

Native Warm-Season Perennial Grasses for Forage in Kentucky

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Native warm-season perennial grasses are well adapted for production in Kentucky's climate and soils. In contrast to cool-season grasses like tall fescue, orchardgrass, and Kentucky bluegrass, warm-season native grasses grow best in late spring and summer. They can be grazed during summer when cool-season grass pastures are less productive. They can also be harvested as hay and biomass or used for soil conservation and wildlife habitat.

Eastern gamagrass, switchgrass, big bluestem, Indiangrass, and little bluestem were an important part of about 3 million acres of native grasslands in Kentucky when Europeans first came into the area. These grasses supplied food and cover for native wildlife such as the American bison, elk, whitetail deer, small mammals and numerous bird species. Because these grassland areas had very few trees, these grasses were some of the first to be plowed and planted to crops. Plowing, overgrazing, and encroachment of introduced grass species and forests quickly led to the near-extinction of native warm-season grasses in the state. Over the last 25 years, interest has increased in these species due to their ability to produce high yields under hot, dry conditions even on poorer soils and their potential use as biomass and alternative energy crops.

In this publication, native warm-season perennial grasses that have the greatest forage potential for Kentucky are described. Management techniques necessary to establish stands and keep them productive are also discussed.

Species Adapted to Kentucky

Eastern gamagrass is a bunchgrass that produces short, thick rhizomes near the soil surface. It is among the highest quality native warm-season grasses, with high palatability and digestibility and one of the longest growing seasons. Individual plants grow in size as the surface rhizomes spread outward forming large circular clumps over time, with the center often becoming open after a few years. Leaves of eastern gamagrass emerge from the base of the clump and may easily reach a length of 3



Eastern gamagrass develops "clumps" that spread from short rhizomes.

Native Warm-Season Grasses	
Origin:	Eastern and Central USA
Characteristics:	Long-lived perennial bunchgrasses
	Some have short rhizomes
	Tall (3 to 10 feet)
	Thick stems develop with maturity
	Need a fall rest period
	Sensitive to overgrazing
	Require 8 to 10-inch stubble height after grazing or hay cutting
Uses:	Hay, rotational pasture, biomass, conservation, and wildlife habitat
Seed:	Small with many appendages (little and big bluestems and Indiangrass); smooth and medium size (switchgrass); large, cylindrical (eastern gamagrass)
Seeding rate:	7 to 10 pounds pure live seed per acre depending on species
Seeding depth:	1/8 to 1/4 inch for all except 1/2 to 1 inch for eastern gamagrass
Primary seeding date:	Mid-May to early-June
Secondary seeding date:	Mid- to late June
First harvest:	Mid-May to mid-June depending on species
Yield:	4 to 7 tons/acre/year

or more feet, with the seedheads extending to 6 to 7 feet. The seeds are large and enclosed in a cylindrical seed coat, and tend to have high levels of seed dormancy. Seed treatments such as wet-chilling are usually required to increase seed germination, and as a result many companies sell treated seed. Eastern gamagrass does best on deep, well-drained soils but can withstand short periods of flooding. Corn planters are usually used to seed eastern gamagrass in 30-inch or narrower rows. Some farmers have even been successful seeding it with a corn crop. Eastern gamagrass is often the preferred native warm-season grass for pasture, but its high quality also produces excellent hay and baleage. The large clumps formed by eastern gamagrass can make for a "bumpy" ride when harvesting for hay, but the high quality forage produced offsets driver discomfort.



Big bluestem ready for first harvest.

Big bluestem is a tall growing (6 to 8 feet) bunchgrass with generally higher forage quality than switchgrass. It also provides excellent wildlife habitat. Yield potential is generally less than switchgrass and eastern gamagrass; however, big bluestem is more drought tolerant and can be grown on poorer soils—especially those that are shallow and steep. The seed are small and have appendages that impede gravity flow through the distribution tubes in most seed drills. Seed can be debarbed, but even then, drills with specially modified warm-season grass seed hoppers may be necessary for even seed distribution. Big bluestem produces most of its growth after June 1, a date that coincides with the decline in production of cool-season grasses. Its good forage quality and relative ease of drying make it the preferred native warm-season grass for hay production for beef cattle, horses and other livestock species or it can be used for grazing, especially in July and August.

Switchgrass is a tall growing (4 to 9 feet), wide-leaved grass that produces short rhizomes so that individual plants increase in size over time. The seed are similar in size to orchardgrass and are smooth; unlike other native warm-season grasses switchgrass seed flows easily through most drills. Switchgrass becomes thick stemmed as it matures, so it needs to be harvested at an immature stage (before seed heads emerge) for good quality forage. The first harvest in Kentucky should generally be no later than early June. Upland varieties such as Cave-in-Rock and



Switchgrass in July, with tall fescue on left.

Blackwell are shorter and better adapted to well-drained (even droughty) soils on side slopes and ridge tops. Upland varieties are generally preferred for forage production, with their smaller stems and higher leaf to stem ratio. Lowland varieties such as Alamo and Kanlow are taller, have coarser stems, and do better on sites that may be flooded for short periods or are somewhat poorly drained. Switchgrass works well as a hay crop but can also be rotationally grazed. It is not preferred in the horse hay market, because species in the *Panicum* genus have a potential to cause liver damage in horses. Switchgrass has also been recently promoted as a bioenergy crop because of its high biomass production potential even on marginal soils with low inherent pH and fertility. Generally the lowland types are preferred for bioenergy production because they produce high yields even when harvested only once per year in the late fall.

Indiangrass is also a tall growing (5 to 7 feet) bunchgrass that develops thick stems if allowed to mature. It provides excellent wildlife habitat because of its clumpy growth and a canopy that stands up well during the winter. It produces more of its growth later in the summer than the other native warm-season grasses, which makes it a good match for cool-season grasses. Indiangrass yield potential is comparable to that of big bluestem but less than switchgrass and eastern gamagrass. It is very drought tolerant and can be grown on steeper, shallower soils. Indiangrass makes a good hay crop but may be best used for summer grazing. The seed is similar to big bluestem and should be debarbed when seeding with traditional seed drills.

Little bluestem is less productive than the other native warm-season grasses. It can be harvested as hay or rotationally grazed, but its lower yield and quality make it best suited for conservation and wildlife habitat plantings. It is usually planted in mixtures with other grass species.

Establishing New Stands

Native warm-season grasses are very different in establishment requirements from the cool-season grasses with which most Kentucky farmers are familiar. It is important to learn as much as possible about them before trying to get them established. This publication gives some basic information, but other extension and industry publications provide more detailed establishment information. One of the best ways to increase establishment success is to learn from other farmers, county agents, and NRCS personnel who have experience growing native warm-season grasses. A number of seed companies now provide contract seeding services as well. Because these grasses are somewhat slow in becoming established (usually it takes a full growing season) and few options exist for chemical weed control, it is essential to start with a weed-free seedbed.

Preparing the Seedbed

When seeding into a prepared seedbed, soils should be tilled in the spring at least a month before seeding time. This practice kills existing weeds and allows time to prepare a smooth, firm seedbed. A light, shallow tilling immediately prior to seeding, followed by cultipacking (packing the soil) should kill newly emerged weed seedlings and leave the surface ready for seeding. It is very easy to get seed too deep in a prepared seedbed when

using a grain drill or no-till seed drill. Some studies indicate that broadcasting seed and then cultipacking is a viable seeding option on a prepared seedbed. Native warm-season grasses can be also be no-till seeded into the previous year's crop stubble by using a "burn back" application of a broad spectrum herbicide like glyphosate prior to seeding.

Another establishment system involves using a winter cover crop of wheat or other small grains. The cover crop can be grazed, harvested as hay, and/or killed with a herbicide in the spring before seeding the grass. Always use herbicides in accordance with label directions.

In recent years, more and more producers are seeding native grasses into existing pastures and hay fields. This practice works well as long as the existing grass sod is completely killed. Ideally, the first herbicide application using glyphosate or similar product should be done in the fall when the stand is actively growing. A second application should be made in the spring immediately prior to seeding. Fall spraying not only kills the existing plant material but allows the sod time to decay over winter. If a fall spray is not possible, two sprays in the spring provide a secondary option as long as one allows at least 4 to 6 weeks between spray treatments. In addition, watch closely for insect damage on seedlings when planting into a killed sod.

Timing

In Kentucky, the best time to seed native warm-season grasses is mid-May to early June, after risk of frost, to allow time for sufficient soil warming. A soil temperature above 55°F is needed for warm-season grass seed to germinate. Seeding too early will result in the loss of some seed due to decay, birds or other pests eating the seed. Seeding too early when environmental conditions are not yet ideal for warm-season grasses to germinate can also result in increased weed competition.

Seeding after mid-June increases the risk of drought stress and damage to the new stand. If it is necessary to seed in late June, it is important that good soil moisture is present at the time of seeding to provide adequate moisture to get the crop started. Late seedlings have a higher success rate when no-till seeded into crop residue or a killed sod because the existing plant residue helps to preserve soil moisture. After the seed has germinated in a no-till environment, it is more likely to survive moderate droughts.

Seeding Rates

Native warm-season grasses intended for hay or grazing purposes will require more seed than conservation or wildlife plantings because a dense stand is desired. Use the following table when seeding a single species. It is essential to seed on a PLS or "Pure Live Seed" basis because native warm-season grass seedlots often have lower germination and purity percentages than traditional forages. Pure Live Seed percentage is calculated with the following simple formula: germination x purity/100. Then multiply PLS percentage by the recommended seeding rate to determine how many pounds of seed to actually plant. For example, a seedlot of big bluestem with a PLS of 50 percent should be planted at 20 lb/acre actual seed (10 lb/acre x .50 PLS = 20 lb/acre).

Native Warm-Season Grass Seeding Rates for Hay or Pasture

	(Pounds of pure live seed per acre)
Switchgrass	8-10
Big Bluestem	10
Indiangrass	10
Little Bluestem	7
Eastern Gamagrass	8

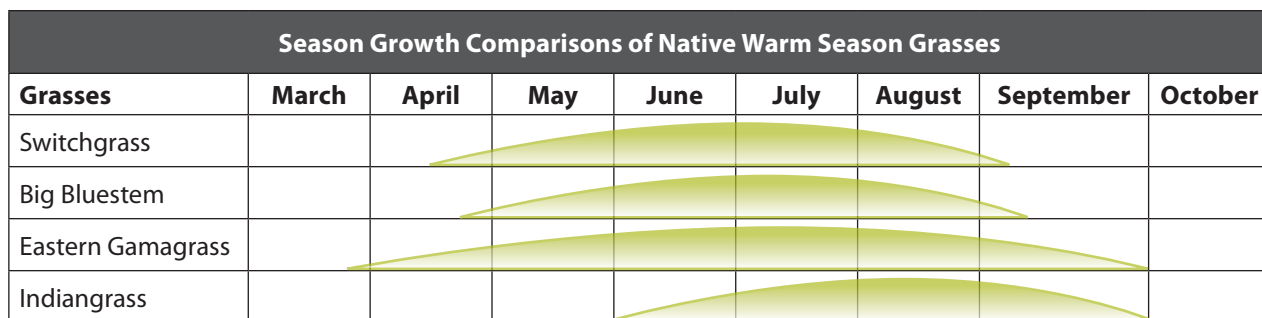
Note: If mixtures are used, above seeding rates should be reduced in proportion to the number of species used. For example, if three species are used in a mixture, use one-third of the rate listed in the table for each species.

Mowing to Control Weed Competition after Establishment

Check herbicide labels for chemical options for post-emergent weed control. Since few herbicides are labeled for use on native warm-season grasses in comparison to other forage species, it may be necessary to mow during the establishment year. (This is especially true for annual grass weeds like crabgrass and yellow foxtail.) Mowing tall weeds reduces weed seed production and competition for light and improves stand establishment. Under normal circumstances mowing height should be maintained at 6 inches or higher. Ideally, maintain mower height above young warm-season grass seedlings and do not mow after the end of August. Native warm-season grasses need a recovery period in late summer and early fall, similar to alfalfa, in order to build up root carbohydrate reserves for winter. If first year grass growth is sufficient by the end of August, these grasses can be harvested as hay. However, grazing is not recommended during the establishment year because the young seedlings may be damaged by trampling or may be pulled out of the ground.

Managing Established Stands

Once established, a good stand of native warm-season grasses will last indefinitely if properly managed to give the grasses a competitive advantage over weeds and cool-season grasses. If the grasses are harvested by grazing, it is necessary to use a rotational grazing system and leave at least 6 inches of stubble (8 to 10 inches preferred). Overgrazing may lead to rapid stand loss. Do not leave cattle or other livestock on an area more than five days at a time. Plan to allow 30 to 40 days of regrowth before grazing again. This means a field will need to be divided into at least seven paddocks. Temporary electric fence provides the most flexibility. If grazing is started in late May, it will be possible to graze some of the paddocks three or four times before the end of the grazing season in early September. Rotational grazing can start once plants reach a height of 20 to 25 inches. When grazing at early growth stages, it may be necessary to rotate to new areas more quickly—perhaps after two to three days rather than five. The higher quality of eastern gamagrass provides the opportunity for grazing after frost, but it is essential that the stand be allowed to regrow from late August until frost to insure high level of root carbohydrates for winter survival.



For hay production, the first cutting of some of these species can be taken in late May (i.e., eastern gamagrass or switchgrass), while others should not be cut until mid-June or later (i.e., Indiangrass). These grasses should be harvested before seed heads emerge in order to make good quality hay. Forage quality declines rapidly after seedhead emergence. When cutting for hay it is essential to leave an 8 to 10-inch stubble height.

Fertilization

Lime and fertilizer applications to native warm-season grasses should be based on regular soil testing, with at least one sample taken every third year for pasture stands and every year for hay stands. Although these grass species tolerate low fertility, fertilizer should be applied based on soil test recommendations for good production and stand persistence. Regular applications of nitrogen (N) fertilizer are needed in order to increase yields and improve forage quality since it is difficult to maintain legumes in a stand of tall growing native grasses. Some producers have had success interseeding red clover into well established eastern gamagrass stands, but this practice should not be attempted in stands less than 3 years old because red clover will outcompete young gamagrass plants. Plant nutrient removal from the soil as a result of hay harvesting requires annual application of N in order to maintain optimum hay production levels. The efficient recycling of N from manure and urine under well managed rotational grazing systems can reduce recommended N application rates for hay by 50 percent. Similarly, requirements are lower for P and K under rotational grazing. When harvesting for hay, an early application of 40 to 60 pounds of N per acre should be made in spring just as the grass begins to green up. Additional applications of N should be made following each harvest up to a maximum of 150 pounds per acre per year. Eastern gamagrass has a higher N requirement than switchgrass, Indiangrass and big bluestem due to its higher dry matter yield and protein content. It is important to not apply N before native warm-season grasses begin to green up in the spring, as this will stimulate weed growth before the grass is ready to grow and compete. If urea is to be used as the N fertilizer source after mid-May, N

rates should be increased by about 20 percent to compensate for N volatilization losses that are likely to occur. Nitrogen is normally not recommended during the establishment year since nutrient uptake by seedlings is low, and N applications in year one often encourage weed competition. Soil K levels should also be monitored frequently by soil testing because K removal in hay is high for these species.

Summary

Native warm-season perennial grasses have the potential to supply grazing for Kentucky livestock during summer when cool-season pastures are less productive. Developing a grazing system that includes up to 25 percent of the forage acreage as warm-season grasses may reduce the risk of a pasture shortage during July and August. Incorporating native warm-season grasses into the forage plan will also allow for the resting of the cool-season pastures when they are stressed by heat and drought. Native warm-season grasses can also be harvested as high yielding hay crops during the summer.

Some important points to remember when considering native warm-season grasses:

- They are more difficult to establish than cool-season grasses.
- At least one growing season is needed to get them established and ready to utilize.
- They must be carefully managed through rotational grazing or timely hay harvests.
- Grazing should only occur from May through August for all species and after frost for eastern gamagrass.
- Soil fertility is important. Nitrogen fertilization is required, especially for hay and biomass production.

Related publications from the University of Kentucky Cooperative Extension Service that can be obtained from Kentucky county extension offices or downloaded from the UK Forage Website: www.uky.edu/Ag/Forage.

- AGR-1 Lime and Nutrient Recommendations
- AGR-18 Grain and Forage Crop Guide for Kentucky
- AGR-175 Forage Identification and Use Guide
- ID-143 Rotational Grazing

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