



Warm-Season Grasses

Native, perennial warm-season grasses such as switchgrass (*Panicum virgatum* L.) and big bluestem (*Andropogon gerardi* Vitman) grow primarily during the warm part of the summer. They produce well compared to cool-season grasses during the hot and dry weather of July and August and on soils with low moisture-holding capacity, low pH, and low phosphorus levels.

Although recognized as a summer component of a pasture system, warm-season grasses can be harvested and stored as hay. Primary growth of the warm-season grasses is in mid-summer (65 to 75 percent) and can be used to complement a cool-season grass forage program. Their establishment and management requirements are quite different from cool-season grasses. First-time users must pay special attention to details of managing these grasses. When managed properly, warm-season grass hay can provide good quality forage, especially for beef cattle. In digestibility trials conducted at Penn State over a three-year period, warm-season grasses were 65 percent digestible and orchardgrass was 68 percent digestible. Two warm-season grasses adapted to Pennsylvania are switchgrass and big bluestem.

ADAPTED VARIETIES

Switchgrass is a tall-growing bunch grass that tolerates poorly drained soils, flooding, and perched water tables better than other warm-season grasses. With proper management, stands in Pennsylvania have remained productive for 20 years. Varieties of switchgrass used in Pennsylvania are Blackwell and Cave-In-Rock. Blackwell and Cave-In-Rock are highly productive varieties that head in early and mid-summer, respectively. Trailblazer, a variety selected for increased digestibility and palatability, does not persist well under Pennsylvania conditions.

Big bluestem is a tall-growing bunch grass that is more drought tolerant than other warm-season grasses and thus is better adapted to excessively drained soils with low

water-holding capacity. Niagara is a variety that is especially adapted to Northeast conditions. Forage quality of Niagara is good, it is tolerant to leaf spot, and it matures early in the summer.

ESTABLISHMENT

Warm-season grasses grow best on deep, well-drained soils. However, if they must be seeded in a poorly drained site, switchgrass is more tolerant than is big bluestem. Both switchgrass and big bluestem have been established on low-fertility and low-pH (4.6) soils without adding lime or fertilizer. However, warm-season grasses establish faster on low-fertility soils when fertilizer is applied.

Warm-season grasses should be seeded alone, either on a conventional, tilled seedbed or no-tilled into grain stubble between mid-April and mid-May. Later seedings are slower to establish, yield less, and have more weed infestation the year after seeding (Table 1). Successful spring seedings have also been made by no-tilling warm-season grasses into a small grain crop that has been killed with a herbicide. Good seed and soil contact is very important for establishment of warm-season grasses; therefore, a tilled seedbed should be free of weeds, fine textured, and firm. Plowing, disking, harrowing, and cultipacking generally are required. Band seed ½ inch deep with a drill equipped with press wheels. If broadcast seeded or drilled without press wheels, rolling or cultipacking after seeding is necessary to ensure a good firm seedbed.

Switchgrass seed is hard and smooth and can be handled without special drills. Big bluestem seed is chaffy and will not flow well unless it has been debearded, a process that removes the chaff and hair from this seed. Switchgrass and bluestem seeding rates of 8 to 10 and 10 to 12 pounds per acre, respectively, of pure live seed are recommended for vigorous stand establishment. Pure live seed is easily calculated ($\% \text{ germination} \times \% \text{ pure seed} / 100$). Most

Table 1. Effect of planting date on Blackwell switchgrass and weed yields one year after seeding.

Component	Planting date				
	Early-mid May	Mid-late May	Early-mid June	Mid-late June	Early July
	lbs/acre				
Switchgrass	3,298	5,081	3,418	338	48
Weeds	276	143	260	1,057	1,053

Adapted from: Panciera, M. T., and G. A. Jung. 1983. Switchgrass establishment by conservation tillage: Planting date response of two varieties. *J. of Soil and Water Conservation* 39:68-70.

attempts to establish and manage a switchgrass or big bluestem mixture with either alfalfa or red clover have not been successful. The legume dominates the mixture within 2 years. However, recent research has shown that legumes can be maintained in a stand with warm-season grasses if the legume and grass are seeded in alternate rows and harvest in the spring is based on the warm-season grass.

In ideal conditions, warm-season grasses can establish and reach a height of 5 feet in the year of establishment. However, it generally takes 2 years to reach their maximum growth potential because of slow germination and seedling growth. Stands that appear poor at the end of the first year usually develop into good stands the second year. It is important to evaluate the stands at the end of the seeding year. If there are at least one to three seedlings per square foot in September, the stand is adequate.

Weeds can be very detrimental in the seeding year because of the slow growth of warm-season grass seedlings. Because warm-season grass seedlings are poor competitors with weeds, sites with severe perennial weed problems such as quackgrass or broadleaf weeds should be avoided. Following recommended establishment procedures can help reduce weed pressures. If plowing and disking are done early, weeds can be allowed to germinate and then be eliminated with a contact herbicide or a light harrowing or disking before seeding. Mowing weeds to reduce shading may be beneficial and should be done at a height above the grass seedlings and not later than early August. Broadleaf weeds can be controlled with herbicides when the grasses are seedlings. Refer to the *Penn State Agronomy Guide* for current herbicide recommendations and label restrictions.

HARVEST MANAGEMENT

The seeding year stand should not be harvested unless there is unusually good growth and the stand is vigorous. Established plants should be cut or grazed when they are 18 to 24 inches high (late boot stage). Leave a 4- to 6-inch stubble for rapid regrowth. Liveweight gains of 2.5 pounds per day have been obtained when steers grazed warm-season grasses. While warm-season grasses are normally harvested twice or grazed for a short period of time during the late summer, they produce relatively high yields (Table 2). Enough time should be allowed for at least 12 inches of fall regrowth before frost. Plants can be harvested after frost without damage to them.

Insects normally are not a problem on warm-season grasses. However, leaf spot can be a problem on big bluestem. Use a resistant or tolerant variety to avoid it.

Normally, a well-managed, vigorous stand should not have a broadleaf weed problem. However, thin stands may require some weed control. For chemical control of broadleaf weeds, refer to the *Penn State Agronomy Guide*. Perennial cool-season grasses that may invade warm-season grass stands can be somewhat controlled by spring grazing.

FERTILITY

While warm-season grasses are good producers on low-fertility soils, adequate P and K will increase stand vigor and production when these nutrients are low in the soil. Determine lime and fertility needs by a soil test. Lime is

Table 2. Yield of warm- and cool-season grasses grown on shallow, droughty soils (SDS) or deep, fertile soils (DFS).

Species	Soil type	
	SDS	DFS
Switchgrass	3.53	3.80
Big bluestem	3.02	3.47
Tall fescue	1.69	4.83
Orchardgrass	1.36	3.99
Reed canarygrass	1.73	4.07
Timothy	0.82	3.76

Compiled from Penn State, USDA-Pasture Laboratory, and USDA-SCS reports from 1982 through 1993.

not necessary if soil pH is above 6.0. In the absence of a soil test, apply 0-60-60 pounds per acre. Nitrogen is not recommended to use at establishment because it leads to increased competition from weeds. However, on sites with low fertility, good weed control, and a good stand of grass, apply 25 to 30 pounds N per acre.

Maintain a pH of 6.0 or higher. Apply phosphorus and potash based on soil test. On established stands, apply 75 pounds nitrogen per acre annually in May when plants are less than 8 inches tall. Do not apply nitrogen in early spring.

SUMMARY

Warm-season grasses such as big bluestem and switchgrass can provide forage for animals throughout the summer months when cool-season grasses become less productive. Warm-season grasses establish relatively slow; however, if they are properly managed, a stand of warm-season grasses can last for many years. Because of the expense and difficulty in establishment, these grasses should be established as permanent sod pastures or hay fields. Warm-season grasses are not as well suited for crop rotation as the cool-season forage crops.

Prepared by Marvin H. Hall, professor of forage management.

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