

NATIVE WARM-SEASON GRASSES

Native Warm-Season Grasses for Mid-South Forage Production

University of Tennessee, Center for Native Grasslands Management

Patrick Keyser, Associate Professor and Director, Center for Native Grasslands Management

Craig Harper, Professor and Wildlife Specialist

Gary Bates, Professor and Forage Specialist, Plant Sciences

John Waller, Associate Professor, Animal Science, and

Elizabeth Doxon, Research Associate, Center for Native Grasslands Management

Introduction

What Are Native Warm-season Grasses?

Native warm-season grasses (NWSG) are a group of tall-growing bunch grasses that offer the potential for excellent forage production across the Mid-South. They have a number of key attributes that make them of interest to forage growers in the region.

Native to the Mid-South

These grasses have grown in the Mid-South since before human settlement. Native warm-season grasses were grazed by buffalo and elk for thousands of years and then, during the first two centuries of European settlement, by free-ranging domestic livestock. Native grasses are naturally well-adapted to the region's soils, climate and pests (insects and diseases).

Vigorous Summer Growth

Peak growth of these grasses occurs during summer. They break dormancy in late March and early April and then grow rapidly from mid-May through mid-summer. In late summer, growth slows until fall dormancy, usually in October. The maturity dates of the various species vary somewhat, but all follow this pattern. They remain dormant through winter.

Five Key Species

While there are many species of grasses native to the Mid-South, this publication will focus on five species that are important for forage production: big bluestem, little bluestem, indiagrass, switchgrass and eastern gamagrass.

Should I Plant NWSG?

Native warm-season grasses, like any forage option, have advantages and disadvantages. The most important are described below.

Advantages of NWSG

Filling the Summer Forage Gap

Because NWSG grow during the summer months, they readily complement existing cool-season forage production (Fig 1). Tall fescue, the major forage grown in the Mid-South, becomes semi-dormant during summer, especially when prolonged droughts occur. A good source of high-quality forage during the summer can make a strong contribution to the profitability and success of forage and cattle enterprises.

Where Have They Gone?

The simple answer is nowhere – they are still here. You can find native grasses growing along roadsides, railroad and power line rights-of-way, and other out-of-the-way places. But where forests have grown-up, they were shaded-out. Where ground was plowed, they are gone. And where fences were built and year-round grazing was practiced, they disappeared – cattle preferentially graze these species and they can be eliminated where grazing pressure is not managed.

Perennial Grasses

The five NWSG described here are perennials that can last 15 – 20 years or longer with proper management (Fig 2). As with any perennial, NWSG provide considerable annual savings in seed, fertilizer, herbicides and time when compared to warm-season annuals (see UT Extension publication *Economic Implications of Growing Native Warm-season Grasses for Forage in the Mid-South*, SP731-E, for more information). Perennial forage crops also help producers avoid the risk of establishment failure each summer inherent with annuals.

Widely Adapted

The grasses described here are native to the Mid-South, but also are found throughout much of eastern North America. For example, switchgrass occurs from southern Canada to northern Mexico, east to the Atlantic Coast. Within that vast range, NWSG can grow well on sites that vary from poor, ridge-top soils to poorly drained bottoms. These adaptations vary among the five species. As long as the proper variety and species are selected, NWSG can be grown on most sites in the Mid-South where you might want to produce forages.

Exceptional Drought Tolerance

There are two major reasons NWSG are particularly drought-tolerant. First, like many warm-season species, they have a metabolic pathway that is very efficient in water use. This pathway is referred to as C-4 and is in contrast to that of cool-season grasses, which have a C-3 metabolic pathway. The second major reason NWSG are drought-tolerant is they produce exceptionally deep root systems, up to 12 feet in many cases. One large-scale, 10-year study documented no relationship between first cutting yield (June) of switchgrass and spring rainfall (April - June). In a West Tennessee study conducted during a record-breaking drought year (2007), switchgrass still yielded an impressive 5.3 tons/ac of biomass. NWSG are the most drought-tolerant forages we can grow in the region.

Reduced Fertilizer Inputs

Because they are naturally adapted to the region's soils, NWSG can be productive even where fertility is not high. Most research indicates there are not substantial improvements in yield above about 90 lb of N per acre and there is not a consistent yield response to P and K amendments. Furthermore, as long as pH exceeds 5.0, there does not appear to be any need for lime.

Isn't This Just Broomsedge?

Broomsedge, a species also native to the region, is closely related to the other NWSG and shares their growth habit, growth season, drought tolerance and ability to grow well in poor soils. However, the five species of NWSG we are focusing on produce more forage and are far more palatable to cattle than broomsedge.

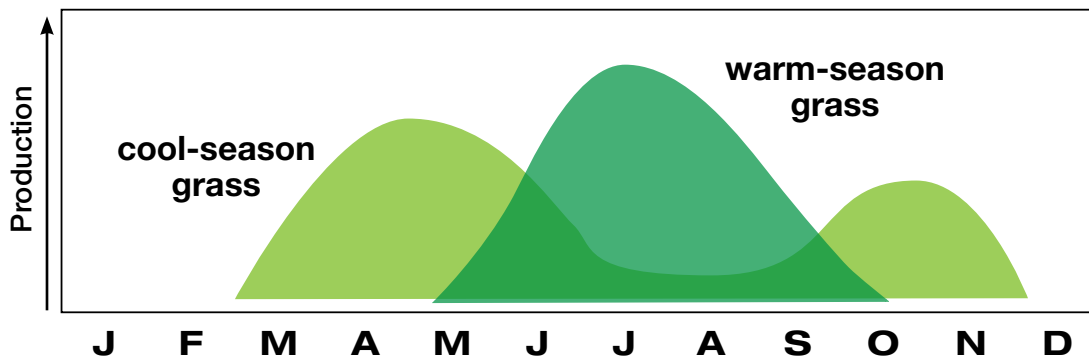


Fig. 1. Warm-season grasses, those that put on most of their growth during the summer, can be an excellent complement to cool-season grasses that primarily grow in the spring and fall. Having both types of forages can eliminate the summer “forage slump.”

High Yields

Depending on species, site quality and available moisture, NWSG can yield 4 – 5 tons of forage per acre when harvested for hay (see *Producing Hay from Native Warm-Season Grasses in the Mid-South*, SP731-D, for more information). In a grazing setting, stocking rates can be approximately 1,400 – 2,000 lb per acre, depending on species, under full-season summer grazing (see *Grazing Native Warm-Season Grasses in the Mid-South*, SP731-C, for more information).

High-Quality Forage

As with any forage, hay quality is strongly influenced by timing of harvest. Harvest of NWSG at late-boot stage will typically produce hay with protein levels of 10 percent or higher. However, like most warm-season forages, NWSG will test at levels below those for cool-season forages harvested at a comparable maturity level. This is partly because proteins in NWSG do not break down as quickly during ruminant digestion and bypass the rumen; thus, they are referred to as “bypass proteins.” Because bypass proteins can be absorbed in the intestines, animal performance on NWSG exceeds what we would predict based on forage sample analysis. For example, when grazed, NWSG routinely produce from 1.5 – 2.5 lb of daily gain in steers (Fig 3). Furthermore, NWSG forage quality is not diminished by endophyte fungi, a substantial problem with tall fescue.



Fig. 2. This 18-year-old stand of cave-in-rock switchgrass continues to produce large volumes of quality forage.



Fig. 3. This 2-year-old stand of big bluestem and indiagrass is providing excellent summer forage with gains of more than 2.2 lb per day on 600 - 800 lb steers.

Non-Invasive

Because NWSG are adapted to the soils and climate of our region and are late-successional species that do not spread quickly, they are not invasive. Even after many years, native grasses will remain where they were originally planted.

Few Pests

Because these grasses are native to the Mid-South, they have few important pests. At this time, the only pest known to be a problem for NWSG is leaf rust, which is observed on switchgrass.

Wildlife Friendly

Many species of wildlife, such as eastern cottontail and northern bobwhite, thrive in native grasses. This is in sharp contrast to other common forage species, such as tall fescue and bermudagrass, which provide habitat of little to no value for quail or rabbits. Other species, such as eastern wild turkey, grasshopper sparrow and dickcissel, also readily use NWSG. The benefit of NWSG to wildlife is not the food value of the seed or foliage, but rather the structure and cover provided by the erect growth habit of these species.

Disadvantages of NWSG

Establishment

Native warm-season grasses are often slower to establish than introduced cool-season grasses, developing more root than top growth during the first two years after planting. Attention to detail is necessary to successfully establish these species (see *Establishing Native Warm-season Grasses for Livestock Forage in the Mid-South*, SP731-B, for more information). Advanced weed competition control, well-prepared seedbeds, shallow

seeding and aggressive seedling-year weed control are all important for successful establishment. Failure to address these issues can result in poor or very slow establishment. Producers who don't recognize the small seedlings or can't readily find them among weeds often consider the planting a failure. Establishment success, however, can be high if producers follow key steps and are patient.

More Management

Because NWSG can grow so quickly during late spring and early summer, timing of hay harvests and/or maintaining stocking rates heavy enough to capture this growth are critical. If NWSG get too tall, they will become coarse and stemmy. On the other hand, it is important to avoid haying or grazing them too closely. Repeated close grazing or haying will weaken stands, reduce yields and encourage weed encroachment. Maintaining canopy heights of 15 – 20 inches while grazing will help ensure NWSG forage quality remains high.

Winter Dormancy

Like any warm-season perennial, NWSG remain dormant and do not produce forage during winter. Approaches have been developed to grow winter annuals in other warm-season perennial forages. At this time, tests are underway at the University of Tennessee to evaluate such options for NWSG, but no recommendations have been developed yet.

Important Species for Forage Production

Switchgrass

In recent years, many people have become familiar with switchgrass because of interest in growing it as a biofuel crop (Fig 4). There are two major types of switchgrass: lowland varieties and upland varieties. Lowland varieties are taller, stemmier and produce greater amounts of biomass. Consequently, most interest in switchgrass as a biofuel crop has been focused on lowland varieties. The leafier upland varieties may be more desirable for forage production. Although there are numerous varieties of switchgrass, we will focus on only three.

Alamo

Developed from plant material collected in southern Texas, *Alamo* is a lowland variety that is currently considered the primary species for biofuel production. At maturity, *Alamo* commonly reaches heights of 10 feet and can produce substantial amounts of forage. Like



Fig. 4. Switchgrass is a tall, robust grass that produces high yields. Seedheads are open “panicles” typical of the panic grasses and appear during mid- to late-June.

most switchgrass varieties, *Alamo* does well on wet sites. Although yields will be lower than on deep, well-drained soils, *Alamo* can also be grown on dry sites with poor soils. Because of its steminess and rapid spring growth, careful management of *Alamo* is needed to ensure optimum forage quality.

Kanlow

The other widely available lowland variety is *Kanlow*. It was developed from plant material collected in Kansas. Its growth habits, site adaptations, yield and management requirements are quite similar to *Alamo*. An important difference is that *Kanlow* typically has much higher seed dormancy rates.

Cave-in-Rock

Developed from plant material collected in southern Illinois, this upland variety has higher yields than other upland varieties. Like *Kanlow*, *Cave-in-Rock* typically has high seed dormancy rates. Although it can grow where soils are wet-natured, it is not as tolerant of flooding as lowland varieties. Like other upland varieties, it has received only limited attention as a prospective biofuel crop.

Big Bluestem

Widely used as forage in the Great Plains, big bluestem may be the best of the NWSG for livestock (Fig 5). Yields are not as high as that of the switchgrass varieties mentioned above, but they are still quite substantial and cattle perform on it better than they do on most other NWSG. Because it does not grow quite as fast as switchgrass and does not get as coarse, it is



Fig. 5. Big bluestem is a fine-leaved species that produces good yields of excellent forage. Seedheads are produced in June and July and are easily recognized by their “turkey-foot” appearance.

easier to manage. It tends to mature somewhat later than switchgrass. There are many varieties of big bluestem available, but here we consider only two.

OZ-70

A more recent release, *OZ-70* was developed from plant material collected from a number of locations in the Mid-South. As such, it is one of the first varieties of big bluestem from this region. Like other varieties of big bluestem, it has wide site adaptation, but will not tolerate flooding as well as switchgrass.



Fig. 6. A mature clump of little bluestem, a smaller bunch grass that often shows a reddish hue on its stems. Note the mature big bluestem plant in the background on the right. Despite its smaller size, little bluestem can produce desirable forages – even on poor ground.

Rountree

A variety based on plant material collected in western Iowa, *Rountree* has been available for many years and is carried by many seed dealers. Although derived from a more northerly genetic base than *OZ-70*, it does well in the Mid-South and is probably a better choice in this region than varieties developed in the Great Plains.

Little Bluestem

A much smaller plant that produces less forage than the other NWSG, little bluestem still has a place in Mid-South forage production (Fig 6). When planted with big bluestem or indiangrass, little bluestem can help fill-in stands, especially where soil quality is poor. Little bluestem is more tolerant of poor soils than any of the other NWSG. It is also easier to establish. Its only shortcoming is that it does not produce yields as high as the other NWSG.

Aldous

Derived from plant material collected in east-central Kansas, this variety is widely available and grows well in the Mid-South.

Ozark

This recently released variety is based on plant material collected from Missouri, Arkansas and Illinois. It should be well-suited for the Mid-South.

A Word About Local Ecotypes

Through the years, it has become apparent that when planting widely distributed species, it is better to use varieties that originated locally. They are better adapted to the season length, rainfall, insects and diseases of that locality. For instance, varieties of switchgrass developed in the South, such as Alamo, do not do well in northern latitudes and those developed in the North are less vigorous in southern latitudes. Because of a longer history of using NWSG, there are many varieties developed in the Great Plains and Midwest. There are far fewer developed in the Mid-South. Recently, more attention has been paid to trying to develop local ecotypes – plant material collected in a particular locality. Although few of these local ecotypes have been formally released as varieties, and in many cases variety trials have not been conducted, they hold much promise because of their natural adaptation to the region.

Indiangrass

Like big bluestem, indiangrass is a common forage grass in the Great Plains (Fig 7). It typically grows in mixed stands with bluestems, but favors better-drained sites than big bluestem. Cattle consume indiangrass as readily as big bluestem and perform well on it. While it can be somewhat more stemmy than big bluestem, it still is easier to manage than switchgrass.

Cheyenne

This variety was developed in Oklahoma, but does well in the Mid-South. In variety trials conducted at the University of Kentucky, it was one of the best producers in terms of total yield.

Rumsey

Probably the most widely used variety in the Mid-South, *Rumsey* was developed from plant material from south-central Illinois. It produced yields similar to *Cheyenne* in variety trials conducted by the University of Kentucky.



Fig. 7. Indiangrass is easily recognizable by the blueish hue of its stems and the large yellow seedheads. Indiangrass is the latest of the NWSG to produce seedheads; typically they appear in July and August.

Osage

This variety is later-maturing and was developed from southeast Kansas sources. It is a leafy variety well-suited for the Mid-South.

Eastern Gamagrass

Like switchgrass, eastern gamagrass produces very high yields and tolerates wet sites (Fig 8). It begins spring growth sooner than the other NWSG and also maintains growth later in the season than the other species – with the exception of indiangrass. It can support high stocking rates due to its high productivity.



Fig. 8. Eastern gamagrass produces impressive yields of quality forage. Its seedheads appear in June and are quite distinctive.

Pete

Long a standard variety, and still one of the most readily available, *Pete* was developed from plant material collected in Oklahoma and Kansas. It has been widely planted in the Mid-South and produces well in this region.

Highlander

This recently released variety was developed from plant material collected along the Tennessee-Kentucky border and is well-adapted to growing conditions in the region. It generally produces more forage than *Pete* in this region. This newer release is becoming more readily available as more seed growers produce it.

Other Resources

If you are interested in learning more about using NWSG for forage production, there are a number of other resources you may find helpful. These include four other technical bulletins within this series:

- *Establishing Native Warm-Season Grasses for Livestock Forage in the Mid-South* (SP731-B)
- *Grazing Native Warm-Season Grasses in the Mid-South* (SP731-C)
- *Producing Hay from Native Warm-Season Grasses in the Mid-South* (SP731-D)
- *Economic Implications of Growing Native Warm-Season Grasses for Forage in the Mid-South* (SP731-E)

There are also several other helpful publications you may want to refer to, including:

- *A Landowner's Guide to Native Warm-Season Grasses in the Mid-South* (PB1746)
- *Native Warm-Season Grasses: Identification, Establishment and Management for Wildlife and Forage Production in the Mid-South* (PB1752)
- *Using Switchgrass for Forage* (SP701-B)

All of these publications may be accessed online by going to: <http://nativegrasses.utk.edu>.



Fig. 9. Native warm-season grasses, such as this mixed stand of big bluestem and indiangrass, provide excellent grazing during the summer and provide a buffer against drought. Bred Holstein heifers (1000 – 1100 lb) gained nearly 1.9 lb per day during 2010, one of the hottest summers on record in Tennessee. Such grasses can provide a strong complement to existing cool-season grass forages.

Summary

Native warm-season grasses, like any other forage production option, have advantages and disadvantages that you should consider when making a decision about using them on your farm. While NWSG require attention to detail to successfully establish and manage, these long-lived, low-input perennial grasses provide a number of benefits, including high yields, high-quality forage and exceptional drought tolerance (Fig 9). These qualities make NWSG a good option for filling the summer forage gap – they are a good complement to cool-season pastures and a valuable alternative for hay production.



www.nativegrasses.utk.edu

Support for this publication was provided by the Natural Resources Conservation Service through a Conservation Innovation Grant.

SP731-A Rep. 4/12 1.5M 12-0148 E11-2225-00-013-12

Programs in agriculture and natural resources, 4-H youth development, family and consumer sciences, and resource development. University of Tennessee Institute of Agriculture, U.S. Department of Agriculture and county governments cooperating. UT Extension provides equal opportunities in programs and employment.