



# NATIVE WARM-SEASON GRASSES

## Establishing Native Warm-season Grasses for Livestock Forage in the Mid-South

University of Tennessee, Center for Native Grasslands Management

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

*Craig Harper, Professor and Wildlife Specialist, Forestry, Wildlife and Fisheries*

*Gary Bates, Professor and Forage Specialist, Plant Sciences*

*John Waller, Professor Emeritus, Animal Science*

*Elizabeth Doxon Holcomb, Research Associate, Center for Native Grasslands Management*

### Introduction

Planting native warm-season grasses (NWSG) can be more challenging than planting many of the other crops or forage species you may have worked with in the past. They have small seeds, which germinate slowly and produce small seedlings that are vulnerable to competition. However, these challenges can be readily dealt with by doing two very simple things:

1. Plan ahead
2. Pay attention to detail!

### Planning Ahead

#### Site Selection

Native warm-season grasses will grow on virtually any site in the Mid-South where you might normally try to produce forage.

#### *Past Management History*

Past management can determine weed pressure and, therefore, establishment success. While each field and each season will be different, there are some consistent patterns that occur when establishing native grasses. Several commonly encountered scenarios are described below – in order of decreasing desirability for native grass establishment.

New ground, or land that has just been cleared of timber, normally has very little weed pressure, low pH and moderate-to-low fertility. As a result, these are ideal sites for establishing NWSG. Such sites though, may need soil amendment (lime, P and K) and once stump removal has been completed, tillage will likely be needed to prepare a high-quality seedbed.

Crop ground with a recent history of cotton, soybeans, small grains or corn makes an excellent choice for establishing NWSG. Modern, clean-cropping methods reduce weed pressure considerably in such fields. Because non-grass crops (cotton and soybeans) provide better control of grass weeds, they are preferable to corn. Small grains, such as wheat or cereal rye, help reduce spring and early summer weed pressure.

Hay and pasture ground in this region is normally planted in a cool-season grass, such as tall fescue or orchardgrass. These grass fields tend to suppress a large seedbank of various weeds. When the old sod is removed by spraying or tillage, the latent seedbank erupts into a heavy stand of aggressive weeds (broadleaf and grass) that require a season or two (a summer, fall or both) to properly control. To establish NWSG successfully, you must plan ahead to properly address this problem.

Bermudagrass fields, or fields that simply have patches of bermudagrass, are poor candidates for establishment of NWSG. Bermudagrass is very difficult to control and all of the herbicides that control it also control NWSG. There are few cultural tools that are effective in promoting NWSG in the presence of bermudagrass. One or two summers of treatment with a heavy rate of glyphosate or use of an imazapyr-based herbicide two seasons before planting will be required.

*Suitability for Grazing or Hay Production*

Whatever site you select should be suitable for its intended use as either pasture or hay production. Because the site may not have been used for summer pasture in the past, some consideration should be given to availability of shade, water and possibly cross-fencing, and logistics for moving cattle among pastures at that time of year. Also, because proper management of NWSG pasture, particularly eastern gamagrass and switchgrass, may require you to periodically cut hay, topography and roughness should also be taken into account. On poor sites where yields will be moderate, this is not usually a problem.

**Selecting the Proper Species to Plant**

Many species of grasses are native to the Mid-South, but from a forage production standpoint, we focus on big bluestem, little bluestem, indiagrass, eastern gamagrass and switchgrass. All have wide site adaptations and could be grown about anywhere on your farm. Consider your site first. Is it prone to flooding, or dry with thin soils? Also consider what level of production you need. Some species, such as switchgrass and eastern gamagrass, produce more forage per acre than the others. Refer to Table 1 for more information on these five species.

From a management standpoint, bluestems and indian-grass, either alone or together in blends, are easiest to manage and also provide the best gains for cattle. They are also easiest to establish (less seed dormancy, more herbi-

cide options). Eastern gamagrass is the next easiest to manage and to establish (despite high seed dormancy, it has more flexibility in seeding depth, more herbicide options and more vigorous seedlings). Switchgrass is the most difficult to establish (potentially high seed dormancy, less flexible in seeding depth and fewest weed control options) of the native forages. Both eastern gamagrass and switchgrass produce very high yields, especially early in the summer. Therefore, during the first 4-6 weeks of the season, these grasses require heavy stocking. If you get behind or are late cutting hay, quality will deteriorate. Because it can become quite stemmy as it matures, the decline in quality is more pronounced with switchgrass than eastern gamagrass.

Blends of bluestems and indiagrass are very compatible for hay or grazing. In fact, such blends are preferable to single-species plantings of these grasses. Switchgrass and gamagrass, however, should not be planted in mixtures with other NWSG. This is because their growth seasons are not compatible with bluestems and indiagrass (these three mature later) and, where grazing, cattle preferences will result in selective grazing of the bluestems and indiagrass and their eventual loss from the stand.

**Site Preparation**

Because of their small seeds and limited tolerance of weed pressure as seedlings, NWSG require a clean, firm seedbed and a smooth soil surface for shallow planting (Fig. 1). As emphasized under Site Selection, suppression of weeds ahead of time is critical. The problem is made worse by the fact that there are few herbicides labeled for use on NWSG. Thus ADVANCED control of weeds is essential. Getting into a rush and planting into a weed-infested seedbed is almost a guarantee of stand failure.

*Advance Control of Perennial Cool-season Grasses*

Species such as tall fescue and orchardgrass should be sprayed during October or November the year BEFORE

**Table 1. Relative comparison of key attributes of five important native warm-season grass forages.**

Attribute	Switchgrass	Big bluestem	Little bluestem	Indiagrass	Eastern gamagrass
Yield	Very high	High	Moderate	High	Very high
Wet Site Tolerance	High	Moderate	Low	Moderate - Low	High
Dry Site Tolerance	Moderate	Moderate	High	Moderate - High	Low
Maturity	Early	Middle	Late	Late	Earliest
Palatability	Moderate	Highest	High	High	Moderate
Establishment	Most difficult	Moderate - easy	Easiest	Easiest	Moderate
Management	More difficult	Easier	Easier	Easier	Moderate

planting. Moderate rates of glyphosate (1.5 – 2.0 qt/ac for 4 lb active ingredient/gal formulations) can be effective (and inexpensive) for controlling these grasses during the fall. Another burn-down application will be needed in the spring prior to planting to control missed plants and newly emerged seedlings. To accomplish this, you should spray in late March or early April when cool-season grasses are once again actively growing.

You may want to consider planting a winter annual, such as wheat, after the fall treatment if you are concerned about soil erosion or need additional forage. Winter annuals can also help suppress weed germination during the spring. If you plant a winter annual, be sure to either spray it soon enough the following spring to prevent build-up of a large amount of thatch, or cut it for hay (or haylage), and then spray the re-growth.

It is worth noting that some cool-season pastures and hayfields have a substantial component of perennial warm-season grasses. Where this is the case, you should follow the guidelines below for controlling those species. This will likely mean you will need to initiate weed control in August instead of October the year prior to planting.

#### *Advance Control of Perennial Warm-season Grasses*

Broomsedge, johnsongrass and dallisgrass can all compete aggressively with NWSG. Where any of these are present, plan to spray during August the year BEFORE planting. For johnsongrass or broomsedge, 1 – 2 qt/ac (for 4 lb active ingredient/gal formulations) glyphosate will be adequate, but for dallisgrass or bermudagrass (see sidebar, “Controlling bermudagrass”), rates of up to 5 qt/ac will be



*Fig. 1. Native grass seedlings are slow to develop. However, on this clean, firm, conventionally prepared seedbed, these small seedlings will develop into a good-quality forage stand.*

#### **Controlling Bermudagrass**

Bermudagrass-dominated fields are among the worst candidates for establishing NWSG. If you decide to attempt establishment on such sites, plan to spray with 5 qt/ac (for 4 lb active ingredient /gal formulations) glyphosate, during August. Follow-up treatments should be applied (at the same rate) as needed until fall dormancy. Up to three treatments may be necessary. A second option is to spray imazapyr (24 oz Arsenal AC/ac) in August two summers prior to planting. Planting after just one year may result in a stand failure, because this chemical remains soil-active for up to 18 months.

required. Dallisgrass can also be effectively controlled with imazapic (2-3 oz active ingredient/ac). Use of a broadleaf crop, such as soybeans, can leave open many herbicide options while creating the opportunity for income.

Even though you sprayed the year prior to planting, another burn-down application will be needed in the spring immediately prior to planting to control missed plants and newly emerged seedlings. For warm-season grasses, re-treat in May once these plants are up and growing. If you only have seedlings at this point, a rate of only 1 qt/ac (for 4 lb active ingredient/gal formulations) glyphosate will be adequate. If you have a large number of mature plants, you will not be able to effectively control them at this time of year and may want to consider delaying planting an additional year until the competing grasses have been controlled.

#### *Advance Control of Annual Cool-season Grasses*

Because these grasses are at the end of their growing season when you are seeding NWSG, they rarely present a major problem during establishment. However, you should plan to kill any weeds prior to planting, and this will eliminate any cool-season annual grasses. One to two quarts (for 4 lb active ingredient/gal formulations) of glyphosate or 2 pt/ac of paraquat could be used. If perennial weeds of any type are present, glyphosate will be the better option.

#### *Advance Control of Annual Warm-season Grasses*

Annual summer grasses, especially crabgrass, broadleaf signalgrass and goosegrass, are among the worst competitors with NWSG seedlings and may account for more establishment failures than any other group of weeds. The first flush of annual summer grasses should be treated

once they emerge, normally in late April/early May. Delaying your planting by a week or two to allow this flush to occur can be helpful in gaining improved weed control. Because these will only be seedlings at this time of year, one quart (for 4 lb active ingredient/gal formulations) of glyphosate or 2 pt/ac of paraquat could be used. If perennial weeds of any type are present, choose glyphosate. Depending on the level of infestation, it may be advisable to delay planting until a second flush can be treated. This is a very important consideration where annual grass weeds are well-established.

#### *Advanced Control of Broadleaf Weeds*

Many broadleaf weeds will be controlled with one of the treatments described above for perennial grasses or, as seedlings or annuals, by the spring treatments for annual warm-season grasses. Pay particular attention to perennial species, such as ironweed, plantain and horsenettle, or glyphosate-resistant weeds such as pigweeds or marehail, to determine if an additional herbicide is needed to specifically target these weeds.

Information regarding rates, susceptible weeds and use restrictions for herbicides mentioned in this publication and others that may be useful in establishing NWSG can be found in UT Extension publications, including *Competition Control in Native Warm-Season Grasses Grown for Livestock Forage in the Mid-South* (SP 731-F), *Weed Management in Pastures and Hay Crops* (PB 1801) or *Weed Control Manual for Tennessee* (PB 1580). Always read the label before applying and follow all instructions when spraying. Labels and other information regarding proper spraying of these and other herbicides may be available through your farm supply store, the manufacturer or your local Extension agent.

## **Planting**

### **Planting Methods**

Native grasses may be planted one of two ways, no-till or conventional.

#### *No-till*

The preferred method for planting NWSG is no-till. Firm seedbeds, greater retained moisture, fewer trips over the field and reduced erosion are all benefits from this approach. As described above under Site Preparation, any emerged weeds should be treated with a final application of an appropriate herbicide prior to planting. This should be done about 10 – 14 days prior to planting to ensure a good kill has been achieved. If needed, another application can be made immediately post-planting (but no later than about day five).

The preferred equipment for planting NWSG (except eastern gamagrass), whether on a conventional or no-till seedbed, is a drill (see sidebar, “Do I need special equipment to plant native warm-season grasses?”). The drill should be calibrated to assure the proper seeding rate (see UT publication, *Adjusting and Calibrating a Drill for Planting Switchgrass for Biofuels* (SP 701-C) or *Native Warm-Season Grasses: Identification, Establishment and Management for Wildlife and Forage Production in the Mid-South* (PB 1752), for more details on drill calibration). It should also be adjusted to ensure proper seeding depth. This is essential. Besides weed pressure, planting too deep has probably accounted for more failed NWSG plantings than any other factor. Eastern gamagrass, because of its larger seed size, is typically planted with a corn planter, either traditional or vacuum-type.

#### *Conventional Seedbeds*

Native warm-season grasses can be planted successfully in conventional seedbeds. A conventional seed-

bed should be fine, firm and clean. Multiple passes with a disc and/or cultipacker may be required – similar to that necessary when planting alfalfa, clovers or seeded bermudagrass. If a fine and clean seedbed has been prepared, but the soil is still loose (your shoe sinks in more than ¼ inch when you walk across it), either cultipack the seedbed or wait until it rains to firm the seedbed prior to planting.

Seed can be sown (broadcast) on conventional seedbeds, but this often does not provide consistent seed-soil contact. Therefore, seeding rates should be increased (Table 2) to compensate for poorer germination and seedling survival. Following sowing,

### **Do I need special equipment to plant native warm-season grasses?**

Bluestems and indiagrass have long-awned seed. Many seed vendors clean their seed and remove most of these awns. Such seed passes easily through standard grass seed boxes on most drills. If you purchase seed that is not this clean, it will be necessary to use a drill equipped with a specialized “native grass box” that has agitators, picker wheels and oversized tubes that keep fluffy seed moving through the drill. Such drills can commonly be rented from Soil Conservation Districts and state fish and wildlife agencies. If you plan to sow fluffy seed, it will be helpful to blend the seed with pelletized lime as a carrier to allow the seed to be sown evenly. Switchgrass can easily be planted using the “legume” or “small-seed box” standard on most drills.

proper covering of the seed is important and can be accomplished with a cultipacker or drag. Care must be taken not to cover the seed too deeply, regardless of equipment used. If a firm seedbed was not prepared ahead of time, and the soil is still loose, seed can easily be covered too deeply.

### Planting Rates

Follow the rates in Table 2 when planting NWSG for forage production. Note that these rates are given in “PLS” or “Pure Live Seed” (see sidebar). When you are ordering seed, always specify PLS.

### Seed Dormancy

Special attention should be paid to dormancy rate. This is particularly true for eastern gamagrass and switchgrass. For switchgrass, this is more often an issue with *Cave-in-Rock* and *Kanlow* varieties than with *Alamo*. It is rarely a concern for bluestems or indiagrass. Reported dormancy rates on NWSG seed tags include seed that requires stratification to induce germination. Thus, a seed lot may be 80 percent PLS but be 80 percent dormant – still viable seed, but requiring a period of cold and wet to break dormancy. Planting such seed in the spring once soil temperatures have warmed and any chance of stratification is past will result in very poor stands. (Also, see sidebar on dormant-season planting.)

Always inquire about dormancy when purchasing NWSG seed and be prepared to treat seed with high dormancy rates before planting. While there is no particular threshold that requires treatment, dormancy rates above 50 percent are a concern, as they could potentially cut your effective seeding rate by up to one-half. High-dormancy seed can be “treated” by storing it (but not in a cooler) until the following spring. Dormancy normally drops

### Calculating Pure Live Seed (PLS)

Pure Live Seed (PLS) refers to the proportion of a particular seed lot that is viable, germinable seed. It will always be expressed as a percentage. It is calculated as follows: (Germination % x Purity %)/100 = % PLS.

Percent germination and purity can be taken directly from a shipping tag or the tag on the bag. You should note the percent germination is made up of two types of seed, that which is ready to germinate immediately (“quick germ”) and that which will germinate when stratified (“hard” or “firm”). Purity is 100 percent minus the sum of the percent inert matter and the percent weed seed.

Because NWSG seed traditionally could be quite chaffy and/or quite high in dormancy, this calculation is very important. PLS rates for most switchgrass will run in the 80s and 90s, while for bluestems and indiagrass, it will range from the 40s to the 80s in most cases.

### Example calculation:

Germination	54.00%
Firm or dormant seed	12.00%
Inert matter	3.10%
Weed seed	1.40%

Total Germination = 54.00 + 12.00 = 66.00%

Purity = 100 – (3.10 + 1.40) = 95.50%

0.6600 x 0.9550 = 63.03% PLS

Thus, to plant one acre at 6 PLS lb, you would need

6 lb/0.6303 = 9.5 bulk lb

of the seed from that bag to be planted to achieve the desired seeding rate.

**Table 2. Recommended seeding rates for native warm-season grasses established for forage production in the Mid-South. All rates are expressed in PLS pounds per acre.**

Species	Pure Stand		Blends (drilled)			
	Drilled	Sowed	Two-way	Two-way	Two-way	Three-way
Big bluestem	9	12	6	8	-	6
Little bluestem	7	10	-	1	1	1
Indiagrass	7	10	3	-	6	3
Switchgrass	6	8	nr	nr	nr	nr
Eastern gamagrass	12	nr <sup>1</sup>	nr	nr	nr	nr

<sup>1</sup>nr = not recommended. Blends of either eastern gamagrass or switchgrass with the other three species are not recommended.

markedly after such “after-ripening” of the seed. You can often purchase year-old seed from vendors if you encounter this problem. Otherwise, seed can be cold-stratified (about 45 F) for two weeks following soaking in water for 24 hours. Be sure to drain the seed before placing it in the cooler.

### Planting Dates

Eastern gamagrass can be seeded in the spring after soil temperatures reach about 60 degrees, or early to mid-April for much of the Mid-South. The other species should be planted after soil temperatures reach 65 degrees, typically the last week of April into the first week of May in the Mid-South. Planting can take place well before soils are warm enough to induce germination (see sidebar on dormant-season planting), but whether you have planted in the dormant season (February or March) or early spring (April), you must still address spring weed control. Following dormant-season planting, spray when soil temperatures have reached about 60 – 65 degrees to ensure you provide weed control that best corresponds with seedling emergence and early growth.

While it is preferable to take advantage of early-season moisture, native warm-season grasses, with the exception of eastern gamagrass, can be planted successfully through June. Such late plantings, however, require good soil moisture at the time of planting and in the following weeks to ensure germination occurs quickly and that seedlings grow to an acceptable size (6 inches) prior to fall dormancy. Late-seeded stands go into fall dormancy much smaller than earlier-seeded stands, but with acceptable plant populations and seedlings size, overwinter survival will be high and a successful stand likely.

Later plantings are always a trade-off between less available soil mois-

ture and improved weed control. By planting in June, for example, you will have the opportunity to kill more weed flushes and further reduce competition. This works especially well in bottomland sites where moist soil conditions might prevent early plantings and where seedbanks harbor large quantities of invasive weeds. Keep in mind that NWSG seedlings can survive in remarkably dry conditions, but cannot survive long under a weed canopy. If there is enough moisture to germinate the NWSG seed, they can have a competitive advantage over many weeds during dry summers.

### Planting Depth

As is the case with any small-seeded crop, shallow planting depths and good seed-soil contact is essential when planting NWSG. For switchgrass, bluestems and indiagrass, seeding depths should be less than ¼ inch (Fig. 2.). Depths greater than about ½ inch, unless in very coarse-textured (sandy) soils, can result in substantial reductions in seedling recruitment. Eastern gamagrass seed is much larger and should be planted ¾ to 1¼ inches deep. In addition to maintaining appropriate seeding depths, it is important to have minimal thatch on the field. Thick thatch (> ½ inch) can interfere with proper seed placement and later, emergence of seedlings. Proper management ahead of time (such as mowing, graz-

### Dormant-season Planting

Research at the University of Tennessee shows promise for planting native grasses in winter. Switchgrass planted in February and March (but not December) performed as well or better than traditional May plantings. Such early plantings mimic the natural biology of NWSG (fall seed shattering), ensure in-place stratification of seed, early germination and optimum moisture availability. Dormant-season switchgrass plantings also did well when planted into a small grain cover crop. Small grains provide a form of spring/early summer weed control. In these tests, though, plots were sprayed with glyphosate in mid-April to kill any weeds and remaining small grain cover. Timing of such a spray treatment is clearly important.

ing or burning) will allow you to avoid this problem.

### Preemergence Herbicides

When planting bluestems and indiagrass, imazapic-based herbicides (such as Plateau, Journey and Panoramic) should be applied preemergence (preferably immediately after planting) to control a number of



*Fig. 2. Native grass should be planted only about ¼ inch deep. When planted this shallow, some of the seed (about 15 percent of the length of any furrow) will not even be covered and will be visible on the soil surface, as seen in this picture.*

weeds, including crabgrass, signalgrass and seedling johnsongrass. Collectively, these are among the worst competitors when establishing NWSG and are probably responsible for more stand failures than any other weeds. Goosegrass control is not as good when using rates that are acceptable to native grass seedlings. When using imazapic, be careful to avoid overlapping spray patterns when you are using rates that approach the tolerance limit for NWSG (10 - 12 oz Plateau/ac); applications that exceed this rate can kill native grass seedlings. Do not use imazapic herbicides on switchgrass or eastern gamagrass because their tolerance to this chemical is much lower.

### What about Fertilization?

NWSG seedlings are small and require only modest fertility levels to thrive. Therefore, fertilizer should only be added during establishment if P or K tests in the low category. Lime should only be added when pH tests below 5.0. Nitrogen should never be added during establishment, as it will only help weeds be more aggressive. In fact, where N levels are thought to be high, consideration should be given to reducing those levels through use of a small grain cover crop. During the stand's second year, if NWSG dominate the site and weed pressure is low, N could be applied at 45 – 60 units per acre (late April) to boost the stand's growth rate.

### Following up after Seeding

Once you have planted your grass, you have two jobs left to do: control weed pressure and be patient! Native warm-season grasses require three growing-seasons to become fully established. That is because they grow deep, extensive root systems – up to five tons of root mass per acre by age 10. This is one reason NWSG are so drought-tolerant. But it also is why the seedlings can be slow in developing. Under the right circumstances though, first-year seedlings of the taller grass species routinely can reach heights of 6 – 8 feet and can consistently produce seedheads.

### How Much Is Enough?

A stand with an average seedling density of one or more plants per square foot is your goal. Stands with densities of one per 2 square feet are acceptable. Stands below one seedling per 4 square feet are candidates for reseeding. Drilling through a weak stand after appropriate weed control during the second year can be successful for thickening thin stands. But again, during the seedling year, having acceptable plant populations is far more important than their size – they will become robust in another year (Fig. 1.).

### First-year Weed Control

With a seedling stand of acceptable density, your remaining challenge during the summer is to ensure seedlings have reasonable relief from weed pressure. The key is to not allow weeds to form a canopy above the seedlings (Fig. 3). A few scattered weeds are not much of a concern. Dense stands of johnsongrass, signalgrass, crabgrass or broadleaf weeds, on the other hand, can be a serious problem and can easily result in the loss of the stand. The best way to handle this is to regularly inspect your field in the weeks following planting. Be prepared to either clip or spray weeds as needed. Timeliness is critical. Some herbicides that control broadleaf weeds can damage smaller grass seedlings. When clipping, be sure to keep your mower above the developing seedlings. You may be forced to cut them at some point, though, depending on the type of weeds you are controlling. In many cases, you can take a hay cutting rather than clipping. With severe competition, bale the clippings to allow sunlight to reach the seedling. Regardless, it is important to not clip the seedlings below 6 – 8 inches.

By mid- to late-August, you will be at a point where further weed control does not matter and the grass can be allowed to compete with whatever is out there. If your first-year stand has substantial weed pressure going into fall dormancy, consider using a prescribed burn the following April when the NWSG is just beginning to grow. Such fires can be helpful in weed control.



*Fig. 3. Even though large switchgrass seedlings (being held in each hand, above) have developed as a result of this planting, the weed canopy was allowed to overtop the seedlings. When this occurs, there is little chance of a successful stand. These weeds MUST be controlled in a timely manner.*

## Second-year Weed Control

By the second year (12 months post-planting), your NWSG will be well-established, but not mature. Regardless, they will be quite competitive with most weeds. There are a few situations though, that may bear some attention. If the first-year stand was slow-developing, weeds may have become well-established. Most annuals will not be an issue during year two. But other weeds, especially johnsongrass and broadleaves, should be sprayed during the spring. For bluestems and indiangrass, heavier rates of imazapic (up to 3 oz active ingredient/ac) can be used to control many of these weeds. For switchgrass, nicosulfuron + metsulfuron (Pastora ) applied at 1.0 oz/ac of product provides good control. Also, any number of broadleaf-selective herbicides, such as 2,4-D, Weedmaster and CimarronPlus, can be used on second-year NWSG.

Before any herbicides are used, you should consider the palatability of any weeds you may be planning to treat.



*Fig. 4. This first-year stand was drilled into a high quality seedbed during late April. With good competition control and adequate rainfall, such stands can be established and provide excellent forage for years to come.*

If they are readily consumed by cattle, like johnsongrass, then spraying will not be necessary. The cattle can provide the appropriate weed control. If grazing is not an option though, spraying will be an important tool for weed control.

## When Can I Start Haying or Grazing?

While NWSG continue to mature during their second growing-season, some forage can be taken in year two without adverse impact to the continued development of the stand. However, you should take care not to stress the stand. Therefore, a single early cutting (before mid-June) or 40 – 70 days of grazing is possible. Late grazing (after August 1) or taking a second cutting of hay is not recommended. See, *Grazing Native Grasses in the Mid-South* (SP 731-C) and *Producing Hay from Native Grasses in the Mid-South* (SP 731-D) for more details on proper management of these grasses for forage production.

## Summary

Successful establishment of NWSG requires more attention to detail than most other forage crops. Good advanced preparation of seedbeds to ensure adequate weed control and limited thatch, shallow seeding of non-dormant seed and reasonable weed control during the establishment year are all critical to success. Cutting corners or inattention to the details described in this publication will lower your chance of success. But if care is taken, you have the opportunity to have a highly productive, low-input stand of desirable and highly drought-tolerant forages on your farm (Fig. 4).



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