# Native Warm-Season Grasses as a Forage in Mississippi: *Grazing Management*

MISSISSIPPI STATE UNIVERSITY EXTENSION

Native warm-season grasses (NWSG) are indigenous species that were the dominant forage source for roaming buffalo and other grazing animals before European settlement in the United States. These grasses, as their name implies, produce a majority of their aboveground biomass during the warmer months of the year, particularly May through August.

Species most commonly referred to as NWSG for grazing purposes include big bluestem (*Andropogon gerardii*), little bluestem (*Schizachyrium scoparium*), indiangrass (*Sorghastrum nutans*), switchgrass (*Panicum virgatum*), and eastern gamagrass (*Tripsacum dactyloides*). These species are all particularly drought tolerant, require few external inputs (such as fertilizer), and have environmental benefits, such as wildlife habitat creation, enhanced soil health, and overall improved aesthetics of a given piece of land.

However, one characteristic often overlooked is their ability to generate quality forage for livestock. With proper grazing management, NWSG can provide Mississippi livestock producers a dependable summer forage source, while simultaneously creating grassland habitat for local wildlife.

One advantage NWSG have is their ability to extend the grazing season. Typical forage systems across Mississippi involve the use of a perennial warm- (bahiagrass and bermudagrass) or cool-season (tall fescue) species as their dominant forage source throughout the year. During the off season, producers must use stored (hay, haylage, or baleage) or stockpiled feeds to sustain nutritional requirements for livestock. NWSG can help alleviate the demand placed on the traditional, perennial forages Mississippi producers use, and reduce the amount of stored feed fed to livestock. In this publication, we will focus on the grazing management practices for NWSG that address this issue.

## NWSG in Grazing Systems

Historically, NWSG were consumed by roaming grazers, like buffalo, which would come into an area, graze the most nutritional parts of the grass (leaves), and move on to greener, ungrazed pastures or grasslands. This nomadic grazing behavior took advantage of the nutritional qualities NWSG have to offer without overgrazing. It also allowed these species ample rest time for regrowth and carbohydrate storage before going dormant during the winter months. This preserved the longevity of these native grass stands while allowing them to produce winter cover for ground-nesting birds and small mammals. This type of grazing behavior is required in order to use NWSG most effectively.

As with other warm-season perennial grasses, NWSG begin to emerge in late spring, and vegetative growth continues until midsummer. Once daylight begins to shorten following the summer solstice, these grasses begin to convert their growth from a vegetative state (mostly leaves) to a reproductive state (elongated stems and seed heads). During this transition, the nutritional quality dramatically decreases as these species become quite difficult to digest by livestock. In order to capture the highest quality forage these species can produce, they must be grazed at the optimum time. Two typical grazing systems will be outlined to show how to take full advantage of the forage quality of NWSG.

### *Warm-Season Perennial*

For most producers in central and south Mississippi, bermudagrass and bahiagrass are the major forage base. These species are grazed from late spring until early fall. These species are excellent sources of forage, but they provide little to no benefits for wildlife and require higher amounts of fertilizer to remain productive. One key advantage these traditional species have over NWSG is their ability to be stockpiled and grazed later into the fall. A 3-year study (2003–06) conducted in Arkansas compared the economic benefits and forage quality analysis of stockpiled warm-season grasses (bahiagrass and bermudagrass) and feeding hay (Evers et al., 2004). The results showed a $20.14 per animal unit advantage for grazing stockpiled forage

from November to February, and nutritive quality remained high enough to maintain livestock requirements. It is not recommended to stockpile NWSG, as quality will be significantly lower than traditional forages, and the added benefits of wildlife cover will not be expressed. If NWSG were established in a separate area from bermudagrass and bahiagrass, livestock could be rotated onto the NWSG during the peak production months (May to July) and rotated onto the traditional species for late summer, fall, and winter (if stockpiled and grazed correctly). Since NWSG are more drought-tolerant than traditional forage species, this benefit may also allow producers the opportunity to lightly graze NWSG during drier periods of the year when bermudagrass and bahiagrass biomass production could be compromised by drought stress.

### *Cool-Season Perennial*

For the northern half of Mississippi, tall fescue is the preferred forage of choice for livestock producers. This species generates a majority of its biomass during the spring and fall months. It is commonly grazed heavily during the spring, and only moderately during the fall. Tall fescue is an excellent forage source for stockpiling. With adequate rainfall and timely nitrogen application, tall fescue can easily be grazed throughout the fall and winter months. The window for grazing NWSG in this system is more apparent during the summer months, as tall fescue matures and drastically slows down production, and for some varieties, goes completely dormant. One disadvantage in this system, however, is that NWSG cannot be heavily grazed. If NWSG are the only source of forage during summer months, these areas must be either lightly stocked or large enough to be divided and moved regularly to avoid impacting the overall health of the stand. Supplemental sources of feed, such as hay or baleage, may be required for periods of extreme drought and in late summer to early fall when NWSG begin to reduce in quality and availability.

### *Precautions*

Grazing too late into the summer or early fall can reduce the longevity of NWSG pastures. Overgrazing these species will deprive them of the necessary time needed for carbohydrate storage into their roots before a killing freeze. An absolute minimum of 4 weeks of rest should be provided before a frost (Keyser et al., 2001). Not allowing this rest to take place can ultimately reduce the stand's composition and increase the amount of weed pressure. Also, the forage quality of the NWSG at this point of the growing season will be mediocre at best, so the value and advantages of grazing during this growth stage will be severely diminished.

## Forage Quality

Forage quality is highly correlated with the maturity of the given plant. For NWSG, the greatest potential for capturing (by grazing) the highest-quality portions of the plant is when the grass sward is vegetative (nonreproductive). Forage quality encompasses nutritive value, voluntary feed intake, and the effects of anti-quality components, such as tannins. Forage quality can be altered by several external causes, such as available moisture and nutrients, mainly nitrogen.

A study conducted at the Prairie Research Unit of the North Mississippi Research and Extension Center during the summer grazing seasons of 2011 and 2012 compared the forage quality of NWSG and bermudagrass (Oloyede, 2013). There were three treatments used in this study: bermudagrass, indiangrass, and a mixed stand of NWSG including big bluestem, little bluestem, and indiangrass. Bermudagrass pastures were fertilized with 50 pounds of nitrogen per acre, while the native pastures only received 30 pounds of nitrogen per acre. Results from this study suggest there is no difference in nutrient content between mono- (indiangrass) and multi-species (big bluestem, little bluestem, indiangrass) pastures. Crude protein (CP) concentrations were greater for bermudagrass compared to the two native grass treatments (**Table 1**). This was attributed to the greater amount of nitrogen that was applied to the bermudagrass pasture. However, the CP levels of the NWSG pastures remained above 8 percent, which is critical for microbial populations in the rumen. Neutral detergent fiber (NDF) and acid detergent fiber (ADF) were significantly lower (greater in digestibility and intake) for the bermudagrass treatments. In terms of dry matter (DM), the native grass treatments produced significantly more forage than bermudagrass for both years of the study, even though they received less nitrogen (**Table 2**). Almost twice as much DM was produced by the mixed native stand compared to bermudagrass, and almost three times as much was produced by the indiangrass treatment. This study clearly showed the ability for mono-species and mixed stands of NWSG to provide ample quality forage during the summer months in Mississippi.

## Animal Performance

Research and data on NWSG and animal performance is lacking for Mississippi. The previous study by Oloyede (2013) also compared animal productivity on the three grazing treatments (bermudagrass, indiangrass, and mixed native grass). For this part of the study, crossbred beef steers (Angus x Hereford; 520 ± 3.3 pounds) were grazed for 112 days in 2011 and 62 days in 2012. The stocking density was one steer per acre. Results from this portion of the study

showed that average daily gain (ADG) of the steers was similar among treatments during June, August, and September. During July, when grass production was at its peak, ADG was greater for steers grazing on monoculture indiangrass (2.4 pounds per day) (**Table 3**). For the bermudagrass pasture, ADG for July was 0.8 pounds per day, and 2.0 pounds per day for the mixed native grass treatment. This data supports the idea that NWSG offer viable alternatives to bermudagrass for grazing steers during the summer.

Cattle performance on NWSG was also assessed in Tennessee (Keyser et al., 2011). During the summers of 2009 and 2010, stockers (600 pounds) and bred heifers (1,000 pounds) were assigned to different NWSG grass treatments where ADG was monitored (**Table 4**). The grazing treatments consisted of an early-season system (30 days) and a full-season system (60–95 days; based on forage availability). Gains from these studies were 1.1–2.4 pounds per day for weaned steers during a 90-day grazing season. The early system, however, produced the greatest gains, ranging from 1.7–2.8 pounds per day. Early grazing of NWSG could allow ample time for bermudagrass or bahiagrass in other pastures to generate enough biomass to be grazed in early summer. Also, if the forage base is bermudagrass or bahiagrass, earlier grazing of NWSG in the late spring can reduce the amount of hay being fed to animals before spring green-up.

**Table 1. Nutrient composition (% dry matter basis) of native warm-season grasses and bermudagrass during the summer of 2011 and 2012 at Prairie, Mississippi.**

| Treatment | Dry matter | Crude protein | Neutral detergent fiber | Acid detergent fiber | *in vitro* DM disappearance |
|---|---|---|---|---|---|
| bermudagrass | 28.86a* | 10.32a | 66.38b | 34.04b | 55.14a |
| indiangrass | 29.43a | 8.96b | 68.74a | 35.51a | 56.61ab |
| mixed NWSG (big bluestem, little bluestem, and indiangrass) | 34.52b | 8.05b | 68.93a | 35.41a | 48.41b |

Source: Oloyede, B. 2013.
*Lowercase letter denotes significant differences within a column ($P < 0.05$).

**Table 2. Dry matter yield (pounds per acre) of native warm-season grass and bermudagrass pastures during the summer of 2011 and 2012 at Prairie, Mississippi.**

| Treatment | June | July | August | September |
|---|---|---|---|---|
| bermudagrass | 3154.28b* | 2425.53c | 2010.10 | 1841.31 |
| indiangrass | 4664.87a | 5794.38a | 3798.60 | 1788.38 |
| mixed NWSG (big bluestem, little bluestem, and indiangrass) | 3534.19ab | 3862.29b | 2216.29 | 2848.88 |

Source: Oloyede, B. 2013.
June to September = estimated pasture DM yield measured every 28 days.
August and September = average values for 2011 only.
*Lowercase letter denotes significant differences within a column ($P < 0.05$).

**Table 3. Dry matter intake (pounds per steer per acre) of steers grazing native warm-season grass and bermudagrass pastures during the summer of 2011 and 2012 at Prairie, Mississippi.**

| Treatment | June | July | August | September |
|---|---|---|---|---|
| bermudagrass | 118.44b* | 95.91c | 104.06 | 50.59 |
| indiangrass | 201.59a | 251.15a | 127.86 | 63.64 |
| mixed NWSG (big bluestem, little bluestem, and indiangrass) | 147.54ab | 162.09b | 121.92 | 84.48 |

Source: Oloyede, B. 2013.
June to September = estimated steer DM intake during 28-day grazing period.
August and September = average values for 2011 only.
*Lowercase letter denotes significant differences within a column ($P < 0.05$).

**Table 4. Cattle performance of stockers and bred heifers grazing native warm-season grasses at four University of Tennessee Research and Education Centers in summers 2009 and 2010.**

| Animals | System | Forage species | ADG | Days grazed | Total animal days/acre | Total gain/acre |
|---|---|---|---|---|---|---|
| Stockers (600 lb) | early season | big bluestem, indiangrass | 2.65 | 30 | 74 | 196 |
| | | switchgrass | 2.21 | 30 | 85 | 189 |
| | | eastern gamagrass | 1.70 | 30 | 98 | 162 |
| | full season | big bluestem, indiangrass | 2.21 | 60–95 | 136 | 299 |
| | | switchgrass | 1.65 | 74–95 | 169 | 289 |
| | | eastern gamagrass | 1.12 | 95 | 223 | 249 |
| Bred heifers (1,000 lb) | full season | big bluestem, indiangrass | 1.87 | 66–87 | 125 | 189 |
| | | switchgrass | 1.45 | 66–87 | 101 | 180 |

Source: Keyser et al., 2011.

## Grazing Management

As with most forages, animal performance and desired gain is directly correlated with the maturity of the plants being harvested or grazed. NWSG, as previously mentioned, are quite prolific during the spring and early summer months in terms of biomass production. That being said, these species must be grazed during this time of accelerated growth. A good rule of thumb is to commence grazing when NWSG have reached 20–24 inches in height, and to maintain the stand between 15 and 18 inches.

There are several reasons for doing this. First, keeping the forage sward at this height minimizes the amount of sunlight that can reach the soil surface. This shading reduces the amount of weed pressure that could compete with the existing stand. Secondly, grazing at this height ensures higher levels of forage quality. Preventing stem elongation and seed production is key to holding this quality. Finally, frequent defoliation of NWSG to heights lower than suggested can drastically reduce the longevity of the stand by reducing the plant's ability to store and conserve carbohydrates (sugars) below the surface through the root system.

Following spring green-up, heavier stocking will be required to keep up with forage production. Allowing the stand to get too tall (greater than 30 inches) promotes reproductive development, which reduces forage quality. If you do not have enough animals to keep up with NWSG pastures, or if you are grazing cool-season species in conjunction with NWSG, you may consider custom grazing (allowing outside parties to graze your forage surplus) or haying the excess forage that is not grazed. Early-season stocking rates can range from 1,600 to 2,000 pounds of animal per acre on switchgrass and eastern gamagrass. Lower rates (1,200–1,400 pounds of animal per acre) should be used on big bluestem and indiangrass pastures (Keyser et al., 2011). These rates, depending on rainfall and stand density, will suffice until midsummer when heat and drier conditions become more constant.

As the season progresses, stocking rates will need to be adjusted. There are several variables that come into play when making these adjustments. The first consideration is based on the environment. Heat and drought stress can compound the effects of overgrazing. Keeping an eye on weather conditions, especially long-range forecasts, can help in management decisions that alleviate these effects. Forage production and quality drop quickly later in the summer months (July to August). Reducing stocking rates at this time is critical for stand persistence. Rates on switchgrass and eastern gamagrass should be dropped to 1,400–1,600 pounds of animal per acre. The same should be done for big bluestem and indiangrass (900–1,200 pounds of animal per acre). With any grazing system, time and experience are the best guides. Pastures established with big bluestem and indiangrass may require only two to three adjustments, while switchgrass may require more frequent monitoring due to its more rapid growth. For Mississippi producers, grazing NWSG should slow down and eventually stop around September 1. Of course, this is just a reference point and is dependent upon external factors such as rainfall and temperature. Rotating to other warm-season grass or stockpiled cool-season grass pastures at this point is highly encouraged.

## Fertility Management

Upon successful establishment, NWSG stands should be fertilized according to soil test recommendations for phosphorous and potassium if your test is low. However, if medium or high levels of phosphorous and potassium are present, no additional fertilizer is required. If soil pH is below 5.5, liming is highly recommended to increase pH to at least 6.0. This will allow the added fertilizer to become more available, increasing the productivity of the stand. In terms of nitrogen, no more than 50–60 units are recommended per year. Overapplying nitrogen will result in increased weed pressure (nitrogen is taken up by weeds, as opposed to the desired grasses), and yields will not justify the added expense. Fertilizer application is recommended in late spring, once NWSG have reached 12–14 inches in height. Applying fertilizer before this stage of growth may promote cool-season weed competition. If the stand is thin, or has been overgrazed or hayed, nitrogen applications will encourage weed competition. In these areas, reseeding and timely weed control are higher in priority compared to fertility management.

In a grazing system, split applications of fertilizer are highly recommended, especially for nitrogen. Two applications of 25–30 units of nitrogen are recommended: once prior to initiating grazing (12–14 inches) and a second midseason application (mid-June). As with traditional warm-season forage grasses, nitrogen applications should be made when moisture is available and environmental stresses (drought, herbicide or insect damage, stand thinning) are not present.

One management practice that can help in fertility management is the use of rotational grazing. By moving grazers across a given stand in a uniform manner, urine and fecal deposits can be evenly distributed across the field, instead of concentrated in water troughs, feed bunks, walking paths, and other areas. This distribution can help reduce the need for additional fertilizer inputs, while also building soil organic matter and increasing microbial activity.

## Conclusion

NWSG can be an effective summer forage source for livestock producers in Mississippi. These grasses are excellent choices for summer forage production because of their drought tolerance and low fertility requirements. Establishing these species also helps create wildlife habitat because of their structure and growth habits. Proper grazing management is key to achieving desired NWSG production goals and for gaining the associated environmental benefits these grasses have to offer. If you are interested in using NWSG on your property, please contact your local Mississippi State University Extension Service office for more information.

## References

Evers, G.W., L.A. Redmon, and T.L. Provin. 2004. Comparison of bermudagrass, bahiagrass, and kikuyugrass as a standing hay crop. Crop Sci. 44:1370-1378.

Harper, C.A., G.E. Bates, M.P. Hansbrough, M.J. Gudlin, J.P. Gruchy, and P.D. Keyser. 2007. Native warm-season grasses: Identification, establishment, and management for wildlife and forage production in the Midsouth. University of Tennessee Extension Service. Pub. 1752. http://fwf.ag.utk.edu/personnel/charper/pdfs/PB1752.pdf. Verified June 18, 2014.

Keyser, P.D., G.E. Bates, J.C. Waller, C.A. Harper, and E.D. Doxon. 2011. Native warm-season grasses for Midsouth forage production. University of Tennessee Extension Service. Pub. SP731-A. https://utextension.tennessee.edu/publications/Documents/SP731-A.pdf. Verified June 18, 2014.

Keyser, P.D., G.E. Bates, J.C. Waller, C.A. Harper, and E.D. Doxon. 2011. Grazing native warm-season grasses in the Midsouth. University of Tennessee Extension Service. Pub. SP731-C. https://utextension.tennessee.edu/publications/Documents/SP731-C.pdf. Verified June 18, 2014.

Oloyede, B. 2013. Nutritional profile of native warm-season grass grown as a mono- or multi-species pasture. Master's Thesis. Department of Animal and Dairy Sciences. Mississippi State University Library. Mississippi State, MS 39762.

Weed Control Guidelines for Mississippi. 2014. Mississippi State Cooperative Extension Service. Pub. 1532. http://msucares.com/pubs/publications/p1532.pdf. Verified June 18, 2014.

The information given here is for educational purposes only. References to commercial products, trade names, or suppliers are made with the understanding that no endorsement is implied and that no discrimination against other products or suppliers is intended.

**Publication 2843** (POD-06-14)

By **J. Brett Rushing**, Assistant Research/Extension Professor, Coastal Plains Research and Experiment Station, and **Rocky Lemus**, Associate Extension/Research Professor and Extension Forage Specialist, Plant and Soil Sciences.



Produced by Agricultural Communications.



Extension Service of Mississippi State University, cooperating with U.S. Department of Agriculture. Published in furtherance of Acts of Congress, May 8 and June 30, 1914. GARY B. JACKSON, Director