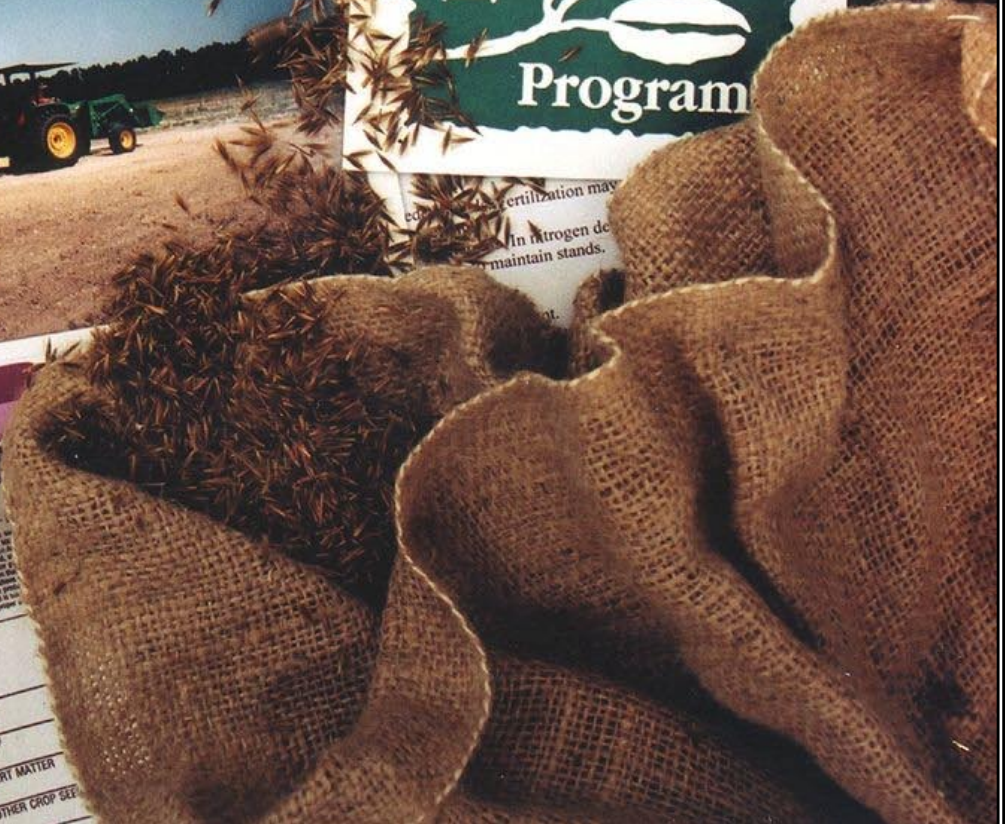
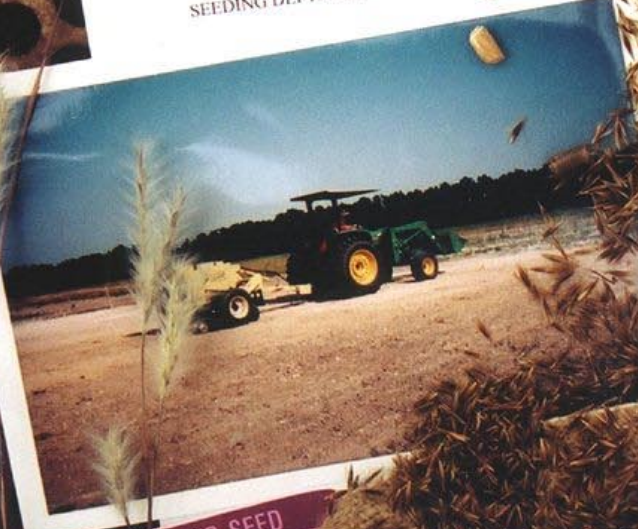


# Florida Native Seed Production Manual



**Lopsided Indian grass** (*Sorghastrum nutans*)  
**SPECIES DESCRIPTION:** A short-lived, warm season perennial, 3 to 6 feet tall with seed hanging on 1 to 2 inches long; seed heads on 2 to 4 foot panicles; useful for a variety of soils from drier flatwoods to rougher sandhills; useful for wildlife cover and as an erosion control plant.  
**AVERAGE SEED WEIGHT:** 252,000 lb (555,600 kg) (debearded)  
**SEEDING RATE:** (Pure live seed) 5 lb/ac for 12" rows, double by 2, 3 or 4 for 24", 36" or 48"  
**SEEDING DEPTH:** 1/2" or less.



# FLORIDA NATIVE SEED PRODUCTION MANUAL

Written by

*Sharon Pfaff, Agronomist  
Mary Anne Gonter, Biological Technician  
Clarence Maura, Plant Materials Manager*

United States Department of Agriculture  
Natural Resources Conservation Service  
Plant Materials Center  
14119 Broad Street  
Brooksville, FL 34601  
(352) 796-9600

*T. Niles Glasgow, State Conservationist*



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1855 West Main Street  
Bartow, Florida 33830-7718  
(863) 534-7160

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## Introduction

For many years, the Florida phosphate industry had attempted to restore native plant communities on reclaimed minedlands. Earlier efforts often failed because Florida native varieties were not readily available, and no one fully understood how to harvest and plant most natives on a large scale.

Information about seed and plant adaptation ranges, seed and plant production characteristics, maturity dates, germination rates, seedling vigor, and management practices to induce flowering was also not available.

Between 1991 and 2002, the USDA Natural Resources Conservation Service Plant Materials Center (PMC) at Brooksville, Florida conducted research on native plant species under two agreements with the Florida Institute of Phosphate Research (FIPR). Results of these studies were published by FIPR in a technical document called *"Development of Seed Sources and Establishment Methods for Native Upland Reclamation."*

A native grass seed production manual was recently published for seed growers in the Midwestern United States and Canada. It contained many valuable production guidelines. However, this information needed to be expanded to include native species unique to Florida.

The *"Florida Native Seed Production Manual"* contains comprehensive information about growing Florida native species for seed, including state-of-the-art planting and production technology. Planting and collection equipment currently on the market is discussed, along with detailed information about seed conditioning equipment.

Several native Florida species are showcased in this manual. All of them have performed well on reclaimed minedlands. Each has potential for being included in a native upland seed mixture.

The native species featured in this manual should not be considered an all-inclusive list. Other native species in Florida may be useful for reclaiming uplands, however research on them is incomplete at this time.

Special thanks to the Florida Institute of Phosphate Research for sponsoring research and providing grant money to produce this document. Thanks also to the Florida phosphate industry for providing reclaimed minedland sites for research studies.

Additional information about the Brooksville, Florida Plant Material Center is available on the National Plant Materials Program web site at <http://Plant-Materials.nrcs.usda.gov>.

## **Native Seed Production in Florida**

Native seed production is still in its infant stages in Florida. New producers in this growing industry face many challenges.

Economic challenges include land values that are inflated from urban development. Native seed markets also need to be expanded.

The phosphate mine industry has been one of the most important consumers of native seed. Every year, several thousand acres are revegetated with native plants.

The United States Department of Transportation and the landscape industry are also big users of native plants. Demand continues to grow as the public sees the benefits of planting natives.

County, State and Federal agencies are also very interested in restoring public lands to native habitats. However, some of these prospective buyers may insist on native seed sources from specific geographic areas in the State. Therefore, it is important for producers to know how a buyer defines "native species."

The quality and source of native seed produced by Florida growers will strongly influence future consumer confidence and demand. Following seed certification standards adds value to native seed products and increases the potential for successful establishment. Guidelines exist on a national and regional level for seed certification. Growers need to be aware of the

certification agency for Florida - the Southern Seed Association - and the guidelines they work under.

Producing native seed is quite different from producing other agricultural crops. Native species are often more drought-tolerant and disease-resistant than introduced species. However, weed competition is a major concern. Most problem weeds are introduced grasses and legumes. To effectively control weeds, a producer must incorporate appropriate crop management practices with chemical and mechanical measures.

Florida has a very unique climate. Though many Florida species are found throughout the Southeastern United States, Florida ecotypes are highly adapted to local conditions. They often cannot survive in more northern zones. Therefore, several species can only be produced within the state.

Florida ecotypes are adapted to conditions such as mild temperatures, long growing seasons, periods of high rainfall and severe drought, coarse sandy or heavy clay soils and often seasonally high water tables. Many of the ecological plant communities in Florida are also fire-dependant. Periodic burning is important for seed production in some species.

Specialized planting, harvesting and cleaning equipment is necessary for large-scale production. Conventional equipment cannot handle native seeds that are light and chaffy, or have awns or hairy appendages.

With native seed use gaining popularity across the United States, many innovative types of equipment are becoming available. The development of new technology has also increased establishment success and production of native species.

Native seed production is not an easy process. If it were, the industry would already be thriving in Florida. However, it can be very rewarding for those who enjoy challenges and like to work with native plant species.

## Choosing a Seed Source

### Source of Seed

Even though demand drives the kinds of species producers will grow, the source of seed must be carefully considered before a grower starts production.

There are generally two schools of thought on choosing the right sources of seed for reclamation projects. In preserves and parks with existing populations of native species, many land managers believe that plant populations found in or near these locations should be used for revegetation projects. In their opinion, this will avoid contamination of the local genotype or what some call "genetic pollution."

On the other hand, where soil structure and hydrology have been drastically altered, as on minedlands, genetic sources are not nearly as important as plant adaptability. Native plants are desired because of what they brought to the historic landscape and ecological communities.

Plant varieties with a broad genetic range may have greater adaptability on these heterogeneous sites than those gathered from small geographic areas. In some cases, improved varieties from other regions or

states may be more adaptable than local ecotypes.

Most seed growers produce seed for customers with less restrictive genetic source criteria. If a grower does contract to grow seed for a preserve or park, the grower needs to be fully aware of seed source and production criteria. Contracts such as these could require the seed producer to grow seed in isolation to prevent genetic contamination.

Lack of improved varieties has previously limited the native seed production industry in Florida. It is often quite risky to begin large-scale production with seed taken directly from the wild. Whether sampling different seed across the State or within a designated community, native species in the wild vary greatly in growth and seed production characteristics.

In the past, research agencies have developed cultivars with narrow, highly selected gene pools. These cultivars often excelled in high forage production and ease of establishment.

Many research agencies, including the Plant Materials Center, have begun developing varieties with broader genetic bases. Varieties may be developed from ecological regions that span several hundred square miles. (An old rule of thumb is that an ecotype should be planted no more than 50 to 300 miles from its original location. However, soil, climate and hydrology may be more important to plant adaptation than physical distances.)

Varieties with broad genetic bases may not excel in forage production, but they do have two advantages. First, they may potentially be more adaptable to a broader range of habitats.

Secondly, native genetic material is lost daily to urban development and other land conversions. Releases with broad genetic pools are potentially preserving this material for future generations.

### **Classes of Commercial Plant Material Releases**

Genetic diversity needs to be balanced with reliable performance. Some genetic selection can enhance the dependability of seed production and establishment characteristics. The more selection a species undergoes, the more predictable its performance will be in a given environment.

In the past, it took decades of selection and testing to develop commercial varieties. Seed stocks were then increased under a very strictly defined certification program. Seed categories included breeder, foundation, registered and certified. To reflect changing market demands, four alternative seed certification classes have been added. These are:

**Source Identified Seed:** Seeds from a naturally growing population occupying a known or defined geographic area. Material sold commercially may be collected directly from the site or grown under cultivated conditions. No selection or testing has been conducted and seed grown under cultivation should be representative of the entire population.

**Selected Seed:** Seeds from plants which have been through some testing, and show desirable superior traits or show promise of performance when

compared to other accessions at a common site. Performance of this material has not yet been proven, as it has not been tested at multiple sites or for more than one generation. Therefore, plants may not breed true, and desirable characteristics may not show up in all offspring.

**Tested Seed:** Seed from plants that have been through additional testing for more than one generation. This includes testing on multiple sites with replicated plots to verify performance and heritability of desirable traits. The material has proven genetic superiority or possesses distinctive traits for which heritability is stable. Complete area of adaptation may not be known.

**Cultivar/Variety Seed:** Cultivars have undergone replicated testing of two or more generations at multiple sites. The material is clearly distinguished by documented characteristics and when reproduced it will retain these characteristics. Testing has proven and documented the heritability of these traits, the superiority and/or performance, and the range of adaptation.

Although certified seed is not always commercially available, it should be purchased whenever possible. Certified seed insures that the buyer knows the source, genetic integrity, germination, and purity (amount and kinds of weed seed, inert matter, etc.) of the seed.

### **Selecting a Field Site**

Before planting, producers should consider factors such as climate, precipitation, slope, soil texture, and hydrology, as well as the pH and nutrient levels in the soils. The State of Florida has

six “plant hardiness zones,” which range from 8a to 10b. Two of these zones (10a and 10b) rarely experience temperatures below freezing.

Soils in Florida vary widely from coarse sands to rich peat. Heavy clays occur in several regions, either on the surface or in subsoil layers.

Hydrology varies widely from dry sandhills to seasonally ponded areas. Average annual precipitation in Florida is 40 to 60 inches per year. Intense rain events often cause erosion on unprotected soil. Soil erosion is a serious concern in some regions of the State.

Despite high rainfall, coarse sandy soils and long, hot, dry weather patterns cause many sites to experience severe drought during the growing season. Supplemental irrigation may be necessary to provide extra moisture during droughty periods.

Many Florida soils are highly acidic and do not have adequate nutrients for plant growth. High soil acidity causes important nutrients to be less available to plants. Application of soil amendments may be necessary to produce economically viable yields.

Native species often require specific conditions for best growth and seed production. They may not do well when placed in environments different from where they originated. Soil moisture is especially important. For example, species growing in sandhill sites may not persist when planted in heavy soils. Lowland species grow best in soils where moisture is present during part of the growing season.

Though some species may prefer saturated soils, fields must also be accessible to weed control and harvesting equipment.

If producers are growing certified seed, they need to make certain fields meet isolation standards for cultivars, and weed seed contamination standards for different seed classes.

## **Seedbed Preparation**

Since the establishment of native species is a major expense, it is essential to start with good seedbed preparation. Weed competition can substantially reduce stand density, plant longevity, and seed yields.

For weedy fields, it may be necessary to carry out an intensive weed control program for one to two years prior to planting. However, two years of intensive tillage is not always economically feasible. In that case, a minimum tillage system that includes multiple herbicide and mowing treatments and almost no soil disturbance may be effective.

Reducing weed populations to their lowest possible level prior to planting can dramatically reduce future weed control costs.

The amount of necessary weed control depends on weed species at the planting site. Invasive rhizomatous species, such as bermudagrass or cogongrass must be completely eradicated prior to planting. If not they can quickly reestablish from root fragments and choke out less aggressive native species.

Seed banks of annual weeds can be substantially reduced in one year by not

allowing emerging seedlings to produce seed.

A combination of tillage and broad-spectrum herbicides is usually the most effective method of controlling weeds prior to planting.

Bahiagrass pastures have been successfully returned to native vegetation by using herbicide treatments in the spring and fall, along with two to three disk treatments during the summer. This system is adequate for native site restoration projects. In the case of production fields, an additional year of weed control may be necessary to eradicate most invasive weeds.

Producers converting cropland to native grass or forb seed production fields will need to make certain that previously applied herbicide residues are not high enough to injure native species. Oats or other highly sensitive species can be used to test for herbicide residual levels in fields.

Before planting, a seedbed must be properly prepared. If deficient, soil amendments such as lime or phosphorous need to be incorporated into the soil prior to planting. Unless using a no-till system, the seedbed should be bare mineral soil. If necessary, it needs to be tilled to loosen any crusted surface layers.

Tilled soil should be smoothed and packed to break up large clods. This will provide an even planting surface. A firm even seedbed is especially important when drilling seed. This will help the producer to obtain precise seed placement in the soil.

A good rule of thumb for checking seedbed firmness is that a footprint leaves an impression no deeper than 1/4 inch.

Good soil moisture helps to insure good seedling establishment.

## **Establishment of Production Fields**

### **Cover or Nurse Crops**

In cases where soil erosion is a problem, especially wind erosion, it may be necessary to plant a cover crop prior to establishment of production fields.

Cover crops should not be allowed to harbor weeds or go to seed. Cover crops should be destroyed prior to planting native seeds or plants.

In general, nurse or companion crops are not recommended, because they tend to out-compete natives seeds for moisture, nutrients, and light. If nurse crops are allowed to produce viable seed, they can become competitive weed species in future years.

### **Transplanting verses Seeding**

If seed is limited or is very expensive, it may be more cost-effective to establish production fields using transplants verses direct seeding. Although growing and planting transplants is labor intensive, this method has several advantages.

Solid stands can be immediately established. Spacing between plants can be precisely controlled. Transplants are more competitive with weeds because they are

larger and more vigorous than emerging seedlings.

Transplants are less susceptible than emerging seedlings to drought or wind erosion on coarse soils. Transplants are less susceptible than emerging seedlings to crusting on heavy soils.

Subsequent seed production often occurs more quickly. Many species take only a year to become established and produce seed.

### **Seeding Equipment and Methods**

Broadcasting and drilling are two primary methods of seeding grasses and forbs.

One advantage of broadcasting is that equipment is often inexpensive. It is also usually easy to obtain.

Lighter, fluffier, bearded or chaffy seeds can be dispersed from certain types of mechanical broadcasters without debearding or conditioning.

Conventional seed broadcasters cannot distribute bearded or fluffy seed if they operate on a gravity-flow system. Forced air systems, such as hay blowers, work well to distribute all types of seed.

Modified sprig planters work well to distribute plant material collected with a forage harvester.

Broadcasting does not provide precise depth and spatial seed placement like drilling does. If broadcasting is used, it is recommended that seed be planted at two times the required rate for drilling.

After broadcasting seed, a field should be lightly packed to incorporate the seed.

Weeds are often more difficult to control in a broadcast field.

In contrast, drilling allows a producer to control the depth of his seed, row spacing, and spacing between the plants. Although this method is more expensive in terms of time, labor and equipment, the drilling method may be more cost-effective because of the reduced seeding rate and precise placement of the seed.

A major disadvantage of drilling is that the seed of some of the more desirable native species will not flow through a conventional drill without conditioning. Even then, seed of some species are still too light and will bridge or fail to flow properly through the planter.

Specialized drills that handle light chaffy seed are available on the market. These drills are equipped with aggressive picker wheels and stirring rods to overcome bridging problems. Seed must still be debearded to flow through these chaffy-seed drills.

A further modification of the chaffy-seed type drill has recently been developed that can handle fluffy bearded seed. The seed metering system in this fluffy-seed drill is even more aggressive, and drop tubes are very short and wide to prevent clogging.

### **Row Spacing**

Seed production fields are planted on wider row spacings than would be used for native reclamation plantings. Wider row

spacings are necessary to achieve optimum seed production.

General recommended production field row spacings in other parts of the United States range from 12 to 48 inches, depending on slope, amount of precipitation, and species planted.

Cultivation and harvest equipment also need to be considered when determining row spacing.

As a general rule, the wider the row spacing, the greater the seed production. Narrow row widths will increase plant competition. Wider spacings will increase weed competition.

Research has not yet been conducted to determine the ideal row spacing for most Florida natives. An alternative spacing method currently being studied is to plant double rows.

Double rows are spaced 6 to 12 inches apart and are placed 36 to 60 inches apart from the adjacent sets of double rows. This is an effective way to minimize competition between plants, maximize production and minimize weed competition.

Double rows provide a more solid canopy to shade out weeds within the rows. They leave space for mechanical tillage between wide rows and allow room for harvest equipment.

### **Seeding Rate**

For native reclamation seedings, the general rule of thumb is that seed must be applied at a rate of 15 to 30 pure live seed (pls) per square foot to obtain a

satisfactory stand when drilling on favorable sites.

This rate should be increased by 50 to 100% on critical or unfavorable sites, to obtain a satisfactory stand. Higher seeding rates should also be used for those species that lack seedling vigor, and do not spread readily once established.

The broadcast rate is generally two times the drill rate. A seeding rate that is too low will produce unsatisfactory stands. A seeding rate that is too high produces unnecessary plant competition and increases seed costs.

For seed production fields planted with a drill, the recommended seeding rate is generally 25 to 30 pls per linear foot.

Because natives tend to have very low seed viability, seeding rates are calculated on a pure live seed basis. To determine the percentage of pure live seed, multiply the percentage of germination by the percentage of purity for a given seedlot, then divide by 100. For example, if a seedlot of indiagrass has 95 percent purity and 32 percent germination, it contains approximately 30 percent pure live seed:

$$\frac{95\% \text{ purity} \times 32\% \text{ germ}}{100} = 30.4\% \text{ pls}$$

The recommended seeding rate is then divided by the percent pure live seed to determine the actual seeding rate. In this case, if the recommended indiagrass seeding rate is 5 pounds/acre, then the actual seeding rate would be approximately 16.4 pounds/acre:

$$\frac{5 \text{ lbs./ac.}}{0.30 \text{ pls}} = 16.4 \text{ lbs./ac.}$$



## Seeding Depth

The seeding depth is critical in small seeded native species, especially if the soil they are planted in has a tendency to crust.

In general, small seeded species such as wiregrass, should be planted no deeper than 1/8 to 1/4 inch. Medium sized seed, such as lopsided indiagrass, should be planted no deeper than 1/4 to 1/2 inch. Large seed, such as eastern gamagrass, should be planted no deeper than one inch.

Medium and large seed can be planted 1/2 inch deeper in sandy soils. When planting in heavy clay soils, the seeding depth should be decreased.

## Seeding Dates

Florida has an exceptionally long growing season. Many native species can be seeded year-round, if moisture conditions are favorable. A general rule-of-thumb is to plant just prior to the season of most dependable moisture. In Florida, this would be in May or June, just prior to the summer rainy season.

Although the winter rains are not as dependable, late fall/early winter seedings of some native species have often been more successful than summer seedings. This may be due to reduced weed competition and cooler soil temperatures.

Many types of wildflowers, such as blackeyed susan, require a fall/early winter seeding date in order to produce seed by the following summer. Unless research has shown otherwise, the best

time to plant wildflowers may be immediately after seed harvest.

The least optimum seeding time on Florida's uplands and sandhill sites is March and April. These months are typically very dry with periods of high winds.

On the other hand, spring may be the only season when seeding equipment can be used to plant flatwoods that undergo periodic flooding.

When considering seeding date, producers should be aware of how day length and cold stratification affect some species. For example, some types of *Liatris* may only germinate during periods of short day length.

Other species, such as eastern gamagrass, may have higher germination if seeds are planted in the late fall/early winter. This causes the seeds to go through a period of cold stratification. Cold stratification stimulates the seeds to rapidly germinate in the spring.

## Production Field Management

### Weed Control

Weed control can be difficult in native species, especially in forbs. Natives are typically less aggressive and do not compete well with weeds. Very few herbicides are labeled for use on native species. Additional research is needed to determine native species tolerance to herbicides.

One of the most effective methods of controlling weeds in native production fields is to make seedbeds as weed free as

possible. Care should be given to planting weed free seed.

Minor weed infestations should be controlled early before they become major infestations. Major weed infestations can overtake a field within a year.

Weeds should also be controlled around field margins. Several types of control measures are available to seed producers. These include:

**Cultural Practices:** A healthy, vigorous stand is more capable of competing with weeds than a sparse stand. To produce a heavy canopy, use practices such as planting double rows. It will help to shade out weeds.

For high value crops, such as wildflowers, weed cloth or fiber mulch blankets can be placed around transplants. Not all species can tolerate weed barriers though. Mulching around roots can trap moisture and increase the activity of some soil pathogens.

Banding fertilizer along rows rather than broadcasting it over the entire field helps discourage weed growth. Proper irrigation can also reduce weed competition.

**Mechanical Control:** Cultivating between rows is an effective practice for controlling weed seedlings. A variety of equipment for this practice is available.

Many problem weed species in Florida can quickly re-root themselves from the nodes or resprout from root fragments. Aggressive rotary tillers or cultivators are usually more effective in

controlling these types of weeds. Sweeps or shovels are not as effective because they cause less soil disturbance.

Florida natives tend to be shallow rooted, especially forbs. Cultivating too close to the rows can disturb root systems.

**Herbicides:** *It is a violation of Federal law to use herbicides in a manner that is inconsistent with label instructions. Read and follow all label directions for worker safety protection and to avoid crop injury.*

It is extremely important to select the appropriate herbicide and apply it at the proper rate and time. Individuals applying herbicides should consult with their Cooperative Extension Service County Agent to obtain the most current recommendations for treating specific weeds.

A limited number of herbicides on the market are useful for controlling weeds in native production fields. Nonselective herbicides, such as glyphosate, can be used to control weeds between rows when applied during calm conditions. Natives are extremely sensitive to glyphosate. To avoid plant injury, shielded spraying equipment should be used to prevent drift.

Root or germination-inhibiting herbicides applied to crops after they are well established are good for controlling emerging weeds in some species. Several of these types of herbicides have been tested on natives in other states with good success.

In some states, atrazine is labeled for use on warm-season grasses, such as switchgrass and eastern gamagrass. However, research has not yet been conducted in Florida to determine how

atrazine affects native grasses under Florida conditions.

Post-emergent herbicides can be effective tools for controlling weeds in production fields. Unfortunately few are labeled for native grasses.

In most cases, 2,4-D can be used for broadleaf control in grass production fields. This herbicide is most effective if applied when weeds are young, preferably in the two-leaf stage. It should be applied when grass plants are in the active growing, vegetative stage. It should not be applied after plants reach the early boot stage (the stage when the seed head is beginning to emerge but is still hidden within the leaf sheath).

Fewer post-emergent herbicides are available for controlling weeds in broadleaf crops. Imazapic has been effective on several species in the Midwest. It is very effective in controlling some varieties of nut sedge.

Imazapic is currently undergoing testing in Florida, but is not yet labeled for use on natives in the State.

It is better to use scientific names rather than common names to determine if a herbicide is labeled for use on a particular crop. Common names are often used to describe entirely different species (e.g. "indiangrass" is the common name used for both *Sorghastrum nutans* and *Sorghastrum secundum*, two distinct species).

Herbicide manufacturers may only list general categories of grasses or forbs on the label, or only common names. In these cases, it is strongly recommended that preliminary tests be

conducted on only a few plants. Different species may have very different tolerance to a product.

**Hand Weeding:** Pulling weeds by hand and hoeing are the most labor-intensive methods of weed control. However, in some cases, hand weeding may be the only option available for controlling weeds.

Seed certification guidelines prohibit the presence of many noxious weeds, and set tolerance limits for others. Weeds that cannot be controlled by cultivation or by use of pre- or post-emergent herbicides will have to be removed manually.

Manual removal is especially important if the weeds are aggressive or produce seed that is difficult to remove in the cleaning process. Manual removal is good for spot weed control. It may be less costly to manually remove a few weeds than to have to prepare a herbicide solution for a small area.

Any type of post-emergent weed control should occur before weeds have had an opportunity to produce seed. Weeds should be removed completely from the field, so that they have no opportunity to re-root and contaminate a field again.

## **Insect and Disease Control**

Due to a mild, humid climate, Florida is plagued by a multitude of insects and plant diseases. Florida eco-types of native species generally have good disease and insect resistance. Unfortunately, many natives in Florida have very poor viable seed production.

Insects, including a midge, are a suspected cause of poor viable seed

production. Researchers are working to discover specific causes for poor viability.

Heavy infestations of aphids are commonly found on hairawn muhly seed heads, but the amount of damage they cause to seed is unknown. Spider mites can be a problem in fields of eastern gamagrass.

Applying broad-spectrum insecticides on production fields is not recommended at this time. These types of insecticides also destroy beneficial insects.

Effective management starts with scouting fields and becoming familiar with different types of insects, their life cycles, whether they are beneficial or detrimental to production at different stages, etc.

The Cooperative Extension Service and the Florida Department of Agriculture and Consumer Services have several resources available for identification and control of crop pests.

Usually, threshold levels of detrimental insects are low enough that control measures are not necessary. Proper residue management in production fields and along field borders can decrease insect habitat and break life cycles.

Rusts and other pathogens that cause lesions on leaves are very common. This is especially true for forage species, like switchgrass and eastern gamagrass. Some ecotypes are less susceptible to rusts than others.

A type of smut is commonly found infesting wiregrass seed heads. The impact of the smut on wiregrass seed production is not known.

Soil pathogens can cause serious problems in native production fields. Natives often have some resistance to soil pathogens. However, species taken from dry sandy environments may not persist in moister environments where there is increased soil pathogen activity.

Skyblue lupine is one example of a native wildflower that is extremely susceptible to soil pathogens. Until researchers can find disease resistant lines, this species will be difficult to grow under cultivation.

There are no cost-effective chemical measures for controlling soil pathogens at this time. Cultural practices, such as crop rotation, may help to break pathogen life cycles.

Researchers have had mixed success inoculating plants with beneficial bacteria and fungi. This practice is more cost-effective in containerized production than in field production.

## **Residue Management**

Proper residue management is important for maintaining healthy native production fields. Old plant residues often shade out plant crowns and host harmful insects and diseases. This can dramatically reduce the longevity of a plant.

Burning and mowing are the most common methods of removing residue. Grazing can also be used in some cases.

Most, but not all, warm season grasses respond well to burning. Often, the best time to burn a production field is between January and early March. Removing residue in the fall is usually not recommended. Most species benefit from having crowns protected with residue during periods of hard frosts or freezes.

Late winter burns are beneficial to stands of lopsided indiangrass since summer burns cause severe plant injury. Wiregrass, on the other hand, usually needs a growing season burn between April and July to flower and produce viable seed.

Mowing can also be used to remove old residue. Dormant plants can be mowed lower than those that are actively growing. Active growing tillers should not be mowed below the growing point at the base of the leaf.

Heavy accumulations of residues should be removed from a field.

### **Irrigation**

Supplemental irrigation can increase establishment success and the productivity of plants. It can also ensure the longevity of stands, especially during dry periods. It is better to thoroughly wet the soil profile periodically than to apply only a small amount daily.

Shallow surface watering promotes weed competition and shallow-rooted plants. Deep watering encourages deeper-rooted plants with greater drought tolerance.

Production fields should have adequate moisture in the soil profile when plants begin to flower. Irrigation should be suspended during pollination, but it can be continued in the early stages of seed development, if necessary.

Dry soil conditions during the period when seeds are developing can cause seed kernels to be small and shrunken. Fields should not be irrigated during the later stages of seed ripening or when seed is ready to harvest.

### **Fertilization**

Prior to planting, soil samples should be taken to determine pH levels and available soil nutrients. Most County Extension Offices provide assistance in testing soil samples.

Liming fields to increase the soil pH is usually not necessary or beneficial, since most Florida natives are adapted to acid soils. Highly acid soils, however, can restrict the uptake of some soil nutrients.

Applying nitrogen at the time of plant establishment is not recommended, because nitrogen stimulates weed competition. In established fields, fertilizing with nitrogen will not directly increase seed production in most cases. It may actually reduce production because it promotes excess forage growth and lodging.

It may be necessary to apply low levels of nitrogen to maintain stands (30 to 50 pounds/acre, depending on soil test results). Most Florida soils have adequate levels of phosphorus, so they do not require extra amounts. If soil tests indicate extra phosphorus is needed, it should be incorporated into the soil before planting.

Levels of potassium and some micronutrients are often low in Florida soils. Apply annually, if necessary.

Fertilizer should be applied in early spring. Applications made later in the growing season may stimulate forage production and reduce production of reproductive tillers. If possible, fertilizer should be applied in bands along rows. Broadcasting fertilizer over the entire field will stimulate weed competition.

## Seed Harvest

### Seed Maturity

One of the more difficult decisions that seed growers face is when to harvest plants in order to obtain maximum amounts of ripe seed. Stands of Florida native species often have broad genetic diversity. This results in uneven seed ripening. In genetically diverse populations, seed ripening can vary between plants by several days. Also, many seed ripen from the top of the seed head down.

In species like eastern gamagrass, seed maturation along a single seed head can extend for several weeks. Reproductive tillers continually emerge for several months. The timing for harvesting forbs can also be difficult because flowering and seed ripening can occur simultaneously on a plant for several weeks.

Conventional combines only allow for a one-time harvest. On the other hand, seed strippers are designed to pull only ripe seed off the seed head.

Fields can be harvested several times as the seed continues to ripen.

Even if a crop is harvested all at once, some wildflower species may re-flower and produce a second seed crop. Blanketflower and lanceleaf coreopsis are typical examples.

Seed shatter may also create concern for producers. In species such as wiregrass or chalky bluestem, seed remains on the plant for several weeks, barring unforeseen high winds. This provides a collection window of two to three weeks.

Other grass species, such as switchgrass, lopsided indiagrass and eastern gamagrass, are very susceptible to seed shatter. These species rapidly release mature seed from the seedhead. This allows only a few days for collection. Forbs, especially legumes or wildflower species like coreopsis, are prone to seed shatter. Legume species produce seedpods that dehisce (or burst open) once they mature.

As harvest time approaches, seed producers need to regularly walk through fields and check the stage of seed maturity. For species such as bluestems or lopsided indiagrass, seed is ready for harvest when it can be easily hand stripped from the seed stalk.

In other species, like hairawn muhly or switchgrass, seed maturity is checked by removing the seed (also called the kernel or caryopsis) from the seed hull.

As seed kernels ripen, they go through 5 stages: milk, soft dough, medium dough, hard dough and mature. A thumbnail test can be used to determine the stage of maturity. Mature kernels are usually darker in color and very hard.

In the hard dough stage, the thumbnail test will leave a slight imprint on the kernel. Long cylindrical shaped seeds such as wiregrass are often brittle and will snap easily when ripe.

For most species, optimum harvest time is usually during the hard dough or mature stage. Harvesting too early may result in shrunken seed with poor viability. In cases where stands are mowed or swathed and seed is allowed to remain on the stem for several days, some after-ripening will occur. In the Midwest, switchgrass is often swathed during the medium dough stage to reduce seed shatter and the amount of green biomass.

Cutting or swathing has not been tested on most Florida species, although researchers have found that wiregrass will after-ripen on cut stems.

Seed should generally be harvested after the morning dew has dried and during warm, dry periods of the day when humidity is low. Equipment using vacuums and/or brushes to remove seed does not work well when seeds are damp.

On the other hand, forage harvesters with flail cutting systems cause less seed shatter if seed is still slightly damp from the morning dew. Damp seed must be rapidly dried to avoid mold growth or heating.

### **Seed Harvest Equipment**

Conventional three-screen combines work well for the harvest of smooth, hard-seeded species, such as

eastern gamagrass, switchgrass, partridge pea or lupine.

Combines with special pickup-head attachments are used to harvest species that have been cut or swathed and placed in a windrow. Cutting or swathing allows time for green material to dry. This method makes it easier to harvest forbs or grasses that have large amounts of green biomass.

Native species, such as blazing star, wiregrass, lopsided indiangrass and bluestems, have light seed with awns or hairy appendages. These appendages often hinder the seed's flow through conventional combines.

Tractor-propelled, seed stripping harvesters have rotating brushes and vacuum systems. These systems very effectively collect bearded seed. In some cases, if brush speed is set low enough, only ripe seed will be harvested. Fields can be harvested more than one time if this equipment is used.

Forage harvesters can be used to collect native seed if specialized equipment is not available. Material collected with a forage harvester may have a high moisture content. Seed must be rapidly applied to a planting site or spread out to dry before heating lowers the seed viability.

When collecting with a forage harvester, large amounts of inert material must be stored, processed or transported to the planting site. Pure live seed content may vary widely in bulk material. This makes it more difficult to obtain a consistent seeding rate.

Some native wildflower species have seed maturity and physical seed characteristics that do not lend themselves to either a single harvest with a combine, or

collection by a seed stripper. Newer harvest methods, such as vacuum collection systems, are being developed to allow multiple harvests.

### **Post Harvest Drying**

Due to high seed moisture content and humid conditions in Florida, many native seeds need to be dried before they can be cleaned or stored. Drying consists of placing seed on fine-mesh screens, and forcing air over or through the screens. The air does not need to be heated to be effective; however, heated air will speed drying time. The temperature of heated air should not exceed 104° F (40° C).

### **Seed Conditioning Equipment**

Unconditioned native seed can be difficult to plant, causing increased establishment costs and poor planting results.

Seed may need conditioning for several reasons: To remove large volumes of green or inert material from seed; to remove awns or beards from seeds that inhibit flow through planting equipment; to break apart pods or remove hulls in preparation for cleaning.

There are several types of equipment on the market for conditioning seed:

**Scalping:** In this process, an air-screen cleaner is used immediately after harvest to remove large volumes of green material, which may cause heating. A scalper can also remove large volumes of sticks, stems, hulls and other

inert material. Scalping makes other cleaning operations more efficient.

**Hammermill:** This equipment has flailing metal arms which are attached to a central shaft. The shaft rotates inside a perforated metal screen to break off awns, open seedpods, and remove seed hulls. Seed and inert particles are aggressively processed until they become small enough to drop through the holes of the screen.

Choosing the proper screen size determines the balance between how well the material is debearded and how much the seed is cracked. The amount of damage to seed can be reduced by using a hammermill with a variable speed motor, and by regulating rate of flow.

**Debearder:** At least two debearding systems are available on the market at this time. One system uses rotary and stationary arms in a metal drum to stir the material. Awns and other appendages are removed primarily by the action of seeds rubbing against each other. Varying motor speeds changes how aggressively the material is processed.

The second system uses a rotating brush inside a wire mesh screen. The brush rubs seeds against each other and against the screen to remove the beards.

Debearders process seed less aggressively than hammermills. However, processing time is greater, which may, in turn, cause more damage to brittle seed.

### **Seed Cleaning Equipment**

Determining which seed cleaning system to use will depend upon the physical characteristics of the seed, types of weed



seed present, and the type and amount of inert material that must be removed. Those raising certified seed must meet designated seed purity standards.

A large variety of seed cleaners are commercially available. Descriptions of those most useful for cleaning native seeds are given below:

**Air-Screen Cleaners:** The air-screen cleaner is the most widely used system for cleaning seed. Models range in size from two-screen tabletop models to six-screen industrial-size models.

Screen sizes vary. Some screens are made of perforated metal while others are made of wire mesh. Air flowing over the screens allows the material to be separated by size, shape, and weight. Air-screen cleaners have difficulty processing bearded seed and separating seeds of similar shapes and sizes.

**Gravity Separator:** The gravity separator is an angled oscillating table, with air forced through the perforated metal or canvas top.

Table movement and air-flow cause seed to move upslope or down, depending on the seed's density or specific gravity. Different species of seed can be separated, or seed can be graded according to weight.

**Air Separators:** This system separates seed from foreign matter by passing a current of air through a column of falling material. Air separators can be adjusted to produce a fairly pure product, but most models can not handle large quantities of material.

**Velvet Roll Separator:** These machines use velvet covered rollers to separate seeds by surface texture and shape. They are useful for separating out certain types of weed seeds.

**Seed Scarifier:** This system employs a metal drum with a rough surface on the inside. The machine removes outer hulls or husks from seed and abrades the surface of hard seeded species. Scarification is useful for promoting germination of hard-seeded species like legumes.

### Seed Storage

Seed storage methods can dramatically affect seed viability. High heat and humidity can cause seed to deteriorate rapidly. If stored in an air-conditioned building, many species will maintain their viability in Florida for several years. This is especially true for species with hard impermeable seed coats.

In order to maintain maximum viability over a longer period of time, seed needs to be stored under highly controlled conditions. Storing seed in a room where temperature and humidity is strictly controlled can extend shelf life.

As a rule of thumb, the sum of the air temperature (Fahrenheit) and relative humidity should equal less than 100 in long-term seed storage units.



## **Additional Publications Addressing Native Species Production**

**Development of Seed Sources and Establishment Methods for Native Upland Reclamation.** 2002. USDA NRCS Brooksville Plant Materials Center and the Florida Institute of Phosphate Research.

**Provided by:** Florida Institute of Phosphate Research, 1855 West Main Street, Bartow, Florida 33830-7718.

**Eastern Gamagrass Technology Update.** 2000. NRCS Plant Materials Center.

**Provided by:** NRCS Jamie L. Whitten Plant Materials Center, 2533 County Road 65 Coffeerville, MS 38922-2652.

**Native Grass Seed Production Manual (including Selected Forbs).** USDA NRCS Plant Materials Center Program, Ducks Unlimited Canada, the Manitoba Forage Seed Association and the University of Manitoba.

**Provided by:** Ducks Unlimited Canada, Stonewall Box 1160, Oak Hammock Marsh, Manitoba, Canada, ROC 2Z0; or Natural Resources Conservation Service, PO Box 1458, Bismarck, ND 58502

**Native Plant Propagation Techniques for National Parks, Interim Guide.** 1993. USDA NRCS Rose Lake Plant Materials Center and US Dept. of Interior National Park Service.

**Provided by:** Rose Lake Plant Materials Center, 7472 Stoll road, East Lansing, MI 48823

**Proceedings of the Second Eastern Native Grass Symposium (held in Baltimore, MD Nov. 17-19, 1999).** 2000. USDA Natural Resources Conservation Service and NRCS Plant Materials Program, USDA Agriculture Research Service, and National Association of Conservation Districts.

**Provided by:** ARS and NRCS, Beltsville, MD. Electronic copies obtained from <http://www.nhq.nrcs.usda.gov/BCS/PMC/eng/eng.html>

## Additional Sources of Useful Information

**Florida Cooperative Extension Service.** Provides helpful information on crop pest identification and control. Contact information for county extension agents are listed on their website: <http://www.ifas.ufl.edu/www/extension/ces.htm>

**Florida Department of Agriculture and Consumer Services.** Provides assistance with identification and control of crop pests. Contact Division of Plant Industry, P.O. Box 147100, Gainesville, FL 32614-7100. Phone: (352) 372-3505. Florida Department of Agriculture website: <http://doacs.state.fl.us/>

**Florida Institute of Phosphate Research.** Has numerous publications on minedland reclamation research, including research publications on the development and seeding of native species, and on the effect of imazapic herbicide on native species. Contact FIPR, 1855 West Main Street, Bartow, Florida 33830-7718, (863) 534-7160. Website: <http://www.fipr.state.fl.us>

**National Plant Materials Program Website.** Contains information on past and present research being conducted by the 26 Plant Materials Centers in the US along with information on plant releases. Many publications are in electronic format and can be downloaded: <http://Plant-Materials.nrcs.usda.gov/>

**Native Plants Network Protocol Database.** Contains information on growing natives: <http://nativeplants.for.uidaho.edu/network/search.asp>

**Non-Native Plant Species Restricted by Federal, State, or Local Law in Florida.**  
Compiled by K. Craddock Burks, Botanist,  
**Provided by:** Bureau of Invasive Plant Management, Florida Department of Environmental Protection, Tallahassee, FL 32399. Phone: (850) 487-2600

**Plants National Database Website.** A website maintained by the NRCS National Plant Data Center. An excellent source of standardized information about US plant species: <http://plants.usda.gov/>

**Southern Seed Certification Association.** (Florida's seed certification agency.) PO Box 2619, Auburn, AL 36831, Phone: (334) 844-4995, (334) 821-7400, FAX: (334) 844-4901, Contact: Robert Burdett: (205) 477-6565; [rburdett@acesag.auburn.edu](mailto:rburdett@acesag.auburn.edu)  
<http://www.ag.auburn.edu/ssca/>

## **Equipment Dealers**

Dealers who sell equipment in the Southeast are listed below. This list is intended to help producers in their search for equipment. The USDA - NRCS Plant Materials Program does not endorse any manufacturer, dealer, or piece of equipment. Use of this equipment does not guarantee successful results.

### **Seed Strippers**

Hand held and pull type seed strippers:

Contact: Prairie Habitats Inc., Box 1, Arglye MB, Canada ROC OBO, Phone: (204)467-9371, Website: [www.prairiehabitats.com](http://www.prairiehabitats.com)

Tractor mounted seed strippers:

Contact: Ag-Renewal, Inc., 2605 East Main, Weatherford, OK 73096, Phone: (405) 772-7059

### **Seed Planters**

Fluffy bearded seed drills:

Contact: Chuck Grimes, Rt. 1 Box 56 Hennessey, OK 73742, Phone: (405) 853-2607

Chaffy debearded seed drills and broadcasters:

Contact: Truax Company, Inc., 4821 Xerxes Ave. North, Minneapolis, MN 55430, Phone: (763) 537-6639, Website: [www.truaxcomp.com](http://www.truaxcomp.com)

Contact to find local dealers: Tye Company, Box 218, Lockney, TX 79241, Phone: (806) 652-3367

### **Seed Cleaning Equipment**

Manufacturer of several types of cleaning equipment including an industrial size debearder:

Contact for local dealers: The Clipper Co., 805 S. Decker Dr., P.O. Box 256, Bluffton, IN 46714, Phone (219) 824-3400

Manufacturer of seed cleaning equipment:

Contact for local dealers: Westrup Inc., 1400 Preston Road, Plano, TX 75093, Phone: (214) 985-7887

Many types of seed cleaning equipment:

Contact: Seedburo Equipment Company, 1022 W. Jackson Blvd, Chicago, IL 60607, Phone: 1-800-284-5779, Website: [www.seedburo.com](http://www.seedburo.com)



## **SELECTED SPECIES SEED PRODUCTION GUIDELINES**

The technical information in these guidelines is based on research conducted on reclaimed minedlands in central Florida, and at the Brooksville Plant Materials Center.

Seed characteristics and plant performance vary widely within a species. Guidelines are based on averages rather than single ecotypes.

Unless otherwise stated, seeding rates are based on 30 pure live seed per linear foot, planted in 12" rows. This is a standard seeding rate for irrigated fields under ideal conditions.

Research still needs to be conducted on most Florida species, to determine optimum rates and planting dates under a broad spectrum of conditions.





**Bluestem, Chalky** [*Andropogon capillipes* Nash or *Andropogon glomeratus* var. *glaucopsis* (Ell.) C. Mohr]

**SPECIES DESCRIPTION:** Warm season perennial bunchgrass; leaf blades are 20 to 25 inches long and covered with a conspicuous white chalky residue; seed stalks are 3 to 5 feet tall; adapted to flatwoods, sloughs and margins of freshwater ponds or marshes throughout Florida. Will not survive on droughty uplands without supplemental irrigation. A prolific seed producer that readily colonizes moist disturbed areas. Provides cover for wildlife and is highly palatable to livestock.

**AVERAGE SEED/LB (KG):** 1,513,000/lb (3,333,000/kg) (bearded).  
2,270,000/lb (5,000,000/kg) (debearded)

**SEEDING RATE-DRILLED:** (Pure live seed)  
1 lb/ac (bearded), 0.75 lb/ac (debearded) for 12" rows; divide by 2, 3 or 4 for 24", 36" or 48" rows.

**SEEDING DEPTH:** 1/4" or less.

**ROW SPACING:** 24" to 48" (Narrower rows may be used but seed production may be reduced).

**PLANTING DATE:** Successful plantings were made in central Florida in early January and early August. May be planted throughout growing season with adequate moisture.

**WEED CONTROL:**

**Prior to Establishment:** Use herbicides and/or cultivation for 1 to 2 years to obtain a clean weed-free seedbed.

**Established Stand:** Hand weeding and cultivation. In preliminary tests, dicamba caused plant injury, but 2,4-D did not. Some preemergent herbicides may stunt growth. Further studies will need to be conducted before any herbicides can be recommended.

**INSECT/PATHOGEN CONTROL:** No serious pests observed under cultivation.

**FERTILIZATION:**

**During Establishment:** Not recommended for direct-seeded stands. Fertilization may be beneficial to transplants if soil tests indicate nutrients are lacking.

**Established Stand:** Fertilize according to soil test recommendations. In nitrogen deficient soils 30 to 50 lbs nitrogen/ac may be applied in the early spring to maintain stands.

**IRRIGATION:**

**During Establishment:** Keep soil profile moist during stand establishment.

**Established Stand:** Cannot survive on uplands without supplemental irrigation. Irrigate during the growing season if rainfall is not adequate to meet plant needs. Good soil moisture is necessary for seed production. However, stands should not be irrigated when plants are pollinating or during the final stages of seed ripening.

## **Bluestem, Chalky** continued

### HARVEST:

**Harvest Dates:** November through early December.

**Collection Window:** Several weeks, barring high winds. Seeds cling together on plant even after they have been released, until they are dispersed by the wind.

**Stripping:** Preferable; harvest seed during the warmest, driest time of the day.

Stage: When seed is released from plant -- hard dough to mature seed.

Brush Speed: 800 to 900 rpm for 1 harvest or 400 to 600 rpm for multiple harvests.

**Forage Harvester:** Adequate, although a large percentage of seed is lost by air movement.

**Direct Combine:** N/A

**Lodging:** Moderate

**Shattering:** No

### PRECLEANING TREATMENT/STORAGE:

**Stripped Seed:** Air-dry 5 to 10 days if necessary.

**Forage Harvest:** Immediately air-dry for 5 to 10 days as necessary.

### PROCESSING:

**Scalping:** Clipper 2 screen fanning mill, immediately after harvest while seed is damp

Top screen only: 32 round

**Debearding:** Yes, if drilling

Clipper debearder: 300 rpm for 60 minutes

Hammer mill: 1-8 round screen at 60 rpm

**First Cleaning:** Clipper 2 screen fanning mill

Top screen: 1/16 x 1/12

Bottom screen: 1/18 x 1/4

Air: Closed

**Final Cleaning:** Clipper 2 screen fanning mill

Top screen: 6 x 34

Bottom screen: 50 x 50

Air: Closed

### SEED YIELD:

**Irrigated:** A year-old stand at the Brooksville PMC produced 17 lbs pure seed/ac with 52% germination. Yields may be higher in more mature stands that undergo multiple harvests.

**STAND MANAGEMENT:** In late winter just prior to spring regrowth, remove old residue by mowing plants to a stubble height of 4 to 8" with a rotary mower or bush hog. Burning old residue is not recommended, as it severely injured or killed plants in preliminary tests.

**EXPECTED PRODUCTIVE STAND LIFE:** Stands of selected accessions persisted at the Brooksville PMC for 4 years and are expected to remain productive for 10 years or more if properly maintained.

**Bluestem, Creeping** [*Schizachyrium stoloniferum* Nash or *Schizachyrium scoparium* (Michx.) Nash var. *stoloniferum* (Nash) J. Wipff]

**SPECIES DESCRIPTION:** A warm season perennial rhizomatous grass; leaf blades up to 24 inches long; seed stalks 2 to 6 feet tall; adapted to flatwoods, hardwood hammocks, and longleaf pine-turkey oak sandhills throughout Florida. It has superior forage production and is grazed by livestock. Because it is a sod-former, it is important for erosion control.

**AVERAGE SEED/LB (KG):** 756,000/lb (1,667,000/kg) (bearded).

**SEEDING RATE-DRILLED:** (Pure live seed)  
2 lb/ac (bearded seed) for 12" rows; divide by 2, 3 or 4 for 24", 36" or 48" rows.

**SEEDING DEPTH:** 1/4" or less.

**ROW SPACING:** 24" to 48" (Narrower rows can be used, but seed production may be reduced).

**PLANTING DATE:** Winter (December, January). Only winter plantings were successful in central Florida; May plantings had poor seedling emergence.

**WEED CONTROL:**

**Prior to Establishment:** Use herbicides and/or cultivation for 1 to 2 years to obtain a clean weed-free seedbed.

**Established Stand:** Hand weeding and cultivation. Currently, no herbicides can be recommended.

**INSECT/PATHOGEN CONTROL:** Viable seed production varies widely between years and genotypes in this species and is often very low. Insects that harm the seed, such as midges, may be one cause, however researchers have yet to confirm this. Currently, no pesticides can be recommended that improve viable seed production.

**FERTILIZATION:**

**During Establishment:** Not recommended for direct-seeded stands. Fertilization may be beneficial to transplants if soil tests indicate nutrients are lacking.

**Established Stand:** Fertilize according to soil test recommendations. In nitrogen deficient soils 30 to 50 lbs nitrogen/ac may be applied in the early spring to maintain stands.

**IRRIGATION:**

**During Establishment:** Requires good soil moisture during establishment.

**Established Stand:** Flatwoods types need moist conditions and will tolerate soils with high water tables. Upland types do not require supplemental irrigation except on coarse droughty sands. Irrigate during the growing season if rainfall is not adequate to meet plant needs. Good soil moisture is necessary for seed production. However, stands should not be irrigated when plants are pollinating or during the final stages of seed ripening.

## **Bluestem, Creeping** continued

### HARVEST:

**Harvest Dates:** Late November through early December.

**Collection Window:** Several weeks, barring high winds, which disperses the seed. Seeds ripen on the spikelets from the top down, and are released over several weeks.

**Stripping:** Preferable; harvest seed during the warmest driest time of the day.

Stage: When seed is released from plant -- hard dough to mature seed.

Brush Speed: 800 to 900 rpm for 1 harvest or 400 to 600 rpm for multiple harvests.

**Forage Harvester:** Adequate, although a large percentage of seed is lost by air movement.

**Direct Combine:** N/A

**Lodging:** Varies widely depending on genotype.

**Shattering:** No

### PRECLEANING TREATMENT/STORAGE:

**Stripped Seed:** Air-dry 5 to 10 days if necessary.

**Forage Harvest:** Immediately air-dry for 5 to 10 days as necessary.

**PROCESSING:** Methods of conditioning seed have not yet been developed. Seed is light, but has less pubescence than other types of bluestem, and should flow through a fluffy-seed drill designed to plant bearded seed.

**Scalping:** Clipper 2 screen fanning mill

Top screen only: 32 round

### SEED YIELD:

**Irrigated:** A sandhill type produced 52 lb/ac pure seed with 8% germ under irrigation at the Brooksville PMC. Production varies widely between genotypes.

**Dryland:** The sandhill type produced 43 lb/ac pure seed with 8% germ without irrigation.

**STAND MANAGEMENT:** Burn or mow stands in late winter prior to spring regrowth, or in the spring/early summer (May-June). Summer burns may increase viable seed production over winter burns.

**EXPECTED PRODUCTIVE STAND LIFE:** Stands of selected accessions persisted at the Brooksville PMC over 10 years. If rows become sod-bound, they may need to be renovated using tillage or herbicides.

**Bluestem, Splitbeard** (*Andropogon ternarius* Michx.)

**SPECIES DESCRIPTION:** Warm season perennial bunchgrass; plants are 3 to 8 inches tall or taller; seed stalks 1 to 3 feet tall with paired spikelets. On moist fertile soils, plants can double or triple in size. Adapted to droughty sandhill soils; this species is grazed by livestock, but one of its greatest potential uses is as a natural nurse crop/erosion control plant on coarse dry soils, when planted in conjunction with wiregrass.

**AVERAGE SEED/LB (KG):** 200,000/lb (440,000/kg) (bearded),  
350,000 (770,000/kg) (debearded)  
360,000/lb (800,000/kg) (dehulled)

**SEEDING RATE-DRILLED:** (Pure live seed)  
6 lb/ac (bearded), 4 lb/ac (debearded), 3.75 lb/ac (dehulled) for 12" rows, divide by 2, 3 or 4 for 24", 36" or 48" rows.

**SEEDING DEPTH:** 1/4" or less.

**ROW SPACING:** 24" to 48" (Narrower rows can be used, but seed production may be reduced).

**PLANTING DATE:** Winter (December, January) may be optimum, however plantings made in May in central Florida were successful if adequate moisture was available.

**WEED CONTROL:**

**Prior to Establishment:** Use herbicides and/or cultivation for 1 to 2 years to obtain a clean weed-free seedbed.

**Established Stand:** Hand weeding, cultivation and labeled broadleaf herbicides. Currently, no other herbicides can be recommended.

**INSECT/PATHOGEN CONTROL:** No serious pests observed under cultivation.

**FERTILIZATION:**

**During Establishment:** Not recommended for direct-seeded stands. Fertilization may be beneficial to transplants if soil tests indicate nutrients are lacking.

**Established Stand:** Fertilize according to soil test recommendations. In nitrogen deficient soils 30 to 50 lbs nitrogen/ac may be applied in the early spring to maintain stands. Highly fertile soils may encourage lodging.

**IRRIGATION:**

**During Establishment:** Requires good soil moisture during establishment.

**Established Stand:** Can tolerate dry conditions, and stands may actually persist longer on dryland sites. Will not tolerate saturated soils or high water tables. If irrigation is available and conditions are droughty, stands can be irrigated between pollination and the final stages of seed ripening. However, precipitation is usually adequate to meet plant needs.

## **Bluestem, Splitbeard** continued

### HARVEST:

**Harvest Date:** Late November.

**Collection Window:** Approximately 2 - 4 weeks barring high winds. Seed ripens from the top of the spikelet down and is dispersed by wind after it is released.

**Stripping:** Preferable; harvest seed during the warmest driest time of the day.

Stage: When seed is easily hand stripped from the stalk - hard dough to mature stage.

Brush Speed: 400 to 600 rpm and harvest several times as seed ripens.

**Forage Harvester:** Adequate, although a large percentage of seed is lost by air movement.

**Direct Combine:** N/A

**Lodging:** Moderate; varies widely depending on fertility and field moisture conditions.

**Shattering:** Low

### PRECLEANING TREATMENT/STORAGE:

**Stripped Seed:** Immediately air-dry 3 to 7 days as necessary.

**Forage Harvest:** Immediately air-dry for 3 to 7 days as necessary.

### PROCESSING:

**Scalping:** Clipper 2 screen fanning mill immediately after harvest when seed is damp.

Top screen only: 32 round

**Debearding:** Yes (seed is readily dehulled in hammermill)

Clipper debearder: 300 rpm for 60 minutes

Hammer mill: 1-8 round screen at 60 rpm

**First Cleaning:** Clipper 2 screen fanning mill

Top screen: 6 x 22 wire mesh

Bottom screen: 50 x 50

Air: Closed

**Final Cleaning:** Clipper 2 screen fanning mill

Top screen: 1/16 round (and then 1/16 x 1/2 slotted if necessary)

Bottom screen: 50 x 50

### SEED YIELD:

**Irrigated:** A sandhill ecotype produced 90 lb/ac pure seed with 18% germ at the Brooksville PMC.

**Dryland:** The same accession produced 86 lb/ac pure seed with 36% germ on dryland.

**STAND MANAGEMENT:** Burn or mow stands to 2 inches stubble height in late winter; or mow to 6 to 8 inches (above growing point) in the summer (June- early July). Summer burning did not injure plants in native stands, but effect on seed production has not yet been tested.

**EXPECTED PRODUCTIVE STAND LIFE:** Stands persisted 5 years on dryland and irrigated sites at the PMC if they were properly managed. Expected stand life is 10 years. Irrigated plots that were not fertilized and did not undergo any residue management only persisted 3 years.

## **Eastern Gamagrass** (*Tripsacum dactyloides* (L.) L.)

**SPECIES DESCRIPTION:** A robust warm season perennial bunchgrass; 3 to 8 feet tall; seed stalks 2 to 6 feet or taller; seed heads 6 to 10 inches long, with the upper portion being the male part of the flower and the lower portion, where the seeds are formed, the female part. Adapted to fertile soils in wet flatwoods and prairies throughout Florida. Produces large quantities of high quality livestock forage. It is also valuable for wildlife food and cover, and as a buffer to reduce soil and nutrient runoff from fields.

**AVERAGE SEED/LB (KG):** 2,800/lb (6,230/kg) (for Florida types, which are 2x larger than 'Pete').

**SEEDING RATE-DRILLED:** (Good seed, in which the fruitcase contains a viable kernel) 13, 10, and 8 lb/ac for 36", 48" and 60" rows respectively (2.5 seed/ft of row). Gamagrass seed is prone to dormancy. To break dormancy, seed is soaked in water for 12 - 24 hours and chilled for 6-10 weeks at 35-45° F. A more effective method is to soak seed in a solution of gibberellic acid (105 mg/L water) and chill for approx. 4 weeks. Seed should be planted immediately after being treated or it will slowly return to a dormant state.

**SEEDING DEPTH:** 1/2" to 1 1/2".

**ROW SPACING:** 36" to 60". For production purposes, row width should allow equipment to pass through without damaging plants. On moist fertile soils, plant bases can reach 2-3 feet in diameter.

**PLANTING DATE:** A dormant winter planting (November-January) allows the seed to undergo natural stratification. Plantings in January, June and September were all successful in Florida, as long as moisture was adequate.

### **WEED CONTROL:**

**Prior to Establishment:** Use herbicides and/or cultivation for 1 to 2 years to obtain a clean weed-free seedbed. Gamagrass is similar to corn, and corn herbicides, such as atrazine, are not known to cause injury. Few herbicides are currently labeled specifically for use on gamagrass, however more are being developed.

**Established Stand:** Hand weeding, cultivation and labeled broad leaf herbicides while stands are young. Mature plants can generally out-compete most weeds.

**INSECT/PATHOGEN CONTROL:** Spider mites have caused substantial leaf injury on stands at the Brooksville PMC. Mowing off infected foliage adequately controlled the disease.

### **FERTILIZATION:**

**During Establishment:** Not recommended for direct-seeded stands. Fertilization may be beneficial to transplants if soil tests indicate nutrients are lacking.

**Established Stand:** Fertilize according to soil test recommendations. In nitrogen deficient soils 50 to 100 lbs nitrogen/ac may be applied in the early spring to support plant growth. Over-fertilization or fertilizing later in the season will encourage forage production and may reduce seed production.

## Eastern Gamagrass continued

### IRRIGATION:

**During Establishment:** Requires good soil moisture during establishment.

**Established Stand:** Prefers moist soil conditions and will tolerate high water tables. Can tolerate periods of drought in the fall and winter. Good soil moisture is necessary for seed production.

### HARVEST:

**Harvest Dates:** Seeds develop and ripen continuously May - September. Highest viable seed production for large-seeded Florida types usually occurs between July 15 and August 15.

**Collection Window:** Seeds slowly ripen from the top of the seed head down, with the topmost seeds shattering 1-2 weeks before lower seeds are ripe.

**Stripping:** N/A

**Forage Harvester:** N/A.

**Direct Combine:** Preferred method.

Stage: Ripe seed are dark brown to bronze in color, and readily release at the joints.

**Lodging:** Varies depending on genotype. Most types experience some lodging, especially under high fertility conditions.

**Shattering:** Very high.

### PRECLEANING TREATMENT/STORAGE:

Unless there is a large amount of green material, seed does not need drying.

### PROCESSING:

**Scalping:** Clipper 2 screen fanning mill

Top screen: 20 round

Bottom screen: 11 round

Air: full

**Final Cleaning:** Clipper 2 screen fanning mill

Top screen: 16 round

Bottom screen: 12 round

Air: Full

**Gravity Separator:** To separate viable seed from empty fruitcases.

### SEED YIELD:

**Irrigated:** Two Florida types in 36" rows yielded 28 and 36 lb/ac (with approx. 60% being good seed) at the Brooksville PMC. Yields may possibly be increased with wider row spacings.

**STAND MANAGEMENT:** Burn or mow stands in winter (January - March) to remove old residue.

**EXPECTED PRODUCTIVE STAND LIFE:** Properly managed stands can persist over 15 years.



**Hairawn Muhly** [*Muhlenbergia capillaris* (Lam.) Trin.]

**SPECIES DESCRIPTION:** A warm season perennial bunchgrass; plants 1 to 3 feet tall; seed stalks 2 to 5 feet tall, a very showy pink to purple color; adapted to the backside of dunes, cabbage palm hammocks, saline flats, marl prairies and marshy areas throughout Florida; some types also grow in sandhills. Vegetatively, very similar to wiregrass, and useful for wildlife cover and fine fuels for understory burn management programs.

**AVERAGE SEED/LB (KG):** 2,522,000/lb (5,560,000/kg) (bearded).

**SEEDING RATE-DRILLED:** (Pure live seed)

0.75 lb/ac (bearded seed) for 12" rows; divide by 2, 3 or 4 for 24", 36" or 48" rows.

**SEEDING DEPTH:** 1/8"

**ROW SPACING:** 24" to 48" (Narrower rows can be used, but seed production may be reduced).

**PLANTING DATE:** Not yet tested; winter (December, January) is most likely the best planting time.

**WEED CONTROL:**

**Prior to Establishment:** Use herbicides and/or cultivation for 1 to 2 years to obtain a clean weed-free seedbed.

**Established Stand:** Hand weeding and cultivation, and labeled broadleaf herbicides. Currently, no other herbicides can be recommended.

**INSECT/PATHOGEN CONTROL:** Blooms can become heavily infested with aphids during the early stages of seed development, especially in the milk stage. The amount of damage they cause is unknown and insecticides have yet to be tested. Large numbers of beneficial insects, such as ladybug beetles, have also been observed. Increasing their numbers may be a natural means of biological control.

**FERTILIZATION:**

**During Establishment:** Not recommended for direct-seeded stands. Fertilization may be beneficial to transplants if soil tests indicate nutrients are lacking.

**Established Stand:** Fertilize according to soil test recommendations. In nitrogen deficient soils 30 to 50 lbs nitrogen/ac may be applied in the early spring to maintain stands.

**IRRIGATION:**

**During Establishment:** Requires good soil moisture during establishment.

**Established Stand:** Some types may be fairly drought tolerant. Irrigate during the growing season if rainfall is not adequate to meet plant needs. Good soil moisture is necessary for seed production. However, stands should not be irrigated when plants are pollinating or during the final stages of seed ripening.

## Hairawn Muhly continued

### HARVEST:

**Harvest Dates:** Late October through November, depending on genotype.

**Collection Window:** One to 2 weeks at most, barring high winds.

**Stripping:** Preferable; harvest seed during the warmest driest time of the day.

Stage: When seed is released from plant - hard dough to mature seed.

Brush Speed: 700 to 900 rpm.

**Forage Harvester:** Adequate, although a large percentage of seed is lost due to shattering.

**Direct Combine:** Untested

**Lodging:** Varies depending on genotype.

**Shattering:** High

### PRECLEANING TREATMENT/STORAGE:

**Stripped Seed:** Air-dry 5 to 10 days if necessary.

**Forage Harvest:** Immediately air-dry for 5 to 10 days as necessary.

### PROCESSING:

**Debearding:** Yes

Hammer mill: 1-8 round screen at 60 rpm.

**Cleaning:** Clipper 2 screen fanning mill

Top screen: 6 x 21 wire mesh

Bottom screen: 50 x 50

Air: Closed

### SEED YIELD:

**Irrigated:** Unknown - viable seed production varies widely between ecotypes.

**Dryland:** Unknown.

**STAND MANAGEMENT:** Burn or mow stands in late winter to remove old residue.

**EXPECTED PRODUCTIVE STAND LIFE:** Stands of selected accessions persisted at the Brooksville PMC over 10 years.

## **Lopsided Indiangrass** [*Sorghastrum secundum* (Elliot) Nash]

**SPECIES DESCRIPTION:** A short-lived warm season perennial bunchgrass; leaf blades 12 to 24 inches long; seed stalks 3 to 6 feet tall with seed hanging on one side; adapted to a wide variety of soils from drier flatwoods to droughty sandhills throughout Florida; useful for livestock forage, wildlife cover and as an erosion control plant.

**AVERAGE SEED/LB (KG):** 252,000/lb (556,000/kg) (debearded).

**SEEDING RATE-DRILLED:** (Pure live seed)  
5 lb/ac for 12" rows, divide by 2, 3 or 4 for 24", 36" or 48" rows.

**SEEDING DEPTH:** 1/2" or less.

**ROW SPACING:** 24" to 48" (Narrower rows can be used, but seed production may be reduced).

**PLANTING DATE:** Winter (December, January) may be the optimum time to seed, however plantings made throughout the year in both the panhandle and central Florida were successful if adequate moisture was available.

### **WEED CONTROL:**

**Prior to Establishment:** Use herbicides and/or cultivation for 1 to 2 years to obtain a clean weed-free seedbed.

**Established Stand:** Hand weeding and cultivation. Some herbicides, such as 2,4-D, labeled for grass seed production fields may be used to control broadleaf weeds. In tests on reclaimed uplands, imazapic applications at low to medium rates caused plant injury.

**INSECT/PATHOGEN CONTROL:** Plants older than 3 years appear to be susceptible to soil pathogens, especially nematodes, however no economical chemical controls are currently available.

### **FERTILIZATION:**

**During Establishment:** Not recommended for direct-seeded stands. Fertilization may be beneficial to transplants if soil tests indicate nutrients are lacking.

**Established Stand:** Fertilize according to soil test recommendations. In nitrogen deficient soils 30 to 50 lbs nitrogen/ac may be applied in the early spring to maintain stands.

### **IRRIGATION:**

**During Establishment:** Requires good soil moisture during establishment.

**Established Stand:** Can tolerate dry conditions, and stands may actually persist longer on dryland sites. If irrigation is available and conditions are dry, stands can be irrigated after pollination up to the final stages of seed ripening.

## **Lopsided Indiangrass** continued

### HARVEST:

**Harvest Dates:** Late October.

**Collection Window:** Approximately 1 week, barring high winds. Seed rapidly drops from plant once it is ripe.

**Stripping:** Preferable; harvest seed during the warmest driest time of the day.

Stage: When seed is easily hand stripped from the stalk - soft to medium dough stage.

Brush Speed: 500 to 800 rpm.

**Forage Harvester:** Adequate, although a large percentage of seed is lost by shattering.

**Direct Combine:** N/A

**Lodging:** Moderate, varies widely depending on genotype.

**Shattering:** Moderate to High

### PRECLEANING TREATMENT/STORAGE:

**Stripped Seed:** Immediately air-dry 3 to 7 days as necessary.

**Forage Harvest:** Immediately air-dry for 3 to 7 days as necessary.

### PROCESSING:

**Debearding:** Yes

Clipper debearder: 300 rpm for 60 minutes

Hammer mill: 1-8 screen at 60 rpm

**Scalping:** Clipper 2 screen fanning mill

Top screen only (to remove awns): 6 x 32 wire mesh (3x). Use squeegee to periodically clean seed off of screen.

**Final Cleaning:** Clipper 2 screen fanning mill

Top screen: 12 round

Bottom screen: 10 round

Air: Full open

### SEED YIELD:

**Irrigated:** A sandhill type produced 75 lb/ac pure seed with 26% germ under irrigation at the Brooksville PMC the second year after establishment. Production had dropped dramatically by the third year.

**Dryland:** Yields on dryland may be similar to irrigated yields if precipitation is adequate to meet plant needs.

**STAND MANAGEMENT:** Burn or mow stands to 2 inches stubble height in late winter; or mow to approximately 6 to 8 inches (just above growing point) in the summer (June- early July). Do not burn in the summer as it severely injures plants.

**EXPECTED PRODUCTIVE STAND LIFE:** Stands persisted 3 years under irrigation and up to 4 years on dryland at the Brooksville PMC. This species is a short-lived perennial, even in the wild. Proper residue management may increase stand longevity.

## **Pinewoods Dropseed** [*Sporobolus junceus* (Michx.) Kunth]

**SPECIES DESCRIPTION:** A small warm season perennial bunchgrass that looks very similar to wiregrass (*Aristida beyrichiana*); leaves threadlike 4 to 6 inches long; seed stalks 1 to 2 feet tall, having a small distinctive seed head, with branches forming a whorled pattern around the stem. Adapted to a variety of sites from flatwoods to sandhills. The foliage is grazed by livestock when it is young, provides wildlife food and cover, and also fine fuels for pine forest understory burn management programs. This species fills the same role as wiregrass but is easier to plant with conventional equipment.

**AVERAGE SEED/LB (KG):** 1,134,000/lb (2,500,000/kg).

**SEEDING RATE-DRILLED:** (Pure live seed)

1.25 lb/ac for 12" rows, divide by 2 or 3 for 24" or 36" rows.

**SEEDING DEPTH:** 1/4" or less.

**ROW SPACING:** 12" to 36" (Narrower rows can be used, but seed production may be reduced).

**PLANTING DATE:** Winter (December, January) optimum; plantings made in January in central Florida were successful, while May plantings were not.

**WEED CONTROL:**

**Prior to Establishment:** Use herbicides and/or cultivation for 1 to 2 years to obtain a clean weed-free seedbed.

**Established Stand:** Hand weeding, cultivation and labeled broadleaf herbicides. Currently, no other herbicides can be recommended.

**INSECT/PATHOGEN CONTROL:** No serious pests observed under cultivation.

**FERTILIZATION:**

**During Establishment:** Not recommended for direct-seeded stands. Fertilization may be beneficial to transplants if soil tests indicate nutrients are lacking.

**Established Stand:** Fertilize according to soil test recommendations. In nitrogen deficient soils 30 to 50 lbs nitrogen/ac may be applied in the early spring to maintain stands. This species is highly tolerant of low fertility conditions.

**IRRIGATION:**

**During Establishment:** Requires good soil moisture during establishment.

**Established Stand:** Can tolerate very droughty conditions once established, but also thrives on well-drained irrigated sites. If necessary, stands can be irrigated between pollination and the final stages of seed ripening to promote seed production.

## **Pinewoods Dropseed** continued

### HARVEST:

**Harvest Dates:** Usually in May or June, but can occur during July; seed ripening varies greatly between genotypes, locations and weather conditions.

**Collection Window:** Seed ripens from the top of the seed head down, over a period of 2 or more weeks and rapidly drops from the plant once it is ripe.

**Stripping:** N/A

**Forage Harvester:** N/A

**Direct Combine:** Preferred.

Stage: Medium dough to mature. Mature seed is black or blue in color.

**Lodging:** Low

**Shattering:** Very high

### PRECLEANING TREATMENT/STORAGE:

**Combined Seed:** Immediately air-dry 3 to 7 days if necessary.

PROCESSING: Cleaning methods have not yet been developed.

SEED YIELD: Unknown.

STAND MANAGEMENT: Burn or mow stands to 2 inches stubble height in late winter (early February); or burn in the summer after seed production.

EXPECTED PRODUCTIVE STAND LIFE: Stands persisted 5 years on well-drained irrigated sites at the Brooksville PMC. Expected stand life is 10 years or more under favorable conditions.

## **Switchgrass** (*Panicum virgatum* L.)

**SPECIES DESCRIPTION:** A robust warm season perennial bunchgrass; two types occur in Florida-- bunch types are larger (up to 5 feet tall), more robust and slightly rhizomatous; rhizomatous types are smaller (1-2 feet) and usually highly rhizomatous; seed stalks 2 to 6 feet tall; seed heads are multi branched panicles. Adapted to a broad range of sites from brackish and freshwater marshes, flatwoods to dry sandy uplands and the backside of coastal dunes. Bunch types produce a large volume of high quality forage for livestock; switchgrass also provides wildlife food and cover, is useful for erosion control plantings and in buffer strips.

**AVERAGE SEED/LB (KG):** 567,000/lb (1,250,000/kg) (weight varies between different varieties).

**SEEDING RATE-DRILLED:** (Pure live seed)

2.5 lb/ac for 12" rows, divide by 2, 3, 4 or 5 for 24", 36", 48" or 60" rows.

**SEEDING DEPTH:** 1/2" or less.

**ROW SPACING:** 36" to 60" (Narrower rows are not recommended for robust bunch types, and wider rows may encourage greater seed production over the long term).

**PLANTING DATE:** Planted year round with adequate moisture; successful plantings were made in central Florida in early January and early August; May plantings were not as successful.

**WEED CONTROL:**

**Prior to Establishment:** Use herbicides and/or cultivation for 1 to 2 years to obtain a clean weed-free seedbed.

**Established Stand:** Hand weeding, cultivation and labeled broadleaf herbicides.

**INSECT/PATHOGEN CONTROL:** Some types are prone to rust on the leaves, but there are no control measures available.

**FERTILIZATION:**

**During Establishment:** Not recommended for direct-seeded stands. Fertilization may be beneficial to transplants if soil tests indicate nutrients are lacking.

**Established Stand:** Fertilize according to soil test recommendations. In nitrogen deficient soils 30 to 50 lbs nitrogen/ac may be applied in the early spring to maintain stands. Over fertilizing or fertilizing later in the growing season will encourage vegetative growth and reduce seed yields. It may also encourage lodging.

**IRRIGATION:**

**During Establishment:** Requires good soil moisture during establishment.

**Established Stand:** Some types are very tolerant of dry conditions, but irrigation is recommended on dry uplands for consistent seed production. Other types can grow in seasonally ponded sites. Irrigate during the growing season if rainfall is not adequate to meet plant needs. Good soil moisture is necessary for seed production. However, stands should not be irrigated when plants are pollinating or during the final stages of seed ripening.

## Switchgrass continued

### HARVEST:

**Harvest Dates:** Late September through October, depending on genotype.

**Collection Window:** Approximately 1 week. Harvest when seeds at the top of the seed head have dropped and seeds at the bottom are just coming ripe.

**Stripping:** N/A

**Forage Harvester:** N/A

**Direct Combine:** Preferable

Stage: Hard dough to mature.

**Lodging:** Medium to high depending on genotype, fertility and field moisture conditions.

**Shattering:** High

### PRECLEANING TREATMENT/STORAGE:

**Combined Seed:** Drying usually not necessary.

### PROCESSING:

**Scalping:** Clipper 2 screen fanning mill

Top screen: 9 round

Bottom screen: 7 round

Air: Closed

**Debearding:** Yes (to remove seed hulls)

Hammermill: 70 rpm, 1/8 screen, moderately fast flow.

**Final Cleaning:** Clipper 2 screen fanning mill

Top screen: 7 round

Bottom screen: 6 x 32 wire mesh

Air: Closed

### SEED YIELD:

**Irrigated:** For unknown reasons, it has been difficult to obtain consistent switchgrass seed yields in Florida. Yields of various cultivars at the Brooksville PMC have ranged between 60 and 120 lb/ac with 5 to 40% germination. In the Midwest, yields range between 200 and 700 lbs/ac. Florida varieties with higher seed production are currently being developed.

**STAND MANAGEMENT:** Burn or mow stands to 6-8 inch stubble height in late winter just prior to spring regrowth. Burning or mowing during the summer will severely injure plants. Removing old residue in the fall will make stands susceptible to winterkill.

**EXPECTED PRODUCTIVE STAND LIFE:** Stands persisted 10-15 years on both dryland and irrigated sites at the Brooksville PMC with proper management. However, seed production drops as plants mature and stands become denser. Seed production fields may need to be renovated or replanted after 5 or more years. Initially planting wider rows may increase productive stand life.



**Wiregrass** (*Aristida beyrichiana* Trin. & Rupr.)

**SPECIES DESCRIPTION:** Warm season perennial bunchgrass; leaf blades are narrow and rolled inward (wire-like), 12 to 20 inches long; seed stalks are 1 to 3 feet tall. Adapted to a wide variety of soils from flatwoods to droughty sandhills throughout Florida. Primary use is as a fine fuel for pine forest understory burn management programs; also an important source of nesting cover for upland game birds; livestock graze foliage after a burn when it is tender.

**AVERAGE SEED/LB (KG):** 907,000/lb (2,000,000/kg) (bearded).

**SEEDING RATE-DRILLED:** (Pure live seed)

2 lb/ac for 12" rows, divide by 2, 3 or 4 for 24", 36" or 48" rows.

**SEEDING DEPTH:** 1/4" or less.

**ROW SPACING:** 24" to 48" [Planting double rows (6-12" spacings) within main rows is highly recommended to form a heavy canopy that will shade out weeds].

**PLANTING DATE:** Winter (November-January) plantings were successful in central Florida and the panhandle. Plantings during other seasons generally had lower stand densities.

**WEED CONTROL:**

**Prior to Establishment:** Use herbicides and/or cultivation for 1 to 2 years to obtain a clean weed-free seedbed.

**Established Stand:** Weeds can be a problem in this species because it is slow growing and shallow rooted. Spacing rows to allow for cultivation is recommended. Also hand weeding and labeled broadleaf herbicides can be used. In tests on reclaimed uplands, imazapic applications at low to medium rates did not injure seedlings or mature plants.

**INSECT/PATHOGEN CONTROL:** Seeds commonly infected with smut-like fungus. Amount of damage to viable seed unknown; no known control measures available.

**FERTILIZATION:**

**During Establishment:** Not recommended for direct-seeded stands. Fertilization may be beneficial to transplants if soil tests indicate nutrients are lacking.

**Established Stand:** Fertilize according to soil test recommendations. In nitrogen deficient soils 30 to 50 lbs nitrogen/ac may be applied in the early spring to maintain stands. Wiregrass shows very little response to nitrogen fertilization, but it may be important for stand persistence.

**IRRIGATION:**

**During Establishment:** Requires good soil moisture during establishment.

**Established Stand:** Highly tolerant of droughty conditions once established. Irrigate during the growing season, if necessary, to keep plants vigorous. Good soil moisture is necessary for seed production. However, stands should not be irrigated when plants are pollinating or during the final stages of seed ripening.

## Wiregrass continued

### HARVEST:

**Harvest Dates:** Late November to early December.

**Collection Window:** Approximately 1 to 2 weeks, barring high winds. Ripe seed is loosely held on seed head until it is dispersed by wind.

**Stripping:** Preferable; harvest when conditions are warm and dry; damp seed won't strip off.

Stage: When seed is easily hand stripped from the stalk - mature viable seed is very brittle and snaps when pressed with thumbnail.

Brush Speed: 700 to 900 rpm.

**Forage Harvester:** Adequate.

**Direct Combine:** N/A

**Lodging:** Low

**Shattering:** Low

### PRECLEANING TREATMENT/STORAGE:

**Stripped Seed:** Usually not necessary if harvested during the dry period of the day.

**Forage Harvest:** Immediately air-dry for 3 to 7 days as necessary.

### PROCESSING:

**Specialized Cleaning instructions:** Debearding not recommended, as seed is brittle and easily cracked. Stripped seed can be scalped to remove large stems.

**Scalping:** Clipper 2 screen fanning mill

Top screen only: 32 round

**Preparation for Planting with a Hay Blower:** (To break up large stems.)

Hammer mill: 1/4 round

### SEED YIELD:

**Irrigated:** On research plots at the Brooksville PMC, production varied between 13 and 28 lb/ac pure seed with 17 to 29% germ. Yields may be increased with proper management and improved varieties.

**STAND MANAGEMENT:** Seed head production is influenced by the amount of light reaching the crown. Burn plants in the spring/early summer (May - July) or mow to 1 - 2 inch stubble height to remove old biomass. Burning or mowing in August will injure plants if they have already begun to flower. Plants do not need to be burned every year to produce seed, although viable seed production may be lower on unburned plants. Burning annually will reduce plant vigor, but proper fertilization may compensate for biomass removal.

**EXPECTED PRODUCTIVE STAND LIFE:** Stands persisted 6 years under irrigation at the Brooksville PMC. However annual biomass removal without fertilization severely reduced plant numbers after 4 years. Proper management will increase stand longevity.

## **Blazing Star, Handsome** [*Liatris elegans* (Walt.) Michx.]

**SPECIES DESCRIPTION:** Hardy perennial herb. One to several long upright spikes (3 feet tall or more) arise from a tuber (woody corm). Stems that have been damaged or grazed may produce multiple spikes. Leaves are alternate, gradually decreasing in length from the base of the stem upward. Many lavender or purple colored flowers are produced on the spikes in the fall. Adapted to extremely coarse droughty soils, such as long leaf pine - turkey oak sandhills. Grazed by deer; flowers are favored by butterflies and bees.

**AVERAGE SEED/LB (KG):** 103,000/lb (227,000/kg) (bearded)  
189,000/lb (417,000/kg) (debearded)

**SEEDING RATE-DRILLED:** (Pure live seed)  
12.5 lb/ac (bearded), 7 lb/ac (debearded) for 12" rows, divide by 2, 3 or 4 for 24", 36" or 48" rows.  
Can also be established using corms planted on 6-8" within row spacings.

**SEEDING DEPTH:** 1/4 to 1/2".

**ROW SPACING:** 24" to 48" [Planting double or triple rows (6-8" spacings) within main rows is highly recommended to reduce weed competition].

**PLANTING DATE:** Fall/Winter (October-February); *Liatris* species appear to be sensitive to day length and do not normally emerge from summer seedings (stratifying seed or priming with growth hormones may overcome dormancy during periods of long day length).

### **WEED CONTROL:**

**Prior to Establishment:** Use herbicides and/or cultivation for 1 to 2 years to obtain a clean weed-free seedbed. It is very important that broadleaf weeds be controlled before planting.  
**Established Stand:** Weed control can be a problem because this species has a very open canopy. Spacing rows to allow for cultivation is recommended, along with hand weeding.

**INSECT/PATHOGEN CONTROL:** Appears to be susceptible to unknown soil pathogens in moist soils.

### **FERTILIZATION:**

**During Establishment:** Not recommended.  
**Established Stand:** Not recommended, as it will encourage weed competition.

### **IRRIGATION:**

**During Establishment:** This species is able to emerge under dry winter conditions better than most other native species. Some soil moisture is required during establishment. Irrigate new stands only in cases of severe drought.  
**Established Stand:** Prefers dry coarse soils and will not persist in moist soils. Irrigate during the growing season only in cases of extreme drought. Summer precipitation is usually adequate for seed production.

## Handsome Blazing Star continued

### HARVEST:

**Harvest Dates:** November.

**Collection Window:** Approximately 1 week, barring high winds. Seed ripens from the top down, ripening between different plants is very uneven, lasting approximately a month.

**Stripping:** Preferable; slower brush speeds allow for multiple harvests.

Stage: When seed is easily hand stripped from the stalk - hard dough stage.

Brush Speed: 400 to 600 rpm.

**Forage Harvester:** N/A.

**Direct Combine:** N/A

**Lodging:** High

**Shattering:** Medium

### PRECLEANING TREATMENT/STORAGE:

**Stripped Seed:** May require drying for 3 to 5 days.

### PROCESSING:

**Debearding:** Yes (although debearding may reduce seed viability because it strips the seed out of the hull). Cleaning methods are currently undergoing further testing.

Hammermill: 55 rpm, 1-8 round screen, moderately slow feed.

**First Cleaning:** Clipper 2 screen fanning mill

Top screen: 6 x 21 wire mesh

Bottom screen: 6 x 32 wire mesh

Air: Closed

**Final Cleaning:** Clipper 2 screen fanning mill

Top screen: 8 round

Bottom screen: 6 x 32 wire mesh

Air: Closed

### SEED YIELD:

**Dryland:** On research plots at the Brooksville PMC, production varied between 20 and 300 lb/ac pure seed with 45 to 70% germ. Extreme drought conditions reduced seed production.

**STAND MANAGEMENT:** Cutting off tips of spikes during the growing season (June - July) to a height of 10 - 16 inches encourages development of multiple seed stalks. Ideal clipping height has yet to be determined. Unclipped spikes are likely to lodge. Mow off old seed stalks in late winter.

**EXPECTED PRODUCTIVE STAND LIFE:** Stands persisted 3 years on extremely dry soils at the Brooksville PMC. With proper management, they are expected to survive 6 or more years.

**Grassy-leaf Goldenaster** [*Pityopsis graminifolia* (Michx.) Nutt.]

**SPECIES DESCRIPTION:** Hardy perennial herb, up to 3 feet tall, rhizomatous. Multi-branching stems with silvery colored narrow leaves, covered with silky hairs. Many yellow flowers are produced generally in the fall. Adapted to a variety of sites from drier flatwoods to dry sandhills throughout Florida. Grazed by livestock and wildlife; rhizomatous growth habit useful for controlling erosion on uplands.

**AVERAGE SEED/LB (KG):** 570,000/lb (1,250,000/kg) (bearded).

**SEEDING RATE-DRILLED:** (Pure live seed)  
2.5 lb/ac (bearded) for 12" rows, divide by 2, 3 or 4 for 24", 36" or 48" rows.

**SEEDING DEPTH:** 1/4" or less.

**ROW SPACING:** 24" to 48".

**PLANTING DATE:** Winter (December-January) seedings were more successful than summer (May) seedings in central Florida.

**WEED CONTROL:**

**Prior to Establishment:** Use herbicides and/or cultivation for 1 to 2 years to obtain a clean weed-free seedbed. It is very important that broadleaf weeds be controlled before planting.  
**Established Stand:** Spacing rows to allow for cultivation is recommended, along with hand weeding.

**INSECT/PATHOGEN CONTROL:** No serious pests observed under cultivation.

**FERTILIZATION:**

**During Establishment:** Not recommended.  
**Established Stand:** Fertilize according to soil test recommendations. In nitrogen deficient soils 30 to 50 lbs nitrogen/ac applied in the early spring might help maintain stands.

**IRRIGATION:**

**During Establishment:** Good soil moisture is required during establishment.  
**Established Stand:** Can tolerate dry conditions once established, but also thrives on well-drained irrigated sites. Good soil moisture is necessary for production of viable seed, so dryland stands may have lower production. If necessary, stands can be irrigated between pollination and the final stages of seed ripening to promote seed production.

## **Grassy-leaf Goldenaster** continued

### HARVEST:

**Harvest Dates:** November/December.

**Collection Window:** Flowering and seed ripening occur simultaneously on the same plant over approximately 1 month. Once seed is ripe it is readily dislodged by the wind.

**Specialized Harvest - Vacuum system:** Experimental vacuum systems have worked well with this species, as they allow for multiple harvests.

**Stripping:** Can be used; slower brush speeds may allow for multiple harvests.

Stage: When seed is easily hand picked from the plant. Ripe viable seed is dark in color.

Brush Speed: 400 to 600 rpm.

**Forage Harvester:** N/A.

**Direct Combine:** N/A

**Lodging:** Medium

**Shattering:** High

### PRECLEANING TREATMENT/STORAGE:

**Vacuumed or Stripped Seed:** May require drying for 3 to 5 days.

PROCESSING: Cleaning procedures have not yet been developed for this species.

SEED YIELD: Currently unknown.

STAND MANAGEMENT: Burn or mow off old residue in the late winter (January - February). In native stands, waiting to burn until the summer (May - July) encouraged more uniform flowering in the fall, but plants do not need to be burned to produce flowers. Stand densities may increase over time because of the rhizomatous growth habit of this species, and therefore require occasional renovation.

EXPECTED PRODUCTIVE STAND LIFE: Stands persisted 3 years on a dryland site at the Brooksville PMC. With proper management, they are expected to survive 10 or more years.

## **Partridge Pea** [*Chamaecrista fasciculata* (Michx.) Greene]

**SPECIES DESCRIPTION:** Warm season annual legume; feather-like leaves composed of many leaflets; multi branching stems; bright yellow pea-like flowers; seed are contained in a pod. Adapted to dry sandy sites and open disturbed areas. Partridge pea seed is an important source of food for many species of wildlife; foliage is preferentially grazed by livestock and deer; being a legume, it provides a sustainable source of nitrogen to native systems.

**AVERAGE SEED/LB (KG):** 45,000/lb (100,000/kg).

**SEEDING RATE-DRILLED:** (Pure live seed)

10 lb/ac for 6 - 12" rows. Scarify seed to increase germination. Inoculate with appropriate rhizobial bacteria.

**SEEDING DEPTH:** 1/2 to 3/4".

**ROW SPACING:** 6 to 12". Wider rows encourage more weed competition.

**PLANTING DATE:** Winter through spring as long as there is good moisture. Planting time needs to be early enough in the year to allow plants to mature and produce seed.

**WEED CONTROL:**

**Prior to Establishment:** Use herbicides and/or cultivation for 1 to 2 years to obtain a clean weed-free seedbed. Controlling weeds before planting will greatly reduce the amount of weed control needed after establishment.

**Established Stand:** Hand weed. No herbicides are specifically labeled for use on partridge pea at this time.

**INSECT/PATHOGEN CONTROL:** No serious pests observed under cultivation.

**FERTILIZATION:**

**During Establishment:** Apply phosphorus, potassium and micronutrients according to soil test recommendations.

**Established Stand:** Usually not necessary.

**IRRIGATION:**

**During Establishment:** Good soil moisture is required during establishment.

**Established Stand:** Can tolerate dry conditions once established, but good soil moisture is necessary for production of viable seed. If necessary, stands can be irrigated between pollination and the final stages of seed ripening to promote seed production.

## Partridge Pea continued

### HARVEST:

**Harvest Dates:** Late September through early November.

**Collection Window:** Flowering and seed ripening occur simultaneously on the same plant over approximately 1 month, so collection must be timed to obtain the greatest amount of mature seed. Dried pods dehisce within a few days after reaching maturity.

**Stripping:** N/A

**Forage Harvester:** N/A.

**Direct Combine:** Preferred

Stage: Hard dough to mature stage

**Lodging:** Low

**Shattering:** High

### PRECLEANING TREATMENT/STORAGE:

**Combined:** Mature material typically does not require additional drying.

### PROCESSING:

**Dehulling:** May be necessary to break up pods.

Hammermill: 60 - 70 rpm, 5-16 screen, medium feed.

**Scalping:** Clipper 2 screen fanning mill

Top screen: 10 round

Bottom screen: 1/16 x 1/2 wire mesh

Air: 1/2 open

**Final Cleaning:** Clipper 2 screen fanning mill

Top screen: 1/16 round

Bottom screen: 1/18 round

Air: 1/2 open

**SEED YIELD:** This crop has not been grown on a large scale in Florida; only wild stands have been collected. In Texas, stands of partridge pea yield 500 to 2000 lbs/ac, depending on available moisture and fertility.

**EXPECTED PRODUCTIVE STAND LIFE:** Stands persist only 1 year unless a large seed bank is built up in the soil. Stands may naturally reseed the following year, however, seeds are highly dormant and a large percentage will not germinate the first year. Weed competition can also become a problem in reseeded stands.



**GRASS AND FORB CHARACTERISTICS AND SEED PRODUCTION  
REFERENCE TABLES**



**Table 1. Grass growth characteristics and site adaptation.**

<b>Common Name</b> <i>(Scientific Name)</i>	<b>Warm-Season Perennial</b>	<b>Growth Characteristics</b>	<b>Site Adaptation</b>
<b>Beaked panicum</b> <i>(Panicum anceps)</i>	Yes	Rhizomatous, sod-forming; short to medium; seed heads 2 to 3'	Wet areas including flatwoods, shallow depressions and drainageways
<b>Bluestem, Chalky</b> <i>(Andropogon capillipes)</i>	Yes	Bunchgrass; vigorous medium to tall; seed heads 3 to 5'	Moist areas such as flatwoods and around freshwater marshes
<b>Bluestem, Creeping</b> <i>(Schizachyrium stoloniferum)</i>	Yes	Rhizomatous, forming dense colonies; medium to tall; seed heads 3 to 5'	Adapted to wet flatwoods and droughty sandhills
<b>Bluestem, Elliott</b> <i>(Andropogon gyrans)</i>	Yes	Bunchgrass; short to medium; seed heads 1 to 3'	Drier uplands
<b>Bluestem, Splitbeard</b> <i>(Andropogon ternarius)</i>	Yes	Bunchgrass; short to medium; seed heads 2 to 6'	Droughty sandhills
<b>Eastern gamagrass</b> <i>(Tripsacum dactyloides)</i>	Yes	Bunchgrass with short rhizomes; tall and robust; seed heads 4 to 8'	Fertile moist sites
<b>Hairawn muhly</b> <i>(Muhlenbergia capillaris)</i>	Yes	Bunchgrass; medium to tall; seed heads 3 to 5'	Adapted to a wide variety of sites including dry sandy soils, marshes and saline flats
<b>Lopsided indiagrass</b> <i>(Sorghastrum secundum)</i>	Yes	Bunchgrass; medium to tall; seed heads 3 to 6'; very short lived	Widely adapted, from drier flatwoods to droughty sandhills
<b>Pinewoods dropseed</b> <i>(Sporobolus junceus)</i>	Yes	Bunchgrass; short, often forms dense colonies; seed heads 1 to 2'	Adapted to a wide variety of sites from wet flatwoods to droughty sandhills
<b>Purple lovegrass</b> <i>(Eragrostis spectabilis)</i>	Yes	Bunchgrass with short rhizomes; short to medium; seed heads 1 to 2'	Widely adapted, especially to sandy uplands
<b>Purpletop</b> <i>(Tridens flavus)</i>	Yes	Bunchgrass; medium to tall; seed heads 3 to 5'	Fertile moist lowlands and hammocks
<b>Spike chasmanthium</b> <i>(Chasmanthium laxum)</i>	Yes	Rhizomatous, often forming solid colonies; short to medium; seed heads 2 to 4'	Fertile wetland and upland hammocks; prefers shady conditions
<b>Switchgrass</b> <i>(Panicum virgatum)</i>	Yes	Bunchgrass, some types rhizomatous, form dense colonies; tall; seed heads 3 to 6'	Widely adapted, from fresh and saltwater marshes, flatwoods to droughty sandy sites
<b>Toothachegrass</b> <i>Ctenium aromaticum)</i>	Yes	Bunchgrass; medium to tall; seed heads 2 to 4'	Wet areas such as flatwoods and grassy bogs
<b>Wiregrass</b> <i>(Aristida beyrichiana)</i>	Yes	Bunchgrass; short to medium; seed heads 1 to 3'	Widely adapted, from moist flatwoods to droughty sandhills

**Table 2. Grass general establishment guidelines.**

Common Name	Condition <sup>1</sup>	Seed Weight		Average Seeding Rate <sup>2</sup>		Seeding <sup>3</sup> Date	Seeding Method <sup>4</sup>
		(seed/lb)	(seed/kg)	Drilled (lb/ac pls)	Broadcast		
Beaked panicum	Dehulled	1,134,000	2,500,000	1.25	1.5-2.5	W	Drill, Broadcast Seeder
Bluestem, Chalky	Bearded	1,513,000	3,333,000	1	1-2	W, Su	Blower, Fluffy-Seed Drill
	Debearded	2,270,000	5,000,000	0.75	1-1.5	W, Su	Chaffy-Seed Drill, Broadcast Seeder
Bluestem, Creeping	Bearded	756,000	1,667,000	2	2-4	W	Blower, Fluffy-Seed Drill
Bluestem, Elliott	Bearded	567,000	1,250,000	2.5	3-5	W	Blower, Fluffy-Seed Drill
Bluestem, Splitbeard	Bearded	200,000	440,000	6	6-12	W, Sp, Su, F	Blower, Fluffy-Seed Drill
	Debearded	350,000	770,000	4	4-8	W, Sp, Su, F	Chaffy-Seed Drill, Broadcast Seeder
	Dehulled	360,000	800,000	3.75	4-8	W, Sp, Su, F	Drill, Broadcast Seeder
Eastern gamagrass	Fruitcase	2,800	6,230	13*	N/A	W, Sp, Su, F	Drill
Hairawn muhly	Bearded	2,522,000	5,560,000	0.75	1-2	W	Blower, Fluffy-Seed Drill
Lopsided indiagrass	Debearded	252,000	556,000	5*	5-7*	W, Sp, Su, F	Chaffy-Seed Drill, Broadcast Seeder
Pinewoods dropseed	Dehulled	1,134,000	2,500,000	1.25	1.5-2.5	W, Sp, Su	Drill, Broadcast Seeder
Purple lovegrass	Dehulled	6,500,000	14,300,000	0.25-1	1-2	W	Drill, Broadcast Seeder
Purpletop	Hulled	454,000	1,000,000	3	3-6	W	Chaffy-Seed Drill, Broadcast Seeder
Spike chasmanthium	Hulled	284,000	625,000	4.75	5-10	W	Chaffy-Seed Drill, Broadcast Seeder
Switchgrass	Dehulled	567,000	1,250,000	2.5	3-5*	W, Sp, Su, F	Drill, Broadcast Seeder
Toothachegrass	Hulled	412,000	909,000	3.5	4-7	Unknown	Chaffy-Seed Drill, Broadcast Seeder
Wiregrass	Bearded	907,000	2,000,000	2	3-4*	W	Blower, Fluffy-Seed Drill

<sup>1</sup>**Condition:** Some species have hairy appendages. These need to be removed unless specialized planting equipment such as the fluffy-seed drill is used.  
<sup>2</sup>**Average Seeding Rate:** For irrigated fields under ideal conditions. Increase rate by 2 - 3x for dry unfavorable conditions. Drill rates based on 30 pls/ft of row at a 12" row spacing; divide by 2, 3 or 4 to find rates for 24", 36" or 48" row spacings respectively. Broadcast rates are based on 30 - 60 pls/ft<sup>2</sup>. An "\*" indicates that rates are based on research findings instead of general guidelines.

<sup>3</sup>**Seeding Date:** Optimum planting time for central Florida and based on results from studies on reclaimed minedlands near Bartow. Dates have yet to be determined for the Florida Panhandle. Many species may be planted year round if adequate moisture is available. **W** (Winter); Dec. - Feb. (may be a dormant planting, depending on location); **Sp** (Spring); Mar. - May; **Su** (Summer); June - Aug; **F** (Fall); Sept. - Nov.

<sup>4</sup>**Seeding Method:** The different types of equipment used for seeding native species are discussed in detail in the first section of this manual.

**Table 3. Grass seed harvest guidelines.**

Common Name	Preferred Harvest Method <sup>1</sup>	Average Harvest Date <sup>2</sup>	Seed Maturity Stage <sup>3</sup>	Lodging Potential <sup>4</sup>	Shatter Potential
Beaked panicum	Direct combine	mid-Nov	hard dough to mature	low	medium
Bluestem, Chalky	Seed Stripper	mid-Nov	hard dough to mature	medium	low
Bluestem, Creeping	Seed Stripper	late-Nov	mature	medium	low
Bluestem, Elliott	Seed Stripper	early-Dec	hard dough to mature	medium	low
Bluestem, Splitbeard	Seed Stripper	mid-Nov	hard dough to mature	medium	low
Eastern gamagrass	Direct combine	late-July	mature	medium	high
Hairawn muhly	Seed Stripper	mid-Nov	hard dough to mature	medium	high
Lopsided indiagrass	Seed Stripper	late-Oct	soft to medium dough	medium	high
Pinewoods dropseed	Direct combine	May/June	medium dough to mature	low	high
Purple lovegrass	Seed Stripper	mid-Nov	mature	low	high
Purpletop	Direct combine	mid-Nov	hard dough to mature	low	low
Spike chasmanthium	Direct combine	early-Dec	mature	medium	medium
Switchgrass	Direct combine	late-Sept	hard dough to mature	medium	high
Toothachegrass	Seed Stripper	early-Dec	mature	medium	low
Wiregrass	Seed Stripper	early-Dec	mature	low	low

<sup>1</sup>**Preferred Harvest Method:** Many native species are very difficult to harvest because of plant or seed characteristics. Equipment listed under harvest method was chosen because it is most capable of handling the type of seed produced by the plant. Alternative harvest methods are listed under individual species discussions.

<sup>2</sup>**Average Harvest Date:** Harvest information was gathered primarily from the Brooksville PMC. Actual harvest dates will vary according to weather conditions, location and cultivar.

<sup>3</sup>**Seed Maturity Stage:** A full description of the different stages of seed ripening is included in the front section of this manual.

<sup>4</sup>**Lodging Potential:** This trait varies widely between different cultivars within a species, and is also dependent upon available nutrients and climatic conditions.

**Table 4. Forb growth characteristics and site adaptation.**

<b>Common Name</b> <i>(Scientific Name)</i>	<b>Flowering Time</b>	<b>Growth Characteristics</b>	<b>Site Adaptation</b>
<b>Blazing star, Fine-leaf</b> <i>(Liatris tenuifolia)</i>	Fall	Perennial; long upright spikes extending from larger leaves at base; 2 to 3' tall or more; multiple rose or purple-colored flowers along spike.	Dry flatwoods and uplands
<b>Blazing star, Handsome</b> <i>(Liatris elegans)</i>	Fall	Perennial; long upright spikes which will form multiple branches if tips are damaged; 3' tall or more; multiple lavender-colored flowers along spike.	Dry uplands
<b>Carphephorus, Large-headed</b> <i>(Carphephorus corymbosus)</i>	Fall	Perennial; basal rosette with seed stalks 3' tall or more; pink to purple multiple flowers on flat crowned seed head.	Dry uplands
<b>Grassy-leaf goldenaster</b> <i>(Pityopsis graminifolia)</i>	Fall	Perennial; rhizomatous; long narrow silvery leaves like grass blades covered with long silky hair; seed stalks are multi branched with a multitude of small yellow flowers, 1 to 3' tall.	Dry flatwoods and uplands
<b>Partridge pea</b> <i>(Chamaecrista fasciculata)</i>	Summer, Fall	Annual legume; multi branched bushy growth habit; 3' tall or more; yellow flowers; seeds in pods.	Dry flatwoods and uplands
<b>Sky-blue lupine</b> <i>(Lupinus diffusus)</i>	Late Winter, Spring	Annual or possibly biennial legume; woody branched with large silky-haired leaves; seed stalk 1' to 2' tall with multiple blue-colored flowers; seeds in pods.	Dry sandy sites

**Table 5. Forb general establishment guidelines.**

Common Name	Condition	Seed Weight (seed/lb) (seed/kg)		Average Seeding Rate <sup>1</sup> Drill Broadcast (lb/ac p/s)		Seeding Date	Seeding Method
		(seed/lb)	(seed/kg)	Drill	Broadcast		
<b>Blazing star, Fine-leaf</b>	Bearded	280,000	617,200	4.75	5-9	F, W	Blower, Fluffy-Seed Drill
<b>Blazing star, Handsome</b>	Bearded	103,000	227,000	12.5	13-25	F, W	Blower, Fluffy-Seed Drill
	Debearded	189,000	417,000	7	7-14	F, W	Drill, Broadcast Seeder
<b>Carphephorus, Large-headed</b>	Bearded	300,000	660,000	4.5	5-9	W	Blower, Fluffy-Seed Drill
<b>Grassy-leaf goldenaster</b>	Bearded	570,000	1,250,000	2.5	3-6	W, Su	Blower, Fluffy-Seed Drill
<b>Partridge pea</b>	Dehulled	45,000	100,000	10*	10-20*	W, Sp, Su	Drill, Broadcast Seeder
<b>Sky-blue lupine</b>	Dehulled	22,000	48,000	5	5-10*	W, Sp, Su	Drill, Broadcast Seeder

<sup>1</sup>See footnote under Table 2 for an explanation of how seeding rates are derived. An "\*" indicates that rates are based on research findings instead of general guidelines.

**Table 6. Forb seed harvest guidelines.**

Common Name	Preferred Harvest Method	Average Harvest Date	Seed Maturity Stage	Lodging Potential	Shatter Potential
<b>Blazing star, Handsome</b>	Seed Stripper	late-Nov	hard dough to mature	high	medium
<b>Blazing star, Fine-leaf</b>	Seed Stripper	late-Nov	hard dough to mature	medium	medium
<b>Carphephorus, Large-headed</b>	Seed Stripper	late-Nov	hard dough to mature	medium	medium
<b>Grassy-leaf goldenaster</b>	Seed Stripper, Vacuum Harvester	late-Nov	hard dough to mature	medium	high
<b>Partridge pea</b>	Direct Combine	Oct	hard dough to mature	low	high
<b>Sky-blue lupine</b>	Direct Combine	late-May	hard dough to mature	low	high





**ADDENDUM**

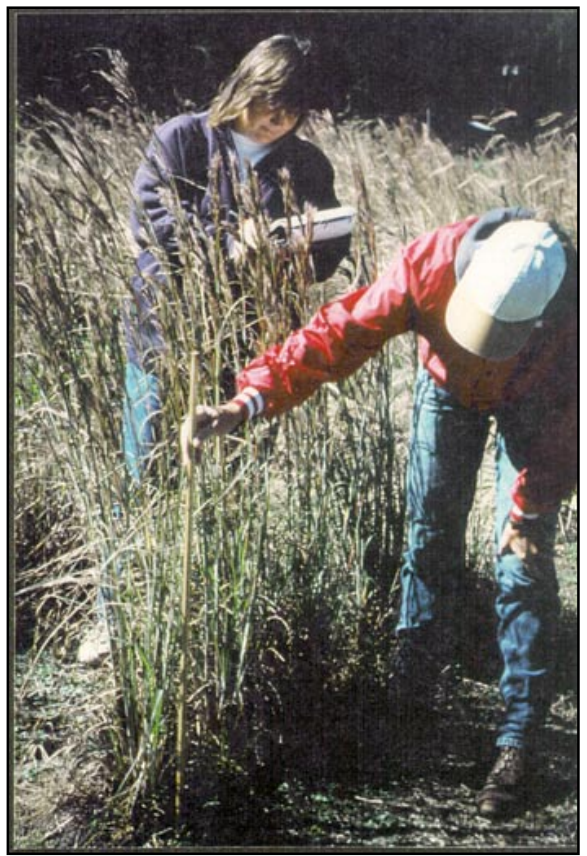
**NATIVE SEED AND PLANT PHOTOGRAPHS**



**Beaked Panicum**  
*Panicum anceps*

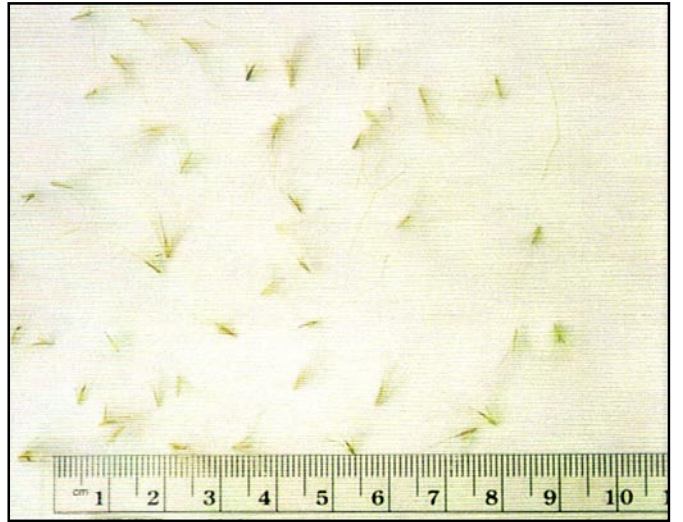


**Chalky Bluestem**  
*Andropogon capillipes*





**Creeping Bluestem**  
*Schizachyrium scoparium*



**Elliot Bluestem**  
*Andropogon gyrans*



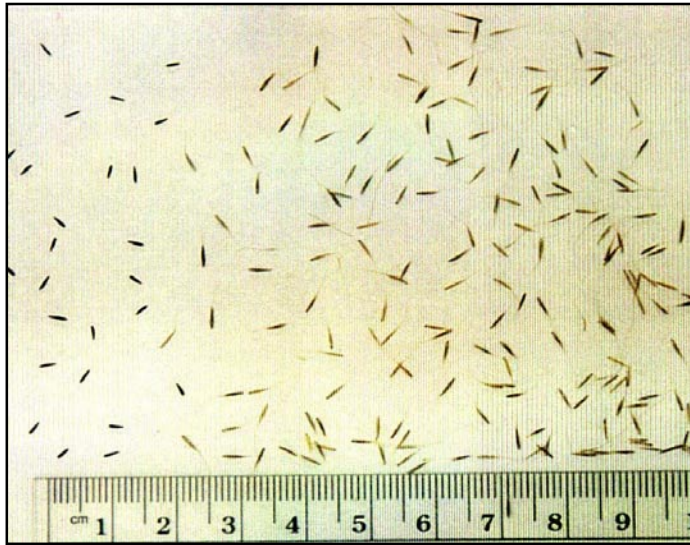


**Splitbeard Bluestem**  
*Andropogon ternarius*



**Eastern Gamagrass**  
*Tripsacum dactyloides*





**Hairyawn Muhly**  
*Muhlenbergia capillaris*

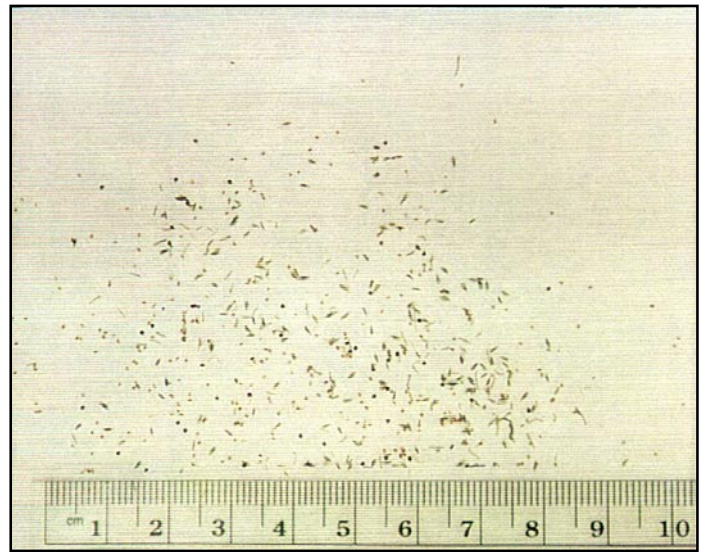


**Lopsided Indiangrass**  
*Sorghastrum secundum*





**Pinewoods Dropseed**  
*Sporobolus junceus*

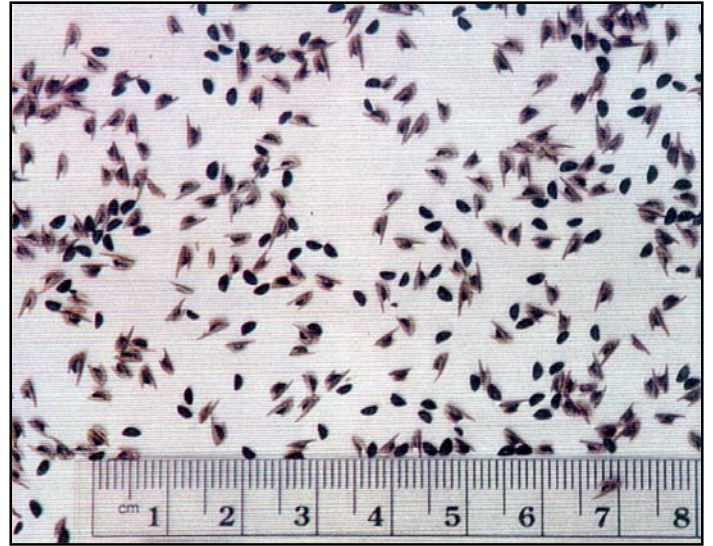


**Purple Lovegrass**  
*Eragrostis spectabilis*

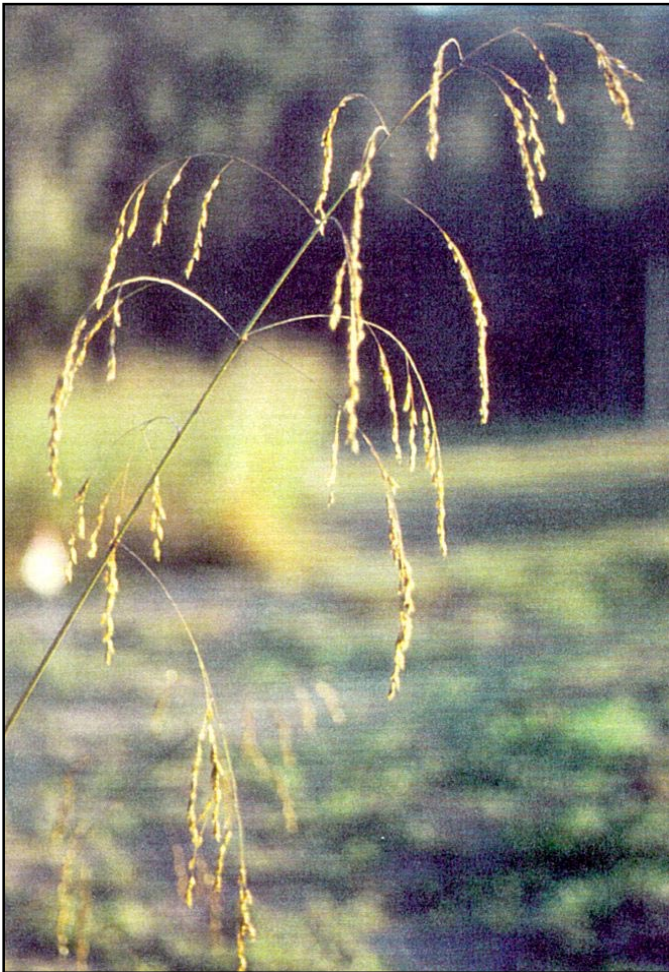




**Purpletop**  
*Tridens flavus*



**Spike Chasmanthium**  
*Chasmanthium laxum*





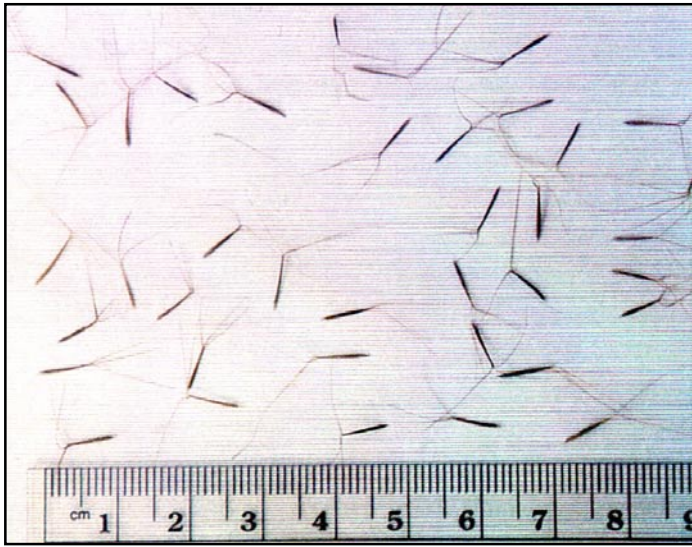
**Switchgrass**  
*Panicum virgatum*



**Toothachegrass**  
*Ctenium aromaticum*





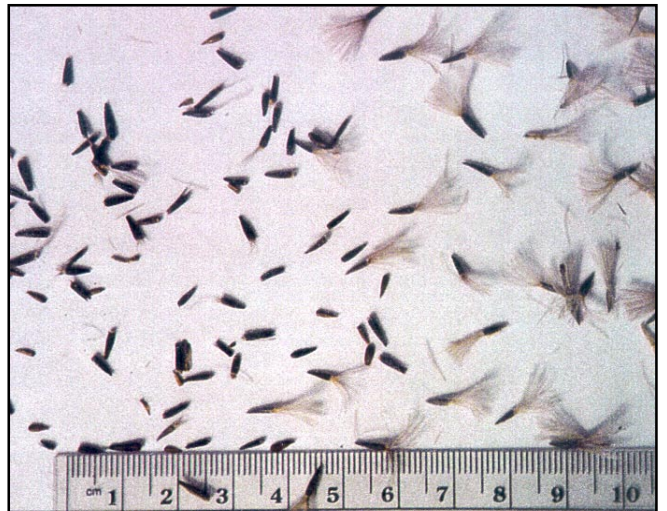


**Wiregrass**  
*Aristida beyrichiana*

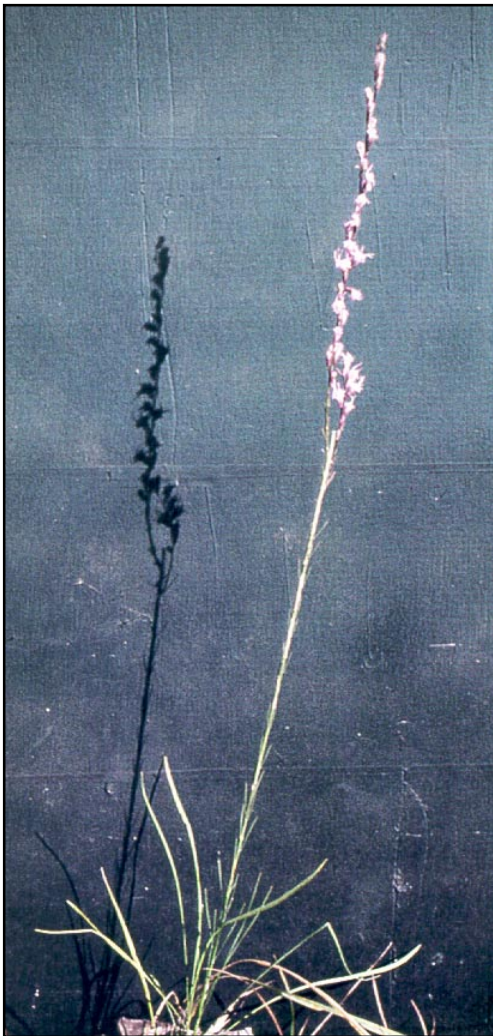




**Fine-leaf Blazing Star**  
*Liatris tenuifolia*

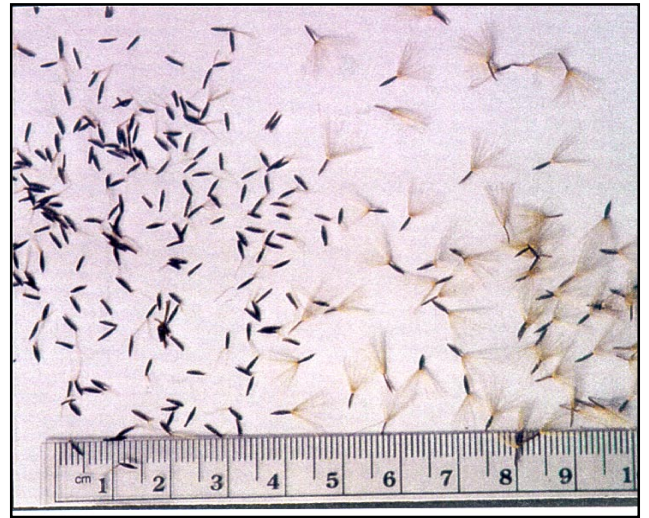


**Handsome Blazing Star**  
*Liatris elegans*



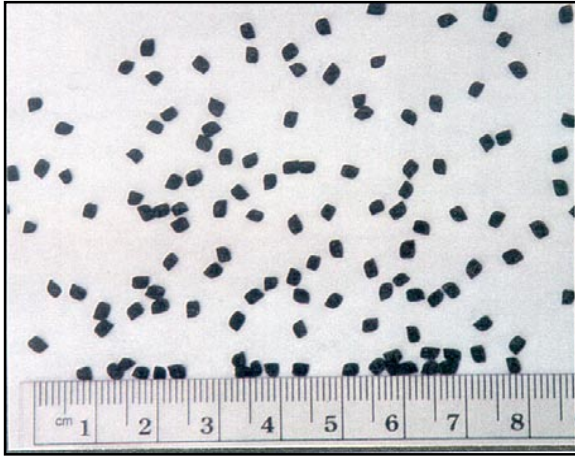


**Large-Headed Carphophorus**  
*Carphophorus corymbosus*

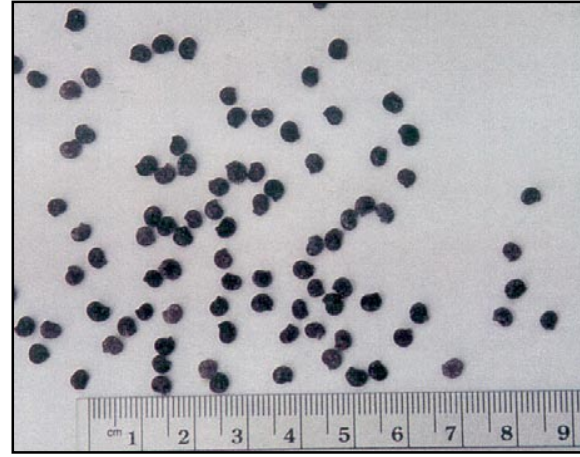


**Grassy-leaf Goldenaster**  
*Pityopsis graminifolia*





**Partridge Pea**  
*Chamaecrista fasciculata*



**Sky-blue Lupine**  
*Lupinus diffusus*

