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Brooksville Plant Materials Center: Developing Sources of Native Grass Seed for Florida

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Abstract

In Florida, there is a lack of commercial seed sources of native materials for revegetation efforts. This is in part due to the fact that many native Florida species have poor seed production or require management techniques such as burning to produce viable seed. The USDA, Natural Resources Conservation Service (NRCS), Brooksville, FL Plant Materials Center (PMC) initiated a cooperative program with the Florida Institute of Phosphate Research (FIPR) in the 1990s to identify accessions of native species with the greatest potential for commercial seed production. Six seed-producing native grasses were identified in preliminary adaptation trials: Eastern gamagrass (*Tripsacum dactyloides*), lopsided indiangrass (*Sorghastrum secundum*), purple bluestem (*Andropogon glomeratus* var. *glaucopsis*), hairawn muhly (*Muhlenbergia capillaris*), switchgrass (*Panicum virgatum*), and wiregrass (*Aristida beyrichiana*). The current focus of the Brooksville Plant Materials Center is to develop reliable seed producing cultivars or germplasm of these grasses and to facilitate their commercial availability.

Key words: Native grass, seed development, revegetation

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Introduction

Unlike most of the eastern US which was heavily wooded, when settlers arrived in Florida they were confronted with large areas of native range vegetation (http://wfrec.ifas.ufl.edu/range/rangelands/). The native vegetation on Florida rangelands included grasses, grasslikes, forbs, or shrubs suitable for grazing and browsing use by livestock and wildlife. An overstory of trees was found on some range sites, while others were composed of mostly herbaceous plants. In Florida, "improvements" were often necessitated due to loss of the native vegetation either as a result of deliberate action when alternative industrial or agriculture uses were found, or inadvertently through improper grazing management. In recent years, there has been an increasing interest in both the public and private sectors in revegetating areas in Florida with native species. This is in part due to the perception that native species provide better wildlife food and habitat and offer more sustainable management systems due to lower nutrient requirements. Revegetation with native species is now mandated for much of the phosphate minelands in Peninsular Florida.

By 1999, approximately 300,000 acres of land, or more than 460 square miles, have been mined for phosphate. Wildlife in those areas has suffered because much of this area previously has been revegetated with non-native plant species such as bahiagrass (*Paspalum notatum*) or has become dominated by exotic invasive species such as cogongrass (*Imperata cylindrica*). Mining operations now are mandated by law to have a reclamation plan that is submitted to the Florida Dep. of Environmental Protection and other local, state and federal agencies for approval. Technical issues associated with reclamation include hydrology, water quality, wetland and other wildlife habitat replacement and mitigation, native vegetation establishment, and exotic weed control. One of the most expensive components of native revegetation projects is the cost of acquiring seed of native species. Due to the lack of commercial seed sources for essentially all Florida native species, current revegetation efforts utilize both mechanical and hand harvested seed from natural stands which by some estimates costs $1000 per acre for the seed alone.

Lack of commercial seed sources for Florida native species is partly due to the fact that many of the Florida native grasses and forbs are poor seed producers, especially those with rhizomatous root systems (Yarlett 1996; Pfaff and Gonter 1996). Also Florida's species evolved under a natural fire regime and some require fairly specific burn timing to produce any quantity of viable seed (Platt et al. 1994). It was apparent, that a systematic approach was necessary to identify the most suitable native species for use on restoration sites and to develop the technology necessary for commercial seed production. In the early 1990's the USDA, NRCS Plant Materials Center in Brooksville, FL, joined with the Florida Institute of Phosphate Research (FIPR) to accomplish this goal. Early work involved the screening of a wide range of native species for growth characteristics and seed production (Pfaff and Gonter 1996). Additionally, much information regarding the management and production of seed from specific Florida native species was developed (Pfaff et al. 2002). As a continuation of this program, the current focus of the Brooksville, FL Plant Materials Center is to develop reliable seed producing cultivars or germplasm of six grasses (eastern gamagrass, lopsided indiangrass, purple bluestem, hairawn muhly, and wiregrass) identified as suitable species for revegetation efforts and to facilitate their commercial availability.

Materials and Methods

Because this material was to be used over a wide area and not a specific locale (e.g., park or preserve), as wide a genetic range of material of the six different grasses was assembled from within the ecoregion. With the help of local NRCS personnel and the PMC staff, effort was made to locate at least three sources of each of the six grasses in each county in the state with the restriction that the sources be no closer than five miles apart. This resulted in the assembly of between 50 and 150 accessions of each grass species. These accessions were planted in initial evaluation, replicated space plant trials and evaluated for such factors as establishment rate, growth, and seed production for a period of one to four years. At this point, accessions rated as superior were selected and progeny of these superior accessions underwent additional evaluation phases designed to demonstrate heritability of superior characteristics (usually 2 to 3 yr) and to determine range of adaptation (usually 2 to 3 yr).

Due to the demand for native seed, the NRCS, Plant Materials Program has 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'.

Results and Discussion

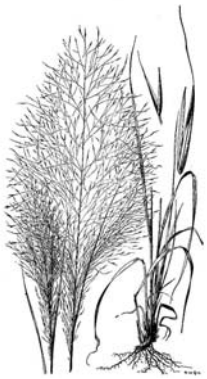
Purple bluestem (A*ndropogon glomeratus* var. *glaucopsis*) is one of the most important species found on native range sites and is usually found around water bodies and in wetter flatwoods sites. It is a good seed producer with excellent potential for erosion control, water quality, forage, and wildlife cover. A total of 91 accessions was collected from 43 counties in the fall of 1996. Transplanted seedlings and direct seeded plants (only 88 accessions) were evaluated for 2 and 3 yr, respectively, for 12 different criteria including plant survival, vigor, plant height, basal width, bloom date, seed maturity date, seed production, and seed viability. The 10 accessions that ranked highest in the largest number of criteria over all years of testing were planted in an increase polycross block to form a composite germplasm. Seed from this crossing block was collected in 2002 and used to establish a breeder seed nursery. The material will be released in 2006 as Ghost Rider selected germplasm (NRCS accession number 9060461).

Lopsided indiangrass (*Sorghastrum secundum*) is one of the most easily recognized upland grass species on Florida. It is useful for erosion control, forage, and wildlife and is considered a relatively good seed producer. In 1996, an assembly of 138 accessions was collected from over 48 of the 67 Florida counties. Seedlings were established in both irrigated and non-irrigated replicated plots in 1997. All accessions died after two years at the irrigated site due to an unidentified soil pathogen, but some accessions lived three years in the non-irrigated site. Twenty-five of the top

performing accessions were selected and managed as a composite. Seed of this composite material is being increased and is expected to be released as a selected germplasm in 2007.

Eastern gamagrasss (*Tripsacum dactyloides*) is a species that has undergone extensive evaluation and cultivar development throughout the eastern US. It grows on moist fertile sites and is typically found on canal banks or ditches in Florida. An assembly of Florida ecotypes was evaluated in 1996 and 1997. As part of this evaluation, seed was collected weekly during the growing season and the amount of viable seed was determined. Although Florida ecotypes were found to produce seed from June through August, the maximum viable seed amount was found in the last two weeks of August both years. In a multilocation (GA, MS, AL, and TX) evaluation trial, Florida accessions of eastern gamagrass failed to survive the winter period in all locations accept Georgia and Florida (Douglas et al. 2000). This is because Florida accessions had no real dormancy mechanisms and would begin regrowth too early in the spring to survive. Lack of dormancy does explain the superior forage production associated with Florida accessions in Florida when compared to eastern gamagrass selections originating in more northern locations (Douglas et al. 2000). Accession 9059266 has been identified for release because of its superior forage and seed production. Seed increased is planned for the next two years with anticipated germplasm release occurring in 2008.

Hairawn muhly (also know as muhlygrass; *Muhlenbergia capillaris*) is found on everything from marshy to very dry sites. It has fair seed production and seedling vigor under natural conditions, but under greenhouse conditions muhly seedlings were a constant source of contamination in adjacent pots unless parent plants were trimmed back. Ninety-four accessions of muhly were planted in an initial evaluation trial in 2000. From this population both seed producing and strictly vegetative material has been identified. Because muhly is now widely planted in low maintenance landscaping areas such as road medians, the vegetative material is currently under advanced evaluation for use in the ornamental trade. The seeded selections are scheduled for advanced evaluations with multilocation adaptation trials starting in 2007 and cultivar release in 2010.



Wiregrass (*Aristida beyrichiana*) can become the dominant grass species in upland communities because of its resistance to fire and its increaser status under grazing. Seed production and seed quality in this species is known to be variable, and fire frequency seems to play an important role in these traits (Kalmbacher et al. 2004). As a consequence direct seeding is not commonly practiced and other techniques for revegetation such as ‘greenhay’ mulching and transplanting slips are being used. In seedling establishment studies on reclaimed phosphate land, Pfaff and Gonter (2000) found that although lopsided indiangrass had higher initial germination rates, wiregrass seedlings persisted better over a 24-month period than indiangrass planted at the same time. To enhance wiregrass utilization in revegetation efforts, accessions of wiregrass have been collected and will be established in initial

evaluation plantings in 2006. These accessions will be evaluated for seed production and seedling vigor under different management strategies including burn frequency, stubble management, and fertility. This program is expected to extend into the next decade.

Switchgrass (*Panicum virgatum*) is perhaps the most widely studied native species in the US. As with eastern gamagrass, switchgrass selections or cultivars originating outside of Florida have proved to be less persistent than selections originating in the state. Seed production has been a problem for Florida accessions. The Brooksville PMC has initiated a cooperative breeding program with the University of Florida to develop seed producing lines of switchgrass based on Florida ecotypes. A statewide collection of switchgrass accessions was made in 2002 and initial evaluation of space plants was conducted in 2003 and 2004. In 2005, remaining accessions were screened to determine ploidy level of the material so superior accessions of similar ploidy level could be selected and crossing blocks established. The main emphasis of this work, which is expected to extend into the next decade, will be to develop commercially viable seed producing Florida germplasm.

Conclusion

Over the past 15 years, an extensive amount of work has been conducted at the PMC toward the goal of developing commercially viable, seed producing native species for Florida. The pressing need for this material must be balanced with the need for accompanying technology development to ensure successful stand establishment.

Acknowledgments

All illustrations from Hitchcock, A.S. (rev. A. Chase). 1950. Manual of the grasses of the United States. USDA Misc. Publ. No. 200. Washington, DC. 1950.

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