

# **BROOKSVILLE PLANT MATERIALS CENTER: DEVELOPING SOURCES OF NATIVE WETLAND PLANTS FOR REVEGETATION IN FLORIDA**

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## **ABSTRACT**

Extreme disturbance (e.g., draining, filling, mining, etc.) in many of Florida's historical wetland communities have eliminated the possibility of natural colonization as an option in wetland restoration. As a consequence, most restoration projects require reintroduction of native wetland species. Often the most limiting factor in current revegetation efforts in Florida is availability and cost of planting material of native species, particularly wetland species. Part of the mission of the USDA, Natural Resources Conservation Service (NRCS), Brooksville Plant Materials Center (PMC) in Brooksville, FL, is to develop selections and commercial sources of native materials to restore ecosystem function. In the area of wetland species, the Brooksville PMC released 'Citrus' maidencane (*Panicum hemitomom*) selected germplasm in 1998. Maidencane is a native perennial, warm season, semi-erect grass that is adapted to aquatic or semi-aquatic sites. Citrus maidencane (PI421993) was collected in Citrus County, FL, and proved to be superior to 120 other accessions collected from throughout the state due to its rate of spread. This year, the Brooksville PMC is releasing a selection of blue maidencane (*Amphicarpum muhlenbergianum*). Blue maidencane (a.k.a., 'goobergrass' because of its geocarpic seed production) is a native, warm season grass that occurs in transitional areas between flatwoods and depressional landscapes where the water tables usually can be found within 12 inches of the soil surface. The initial blue maidencane collection consisted of over 150 accessions from throughout the state and the one selected for release rated high in its growth and establishment potential. Both of these plants need to be propagated vegetatively due to limited seed production, but standard agronomic field production methods can be used which greatly reduces cost. For more information on these and other restoration plants native to Florida, visit the Brooksville PMC website (<http://www.fl.nrcs.usda.gov/programs/pmc/flplantmaterials.html>).

## **INTRODUCTION**

One of the most striking things for most first time visitors to Florida is the differing types and acreage of wetland communities in the state. The Florida Department of Environmental Protection ([www.dep.state.fl.us/water/wetlands](http://www.dep.state.fl.us/water/wetlands)) recognizes over 10 different freshwater wetland communities. In spite of the striking amount of wetland areas still present in Florida, an estimated 46% or over nine million acres of historic Florida wetlands have been altered or destroyed by agricultural, mining, and urban

development (Dahl, 1990). In recent years, there has been an increasing awareness within both the public and private sectors concerning the importance of functional wetlands for flood control, water supply and quality, nutrient retention and removal, and wildlife habitat.

Restoration and even creation of wetland areas has become a priority issue for Florida. For example, the Kissimmee River Restoration is a large scale cooperative project between the South Florida Water Management District and the U.S. Army, Corp of Engineers, undertaken, in part, to restore over 27,000 acres of wetlands. Another example of the importance placed on wetlands are the current state regulations placed on the phosphate mining industry. It is estimated that between 5,000 to 6,000 acres of land are disturbed by phosphate mining annually; of this acreage, 25 to 30% are classified as wetlands. Reclamation and restorations rules (62C-16.0051) require that wetlands disturbed by site preparation of mining operations be restored on at least an acre-for-acre and type-per-type basis (<http://www.dep.state.fl.us/water/mines/rules.htm>).

In any wetland restoration project, plant material sources and restoration technique (e.g., natural revegetation, seeding, bare-rooted planting, containerized seedling planting, root cut planting, sapling planting, etc.) greatly effect the overall project cost and need to be clearly defined in the construction phase of the planning process (FL DEP, 1997). The Society for Ecological Restoration International has identified genetic fitness (i.e., adapted to local environment) as a critical aspect for selecting plant material in restoration projects (SERI Policy & Working Group, 2004); for this reason, local ecotypes are preferred. But for sites where local material is unavailable or for sites that have undergone significant physical disturbance, the introduction of diverse genetic stock is preferred (SREI Policy & Working Group, 2004). Part of the mission of the USDA, Natural Resources Conservation Service (NRCS), Brooksville Plant Materials Center (PMC) in Brooksville, FL, is to develop selections, technology for production, and sources of native materials to restore ecosystem function. By screening and identifying ecotypes of native species that have superior characteristics (e.g., plant vigor, rate of establishment, etc.) and developing production methods that minimize production costs, both public and private native revegetation efforts in the state should be enhanced.

Nearly one third of Florida's freshwater wetlands are classified as marshes, nearly treeless ecosystems compromised of shrubs and grasses (Cervone and Hassell, 2003). Two marsh wetland species, maidencane and blue maidencane, were identified by the Brooksville PMC Technical Advisory Committee as a critical need for current restoration programs.

## **MATERIALS AND METHODS**

Because this material was to be used over a wide area and not a specific locale (e.g., park or preserve), a wide genetic range of material of the two different grasses was assembled. With the help of local NRCS personnel and the PMC staff, effort was made to locate at

least three sources of each of the grasses in each county in the state with the restriction that the sources be no closer than five miles apart.

### Maidencane

One hundred twenty-one accessions of maidencane from throughout the state were planted in a preliminary evaluation study at the Brooksville PMC in the 1970's. Over three years the accessions were rated for such things as number of stems, leaf size, plant size, etc. From this group three accessions were selected for further testing due to superior performance. These accessions were tested at various locations throughout the state for use in effluent spray fields, erosion control, wetland restoration, etc. Based on this work, one accession was selected for plant release in 1999.

### Blue Maidencane

A total of 157 accessions of blue maidencane were collected in 1996 and 1997 from throughout the state of Florida in the form of root and shoot stock. Initial replicated evaluation plots of these accessions along with two maidencane control (Citrus selected germplasm and 'Halifax') 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. In March of 2000, rhizomes of the top rated accessions were planted in tubs for increase and planted out in replicated advanced evaluation trials at three locations (Polk and Collier Co. in 2000 and Hamilton Co. in 2001). From this work, one accession was selected for release in 2007.

## **RESULTS**

### Maidencane

A native perennial, warm season semi-erect grass, maidencane has stems diverging from true vertical by about 30 to 35 degrees. It grows 90- to 100-cm tall and spreads by creeping rhizomes. Growth usually commences in June and persists with vigor until mid-autumn. Leaf blades are characteristically lush green, 20- to 30-cm long and 1-cm wide. Rhizomes produce both sterile and fertile shoots. Sterile stems, which produce no seed heads, have hairy leaf sheaths; stems producing seed are hairless. The inflorescence is a compact, elongated panicle, 15- to 20-cm long; however, very little viable seed is produced. Maidencane grows in a variety of soils varying from peat to mineral and is a good indicator of fresh water marsh conditions.

Citrus selected germplasm (PI421993) was selected from an original assembly of 121 accessions based on its leafy, semi-erect growth habit and rate of spread and it has not been shown to have any disease or insect problems (Fig. 1; Maura and Pfaff, 1999). The accession was named Citrus because it was collected in Citrus County, Florida.



**Figure 1:** Citrus selected germplasm

In evaluations, Citrus maidencane produced over three times more high quality forage than other Florida accessions or the maidencane cultivar Halifax ([http://plant-materials.nrcs.usda.gov/pubs/mspmc\\_rnpahe2.pdf](http://plant-materials.nrcs.usda.gov/pubs/mspmc_rnpahe2.pdf)) released by the Jamie L. Whitten PMC in Coffeeville, MS and the Mississippi State University. Additionally, Citrus maidencane proved superior in terms of stems per plant and rate of spread (Table 1) to Halifax and another Florida accession when planted in a borrow pit area near Defuniak Springs, FL.

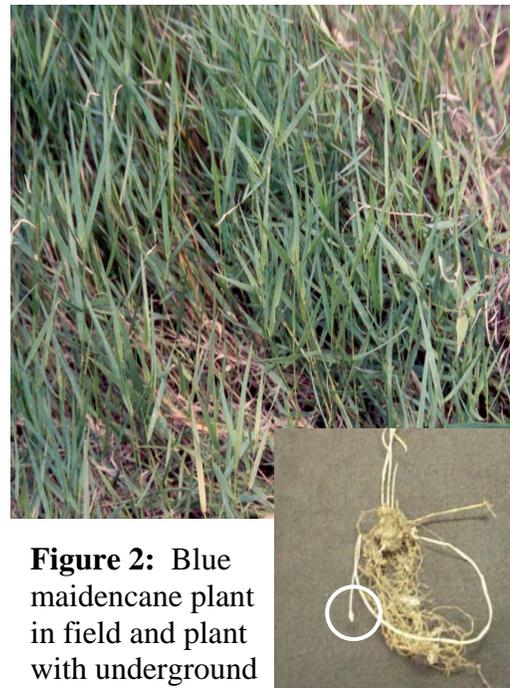
Attribute	Accession		
	PI 421992	PI 421993	Halifax
Vigor <sup>1</sup>	5	5	5
Heat tolerance <sup>1</sup>	4	4	5
Drought tolerance <sup>1</sup>	6	4	7
Leaf abundance	5	5	5
Stem/plant	6	30	8
Basal spread, cm	13	3	13
Canopy width, cm	60	60	75
Canopy height, cm	57	75	60

<sup>1</sup>Rating: 1 = excellent; 9 = very poor.

**Table 1:** Performance of Citrus (PI 421993) maidencane compared to Florida PI 421992 and ‘Halifax’ in Plinthic fine sand near Defuniak Springs, FL.

### Blue maidencane

Also known as ‘goobergrass’ because of its geocarpic seed production, blue maidencane is a native, warm season perennial rhizomatous grass distributed throughout Florida and the coastal areas of Georgia and South Carolina. The leaf blades are flat, about 7- to 12-cm long and 0.75- to 1.0-cm wide. The leaf margins are rough and frequently become white with maturity. Aerial seed stalks with sterile spikelets and fertile subterranean spikelets born on 2- to 5-cm long pedicles are formed in early summer; mature subterranean seed are not present until October or November. It is adapted to acid or neutral sandy soils that are wet 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.



**Figure 2:** Blue maidencane plant in field and plant with underground seed (right in circle).

The initial evaluation planting of the blue maidencane accessions was maintained for only one growing season at the Brooksville PMC because the plots started to grow together due to the aggressive rhizome growth of this grass. Eleven superior accessions were identified from this initial planting (Table 2). Of these, two groups of three (9059859, 9060309, and 9060311 and 9059866, 9060066, and 9060067) were combined because they performed similarly and were from the same basic geographic location and were assigned new accession numbers (9060489 and 9060490, respectively).

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

**Table 2:** Eleven superior blue maidencane accessions selected for increase and advanced evaluation at the PMC in Brooksville, FL.

Three advanced evaluations plantings were made comparing the performance of the selected seven accessions to that of Citrus and Halifax maidencane. In 2000, two plantings were made. One was made on a flatwoods site in Collier Co. that had recently been cleared of Brazilian pepper while the other was made in Polk Co. on reclaimed minedland. The third one was planted in 2001 in Hamilton Co. near Jasper, FL, at a disturbed site on the north side of a cypress marsh. Table 3 summarizes the results of the Hamilton Co. planting which is representative of the results from all three sites.

Accession	Plant Height, cm	Canopy Width, cm	Vigor <sup>1</sup>	Ground Cover, %	Spread Rate <sup>1</sup>
9059869	22.3	7.3	5.7	3.0	8.7
9059956	21.5	8.3	4.8	4.5	7.5
9059971	20.8	6.3	5.5	3.5	8.3
9060008	26.5	19.8	3.3	9.0	6.5
9060295	26.0	9.3	5.5	3.5	8.3
9060489	22.0	4.0	6.5	1.5	9.0
Citrus	53.5	26.3	4.0	17.0	6.8
Halifax	39.0	12.5	5.0	7.5	7.8

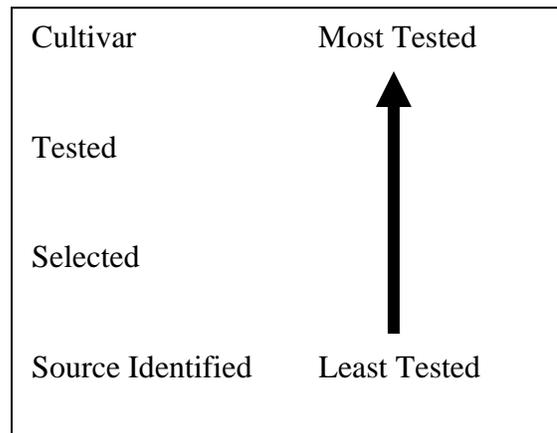
<sup>1</sup>Rating: 1 = excellent; 9 = very poor.

**Table 3:** Performance of blue maidencane accession and Citrus and Halifax common maidencane on Hamilton Co., FL, cypress swamp border six months after planting.

Based on the performance of the advanced evaluations, blue maidencane accession 9059971 has been selected for release in 2007. A planting material increase block has been established to provide planting material to commercial producers.

## DISCUSSION

Due to the nationwide demand for native material, the NRCS, Plant Materials Program, of which the Brooksville PMC is a part, has identified differing release designations that describe the level of testing different plant materials have undergone (Kujawski and Ogle, 2005). It is understood that the earlier in an evaluation program a material is released, the greater risk producers and reclamationists assume related to seed production and survival of the material. 'Selected' germplasm is the release designation for superior material identified after the initial evaluation. If a germplasm is released after the advanced evaluation phase where the heritability of desired characteristics is proven, it receives the classification of 'Tested' germplasm. Only after the superior germplasm has undergone all advanced evaluation phases, including regional evaluation trials, will it be released under the designation 'Cultivar'.



In the NRCS, Plant Materials Program system, both the Citrus maidencane and the to-be-released blue maidencane are classified as 'selected' germplasm because they were chosen for release from a diverse collection of ecotypes tested in a common location. They represent material in the secondary restoration gene pool (RGP) concept of restoration ecology (e.g., same species but geographically isolated; Booth and Jones, 2001; Jones, 2003). Since these plants produce relatively little viable seed, they are highly dependent on vegetative spread to maintain plant populations in both time and space. As a consequence, genetic variation among populations in these species would be expected to be similar to that of self-pollinated species regardless of their actual breeding system (i.e., cross- or self-pollinated). Thus, variations among the populations of these species would be discontinuous and vary greatly between populations (Jones, 2004). Secondary RGP of open-pollinated species are considered to have a moderate likelihood of being similar to the gene pool of a restoration site, but because these grasses are effectively self-pollinated plants they would have only a low likelihood of being genetically similar to the gene pool of any specific restoration site in Florida (Booth and Jones, 2001). Still they represent one of the best choices for restorationists in Florida because many of the freshwater marsh sites in Florida have been so disturbed that original structure and functionality often have been destroyed. Under these circumstances, even if remnant marsh populations still exist, they might not have the

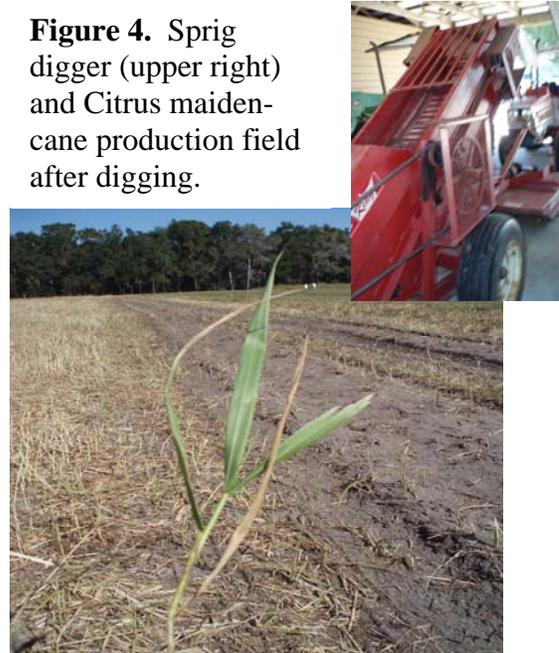
physiological range of tolerance needed to ensure ecosystem function in the restored site (Booth and Jones, 2001). Testing at the Brooksville PMC and off site across a wide range of environments have confirmed the superior rate of establishment and spread of these selections compared to a large number of native populations from around the state.

Although vegetative propagation generally results in higher costs compared to seeded material, planting material expense for these species should be comparable to seed costs because the Brooksville PMC has developed production protocols for both of these species utilizing standard agronomic field equipment. This is possible because both species are not obligate wetland species and can be produced on sites where standard tractor driven harvesting equipment can be used (Fig. 4) and planted on reclaimed sites with out using specialized equipment. For establishment or production details, a list of commercial sources for planting material, or to request planting material for commercial production of either grass species, visit the Brooksville PMC website

(<http://www.fl.nrcs.usda.gov/programs/pmc/flplantmaterials.html>)

or contact M.J. Williams ([mj.williams@fl.usda.gov](mailto:mj.williams@fl.usda.gov)).

**Figure 4.** Sprig digger (upper right) and Citrus maiden-cane production field after digging.



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