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MISSION AND MAJOR OBJECTIVES

The mission of the Plant Materials Program is to provide plant solutions and plant technology to meet natural resource conservation needs. The Plant Materials Center (PMC) selects and releases superior accessions of adapted plants for production by commercial growers as well as developing plant production and management methodology. The use of native plant materials is emphasized. The following are major resource concerns of the Brooksville PMC service area, which includes Florida, Puerto Rico and the Virgin Islands, and the coastal areas of Alabama, Georgia, and South Carolina:

- Improve and maintain water quality
- Control erosion on cropland and stabilize critical areas
- Improve forage on pastures and rangeland
- Improve wildlife habitat

PLANT EVALUATION PROCESS

Assemble Plant Materials - Assemblies are planned to satisfy a specific objective(s) indicated in a study plan. Collections are made from a wide area within the occurrence of the species to ensure that variability and diversity of genotypes are well represented.

Initial Evaluation - The process of recording performance of the plant under controlled conditions. It allows the observance of characteristics and performance of the various collected plants, in order to select the most promising for the proposed conservation use. These plantings are normally done at the PMC, but off-center initial evaluation plantings can be done to suit study objectives.

Advanced Evaluations - Intensive testing of selected plants that were found to be superior in one or more attributes during the initial evaluation process. Cooperating agencies or other PMCs are encouraged to participate in this process. Installing plantings in areas where climatic conditions differ significantly from those at the PMC aids in determining a range of adaptation for the plant materials.

Final Evaluations - Selections that exhibit superior qualities for the intended use are placed in field plantings on sites away from the PMC, under actual growing conditions.

Release of New Plant Materials - This is the final step in the process. The plant's proven usefulness for meeting conservation needs is documented. Insofar as possible, materials are released in cooperation with, or with concurrence of, cooperating agencies. Source-identified, selected, and tested germplasm releases require less stringent evaluation and speed the release process compared to a cultivar release.

Breeder and Foundation Increase - PMCs maintain breeder and foundation seed or plants of materials that have been cooperatively released, or they arrange for maintenance with agencies and organizations participating in the release.

SOILS

Soils at the Brooksville PMC are predominately Kendrick Loamy Fine Sand. Other soil types found are Arredondo Fine Sand; Blichton Loamy Fine Sand; Electra Variant Fine Sand; Fleminton Fine Sandy Loam; Floridana Variant Loamy Fine Sand; Kanapaha Fine Sand, Nobleton Fine Sand; Sparr Fine Sand; and Wauchula Fine Sand.

CLIMATE

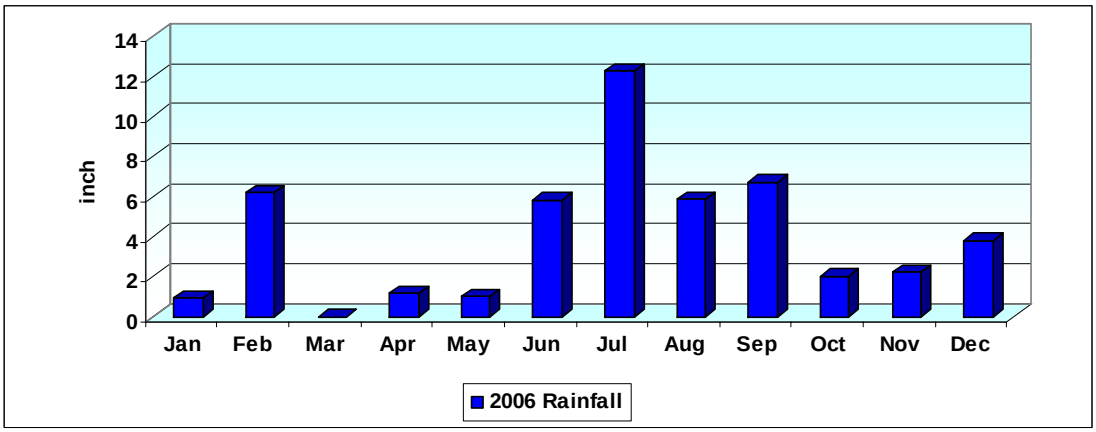

Figure 1. Year 2006 total monthly rainfall.

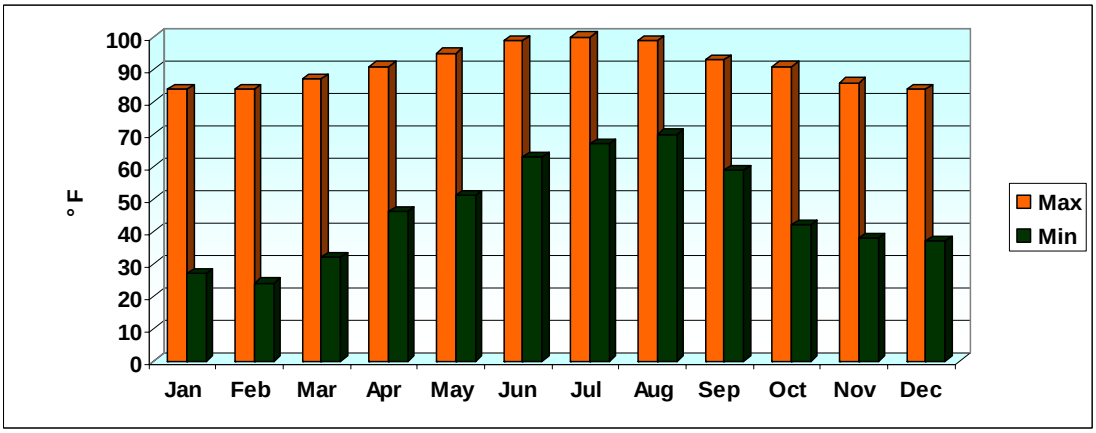

Figure 2. Year 2006 average monthly high and low temperatures.

No major storm events occurred in 2006. The spring was much drier than normal, which resulted in a state-wide burn ban that prevented us from burning our production fields and study plots. Total rainfall for the year was 48 inches, the majority of which fell during our normal rainy season (June to September) (Fig. 1). The average rainfall for this location for the previous 25 years was 57.6 inches. The deteriorating condition of the irrigation pump interfered with normal irrigation cycles which, with the drier than normal conditions, resulted in plant stress affecting fields and study plots.

Twelve frost events were recorded at the PMC during 2006 with the final spring frost occurring on March 20 and the first light frost the following winter occurring on October 24. A hard freeze occurred on February 13 and 14, when night temperatures fell into the 20s. The lowest temperature recorded at the PMC was 24 °F, which occurred on February 14, and the highest was 100 °F, recorded on July 24. The average maximum temperature for 2006 was 91 °F and average minimum temperature was 46 °F (Fig. 2).

PLANT DEVELOPMENT STUDIES
INITIAL EVALUATIONS

Switchgrass (*Panicum virgatum* L.) (FLPMC-P-0001-RA)

Objective: Develop one or more strains of Florida switchgrass with high seed production capabilities, whose primary use will be for reclaiming native areas, wildlife food and cover, and controlling erosion. If selections are identified that produce high amounts of forage, these will be released for range and pasture improvement.

Study Stage: Nearing the end of the initial evaluation phase. Advanced evaluation and seed increase phases are expected to take five or more years.

Cooperators: Ken Quesenberry, Department of Agronomy, University of Florida, Gainesville, FL; Ann Blount, North Florida Research and Education Center, Marianna, FL; and Brian Baldwin, Mississippi State University.

Introduction: Switchgrass has excellent potential for use in revegetating reclaimed mined lands (NRCS Conservation Practice [CP] numbers 543, 544, 342) and native areas, providing high quality livestock forage (CP 512, 550) and wildlife food (CP 645), controlling erosion (CP 601, 386), and improving water quality. There are a few commercially available cultivars of switchgrass, such as Alamo from Texas, that grow in Florida's environmental conditions. However, studies have shown that Florida ecotypes perform better than those from other states. The primary problem hindering development of a Florida cultivar of switchgrass has been poor seed production.

Progress: During the fall of 2000, a total of 88 accessions were collected from 42 counties in Florida in the form of plants and seed if available. Sixteen accessions had been collected previously, so that the final assembly totaled 104 accessions. Seeds were available from 80 of these accessions, and were planted in 6-inch cone trays in the greenhouse in December of 2000. Transplants of all 104 accessions (originating from seed or from original plants if seed was not available) were planted in a crossing block at the PMC on 2 August 2001. Five plants of each accession were planted in a randomized complete block design, with each plant acting as a plot. All five plants of several accessions have died since the initial planting (Table 1).

It is most likely that the improved switchgrass(es) to be released from this study will not be single lines, but the result of polycrosses of several accessions in the assembly. The PMC germplasm releases, Miami, Stuart, and Wabasso, were included in the assembly and will be grouped with other accessions with the appropriate ploidy levels. Since these previous releases have all been shown to be poor seed producers, they may be discontinued if those developed by this research prove to be superior germplasms. Accession 9059616, collected in Walton County on the Defuniak Springs Boy Scout Camp, was collected prior to the initiation of this study. It was never released, but had been used in previous PMC studies, and was included in the initial evaluation assembly

of switchgrasses. There was variability in flowering dates between accessions and may require grouping the plants based on their flowering dates to facilitate crossing.

Growth characteristics in the assembly are highly diverse, from those with bunch-types to fairly rhizomatous ones, with intermediate types in between. Differences, especially in biomass production, are probably due to differences in ploidy levels. Drs. Quesenberry and Williams assisted with cytometry testing to determine the ploidy levels of the accessions. Samples were collected on 24 May, 7 June, 19 July, and 26 July 2005. The node containing the immature inflorescence prior to emergence were removed from the plant and taken immediately to the University of Florida in Gainesville for testing. The last two sampling dates were somewhat late and it was difficult to find tissue in the appropriate stage to sample. Results of the cytometry testing are presented in Table 1. The laboratory apparatus did not function correctly at all times, so there were concerns about the about the reliability of the results. Sampling was to be repeated in 2006; however, it could not be completed due to scheduling problems. Dr. Baldwin offered to assist with retesting in 2007. He plans to use either rhizome or root tips, rather than the floral meristems used in 2005 for the ploidy determinations.

Table 1. Collection information for switchgrass accessions in the initial evaluation planting at the USDA, NRCS PMC in Brooksville, FL and estimated ploidy levels from floral meristems collected in 2005.

Accn. No.	County or Release	Collectors	Ploidy Level
421901	Miami Germplasm	Roush & Quintero	4x
422000	Wabasso Germplasm	Blickensderfer	4x
422001	Stuart Germplasm	Blickensderfer	4x
9059616	Walton (Defuniak Springs)	Stanky & Gonter	4x
9059784	St. Lucie	Gonter & Pfaff	8x
9060100	Osceola	Fults	4x
9060452	Citrus	Rooks & Pfaff	8x
9060455	Citrus	Pfaff & Gonter	8x
9060456	Holmes	Maura, Gonter & Santucci	8x
9060458	Martin	Fults, D. Black & Pfaff	8x
9060459	Palm Beach		8x
9060460	Martin	Fults, D. Black & Pfaff	4x
9060462	Okaloosa	Pfaff, Santucci & E. Black	8x
9060463	Okaloosa	Pfaff, Santucci & E. Black	4x
9060464	Okaloosa	Pfaff, Santucci & E. Black	6x
9060465	Okaloosa	Pfaff, Santucci & E. Black	8x
9060466	Walton	Hall, Pfaff & Gonter	8x
9060474	Citrus	Pfaff & Santucci	8x
9060475	Taylor	Pfaff & Santucci	8x
9060476	Liberty	Pfaff & Santucci	8x
9060477	Calhoun	Pfaff & Santucci	4x
9060478	Calhoun	Pfaff & Santucci	8x
9060479	Bay	Pfaff, Santucci & Valenta	8x+
9060480	Bay	Pfaff, Santucci & Valenta	8x
9060481	Bay	Pfaff, Santucci & Valenta	8x

Accn. No.	County or Release	Collectors	Ploidy Level
9060482	Bay	Pfaff, Santucci & Valenta	8x
9060483	Washington	Pfaff, Santucci & Valenta	8x
9060484	Washington	Pfaff, Santucci & Valenta	4x
9060485	Walton	Pfaff, Santucci & Valenta	8x
9060486	Jackson	Pfaff & Santucci	8x
9060487	Holmes	Pfaff & Santucci	8x
9060488	Holmes	Pfaff & Santucci	8x
9060491	Okaloosa	Pfaff & Santucci	4x
9060492	Okaloosa	Pfaff & Santucci	8x
9060493	Okaloosa	Pfaff & Santucci	6-8x
9060494	Santa Rosa	Pfaff & Santucci	8x
9060495	Santa Rosa	Pfaff & Santucci	4x
9060496	Escambia	Pfaff & Santucci	8x
9060497	Santa Rosa	Pfaff & Santucci	4x
9060498	Okaloosa	Pfaff & Santucci	6x
9060499	Walton	Pfaff & Santucci	Dead
9060501	Walton	Pfaff & Santucci	8x
9060502	Franklin	Pfaff & Santucci	8x
9060503	Franklin	Pfaff & Santucci	4x
9060504	Wakulla	Pfaff & Santucci	8x
9060505	Wakulla	Pfaff & Santucci	8x
9060506	Taylor	Pfaff & Santucci	8x
9060507	Sumter	Pfaff, Santucci & Ellis	4x
9060508	Sumter	Pfaff, Santucci & Ellis	8x
9060509	Pasco	Pfaff, Santucci & Ellis	8x
9060510	Pasco	Pfaff, Santucci & Ellis	8x
9060511	Palm Beach	Fults	6-8x
9060512	Palm Beach	Fults	6-8x
9060513	Palm Beach	Fults	6-8x
9060514	Palm Beach	Fults	8x
9060515	Palm Beach	Fults	6-8x
9060516	Brevard	Fults & Millard	4x
9060517	Hamilton	Gonter & E. Black	Dead
9060518	Levy	Gonter & E. Black	8x
9060519	Levy	Gonter & E. Black	4x
9060520	Levy	Gonter & E. Black	4x
9060521	Dixie	Gonter & E. Black	8x
9060522	Dixie	Gonter & E. Black	4x
9060523	Jefferson	Gonter & E. Black	4x
9060525	Suwannee	Gonter & E. Black	4x
9060526	Suwannee	Gonter & E. Black	8x
9060527	Gilchrist	Gonter & E. Black	8x
9060528	Collier	Pfaff & Gonter	8x
9060529	Collier	Pfaff & Gonter	8x
9060530	Lee	Pfaff & Gonter	6-8x
9060531	Volusia	Pfaff & Santucci	4x
9060532	Putnam	Pfaff & Santucci	8x

Accn. No.	County or Release	Collectors	Ploidy Level
9060533	Putnam	Pfaff & Santucci	6-8x
9060534	St. Johns	Pfaff & Santucci	4x
9060535	Duval	Pfaff & Santucci	8x
9060536	Nassau	Pfaff & Santucci	8x
9060537	Nassau	Pfaff & Santucci	4x
9060538	Duval	Pfaff & Santucci	Dead
9060539	Pasco	Pfaff & Gonter	8x
9060540	Hillsborough	Pfaff & Gonter	Dead
9060541	Manatee	Pfaff & Gonter	6-8x
9060542	Sarasota	Pfaff & Gonter	8x
9060543	Sarasota	Pfaff & Gonter	8x
9060544	Sarasota	Pfaff & Gonter	8x
9060545	Sarasota	Pfaff & Gonter	Dead
9060546	Manatee	Pfaff & Gonter	8x
9060547	Hillsborough	Pfaff & Gonter	8x
9060548	Hernando	Pfaff & Gonter	4x
9060549	Hernando	Pfaff & Gonter	6-8x
9060550	Escambia	Collier & Brown	4x
9060551	Hernando	Pfaff & Santucci	6-8x
9060552	Citrus	Pfaff & Santucci	4x
9060553	Marion	Pfaff & Santucci	8x
9060554	Levy	Pfaff & Santucci	8x
9060555	Levy	Pfaff & Santucci	8x
9060556	Alachua	Pfaff & Santucci	8x
9060557	Alachua	Pfaff & Santucci	8x
9060558	Clay	Pfaff & Santucci	4x
9060559	Sumter	Pfaff & Gonter	4x
9060560	Seminole	Pfaff & Gonter	Dead
9060561	Seminole	Pfaff & Gonter	4x
9060562	Taylor	Harrison	4x
9060563	Citrus	Pfaff & Maura	8x

Future Research Needs: In 2007, the switchgrass accessions will be lifted, divided, and held in the greenhouse until the final ploidy determinations can be made. Then they will be planted is crossing blocks with plants of similar ploidy levels. These plants will be spaced in a manner such as to provide maximum cross-pollination, but they will be protected from pollen from other switchgrass sources by following isolation distance recommendations or using pollen-trapping plantings. Initial selections will be made based on germination, and later selections will be based on important phenotypic and seed production characteristics.

Once the superior cultivars are developed, they will need to be tested for performance and adaptation in Florida as well as surrounding states to determine their region of adaptation. If one or more of the accessions proves to have a growth habit that is suitable for forage production, additional testing may be required to determine its quality characteristics and optimum management system.

Annual Phlox (*Phlox drummondii* Hook.) (FLPMC-P-0202-CR)

Objective: To develop a cultivar or germplasm of annual phlox with unusual flower types that is well adapted to Florida's growing conditions for roadside beautification.

Study Stage: This study is still in the initial evaluation phase. Some selections have been made, but further evaluation of these selections is necessary to begin advanced evaluations.

Cooperators: Steve Melton, Jack Melton Family, Inc.

Introduction: One wildflower species that the Florida Department of Transportation currently plants along roadsides for beautification purposes is annual phlox and the seeds they use primarily come from producers in Texas. They would prefer to have local sources of wildflower seeds. In 2001, Steve Melton located a pasture two miles west of Trilby, FL that had been disked in the early spring. A thick stand of annual phlox germinated following this operation. Mr. Melton was allowed to harvest seed from this area and the PMC staff provided technical assistance. Within this stand, there were some plants with unusual star-shaped corollas. Several of these plants were dug and relocated to the PMC.

Progress: Seeds collected from the plants in 2001 were planted into trays in the PMC greenhouse in 2002. When the seedlings emerged, many had the unique flower patterns, shapes, and colors of their parents, although there were also some common types. The seedlings were put in the shadehouse in the spring, so that pollinators could access them. All types were allowed to cross, and seed was hand collected as it ripened. Seeds collected from the plants in the shadehouse in 2002 were planted into trays in the greenhouse in November of 2002 and then transplanted and placed in the shadehouse for another selection cycle. In this cycle, all seedlings that did not have the desired flower types were removed. These cycles will be continued until adequate seed is available for commercial release. Seeds were sown in the greenhouse on 7 February 2006, however, germination was very poor. There were too few seedlings to make any advancement in the selection process. It is possible that seed viability has deteriorated in storage and this may prevent further progress on this study.

Future Research Needs: Seed germination testing needs to be completed to determine if this study can be continued.

If the determination is made that we can proceed and if the corolla shape proves to be a stable trait that can be maintained through selection, then the material can be released. However, if our selection process does not result in a population with star-shaped corollas, then cooperators should be sought to assist us with genetic analysis to determine the source of this trait and if it can be stabilized

Any released material should undergo further adaptation testing throughout the state. There is strong evidence (Jeff Norcini, 2006, personal communication) that fall

germinated phlox will exhibit nearly continuous flowering in the winter and early spring in north Florida, suggesting this species may be important to the commercial bedding plant trade. There is also a major need for further research in harvesting methods for annual phlox. Uneven ripening, plant morphological, and chemical features present unique production problems for seed producers.

Wiregrass (*Aristida beyrichiana* Trin. & Rupr.) (FLPMC-P-0337-WO)

Objective: To develop one or more germplasm sources of wiregrass with good seedling establishment characteristics and high seed production.

Study Stage: Some materials were assembled, but a planned initial evaluation planting was never made. These plants were initially identified as *A. stricta* Michx.; however, the native range of that species purportedly does not include Florida. The accessions in the assembly will be identified as *A. beyrichiana*, unless individual examination indicates otherwise.

Introduction: Wiregrass is a warm-season perennial bunchgrass distributed throughout Florida and north through South Carolina and west to the southern portions of Mississippi. It is adapted to a broad range of soil and moisture regimes, from wet flatwoods to longleaf pine-turkey oak sandhills. Once established, it is very drought tolerant and hardy. Wiregrass is considered to be one of the most important grasses in a pineland habitat because of its ability to carry fire. In native situations, wiregrass contributes a large percentage of the fuel for understory burn management programs (CP 338, 384). Livestock readily graze new growth after a burn; however, older tissue is unpalatable. Wiregrass also provides cover and nesting sites for wildlife (CP 645, 647). It produces fair quantities of seed if old residues are removed, generally by burning during the growing season.

The only option currently available for individuals interested in planting wiregrass is native seed collection, and the seed collected will generally have fairly low germination percentages. Results from previous work with wiregrass and consultations with plant breeders suggest that germination could be rapidly improved in this species using genetic selection. To do this, large assemblies of wiregrass plants from several stable populations (e.g., parks or preserves) should be gathered to form the base population from which evaluations for improved germplasm and other desirable characteristics will be made.

Progress: Forty-eight accessions of wiregrass were collected in 1997 and 1998; however, the state plant materials technical committee decided that a wiregrass release was not an immediate priority, so collections ceased and an initial evaluation planting was never installed. In conjunction with the switchgrass initial evaluation collection, most of the original collections sites were revisited in 2000, and plants were collected if available. Since that time, the accessions have been maintained in pots in the PMC shadehouse and some materials have been lost.

Future Research Needs: Since wiregrass is such an important plant in the ecosystems that it occupies, the PMC has two options: 1) to recollect material or 2) to move forward with initial evaluation of the materials that are currently available. It has been decided by the state technical committee that, if there should be enough surviving plants to represent the collection region, then the best course of action would be to work with the existing materials in a recurrent selection process and make selections using seed germination as

the initial selection factor. Plantings may be established at various cooperator locations around the state (Marianna and Immokalee) to expedite the selection process. It is anticipated that the initial plots can be planted at the PMC in 2008.

Slender Woodoats [*Chasmanthium laxum* (L.) Yates] (FLPMC-P-0501-PA)

Objective: To develop one or more strains of slender woodoats with high seed production capabilities, whose primary use will be for forage production and critical area stabilization.

Study Stage: In the final year of the assembly phase.

Introduction: Slender woodoats is a grass that can be found growing in hammocks and woodlands in Florida. The foliage remains green during the winter, indicating that it may have potential for use as a cool-season forage (CP 533, 512). Since it is generally found in more shaded locations, its ability to tolerate higher light situations in pastures and rangelands needs to be determined. Its shade-tolerance indicates that it also has potential for use in critical area (CP 345) and buffer plantings (CP 393, 386) in or adjacent to wooded areas.

Progress: In 2004, 48 accessions of slender woodoats were collected, mainly from the eastern Panhandle and northeastern part of the state. Nineteen additional collections were made in 2005, covering the rest of the Panhandle and the east-central counties. No collections were made in the counties in south Florida because the plants could not be located during surveys made in 2004 or 2005. Some reports indicate that this portion of the state may be beyond the native range of this species. A few local counties that have not been surveyed were completed in early 2006, yielding an additional two accessions for a total of 69 accessions of slender woodoats. Kinchafoonee Germplasm Virginia wildrye, (*Elymus virginicus* L.), another cool-season grass with a similar flowering phenology to slender woodoats, will be used as a standard of comparison. Two types of evaluation sites will be used: an open site, where the plants are exposed to full sun and a more protected site, where the plants will receive partial shade. In these plantings, each of the accessions will be evaluated for establishment, vigor, seed production, and disease and insect resistance. The initial evaluation plantings were scheduled for 2007 or 2008, depending on time availability.

At the same time, a forage management study will also be planted using a local accession collected at the PMC. The plants will be clipped and fertilized according to standard forage production practices to determine the potential yields, quality, and persistence of this grass under limited harvesting pressure. There will be three treatment plots will be subjected to a single clipping in December, February, or April, and the treatments will be replicated three times.

Future Research Needs: Seed production technology research needs to be conducted to determine how to manage stands (fertilization, herbicides, etc.) for optimum yields. Also, seed harvesting and processing methods need to be studied. Assuming that the plants tolerate the limited clipping regimes used in the planned clipping plots, further research on harvest management will be required. It will be necessary to determine if the plants can tolerate multiple harvests and what stubble height is best. Grazing studies may also need to be conducted.

Rhizoma Perennial Peanut (*Arachis glabrata* Benth.) Cultivar Development (FLPMC-P-0601-PA)

Objective: To develop new germplasm sources of perennial peanut with improved establishment rates and environmental tolerances.

Study Stage: Materials were assembled by M.J. Williams and others during a plant exploration trip to Paraguay in 2002 and 2003.

Cooperators: Ken Quesenberry, Department of Agronomy, University of Florida, Gainesville, FL; Ann Blount, North Florida Research and Education Center, Marianna, FL; M. Adjei, Range Cattle Research and Education Center, Ona; Ike Ezenwa, Southwest Florida Research and Education Center, Immokalee.

Introduction: Rhizoma perennial peanut is a tropical legume that can be used as a high-value forage crop (CP 512) in the subtropical portions of the United States, with lower growing varieties used as a replacement for turfgrasses in home lawns, along roadsides, and in urban medians (CP 342). Rhizoma peanuts produce limited quantities of geocarpic seed that are impractical to harvest and therefore must be planted vegetatively using rhizomes. The cultivars 'Florigraze' and 'Arbrook', released by the PMC and the University of Florida in 1978 and 1985, respectively, have been planted on more than 8000 ha of pastureland, mainly in Florida and Georgia. However, they are slow to establish and planting substantial acreages is expensive when compared to seeding the tropical forage grasses predominantly used in this area. As a consequence, their use has largely been limited to cutting for high-value hay marketed to horse owners. Also, these cultivars are unsuitable for use in areas with high water tables due to poor tolerance of the roots and rhizomes to anaerobic conditions; growth is limited during the short photoperiods experienced in the spring and fall and the shoots senesce when exposed to freezing temperatures. Therefore, a major emphasis has been identified by germplasm researchers in the southeastern states to develop improved selections that can overcome these limitations. To accomplish this, new germplasm was collected from within the original range of this species for evaluation.

Progress: PMC personnel planted the accessions collected in Paraguay in pots in the shade house and have cared for them for several years. These accessions are also being maintained at the Plant Introduction (PI) Station in Griffin, GA and the plants at the PMC carry the temporary GRIF number assigned at this station, which is the identification number that will be used during testing. Since the pots have been in the shade house for several years, losses have occurred. During the spring of 2006, a count of the remaining plants was conducted and it was found that 29 accessions still have surviving plants. Additional materials will be requested from the PI Station for lost accessions and any remaining accessions with too little material for successful propagation. The stock plants will be divided and a sufficient number of plants will be produced for replicated evaluations to be conducted at the PMC and the University of Florida Research and Education Centers in Marianna, Immokalee, and Ona. Accessions will be evaluated for

establishment, rate of spread, dry matter and flower production, disease resistance, and plant persistence.

Future Research Needs: During advanced evaluation, field trials will need to be conducted outside the state to determine the range of adaptation of materials selected for release. Greenhouse studies may also be required to determine the flooding/waterlogging tolerance of these lines. Laboratory testing to assess if the plants are infected with or susceptible to viruses, which may not be readily apparent during the field evaluation trials, could also be necessary.

ADVANCED EVALUATIONS

Purple Bluestem [*Andropogon glomeratus* var. *glaucopsis* (Ell.) A.S. Hitchc.] (FLPMC-P-9601-RA)

Objective: To evaluate, develop, and release a Florida native selection of purple bluestem for conservation use, especially erosion control, wetland restoration, and wildlife cover.

Study Stage: Study completed. The composite germplasm was released in 2006 as Ghost Rider Germplasm.

Introduction: Purple bluestem is a native warm season perennial bunchgrass distributed throughout Florida, southern North Carolina, South Carolina, Georgia, and west to East Texas. It is adapted to flatwoods, seeps, and the margins of freshwater marshes and ponds. It produces high quality livestock forage (CP 381, 533, 512) and is considered to be one of the most palatable native grasses on flatwoods sites. It is also an important plant for upland water quality preservation and soil erosion control. Purple bluestem is a prolific seed producer and will readily colonize disturbed areas in wet flatwoods.

Progress: Ten superior accessions were selected for seed increase and advanced testing in 1999 (Table 2). Seeds from the original collections that had been stored in the seed cooler were used to start seedlings in the greenhouse in April 2000. In February 2001, the accessions were randomly planted together on an irrigated, poorly drained site and the resulting composite was given the accession number 9060461.

Table 2. Ten superior accessions planted in purple bluestem polycross block at the USDA, NRCS PMC in Brooksville, FL in 2001.

Accession No.	County	Collector
9060226	Orange	Fults
9060251	Nassua	PMC
9060277	Hardee	PMC
9060318	Brevard	Fults
9060331	Sarasota	Deal
9060340	Bay	PMC
9060347	Taylor	PMC
9060363	Citrus	PMC
9060394	Polk	Sheehan/Baxter
9060396	Polk	Sheehan/Baxter

Documentation was prepared in 2005 to release this selected-class release, naming it Ghost Rider. However, when a plant sample was sent for independent verification, it was determined to be *A. glomeratus* var. *glaucopsis* (synonym *A. glaucopsis*), not *A. capillipes*, the name assigned to the material during evaluation. Because this release resulted from cross-pollination of ten separate germplasms, we felt it was imperative to determine that all accessions used in the composite were identified to be the same species. In 2006, we examined plants from the original accessions and were able to

verify that all plants used to form the composite were indeed *A. glomeratus* var. *glaucopsis*.

Future Research Needs: This study will be closed since the release is completed. However, it would be advisable to install field or demonstration plantings throughout Florida and possibly in adjoining states to determine its true range of adaptation and to demonstrate its suitability for various conservation uses. Due to limited seed stocks, these types of plantings will probably need to be delayed, because first priority will be to provide foundation seed to commercial producers. Plant samples should also be collected during the growing season for forage quality analysis. This can easily be done using material collected from the seed increase fields at the PMC.

Hairawn Muhly [*Muhlenbergia capillaris* (Lam.) Trin.] Seeded Types (FLPMC-P-0108-RA)

Objective: To evaluate, develop, and release Florida native germplasms of hairawn muhly with high seed production potential for conservation use.

Study Stage: Advanced evaluation and increase for these materials is expected to take five or more years.

Cooperators: Ken Quesenberry, Department of Agronomy, University of Florida, Gainesville, FL; Ann Blount, North Florida Research and Education Center, Marianna, FL.

Introduction: Hairawn muhly is a hardy warm-season perennial bunchgrass distributed throughout Florida and several other states in the southeastern U.S. It is adapted to a broad range of sites, from seeps and marshes to longleaf pine-turkey oak sandhills. It is more common on wetter sites. In its vegetative state, hairawn muhly looks very similar to wiregrass and it generally fills a similar role in the ecosystem. In native communities, it provides fuel for understory burn management programs and cover for wildlife. Livestock and wildlife can graze early growth. Because of its attractive purple inflorescence, it is becoming very popular for use as an ornamental and is often used for planting in buffers (CP 393) and along roadsides (CP 342).

The hairawn muhly initial evaluation study conducted from 1997 to 1999 (FLPMC-P-9236-RA) identified several accessions with superior characteristics. Accessions with ornamental potential were selected for vegetative increase and are covered separately (see studies FLPMC-P-0201-UR and FLPMC-P-0102-UR). In this study, accessions with high seed production potential were selected to develop materials for erosion control (CP 342, 391), native area and mined land restoration (CP 327, 562, 543, 544), and wildlife cover enhancement (CP 392, 645).

Progress: Ten accessions with similar flowering periods that exhibited superior seed production and growth habit characteristics were selected (Table 3). Seeds collected from these accessions were planted in the greenhouse to produce plants for further testing in 2001.

Plans are to place these ten accessions in a polycross nursery for cross pollination; however, prior to doing this, it will be necessary to positively identify the selections because several *Muhlenbergia* species occur in Florida and they are difficult to distinguish from one another. Also, further investigation into the pollination mechanism of this (these) species may be required. In order for the current protocol to move forward successfully, it is imperative to determine whether cross-pollination is actually occurring. If the plants should self-pollinate or produce seed by apomixis, rather than by sexual means, then use of a polycross block may not be appropriate. A thorough literature search will be conducted on this topic, but if previous reports of its reproductive process

should not be available, we may need to ask for assistance from our cooperators or other individuals to determine this critical information.

Table 3. Ten superior accessions of hairawn muhly being maintained for advanced evaluation.

Accession No.	County	Collector
9059224	Levy	Sikes, Borst & Stankey
9059516	Manatee	Stankey & Maura
9059523	Dixie	Stankey & Gonter
9059524	Taylor	Stankey & Gonter
9059544	Bay	Stankey & Gonter
9059885	Okeechobee	Pfaff & Gonter
9060044	Brevard	Fults & Millard
9060048	Osceola	Fults
9060317	Hernando	Santucci
9060437	Collier	Gonter & Black

Two additional accessions were also identified as having consistently high seed viability in 2000 and 2001. These accessions, 9060304, collected from Jackson Co., and 9060428, collected from Bradford Co, are much smaller and bloom a month earlier than most of the other collections in the assembly. Plants of these accessions are being maintained in pots in the shadehouse. These plants can also be increased for possible release if deemed appropriate.

Future Research Needs: Once sufficient seed of the final release material has been obtained, field planting sites should be installed throughout Florida and possibly in other states. It could take between three and five years before seed is available for these plantings. Other research topics that need to be addressed include seed harvesting and processing techniques and testing insecticides to control aphids on seedheads. Studies also need to be conducted on seeding rates and methods in order to develop recommendations for establishment of hairawn muhly.

Hairawn Muhly Ornamental Vegetatively Propagated Types (FLPMC-P-0201-UR)

Objective: To select and release superior selections of Florida hairawn muhly for ornamental use.

Study Stage: In the final phase of advanced evaluation; selected accessions underwent adaptation testing throughout the state and additional plantings are underway to make selections for release. A plant release(s) is expected in the next three or four years.

Cooperators: Jeff Norcini, Gary Knox, and Jim Aldrich, North Florida Research and Education Center, Quincy, FL.

Introduction: Hairawn muhly is a perennial bunchgrass that is native from Massachusetts to Nebraska, south to Florida and Texas. It grows 1 to 4 feet in height, depending on ecotype, and produces very showy pink to purple seedheads. Rarely, white-flowering types have also been found. Hairawn muhly is a very popular grass for planting in no or limited water use plantings along roadsides (CP 342) and in urban areas; however, the plants offered for sale in the Southeast are mainly from unknown sources and have not be selected for improved growth and aesthetic characteristics.

Progress: Ten accessions of hairawn muhly (Table 4) with ornamental qualities were selected from an assembly of 91 hairawn muhly accessions. Plants of these accessions, along with a white-flowering form (accession 9059717), which was released in 2006 as Morning Mist Germplasm, were planted in three counties (Okaloosa, Alachua, and Hendry) in 2002. Plots were evaluated in the fall of 2003, and at that time it was apparent that some of the plots were not being maintained properly, so further evaluation of these plots was not possible. The results from these plantings were summarized in 2006 in preparation for the final selection phase.

The final evaluation plantings were made at the University of Florida/IFAS, North Florida Research and Education Center (NFREC), Quincy (Gadsen Co.) and at the PMC.

Table 4. Ten superior vegetatively propagated accessions of hairawn muhly to undergo final evaluation.

Accession No.	Source/Site	Growth Habit at PMC
9059237	Pasco (wet)	Tall, very robust
9059516	Manatee (wet)	Tall, very robust
9059717	Citrus	Small, white flowers
9059812	Marion (wet)	Medium, robust
9059825	Gilchrist (dry)	Small, robust
9059826	Suwanee (wet)	Medium, robust
9059929	Jefferson (wet)	Tall, robust, upright
9060317	Hernando (wet)	Medium, fine leaves
9060424	Putnam (dry)	Medium, robust
9060425	St. Johns (wet)	Small, compact, robust
9060428	Bradford (wet)	Small, compact, robust

in Brooksville (Hernando Co.). The ten accessions listed in Table 4 along with Morning Mist Germplasm are being compared to a commercial purple-flowered plant from Monrovia Nursery and White Cloud, another white-flowered hairawn muhly sold by Superior Trees. Plants of the ten purple-flowered accessions were grown at the PMC in 6" pots and bare-root plants of Morning Mist were dug and divided into planting sections prior to the planned planting date in the spring of 2006. Plots were planted at Quincy by PMC and NFREC personnel on 3 April and by PMC personnel in Brooksville on 11 April. Plantings were in three rows mulched with landscape fabric and rows constituted replicates. Five plants were planted in each plot with only the middle three plants evaluated. Plants were fertilized with slow-release fertilizer after planting and irrigated for four weeks after which irrigation was discontinued. Initial plant measurements were taken at the PMC location on 14 April (Table 5) and repeated in the fall (Table 6). Two basal clump diameter measurements were made in the spring; one that just included the green actively growing shoots (Live Clump Diameter) and a second of the entire clump (Max. Clump Diameter). Flowering evaluations were conducted weekly beginning the first week of September to determine the first date that color could be detected on each plant in the plot (Table 7). On October 25, when a majority of the plants were in peak or had just passed peak flowering, visual estimates of quality of the plants in the plot (Overall Rating) were made by three individuals and averaged to obtain overall rating (Table 7). On the same evaluation date, measurements were made of culm height and inflorescence length on a representative flowering stem from each of the three evaluation plants in the plot (if a culm was present on the plant) (Table 6).

White Cloud and the commercial purple plants obtained from the two nurseries were initially much larger plants in both height and basal diameter than the PMC-produced plants (Table 5), which were produced in smaller containers and had their shoots cut back prior to planting. However, by the fall of the first year, several of the PMC accessions either equaled or exceeded the height and basal diameters of the commercial accessions (Table 6). The Morning Mist plants that were planted using bare-root stock had very poor survival and growth rates and will be replaced with container-grown stock next spring. White Cloud was the largest plant and ranked highest in overall performance (Table 7). However, accession 9059237 was comparable in clump basal diameter, culm height, and inflorescence length, indicating that its growth rate was probably superior to White Cloud (Table 6). Accession 9059929 also made impressive growth during the establishment year (Table 6) and was very attractive as indicated by its high overall rating (Table 7). The commercial purple accession had foliar lesions, probably caused by a rust fungus, when the plants were planted and their growth rate (Table 6) and appearance (Table 7) ranked only average. Accessions 9060424, 9060425, and 9060428 rated poorly in all characteristics examined (Tables 6-7). White Cloud and accession 9059825 were the earliest flowering plants in the study (Table 7). The sequence of flowering dates may be different next year when all the plants will be starting from a more uniform growth stage.

Table 5. Initial plant measurements of thirteen hairawn muhly accessions taken at the USDA, NRCS PMC, Brooksville, FL on 14 April 2006.

Accession No.	Live Clump Diameter[1]	Max. Clump Diameter[2]	Avg. Height	Max. Height
	----------cm----------			
9059237	4.0	4.5	26.9	47.3
9059516	3.5	4.3	29.2	50.7
Morning Mist	2.6	3.7	12.4	17.7
9059812	2.4	3.1	21.8	42.3
9059825	2.7	3.5	14.9	19.6
9059826	3.1	3.5	18.0	27.9
9059929	3.7	4.1	28.8	47.9
9060317	3.3	4.5	24.1	43.9
9060424	1.9	2.5	12.6	17.9
9060425	2.0	3.8	12.8	16.4
9060428	2.8	3.6	13.2	17.0
White Cloud	2.9	3.4	40.9	69.2
Com. Purple	6.4	7.3	43.9	65.1
Mean	3.3	4.0	23.0	37.1
LSD (0.05)	1.2	1.3	6.0	8.1

[1] Clump diameter was measured by measuring the basal diameter of the plant across the widest part of clump to the edge of the live shoots and then at a 90° angle to the edge of the live shoots and the two measurements were averaged.

[2] Similar measurement method to above, but senesced shoots to the outside of the live shoots were included in the measurement.

Table 6. Plant measurements of thirteen hairawn muhly accessions taken at the USDA, NRCS PMC, Brooksville, FL on 25 October 2006.

Accession No.	Clump Basal Diameter[1]	Avg. Foliage Height[2]	Avg. Culm Length[3]	Avg. Inflorescence Length
	----------cm----------			
9059237	16.1ab	48.2	64.2a	55.1ab
9059516	13.4abcd	50.3	59.0ab	45.9abcde
Morning Mist	4.7e	34.3	57.8abcd	27.6ef
9059812	10.6bcde	36.4	43.9def	36.8cdef
9059825	10.8abcde	31.2	50.4bcdef	48.4abcd
9059826	15.0abc	35.9	55.6abcd	46.1abcde
9059929	13.4abcd	52.2	58.3abc	52.3abc
9060317	12.4abcd	54.8	54.7abcde	38.1bcdef
9060424	5.7e	19.7	41.2f	23.3f
9060425	9.2cde	18.9	27.5g	24.6f
9060428	7.4de	29.4	41.5ef	33.3def
White Cloud	16.8a	54.0	66.3a	60.3a
Com. Purple	16.0ab	46.1	45.4cdef	35.3dcef
Mean	11.6	39.3	51.2	40.6

[1] Clump diameter was measured by measuring the basal diameter of the plant across the widest part of clump and then at a 90° angle and the two measurements were averaged.
[2] The homogeneous group format cannot be used for this factor because of the pattern of significant differences.
[3] Measured from the ground to the point where the inflorescence began to bend downwards.

Table 7. Overall rating of plant performance as of 25 October 2006 for thirteen hairawn muhly accessions and date of first flower color from weekly observations beginning the first week of September 2006 at the USDA, NRCS PMC, Brooksville, FL.

Accession No.	Overall Rating[1]	Date of First Color[2]
9059237	3.0	09/22
9059516	2.7	09/22
Morning Mist	1.8	10/02
9059812	1.9	09/11
9059825	1.9	09/01
9059826	2.1	09/11
9059929	3.4	09/15
9060317	3.1	09/15
9060424	1.3	09/11
9060425	1.1	09/11
9060428	1.4	09/11
White Cloud	3.8	09/01
Com. Purple	2.4	09/22
Mean	2.3	------
LSD (0.05)	1.1	------

[1] Rating scale: 1= poor; 2 = fair; 3 =good; 4 = very good ; 5 = outstanding. Values given are an average of the plant quality ratings given by three individual people assigning ratings to the plots.

[2] Plants were rated weekly for flowering beginning the first week in September and the date given is the first that any color from an emerging inflorescence was noted. on any plant in one of the plots.

Future Research Needs: Further adaptation testing is unlikely because suitability of these accessions for use in Florida has been well documented; however, plantings can made in other states if there is sufficient interest. An examination of management techniques (i.e., fertilization, clipping) to improve the appearance and performance of plants in the landscape may be needed.

White Muhly Cultivar Development (FLPMC-P-0102-UR)

Objective: To release a white-flowered hairawn muhly for landscape use.

Study Stage: Study completed. This accession was released this year as Morning Mist Germplasm. Morning Mist was also included in advanced testing of other ornamental hairawn muhly accessions (see study FLPMC-P-0201-UR).

Introduction: Several hairawn muhly plants with white flowers (accession 9059717) were found in a native population in Citrus Co., FL, growing alongside normal pink-flowered plants. This white selection has tremendous potential for use in the commercial landscaping industry, especially for limited water use plantings. In initial evaluations, a high percentage of seedlings from these plants also produced white flowers like the parent plant; however, seedling vigor declined.

Progress: Adaptation studies were initiated in 2002, along with the normal, pink-colored hairawn muhly plants as recounted previously. It was well adapted at all planting sites. An environmental assessment of this accession was completed and a release document was prepared this year.

Future Research Needs: In FLPMC-P-0201-UR, this release is currently being compared to White Cloud, another white-flowered muhly selection that was not commercially available when this study began. It appears that they are separate genotypes due to their different flowering periods and growth habit differences; however, since White Cloud was purportedly collected from a similar section of the state, cytological testing may be required.

Further research on nursery production methods and management of these plants in the landscape may be warranted. Also, regional site plantings would provide additional information on where this release can be successfully grown.

Lopsided Indiangrass [*Sorghastrum secundum* (Ell.) Nash] (FLPMC-P-9602-RA)

Objective: To evaluate, develop, and release a native Florida germplasm(s) of lopsided indiangrass for conservation use.

Study Stage: The development and increase phases in advanced evaluation are expected to take an additional two to three years.

Introduction: There is a growing demand for seed sources of native species that can be used to restore native habitats. Lopsided indiangrass is one of the dominant grasses on native uplands and range sites in central and south Florida. It is a warm-season, perennial bunch grass, adapted to a wide variety of soils and hydrologic regimes. Lopsided indiangrass produces good seed yields and seedling vigor is much better than for many other Florida native grasses. Materials that will be released should be well suited for erosion control (CP 342, 391), native area restoration (CP 327, 562), and wildlife cover (CP 392, 645) plantings in the state. It is also fairly attractive due to the weeping seedheads and pendant spikelets that are all held to one side of the stem.

Progress: Plants of three superior early-flowering accessions of lopsided indiangrass (9060186 from Marion Co.; 9060197 from Levy Co.; and 9060205 from Gilchrist Co.) were divided and planted in a polycross block to form accession 9060564. These accessions all have an upright growth habit and the foliage has a definite bluish cast. These will be released as an ornamental selection in the next few years. The seed increase field for this accession is currently being used for a residue management study (see study FLPMC-07RNGE-igS).

Another accession, 9060120 from Santa Rosa Co., flowered several weeks before any of the other accessions tested and was to be maintained as a single line, but its long-term performance was poor, so these plants were destroyed.

The remaining twenty-one superior lopsided indiangrass accessions (Table 8) were planted together to form a composite (9060565). In 2002, seed was collected from all plots of the 21 accessions in the initial evaluation planting and used to establish seedlings for the foundation field. An additional foundation field will be planted in 2007 to increase seed production capability. It is expected that at least three years will be required to produce enough foundation seed for advanced evaluations and eventual release. No seed was harvested from this field in 2006 because it was lost when a storm with high winds hit just as the seed was maturing.

Table 8. Twenty-one superior accessions of lopsided indiangrass planted in a polycross nursery at the USDA, NRCS PMC in Brooksville, FL in 2001.

Accession No.	County	Accession No.	County
9059725	Citrus	9060173	Lake
9059727	Citrus (Ft. Cooper St. Park)	9060182	Madison
9060105	Osceola	9060184	Hamilton
9060110	Sarasota (Myakka St. Park)	9060187	Desoto
9060118	Okeechobee	9060199	Citrus
9060128	Desoto	9060207	Orange
9060133	Desoto	9060208	Hernando
9060137	Desoto	9060209	Citrus
9060146	Manatee	9060210	Hernando
9060147	Manatee	9060351	Dixie
9060168	Levy	----------	----------

Future Research Needs: At this point, we anticipate that we will release 9060565 and 9060564. Once foundation seed has been increased, advanced evaluations may need to be conducted around Florida to determine performance and adaptability. One problem encountered at the PMC is that seed production fields tend to thin out after several years of harvesting. We are currently conducting a residue management study using accession 9060564 (see study FLPMC-07RNGE-igS) and depending on the results of this study, additional testing may be needed on this topic. Other possible areas of study may include irrigation management and inoculation of seedlings with beneficial organisms, such as mycorrhizae.

Blue Maidencane [*Amphicarpum muehlenbergianum* (J.A. Schultes) A.S. Hitchc.] (FLPMC-P-9604-WE)

Objective: To evaluate, develop, and release a Florida native germplasm of blue maidencane for conservation use.

Study Stage: An accession has been selected and it is being increased for release next year.

Introduction: Blue maidencane is a native, warm-season perennial rhizomatous grass distributed throughout Florida and coastal areas of Georgia and South Carolina. Locally, blue maidencane is called goobergrass because its small seeds are produced in the ground like a peanut. It is adapted to acid or neutral sandy soils that are wet for part of the year. It grows in sloughs and intermittently ponded areas in flatwoods sites and has great potential for use in wetland restoration plantings (CP 659, 646) and in constructed wetlands and effluent spray fields for wastewater treatment. Cattle preferentially graze this species, which produces high quality forage. Because it often forms solid stands, it is important for erosion control (CP 322, 580, 397, 390) and maintaining water quality in fresh water systems.

Progress: From 1996 through 1998, a total of 157 accessions of blue maidencane were collected from throughout the state of Florida in the form of root and shoot stock. Initial evaluation plots were planted at the PMC in March of 1999. Because this species spreads aggressively by rhizomes, plots could only be evaluated for one year before accessions began growing together. Eleven superior accessions were selected for advanced evaluation. Accessions 9059859, 9060309, and 9060311 were similar in their performance ratings and come from the same basic location, so they were combined in one tub and given the accession number 9060489. Accessions 9059866, 9060066, and 9060067 were also combined to form accession 9060490 for the same reasons. In March of 2000, rhizomes of these thirteen accessions (Table 9) were planted in tubs for increase. The plants in the tubs were examined in 2005, and 9059971 was chosen for release because of its superior stand persistence.

Table 9. Eleven superior blue maidencane accessions selected for advanced evaluation and increase and at the USDA, NRCS PMC in Brooksville, FL.

Accession No.	County	Collector
9059859	Pasco	Deal/Pfaff
9060309	Pasco	Deal/Pfaff
9060311	Pasco	PMC
9060489	**Composite**	
9059866	Charlotte	PMC
9060066	Sarasota (Myakka State Park)	Perry/Lackmann
9060067	Sarasota (Myakka State Park)	Perry/Lackmann
9060490	**Composite**	
9059869	Palm Beach	PMC
9059956	Madison	PMC
9059971	Citrus	PMC
9060008	St. Johns	PMC
9060295	Polk	PMC

Future Research Needs: The release document for this selection will be completed in 2007 and this study will be completed at that time. Little further research is probably required; however, additional field plantings could be made throughout the species' native range to determine the range of adaptation of this release. Testing for herbicide tolerance could also be conducted to assist potential commercial producers of this plant release. Forage quality determinations may be required if livestock producers express an interest in commercially planting this species for forage production.

Eastern Gamagrass [*Tripsacum dactyloides* (L.) L.] (FLPMC-P-9605-RA)

Objective: To evaluate, develop, and release one or more accessions of eastern gamagrass for conservation use in the lower Southeast.

Study Stage: Final selections have been made and seed increase should take two or three more years.

Introduction: Eastern gamagrass is a warm-season perennial bunchgrass with a broad area of distribution throughout the U.S., including all of the southern states. It has received a great deal of attention in recent years because of its tremendous forage production potential. It typically grows in moist fertile sites, and is often found lining the edges of canals and freshwater bodies in Florida. Florida ecotypes are markedly different than strains from other states, in terms of growth and winter dormancy characteristics, so the commercially available selections are poorly suited for use here. As a consequence, there is a demand in Florida for commercial seed sources of local ecotypes for pasture and rangeland improvement (CP 512, 550) and for planting in buffer strips (CP 393, 386, 601) to provide wildlife food and cover (CP 645).

Progress: From 1996 through 1998, an assembly of Florida eastern gamagrass accessions was evaluated for their forage and seed production characteristics. Four accessions were selected with superior performance in these two categories; they were 9059213 (Clay Co.), 9059264 (Dixie Co.), 9059266 (Polk Co.), and 9059287 (Citrus Co.). All four accessions are apomictic and will not out-cross. Initial seed increase plots of these eastern gamagrass accessions were planted at the PMC in 1999. Seeds were collected by hand from these plots in 2000 and 9059287 produced the most seed, with 9059266 ranking second. Advanced evaluation plots were planted at sites in Collier Co., Polk Co., and Hamilton Co. in 2000 and in Madison Co. in 2001. These plots were evaluated in 2001, but staffing reductions at the PMC did not allow data collection for the additional two or more years that were planned. Despite this, it was determined that accession 9059266 appears to be the superior candidate for release due to its vigor, uniform appearance, and higher than average seed production.

Future Research Needs: Seed increase needs to occur in preparation for release, which was complicated in the past by the fact that the PMC did not have a functional combine, a need which was remedied in 2006 by the purchase of a John Deere 9560 combine. However, the irregular irrigation status at the PMC severely affected this moisture-loving species and no significant amounts of seed could be harvested this year.

Additional advanced demonstration plantings in Florida and possibly outside the state would confirm the forage production potential of this accession and determine its range of adaptation. Also, grazing trials need to be established throughout the area of probable use of this release to gather critical management information. If seed production of this species is to become economical, field management recommendations need to be developed, especially for issues such as fertility and plant spacing (see study FLPMC-T-0106-RA).

Intercenter Strain Trial Florida Paspalum (*Paspalum floridanum* Michx.) (ETPMC-P-0463-WL)

Objective: To determine the area of adaptation for accession 9043874 (Harrison Florida paspalum Select Germplasm), a release from the East Texas Plant Materials Center (ETPMC), in the southern U.S. The information gathered from this study will be used to support elevation of Harrison select germplasm to cultivar status.

Study Stage: This is the third year for this advanced evaluation.

Introduction: Florida paspalum is a native warm-season perennial grass. This grass produces a large seed that is eaten by gamebirds (CP 645). Florida paspalum is adapted from New Jersey, throughout the southeastern United States, the Midwest, and east Texas. However, the specific adaptation area of accession 9043874 has not been determined. This accession was collected from Harrison Co., Texas by NRCS personnel, Ross Brown and Paul Leggett. This accession was evaluated against other Florida paspalum accessions at the East Texas PMC. It is the only named release of this species.

Progress: Rod rows were planted in the spring of 2004 at the participating PMCs, which are TXPMC (Knox City, TX), STPMC (Kingsville, TX), MSPMC (Coffeeville, MS), FLPMC (Brooksville, FL), GAPMC (Americus, GA), and ARPMC (Booneville, AR). Seed was distributed by ETPMC in 2004. Rod rows were to be planted and managed according to practices used at the individual PMCs. Staff at each location were expected to collect data as noted on the accompanying evaluation form and provide this to ETPMC on an annual basis. Stand vigor was fair and density was good in the establishment year (2004) at this PMC, which is amazing because we were affected by four hurricanes in that year. However, there were establishment problems at the other PMCs. Therefore, additional seed was distributed for replanting in 2005 and plots were replanted at the other locations as necessary. Stand data was provided to ETPMC from this location in 2005 as requested. In subsequent years, weed growth has been an issue in the rod-row at this PMC. No data was provided to ETPMC in 2006; however, the row is still present and will be re-examined in 2007.

TECHNOLOGY DEVELOPMENT STUDIES

Lopsided Indiangrass Residue Management Study (FLPMC-07RNGE-igS)

Objective: To determine how residue management methods (clipping or burning) affect viable seed production and stand persistence of lopsided indiangrass.

Study Stage: This residue management study was scheduled to be completed in 2006; however, due to unavoidable problems it must be extended to 2007. At the completion of this study, this field will become a foundation-class production block for this accession.

Introduction: Lopsided indiangrass is an important component of native uplands in Florida. It produces fairly large amounts of seed and has established well in critical area plantings (CP 342) and on reclaimed mined lands (CP 543, 544). Unfortunately, seed production plots on irrigated sites at the Brooksville PMC have been very short-lived, lasting only about three years. This lack of persistence presents problems to potential seed producers of lopsided indiangrass. Treatments being examined in this study were designed to reduce plant residues that can physically interfere with plant growth and/or harbor pathogens that can result in plant death.

Progress: Residue management treatments were imposed on the composite accession 9060564 polycross nursery which was planted 21 February 2001, using seedlings grown in 6" containers. All plots were fertilized annually with approximately 50 lb/ac of 10-10-10 in June. Winter burn treatments were applied on 15 January 2006, before plants began spring regrowth, and winter clip treatments were also applied at this time. Summer clip treatments were applied on 9 June 2006, prior to production of reproductive tillers. Plant counts were taken at this time (Table 10). There were no differences found between the treatments in plant survival. The malfunctioning of the PMC irrigation system was a boon to this particular species, because it is favors drier upland sites, so the plants in the plots were quite vigorous. However, a bad storm knocked all the seed off of the plants as it was maturing, preventing the required seed harvest. This will necessitate an additional year of testing to gather the required data to make production recommendations for lopsided indiangrass.

Table 10. Plant counts recorded 9 June 2006 at the USDA, NRCS PMC, Brooksville, FL for lopsided indiangrass treatments given various residue management treatments.

Treatment	Number of plants[1]
Winter Burn	61
Winter Clip	60
Summer Clip	56
	NS[2]

[1] There were 100 plants originally planted in each plot.
[2] NS – Not significant at $P<0.05$.

Future Research Needs: Further research into fertility and irrigation management may also improve productivity. Also, testing for pathogens may be warranted to determine if the stand persistence problems can be linked to a disease organism(s).

Eastern Gamagrass Row Spacing and Fertility Study (FLPMC-T-0106-RA)

Objective: To determine the optimum row spacing and fertility level to maximize seed production of a Florida ecotype (accession 9059266) of eastern gamagrass grown on a site at the PMC.

Study Stage: One additional year of seed harvesting remain in this study.

Introduction: Eastern gamagrass is a large, native, bunch grass that is well adapted for erosion control (CP 386, 601) and pasture and range plantings (CP 512, 550). Florida ecotypes being studied at the PMC have not produced seed yields that are comparable to those reported for ecotypes grown in other parts of the U.S. Since the Florida ecotypes are larger, more robust plants, they may require a wider row spacing than those used commercially for other ecotypes of eastern gamagrass. In this study, 2', 4', 6', and 8' row spacings will be utilized, with a 3' spacing in the row for all treatments (7260, 3630, 2420, and 1815 plant/ac, respectively). Each plot consists of a single row of 6 plants, with appropriately spaced border rows between each plot.

Also, the effect of fertility on eastern gamagrass seed production has not been thoroughly studied. It is anticipated that the plants require nitrogen to sustain adequate plant growth for seed production; however, excess nitrogen may negatively affect seed production by favoring vegetative growth. Fertilizer rates used in this study were 0, 50, 100, and 200 lb/ac N applied as 10-10-10 on all row spacing treatments at spring greenup.

Progress: Plots could not be burned to remove plant residue due to the burn ban in place during the spring of this year. A green harvester was run over the plants to cut them to approximately 6" in height and the residue was carried off the plots. This took considerably more time and is not as effective as the burning operation that is typically used. The fertilizer treatments were applied on 12 May 2006. Tiller counts were made on three randomly selected plants in each plot row on 21 June to 23 June 2006 (Table 11). There was no effect of any of the treatments on the number of fertile tillers recorded; however, there was a significant interaction between row spacing and fertilizer rate on vegetative tiller production. Tiller counts increased as the row spacing increased, which is expected because the plants at the closest spacing were very crowded. However, plants at the closest spacing responded more favorably to the higher fertilizer rates than those at the wider spacing, which indicates that fertilizer was able to counteract some of the effects of the crowding.

Seed stalks in the study plots were hand cut to simulate a combine harvest on 28 August and 29 August 2006. The number of plants that were harvested was recorded so that seed yields per plant could be calculated. Seeds will be removed from the stalk and weighed to estimate total yields that could be expected from the combine (Average Yield). Then the seed will be run through a South Dakota seed blower to remove inert matter and empty and poorly-filled seeds to estimate yields that could be expected following screen cleaning and finish cleaning using a gravity separator or air-fractionating aspirator

(Average Clean). Seed germination tests will then run on the seed lots using standard germination testing methods.

Table 11. Number of fertile and vegetative eastern gamagrass tillers recorded June 2006 for individual plants planted at different row spacings and given different rates of fertilizer at the USDA, NRCS Plant Materials Center, Brooksville, FL.

Row Spacing	Fertilizer Rate	No. Fertile Tillers	No. Vegetative Tillers
--------ft--------	-------lb/ac N-------		
2	0	0	22
	50	0	29
	100	0	47
	200	0	39
4	0	1	36
	50	0	52
	100	1	58
	200	2	76
6	0	2	40
	50	3	78
	100	4	86
	200	2	77
8	0	3	55
	50	3	65
	100	3	79
	200	2	78
Mean		2	58
LSD (0.05)		NS[1]	43

[1] NS – Not significant at P<0.05.

Processing the seed and running germination tests for the 2006 seed harvest has not been completed in time for inclusion here. However, results from the 2005 seed harvest are reported below (Tables 12-14). The only treatment that affected the average yield and cleaned seed yield was row spacing (Table 12). For average seed yield, there was a significant increase in seed yield between the 4 and 6 foot spacing, with the yield for the two closest (2 an 4 foot) and the two widest (6 and 8 foot) row spacings being similar. In contrast, the trend for cleaned seed yield was to double with row spacing up to the 6-foot row spacing. But when yield of cleaned seed was expressed on a per acre basis, the effect of row spacing was similar to that of average seed yield with two lowest and the two highest row spacings having similar yields (Table 12). Since tiller counts were not made in 2005, there is no way to determine if higher yields were due to an increased number of fertile tillers per plant or if they resulted from an increase in the number of seeds produced per fertile tiller. If the 2006 data are comparable to the data recorded in 2005, increased number of tillers per plant would most likely be the case.

Table 12. Seed yields from individual eastern gamagrass plants planted at different row spacings and given different rates of fertilizer harvested August 2005 at the USDA, NRCS Plant Materials Center, Brooksville, FL.

Row Spacing	Average Yield[1]	Average Clean[2]	Clean Yield/Acre[3]
-----ft-----	----------g----------		-----lb-----
2	11.2	5.3	84
4	23.7	10.5	84
6	42.3	20.6	110
8	49.3	24.3	97
Mean	31.6	15.2	
LSD (0.05)	17.9	8.7	

[1] Average yield is the amount of seed harvested expressed on a per plant basis.
[2] Average clean is the seed lot above cleaned using a South Dakota seed blower.
[3] Estimated yield based on 7260, 3630, 2420, and 1815 plants per acre population for 2, 4, 6, and 8 foot row spacing, respectively.

Table 13. Percentage of eastern gamagrass seeds from the 2005 seed harvest of the row spacing/fertilizer rate study that were retained after treatment with the South Dakota seed blower.

Row Spacing	Fertilizer Rate	Good Seed[1]
--------ft--------	-------lb/ac N-------	----------%----------
2	0	59
	50	48
	100	42
	200	42
4	0	57
	50	39
	100	43
	200	39
6	0	59
	50	47
	100	47
	200	43
8	0	56
	50	48
	100	47
	200	44
Mean		48
LSD (0.05)		9

[1] Cleaned yield for each treatment divided by average yield for that treatment multiplied by 100.

When considering only the percentage of "good" seed, calculated by dividing the cleaned seed yield for each treatment by the average seed yield for that treatment and multiplying by 100, there was an interaction between row spacing and fertilizer rate (Table 13). The main thing to note is that the lowest rates of fertilizer produced the highest percentage of

seeds that were heavy and remained in the bottom of the South Dakota seed blower. This is likely due to a more uniform ripening pattern of the plants that had no fertilizer applied to them. There was no effect of any of the treatments on germination (Table 14), which shows that we did a fairly consistent job of cleaning all the seed lots so they contained equivalent numbers seeds that were capable of germination.

Table 14. Germination percentages of eastern gamagrass seeds from the 2005 seed harvest of the row spacing/fertilizer rate study.

Row Spacing	Fertilizer Rate	Germination
---------ft---------	-------lb/ac N-------	----------%----------
2	0	18
	50	18
	100	16
	200	13
4	0	19
	50	11
	100	20
	200	19
6	0	18
	50	18
	100	22
	200	22
8	0	18
	50	19
	100	21
	200	22
Mean		18
LSD (0.05)		NS[1]

Future Research Needs: All plants in this study were planted using the same in row spacing, so variation of in spacing between plants in the row may be another factor to study. Also, planting in closely spaced double rows with wider spacing between sets of rows may be an alternative spacing regime that should be explored. Further research may be warranted on the best timing of the fertilizer applications. Some literature has reported that yields may be improved when plants have ample fertilizer in the fall.

Forage Bermudagrass [*Cynodon dactylon* (L.) Pers.] Pasture Contamination (FLPMC-T-0602-PA)

Objective: To explain and quantify the phenotypic changes that have been noted in hybrid bermudagrass cultivars in Florida and Georgia.

Study Stage: The final year of a three year study.

Cooperators: Sam Coleman, USDA, ARS, Subtropical Agricultural Research Station, Brooksville, FL, and Bill Anderson, USDA, ARS, Crop Genetics and Breeding Unit, Tifton, GA.

Introduction: The subtropical climate of Florida is characterized by hot, wet summers and dry and winters with occasional freezes. Providing enough forage to maintain livestock through this dry winter season is one of the major cost factors affecting livestock producers. The staple forage in this section of the county is bahiagrass (*Paspalum notatum* Flugge); however, its quality declines later in the summer as the plant matures. This has resulted in increased interest in hybrid bermudagrasses for summer forage production and to provide hay for winter feeding.

Progress: Plots of ten varieties of improved bermudagrasses were established vegetatively in August, 2002. Sprigs of Tifton 85, Coastal, Tifton 44, Tifton 78, Tifton 68, and Coastcross 2 (radiation induced mutant from Coastcross 1) were supplied by scientists at the ARS facility in Tifton, GA. Dr. Carrol Chambliss (deceased), agronomist from the University of Florida supplied planting material for Coastcross 1 and an "improved" selection out of Alicia. Traditional Alicia was provided by a Sumter county hay producer, and the Florida strain of Tifton 44 (from here on called Florida 44) from a local farmer near Brooksville, FL. All varieties were established in 6 x 15' plots. Harvesting was initiated on 21 May 2004, 3 May 2005 and early May 2006 and continued at 28-d intervals. Table 15 shows the yield and forage quality data for the 2004 and 2005 harvests. At the beginning of the growing season and after each harvest, plots were fertilized with a complete 16-4-8 to supply 110 lb N per acre.

Tifton 44 produced the least amount of dry matter, protein, and digestible dry matter (Table 15). This variety is the true Tifton 44, planting material obtained from certified plots in Tifton, GA. It is quite a contrast to what we are calling Florida 44, a popular variety that has been promoted in Central Florida as Tifton 44. Florida 44 was one of the higher producing varieties, especially during the early spring (Table 15). This work clearly shows that Tifton 44 and Florida 44 are distinct lines of bermudagrass based on total yield, seasonal distribution of the yield, and disease resistance (data not reported). What happened to the certified Tifton 44 between the time it was planted in Sarasota and planting material came to Hernando County is unknown. It is possible that there was other bermudagrass material in the area and the two (or more) crossed. At any rate, DNA analysis has shown that Florida 44 is genetically different from Tifton 44.

Preference for variety would depend on expected use. Tifton 85 clearly produces more forage and is as high in quality as any other, except for its parent Tifton 68. However, if cut for hay, at least one more day is required to dry due to the large stem. Coastal, Alicia and Florida 44 are the varieties of choice for haymaking when targeting the horse hay market.

Table 15. Total dry matter, crude protein, and digestible dry matter yield and average % crude protein and digestibility of different bermudagrass cultivars or experimental lines cut at 28-d intervals over 2 years.[1]

Variety	Yield	Crude Protein	Protein Yield	In vitro DM Digestibility	Dig. DM Yield
	----lb/ac----	------%------	-----lb/ac-----	--------%--------	-----lb/ac-----
Alicia	16,053	15.5	2455	48.7	8058
Coastal	15,761	14.9	2299	48.9	7777
Coastcross 1	15,593	17.1	2560	54.6	8415
Coastcross 2	14,483	17.4	2481	54.7	8005
Florida 44	16,186	15.5	2463	52.9	8603
Tifton 44	10,758	14.9	1676	52.1	6110
Tifton 68	16,760	16.6	2739	56.1	9516
Tifton 78	14,264	15.8	2217	50.7	7361
Tifton 85	19,442	16.1	3085	52.2	10,200
Improved Alicia	15,864	15.7	2453	53.6	8484
SE[2]	674	0.24	112	0.87	394

[1] Harvests from May through October.
[2] Standard error of the mean.

Future Research Needs: Educational programs are needed to help horse producers better understanding of the nutritional value of different hays, so that they will ask for and pay premium prices for higher nutritional hays.

PLANT MATERIALS RELEASED BY THE BROOKSVILLE PMC

Year	Species	Cultivar*	Cooperating Agency
1962	*Lupinus elegans* (Mexican lupine)	Armex	
1978	*Hemarthria altissima* (Limpograss)	Bigalta	Univ.FL-IFAS
1978	*Hemarthria altissima* (Limpograss)	Greenalta	" " "
1978	*Hemarthria altissima* (Limpograss)	Redalta	" " "
1978	*Arachis glabrata* (Perennial peanut)	Florigraze	
1985	*Arachis glabrata* (Perennial peanut)	Arbrook	FL Agri. Exp. Sta.
1990	*Spartina patens* (Marshhay cordgrass)	Flageo	GA PMC & Fort Valley Agric. College
1991	*Helianthus debillis* (Beach sunflower)	Flora Sun	
1992	*Panicum amarum* (Bitter panicum)	Northpa Southpa	
1994	*Spartina patens* (Marshhay cordgrass)	Sharp	GA PMC
1995	*Zea mexicana* (Mexican teosinte)	Chapingo	
1996	*Panicum virgatum* (Switchgrass)	Miami Germplasm	
1996	*Panicum virgatum* (Switchgrass)	Wabasso Germplasm	
1996	*Panicum virgatum* (Switchgrass)	Stuart Germplasm	
1998	*Panicum hemitomon* (Maidencane)	Citrus Germplasm	
2000	*Tripsacum dactyloides* (Eastern gamagrass)	Martin Germplasm	
2000	*Tripsacum dactyloides* (Eastern gamagrass)	St. Lucie Germplasm	
2002	*Arachis glabrata* var. *hagenbeckii* (Perennial peanut)	Brooksville 67 Germplasm	
2002	*Arachis glabrata* (Perennial peanut)	Brooksville 68 Germplasm	
2003	*Liatris elegans* (Blazing star)	Floral Passion Germplasm	
2002	*Arachis glabrata* (Perennial peanut)	Brooksville 68 Germplasm	
2003	*Liatris elegans* (Blazing star)	Floral Passion Germplasm	
2006	*Andropogon glomeratus* var. *glaucopsis* (Purple bluestem)	Ghost Rider Germplasm	
2006	*Muhlenbergia capillaris* (Hairawn muhly)	Morning Mist Germplasm	

* 'Artex' Texas millet (*Urochloa texana*), 'Orlando' blue lupine (*Lupinus angustifolius*), and F-149 American joint vetch (*Aeschynomene americana*) to be officially discontinued in 2006 due to lack of commercial production. 'Redalta' and 'Greenalta' limpograss are scheduled to be discontinued in 2007 for a similar reason.

PUBLICATIONS AVAILABLE FROM THE BROOKSVILLE PMC AND THE FLORIDA PLANT MATERIALS SPECIALIST

1997	Technical Note No. 35: Collecting Plant Materials
1997	Plant Materials Program Fact Sheet
1997	Florida Native Plant Collection, Production and Direct Seeding Techniques: Interim Report
1998	Forage Species on Sprayfields – Fact Sheet
2000	Fact Sheet: Gully Stabilization in North Florida
2002	Development of Seed Sources and Establishment Methods for Native Upland Reclamation – Final Report
2002	Florida Native Seed Production Manual
2003	Plant Materials Center, Brooksville, Florida - Visitor Information
2005	Plant Materials Resource List
2006	Ghost Rider Purple Bluestem: A New Conservation Plant with Potential for the Gulf Coast
2006	Brooksville Plant Materials Center: Developing Sources of Native Grass Seed for Revegetation in Florida
Various	Annual Progress Report of Activities
Various	Annual Technical Report
Various	Biannual Newsletter: Sunshine State's PMC Impact
Various	Planting Guides on Released Materials