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 83,601 accessions of 246 genera and 1,432 species. In 2003, a total of 50,995 seed, tissue culture, and clonal accessions were distributed to users for their research use. This is the greatest number of accessions distributed in one year from the Griffin location since the plant genetic resource collection was established in 1949. All accessions were requested from the Griffin location directly by researchers and distributed in 582 orders to users in 44 states and 35 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, 87% of the collection is backed up at the National Center for Genetic Resource Preservation and 84% 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:

Two additional cowpea lines were identified with resistance to cucumber mosaic virus (CMV) by Graves Gillaspie. There is little known resistance to CMV in cowpea which causes the most important disease of cowpeas in the southeastern U.S. Lines were screened in the greenhouse and evaluated in field spread tests for CMV resistance. These resistant lines could lead to development of cowpea cultivars with improved CMV resistance.

Cowpea regeneration was successful as in previous years with 50 lines increased in the winter, 130 lines increased in Griffin, and 50 lines increased in Puerto Rico. Digital images of flowers and seeds were prepared and submitted to Beltsville for inclusion on GRIN.

Peanut:

Twenty-five wild peanut accessions collected in Paraguay in 2003 were taxonomically identified, vegetatively increased, and distributed to the Arachis Research and Evaluation Group by Roy Pittman. A total of 28 herbarium specimens were made and forwarded to Dr. Antonio Krapovickas, Corrientes, Argentina who verified the taxonomic identifications. The collected material was made available to researchers within one year after collection to speed evaluation of these genetic resources. Researchers in Florida, Georgia, Texas, and Puerto Rico are evaluating the accessions for possible forage and horticulture use. These accessions may be used to develop new forage cultivars or bedding plants for turf replacement.

A total of 775 cultivated peanut accessions were selected for increase at the Bledsoe Research Farm for regeneration. The incidence of tomato spotted wilt virus was much less at the Bledsoe Farm compared to previous increases at Byron, Georgia. Over 400 clonal peanut accessions were maintained in the greenhouse and screenhouse.

Grasses:

The entire seashore paspalum grass collection was fingerprinted by Melanie Newman and Ming Li Wang using transferred simple sequence repeat (SSR) markers. This is the first warm-season grass collection to be entirely characterized by the same set of molecular markers. Profiles were produced for each accession using the transferred SSR markers, a phylogeny constructed, and genetic diversity within the species assessed. This study will provide a tool for more efficient curation of the collection and aid in marker assisted breeding of this grass.

Digital images were taken of all grass accessions grown for regeneration and of the entire bamboo collection maintained at Byron, GA. A total of 13 herbarium specimens were collected this year. This will facilitate more accurate taxonomic classification of the grasses in the collection. A set of 53 Paspalum vaginatum accessions were acquired and added to the grass collection.

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

Genetic variability among genotypes of a lectin from hyacinth bean and sesamin and tocopherol from sesame was determined by Brad Morris in collaboration with AgResearch

Consultants (hyacinth bean) and Oklahoma Medical Research Foundation (sesame). The lectin in hyacinth bean has been shown to be cell protective in vitro and sesamin and tocopherol are antioxidants which protect against some cancer types. Several sesame genotypes contained higher amounts of both sesamin and tocopherol than others. These sesame genotypes are of interest to the medical community for cancer research.

Brad Morris collaborated with AgResearch Consultants on development of guar, hyacinth bean, velvetbean, and sesame for use as new netraceutical/pharmaceutical crops that could provide income for small farms in Georgia. He also has a similar collaboration with Natural Resources Conservation Service to evaluate guar, lablab, and velvetbean for use by small farmers or companies interested in producing these crops for alternate uses.

Digital images were made of 36 legume and new crop species and were uploaded onto GRIN. Distribution quantities were adjusted for some legume species that produce very few seeds. Seed levels designating availability and unavailability were adjusted in clover species to increase availability of accessions to the research community. Fall regeneration of some short-day African clovers was successfully conducted in the greenhouse. Additional plantings were made of those species this summer 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 2,100 accessions were sent to St. Croix for regeneration and seed is currently arriving at Griffin from those regenerations. John has been working on sorghum accessions with critically low germination or seed amounts in Puerto Rico and will return seed of those to Griffin shortly.

Discussions have been initiated with the Sorghum CGC to conduct a photoperiod sensitivity evaluation next year of the 9,000 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 characterized the Capsicum baccatum, C. pubescens, and C. frutescens (chile pepper species) germplasm collections 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 praised 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.

Much effort was spent on regenerating the vegetable crop genetic resources in order to ensure their viability and availability to the research community. More than 1,500 accessions of six major crops and related species were maintained in tissue culture (sweetpotato) or grown in the field for seed regeneration.

Almost 600 of the 700 sweetpotato accessions maintained in tissue culture have been backed up in Ft. Collins, CO. This collection was not backed up off site prior to 2002. Twenty additional accessions of sweetpotato were received from Plant Quarantine, propagated, and added to the collection.

Molecular Evaluations:

Simple sequence repeat (SSR) markers from common legume and grass databases were transferred for use to other legume and grass species including peanut, cowpea, clover, lablab, guar, seashore paspalum, bamboo, and bermudagrass by Ming Li Wang. DNA marker development for each individual species maintained at a gene bank can be slow and costly, while transferred markers can be rapidly utilized. Available SSR markers from common crops were adopted and transferred to other species, though polymorphic rate was relatively low. These markers are being utilized for germplasm characterization, genetic variability, and phylogenetic analyses.

Facilities in the laboratory were upgraded with the purchase and installation of an HPLC utilizing funds provided by the ARS, National Program Staff. This instrument will enable scientists to characterize genetic variation for phytochemicals among genetic resources within the collection. Plant genetic resources can now be characterized by both metabolic and genetic analyses.

Germplasm Maintenance:

In the last year, over 50,000 accessions were distributed to researchers and educators at universities ranging from land-grant to 1890 to Ivy League; large biotechnological corporations and small independent 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 35,000 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.

The -18 C cold room was upgraded with purchase and installation of moveable storage shelves to maximize seed storage space in 2003. All seed samples were moved into a freezer-trailer during the installation to prevent seed viability reductions. Expansion of useable space in this freezer enables continuation of the program 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.

Germination tests were conducted on almost 8,000 accessions from 18 crops in 2003 including over 1,600 pepper and 4,700 sorghum accessions. Over 3,000 accessions were sent to Ft. Collins for new back up or replacement of other back up samples.

Proper storage of vital equipment was improved with the purchase of a 60’ x 100’ metal machine shed for storage of farm, regeneration, and irrigation equipment. This machine shed is located next to the regeneration plots at the Westbrook Research Farm. A used rental truck body was purchased for pollination cage storage. An additional 100 pepper regeneration cages were purchased with funds provided by ARS, National Program Staff.

Alabama

Legumes, Forage and Cover Crops

Current work focuses on evaluation of the sunn hemp, clovers and Vicia species. Sunn hemp germplasm is being used for development of cultivars for the continental U.S. The objective is to develop cultivars that can be used as fodder and as cover crops. Evaluation is being done in cooperation with colleagues at Auburn, Mississippi and USDA.

Arkansas
No Report

Florida

Drs. Dan Gorbet and Barry Tillman, NFREC, Marianna, FL report the following regarding use of plant genetic resources in peanut breeding and improvement. We did not make any crosses with new peanut PIs so far in 2004. We continued to evaluate numerous PIs for resistance to tomato spotted wilt virus (TSWV) and other disease resistance (i.e., 536059, 512249, 540866, 497358). Other PIs are being evaluated and used as parents in our peanut CRSP project. Most of this work is being done in Georgia and crosses made by Dr. Roy Pittman (USDA, Griffin). We have a continuing need to identify new sources of disease resistance to use in the breeding program, especially for TSWV.

In forage breeding and improvement research, Dr. Ann Blount and colleagues released two sexual tetraploid lines of bahiagrass, Q4188 and Q4205 (PI 619631 and 619632, respectively). These lines trace to crosses of a sexual tetraploid, produced by colchicine doubling at Tifton, GA, by an apomictic tetraploid white stigma bahiagrass plant (WSB). These plants have the potential for use as female parents in crosses with apomictic tetraploid introductions from South America that may have desirable traits. Drs. Quesenberry and Blount have also been evaluating "Wilmington" type bahiagrass (PIs 315732, 315733, 315734, and 434189) for forage and turf potential. Dr. Ken Quesenberry is evaluating native warm and cool season legumes for forage potential. Included in these evaluations are species in the genera Centrosema, Crotalaria, Desmodium, Galactia, Rhynchosia, and Tephrosia.

Dr. Gordon Prine collected seed from tall ecotypes of castor bean (Ricinus communis) from 20 sites in Peninsular Florida in December 2001. These selections were allowed to intercross in 2002 and 2003 and have been planted again in 2004. He is attempting to preserve adapted Florida genotypes of castor bean for future research. As much as 30 tons of dry matter per acre of stems from a single year's growth of castor bean was measured at Lakeland. FL. Dr. Prine plans to release ornamental perennial peanut (Arachis glabrata) PI 262839 (Abrlick) and PI 262840 (Ecoturf) this year. He also has three populations of pigeonpea (Cajanus cajan) ready to be released as cultivar or germplasm.

Hawaii

Macadamia

Quality and performance trials of HAES selections 294 ('Purvis'), 344 ('Kau'), 741 ('Mauka'), 788 ('Pahala'), 816, 835, 856, 857) are ongoing at the University of Hawaii Captain Cook Experiment Station (elevation 600m) in Kona. Nut and kernel quality data for the 2003-2004 harvest season showed that these selections had 25-39% kernel recovery and 66-91% floaters (No. 1 kernels) with kernel weights between 2.2 and 3.3 grams. The percentage of No. 1

kernels was lowest in selection 857 (66%), while selections 294, 788, 835 and 856 had the highest percentage of No. 1 kernels (91, 91, 89 and 86% respectively).

Evaluation of the newest HAES selections (862, 879, 887, 896, 900, and 932) is ongoing at the University of Hawaii Waiakea Research Station in Hilo and the University of Hawaii Kona Research Station in Kainaliu. Selections 879 and 932 have an upright growth habit, and 900 has a thick shell which may provide some protection against stinkbugs and tropical nut borers. Preliminary evaluations show that selections 879, 887, 900 and 932 have a high percentage of No. 1 kernels which is comparable to 344 and 800.

Longan

An initial consideration in the development of a nutritional program for producing longan trees is to determine the amount of fertilizer nutrients contained in harvested fruits. This amount represents the quantity of nutrient elements removed from the soil, which will need replenishment. Nutrient composition of the harvested fruit is only one important factor involved in nutrient management of bearing longan trees, but it can provide insight into the nutrient requirements for this crop.

Data presented in Table 1 and 2 show the nutrient content of fruits for two longan cultivars (‘Biew Khiew’ and ‘Sri Chompoo’) growing at 3 different locations in East Hawaii on the island of Hawaii. All trees were treated with potassium chlorate to stimulate flowering, but tree age and field management practices varied between the 3 growing locations. Data shown in Table 1 are dry weight values from whole fruits that were analyzed for nutrient content. Values shown in Table 2 are expressed as the percentage of each nutrient element contained within the fresh fruits.

Results obtained from the two varieties were somewhat similar and showed that P levels for the two varieties were nearly identical but showed some variation between the sampling periods. ‘Biew Khiew’ and ‘Sri Chompoo’ fruits contain relatively high amounts of nitrogen and potassium with N levels exhibiting the largest variation within each variety. Table 2 shows that if 100 pounds of ‘Sri Chompoo’ fruits are harvested, approximately 0.2, 0.042 and 0.37 pounds of N, P and K respectively, will be removed from the orchard. The amount of fertilizer to replace these amounts of N, P and K will be dependent upon the tree’s ability to absorb the fertilizer nutrients along with weather and soil factors. As an example, if a grower uses fertilizer with an analysis of 10-5-20, an application of 2 pounds of this fertilizer will supply 0.2 lb of N, 0.043 lb of P and 0.33 lb of K and will replace the amounts removed by 100 pounds of fruit. This amount does not take into account the amount needed to maintain tree growth and health.

Table 1. Nutrient element composition of ‘Sri Chompoo’ and ‘Biew Khiew’ longan fruits on a dry weight basis.

‘Sri Chompoo’	Percent of Dry Weight						ppm	
	N	P	K	Ca	Mg	S	Zn	B
Farm A Jan 03	.83 + .05	.15 + .01	1.51 + .14	.17	.08	.06 + .01	13	12
Farm B May 03	.82 + .02	.13 + .01	0.97 + .02	.38 + .03	.16 + .01	.06 + .01	16	12

Farm C Jan 02	.49 + .02	.16 + .01	1.40 + .04	.24 + .41	.15 + .01	.06 + .01	19	11
Mean	.71 + .16	.15 + .01	1.29 + .23	.26 + .09	.13 + .04	.06 + .003	16	12
'Biew Khiew'	Percent of Dry Weight						ppm	
	N	P	K	Ca	Mg	S	Zn	B
Farm A Jan 03	1.22 + .09	.14 + .01	1.43 + .07	.40 + .12	.14 + .01	.09	16	11
Farm B May 03	1.07 + .08	.17 + .01	1.25 + .11	.34 + .02	.13 + .01	.08 + .01	17	16
Farm C Jan 02	.68 + .07	.16 + .01	1.35 + .10	.30 + .03	.13 + .01	.09 + .01	24	14
Mean	.99 + .23	.16 + .01	1.35 + .08	.34 + .04	.13 + .01	.09 + .004	19	14

Table 2. Nutrient element composition of fresh longan fruits.

'Sri Chompoo'	Percent of Fresh Weight					
	N	P	K	Ca	Mg	S
Farm A Jan 03	.233	.042	.423	.048	.023	.018
Farm B May 03	.250	.040	.295	.115	.049	.017
Farm C Jan 02	.137	.044	.393	.067	.041	.018
Mean	.207 + .049	.042 + .002	.370 + .055	.077 + .029	.037 + .011	.018 + .002
'Biew Khiew'	Percent of Fresh Weight					
	N	P	K	Ca	Mg	S
Farm A Jan 03	.316	.036	.371	.119	.037	.023
Farm B May 03	.302	.048	.354	.096	.038	.023
Farm C Jan 02	.180	.042	.356	.078	.033	.023
Mean	.266 + .061	.042 + .005	.360 + .008	.098 + .017	.036 + .002	.023

Kentucky
No Report

Louisiana

Vigna (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 (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 (Dr. John Veremis, USDA/ARS, Houma, LA)

Acquire and select exotic relatives and make 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 crossing sugarcane with sorghum. We tried to hybridize sorghum with Erianthus and Saccharum, but the crossing was not successful the past two years, because we did not get any hybrids from our attempts. However, we planted in spring of 2002 the core collection of sorghum (greater than 2,000 accessions) 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 colinearity of the grass species and would like to receive some of the ancestral species of sorghum if possible to try additional hybridizations this fall.

Clover-legume (Dr. Stephen Boue, USDA Southern Regional Research Center, 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 soybean 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 (Drs. Don La Bonte and Chris Clark)

Clones were requested in 2004 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.

Mississippi

No Report

North Carolina

Plant breeding and genetics faculty at NC State University are conducting research on strawberry, blueberry, brambles, tree crops, ornamentals, maize, soybean, peanut, cotton, tobacco, small grains, turfgrass, knead, sweet potato, cucurbits, and a miscellaneous collection of other crops. 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. Many of these projects include plant introductions in their cultivar development programs. Germplasm collections include cultivated and/or wild species accessions of *Nicotiana* and Arachis species, South American maize germplasm, and many cultivated and related species introductions of soybean, blueberries and sweet potato.

Germplasm enhancement with peanut involves both cultivated and wild species and involves agronomic improvement for yield, disease and insect resistance. The *Arachis* species are being characterized for disease resistances and species relationships. Several hundreds of species accessions are being maintained in the greenhouse, and we wish to expand the collection, especially for section *Arachis* accessions. A new program has been initiated to investigate allergens in peanut, including proteins and genetic variation for this trait. Through conventional breeding, new advanced breeding lines were developed from exotic Asian cultivars and these lines consistently out-perform popular U.S. cultivars. For soybean, research is concentrating on improving oils, proteins, and resistance to cyst nematode races 2 and 4. Nato varieties are being developed for the Asian market. Yield genes have been identified in Asian cultivars of soybean.

The maize plant breeding and genetics programs are studying methods to incorporate tropical germplasm into North American genotypes. Superior inbreds have been obtained from this work. Molecular analyses of maize for quantitative gene loci is identifying genes related to yield and several disease and insect resistances. Research is testing diallel crosses using tropical germplasm that has gone through a conversion program for adaptation to temperate climates. The Small Grains program utilizes both hexaploid *Triticum* and related species to incorporate disease resistance into cultivars. Interspecific hybridization is a commonly used methodology in this program. The *Avena* project is identifying pathways to domestication from the wild progenitors to modern commercial germplasm; and interspecific crosses have been made to incorporate anti-oxidant compounds into the cultivated oat. Sea oat (*Uniola paniculata*) accessions of diverse geographical origin are being tested in beach areas to stabilize coastal dunes. Turfgrass geneticists are attempting to improve drought and disease resistances. Transformation projects to improve bermudagrass for sting nematode resistance have yielded promising results, and parallel projects with tall fescue and perennial ryegrass for other traits are leading to commercialization of new varieties. Native forage grasses are being evaluated for digestibility in cattle and goats.

Gene clusters for disease resistance in a chromosomal segment from *Nicotiana plumabinifolia* are being used for improvement of black shank disease resistance in tobacco. Other projects are using wild tobacco species to incorporate tomato spotted wilt virus and root knot nematode resistance into tobacco. Flue-cured tobacco hybrids NC 299 and NC 102 were released for seed production in 2003. NC 102 possesses resistance to tobacco mosaic virus and potato virus Y. Blue mold resistant burley cultivar NC 2002 was developed. Breeder seed of the parental lines of experimental burley hybrid NC 2001 free of nicotine demethylating genotypes has been produced. We expect NC ARS to release this hybrid as NC 7 in 2004.

The strawberry project has released several new cultivars which will expand the market into the late summer and fall. 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 are being investigated for bio-fuels. In addition, new collections are being made of bloodroot, goldenseal, black cohosh, and mayapple as potential medicinal herbs. Sicklepod is being collected in the Southeast and tested as a source of gums.

Other information

Interviews have been completed for a new tobacco breeder to replace Dr. Earl Wernsman. The faculty member should join the Crop Science Department during the early fall, 2004. The tomato breeder (Randy Gardner) in the Horticulture Department is planning to retire and a replacement for this position should be advertised in early 2005. A USDA Wheat Genotyping Laboratory is being developed in Raleigh and interviews have been completed for a research scientist to run the laboratory. This laboratory will coordinate multi-state projects for wheat improvement. A Plant Transformation Laboratory is being developed and a Director has been employed. This laboratory will serve all plant breeders at NC State University and incorporate genes from multiple species into cultivars grown in the state.

The curator of the *Nicotiana* collection recently left the Department of Crop Science and maintenance of this collection may be problematic in the future unless additional resources can be obtained. The collection consists of approximately 2000 cultivated, 200 wild species, and a monosomic series for *N. tobaccum*. Many accessions are maintained in the greenhouses at Oxford, NC and others require unique combinations of temperature and day length to flower and propagate seeds. To adequately maintain the collection, a full-time technician and operating support is needed.

Oklahoma

Cynodon dactylon (L.) Pers., bermudagrass Panicum virgatum (L.), switchgrass (C. M. Taliaferro)

Bermudagrass germplasm accessions have contributed to the breeding of new seed- and vegetatively-propagated cultivars and have been used in other research related to its use in breeding and production. ‘Yukon’ and ‘Riviera’ are new seed-propagated turf bermudagrass cultivars. Riviera has achieved rapid market success based on its high turf quality and adaptation to colder climates compared to industry standard cultivars. ‘Patriot’ vegetatively-propagated turf bermudagrass was recently released based on its high turf quality and adaptation to the U.S. transition zone and similar climates in other geographic regions. One hundred and ten switchgrass germplasm accessions were assessed for descriptors and many incorporated into breeding populations. Switchgrass germplasm accessions have been used in studies of genetic variation and geographic adaptation.

Desmodium uncinatum (Shashi B Sharma, De-Yu Xie and Richard A. Dixon. The Samuel Roberts Noble Foundation, Ardmore OK)

We are working on condensed tannin biosynthesis in legumes with long term objective to introduce condensed tannin biosynthesis in alfalfa leaves. Unlike alfalfa, Desmodium and Lotus can synthesis condensed tannins in their leaves. We have shown that the BAN gene from alfalfa and Arabidosis encodes anthocinidin reductase (ANR) which converts anthocyanidins to epicatechins. Epicatechins are then used to synthesize condensed tannins (Xie et al 2003; Xie et al. 2004). Desmodium uncinatum has another enzyme called leucoanthocyanidin reductase (LAR) which converts leucoanthocyandins to catechin and other related sub units used in condensed tannin biosynthesis (Tanner et al 2003). Dr. Xie has now shown that ANR is also present in D. uncinatum and other forage legumes.

Sorghum (David Porter and Yinghua Huang, USDA-ARS,Stillwater, OK)

During the period of 2002 to 2004, we received a total of 29,541 accessions of sorghum germplasm from Griffin, GA. All germplasm materials were included in one research project, for screening their responses to greenbug feeding with the hope to identify new sources of genetic resistance to the insect pest. The germplasm is useful and provided a rich gene pool for breeding insect resistance in sorghum. However, as the screening and evaluation process has not been completed, we do not have any publications yet.

Puerto Rico

The introduction of new diseases and changes in pathogen and insect populations are a major threat to crop production resulting in severe economic losses and reduced food security; thus, sources of host plant resistance are needed to provide an economical means of control. Resistance to sorghum anthracnose was identified for 196 accessions from an evaluation of 270 Malian sorghum accessions conducted at the Tropical Agriculture Research Station in Puerto Rico and College Station, Texas in collaboration with Dr. Louis Prom. Since mutations in the pathogen can result in a loss of host plant resistance, the identification of new sources of resistance is essential for sorghum improvement and germplasm with stable anthracnose resistance over multiple locations will provide a more durable source of resistance.

TARS-PT03-1, a new small seeded pinto dry bean (Phaseolus vulgaris) germplasm line was released. This line was originally selected at Isabela, Puerto Rico, where it yielded higher than pinto cultivar Maverick and MUS PM-31. At temperate sites in Prosser, WA, the yield of this line was not different than that of Pinto bean cultivars Burke and Othello. It has a vine (type 3) growth habit and provides a new and unique source of resistance to soil pathogenic fungi. TARS-PT03-1 will be useful for improving resistance to soil pathogenic fungi in dry edible bean and its adaptation to temperate climates will allow it to be easily utilized in temperate breeding programs. It will also contribute intermediate resistance to common bacterial blight and could potentially contribute new gene combinations for improvement of seed yield.

There is little information regarding optimum water requirement for papaya in the tropics, particularly under semiarid conditions. A study was undertaken to determine the optimum water requirement for papaya grown under semiarid conditions with drip irrigation and to examine how fruit weight and quality are affected by various levels of irrigation. The highest marketable fruit weight (75,907 kg/ha) was obtained when plants were replenished with 125% of the water lost through evapotranspiration (WLET). This represents a 33% increase in fruit weight over that obtained in plants replenished with 25% WLET. Irrigation treatments did not affect fruit sweetness. It was concluded that, to attain high yield of marketable fruits, papaya grown under semiarid conditions should be irrigated with not less than 100% WLET. The recommendations made in this study are highly transferable and will be used by Extension Specialists and growers.

In collaboration with Dr. Graves Gillaspie, PGRCU, Griffin, GA, a two year study was initiated in Puerto Rico to screen 12 cowpea lines for yield and tolerance to cowpea chlorotic mottle virus, cucumber mosaic virus, and/or blackeye cowpea mosaic virus.

The regeneration of 2100 sorghum accessions with low seed viability was conducted at the Germplasm Introduction Research Unit, U.S. Virgin Islands. A total of 220 accessions with germination rates below 20% were germinated in the laboratory and transplanted to pots in the greenhouse with healthy seedlings planted in the USDA-ARS research farm at Isabela. Also, 50 accessions of cowpea, 12 cucurbits, 15 winged bean, and 15 Leucaena were planted at Isabela, Puerto Rico, for seed increase and characterization. A total of 420 accessions of sorghum and 42 accessions of corn (420 rows of 20 feet) were also planted at St. Croix for seed increase, characterization, and release from quarantine. A total of 1500 sorghum panicles from accessions regenerated at St. Croix were photographed, images edited, and database tables prepared for the Plant Genetic Resources Conservation Unit, Griffin, GA, for their incorporation into GRIN. An additional 200 images of cacao pods, banana racemes, and mamey sapote fruits were entered into GRIN.

A total of 3154 distributions of tropical germplasm in the form of budwood, cuttings, rhizomes, corms, and fruits 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 was distributed from the USDA Plant Genetic Resources Conservation Unit at Griffin, GA to the following individuals in South Carolina in 2003: Dr. Judy Thies, USDA Vegetable Laboratory, Charleston, SC, 29 Citrullus spp. (watermelon) accessions; Mr. Paul Berland, USDA Vegetable Laboratory, Charleston, SC, 364 Vigna spp. (cowpea) accessions.

Soybean

Seed of the following soybean (Glycine max) genotypes were obtained from the USDA Soybean Germplasm Collection at Urbana, Illinois (Dr. Randall Nelson, Curator) in 2003: PI 548316 (Cloud), PI 548658 (Lee 74), PI 548402 (Peking), PI 88788, PI 89772, PI 90763, PI 209332, and PI 437654. The PIs were used in a greenhouse bioassay to categorize two South Carolina populations of soybean cyst nematode (Heterodera glycines) (SCN) based on a revised classification scheme for SCN (Niblack et al., 2002. J. Nematology 34:279-288). Based on response to nematode infection of the eight PIs, the two SCN populations utilized to screen for resistance in the Clemson University soybean breeding program were categorized as HG Type 2.5.7 (previously categorized as a race 3 population) and HG Type 1.3.5.6.7 (previously categorized as a race 14 population). A glyphosate-tolerant soybean line, SC00-1075, was released in 2003 by the South Carolina Agricultural Experiment Station. It provides a high-yielding, nematode-resistant, maturity group VIII cultivar for South Carolina and the southeastern region. The line has been licensed to AGSouth Genetics, LLC. and is marketed as AGS 825 RR.

Tennessee

Germplasm accessions shipped to persons in Tennessee in 2003.

Buker, C.	UIND	Bamboo	Hibanobambusa	1
Buker, C.	UIND	Bamboo	Indocalamus	1
Buker, C.	UIND	Bamboo	Phyllostachys	15
Buker, C.	UIND	Bamboo	Pseudosasa	1
Buker, C.	UIND	Bamboo	Sasa	1
Buker, C.	UIND	Bamboo	Semiarundinaria	1
Buker, C.	UIND	Bamboo	Shibataea	1
Collins, S.	UIND	Peppers	Capsicum	12
Joost, R.,	STA (U.TN)	Legumes	Desmanthus	49
Kendall, S.	UIND	Bamboo	Hibanobambusa	1
Kendall, S.	UIND	Bamboo	Phyllostachys	6
Kendall, S.	UIND	Bamboo	Sasa	1
Pendergrass, D.	UCOM	Peanuts, cult.	Arachis	3
Pendergrass, D.	UCOM	Peppers	Capsicum	2
Small, R.	STA (U.TN)	Hibiscus	Hibiscus	1

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 crosses between a fibrous root line, PI416.937, and cultivars with differing leaflet orientation capabilities. The plan is develop isolines that have lo-orientation/normal root; lo-orientation/fibrous root; hi-orientation/normal root; and hi-orientation/fibrous root trait combinations and compare their water-use relative to seed yield. Crosses have been made and F3 and F4 populations are being evaluated in the field during the 2004 growing season. Crosses have also been made with a line that exhibits slow-wilting during severe water stress, PI471.938, in order to develop isolines that will be evaluated for their water-use relative to yield.

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

Objective: Develop new soybean populations with enhanced genetic diversity.

Approach: The TAES registered the soybean variety ‘5002T’, developed from the cross ‘Holladay’ x ‘Manokin’ in Crop Science Vol. 44 July-August 2004. 5002T is registered in GRIN as PI 634193 and small samples are available to breeders and researchers.
Four new cross hybridizations are 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.

Strain	pedigree
HS89-3261	LG82-8379 x A2943
LG82-3002	F5 PI253665D x PI283331
LG82-8224	F4 PI68658 x Lawrence
LG82-8379	F4 PI68508 x FC04007B
LG84-1096	F5 PI297515 x PI290126B
LG85-3343	F5 PI361064 x PI407710
LG86-7382	F9 PI68508 x FC04007B
LG87-1811	F6 PI407720 x PI384474
LG87-1991	F6 PI189930 x PI68600
LG87-496	F6 PI189930 x PI68600
LG88-2227	F6 A78-123018 x PI438205B
LG88-2248	F6 PI438151 x A78-123018
LG88-2696	F6 Ripley x PI370059
LG88-3146	F6 PI427099 x PI445830
LG88-8958	F6 PI253665D x PI283331
LG89-1501	F6 PI68508 x PI384471
LG89-1525	F8 PI90566-1 x L74-3897
LG89-1910	F6 PI437614A x A3127
LG89-6607	F5 LG82-8224 x Hobbit
LG89-6661	F5 Sherman x LG84-1096
LG89-6959	F5 PI358314 x Harper
LG89-7629	F5 Ripley x PI445837
LG89-7657	F5 Ripley x PI438206
LG89-7793	F5 PI391594 x Century
LG89-8286	F5 LG82-3002 x Elgin

LG89-8323	F5 LG82-3002 x Harper
LG89-8665	F5 PI436682 x Ripley
LG89-8810	F5 PI437578 x PI445837
LG90-13144	F6 LG82-8224 x Hobbit
LG90-2179	F6 PI437851A x Ripley
LG90-4181	F6 PI436682 x Lawrence
LG94-1129	F6 LG85-3343 x LG87-1991
LG94-4662	F6 PI458511 x Flyer
LG95-5874	F6 LG87-1811 x (LG85-3343 x LG86-7382)
LG95-7682	F6 LG85-3343 x (LG87-1991 x LG87-496)
LG96-1488	F6 LG89-8665 x LG88-2696
LG96-1546	F6 LG89-8810 x LG88-3146
LG96-1713	F6 LG88-3146 x LG88-2248
LG96-1789	F6 LG89-8665 x LG89-7657
LG97-5474	F6 P6906-16 x P5096-03D
LG97-6859	F6 PI503338 x P5096-03D
LG97-6861	F6 PI503338 x P5096-03D
LG97-7022	F6 LG89-1525 x A3322
LG97-7034	F6 LG89-6607 x LG89-1910
LG97-7132	F6 LG89-6959 x LG89-8323
LG97-7363	F6 LG90-2179 x LG88-3146
LG97-7376	F6 LG90-2179 x LG88-3146
LG97-8655	F6 LG88-2227 x A3322
LG97-8764	F6 LG88-3146 x HS89-3261
LG97-8789	F6 LG88-3146 x P5096-03D
LG97-8856	F6 LG90-13144 x LG88-3146
LG97-8905	F6 LG89-6607 x LG88-2227
LG97-9015	F6 LG89-8286 x LG89-6661
LG97-9226	F6 LG89-7629 x 9303
LG97-9239	F6 LG89-7629 x 9303
LG97-9301	F6 LG89-7793 x LG88-8958
LG97-9340	F6 LG89-8286 x LG89-1501
LG97-9384	F6 LG90-2179 x A3322
LG97-9486	F6 LG88-3146 x HS89-3261
LG97-9685	F6 LG89-1525 x A3322
LG97-9692	F6 LG89-1525 x A3322
LG97-9912	F6 LG90-4181 x A3322
P5096-03D	A3127 x PI273483
P6906-16	[PI80471 x PI86050] x [Wms 79 (2) x A3127]

Corn

Cereal Breeding, Breeding maize lines with exotic germplasm. Dennis West, Univ Tenn; 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, with the objective of crossing with adapted corn lines.

Wheat and Rice

In planta transformation of cereals. Dr. Janice Zale, Assistant Professor, Dept of Plant Sciences, University of Tennessee; Dr. Ludmila Ohnoutkova, Research Associate, Dept. of Plant Sciences, University of Tennessee; Dr. Camille Steber, Molecular Geneticist, USDA/ARS, Pullman , WA.

Objective: Determine whether different wheat and rice cultivars can be transformed using the floral dip.
Approach: We have already transformed one wheat germplasm line and one millet accession using the floral dip. Two different wheat cultivars will be employed to determine whether this method is independent of genotype. Three rice accessions were acquired to determine whether this transformation method can also be applied to rice.

Phytosensors and Genomics
Dr. Neal Stewart and Lab Personnel

Biosafety of Genetically Modified Plants. We have been funded by the USDA Biotechnology Risk Assessment since 1994. We are using the crop canola (Brassica napus) as a model to assess transgene flow, persistence and consequence to free-living wild relatives. In particular, we are interested in the effect the transfer of fitness-enhancing transgenes has on the consequences for agricultural and other ecosystems. A book on the ecological effects of genetic modification written by Neal Stewart is under contract by Oxford University Press. Among the tools used in the biosafety research is the green fluorescent protein-GFP.
Brassica napus cv Westar
Brassica rapa ecotypes: (CA) from Irvine, California, USA, (QC-2974) from Milby, QC, Canada, (QC-2975) from Waterville, QC, Canada
Fernomics—using ferns as sources for the discovery of economically important genes
Asplenium platyneuron, ebony spleenwort
Onoclea sensibilis, sensitive fern
Anthyrium pycnocarpon, glade fern
Gymnocarpium drypoteris, oak fern

GFP. The Stewart lab has heavily used GFP and other fluorescent proteins expressed in plants and algae in gene flow experiments (ER and pollen targeted), and in use of plant bioreporters (termed phytosensors). Several companies and federal agencies have funded GFP research..

Amaranthus spinosa
Amaranthus palmeri
Amaranthus rudis
Amaranthus hybridus
Arabidopsis thaliana ecotype Columbia
Brassica juncea (cv. Florida broadleaf)
Brassica napus cv Westar
Brassica oleracea (cv. Italica)
Brassica rapa ecotypes: (CA) from Irvine, California, USA, (QC-2974) from Milby, QC, Canada, (QC-2975) from Waterville, QC, Canada
Chlamydomonas reinhardtii (UTEX # 89)
Chlamydomonas segnis (UTEX # 1905)
Chlorella fusca var. fusca (UTEX # 343)
Conyza canadensis ecotypes: (Houston) from Houston, DE, (Knoxville) from Knoxville TN, (Salisbury) from Salisbury, MD, (Rt. 301) from MD, and (NJ) from NJ.
Datura stramonium
Nicotiana tabacum cv. Xanthi
Oxalis stricta
Phytolacca Americana
Raphanus raphanistrum ecotypes: (GA) from Leesburg, Georgia, USA, (PEI) from Prince Edward Island, Canada
Sida spinosa

Phytosensor research. Plants are being designed that can sense explosives, plant diseases, and chemical warfare agents. Genetic modification and mutagenesis procedures are being exploited to modify how plants perceive biological and chemical signals in the environment. Then, GFP or other output signals are produced that can be detected using simple to complex instrumentation. This research has been funded by defense and agricultural interests.

Arabidopsis thaliana ecotype: Columbia
Glycine max cv. Jack
Nicotiana tabacum cv. Xanthi
Pteris cretica

Crop improvement. Soybean and other crops are being improved using plant transformation and mutagenesis. We are developing plants that can be used to help farmers with aluminum and drought problems, as well as damaging insects. We are also interested in producing novel ornamental and floral crops. This research has been funded by foundations and companies.

Glycine max cv. Jack

Weed Genomics. Our latest interest is in the genomics underlying competitive traits, abiotic resistances and herbicide tolerance. Since there are hundreds of thousands of acres in

Tennessee infested with glyphosate-tolerant horseweed (*Conyza canadensis*), we would like to understand the molecular mechanisms conferring tolerance.
Amaranthus spinosa
Amaranthus palmeri
Amaranthus rudis
Amaranthus hybridus
Conyza Canadensis ecotypes: (Houston) from Houston, DE, (Knoxville) from Knoxville TN, (Salisbury) from Salisbury, MD, (Rt. 301) from MD, and (NJ) from NJ.
Datura stramonium
Oxalis stricta
Phytolacca Americana
Raphanus raphanistrum ecotypes: (GA) from Leesburg, Georgia, USA, (PEI) from Prince Edward Island, Canada
Sida spinosa

Comparative Genomics. Several genomes of important model plant species have been sequenced (such as *Arabidopsis thaliana* and *Oryza sativa*), and we are performing genomics research to compare the entire set of genes of each model organism with understudied species. Microarray analysis utilizing *Arabidopsis* gene chips to study the gene expression of unrelated organisms is our first foray into this exciting field.
Arabidopsis thaliana ecotype: Columbia
Brassica rapa ecotype: (CA) from Irvine, California, USA, (QC-2974) from Milby, QC, Canada, (QC-2975) from Waterville, QC, Canada
Brassica napus (cv. Westar)
Brassica juncea (cv. Florida broadleaf)
Brassica oleracea (cv. Italica)
Conyza canadensis ecotypes: (Houston) from Houston, DE, (Knoxville) from Knoxville TN, (Salisbury) from Salisbury, MD, (Rt. 301) from MD, and (NJ) from NJ.

Texas

Cotton (College Station)

Drs. Peggy Thaxton and Wayne Smith report that the cotton improvement laboratory (CIL) has placed much effort this past year with converted race stocks (CRS) and interspecific hybrids (ISH). Converted race stocks were derived from photoperiodic, primitive Gossypium hirsutum accessions collected in Mexico and Central America. These accessions were crossed with Deltapine 16 with the resulting F1 and day-neutral BCnF2 plants backcrossed to the original accession to produce day-neural or converted race stocks.

From collaborative efforts with Dr. David Stelly, advanced interspecific backcross populations BC1F3 and BC1F2 between G. hirsutum with G. tomentosum or G. mustelinum were developed and are being evaluated. In addition, we have developed interspecific populations between G. hirsutum and G. barbadense using Sea Island – Barbados and New Mexico-Sea Island plant introductions, and are being evaluated for yield and fiber quality. In the future, ISH will be screened for resistance to abiotic and biotic stresses.

Converted Race Stocks

Screening for abiotic and biotic stresses. 116 CRS are being screened for resistance to fleahopper, aphid, and whitefly, seed and seedling disease complex, and nematodes.

Approximately 70 of the CRS lines were evaluated for seedling root development. Statistical differences were found for root length, number of lateral roots, and root dry weight at 20 days after planting. The lines were designated as robust rooting or non-robust rooting and 11 from each classification were reevaluated.

Studies were initiated with the CRS or their BC progeny in 2003 in the area of salt tolerance using a hydroponic technique for this work. Screening for drought tolerance of the CRS continues in this area. In addition, the lab continues to evaluate the converted race stock (CRS) for seed-seedling disease resistance. From greenhouse screening, eight resistant CRS lines were planted in the field this spring for evaluation for seed-seedling disease resistance.

Collaboratively with Dr. Knutson, entomologist in Dallas, the CRS material is being screened for fleahopper resistance using a small plate screening method. Collaboratively with Dr. Jim Starr and Dr. Edina Moresco, a visiting scientist from Brazil, we are screening an interspecific population segregating for both root-knot and reniform nematode resistance.

Interspecific Hybrids

G. tomentosum or G. mustelinum

Over 500 backcross and F2 populations of G. hirsutum with G. tomentosum and G. mustelinum were planted for further evaluation and selection in College Station.

G. barbadense (NUSI 1331 or Sea-Island Barbados)

Selections were made in 2003 from a large population of F4 PR of *G. hirsutum* and sea island (*G. barbadense*). Based on field performance and fiber quality, forty progeny rows and 658 individual plants were selected from 94L-25/SI-Barbado, 94L-2/NMSI 1331, NUSI 1331/97M-16, 17, or 18 crosses, and will be planted as progeny rows in 2004. In addition, 16 progeny F1 rows between the Sea Island material and CIL germplasm were harvested and were planted in multiple progeny rows in 2004. This material produced several very high fiber quality lines (length greater than 1.4 inches and strength greater than 40 g/tex) and will be incorporated into the breeding program.

Cotton (Lubbock)

Dr. John Gannaway reports that the cotton improvement program at Lubbock is in the process of screening “wild” cotton germplasm that is maintained by the USDA-ARS in College Station, TX, the Russian collection, and one that is maintained by CIRAD in Montpellier, France. These collections contain 8500, 6500, and 2500 accessions, respectively. Initial efforts have focused on increasing seed of each accession to initiate the screening program. Currently adequate seed supplies have been obtained for 300 lines. Initial screening has targeted insect resistance (aphids, lygus, thrips), disease (black root rot [Thielavopsis basicola]) as well as drought and salinity tolerance.

Orchids

Dr. Yin-Tung Wang reports that Phalaenopsis orchids for summer and fall flowering must be grown in air-conditioned greenhouses. The TAES orchid improvement program at Weslaco is attempting to breed Phalaenopsis hybrids that do not require low temperature to induce flowering. Three Phalaenopsis hybrids were registered with the International Orchid

Registration Authority in Kew, England. These include Phalaenopsis Will Bates, Phalaenopsis Alameda, and Doritaenopsis Cherry Bates.

Peanuts

Dr. Mark Burow reports that wild species were used for generating interspecific breeding lines. From these the varieties ‘COAN’ and ‘NemaTAM’ were developed. These materials are currently being used to develop leaf-spot resistant peanut cultivars. In addition, Bolivian landraces are being examined for early maturity and an African accession is being used for developing early maturity Spanish and runner populations. The objective is to combine earliness with high yield and a high oleic/linoleic ratio.

Virgin Islands
No Report

Virginia
No Report

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