Brooksville, Florida Plant Materials Center





Year 2002 Annual Technical Report

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Cover Pictures: Lopsided indiangrass, Muhly grass, Gayfeather, Yellowtop, Wildlife

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MISSION AND MAJOR OBJECTIVES

The mission of the Plant Materials Program is to provide timely and effective vegetative solutions for identified resource needs. Superior accessions of adapted plants are developed, tested and released to commercial growers along with production and management methodology. Plant materials and state-of-the-art plant science technology are promoted to assist in conservation of natural resources and meeting the objectives of environmental programs. The use of native plant materials is emphasized. The following are major objectives of the Brooksville Plant Materials Center (PMC):

- 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 project plan. Collections are made from a wide area within the occurrence of the species to insure diversity of ecotypes and variability within a species.

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 if it suits the purpose.

Advanced Evaluations - Intensive testing of selected plants that were superior in one or more attributes during the initial evaluation process. Cooperating agencies or other PMC's are encouraged to participate in this process. Plantings in areas where climatic conditions are significantly different than the PMC aids in determining 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 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, tested, cultivar, and germplasm releases require less stringent evaluation and speed the release process.

SOILS

Soil at the Florida PMC is predominately Kendrick Loamy Fine Sand. Other types of soil at the Center consist of 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

Florida weather conditions during the early months of 2002 were among the driest on record. Once again, high spring temperatures and dry conditions caused wildfires throughout the state. Rain did not begin falling regularly until June; however, amounts were well below normal averages. Total rainfall for the year was 65.85 inches.

Table 1. Year 2002 total monthly rainfall.

Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
4.02	2.75	2.33	3.47	1.63	11.48	12.58	9.97	4.52	2.22	1.97	8.91	65.85

The last frost occurred on February 28. The first frost occurred on November 23. There were 347 frost-free days in 2002. The lowest temperature recorded at the Florida PMC in 2002 was 24° F, which occurred on January 9.

Table 2. Year 2002 average monthly high and low temperatures.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
74	73	81	87	90	88	91	90	90	87	77	71
49	46	54	62	64	70	71	72	73	65	51	43

INITIAL EVALUATIONS

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

Project Stage: Establishment year of 3 to 4 years of initial evaluation and genetic selection. Increased and advanced evaluation phases are expected to take 5 or more years.

Cooperators: K. Quesenberry, Department of Agronomy, University of Florida, Gainesville, and M. Williams, USDA, Agricultural Research Service, Subtropical Agricultural Research Station, Brooksville, FL.

Introduction: Switchgrass has excellent potential for use in revegetating reclaimed minedlands and native areas, providing high quality livestock forage and wildlife food, controlling erosion and improving water quality. There are a few commercially available cultivars of switchgrass, such as Alamo, that are adaptable to Florida conditions. However, in initial studies, Florida ecotypes appear to have better performance than those from other states. The primary problem hindering development of a Florida cultivar of switchgrass has been poor seed production.

Objective: Develop one or more strains of Florida switchgrass with high seed production capabilities, and 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.

Progress: During the fall of 2000, a total of 88 accessions were collected from 42 counties in Florida in the form of plants and also seed if it was available. Sixteen accessions had been collected previously, so that the final assembly totaled 104 accessions. Seed was available from 80 accessions, and was planted in 6" cone trays in the greenhouse in December of 2000. Transplants of 104 accessions (originating from seed or from original plants if seed was not available) were planted in a crossing block at the PMC on August 2, 2001. Five plants were planted from each accession in a randomized complete block design. In the fall of 2003, each plant is to be evaluated for growth characteristics, and seed samples taken. Seed from the top 20% of superior performers will be used to establish the next generation in the selection cycle.

Growth characteristics in the assembly are highly diverse. Differences, especially in biomass production, are probably due to differences in ploidy level. Higher ploidy levels are known to have a more robust growth habit. An attempt was made, through the assistance of Dr. Quesenberry, to identify ploidy levels of several accessions. However, chromosomes were relatively small and exact counts could not be made. As time permits, more attempts will be made to determine if there are indeed differences in ploidy level between the various accessions.

Future Research Needs: Once a superior cultivar is developed, it will need to be tested for performance and adaptation in Florida, and surrounding states, prior to release.

Wiregrass (*Aristida stricta*) (FLPMC-P-0337-WO)

Project Stage: Develop new project plan and assemble genetically diverse accessions.

Introduction: Wiregrass is a warm-season perennial bunchgrass distributed throughout Florida and the southern portions of Mississippi through North Carolina. 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 resistant 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. Livestock readily graze new growth after a burn. Wiregrass also provides cover and nesting sites for wildlife. It does produce fair quantities of seed if old residues are removed during the growing season.

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

Progress and Future Research Needs: Results from previous work with wiregrass and consultations with plant breeders suggest that viable seed production could be rapidly improved in this species using genetic selection. Large assemblies of wiregrass plants from several stable populations (e.g., parks or preserves) need to be gathered to form the base population from which these selections are to be made. Collections of these species will begin in the spring of 2003. Once an assembly is established, individual plants will be evaluated for seed production, seed quality, and growth characteristics.

Hairawn Muhly (*Muhlenbergia capillaris*) (FLPMC-P-9236-RA)

Project Stage: The second and final year of initial evaluation. Accessions with ornamental potential were selected for vegetative increase. Accessions with seed production potential were selected for placement in polycross nurseries to develop varieties with high seed production. Variety development and advanced evaluation for seed producers are expected to take 7 or more years. Ornamental varieties increased vegetatively may be released within 2 to 3 years.

Introduction: Muhly is a hardy warm-season perennial bunchgrass distributed throughout Florida and several states in the southeastern U.S.A. 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, muhly looks very similar to wiregrass, and fills the same roll. Livestock and wildlife graze early growth. In native communities, it provides fuel for understory burn management programs and cover for wildlife. Because of its attractive purple inflorescence, it is becoming very popular for use in buffers, highway beautification and as a xeriscape ornamental. It is known to produce viable seed, but more information is needed on pollination methods and seed production characteristics.

Objective: To evaluate, develop, and release Florida native varieties of hairawn muhly for conservation use, especially erosion control, native area restoration, xeriscapes, and wildlife cover.

Progress: Ten accessions with superior viable seed production and growth characteristics were selected for placement in a polycross nursery to develop a composite variety with high seed production. Two other accessions were also identified with consistently high seed viability in 2000 and 2001. These accessions are 9060304, collected from Jackson Co., and 9060428, collected from Bradford Co. They are much smaller and bloom a month earlier than most other collections in the assembly. These 2 accessions will be placed in isolation to increase the seed for advanced evaluation.

In addition to development of seed producing strains, 11 accessions were also selected for ornamental potential. These types had superior bloom and foliage attributes that would make them valuable for use in roadside, buffer strip, and xeriscape plantings. They are to be increased vegetatively for advanced evaluation.

Future Research Needs: Once superior accessions have been increased, they are to be placed in advanced evaluation studies throughout Florida, and possibly in other states. Advanced testing of ornamental selections could occur within 1 to 2 years if enough material is available. Development of seed producing cultivars could take between 3 and 5 years before material is available for advanced evaluations. Other studies need to include testing pesticides for use in controlling aphids on seedheads. Seeding studies will also need to be conducted in order to develop successful seed establishment technology for hairawn muhly.

Lopsided Indiangrass (*Sorghastrum secundum*) (FLPMC-P-9602-RA)

Project Stage: Development of composite varieties for foundation seed stock. The development and increase phases are expected to take 4 years of the remaining 7 to 8 years of this project.

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 grass species on native uplands in Florida. It is a warm-season perennial bunch grass, adapted to a wide variety of soils and hydrology regimes. It produces good quality livestock forage and is important for erosion control and also wildlife habitat. Lopsided indiangrass has good seed production and seedling vigor compared to other Florida native species.

Objective: To evaluate, develop, and release native Florida variety of lopsided indiangrass for conservation uses, especially for erosion control, native area restoration, and wildlife cover.

Progress: In 2002, seed was collected from all plots and used to establish seedlings for a foundation field. These seedlings from the composite (9060565) are currently being raised in the greenhouse. They will be put into a field for foundation seed harvest in the spring of 2003. Any additional seed produced by these blocks in 2003 or 2004 should also be collected and held in long-term storage for reestablishment of foundation fields. It is expected that at least 3 years will be necessary to produce enough foundation seed for advanced evaluations and eventual release.

Future Research Needs: Once foundation seed is increased, advanced evaluations may need to be conducted around Florida to determine performance and adaptability. Further studies also need to be conducted to find ways to increase the longevity of production fields. Possible areas

of study may include further residue management trials and inoculation of seedlings with protagonistic organisms, such as mycorrhizae.

Chalky Bluestem (*Andropogon glomeratus* var. *glaucopsis*) (FLPMC-P-9601-RA)

Project Stage: Development of a composite variety. Development and increase of a composite is expected to take another 3 years. Advanced evaluation is expected to require another 3 to 5 years before the material is released.

Introduction: Chalky bluestem is a native warm season perennial bunchgrass distributed throughout Florida, southern North Carolina, South Carolina and 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 and is thought to be one of the most palatable native grasses on flatwoods sites. It is also an important plant for upland water quality and erosion control. Chalky bluestem is a prolific seed producer, and will readily colonize disturbed areas in wet flatwood sites.

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

Progress: Ten superior accessions were selected for increased and advanced testing. Seed from original collections stored in the seed cooler was used to start seedlings in the greenhouse in April of 2000. In February of 2001, these ten accessions were randomly planted together on an irrigated, poorly drained site to form a composite (9060565). Seed was collected with the Flail Vac in November of 2002. Average germination was 52% with 13 lb/A being collected.

Seed needs to be collected again from this nursery for the next 1 to 2 years, to obtain enough material for planting foundation fields. Extra seed should be stored in long-term storage to maintain stocks for future generations. It is expected that it will take 3 years to obtain enough seed from the foundation field for advanced evaluations and eventual release.

Future Research Needs: Once seed is available, the new cultivar needs to be tested for adaptation and performance throughout Florida, and possibly other states. Seed conditioning and seeding methodology also need to be developed for this species to insure establishment success.

Hairawn Muhly *(Muhlenbergia capillaris)* (FLPMC-P-0201-UR)

Project Stage: Plants of selected accessions were planted at 3 locations around the state in 2002. Cooperators have agreed to water and weed plants as necessary. Plots were evaluated in the fall of 2002 and in 2003. Top performers will be released onto the commercial market.

Introduction: Hairawn muhly is a perennial native Florida bunchgrass. It grows 1 to 4 feet in height, depending on ecotype, and produces very showy seedheads that range in color from pink to purple. A rare white bloomed type has also been found in some populations. Hairawn muhly is becoming very popular in xeriscape plantings along roadsides and urban areas. Eleven accessions with desirable ornamental qualities were selected in an initial evaluation study of an assembly of hairawn muhly at the Brooksville PMC.

Objective: Determine the range of adaptation of 11 accessions of hairawn muhly in Florida in low maintenance settings. Evaluation is to include performance, ornamental qualities, and plant persistence in 3 different climatic zones on different soil types.

White Muhly *(Muhlenbergia capillaris)* (FLPMC-P-0102-U) Cultivar Development

Project Stage: To increase these plants in preparation for release.

Introduction: A white bloomed muhly was found in a native population of pink bloomed plants. This white variety has tremendous potential for use in the commercial landscaping industry, especially for xeriscapes. However, seedling vigor decreased when the white variety was grown in isolation, possibly because of inbred depression. Tests were conducted to determine pollination mechanisms. It appears that white blooms occur because of a recessive gene. White bloomed types also have lower vigor than pink bloomed types, and almost all seed is sterile when plants are forced to self -pollinate. Therefore, this accession needs to be released as a vegetatively propagated cultivar.

Progress: Adaptation studies were initiated in 2002, along with the ornamental muhly advanced evaluation project.

Future Research Needs: To increase this accession for commercial release.

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

Project Stage: To develop a variety of Florida annual phlox (*Phlox drummondii*) with unique flowers.

Introduction: Seed collected in 2001 was planted into trays in the PMC greenhouse in 2002. When the seedlings emerged, many of them had unique flower patterns, shapes, and colors, although there were also some common types. Seedlings were put in the shadehouse in the spring, so that natural pollinators could access them. All types were allowed to cross, and seed was hand collected as it ripened.

Objective: To develop a culitivar containing these unusual flower types.

Progress and Future Needs: Seed collected from the shadehouse in 2002 was planted into trays in the greenhouse in November of 2002. Once seedlings are large enough, they will be separated and planted into 6" pots. After the danger of frost is past, they will be placed in the shadehouse. Once plants bloom, common types will be pulled out so they will not cross with the unique types. Seed will be hand collected as it ripens. Collected seed will then be planted into trays in November of 2003 and the process outlined above will be repeated. These cycles will be continued until adequate seed is available for commercial release.

ADVANCED EVALUATIONS

Blue Maidencane (*Amphicarpum muhlenbergianum*) (FLPMC-P-9604-WE)

Project Stage: Increase of superior accessions and advanced evaluation. Advanced evaluations are expected to take 3 to 4 more years.

Introduction: Blue maidencane is a native, warm-season perennial rhizomatous grass distributed throughout Florida and coastal areas of Georgia and South Carolina. 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 range sites. Cattle preferentially graze this species, which produces high quality forage. Because it often forms solid stands, it is important for erosion control and maintaining water quality in fresh water systems.

Objective: To evaluate, develop, and release a Florida native variety of blue maidencane for conservation use, especially for erosion control and wetland restoration purposes.

Progress: From 1996 through 1998, a total of 157 accessions were assembled 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 (Table 3). In March of 2000, accessions were increased by planting rhizomes in tubs. Accessions 9059859, 9060309, and 9060311 were combined to form accession 9060489, since they have very similar performance and come from the same basic location. Accessions 9059866, 9060066, and 9060067 were also combined to form accession 9060490 for the same reasons.

Table 3. Eleven superior blue maidencane accessions selected for increase and evaluation.

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

Enough material was available to plant advanced evaluation plots at two sites in 2000. The first site was planted on July 18, 2000 near Naples in Collier Co. This was a flatwoods site

that had recently been cleared of Brazilian pepper trees under the NRCS EQUIP cost-share program. Plot size was 5' x 10', with three rows per plot. Spacing between rows was 1', with 3' between plots. Plots were replicated 4 times. Planting rate was 80 bushels/A, and it was determined that this rate was much higher than necessary. Rhizomes were laid out by hand in 4" – 6" deep trenches and covered with soil. 'Halifax' and 'Citrus Germplasm' maidencane were planted as standards. Maidencane plots were planted alternately with eastern gamagrass, so that plots would not grow together too quickly. Conditions were extremely dry at the time of this planting, which was very unusual for the area. There was very little subsoil moisture. Some rain did fall on the site within the next two weeks; however; conditions continued unseasonably dry into 2001. In the spring of 2001, he fenced the research plots, and plants had come back well by the time of the summer 7 evaluation (Table 4). The landowner allowed his cattle to graze the site in 2002, which negatively impacted the plants. Plots in March of 2002 had adequate moisture throughout the growing season. Plants were evaluated in April 2003.

Table 4. Performance of blue and common maidencane on Collier County flatwoods site two years after planting.

	Plant	Canopy		Ground		Resistance[1]			
Accession	Ht. (cm)	Wd. (cm)	Vigor[1]	Cover (%)	Spread Rate[1]	Drought	Disease	Insect	Weed Competition[2]
9059869	23.8	5.3	4.5	12.5	5.0	5	5	5	7
9059956	29.0	5	5	5.0	6	5	5	5	8
9059971	21.0	5.4	5.0	2.0	6	5	5	5	7
9060008	0	0	0	0	0	0	0	0	9
9060295	31.0	7.5	5.0	3.5	7.0	5	5	5	8
9060489	27.5	9.5	5.5	6.0	6.5	5	5	5	6.5
9060490	25.0	5.0	5	10.0	4.0	5	5	5	6
Citrus	34.5	9.0	3.0	72.5	1.7	5	5	5	5
Halifax	29.5	7.5	5.0	10.5	6.0	5.0	5	5	7

[1]1 = most and 9 = none. [2]1 = least and 9 = most.

The second advanced evaluation (AE) site was planted on Sept. 21, 2000, south of Bartow in Polk Co., on reclaimed minedlands next to a small lake. Plot size was 5' x 5' with 3 ows per plot, and 2.5' between rows. Planting rate was 40 bushels/A with rhizomes being hand planted in trenches 3" – 6" deep. 'Halifax' and 'Citrus Germplasm' maidencane were also planted as standards, with all maidencane plots being replicated 4 times. Plots of eastern gamagrass were planted between maidencane plots to keep them from growing together too quickly. Soils were overburden that contained a heavy clay fraction. This soil tends to be very sticky when wet and crusts heavily when dry. The site was very wet at the time of planting due to recent heavy showers. However, at a site visit a month after planting it was discovered that the soils had dried out and crusted heavily. Plots were evaluated on May 1, 2001 for emergence. Most plots were heavily infested with bermudagrass and torpedograss, and blue maidencane accessions were having a difficult time competing with these aggressive introduced grasses under severe drought conditions.

During site evaluations in April 2003, it was found that this site was overcome by torpedograss and the plants could not found.

On January 18, 2001, a third set of AE plots was planted in Hamilton Co. near Jasper. The site was located on disturbed soils on the north side of a cypress marsh. Plot size was 2' x 9', with each plot consisting of one row each, established by hand planting rhizomes 3" to 6" deep. Planting rate was 40 bushels/A and plots were replicated 4 times. 'Citrus' and 'Halifax' were planted as standards of comparison. Plots of eastern gamagrass were planted between maidencane plots to keep them from growing together too quickly. Second year evaluations were conducted March 2003 (Table 5). Plots were partially shaded, which caused plants to be small and spindly.

Table 5. Performance of blue and common maidencane on Hamilton County cypress swamp border site 2 years after planting.

Accession	Plant Ht. (cm)	Canopy Wd. (cm)	Vigor[1]	Ground Cover (%)	Spread Rate[1]	Resistance[1]			Weed Competition[2]
						Drought	Disease	Insect	
9059869	21.5	6.2	5.0	14.8	7.0		5.8	5	2
9059956	23.0	11.3	4.8	12.8	5.5		4.8	5	4
9059971	25.3	15.8	5.0	5.6	6.0		5.5	5	3
9060008	53.0	11.3	3.5	35.0	3.2		3.1	5	2
9060295	37.0	12.3	4.6	11.3	4.6		5.3	5	3
9060489	16.6	12.0	6.0	1.5	8.5		6.0	5	2.5
Citrus	65.0	20.0	2.3	80.0	3.0		5.0	5	2
Halifax	65.0	19.5	4.0	48.0	4.5		5.0	5	1.8

[1]1 = most and 9 = none. [2]1 = least and 9 = most.

Future Research Needs: Three or more additional advanced evaluation sites are needed in Florida before superior accessions can be selected for release.

Eastern Gamagrass (*Tripsacum dactyloides*) (FLPMC-P-9605-RA)

Project Stage: Increase of superior accessions and advanced evaluation. Advanced evaluations are expected to take another 2 to 3 years.

Introduction: Eastern gamagrass is a warm-season perennial bunchgrass with a broad area of distribution throughout the U.S.A., including all of the southern states. It has received a great deal of attention in recent years because of its tremendous forage production. 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. There is a demand in Florida for commercial seed sources of local ecotypes. In 1996 through 1998 an assembly of Florida eastern gamagrasses was evaluated for 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.

Objective: To evaluate, develop, and release one or more accessions of eastern gamagrass for conservation use including for buffer strips, pasture and rangeland improvement and wildlife food and cover.

Progress: Advanced evaluation plots of all four eastern gamagrass accessions were planted at the Collier, Polk, and Hamilton Co. sites discussed under the blue maidencane evaluations. At the Collier Co. site, which was planted July 18, 2000, plots were replicated 8 times, with each 5' x 10' plot having two rows, 2' apart. Seeding rate was 100 "good" seed/plot, or approx. 25 lbs./A. "Good" seed were selected by hand sorting those that appeared healthy and viable. Seed had not been treated in any way to overcome dormancy. Most of the seed used had been stored in the cooler for 1 to 2 years (dry storage) or recently collected from the field. Planting depth was 2 to 4" and placement was in very dry soil. Results from the March 2003 evaluation are shown in Table 6. Severe droughty conditions and livestock grazing had negatively impacted seedling survival. However, once the area was fenced, most plots were able to reestablish fairly well by the June evaluation.

Table 6. Performance of eastern gamagrass on Collier County flatwoods site 2 years after planting.

Accession	Plants/ plot	Plant Ht. (cm)	Canopy Wd. (cm)	Vigor[1]	Ground Cover (%)	Resistance[1]			Weed Competition[2]
						Drought	Disease	Insect	
9059213	3	23.0	30.0	3.5	5.6	5.5	5.1	5	5
9059264	0	0	0	0	0	0	0	0	0
9059266	3.0	66.0	122.5	3.0	20.0	5	5	5	6
9059287	4.0	70.0	55.0	4.0	10.0	5	5.0	5	7

[1]1 = most and 9 = none. [2]1 = least and 9 = most.

At the Polk Co. reclaimed minedland site, which was planted Sept. 21, 2000, plots were replicated 8 times, with each 5' x 5' plot having 3 rows 2.5' apart. Seeding rate was 25 "good" seed per plot, or a planting rate of approximately 13 lbs./A. "Good" seed was selected using a South Dakota Seed Blower, which separated out the lighter empty fruitcases. All seed had been collected from increase fields in 2000, and had not been chilled or treated to overcome dormancy in any way. Four plots of 'Pete' were planted as a standard of comparison. Seeding depth was kept to 1" to 2" because of the tendency of the soil to crust heavily. The site was visited 1 month after planting, and a few seedlings were seen emerging from a small number of plots, despite dry conditions and a heavy crust. Emergence was evaluated in March 2003 (Table 7). During the April 2003 evaluation, it was found that this site was overtaken by torpedograss.

At the Hamilton Co. cypress swamp site planted January 18, 2001, plots were replicated 8 times except for Pete, which was replicated 4 times, with each plot being one 9' row, with 2' between adjacent maidencane plots. Seeding rate was 20 "good" seed per plot, or a seeding rate of 60,000 "good" seed/A (approx. 21 lbs/A.) All seed had been collected from increase fields in 2000 and stored in an air-conditioned building. "Good" seed was selected using a South Dakota

Seed Blower. Pete was planted as a standard of comparison. Seeding depth was 2". Plots were evaluated on March 11, 2003 (Table 7).

Table 7. Performance of eastern gamagrass on Hamilton County cypress swamp border site 2 years after planting.

Accession	Plants/ plot	Plant Ht. (cm)	Canopy Wd. (cm)	Vigor[1]	Ground Cover (%)	Resistance[1]			Weed Competition[2]
						Drought	Disease	Insect	
9059213	5.7	38.1	33.8	4.8	7.1		5.8	5	4.5
9059264	6.0	27.5	37.0	4.4	10.4		5.9	5	3.1
9059266	7.0	38.8	42.5	4.1	13.6		5.6	5	3
9059287	9.1	35.0	29.9	4.9	6.4		5.8	5	3.1
Pete	7.0	27.5	17.5	5.5	4.0		5.8	5	3.8

[1]1 = most and 9 = none. [2]1 = least and 9 = most.

A fourth AE planting was established at the Aucilla area landfill in Madison Co. on June 25, 2001. Plots were established along an embankment around a wetland constructed for mitigation purposes. Soils ranged from heavy clays prone to severe crusting, to coarse sands. Plot size was 6' x 10' with each plot containing 3 rows on approximately 1' spacings, with 1 to 2' between plots. Planting depth was ½" to 1". The four Florida accessions were planted as untreated and treated seed. Seed treated to overcome dormancy was soaked in gibberellic acid [105 mg GA (A.I.)/liter of water] for 24 hours and then chilled for 3 weeks. Seeding rate was 50 "good" seed per plot or 60,000 "good" seed/acre (approx. 21 lbs/A) All seed had been collected from increase fields in 2000 and stored in an air-conditioned building. "Good" seed was selected using a South Dakota Seed Blower. All treatments were replicated 4 times. Soil moisture was good at the time of planting. However the summer of 2001 was very droughty, and the site was extremely dry when plots were evaluated on March 11, 2003. Despite this, most accessions established fairly well. There was no apparent difference between the treated and untreated seedling emergence (Table 8). Seed may not have been chilled long enough to overcome dormancy.

Table 8. Performance of eastern gamagrass on Madison County constructed wetland site.

Accession	Treatment	Plants/ Plot	Plant Ht. (cm)	Canopy Wd. (cm)	Vigor[1]	Resistance[1]			Weed Competition[2]
						Drought	Disease	Insect	
9059213	GA/Chill	5.5	15.5	28.5	5	5	5	5	3
	Untreated	9.5	22.5	24.0	5	5	5	5	3
9059264	GA/Chill	7	27.0	43.2	3.5	5	5	5	2
	Untreated	12.3	21.3	33.3	3.5	5	5	5	2
9059266	GA/Chill	12.8	21.3	22.3	4.1	5	5	5	2
	Untreated	13.8	32.3	19.8	5	5	5	5	3
9059287	GA/Chill	7.5	39.5	33.8	5	5	5	5	3
	Untreated	13.0	30.0	29.5	4	5	5	5	2

[1]1 = most and 9 = none. [2]1 = least and 9 = most.

Future Research Needs: Two or more additional advanced evaluation sites are needed in Florida before superior accessions can be selected for release. If seed production of this species is to become economical, production field management technology needs to be developed, especially in such areas as fertility and plant spacing.

Oklahoma Cooperative Eastern Gamagrass Forage Production Study (FLPMC-0005-RA)

Project Stage: Third year of a four-year study.

Introduction: The Oklahoma Agriculture Research Service (ARS) has been in the process of developing superior strains of eastern gamagrass for forage and pasture improvement in the southeastern U.S.A. In the winter of 2000, they asked PMC's in the southeast region to host forage production studies that included four strains of gamagrass they had developed.

Objective: Provide the Oklahoma ARS with performance data on their four strains of gamagrass, in comparison to the four Florida strains currently undergoing advanced evaluation.

Progress: The four OK strains used are identified as FGT I, FT II, FT IV, and FT 94-8. The 4 FL strains used are 9059213, 9059264, 9059266, 9059287. 'Pete' was planted as a standard of comparison. Plants were established at the FL PMC in April of 2000, and allowed to establish during the first year of the study. Oklahoma ARS supplied tubelings of their accessions. The FL PMC accessions were established primarily with divisions of plants. The irrigation system went down for a short while after planting and FL accessions consequently had to be replanted later with larger divisions. Plot size is 9' x 18', with three rows, each row containing 6 plants on 3' centers. First year clipping data was obtained in 2001 (Table 9) on May 8, June 21, August 14, and October 5. While the OK strains were clipped to 8", the FL strains were clipped to 10" because of higher growing points. Thus far, Florida accessions have had greater forage production than most of the OK strains. Accession FT 94-8 contains genetic material gathered

from Homestead, FL, and it performed well in Florida's semi-tropical climate also. The Oklahoma ARS is conducting forage quality tests, the data from which are not yet available.

Table 9. Eastern gamagrass dry matter production in the Oklahoma cooperative study in 2002 at the Brooksville PMC.

	Harvest			Total
Cultivar	1	2	3	Avg DM
	----------(lbs/A)----------			
9059287	2020.0	620.0	900.0	3540.0
9059213	1870	900.0	2150.0	4920.0
9059266	1820.0	965.0	2275.0	5665.0
FT 94-8	1935.0	1195.0	2850.0	5980.0
9059264	2485.0	1325.0	2890.0	6700.0
FT II	2540.0	1035.0	2145.0	5720.0
FGT I	780.0	680.0	1520.0	2985.0
Pete	665.0	665.0	1390.0	2720.0
FT IV	1635.0	635.0	1815.0	4080.0

Future Research Needed: Once this study is complete, cooperative studies can be conducted with the ARS Cattle Research Station next to the FL PMC, in which selected cultivars are planted in field plantings. The purpose of the plantings would be to study cattle response to the selected accessions, develop grazing systems that will help maintain stand quality, and promote the use of eastern gamagrass for pasture improvement in Florida.

Oklahoma Cooperative Eastern Gamagrass Seed Production Study (FLPMC-0006-RA)

Project Stage: Second year of a four-year study.

Introduction: An associate study to the Oklahoma ARS forage production study.

Objective: Provide the Oklahoma ARS with seed production data on two of their strains of gamagrass, in comparison to the four Florida strains currently undergoing advanced evaluation.

Progress: The two OK strains used are identified as FGT I and FT II. The 4 FL strains are those used in the forage study. 'Pete' was also planted as the standard of comparison. Plants were established at the FL PMC in April of 2000, in the same manner as discussed under the forage production section. Plot size is 3' x 33', with 12 plants per row on 3' centers. Seed was collected in 2001 by hand clipping all seed stalks on the date when the largest percentage of seed had ripened. Possibly due to an extremely droughty spring, and extreme dry conditions in August, neither Pete nor the OK strains produced significant amounts of seed. The FL accessions were harvested in mid to late August and the South Dakota Seed Blower was used to remove the light seed that had not filled (Table 15). Production was relatively low when

compared to gamagrass seed production in other states, where yields are commonly 200 lbs/ac. or more.

Eastern gamagrass seed production in the Oklahoma cooperative study in 2002 at the Brooksville PMC. Seed was not collected in 2002 due to severe rainfall and damaging winds.

Future Research Needed: Two factors, row spacing and fertility, need to be investigated, to determine their influence on gamagrass seed production in Florida. A third factor that may be worth investigating is the effect of spring clipping on reproductive tiller production. It was observed in the forage production study that many of the accessions clipped on June 21 produced reproductive tillers by August 13. The average number of reproductive tillers produced by 9059266, FT94-8, 9059213, FT II, FT IV, Pete, 9059287 and 9059264 was 11, 9, 8, 7, 6, 2, 0.3, and 0.1 respectively. Had these tillers been allowed to mature, a seed crop may have been obtained in addition to the two forage clippings.

Intercenter Strain Trial Partridge Pea (FLPMC-0208-WL)

Project Stage: To determine adaptation of Partridge Pea cultivar and new releases to areas in the Southeast and southern Plains.

Introduction: The annual legume partridge pea is an excellent food source for wildlife and is also suitable for planting on many critical areas. The only commercially available cultivar of partridge pea is 'Comanche' , released by the Texas PMC in Knox City. Lark selection, was released by the Kansas PMC in Manhattan, Kansas. The full range of adaptation of these two per-varietal releases is not known. This inter-center strain trial will determine the survival and growth potencial of these releases at sites throughout the Southeast and southern Plains states, using Comanche as the standard of comparison.

Objective: The information obtained by this study will be used to support a cultivar release of Lark Selection. Technical notes, release documentation, revise FTOG standards.

Progress: Seed samples will be obtained from the relevant PMC's. Plots will be planted at MS PMC, AK PMC, ET PMC, TX PMC, ST PMC,GA PMC, FL PMC, and other locations as available. Plot size to be planted will be 5' X 10' with 3 replications. Plots will be prepared and managed according to standard pratices used at the testing sites. The planting rate will be 6 PLS pounds of seed/A, and seeds will be inoculated with proper inoculant prior to planting.

Intercenter Adaptation of Blue-Green Eastern Gamagrass (*Tripsacum dactyloides*) (FLPMC –P-0002-BU)

Project Stage: Advanced evaluation, demonstration and field plantings to develop more adaptation data and establishment technology for commercial growers. Studies are expected to be complete within 2 to 3 years.

Introduction: Eastern gamagrass is a Florida native perennial grass that is relatively insect and disease resistant. Once established, plants are also fairly tolerant of droughty conditions. Eastern gamagrass is one of the most useful native species for removing excess nitrates and phosphates

from the soil. It also provides high quality food and cover for wildlife, making it an excellent choice for buffer strips. Eastern gamagrass has been gaining popularity in recent years for use in xeriscapes, backyard conservation projects, and plantings along roadsides. 'Martin Germplasm' (9056069) and 'St. Lucie Germplasm' (9059278) eastern gamagrass were released onto the commercial market in 2000 by the FL PMC, because their attractive blue-green color and pleasing growth habits enhanced their use in conservation plantings. A pre-varietal release was done because of the great need for native plant materials. However, additional adaptation and performance data on these two accessions would be beneficial to commercial growers.

Objectives: This study was initiated to determine the adaptation range of Martin and St. Lucie in other states. Both strains originated in southeast Florida. Requests for these releases have come from states as far north as Kentucky. Other Florida strains of eastern gamagrass were not cold hardy enough to survive beyond plant hardiness zone 8.

Progress: Plants of both strains were sent to PMC's at Americus, GA; Booneville, AR; Nacogdoches, Knox City, and Kingsville, TX; Galliano, LA; and Coffeeville, MS in June of 2000. PMC staff agreed to document winter hardiness and survival for at least a three-year period.

In 2000, both strains winter killed at the MS and AR PMC's, and could not establish at the GA PMC because of drought. Fifty percent of the plants initially survived establishment at the Kingsville, TX PMC, and had become well established by early 2002. At this location, it was noted that plants did not have a distinctive blue-green color.

Seventy percent of each type established at the Knox City, TX PMC, and were able to survive the winters there. Six of the 10 St. Lucie plants survived at Nocogdoches, TX, but only 1 of the 10 Martin plants survived, possibly because of drought. Surviving plants were noted as being relatively small, and had not yet produced seed heads. (Currently waiting for evaluation data from participating PMC's.)

Future Research Needs: This study is to continue for 1 more year. More adaptation, field and demonstration plantings would be useful to provide commercial growers in Florida with performance data for these two species. It has also been noticed at the PMC that the bluish color of the leaves vary depending on field location. A study to determine the effect of fertility and soil pH on foliage color was initiated in 2001.

ACTIVE STUDIES

The Influence of Fertility and pH on Leaf Color of Blue-Green Eastern Gamagrasses (FLPMC-T-0004-RA)

Project Stage: Second year of a three-year study.

Introduction: 'Martin Germplasm' and 'St. Lucie Germplasm' eastern gamagrass have potential for use in ornamental settings because of their blue-green colored foliage. However, at some sites, this attractive foliage color was not always noticeable. The factors that influence foliage color in these two accessions need to be determined.

Objective: To investigate the influence of different pH and fertility levels on the foliage color of Martin and St. Lucie eastern gamagrass.

Progress: On August 1, 2001, plots were established on 3 irrigated sites at the Brooksville PMC. Previous pH samples taken from these sites ranged from 4.9 to 6.0. Three fertility treatments will be applied in 2002, including 0, 50, 100 and 200 lbs/ac. of 10-10-10. Each plot consists of 2 or 3 plants with 1 border plant between treatments.

Future Research Needs: As mentioned under the Advanced Evaluation section of this report, it would be useful to make several demonstration plantings to determine how these two accessions perform under a variety of conditions.

Seed Production of Upland Native Plants (FLPMC-T-9902-CR)

Project Stage: Increase of selected native accessions.

Introduction: Based on results of direct seeding studies on reclaimed mined lands and at the PMC, 2 species were selected for further increase and possible commercial release. These species are splitbeard bluestem (*Andropogon ternarius*) (formerly thought to be *Andropogon arctatus*) and gayfeather (*Liatris elegans*).

Objective: To increase, test and release native species for restoring dry sandy uplands.

Progress: A *Liatris elegans* seed increase plot was established in January of 2001. One row was established using corms from a previous PMC planting. The remaining rows were established by direct seeding. Hand collections were made in November of 2002 and a final collection was made with the Flail Vac at a slow brush speed. Seed was tested for germination.

In 2002, *Andropogon ternarius* plants were well established, and all bloomed in the fall. Seed was collected with the Flail Vac in November. Only 3 harvests were made to collect the maximum amount of seed. Making the collections at lower brush speeds significantly increased the amount of seed collected, and reduce the amount of inert matter that must be removed from the seed. A hammermill was very effective at dehulling seed.

Future Research Needs: Tests need to be conducted on both *Liatris elegans and Andropogon ternarius* to determine if debearding or dehulling damages seed and reduces viability. Management of residue and top growth of both species also needs to be tested to find ways to maintain stands and increase seed production. *Liatris elegans* is projected to be released in 2003.

Eglin AFB Native Species Erosion Control Mats (FLPMC–T-0105-CR)

Project Stage: First year of a four-year study.

Introduction: Natural resources personnel at Eglin Air Force Base wish to restore borrow pits and other critical areas with native species. Because many of these areas have very steep slopes, erosion is a serious problem, and native species often grow too slowly to stabilize critical areas. Biodegradable mats made out of coconut fiber (coir) are often used to stabilize severe slopes. Establishing grasses and forbs on these mats prior to placement on the site could potentially be used to revegetate critical areas with slow growing native species.

Objective: Develop methods of establishing native species on coir mats, and determine if these vegetated mats can successfully colonize and control erosion on critical areas with high slopes.

Progress: On December 4 and 5 of 2001, Eglin personnel supplied a seed stripper pulled with an ATV to collect seed from two native sites. In addition, PMC personnel made hand collections of selected grasses and forbs. The two sites ranged from xeric to mesic and were dominated by wiregrass. Growing season burns had effectively stimulated the wiregrass to flower and produce viable seed. Seed germination tests were conducted at the PMC laboratory (Table 10) in order to calculate seeding rates. Coir blanket mats (1/4” to 1/2" thick) measuring 3' x 40' were placed on asphalt and plastic at the PMC and were framed with 2" x 4" wood. Mats were seeded on February 14, 2002, and covered with approximately 1/2" of potting soil. Because of cooler weather, seed did not begin to germinate for 1 to 2 months. Once plants have developed a strong root system, they were transported to Eglin AFB and planted in December 2002.

Table 10. Laboratory germination of various native species collected from Eglin AFB in 2002.

Site	Species	Common Name	Seed Viability (%)
Indigo Pond	*Andropogon gyrans*	Elliot bluestem	46
	Andropogon ternarius	Splitbeard bluestem	32
	Liatris spp.	Gayfeather	48
	Pityopsis	Grass leaf golden aster	42
	Schizachyrium stoloniferum	Creeping bluestem	4
Range 78	*Aristida beyrichiana* (stripper mix)	Wiregrass	39
	Aristida beyrichiana (hand clipped)	Wiregrass	35
	Schizachyrium stoloniferum	Creeping bluestem	0

Future Research Needs: Once established, mats will need to be evaluated for 2 to 3 years to determine if this is a viable method of stabilizing critical areas with native species.

Department of Transportation Cooperative Wildflower Seed Increase (FLPMC-S-0104-OT)

Project Stage: Second year of a three- to four-year study.

Introduction: The Florida Department of Transportation (DOT) would like to use Florida ecotypes of native wildflowers to beautify roadways and reduce mowing costs. However, there are very few Florida sources of wildflowers on the commercial market. Dr. Jeff Norcini of the University of Florida, IFAS, has been working under a grant from the DOT to develop Florida seed sources, and has asked the Brooksville PMC to help increase the seed for commercial growers.

Objective: To develop propagation and cultural management protocols, develop harvest methods, and increase seed stocks of two species of Florida wildflowers.

Progress: Seed of yellowtop (*Flaveria linearis*) collected from a south, central and north Florida location was brought to the PMC in the summer of 2001. Seed was started in flats in the greenhouse, and seedlings were transplanted to cone trays. Once seedlings develop a vigorous root system, they are being transplanted to the field. It has been noted that the south and north ecotypes of yellowtop have displayed a completely different growth habit. An accession of blackeyed susan (*Rudbeckia hirta*) is also being increased in a similar manner. A specialized vacuum harvester is being developed to collect the seed. Since blackeyed susan is a biennial, and yellowtop is a perennial, seed increase fields are expected to be productive for 2 or more years.

Future Research Needs: Herbicide tolerance information needs to be developed for these two wildflower species.

Lopsided Indiangrass *(Sorghastrum secundum)* Residue Management Study

Project Stage: This is a residue management study that will continue for 2 to 3 years. Seed will be collected, depending on how long the majority of the plants survive.

Introduction: Lopsided indiangrass is an important component of native uplands in Florida. It has good seed production and has established well in critical area plantings on reclaimed minedlands. Unfortunately, seed production plots have been very short-lived at the Brooksville PMC, lasting only about 3 years on irrigated sites. Soil pathogens are most likely the cause of plant death, although this species may naturally be a short-lived perennial.

Objective: To determine how residue management method affects viable seed production and plant persistence.

Progress: Study plots were imposed on the composite Acc. 9060564 polycross nursery which was planted February 21, 2001, using seedlings from 6' containers. All plots are to be fertilized annually with approx. 50 lb/A 10-10-10 at the time of spring growth. Winter burn treatments are to be applied approx. January before plants begin spring regrowth. Winter clip treatments are to be applied at the same time as burn treatments. Summer clip treatments are to be applied in late June prior to production of reproductive tillers.

Future Research Needs: Seed collected from this project will be used to establish the foundation field for Acc. 9060564.

PLANT MATERIALS RELEASED BY THE BROOKSVILLE, FL PMC

Year	Species	Cultivar	Cooperating Agency
1944	*Paspalum notatum* (Bahiagrass)	Pensacola	GA PMC
1960	*Panicum texanum* (Texas millet)	Artex	N/A
1962	*Lupinus elegans* (Mexican lupine)	Armex	N/A
1963	*Lupinus angustifolius* (Blue lupine)	Orlando	N/A
1969	*Aeschynomene americana* (American joint vetch)	F-149	N/A
1978	*Hemarthria altissima* (Limpograss)	Bigalta	Univ.FL-I.F.A.S.
		Greenalta	" " "
		Redalta	" " "
1978	*Arachis glabrata* (Perennial peanut)	Florigraze	N/A
1985	*Arachis glabrata* (Perennial peanut)	Arbrook	FL Agri. Exp. Sta.
1990	*Spartina patens* (Marshhay cordgrass)	Flageo	GA PMC & Ft. Valley Agri. College
1991	*Helianthus debillis* (Beach sunflower)	Flora Sun	N/A
1992	*Panicum amarum* (Bitter panicum)	Northpa	N/A
		Southpa	N/A
1994	*Spartina patens* (Marshhay cordgrass)	Sharp	GA PMC
1995	*Zea mexicana* (Mexican teosinte)	Chapingo	N/A
1996	*Panicum virgatum* (Switchgrass)	Miami	N/A
		Wabasso	N/A
		Stuart	N/A
1998	*Panicum hemitomon* (Maidencane)	Citrus	N/A
2000	*Tripsacum dactyloides* (Eastern gamagrass)	Martin	N/A
		St. Lucie	N/A
2002	*Arachis glabrata* (Perennial peanut)	Brooksville 67	N/A
2002	*Arachis glabrata* (Perennial peanut)	Brooksville 68	N/A

PUBLICATIONS AVAILABLE FROM THE BROOKSVILLE, FL PMC

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
June 1995 - Oct. 2002	Semi-Annual Newsletter: Sunshine State's PMC Impact
1998	Forage Species on Sprayfields – Fact Sheet
2000	Fact Sheet: Gully Stabilization in North Florida
2000	Plant Materials Center, Brooksville, Florida - Visitor Information
2002	Florida Native Seed Production Manual
Through 2002	Annual PMC Activity Reports