Brooksville, Florida Plant Materials Center

Year 2000 Annual Technical Report

Issued May 2001

TABLE OF CONTENTS

Cover Picture: Hairawn muhly initial evaluation plots at the Plant Materials Center

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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 major objectives of the Brooksville PMC are:

- 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 Plant Materials Center, 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 plant materials centers 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 plants 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 in 2000 were among the driest on record, especially during the spring. 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 41.47 inches. The 20 - year rainfall average is 54.72 inches.

Table 1. Year 2000 total monthly rainfall.

Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
1.45	0.66	1.09	0.65	1.48	13.04	8.46	7.29	4.73	0.02	1.35	1.25	41.47

The last heavy frost occurred on February 12. The first frost occurred on November 20. There were 282 frost-free days in 2000. The lowest temperature recorded at the Florida PMC in 2000 was 20° F, which occurred on December 30 and 31.

Table 2. Year 2000 average monthly high and low temperatures.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Avg.
72	76	83	84	92	92	91	92	91	85	80	72	84
45	46	53	53	63	69	72	70	71	58	45	43	57

INITIAL EVALUATIONS

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

Project Stage: Assembly of a wide range of genetically diverse accessions. Increase and advanced evaluations phases are expected to take 5 or more years.

Cooperators: K. Quesenberry, Dep. of Agronomy, Univ. of Florida, Gainesville, and M. Williams USDA, ARS, STARS, Brooksville, FL

Introduction: Switchgrass has excellent potential for use in revegetating reclaimed mined lands 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, reclamationists in Florida desire a Florida ecotype of this species. 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 use and controlling erosion. If selections are identified that produce high amounts of dry matter, 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 both 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 are to be planted into a crossing block in 2001, from which accessions with high seed production and favorable growth characteristics will be selected.

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

Wiregrass (*Aristida stricta*) FLPMC-P-9235-WO

Project Stage: Assembly of a wide range of 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. However, it must undergo a summer burn in order for the seed to be viable.

Objective: To evaluate a broad assembly of wiregrass accessions for growth characteristics and seed production. If superior accessions are found, they may be released for conservation purposes.

Progress and Future Research Needs: To date, over 70 accessions have been collected in the form of plants or seed. Plants are being held in 6" pots in the PMC shadehouse. However, a larger assembly will be necessary if it is decided that there is a market for a cultivar that has been genetically manipulated to increase viable seed production.

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

Project Stage: Initial evaluation, which is expected to take 2 more years. Seed increase and advanced evaluation is then expected to require another 7 years before material can be released.

Introduction: Muhly is a hardy warm-season perennial bunchgrass distributed throughout Florida and several states in the southeastern US. 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 a Florida native variety of hairawn muhly for conservation use, especially erosion control, native area restoration and wildlife cover.

Progress: Muhly plants were collected from throughout the state of Florida in 1997 through 1999. In March of 2000, 94 accessions were planted in plots at the PMC. This included 3 accessions received from the GA PMC. Sharp marshhay cordgrass was planted as a standard of comparison. Plots were replicated 3 times. Evaluations were conducted in the fall, and seed samples were collected. Plants were evaluated for forage and seed production, vigor, leaf and seed head attributes, lodging, drought and disease resistance. The 20 plants with the highest overall score are shown in Table 3.

Timing of seed collection appears to be very critical. Seed was not collected until at least the hard dough stage, and preferably when seed was completely ripe. However, collection could not be delayed too long, or ripe seed would quickly shatter. During the time between pollination and the hard dough stage, seed heads were covered with aphids. No attempt was made to control them with pesticides. Lady bug beetles and other natural predators were observed also, so some natural control was occurring. Amount of damage to seed caused by the aphids is unknown. Seed germination for all accessions averaged between 54% and 0% with the median being 14%. Only three accessions ranked in the top 20 for both growth characteristics and seed viability.

These are 9059239 (28% germ.), 9059717 (26% germ.), and 9059716 (23% germ.). There is some evidence that collecting seed before it is completely ripe decreases germination. A greater effort needs to be made in 2001 to collect seed when it is fully ripe. Initial evaluations are to continue for two more years.

Table 3. The 20 highest scoring hairawn muhly accessions according to overall first year initial evaluation results at the FL PMC in the fall of 2000.

Accession No.	Rank	Source/County	Collector
9057242	1	GA PMC	
9059716	2	Citrus	FL PMC
9059720	3	Levy	FL PMC
9057241	4	GA PMC	
9059190	5	Sumter	FL PMC
9059224	6	Levy	FL PMC
9059239	7	Pasco	FL PMC
9059237	8	Pasco	FL PMC
9059514	9	Charlotte	FL PMC
9059544	10	Bay	FL PMC
9059929	11	Jefferson	FL PMC
9059516	12	Manatee	FL PMC
9059532	13	Taylor	FL PMC
9059897	14	Sumter	FL PMC
9060304	15	Jackson	FL PMC
9059717	16	Citrus	FL PMC
9059973	17	Marion	FL PMC
9060419	18	Citrus	FL PMC
9059523	19	Dixie	FL PMC
9059928	20	Charlotte	Eckert, Gonter, Pfaff

Future Research Needs: Once superior accessions are selected, they will need to be increased to supply seed for advanced evaluations throughout Florida, and possibly in other states. 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: Initial seed increase of superior accessions for foundation seed stock. The increase phase is 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, 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 a Florida native variety of lopsided indiangrass for conservation uses, especially for erosion control, native area restoration and wildlife cover.

Table 4. Twenty-five superior lopsided indiangrass accessions increased in 2000.

Accession No.	County	Collector
9059725	Citrus	PMC
9059727	Citrus (Ft. Cooper State Park)	PMC
9060105	Osceola	Fults/Benetis
9060110	Sarasota (Myakka State Park)	Lackman/Perry
9060118	Okeechobee	PMC
9060120	Santa Rosa	Hauer/Reyes/Pfaff
9060128	Desoto	PMC
9060133	Desoto	PMC
9060137	Desoto	PMC
9060146	Manatee	PMC
9060147	Manatee	PMC
9060168	Levy	PMC
9060173	Lake	PMC
9060182	Madison	PMC
9060184	Hamilton	PMC
9060186	Marion	PMC
9060187	Desoto	Crockett
9060197	Levy	PMC
9060199	Citrus	PMC
9060205	Gilchrist	Fults
9060207	Orange	Fults/Swims
9060208	Hernando	PMC
9060209	Citrus	PMC
9060210	Hernando	PMC
9060351	Dixie	Stephens/Porter

Progress: A statewide collection totaling 132 accessions of indiangrass was assembled between 1989 through 1996. Initial evaluation trials were conducted on irrigated and non-irrigated fields at the PMC between 1997 and 1999. From these studies, 25 accessions were selected for advanced evaluation trials (Table 4). Original seed collections of all accessions had been stored in the cooler at the PMC and were still viable. This seed was planted in cone trays in the greenhouse in April of 2000. Accessions 9060186, 9060197, and 9060205 have a very similar blue-green color and very stiff, upright leaves and will be planted together to form one composite. Accession 9060120 from Santa Rosa County blooms several weeks earlier than the other accessions selected. It is to be increased and maintained as a single accession, since it is unlikely that it will cross-pollinate with any of the other accessions. The remaining accessions are to be planted together in one field to form one composite. Seedlings established well in the greenhouse, and are to be placed in the field early in 2001. It is expected that at least 2 years will be necessary to produce enough seed to plant foundation fields at the PMC, and another 2 years to increase foundation material for advanced evaluation.

Future Research Needs: Once foundation seed is increased for superior accessions, advanced evaluations 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: Initial seed increase of superior accessions, which is expected to take 4 years. Advanced evaluation is expected to require another 3 to 5 years.

Introduction: Chalky bluestem is a native warm season perennial bunch grass 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 wild cover.

Table 5. Ten superior chalky bluestem accessions increased in 2000.

Accession No.	County	Collector
9060226	Orange	Fults
9060251	Nassau	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

Progress: In 1996, 91 accessions were assembled from throughout the state of Florida in the form of seed. These accessions were planted in initial evaluation plots at the PMC in 1997, and underwent evaluation until 1999. Ten superior accessions were selected for increase and advanced testing (Table 5). These ten accessions are to be planted together in an increase plot to form one composite. Seed from original collections stored in the seed cooler was used to start seedlings in the greenhouse in April of 2000. All accessions established well, and seedlings are to be transplanted to the field in early 2001. Seed increase is expected to take 2 years before enough seed is available for planting a foundation field, and another 2 - 3 years to increase foundation seed stock for advanced evaluation.

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 needs to be developed for this species to insure establishment success.

Reclaimed Minedlands Native Plant Materials Adaptability Study
FLPMC–P–9708-CR

Project Stage: Sixth year of initial evaluation in this 7-year study.

Introduction: The phosphate mine industry needs seed sources of Florida native species to restore reclaimed uplands. Since restored sites are primarily targeted for wildlife, a diversity of species is desired.

Objective: To study the ability of selected native species to establish by direct seeding.

Progress: Seed from native species was hand collected from various native sites in Florida between 1996 and 1998. Plantings were then done in Jan. and May of 1997, 1998 and 1999, on both overburden and sand tailings, at a site south of Bartow, provided by Cargill Fertilizer, Inc. Seed was hand-planted in 20' rows, with 3' between rows on both soils. Planting depth was generally ½ to ¾ inches. Seeding rate was generally 60 pure live seed (pls) per acre. 'Alamo' switchgrass (*Panicum virgatum*) was planted each time as a standard of comparison. Due to scarcity of seed, plots were not replicated. Overall, 18 species were planted, with many species being planted on several of the planting dates. Evaluation results for each species were discussed in length in the 2000 Annual Report to the Florida Institute of Phosphate Research (FIPR), and will not be repeated here. This study has already supplied excellent information on potential native grasses and forbs that are adaptable to reclaimed minedland soils. Final evaluations are to be conducted in May of 2001, and published in a final report for FIPR.

Future Research Needs: Selected candidates from this study need to be increased. Progeny may possibly need to be tested for adaptability and performance on reclaimed minedland soils prior to release onto the commercial market.

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 6). 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 had 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 6. Eleven superior blue maidencane accessions increased in 2000.

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. 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/acre, 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. The district conservationist in Collier Co. visited the site one month after planting and reported that some of the material was growing. Annual evaluations are to be conducted through at least 2002 to determine accession performance.

The second AE site was planted on Sept. 21, 2000 at a site south of Bartow in Polk Co., on reclaimed minedlands next to a small lake. Plot size was 5' x5' with 3 rows per plot, and 2.5' between rows. Planting rate was 40 bushels/acre 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. The common maidencane had begun to emerge, but only a few shoots could be found in a small number of the blue maidencane plots. Annual evaluations are to be conducted through at least 2002 to determine accession performance.

Future Research Needs: Four or more advanced evaluation sites are needed in central and north 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 last take another 3 to 4 years.

Introduction: Eastern gamagrass is a warm-season perennial bunchgrass with a broad area of distribution throughout the US, 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; these 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: Initial increase fields of the 4 accessions were planted at the PMC in July of 1999. All increase plots produced seed in 2000. Seed was gathered by hand, since the FL PMC does not currently have a functional combine. Seed production varied greatly between accessions, a phenomenon that appeared to be closely related to soil type and fertility. Accession 9059264 was planted on the soil type with the highest fertility and water holding capacity, yet it had the lowest viable seed production. Highest seed production for each accession for a given date is shown in Table 7. Seed was collected from each plot 4 to 6 times. Sum of all collections made is shown as total seed production Table 7.

Table 7. Pounds of seed produced per acre in eastern gamagrass seed increase fields at the PMC, including highest production on a single date and total production for the year.

	Highest Production/Date	Total Production
Accession No.	Lbs./ac.	Lbs./ac.
9059213	5	13
9059264	6	12
9059266	8	21
9059287	16	30

Advanced evaluation plots of all four eastern gamagrass accessions were planted at the Collier Co. and Polk 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./ac. "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. Plots are to be evaluated annually for 2 or more years.

At the Polk Co. 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./ac. "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. Plots are to be evaluated annually for 2 or more years.

Future Research Needs: Four or more 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.

Maidencane (*Panicum hemitomon*) FLPMC-P-9502-BU

Project Stage: Advanced evaluation and field plantings to develop more adaptation data and establishment technology for commercial growers. Studies are expected to be complete within 3 to 4 years.

Introduction: Maidencane is a perennial, warm season rhizomatous grass. It is adapted to fresh-water marshes, swamps, moist areas, and road ditches throughout Florida and the coastal areas of the southeastern states. It produces high quality forage, which is preferentially grazed by livestock throughout the growing season. Maidencane is also an important component in controlling erosion, and maintaining water quality in freshwater systems. This species has poor seed production, but can be established vegetatively with rootstock. Presently, the only commercially available cultivar of maidencane is 'Halifax', which is not as adapted to central and south Florida as native Florida varieties. An assembly of this species underwent initial evaluation at the Florida PMC, from which 'Citrus Germplasm' was selected. Because of demand, this accession was released onto the commercial market as a selected class release.

Objective: To test 'Citrus Germplasm' maidencane for adaptability and usefulness in improvement of water quality, pasture and rangeland improvement and erosion control throughout Florida. Also, to develop successful stand establishment technology.

Progress: Adaptation trials were planted at various locations throughout Florida between 1997 and 1999. Evaluation information for these plantings was reported in the 1999 Activity Report, and will not be duplicated here. In 2000, as mentioned under the blue maidencane section, 'Halifax' and 'Citrus Germplasm' common maidencane were planted in the advanced evaluation sites in Collier and Polk Co. The common maidencane plots were planted in a similar fashion to the blue maidencane plots, except that the planting rate at both sites was 40 bushels/acre.

In July of 2000 the Florida State Dept. of Environmental Protection Bureau of Mine Reclamation near Bartow Florida obtained 25 bushels of Citrus maidencane for a demonstration/increase plot at their facility. The rhizomes were hand planted in trenches on approximately ½ acre of irrigated land. At the same time, rhizomes from a maidencane found near their facility were also planted. Within 6 months after planting, the Citrus maidencane had formed a solid stand. Only a few plants from the local ecotype could be found.

A field planting of Citrus maidencane was established on a wetland site on Cargill Fertilizer reclaimed minedlands near Bartow in early October. Approximately two acres were planted with 80 bushels of rhizomes using a bermudagrass sprig planter. Rhizomes had begun to emerge within two weeks after planting, including in areas that become slightly submerged. This planting will continue to be monitored for establishment for 1 to 2 more years, however, it has already supplied a great deal of useful establishment data for this species.

Future Research Needs: Conduct four or more advanced evaluation studies along with blue maidencane. Citrus Germplasm maidencane should also be tested out of state, possibly at other PMC's to determine adaptability outside of Florida.

Perennial Peanut (*Arachis glabrata*) FLPMC-9303-CP

Project Stage: Advanced evaluation to determine adaptability and performance. Evaluations are expected to take 4 to 5 more years. However, due to demand, 1 or more accessions may need to be released within the next year.

Introduction: Perennial peanut is a warm-season rhizomatous legume. Several strains have been developed for high-protein forage in the Southeast. However, other strains exist which could be useful as a low maintenance, soil stabilizing ground cover in groves, recreation areas, lawns and along roadsides. Perennial peanut has the potential to reduce non-point source pollution by reducing the use of nitrogen fertilizers that leach into the ground water. Perennial peanut forms a dense sod and is fairly drought tolerant and insect resistant. Because it is a legume, it does not require fertilization with nitrogen. Commercial forage varieties of perennial peanut were developed for maximum forage and protein production. However, in a ground cover situation, lower growing varieties would be more desirable, as long as maximum soil coverage and ability to compete with weedy species was still retained. This would minimize the amount of watering and mowing necessary to maintain an area.

Objective: To evaluate the performance of two accessions of perennial peanut for use as ground cover on coarse well-drained soils, like those citrus groves are planted on.

Table 8. Average performance of four strains of perennial peanut on a Citrus Co. site, six months after planting.

Accession	% Cover	Height (cm)	Spread Rating (1–9, 1=most)	Number of Blooms/m^2
Ecoturf	31b	3.3b	5.3b	5a
Waxy Leaf	57a	10.5a	3.8a	1b
Pointed Leaf	19bc	2.0b	6.0c	6a
Arblick	5c	3.0b	8.0d	2b

Accession means followed by different letters are significantly different by Tukey's HSD at P≤0.05.

Progress: On 7/2/99 two strains of perennial peanut maintained at the Florida PMC (referred to as 'Waxy Leaf', and 'Pointed Leaf') were established on a lot in the Emerald Hills subdivision in Citrus Co. The commercially available 'Ecoturf' and 'Arblick' were also planted as standards of comparison. Soils are Lake fine sands, which are deep and excessively drained. The site had been in bahiagrass sod prior to planting. Rhizomes were hand-planted in shallow trenches placed 6" apart, in 6' x 10' plots, with four replicates. Ecoturf had been obtained from the Univ. of Florida, in Gainesville and had been dug with a sprig digger. The other three strains had been hand dug from plots at the PMC, so rhizomes were longer than Ecoturf rhizomes. Planting rate was estimated to be 120 – 140 bu./ac. Irrigation was not available at the time of planting. However, summer rains were adequate to keep plots moist. An underground sprinkler system was used later in the season to apply water daily at subsistence levels. Weeds were controlled by hand weeding. Soil samples were taken at the time of planting. Average pH was 5; P was adequate for plant needs, but N, K and most of the micronutrients were low. Acid, nutrient-poor soils are very common in Florida, especially along roadsides. A six-month evaluation was conducted in mid-November of 1999. Results are shown below in Table 8. Waxy Leaf was the quickest to establish, in the short-term, producing the most ground cover. The waxy coating on the leaves of this accession may make it more drought tolerant than the other species.

One-year evaluation data for the Citrus County site is shown in Table 9. All strains had established very well except Arblick, which did poorly at this location. Waxy Leaf was substantially taller than the other three accessions and had produced the greatest percentage of ground cover on this irrigated site. On a non-irrigated site at the PMC, Waxy Leaf grows much lower. Plots were not mowed prior to evaluation, and this may also affect growth habit. Pointed leaf produced a very low growing dense sod at the Citrus Co. site and a tremendous number of bright yellow blooms, making it an excellent candidate for use along roadsides. Mowing treatments were done on all plots after the July evaluation. Evaluation is to continue for one more year.

Table 9. Average performance of four strains of perennial peanut on a Citrus Co. site one year after planting

Accession	Cover (%)	Height (inches)	Spread Rating (1–9, 1=most)	Number of Blooms/ft^2
Ecoturf	82a	6b	2.8a	4b
Waxy Leaf	95a	11a	3.5a	5b
Pointed Leaf	79a	3bc	3.0a	12a
Arblick	30b	2c	6.8b	2b

Accession means followed by different letters are significantly different by Tukey's HSD at P≤0.05.

In 2000, a perennial peanut ground cover study was established in a citrus grove in Pasco Co. on deep well-drained sandy soils. Rhizomes of Waxy Leaf and Pointed Leaf, plus the commercially available Arblick, Ecoturf and also 'Floragraze' were planted on July 12, 2000. Rhizomes were planted into dry soil. Plots were not irrigated, and the summer of 2000 was exceptionally dry in central Florida. Almost no precipitation was received in the following months. Six months after planting, the grove owner reported that none of the accessions appeared to have survived. Plots will be checked again in 2001 to determine if any accessions were able to establish.

Future Research Needs: Plant further grove ground cover studies. Since droughty conditions are expected to continue into 2001, it may be beneficial to compare irrigated verses non-irrigated treatments. The FL PMC planted several Waxy Leaf and Pointed Leaf adaptation studies throughout Florida in the 1990's. These sites need to be visited to gather performance and adaptability data that can be reported in future release documents.

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

Project Stage: The establishment year of a 4 - year study which is to last through 2003.

Introduction: The Oklahoma Agriculture Research Service has been in the process of developing superior strains of eastern gamagrass for forage and pasture improvement in the southeastern US. 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 for the 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. Plots size is 9' x 18', with three rows, each row containing 6 plants. Transplants are spaced on 3' centers. Forage collection will commence in 2001, and be conducted for three years. This study will not only provide Oklahoma researchers with valuable adaptation data, but forage quality data under controlled conditions will be gathered for Florida strains.

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: The establishment year of a 4 year study which is to last through 2003.

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 for 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 collection is to commence in 2001.

Future Research Needed: Seed production technology research needs are discussed above under the Florida eastern gamagrass development section.

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 3 to 4 years.

Introduction: Eastern gamagrass is a Florida native perennial grass that is relatively insect and disease resistant. Once established, plants are also relatively 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, it would be very beneficial for commercial growers to have additional adaptation and performance information on these two accessions.

Objectives: 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. This study was initiated to determine the adaptation range of Martin and St. Lucie in other states. More adaptation data also needs to be gathered from around Florida.

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.

Other demonstration plantings were also initiated within Florida. NRCS office bound employees toured the FL PMC in April 2000, in an event sponsored by the Federal Women's Program Committee. Participants were given samples of both gamagrass accessions, along with evaluation sheets, and asked to evaluate plant performance at 6 months and annually. At the writing of this report, two participants have reported back. The first participant is located in the Florida Panhandle, and reported that both plants had survived, but Martin was much more vigorous. The second participant is in east central Florida, and reported that Martin survived on a dry site but St. Lucie did not.

Future Research Needs: More adaptation, field and demonstration plantings would be useful to provide commercial growers with performance technology for these two species. It has also been noticed at the PMC that the bluish color of the leaves varies depending on field location. It is not known how pH and fertility affect the color, and a study addressing these questions would be useful.

Lanceleaf Crotalaria (*Crotalaria lanceolata*) FLPMC – P-9501-WL

Project Stage: Initial seed increase for advanced evaluation. Increase in expected to take 1 to 3 years, and advanced evaluation another 2 to 4, unless a pre-varietal release in done.

Introduction: Lanceleaf crotalaria is an annual warm season legume that can be used as a green manure/cover crop on cropland and mature citrus groves. It has good reseeding characteristics and nitrogen fixing capabilities. Deer preferentially graze early growth. However, seeds and plant tissue of some species of *Crotalaria* are known to be toxic to livestock. The toxicity of this particular species is not fully known.

Objectives: To increase seed stocks for future studies and release an adapted ecotype for cover crop and wildlife use.

Progress: Deer grazed out seed increase plots planted at the PMC in 2000. Future increase plots will need to be surrounded with electric fencing.

Future Research Needs: Work with other scientists to determine how toxic lanceleaf crotalaria is to livestock. Some investigation may also be necessary to determine how open seed dealers are to handling the species, since some closely related *Crotalaria* species are considered noxious weeds.

ACTIVE STUDIES

Seed Treatment Methods for Promoting Germination of Eastern Gamagrass
FLPMC-T-0004-RA

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

Introduction: Eastern gamagrass has several inherent traits that make it difficult to establish, including seed dormancy. Dormancy has been overcome by chilling seed on moist substrate. In published studies, maximum germination was obtained by chilling seed between two and four weeks, depending on the genetic population. Results from other studies have shown that treatment with gibberellin (GA) increased germination. Since eastern gamagrass in Florida evolved under a milder climatic regime than more northern ecotypes, it was not known how seed from Florida ecotypes would respond to cold stratification.

Objective: To investigate methods of stimulating seed germination in Florida populations of eastern gamagrass.

Progress: Seed from two native Florida accessions of eastern gamagrass (9059213 and 9059264) was hand collected from plots established at the PMC. Seed was collected in July of 1999 and stored in a cooler at approximately 45^{o} F and 45% humidity until it was treated. Three treatments were applied to both accessions plus an untreated control. In the first treatment, GA-plus-chilling, seed was soaked in a solution of GA and tap water (105 mg GA (A.I.)/liter water) for 24 hours. Seed was then rinsed and drained. Damp seed was placed in plastic bags and refrigerated for 4 weeks at 35 to 45^{o} F. The chill-only treatment involved rinsing with water to moisten seed, draining, placing in plastic bags and refrigerating for 4 weeks. The GA-only treatment involved soaking seed in GA solution for 24 hours before planting. Dry untreated seed stored in the cooler was used as a control. All treatments were replicated four times with 38 seed used per treatment. Seed was planted in containers of potting soil in the PMC greenhouse on September 22, 1999. Emergence was recorded every 7 to 10 days following planting.

Table 10. Greenhouse emergence at 2 dates of 2 accessions of eastern gamagrass seed treated with 3 different seed treatments, and an untreated control.

Treatment	9059213		9059264	
	45 Days	8 Months	45 Days	8 Months
GA + Chill	69a	70a	59a	61ab
Chill	57ab	65ab	39bc	50abc
GA	17de	57abc	34de	57abc
No Treatment	3e	29d	9e	42cd

*Means followed by different letters are different (P<0.05) according to Tukey's HSD Test

All seed treatments had significantly higher germination than did untreated seed after 45 days (Table 10). Highest germination was obtained with chilled GA-treated seed. The two accessions used in this study responded differently to chilling or GA alone. Chilling seed of accession 9059213 produced a similar response to the chilled GA treatment, indicating that this accession is very sensitive to cold stratification. Response to GA alone was significantly less

than chilling. Chilling and GA alone produced very similar responses in accession 9059264, both of which promoted significantly lower germination than the chilled GA treatment at 45 days. This accession may not be as sensitive to cold stratification, and may be less prone to dormancy.

A late seeding date and cooler winter temperatures in the greenhouse may have actually simulated a natural chill treatment. Emergence slowed greatly between December and April. At the inception of warmer spring temperatures, emergence increased rapidly in several treatments, especially in the untreated control. A final count was made on 5/31/00, eight months after planting. Emergence from GA plus chill treatments had the highest immediate and long-term emergence. Even though untreated seed had substantial emergence in the spring, it was significantly less than emergence from the other three treatments. It may be worthwhile to repeat this study in the spring of the year so that cooler winter temperatures do not confound the different treatments.

As noted above, not only did the chilled GA treatment promote the highest germination it also promoted very rapid germination (Figure 1). Most of the chilled GA seeds emerged between 5 and 10 days after planting. Only 21% of the chilled seed and 10% of the GA-treated seed that germinated in 45 days had done so within the first 10 days after planting. None of the untreated seeds had emerged within the first 10 days. The chilled GA seedlings were also taller and more robust than the other treatments, with many seedlings having double shoots.

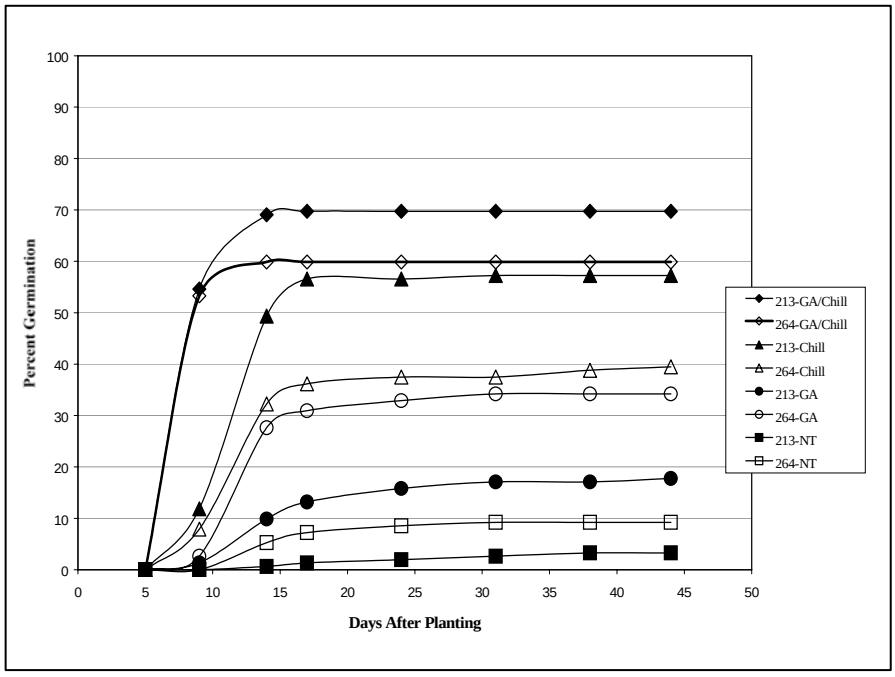

Figure 1. Percent germination of two Florida populations of eastern gamagrass seed (9059213 and 9059264) from four seed treatments: GA/Chill = soaked in GA and chilled for 4 weeks; Chill = chilled for 4 weeks; GA = soaked in GA; NT = no treatment.

In conclusion, it is apparent from the results of this study that Florida accessions of eastern gamagrass do have dormancy mechanisms. Chilling and GA both promoted germination in the two Florida accessions used in this study, but a combination of both treatments produced the greatest seed germination. In addition, this dual treatment promotes very rapid emergence

and robust plants. Seed treated in this manner has the potential to dramatically increase field establishment success, if processes can be refined for large-scale plantings.

Future Research Needs: It would be beneficial to repeat this study in the summer, to determine if warmer soil temperatures would promote higher germination, especially in untreated seed.

Seed Production of Upland Native Plants – FLPMC-T-9902-CR

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

Introduction: Based on results of direct seeding studies on reclaimed mined lands, several species of native forbs and grasses were selected for further increase and possible commercial release. These species are pinewoods bluestem (*Andropogon arctatus*), a rhizomatous little bluestem (*Schizachyrium scoparium*), three types of gayfeather (*Liatris elegans, L. gracilis and L. tenuifolia*), and paintbrush (*Carphephorus corymbosus*).

Objective: To develop methods to maximize seed production in the selected species and determine stand longevity under cultivation.

Table 11. Native seed production study laboratory germination results for 2000.

Species	Common Name	Acc. Number	Origin	Collection Date	% Lab Germ
Andropogon arctatus	Pinewoods bluestem	9060084	PMC-dry (Ft. Cooper)	11/9/00	36
			PMC-irr.	11/21/00	18
Schizachyrium scoparium	Creeping bluestem	9060083	PMC-dry (Ft. Cooper)	11/9/00	8
			PMC-irr.	11/21/00	8
Liatris elegans	Gayfeather	9059730	PMC –dry (Floral City)	11/3/00	19
			PMC-dry	11/21/00	45
			PMC-irr.	11/21/00	63
Liatris tenuifolia	Gayfeather	9059731	PMC-dry (Ft. Cooper)	11/3/00	24
			PMC-dry	11/22/00	15
Liatris tenuifolia	Gayfeather	9060449	PMC-irr. (Avon Park)	11/21/00	56
Liatris gracilis	Gayfeather	9060449	PMC-irr.	11/21/00	42
Carphephorus corymbosus	Paintbrush	9059729	PMC-irr. (Ft. Cooper)	11/21/00	38

Progress: The six species were established in small increase plots on irrigated and non-irrigated fields at the Florida PMC in 1999. Depending on the species, plants were established by either direct seeding or from transplants started in the greenhouse. Sky blue lupine (*Lupinus diffusus*)

was also direct seeded onto the non-irrigated site. Due to an apparent susceptibility to a soil-borne pathogen, all lupine plants died shortly after emergence. Pinewoods bluestem and *Liatris elegans* both established well by direct seeding in the non-irrigated field, despite a very droughty spring. In fact, *L. elegans* appears to be easier to establish by direct seeding into the field, rather than starting transplants in the greenhouse. *L. elegans* prefers very dry conditions, and does not establish well in moist soils. Both species produced seed in the fall of 1999, with *L. elegans* producing over 100 pounds of pure seed per acre.

Table 12. Seed production by native species in 2000

Species	Acc. Number	Origin	Collection Date	Estimated Purity (%)	Pure Seed Wt. (g)	Pounds Pure Seed/ Acre
Andropogon arctatus	9060084	PMC-dry (Ft. Cooper)	11/9/00	59	236	86
		PMC-irr.	11/21/00	59	368	90
Schizachyrium scoparium	9060083	PMC-dry (Ft. Cooper)	11/9/00	48	54	48
		PMC-irr.	11/21/00	48	216	52
Liatris elegans	9059730	PMC –dry (Floral City)	11/3/00	65	59	21
		PMC-dry	11/21/00	65	79	28
		PMC-irr.	11/21/00	65	5	4
Liatris tenuifolia	9059731	PMC-dry (Ft. Cooper)	11/3/00	65	57	104
		PMC-dry	11/22/00	65	5	9
Liatris tenuifolia	9060449	PMC-irr. (Avon Park)	11/21/00	65	32	24
Liatris gracilis	9060449	PMC-irr.	11/30/00	65	46	35
		PMC-irr.	12/5/00	65	15	14
Carphephorus corymbosus	9059729	PMC-irr. (Ft. Cooper)	11/21/00	65	62	76

All species produced seed in 2000. Due to an extremely droughty year, seed production was relatively low in the non-irrigated plots. However, pinewoods bluestem seed had higher germination in non-irrigated plots (Table 11). Seed may have been collected too early from irrigated plots, which would account for the lower viability. Pinewoods bluestem had slightly greater production on irrigated plots than on non-irrigated (Table 12). Because of droughty conditions, *L. elegans* had much lower seed production on non-irrigated plots in 2000 than the previous year. Seed viability was also mediocre on non-irrigated plots. Viability was higher on irrigated plots, however, *L. elegans* does not perform well on irrigated soils and actual production was very low. Clearly, this species needs to be cultivated under dryland conditions. The other species had fair production on irrigated plots in 2000.

Future Research Needs: Management of residue and top growth need to be tested in 2001 to find ways to increase seed production in these six species.

Wiregrass Residue Management for Seed Production – FLPMC-T-9607-WO

Project Stage: Fifth year of a six-year study.

Introduction: Wiregrass is considered an important component of pineland habitats because of its ability to carry fire. In native situations, wiregrass contributes a large percentage of the fuel for understory burn management programs. Many public agencies and private conservation groups, among others, are interested in using wiregrass to revegetate native habitat. Dependable supplies of seed are needed to meet this growing demand, and so it must be economically feasible for commercial producers to establish and maintain production fields of wiregrass. Cultural methods, which will maximize viable seed production and stand longevity, need to be developed. However, very little is known about growing this species under cultivation. It has been shown that wiregrass requires a growing season burn to produce viable seed, but burning is not always feasible. Clipping would be more practical in some situations, but it is not known if clipping will have the same effect as burning. Wiregrass evolved in very nutrient-poor soils, so it is not known how fertilization will interact with residue management treatments either.

Objective: To study the effects of method of canopy removal and fertility on seed production and seed viability of wiregrass.

Progress: A field of wiregrass was established on an irrigated site at the PMC with 4" tubelings in February of 1996. Transplants were planted on 2' centers. The field was extended with 6" tubelings planted in October of 1997. The seed source was from a wet flatwoods site at Avon Park Bombing Range. Soils in the study plots are predominately Kendrick fine sand which is well drained. Plants were allowed to establish for 2 years, and the field was then divided into subplots in 1999 in a split-plot design. Main plots are canopy removal method (burn vs. clip). Subplots are fertilization treatment (none vs. 50 lbs/ac of 0-10-20 applied just after canopy removal). In 1999, plots were clipped and burned on July 8 between 1:00 and 4:00 p.m. High temperature that day was 94^{o} F. Humidity was not recorded at the PMC, however, for the sake of comparison, relative humidity at the Tampa Airport on 7/8 was 68% at 1:00 p.m. The clipping treatment was done with a Grasshopper mower, which cut the stubble to a height of 1 to 2". Residue was left on the plots. For the burn treatment, plants were set on fire with a drip torch. Most plots were not dense enough to carry fire across the entire plot, so plants often had to be individually burned. Fertilizer was applied with a hand-held fertilizer spreader. Plot size is 10' x 40' and each treatment is replicated 4 times. Plots were harvested with the Flail-Vac Seed Stripper on December 8, 1999. Purity was estimated to be 42%. Seed samples were weighed and germination tests were conducted.

Clipping and burning treatments were applied for the second year of this study on July 12, 2000. High temperature for the day at the PMC was 94^{o} F. The Brooksville airport reported the relative humidity at the airport to be 65% at 3:53 p.m. Half of each plot was fertilized (150 lbs. K/ac.) in split applications (applied on 8/1 and 8/23). Fertilizer treatments were increased three-fold in 2000 in an attempt to elicit a larger response. Plots were harvested with the Flail-Vac Seed Stripper on December 12, 1999. Average seed purity was estimated to be 56%. Seed samples were weighed and germination tests were conducted.

Pounds of seed/acre obtained in 1999 from the clip vs. burn study and percent viable seed are shown in Table 13. There was no significant difference in pounds of seed produced per residue or fertilizer treatment. This was especially true when calculated on a production per plant basis. Number of seed producing plants varied somewhat per plot, so plant numbers in each plot was used to more accurately determine actual production. Regarding seed viability, there were no differences between clipping and burning or fertilizer treatments.

Table 13. Wiregrass canopy removal method study, 1999 percent seed viability and production in pounds per acre and grams per plant.

Treatment	Seed Produced lbs./ac.	Seed per Plant (g)	% Viable Seed
Burn/Fertilized	19.3	0.97	18
Burn/Unfertilized	24.3	1.21	21
Clip/Fertilized	21.7	1.05	21
Clip/Unfertilized	21.8	1.06	17
LSD (0.05)		0.51	

In 2000, there was again no significant difference in pounds of seed produced per residue or fertilizer treatment (Table 14). This is good news for land managers who want to manage wiregrass for seed but may be restricted from burning at an appropriate time. Number of seed producing plants varied somewhat per plot, so plant numbers in each plot were used to more accurately determine actual production. Average germination had increased slightly over 1999 levels. Total pounds of seed produced per acre decreased slightly from 1999 levels. Removing residue annually may be negatively impacting the plants and decreasing plant populations. Burned fertilized and unfertilized treatment plant losses were 12% and 8% respectively between 1999 and 2000. Clipped fertilized and unfertilized treatment plant losses were 6% and 10% respectively.

Table 14. Wiregrass canopy removal method study, 2000 percent seed viability and production in pounds per acre and grams per plant.

Treatment	Seed Produced lbs./ac.	Seed per Plant (g)	% Viable Seed
Burn/Fertilized	15.6	1.0	28
Burn/Unfertilized	18.5	0.9	26
Clip/Fertilized	18.0	1.0	25
Clip/Unfertilized	17.5	1.0	25
LSD (0.05)		0.4	6

Future Research Needs: This study will continue for one more year, however, fertilized treatments may be adjusted to include applying nitrogen in the spring of the year to determine if this will decrease plant losses and increase viable seed production.

Wiregrass Burn Frequency Study – FLPMC-T-9608-WO

Project Stage: Fifth year of a seven-year study.

Introduction: Although a growing season fire is known to stimulate viable seed production, there is some thought that burning annually reduces stand vitality. Little research has been done to document this or consider how fertilization interacts with burn frequency.

Objective: To study the relationship between burn frequency and fertility as it relates to seed production and viability.

Progress: A portion of the Avon Park source wiregrass field discussed above was used for this study, which is a split-plot design. Main plots are burn frequency (annual, every 2 years or every 3 years). Subplots are fertilization treatment (none vs. 50 lbs./ac. of 0-10-20 applied shortly after the time of canopy removal on burned and unburned plots). Plots were burned 7/8/99 as outlined above. Fertilizer was then applied with a hand-held fertilizer spreader. Plot size is 10' x 40' with four replications. Plots were harvested with the Flail-Vac Seed Stripper on December 9, 1999. Seed purity was estimated to be 24%. Number of seeds per gram averaged 2300 and had an average of 1,038,000 seed/lb. Flowering plants were counted in each plot just prior to harvest. Since all treatments were burned in 1999, the only difference in treatments in 1999 was fertilization. Unfertilized plots averaged 15.35 lbs. seed/ac., fertilized averaged 15 lbs. seed/ac. Production per plant of the unfertilized plants was 0.79 g, fertilized was 0.76 g. Fertilization did not significantly affect seed viability, which was 25% and 26% for unfertilized and fertilized plots respectively.

Table 15. Wiregrass burn frequency study, 2000 percent seed viability, and production in pounds per acre and grams per plant.

Treatment	Seed Produced lbs./ac.	Seed per Plant (g)	% Viable Seed
1 Year/Fertilized	27.8	1.0	26
1 Year/Unfertilized	27.1	0.9	17
2 Year/Fertilized	15.8	0.6	17
2 Year/Unfertilized	16.1	0.7	17
3 Year/Fertilized	14.8	0.7	13
3 Year/Unfertilized	14.2	0.6	14
LSD (0.05)		0.4	9

On July 12, 2000, the 1-year frequency plots were burned in this study. Half of each plot was then fertilized (150 lbs. K/ac.) in split applications (applied 8/1 and 8/23). Fertilizer rates were increased three-fold in an attempt to elicit a greater response. Plots were harvested in December. Purity was estimated to be 56%. Number of flowering plants was recorded for each plot just prior to harvest. Even though 2 and 3-year cycle plots weren't burned, many plants still flowered. Flowering appears to be related to plant size and the amount of old growth shading the crown. Seed samples were harvested from unburned plots also. As would be expected, seed production was higher in burned plots, but not greatly so (Table 15), especially when placed on a per plant basis. Fertilizer did seem to increase viability in the burned treatment, but not in the unburned treatments. It is surprising that the burned, unfertilized treatment had no higher germination than the unburned treatments. Plant losses in annually burned plots between 1999 and 2000 were 15% and 18% for fertilized and unfertilized treatments respectively.

Future Research Needs: This study is to continue for at least 2 more years. Future fertilizer treatments may be adjusted to include an application of nitrogen at the beginning of the growing season, to determine if this will decrease plant losses and increase viable seed production.

Wiregrass Fertility Management Study – FLPMC-T-9609-WO

Project Stage: The fifth year of a six-year study.

Introduction: Wiregrass grows in a broad range of ecotypes in Florida, from mesic flatwoods to xeric sandhills. Soil conditions, moisture and fertility vary widely in these ecotypes. Wiregrass, especially upland types, typically grows in very nutrient-poor environments. Wiregrass evolved under a fire regime, and requires a growing season fire to produce viable seed. Nitrogen is volatilized by burning, therefore, much of this nutrient, along with some of the phosphorous, is permanently lost by burning. On the other hand, beneficial nutrients such as Ca, K and Mg are released in the ash, and may be important for stimulating production of viable seed.

Objective: To determine the effect of N, P and K on seed viability of an upland ecotype of wiregrass, with K hypothesized to be the most essential nutrient for seed viability.

Progress: Seed collected from an uplands site in Wekiwa State Park was planted into six-inch cone trays in the greenhouse in 1996. In October of 1997, tubelings were transplanted into an irrigated field at the Florida PMC which had been kept clean tilled for two years. Within and between row spacing was two feet. The site is predominately Kendrick fine sand, which is well drained. In 1999, the field was broken into study plots to compare fertilization treatments (none vs. 50 lbs. K/ac. of 0-10-20, vs. 50 lbs. K/ac. 10-10-10) applied after canopy is removed. Plot size is 10' x 30', with 6 replications. The field was partially burned on 7/8 from 4:00 to 5:00 p.m., with the remainder being burned on 7/9/99 between 1:00 and 4:00 p.m. A temperature high on both days was 94^{o} F. Relative humidity at the Tampa airport on 7/8 was 72%, although it was probably higher than that at the Florida PMC because a thunderstorm was moving in. Humidity at the Tampa Airport on 7/9 between 1:00 and 4:00 p.m. was 74%. Plants were fired with a drip torch. The canopy was not dense enough to carry the fire over the entire field so many plants were burned individually. Some plants were too green, and would not completely burn. Plant counts were made prior to harvest in each plot. Seed was harvested with the Flail-Vac on December 9, 1999. Seed purity was estimated to be 34%. Number of seed per gram averaged 2,500 with there being 1,135,000 seed/lb. There was no significant difference in seed production or viability between treatments (Table 16) in 1999. Soil tests revealed that nutrients were low in most plots.

Table 16. Wiregrass fertilization study, 1999 percent seed viability, and production in lbs./ac. and grams per plant.

Treatment	Seed Produced lbs./ac.	Seed per Plant (g)	% Seed Viability
K	20.9	1.32	27

Treatment	Seed Produced lbs./ac.	Seed per Plant (g)	% Seed Viability
K & N	23.0	1.35	29
No treatment	21.8	1.21	26
LSD (0.05)		0.36	

In the second year of this study, fertilizer treatments were increased three-fold (150 lbs. K/ac., 150 lbs. N & K/ac.) from 1999 levels. All plots were burned on July 12, 2000. Fertilizer was then applied in split applications (applied 8/1 and 8/23). Seed was harvested with the Flail-Vac in December. Flowering plants in each plot were counted just prior to harvest. Seed was weighed, and purity averaged 56%. Seed were smaller in 2000 than in 1999, with there being an average of 1,667 seed per gram and 756,667 seed per pound in 2000. There was no difference in seed viability or production between any of the treatments (Table 17) in 2000 and viable seed production had decreased from 1999 levels. Intensive annual burning appears to be stressing the plants in this study. Plant numbers dropped 31% in both fertilized treatments between 1999 and 2000, while unfertilized treatments lost 37%.

Table 17. Wiregrass fertilization study, 2000 percent seed viability, and seed production in lbs./ac. and grams per plant.

Treatment	Seed Produced lbs./ac.	Seed per Plant (g)	% Viable Seed
K	13.1	1.2	21
K & N	14.3	1.2	23
No treatment	12.6	1.1	23
LSD (0.05)		0.7	8

Future Research Needs: This study is to continue for 1 more year. Future fertilizer treatments may be adjusted to include an application of nitrogen at the beginning of the growing season, to determine if this will decrease plant losses and increase viable seed production.

Reclaimed Minedlands Lakeshore Native Species Establishment Study FLPMC-T-9901-CR

Project Stage: The second year of a four-year study.
Introduction: The FLPMC is working with several native grasses that are adapted to mesic environments, these include switchgrass, eastern gamagrass, chalky bluestem and common maidencane. Very little information is available on establishing these species in Florida ecosystems.

Objective: Develop site adaptation and establishment technology for these mesic grass species.

Progress: In August of 1999, maidencane was established with rhizomes and the other three grass species were direct seeded on a newly reclaimed lake shoreline site provided by Cargill Fertilizer, Inc. The study plots began within one foot of the water line, and extended 25' up a

relatively steep bank. Soils were sandtails and overburden topped with 6 to 12" of muck soils. Plot size was 8' x 25', with four replications. Two Florida accessions of eastern gamagrass (9059213 and 9059264) were hand seeded at a rate of 4 seeds per linear foot (approx. 19 lbs./ac.) Three rows of each accession were planted in each plot, with row spacing between plots being approx. 1.5'. Planting depth was 2 to 4". 'Alamo' switchgrass and the Florida switchgrass accession 9060500 (progeny from 'Miami' x 'Stuart' cross) were seeded in 3 rows each per plot, at a rate of approx. 60 pls/ft^2. Planting depth was 1 to 2". Chalky bluestem seed (collected from several initial evaluation plots at the PMC in 1998 with a forage harvester) was hand broadcast over plots. Rhizomes of 'Halifax' maidencane (*Panicum hemitomon*) from Mississippi, and the FLPMC released Florida accession 'Citrus' maidencane, were hand planted in trenches. Maidencane planting depth was 2 to 6" with approx. 5 rows per accession.

In addition to monoculture treatments, 3 rows of 'Citrus' maidencane were established in plots that were then hand broadcast with a mixture of gamagrass (0.25 seed/ft^2), switchgrass and chalky bluestem at a rate 15 pls/ft^2 each. All plots were packed with a cultipacker before and after seeding.

Table 18. One-year percent canopy cover of native species on Cargill lake shoreline at three levels on the slope.

Accession	Lower Slope	Middle slope	Upper Slope
	Average % Canopy Cover		
Halifax Maidencane	10	7	5
Citrus Maidencane	29	15	13
Chalky Bluestem	10	7	9
Gama – 9059213	15	15	11
Gama – 9059264	22	16	11
Switchgrass – Alamo	27	23	28
Switchgrass – 9060500	30	34	39

One-year evaluations were conducted on August 29, 2000. Measurements were taken at the top of the slope, in the middle, and at the base of the slope next to the water line, to observe the effect of moisture on establishment. Despite extremely droughty conditions, all species established well in the first year. Dry conditions did inhibit establishment on the upper slopes. Average percent canopy cover for each accession is shown in Table 18. Numbers do not include the amount of canopy cover provided by weeds in the plots. Overall, switchgrass produced the densest canopy of the four species, due in part to a high seeding rate. Dense stands substantially suppressed weed competition in the switchgrass plots. 'Citrus' maidencane very aggressively colonized the area next to the water.

General planting recommendations for eastern gamagrass call for a dormant winter seeding in which seed is planted in the late fall. This allows seed to undergo a cold stratification period that stimulates seed germination in the spring. Eastern gamagrass is typically slower to establish because of seed dormancy, but germinated well at this site. A surprising number of eastern gamagrass seedlings emerged between August and December in 1999 (Table 19). Accession 9059213 showed little change in plant densities between the 5-month and 1-year evaluations, except near the waterline. Several small seedlings were seen emerging at the time of the 1-year evaluation. Accession 9059264, had relatively higher emergence shortly after

planting than did 9059213. Possibly due to the drought, plant densities had actually decreased in 9059264 plots after 1 year.

Table 19. Five month and one-year stand densities of 2 eastern gamagrass accessions at Cargill lake shoreline; measurements taken at three levels above the waterline.

Accession	Lower Slope	Middle slope	Upper Slope
	Average Plants/m^2		
Gama – 9059213 (5 months)	3	4	3
Gama – 9059213 (1 year)	7	4.3	3.5
Gama – 9059264 (5 months)	15	10	11
Gama – 9059264 (1 year)	11	7	7.3

Chalky bluestem plants were generally smaller at one year of age than the other species in the study (Table 20) and had less canopy closure. Although not as tall as switchgrass, the gamagrass plants grew surprisingly tall in the first year. Nutrient rich muck soils contributed greatly to the height of this nitrogen-loving species.

Table 20. One-year plant height of native species at Cargill lake shoreline; measurements taken at three levels above the waterline.

Accession	Lower Slope	Middle slope	Upper Slope
	Plant Height (cm)		
Halifax Maidencane	38	42	33
Citrus Maidencane	64	55	65
Chalky Bluestem	57	49	42
Gama – 9059213	61	65	66
Gama – 9059264	56	59	54
Switchgrass – Alamo	75	77	87
Switchgrass – 9060500	73	72	72

Gamagrass did not emerge from the mixture seedings (Table 21). Since mixture plots were broadcast instead of planted in a row, it appears that the seed was planted too shallowly to promote emergence. Switchgrass and maidencane tended to dominate the mixture plots. Chalky bluestem established only on the two lowest levels evaluated. Competition from the other species may have inhibited chalky bluestem establishment.

Based on the results of this study thus far, chalky bluestem has potential to add diversity to a native lowland mix. However, due to its slower growth, it is not as useful for controlling soil erosion as switchgrass and maidencane. Despite the late August seeding date, the other 3 species established well before being slowed by winter frosts. If gamagrass is to be used as the primary erosion control agent when planting on slopes, results from this study suggest that either the seeding rate needs to be increased, or the seed needs to be pretreated so that it will germinate at the time of planting. A nurse crop may also be helpful.

Table 21. One-year percent canopy cover provided by native species planted as a mixture at Cargill lake shoreline at three levels above the waterline.

Accession	Lower Slope	Middle slope	Upper Slope

	Average % Canopy Cover		
Citrus Maidencane	12	11	12
Chalky Bluestem	6	6	
Gama – 9059213			
Switchgrass – 9060500	25	18	17
Total	43	35	29

Future Research Needs: Plots will continue to be evaluated for two more years.

Reclaimed Minedland Wiregrass and Indiangrass Seeding Study – FLPMC-T-9707-CR

Project Stage: The fourth year of a five-year study.

Introduction: Direct seeding technology is necessary for successful revegetation of native species on reclaimed phosphate mined lands. An extensive series of studies were planted at a reclaimed minedland site near Bartow, Florida provided by Cargill Fertilizer, Inc. Lopsided indiangrass and wiregrass were direct seeded in sandtails and overburden soils during Jan. and May of 1997 through 1999.

Objective: To determine the effect of seeding method, seeding rate, and planting date on the establishment of wiregrass and lopsided indiangrass in monoculture and mix.

Progress: The experiments (including establishment data collected through January 2000) were discussed in-depth in the paper "Seeding Two Native Grass Species on Reclaimed Phosphate Minedlands", which was presented by S. Pfaff at the American Society for Surface Mining and Reclamation annual national meeting at Tampa, FL June 12, 2000.

Future Research Needs: Experimental plots will continue to be evaluated through 2001 for establishment and persistence. Results are to be summarized in 2001 and presented to the Florida Institute of Phosphate Research, the agency who sponsored this research, for publication.

Critical Area Restoration with Florida Native Species– FLPMC-T-9710CR

Project Stage: A five-year project ending in 2001

Introduction: Eglin Air Force Base in the Florida Panhandle is interested in restoring borrow pits and other critical areas with native vegetation. They would prefer to use seed sources from the base. The PMC has been working with them to collect, grow and plant native species on the on critical area sites.

Objective: Determine the ability of local Eglin and other Florida ecotypes of native grasses to colonize critical areas.

Progress: Three native grasses were collected, grown and replanted on a reclaimed borrow pit site in 1997 through 1998. Final evaluations are to be conducted on this site in 2001. In the fall of 1999, switchgrass was collected from 4 locations on Eglin in the form of plants. These plants were then placed into a field at the Brooksville PMC in the spring of 2000 for the purpose of seed production. Seed was collected on 10/10/00 and cleaned in an air screen cleaner to remove chaff and light seed. Much of the seed remaining after cleaning was still very light. Germination was poor, averaging only 2%. Although an abundance of seed was produced, most did not fill - a common problem with Florida ecotypes of switchgrass.

Future Research Needs: Much work still needs to be done on finding ways to successfully establish native grasses, especially on critical area sites. This work also needs to include developing seed sources Florida ecotypes that are vigorous and have high viable seed production.

Constructed Wetland – PMC Sewage Disposal System – FLPMC-T-9101-WE

Project Stage: Ongoing long-term monitoring.

Introduction: Constructed wetlands are relatively new innovations designed to remove harmful substances from wastewater before they can leach into the groundwater. These systems have been shown to be very effective in treating domestic wastewater on a small or large scale. Due to a predominance of coarse sandy soils that percolate rapidly and also soils with high water tables in which drain fields do not work properly, the state of Florida could benefit greatly from constructed wetlands. In 1993, the Brooksville, FL PMC installed an experimental constructed wetland system as part of the onsite sewage disposal system. This system was called a "Rock Reed Filter" because it uses aquatic plants placed in a rock substrate to filter the effluent water coming from the septic tank. Although this system was shown to be effective in treating wastewater, state health officials were still reluctant to permit such systems in Florida. Long-term effectiveness and necessary maintenance were two aspects they expressed concern over.

Objective: To demonstrate maintenance needs of the Rock Reed Filter, and long-term effectiveness, especially during the winter months when vegetation is dormant due to frost.

Progress: Three wells for testing purposes are located in the Rock Reed Filter. Well number 1 is located at the opening where the water from the septic tank (influent) enters the system. Well number 2 is located in the center, and well number 3 is located where the effluent water exits the system. Wells are used to test the quality of the water as it moves through the Rock Reed Filter, which has an impermeable base so that no water can leach out of the system. PM personnel tested water samples three times in 1999, and three times in 2000. Two of these tests occurred during the winter after several species had gone dormant because of killing frosts. The first killing frost occurred in 1999 on December 1, and the last frost of the winter occurred on February 6, 2000. Tests were conducted to determine reduction in total suspended solids (Table 22), nitrate nitrogen (Table 23) and phosphorous (Tables 24 and 25). Nitrogen ammonia was also tested, however concentrations were usually too low to obtain a proper reading.

Table 22. Total suspended solids in water samples from the Rock Reed Filter at the Brooksville PMC in 1999 and 2000, and percent reduction from influent to effluent.

	Total Suspended Solids (mg/l)			
Sample	Well			%
Date	1	2	3	Reduction
9/22/99	10.0	2.0	1.5	85
11/04/99	10.5	1.0	2.5	76
12/14/99	19.5	0.0	1.0	95
1/20/00	19.5	0.5	0.5	97
5/09/00	59.0	16.5	2.5	96
6/27/00	9.5	2.5	4.5	53

(For comparison, the annual average standard for advanced wastewater treatment systems is <5 mg/l TSS)

Table 23. Nitrate LR test results from Rock Reed Filter water samples at the Brooksville PMC in 1999 and 2000, and percent reduction from influent to effluent.

	Nitrate LR (mg/l)			
Sample	Well			%
Date	1	2	3	Reduction
9/22/99	0.04	0.05	0.04	0
11/04/99	0.03	0.03	0.02	20
12/14/99	0.44	0.48	0.05	89
1/20/00	0.00	0.33	0.04	89
5/09/00	0.20	0.05	0.06	69
6/27/00	0.18	0.07	0.04	77

(For comparison, the annual average standard for advanced wastewater treatment systems is <3 mg/l total N)

Table 24. Total phosphorous test results from Rock Reed Filter water samples at the Brooksville PMC in 1999 and 2000, and percent reduction from influent to effluent.

	Total P (mg/l)			
Sample	Well			%
Date	1	2	3	Reduction
9/22/99	6.4	5.4	3.6	45
11/04/99	4.2	3.6	3.8	11
12/14/99	2.2	3.3	3.8	
1/20/00	9.7	5.2	2.9	70
5/09/00	9.4	6.8	6.1	35
6/27/00	1.8	1.9	2.0	

(The annual average baseline system standard for septic tank effluent is 6-10 mg/l, and the annual average for advanced wastewater treatment systems is <1 mg/l total P)

Table 25. Reactive phosphorous test results from Rock Reed Filter water samples at the Brooksville PMC in 1999 and 2000, and percent reduction from influent to effluent.

Sample Date	Reactive P (mg/l) Well 1	Well 2	Well 3	% Reduction
9/22/99	10.1	8.5	5.9	42
11/04/99	6.0	5.5	5.4	9
12/14/99	4.1	4.4	6.2	
1/20/00	13.1	6.3	3.8	71
5/09/00	14.2	9.6	6.3	56
6/27/00	3.4	4.6	5.4	

Concerning maintenance, weeds, which had encroached into the system, were removed in 12/00.

Future Research Needs: System will continue to be maintained and monitored.

Sunn Hemp Seed Production Study – FLPMC-T-0003-CP

Project Stage: One - year study.

Introduction: Sunn hemp (*Crotalaria juncea*) is an annual legume that grows very rapidly and produces a substantial amount of nitrogen and biomass. Cotton and vegetable farmers in the southern US are becoming very interested in using sunn hemp as a green manure crop. Because of its ability to suppress weeds and root knot nematodes, sunn hemp can also potentially reduce pesticide use. In 1983, the Hawaii PMC and the University of Hawaii jointly released the sunn hemp cultivar 'Tropic Sun'. Currently, the only commercial source of sunn hemp seed is from Hawaiian growers, and seed costs are too high to be economical for cover crop use. Efforts have been made to produce seed in the southeastern US, however sunn hemp typically does not set seed until fall or winter. Therefore, a semi-tropical climate is necessary for seed production.

Objective: Determine locations in Florida where the climate is conducive to sunn hemp seed production. Secondly, study the effect of planting date on seed production.

Progress: Seed was distributed to several cooperators throughout Florida, with 14 responding back with results (Table 26). Cooperators were asked to plant seed on 3 dates, one month apart. First seeding date in north Florida was June 1, in central Florida July 1, and in south Florida August 1. Plot size was typically 0.3 acres with a planting rate of 10 pounds per acre. The winter of 2000 was unusually cool, with the first frost occurring earlier than normal. As would be expected, most plantings in north and central Florida were killed by frost before viable seed could be produced. The one exception to this occurred in Putnam Co., where cooperator, George Miller, was able to produce an average of 258 lbs. of seed per acre, with a germination rate of

30%. Most of the cooperators in this study felt that moving the first planting date up one month would have provided a greater opportunity for viable seed to be produced.

All locations reported an abundance of blooms, and several noticed honeybees and bumblebees visiting the plantings. At the PMC, honeybees were observed among the blooms, but bumblebees ignored them, and instead went to an adjacent native wildflower plot. Bumblebees may possibly not prefer sunn hemp flowers, and will not visit them until they become the only source of nectar during the winter months. It requires a very large insect to trip the stamen of the sunn hemp flower and expose the pollen. Honeybees appear to be too small to do this, but not bumblebees. Seed production may be largely dependent on these large pollinators.

Several producers in south Florida reported that their plantings had been frosted, but the oldest plantings had resprouted from the roots and were blooming again. Samples were taken to determine original production from these plantings. Production from the second flush is to be determined once seed has matured. Plantings below Miami had not been frosted, but planting date had been delayed because of heavy fall rains, and seed was not yet available.

Future Research Needs: Future studies should be located in south Florida, where the chances of producing viable seed are highest. The role of pollinators also needs to be better defined for this crop.

Table 26. Sunn hemp 2000 seed production study cooperators, locations, and planting and harvesting information.

Cooperator (Coordinator)	County	Latitude	Longitude	Planting Date	Killing Frost	Harvest Date	Seed* lbs/ac	Viability %
Dennis Hall (Darryl Williams)	Okaloosa	30° 46' 1"	86° 56' 22"	1-Aug	15-Nov		0	
D.L. Wright (George Hochmuth)	Gadsen (Quincy Ag Exp. Sta.)	30°	85°	20-Jun		27-Nov	Trace	<1
				20-Jul		27-Nov	Trace	<1
Gene Bertine (Allen Moore)	Suwannee	30° 10' 42"	83° 03' 11"	30-Jul		1-Feb	Trace	<1
Chad Hutchinson (Bill Harb)	St. Johns (Hastings IFAS)	29° 39' 26"	81° 27' 23"	5-Jun	20-Nov		0	
				7-Jul			0	
				9-Aug			0	
George Miller (Tom Cheyne)	Putnam	29° 0' 13"	81° 30' 39"	10-Jun	5-Nov	18-Jan	258	30
				15-Jul			0	
Winston Tooke	Alachua	29° 36'	82° 26'	2-Jul	18-Nov		Trace	<1
William Carter (Donna Hopwood)	Levy	29°	83°	29-Jun	22-Nov		0	
				13-Jul			0	
Brooksville PMC	Hernando	28° 38'	82° 20'	7-Jul	27-Nov		Trace	<1
				3-Aug			0	
				1-Sep			0	
Bill Rollins (Dan Oliver)	Pasco	28° 17' 0"	82° 11' 40"	10-Jul	15-Nov		Trace	<1 ?
				10-Aug				
Steward Lynn	Desoto	27° 20' 03"	81° 94' 76"	29-Jul	15-Dec		0	

Cooperator (Coordinator)	County	Latitude	Longitude	Planting Date	Killing Frost	Harvest Date	Seed* lbs/ac	Viability %
(LeRoy Crocket)				31-Aug				
Mitch Van Page	Lee	26° 31' 42"	81° 36' 53"	1-Aug	31-Dec		363	NA
(Tim Eckert)				4-Sep			0	
				7-Oct			0	
Chuck O'Bern	Hendry	26° 27' 30"	80° 58' 15"	1-Sep	22-Dec		0	
(Dan Rutledge)				1-Oct			0	
				1-Nov			0	
Pacific Tomato	Collier	26° 20' 00"	81° 22' 00"	1-Aug	30-Dec		282	NA
Growers				1-Sep				
(Tony Polizos)				5-Oct				
Barron Collier Co.	Collier	26° 20' 30"	81° 25' 30"	4-Aug	30-Dec		815	NA
(Tony Polizos)				1-Sep				
				2-Oct				
Teresa Olczyk	Dade	25°	81°	6-Nov	None		NA	NA
(Christine coffin)				8-Dec				

NA = Not Available

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

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. 2000	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
Through 1999	Annual PMC Activity Reports