, CBR, some root knot) and PI 203396 is in its pedigree, contributing many of these resistance factors. Another new release in 2002 was DP-1, which also has PI 203396 in its pedigree and it has very strong resistance to late leafspot, white mold, and TSWV. Plant introductions materials are a primary source of new disease resistance.

Dr. Ann Blount reports that a new research initiative between University of Florida and USDA, ARS has begun on the evaluation of bahiagrass and other *Paspalum* spp. using plant introductions obtained from NPGS and other scientists working with *Paspalum* species in Uruguay and Argentina. Concurrent evaluations of this material are underway at Ona, Brooksville, Gainesville, Live Oak, Marianna, and Tifton. Some of these new species have shown superior winter growth and better seasonal forage distribution compared to bahiagrass. Selection criteria being considered at the various test locations are winter survival, frost tolerance, forage yield, forage quality, seasonal forage distribution, turf characteristics, seed production, and persistence under grazing. Approximately 55 new accessions are under evaluation including accessions of *P. nicorae, P. quadrifarium* and *P. guaraniticum*. Accession being evaluated include: *P. nicorae* - PIs 202044, 209983, 276248, 276249, 283020, 284171, 304004, 310131, 404469, 404471, 404859, 462273, 477103, 490363, 490364, 508818, 508819, 508820, 508821; *P. quadrifarium* - 404880, 404881, 404882, 462302, 462295, 462298, 508942, 508947; *P. guaraniticum* - 404449

Louisiana

The core collection of Vigna was sent to the Calhoun Research Station for bacaterial blight screening. *Ipomoea batatas* was shipped to the LSU Dept. of Horticulture for insect resistance evaluation, evaluation of high and low dry matter types and evaluation of high anthocyanin types used in food colorant industries. Several accession of *Medicago sativa* were shipped to the Macon Ridge Research Center for evaluation. Several accessions of *Capsicum* sp. were shipped to the USDA-ARS-SRRC in New Orleans for isolation of antifungal compounds. Accessions of *Capsicum annuum* were shipped to an educator for use in home school agriculture/science projects in the New Orleans area. Accessions of two sorghum sp. were shipped to the USDA-ARS, SRRC facility in Houma. The intent was to identify exotic relatives of *Saccharum* for use in crosses.

North Carolina

Faculty in the NC State Crop Science Department are conducting research on corn, soybean, peanut, cotton, tobacco, small grains and turfgrass which have major economic importance not only to NC and the United States, but worldwide. In addition, faculty are working on several new or specialty crops, such a kenaf, borage, and several other species. Most projects involve interdisciplinary teams who are attempting to incorporate disease resistance, quality factors, or abiotic stress resistance from introduced plant accessions into their improved breeding materials. Faculty in the Department of Horticulture work with sweet potato, cucurbits,

blueberry, brambles, tree crops, ornamentals, and a miscellaneous collection of other crops. Many of these projects include plant introductions in their cultivar development programs. Several projects in the two departments maintain large collections of cultivated and/or wild species accessions, including the *Nicotiana* collection, *Arachis* species, South American maize germplasm, and soybean introductions.

Germplasm work in the legumes includes peanut research, which is concentrating on evaluating plant introductions for flavor and an array of disease resistances. Attempts to incorporate wild species genes into the cultivated peanut is concentrating on tomato spotted wilt virus, leaf spots, Sclerotinia blight and nematodes. Twelve germplasm lines with *Arachis* species in their pedigrees were released during the past year. Plant introductions in soybean are being used to identify aluminum tolerant genotypes and for drought stress resistance. The soybean breeders have increased genetic diversity in commercial soybeans with the release of a cultivar containing 50% Japanese germplasm in its pedigree. This unique cultivar topped the N.C. Official Variety Test in its maturity class and is being widely utilized as a parent at other institutions.

In the grass family, the recovery of alleles from tropical corn landraces to produce superior semi-exotic inbreds is being conducted. The corn geneticists have demonstrated the ability of tropical corn to increase U.S. corn yields and they have uncovered a third heterotic group for commercial U.S. corn breeders. An oat project is identifying pathways to domestication from the wild progenitor to modern commercial germplasm. A soft red winter wheat was released that contained germplasm with powdery mildew resistance factors introgressed from diploid and tetraploid wheat relatives.

The tobacco program is using exotic plant introductions and *Nicotiana* species to incorporate resistance alleles to improved cultivars and as a mechanism to create haploids for plant breeding. The blueberry project is evaluating plant introductions for quality factors and making crosses between plant introductions and improved cultivars. Wild sweet potato species with high starch content is being investigated for bio-fuels.

Oklahoma

USDA-ARS, Southern Plains Range Research Station, Woodward, OK

Germplasm Development to Sustain Southern Plains Agricultural and Rangeland Ecosystems. Timothy Springer, Robert Gillen, Terry Kamps, Phillip Simns. Develop enhanced forage and grain producing eastern gamagrass and big and sand bluestem cultivars for improved pastures and to complement native rangeland. Develop Texas bluegrass lines and interspecific hybrids with Argentine and Kentucky bluegrass for improved mode of reproduction and quantity and quality of cool-season forage. Select, characterize, and map genes controlling apomixis in Eastern gamagrass and develop methods for their transfer to other grasses and crops.

USDA-ARS Grazinglands Research Laboratory, El Reno, OK

Plant Resources for Sustainable Forage and Biomass Production Systems in the Southern Great Plains. Herman Mayeux, Srinivas Rao, Bryan Kindiger, John Daniel, Brian Northup, Charles Mackown, Lisa Appeddu, William Phillips, Partick Starks, Michael Brown. Evaluate forage and biomass production systems for the Southern Great Plains. Specific objectives are: 1) Evaluate and modify legumes and grasses to fill gaps with high-quality, and sustainable forages; 2) Determine and resolve physiological and ecological constraints to establishment, persistence

and productivity of forages and biomass crops; 3) Integrate new and existing forages into efficient production systems; and 4) Develop sustainable biomass production systems for CRP lands and buffer strips.

Use Of Legumes In Ecologically And Economically Sound Production Systems. S. C. Rao And J. E. Bidlack. Provide farmers and ecologists with alternatives that encourage environmentally-friendly and sustainable agricultural systems for Oklahoma and surrounding areas and expand research on pigeon pea, as well as other alternative crops, that can be used by area farmers to improve management practices of wheat-legume cropping systems in Oklahoma.

USDA-ARS South Central Agricultural Research Laboratory, Lane, OK

Genetic Factors and Production Methods that Affect Yield and Quality of Vegetable Crops. Angela Davis, Sammy Pair, Vincent Russo. Pathogens, insect pests, and changing consumer demands for more nutritious and culturally diverse foods are driving vegetable production into new arenas. Producers who diversify their agricultural operations will be in a position to capitalize on these changes. The overall objective of this project is to develop improved germplasm and sustainable production systems that vegetable producers can use to maintain a competitive advantage while producing safe, produce of high quality for delivery to consumers.

Overall objective is to develop customer-based pre and postharvest disease control technologies for economic production and postharvest maintenance of cucurbit crops. Due to consumer concerns of the adverse effects of pesticides on environmental quality and food safety, research will focus on alternative, safe, and efficient disease management programs having regional and national applicability that insure sustainable and productive farm production systems that preserve soil and water quality.

Postharvest Quality And Physiology Of Vegetables And Small Fruits. Veazie P. M. Perkins and W. W. Fish. To characterize the physiological changes occurring during storage and/or ripening of vegetables and small fruits and use this information to develop practices leading to increased shelf life and dollar value.

Production Methods And Germplasm Enhancement For Vegetable Crops In The Southern Plains. V. M. Russo And A. R. Davis. To develop production methods and improved, or specialty use, cultivars of vegetable crops intended for fresh market or as value added products, in diversified farming systems where alternative, sustainable types of agriculture are desired.

USDA-ARS Plant Science & Water Conservation Research Laboratory, Stillwater, OK

Enhancement Of Disease Resistance And Quality Of Peanut Germplasm. H. A. Melouk H A and K. D. Chenault. Identify disease resistance in the cultivated peanut, and improve cropping systems to sustain profitable production in the Southwestern U.S. Develop improved methodology to select genotypes with resistance to biotic stress, and elucidate host-pathogen interactions. Develop agronomically useful transgenic peanut germplasm resistant to economically important pathogens, and improve oil quality. Determine patterns of inheritance and genetic mechanisms regulating expression of resistance and other desirable traits.

Oklahoma Agricultural Experiment Station

Peanut Breeding And Management. K. E. Dashiell, R. J. Sholar, N. Dunford, N. O. Maness, J. P. Damicone, K. E. Jackson, P. G. Mulder, P. D. Blankship, T. H. Sanders, H. A.

Melouk, K. D. Chenault, and M. D. Burow. To develop early maturing, high yielding peanut cultivars with resistance to sclerotinia blight and improved oil quality characteristics for Oklahoma. Emphasis will be on the development of runner and spanish market types. To evaluate production potential and market value of cultivars and advanced breeding lines through performance testing over multiple years and locations. To conduct management or cultural studies, such as disease management options, row spacings, plant populations, dates of planting and harvest, tillage practices and double cropping with wheat or other winter crops to optimize production practices with the new breeding lines or cultivars that are available. To determine the inheritance of various traits in peanut.

Pasture, Range And Turf Grass Breeding. C. M. Taliaferro. To develop new grass cultivars bred for improvements in selected yield, quality, adaptation, and other performance features. Cultivars will be bred for pasture, turf, and bioenergy feedstock uses. Collect, evaluate, and enhance germplasm of selected grass species. Elucidate reproductive behavior, genetic variation, and breeding improvement potential in selected grass species. Develop and test new plant breeding models that incorporate molecular techniques.

Samuel Roberts Noble Foundation, Ardmore, OK

Forage Grass Breeding. A. A. Hopkins. Development of an improved cultivar is much like that of almost any "new and improved" product in that a need is identified, various alternatives are tested, and a product meeting consumer demand is brought to market. The FBG grass breeding program is focusing on addressing the need for forage production during the fall to spring months, which in turn should decrease livestock production costs. Cool season perennial grasses which are persistent and productive are the "products" being developed to meet this need.

Forage Legume Breeding. Mary Sledge. Dr. Sledge's molecular breeding program includes the use of traditional field breeding techniques, use of molecular markers to tag genes of agronomic importance, and the direct introduction of agronomically useful genes by genetic transformation. Species of interest include alfalfa, red and white clovers, and annual medics.

Genetic Transformation: Genetic Manipulation of Cool Season Forage Grasses. Zengyu Wang. The research in currently focuses on developing reliable plant regeneration and genetic transformation systems for different cool season forage grasses and cloning important agronomic genes. The aim of the tissue culture and transformation program is to accelerate or complement FBG's breeding program by direct introduction of agronomically useful genes into important forage crops.

Puerto Rico

Research Accomplishments

The sorghum core collection was evaluated for ergot resistance in cooperation with Dr. L. K. Prom (USDA-ARS, College Station, Texas). The collection consists of 2443 accessions with 2353 available for evaluation. Panicles were artificially inoculated before and during anthesis to assess resistance. Rust resistance was also evaluated.

The first year of a study to evaluate yield and growth rate of early-maturing sorghum germplasm in the base collection was initiated. The results of this study will provide necessary information to evaluate accessions from the sorghum germplasm collection, which will expand the amount of data available on each accession.

The plantain (*Musa acuminata* x *Musa balbisiana*) collection was characterized using 20 descriptors which were entered into GRIN. The banana (*Musa acuminata*) collection consisting of 83 accessions was planted in replicated plots. Accessions are being phenotypically characterized using 15 plant, bunch and fruit descriptors.

Two French-type plantain clones, Maiden and Dominican-Red, belonging to the *Musa* AAB group are being subjected to bunch pruning of the lower hands in an attempt to increase fruit size in the remaining hands of the bunch. For this purpose, immature bunches are being pruned to leave four, five and six hands. Fruits from these hands will be compared for size with fruits from the same hands of the unpruned horn-type Maricongo bunch, a commercial clone used as control.

A mamey sapote (*Pouteria sapota*) collection consisting of 26 accessions was planted in replicated plots. Partial establishment (8 accessions) of a sapodilla (*Manilkara zapota*) collection (24 accessions) was made in replicated plots. Partial establishment (128 accessions) of a cacao (*Theobroma cacao*) collection consisting of 148 accessions was made in replicated plots. The three collections will be phenotypically characterized and evaluated; all clones within collections were grafted onto a common rootstock.

Service Accomplishments

The regeneration of 1680 sorghum accessions with low seed viability was conducted at GIRU, US Virgin Islands. A total of 241 accessions with germination rates below 15% were germinated in the laboratory and transplanted to pots in the greenhouse with healthy seedlings planted in the TARS research farm at Isabela. Also, 50 accessions of cowpea, 34 of maize (388 rows) and two of *Sicana oderifera* were seed-regenerated at St. Croix and Mayaguez.

Preliminary phenotypic characterization data were obtained from approximately 500 sorghum accessions collected from Algeria, Chad, Egypt, Gambia, Guinea, Madagascar, Mauritania, Mozambique, Rwanda, Tanzania, and Zaire.

Fifteen tropical bulks were increased as part of the sorghum conversion program in cooperation with Dr. D. Rosenow (Texas A&M University, Lubbock, Texas). Phenotypic evaluation was conducted on 112 selections representing 19 converted lines to identify desirable lines for release. Backcrosses were conducted on 67 lines being advanced in the program. Exotic accessions used in the conversion program were supplied to researchers for molecular genetic studies.

A total of 1,000 distributions in the form of budwood, cuttings, rhizomes, corms, fruits and seeds were made available to cooperators, and local, national and international requesters. Additionally, program personnel answered many technical questions concerning the agronomy and cultivation of crops that are the responsibility of this repository.

South Carolina

Germplasm activity

Mike Watkins, SC Foundation Seed, Clemson, SC; shipped Oct. 3, 2001; *Vigna unguiculata* PI 612607. Dr. Judy Thies, USDA, Charleston, SC; Shipped March 15, 2002; 613 *Capsicum* spp. accessions. Dr. Howard Harrison, USDA, Charleston, SC; Shipped April 23, 2002; 19 *Macuna* spp. accessions

Tennessee

Nine hundred ninety-three experimental hybrids were evaluated in 18 yield trials at The University of Tennessee Experiment Stations. These hybrids were crosses between Germplasm Enhancement of Maize (GEM) lines and adapted germplasm. Several experimental hybrids were competitive with commercial check hybrids included in these trials. The best lines from the GEM accessions will be selected for further testing and incorporation into value-added breeding for new white-grain lines. Inbreeding and selection was continued in populations resulting from crosses between GEM lines identified in previous trials, and 24 new GEM lines were crossed with adapted elite germplasm in 2001 to initiate additional populations for selection.

Again in 2001, a private breeder from Hermitage, TN received seeds of accessions of Capsicum from the USDA Plant Genetic Resources Conservation Unit, Griffin, GA. These included 9 accessions of C. annuum, 2 accessions of C. chinenseis, and 1 accession of Capsicum sp. A nurseyman from McDonald, TN received 17 vegetative accessions of bamboo for establishment in nursery. Accessions distributed included: *Phyllostachys* sp. (13), *Arundinaria funghomii* (1), *Hibanobambusa tranquillans* (1), *Indocalamus solidus* (1) and *Pseudosasa jaopnica* var. *tsutsumiana* (1).

In 2003, Dr. Fred L. Allen, Professor and Coordinator, Agronomic Crop Variety Testing and Demonstrations, The University of Tennessee, will replace David Coffey as the official technical representative from Tennessee.

Virgin Islands

Germplasm conservation and evaluation are a major focus at the University of the Virgin Islands with emphasis on fruits and rare native plant species. In the area of fruit germplasm, three new papaya varieties were planted and grown that originated from Africa. One variety 'Redonda' has been very productive and has good fruit size and quality. The calcareous soils and semiarid environment of the island provides a strong selection pressure for any new variety being evaluated. The new papaya variety 'Redonda' has great potential in filling a niche for an early productive medium-large sized fruit that farmers and backyard growers have been requesting. Seeds are produced and made available to farmers and backyard growers of selected papaya varieties and hybrid lines. UVI produces seeds of papaya that would not readily be available in the Virgin Islands.

Work on the in vitro germination of the 'Sandy Point Orchid' *Psychilis macconnellia*, on the local Virgin Islands endangered species list, has neared completion. Plants have been successfully transferred from tissue culture to greenhouse-established plants. The seed propagation system developed for the 'Sandy Point Orchid' allows for production of this native plant without going into the wild to collect this rare and endangered species. The tissue culture system has been developed for use by nurseries and orchid enthusiasts in the home.

Cassava germplasm is being evaluated for production during the dry season. Water is a limiting factor for crop production in the Virgin Islands. Cassava is able to grow and produce in poor soils and under limited water. Cassava has the potential of providing the farmer with a crop during the extended dry season on limited water. Tissue culture was used to develop a micropropagation system to increase the number of plants for the lines obtained.

Virginia

Grasses and cereal crop accessions from the USDA Plant Genetic Resources

Conservation Unit, Griffin, Georgia, were used to study systematics and genetic diversity by Dr. K. Hilu at the Department of Biology at Virginia Polytechnic Institute & State University. Dr. Harbans Bhardwaj at Virginia State University evaluated accessions of white lupin (*Lupinus albus*) from NPGS for winter hardiness and alkaloid content. Peanut accessions acquired from the Plant Germplasm Conservation Unit in Griffin Georgia were used for a field day demonstration at the Tidewater Agricultural Research and Extension Center, Suffolk, Virginia. Ms. Mary Ann Silverman obtained several bamboo accessions from Griffin Georgia to evaluate their ornamental potential. John Wise grew *Capsicum* accessions (10 PIs) for display purposes at the Lewis Ginter Botanical Garden in Richmond where a black cluster selection was made for its fastigiate habit. Selester Bennett, Dept. of Plant Pathology, Physiology and Weed Science, VPI & SU, has begun a program to investigate the utility of using sweetpotato as an alternative plant bioproduction system for the expression of transgenic proteins. These activities document distribution and utilization of plant genetic resources, a primary objective of the regional project. The work of Dr. Hilu addresses another objective of the project, i.e., to study genetic relationships among grasses and the genes encoding proteins in cereal crops. Dr. Asim Esen of the Dept. of Biology at Virginia Polytechnic Institute & State University has used teosinte seeds received from the Plant Genetic Resources Conservation Unit for DNA and RNA isolation to clone beta-glucosidase cDNAs and genes. An understanding of genetic relationships and the value of plant germplasm in terms of biotic and abiotic resistances and evaluation of new plant material in trials have traditionally been instrumental in plant domestication and breeding.

Plans

USDA - Plant Genetic Resources Conservation Unit

Vigna: Work on developing a greenhouse screening method for cucumber mosaic virus resistance in cowpeas. This study will involve evaluation of SSR markers for CMV resistance to be used in conjunction with the biological approach. This study will be done in cooperation with others in the Unit.

Regenerate *Vigna* germplasm free of exotic viruses as selected based upon core collection, upon usage of accessions, and upon low numbers remaining in the collection. Number of accessions handled will depend upon the quantity and quality of technical support available and upon the greenhouse, screenhouse, and field space available. Plants to be grown will be tested in the greenhouse for virus contamination before transplanting to the field or screenhouse. A minimum of 300 accessions will be planted for seed increase and characterization, ~50 of which may have to be increased in the greenhouse (for photoperiod reasons). The seeds obtained from the winter increase will be used for a summer increase at Puerto Rico. A group of 50 lines of photoperiod-sensitive materials will be increased at Puerto Rico as space, time, and help allow.

Peanut: Wild germplasm will be increased again in the screenhouse with about 25 accessions expected to be increased. We plan to used the same type of soil as 2001 as yields were very good. New increases will most likely evolve material that might be somewhat difficult to increase and thus require more pots. Clonal wild peanuts will continue to be repotted as time and labor permit.

At least 500 accessions will be increased at the Bledsoe farm depending upon the amount

of available usable land for production.

A collection to Paraguay is planned for May to collect wild forage type peanuts and any cultivated peanuts that might be in the collection area. All material brought back from the collection will be quarantine tested and/or increased prior to any distribution to scientists.

Perform tests to attempt to develop a RT-PCR test for detection of peanut clump furovirus in peanuts from Africa and India. Involves development of procedures for inoculation of peanuts with the strains of the virus that we have imported so that extraction methods can be developed for peanuts and not just tobacco. Obtaining some additional strains of the viruses would also add to our knowledge of how the method will work.

Clovers, Grasses, New Crops, Misc. Legumes and Misc. Crops: A total of 300 special purpose legumes, new crops, and miscellaneous crops will be regenerated and characterized during FY 02. Species to be regenerated will be based on importance with regard to function such as pharmaceutical/phytochemical, nutraceutical, forage, and cover cropping traits. Gaps will be identified and corrected in the GRIN system for these species.

Collaborate with Jerry Walker for testing the variation of several *Mucuna* spp. when added as soil amendments for nematode control. Collaborate with Ron Oetting to evaluate velvetbean accessions effect on fungus knat reduction. Collaborate with Kim Moore, AgResearch Consultants for value added crop development in the areas of nutraceutical and pharmaceutical attributes.

Clover accessions will be selected that require regeneration due to low seed numbers or poor seed quality. Both field and greenhouse regeneration will be conducted of more than 100 clover accessions.

Vegetable Crops: Approximately 150 accessions of *Citrullus* will be increased in the field in 2003. Characterization data will be taken on all materials and entered into the GRIN database.

Fifty accessions of *Capsicum* will be increased using the protocols utilized in 2002, with minor modifications. Accessions for increase will be selected based primarily on inventory level. The entire collection of *Capsicum baccatum* will be grown in the field in 2003. Characterization data and digital photos will be taken of all *Capsicum* grown in the field and placed in GRIN.

Twenty accessions of *Cucurbita moschata* will be increased as per 2002. Due to its importance in crop improvement efforts, 'Nigerian Local' will be increased again (it was increased in 2001 but only 500 seed were recovered) by open-pollination in isolation.

A small polycross nursery will be established in Byron, GA to produce botanical seed from six sweetpotato breeding lines currently maintained in vitro. As seed is produced from these lines, the seed will be placed in long-term storage in Fort Collins and the lines removed from the in vitro collection.

Twenty *Ipomoea* spp. accessions will be increased in the greenhouse in the fall of 2003. Accessions for increase will be selected based on the availability of seed of representative examples of individual taxa, or user demand. Cross-pollinated species will be increased in screen cages with bumblebees. The correct taxonomic identification of each accession will be determined and corrected as required. Digital image of flowers will be taken and added to the GRIN database.

The sweetpotato in vitro collection will be maintained in its current state. New accessions will be propagated and added to the inventory as received.

Several miscellaneous cucurbits will be increased (3 per location) in Parlier, CA,

Mayaguez, PR and Griffin, GA. Reproductive characteristics, morphological characterization data, and digital images will be recorded and added to the database.

A portion of the *Capsicum* core collection (150 genotypes) will be evaluated for carbohydrate content (sucrose and reducing sugars) and total capsaicin content. Genetic relationships among certain species of *Capsicum* will be investigated.

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Georgia

No publications submitted.

Guam

No publications submitted.

Hawaii

No publications submitted.

Kentucky

No publications submitted.

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Puerto Rico

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South Carolina

No publications submitted.

Tennessee

No publications submitted.

Texas

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