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GUIDE
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Big Bluestem, Indiangrass and Switchgrass

Jimmy C. Henning
Agronomy Department

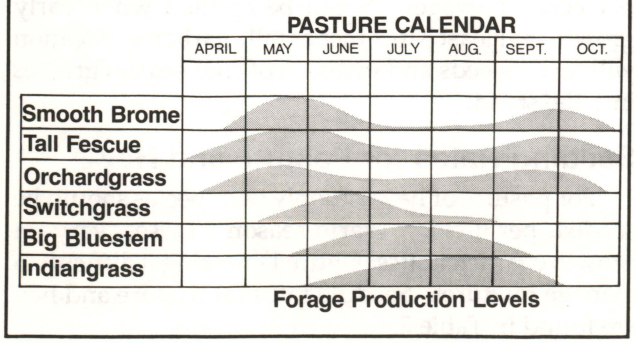
Many warm-season perennial grasses were once an important part of the plant community in much of Missouri. But crop rotations, overgrazing, lack of regular fire and increased competition from cool-season grasses and legumes have caused these grasses to disappear from much of the state. However, these grasses can complement cool-season pastures if managed properly. They are highly palatable to livestock prior to heading and can produce beef animal gain more than two pounds per day during summer.

Warm-season grasses for forage have been reintroduced successfully across Missouri, contributing to both pasture and hay systems. Management is the key to establishment and top production.

Characteristics of Warm-Season Grasses

Unlike tall fescue and other cool-season grasses, warm-season grasses are most productive from June to September 1. Therefore, a combination of separate cool- and warm-season pastures can be managed to supply a more constant supply of high-quality forage throughout the season than either cool- or warm-season grasses alone.

Figure 1. Seasonal Distribution of Forage Production



Of the many native warm-season grasses, switchgrass, big bluestem, and indiangrass show the most potential for Missouri. (Caucasian bluestem, Plains bluestem, and bermudagrass are introduced warm-season grasses and have potential as well.) All are called warm-season grasses because of their adaptation to warm day climates but they differ in their seasonal production of forage. In general, switchgrass greens up and matures earliest, big bluestem is intermediate, and indiangrass matures latest (Figure 1). Caucasian bluestem fits between switchgrass and big bluestem.

Seedlings of these native grasses have very low vigor and are poor competitors with weeds. Consequently, switchgrass, big bluestem and indiangrass are moderately difficult to establish and may need two years before they can be hayed or grazed. In exceptional years, plantings may establish well enough to allow grazing in the second year.

Warm-season grass pastures won't withstand continuous, close grazing or close clipping without reducing yield the following year. Rotational grazing is mandatory to keep productive warm-season grass stands.

In return for careful management, a farmer can produce two to four tons of forage per acre on well-fertilized,warm-season grasses between late June and early September. Assuming a mature cow requires 30 pounds of forage per day, one acre of warm-season grass can supply sufficient forage for two cows during the summer.

Establishment

Warm-season grasses have traditionally been slow to establish because their chaffy, hairy seed is hard to handle using conventional grain drills, and their seedlings are poor competitors with weeds.

Switchgrass seed is hard and slick and can be handled without special drills. Big bluestem and indiangrass seed are chaffy and will not flow through conventional drills. Seed can be debearded — a process which removes much of the chaff and hair from seed of big bluestem and indiangrass — allowing them to be seeded using conventional equipment. Rangeland drills such as those made by Horizon,

Marliss, Truax and others can handle non-debearded seed. It is often easier to use debearded seed than to find one of the special rangeland drills.

Warm-season grasses may be planted into a conventional, tilled seedbed or drilled into standing or killed vegetation.

Using conventional tillage, the seedbed should be free of weeds, fine-textured and firm. After tillage, the ground should be rolled with a cultipacker for firmness. If seed are broadcast, the field should be cultipacked or rolled a second time to place the seed in good contact with the soil and to cover the seed properly. Seeding with a drill which has press wheels eliminates the need for a second rolling. Whether drilling or broadcast/cultipacking, seed depth should be no greater than 1/4 or 1/2 inch.

A practical method of broadcasting non-debearded seed is to mix the seed with the fertilizer. Apply half of the seed at a time and make two trips over the field, lapping in between the first tracks on the second trip. Remember to roll the field before and after broadcasting.

Another seeding method would be to make a spring seeding into fall-seeded spring oats. The oats will winter kill. A no-till drill is needed to cut through the mulch. Seeding into wheat or another grain crop that will grow in spring is not recommended. The growing crop offers too much competition.

Excessive weed competition is a major cause of slow stand establishment. Weed control can be accomplished by a combination of timely tillage, herbicides (pre- and post-emergence) and clipping.

Atrazine can be used as a pre-emergence herbicide to control grassy and broadleaf weeds on certain types of soil, but only when establishing big bluestem or switchgrass. Atrazine is toxic to indiangrass seedlings.

Shortly after planting, apply atrazine on the surface at 1 pound active ingredient per acre. Do not incorporate. Atrazine injury can occur on soils of less than 2 percent organic matter with neutral pH, and where atrazine is in the zone where the root of the warm-season grass emerges. Atrazine injury is more likely when seed is broadcast rather than drilled. Remember, do not use atrazine when establishing indiangrass.

Table 1. Effect of atrazine on yields of big bluestem and switchgrass during the establishment year.[1]

Grass	Atrazine	Yield
		lb/A
Big Bluestem	no	680
	yes	6400
Switchgrass	no	0
	yes	4940

[1]Mead, Nebraska

Nebraska research has shown that use of atrazine results in productive big bluestem and switchgrass pastures in the year of seeding. (See Table 1)

When atrazine is not used, as with indiangrass, the seedbed should be prepared early. Allow the weeds to emerge and then use a burn-down herbicide such as Gramoxone. Grass can then be drilled into the seedbed, which should not be further disturbed. Tillage after burn-down will expose ungerminated weed seed and increase problems.

Time of Seeding

Warm-season grasses are best established during April and May. Cost-share programs require that they be planted between April 15 and June 10. Early planting is critical even though warm-season grasses do not germinate when soil temperatures are below 50 to 55 degrees Fahrenheit. Early establishment allows seedings to develop good root systems before summer drought and greatly increases the ability of the grasses to compete with weeds.

Seed of native grasses typically contains higher percentages of dormant seed than cool-season forages. One of the ways to break dormancy is to chill seeds that have absorbed water. Planting early into cool soil will chill the seed and can cause dormant seed to germinate.

Seeding into warmer soil in late spring can be helpful in controlling weeds. The first flush of weeds is allowed to germinate and then is killed by final tillage or contact herbicide just prior to planting. Ideally, this practice would result in the shortest period of bare ground and would get grass seedlings up as quick as possible to compete with other weeds.

Fertility

While warm-season grasses are good producers on low-fertility soils, adequate P and K will increase stand vigor and production when these elements are low in the soil. Having the soil tested is the only way to know the proper level of P, K and lime to use. Lime is not necessary if soil pH is 5.5 or higher.

Nitrogen is not recommended when establishing warm-season grasses because it leads to increased competition from weeds. However, established stands will respond positively to 40 to 60 pounds of N per acre. Nitrogen should be applied when early growth is at least 3 to 5 inches tall. Earlier application will favor weeds and invasion of cool-season grasses into the stand.

Seeding Rates for Pasture and Hay

For pasture or hay use, only one species should be seeded per field. Warm-season grasses vary in growth characteristics (Figure 1) making it difficult to manage mixtures. Seeding rates for pasture and hay are found in Table 2.

Table 2. Seeding Rate for Species Planted Alone

Species	Seeds per pound	Pounds of pure live seed (PLS) per acre
Big Bluestem	165,000	7
Switchgrass	389,000	4
Indiangrass	175,000	7

Warm-season grass seed should be bought and seeded on a pure live seed (PLS) basis. To determine the percent PLS, multiply percent germination by percent purity and divide by 100. Certification requirements for switchgrass, big bluestem and indiangrass are lower for germination and purity than for cool-season forages like tall fescue and red clover (Table 3). For example, a bag of certified seed of indiangrass weighing 100 pounds may contain only 11 pounds of pure live seed. Be sure to determine how much bulk seed is required to deliver the required pounds of pure live seed per acre (Table 4).

Table 3. Minimum purity, germination, and pure live seed (PLS) content of certified seed. Information from Missouri Seed Improvement Association.

Crop	Pure Seed	Germination[1]	%PLS
	%	%	%
Tall Fescue	95	80	76
Red Clover	99	85	84
Switchgrass	80	50	40
Big Bluestem	90	70	63
Indiangrass	25	45	11

[1]Includes % hard seed for red clover and dormant seed for warm-season grasses.

Table 4. Determining bulk seed required from % PLS and desired PLS seeding rate.

	Desired lb PLS/A									
%PLS	1	2	3	4	5	6	7	8	9	10
	Pounds Bulk Seed									
10	10	20	30	40	50	60	70	80	90	100
15	7	13	20	27	33	40	47	53	60	67
20	5	10	15	20	25	30	35	40	45	50
25	4	8	12	16	20	24	28	32	36	40
30	3	7	20	13	17	20	23	27	30	33
35	3	6	9	11	24	17	20	23	26	29
40	3	5	8	10	13	15	18	20	23	25
45	2	4	7	9	11	13	16	18	20	22
50	2	4	6	8	10	12	14	16	18	20

To use Table 4, locate the percent PLS of the seed to be planted in the column on the left and the desired PLS planting rate in the row along the top. The proper bulk seeding rate is found where the '%PLS' column and 'lb PLS/A' row meet. For example, if big bluestem is 40% PLS and the desired seeding rate is 7 pounds PLS per acre, 18 pounds of bulk seed would have to be drilled per acre.

Seed of native grasses typically contains higher percentages of dormant seed than do introduced cool-season grasses or legumes. Dormant seed is assumed to be alive and is counted in total germination, but seed companies are not required to specify the percent dormant seed on the label. With the new minimum seeding rates, first-year stands can be sparse simply due to dormant seed. As a consequence, stands should not be considered a failure until the second summer at the earliest. If one or more seedling is found per square foot of soil, the stand will be adequate.

Variety Selection

Native (local) seed and certified varieties are both acceptable as seed sources in Missouri. Use seed harvested from native stands near the place of origin, and use named varieties when adaptation to the area has been demonstrated (see Table 5).

For native or non-certified seed, use seed whose place of origin is within 250 to 400 miles south, or within 100 to 150 miles north of the intended location of use. Extreme southern-grown seed may produce stands that die during winter or at least not produce viable seed. Stands planted to northern-grown seed will tend to mature early and be less productive.

Named or certified cultivars are selections whose characteristics are known and whose area of adaptation has been determined. The location where certified seed are produced is less critical than with native seed. The important characteristic of named varieties is that they have proven adaptation in the area to be seeded. Varieties adapted to more northern sites will have the same general limitations as native seed grown in those regions. For example, 'Holt' indiangrass was developed in Holt County, Nebraska, which is more than 140 miles north of the Missouri-Iowa line. 'Holt' was very early maturing and was low in productivity in trials at the SCS Plant Materials Center at Elsberry, Missouri and at the Forage Systems Research Center at Linneus. All species were harvested only once in late July or early August, and yields represent a relative estimate of bulk productivity. No effort was made to harvest them according to stage of maturity. Be aware that productivity is difficult to predict in native grasses because individual sites are variable and maturity dates vary with latitude. Early maturity usually means less forage production. Moving northern adapted varieties south shortens time to maturity and vice versa.

Management and Utilization

During the seeding year, warm-season grasses should not be grazed unless forage production is exceptional. Mowing or 2,4-D can be used to control weeds in seedling stands. After June, leave at least 6

inches of grass stubble when mowing. Applications of 2,4-D can be made after the grass has four or five leaves. In the second year, 2 pounds of atrazine may be used in switchgrass, big bluestem and indiangrass (established indiangrass is tolerant of atrazine) to control annual grass weeds.

Warm-season grasses can be utilized for hay production, grazing or both. In general, pastures should not be clipped or grazed too often or too short, or yield and vigor will suffer the following year.

Switchgrass begins growth two to three weeks earlier than big bluestem which is about a week earlier than indiangrass (Figure 1). Quality of switchgrass is good if grazed early but very poor if grazing is delayed until heading. Generally, grazing of switchgrass needs to begin before the cool-season forage is depleted or switchgrass will be too far ahead of the cattle. Beginning later will result in poor animal acceptance and gains. Start grazing when switchgrass is 10 to 12 inches tall and graze heavily so it is grazed down to about 4 inches in two to three weeks. Remove the cattle and allow a month to recover. Graze the regrowth to no less than an 8-inch stubble height. Leave at least 8 inches of leaves and stubble after September 1. The plants stop growth in early September and need the stubble to survive the winter.

Separating the switchgrass into smaller pasture units and grazing rotationally is recommended to provide more control over the grazing period and to stagger pasture availability. Also, it is difficult to manage switchgrass pastures as the sole source of forage from June through August. Having the option to move back onto a rested cool-season pasture or to another warm-season pasture such as big bluestem will help make it more practical to work around the long rest periods in the switchgrass rotation.

Big bluestem and indiangrass are later maturing than switchgrass and are more complementary in grazing systems with cool-season grasses. Rotational grazing should be practiced beginning when forage is 12 inches to 18 inches tall (about June 1), removing cattle when 6 inches of leaves and stubble remain. Allow three to four weeks recovery time depending on moisture. Manage pastures so that 8 inches of leaves and stubble are present on each pasture when grazing ends in early to mid-September. For haying followed by grazing, cut in the boot stage leaving a 3- to 4-inch stubble. Graze lightly from August until September 1 leaving 8 inches of stubble.

Special Uses of Warm-Season Grasses

On critical areas, warm-season grasses will control erosion. They will provide low maintenance cover on banks and roadsides of state and U.S. highways.

Also, wildlife biologists and upland game managers use warm-season grasses for game habitat, nesting and holding areas. The stubble of the grasses remains erect over the winter providing nesting cover and protected "trafficways." Little bluestem, lovegrass and sideoats grama are usually in these seeding mixtures in addition to big bluestem and indiangrass.

Warm-Season Grass Forage Quality

Forage quality measurements (protein, fiber, digestibility) of warm-season grasses have consistently been lower than measurements for cool-season grasses at the same growth stage. This quality difference has led scientists to conclude that warm-season grasses would be poor feed for growing livestock. However, more careful studies of actual animal gains from cool-season and warm-season pastures has revealed that native grass pastures may be much more nutritious than their quality analysis indicates. In a University of Missouri trial at the Forage Systems Research Center at Linneus, Mo., milk production of beef cows grazing big bluestem was equivalent to that of cows grazing high-quality bromegrass-alfalfa pastures.

It is now clear that it is unfair to compare native grasses and cool-season grasses according to chemical analyses alone. However, no better system has been found. The University of Missouri is continuing to study how to accurately describe the forage quality of native grasses.

Summary

Native warm-season grasses are good viable options to complement present cool-season pastures in north and south Missouri. Good management at establishment and afterward will result in high-yielding, high-quality forage during the summer months when cool-season grass pastures are at a disadvantage.

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Table 5. Recommended varieties of warm-season grasses for Missouri, 1987.

Grass Cultivar	Yield[1] tons/A	Comments
BIG BLUESTEM		
Rountree	3.4	Preferred variety for hay production, adapted statewide. Good seedling vigor and forage productivity. Matures two weeks earlier than Kaw. Origin: Iowa
Kaw	2.9	Preferred pasture variety, adapted statewide, especially to droughty sites. Origin: Kansas
Pawnee	2.8	Adapted to North Missouri only. Maturity similar to Rountree. Origin: Nebraska
INDIANGRASS		
Rumsey	3.0	Preferred variety, adapted statewide. Good seedling vigor and superior forage production given normal rainfall. Does not establish well in dry years. Origin: Illinois
Osage	2.7	Adapted statewide. Well adapted for droughty sites. Origin: Kansas.
Oto	2.3	Acceptable for North Missouri only. Origin: Nebraska
Cheyenne	—	Not a certified variety, although noncertified seed is available. Adapted to droughty sites and has been used statewide with good success by Missouri Department of Conservation. Origin: Oklahoma
Holt	2.4	Adapted for North Missouri only. Very early maturing. Origin: Holt County, Nebraska
Nebraska 54	—	Adapted for North Missouri. More productive than "Holt". Origin: Nebraska
SWITCHGRASS		
Cave-In-Rock	—	Preferred variety, adapted statewide. Adapted to lowland and upland sites with good palatability and animal gains. More dormant seed than "Blackwell" and tends to be slow to establish. Origin: Illinois
Pathfinder	3.7	Adapted statewide. Easier to establish than "Cave-In-Rock". Origin: Nebraska
Trailblazer	—	Adapted statewide. Selected from "Pathfinder", for increased palatability and digestibility. Gives superior animal gains in Nebraska. A poor establisher. Origin: Nebraska
Blackwell	—	Adapted statewide. Less forage production than "Cave-In-Rock". Fine-stemmed and rust-resistant. Origin: Blackwell, Oklahoma
Alamo	—	Later in maturity than "Kaw" big bluestem. Adapted to South Missouri only. About 30% winterkilled at Clinton, Missouri. A lowland type that is slow to establish. Origin: Texas

[1] Data from Forage Systems Research Center, 1984-86, one harvest per year.

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