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## Warm-Season Grasses for Hay and Pasture

Switchgrass, Indiangrass, and big bluestem are warm-season grasses that are a suitable alternative for summer pasture in Iowa. Their advantage over cool-season grasses such as bluegrass, bromegrass, and orchardgrass is their ability to produce during midsummer.

These warm-season perennial grasses start growing in late spring as air and soil temperatures increase. Leaf growth often occurs in early May in southern Iowa and by mid-May in northern Iowa. Growth may start slightly earlier on south-facing slopes. Greatest growth occurs from June through September. Growth slows in the autumn and ceases with the first killing frost.

Pasture efficiency may be improved by converting one-fourth to one-third of the cool-season grass pasture acreage to a warm-season grass to be used in conjunction with cool-season grasses. Cool-season grasses can be grazed in the early and late parts of the grazing season, with the warm-season grasses grazed during midsummer. This scheme provides a larger and more uniform supply of forage, and greater seasonal animal gains can be expected. Furthermore, the cool-season grasses can be given a rest during midsummer. This improves their vigor and provides a greater supply of forage for late-summer and fall grazing.

### Adaptation

Switchgrass, Indiangrass, and big bluestem have been the most frequently used warm-season grasses in Iowa. They are winterhardy and will grow in all areas of the state. They produce best on fertile, well-drained soils with a good moisture supply. Switchgrass and Indiangrass withstand moderately wet soil conditions and occasional flooding. Switchgrass also tolerates more droughty soils than big bluestem or Indiangrass.

These grasses can be seeded alone or as a mixture. Seeding a single grass species is preferred because mixed species are more difficult to manage. Cool-season grasses generally are not recommended for planting with warm-season grasses because of strong competition from cool-season grasses in the spring.

Switchgrass often is the first choice among farmers trying a warm-season grass for the first time. This species has been more easily established and less expensive than big bluestem or Indiangrass; however, it sometimes is considered to be less palatable.

### Species Description and Varieties

**Switchgrass** (*Panicum virgatum L*) is a tall, rhizomatous perennial that grows 3 to 5 feet tall. It appears bunchlike, but the short rhizomes may produce a coarse sod. The early growing point is the developing seed head that terminates in a large spreading panicle by mid-July. During the growing season, leafy regrowth develops from basal shoots emerging along the lower stems at leaf nodes.

In the immature stage, leaves and stems of switchgrass have good forage value and are readily grazed by livestock. Palatability and nutrient content of stems decline rapidly after heading.

Improved varieties of switchgrass which are suggested for use in Iowa are Blackwell, Pathfinder, Cave-in-Rock, Trailblazer, and Sunburst.

**Big bluestem** (*Andropogon gerardi*) is an erect, robust, perennial bunchgrass. It produces foliage in late spring from buds at basal nodes and from short, scaly rhizomes. Growing points stay close to the ground until late-summer. Seed heads appear in August and September.

Big bluestem grows 3 to 6 feet tall and often is reddish-purple at maturity. The seed head consists of two or three racemes which arise from a common joint of the seedstalk, resembling a turkey's foot. It is considered more palatable than switchgrass or Indiangrass, especially after maturity. Rountree, Kaw, and Pawnee varieties are suggested.

**Indiangrass** (*Sorghastrum nutans L*) is an erect, robust perennial growing 3 to 6 feet tall. It has short, knobby rhizomes and spreads slowly. When headed, it has a narrow panicle 6 to 12 inches long.

Indiangrass starts regrowth somewhat later than switchgrass and provides good-quality forage during much of the summer. It is considered moderately palatable after heading.

The varieties Nebraska 54 and Rumsey are suggested for all of Iowa. Holt matures earlier and may be used for northern Iowa.

Other warm-season grass species such as the little bluestem (*Schizachyrium scoparium*), side-oats grama (*Bouteloua curtipendula*), and Eastern gamagrass (*Tripsacum dactyloides*) also are adapted to Iowa conditions. There has been less research and producer experience with these lesser-used species in Iowa so there still is much to be learned about variety adaptation, specific establishment practices, and harvest or grazing management.

## Yield and Quality

Dry matter yields of switchgrass, big bluestem, and Indiangrass for pasture or hay are greatly influenced by stand density and nitrogen fertilization. Iowa studies of these three grass species show hay yields of 2.0-2.5 tons per acre of dry matter when no fertilizer nitrogen was applied. Yield response to nitrogen application is found in Table 1. Similar yields have been reported from studies in eastern Nebraska and Missouri.

**Table 1. The effect of nitrogen fertilization on dry matter yield, % crude protein and % IVDMD of switchgrass, big bluestem, and Indiangrass. Summarized from three research studies in Iowa, 1972-92.\***

N Level	Dry Matter Yield	% CP	% IVDMD
lb/A	T/A		
<b>Switchgrass</b>			
0	1.83-2.82	6.0-10.4	47.0-64.0
67	3.19-3.58	7.5-15.9	48.6-66.0
120-134	3.00-4.54	8.4-12.0	50.6-66.0
201	5.26	9.1	51.7
240-268	3.56-5.80	9.5-14.1	51.7-67.0
<b>Big bluestem</b>			
0	2.30	11.1	54.0
67	3.07	15.1	55.0
134	3.11	12.6	55.5
268	3.00	9.4	58.1
<b>Indiangrass</b>			
0	2.23	8.9	54.7
67	2.54	15.0	55.2
134	2.55	11.7	58.1
268	2.93	8.8	61.1

\*Yield and quality of switchgrass varied with thickness of stand and cutting management in these studies.

Forage quality often is estimated by an analysis of crude protein and *in-vitro* dry matter disappearance (IVDMD). The IVDMD percentage is an estimate of the digestibility of the forage by a ruminant animal. Crude protein and IVDMD values for switchgrass, big bluestem, and Indiangrass harvested in Iowa are summarized in Table 1. Crude protein and IVDMD in the forage both can be increased with added nitrogen and by grazing or

harvesting the forage at an earlier stage of growth. On the same calendar date, big bluestem and Indiangrass are less mature than switchgrass and often are considered to be higher in these quality estimates and to be more palatable than switchgrass.

Iowa grazing research conducted in 1975-77 evaluated a traditional cool-season/warm-season/cool-season rotation. These studies showed that animals grazing switchgrass pastures gained more weight during the mid-summer graze period than those grazing smooth bromegrass under continuous grazing during the same months (Table 2).

**Table 2. Grazing days, animal performance, carrying capacity, and liveweight gain for steers on summer pastures. Western Iowa Research Center, Castana, Iowa, 1975-77.**

Type of pasture	Grazing days/ summer	Avg. daily gain (lb.)	Steer days	Live-weight gain (lb.)
Smooth bromegrass	58	1.38	96	132
Switchgrass	67	1.45	139	201

Another study (1978-80) used smooth bromegrass and switchgrass in rotation, but began the grazing of switchgrass about 10 days earlier, in late June, when the switchgrass had not yet produced seed stems. Table 3 shows the summary of this study and indicates that the steer average daily gain (ADG) was improved and that an earlier rest for the smooth bromegrass allowed an earlier autumn cool-season grazing and a late grazing of switchgrass regrowth.

New research at the Western Iowa Research Farm in 1993-94 has focused on an even earlier warm-season grazing management to allow use of the warm-season grasses when they are at their nutritional best. In these studies, the first grazing of warm-season grasses occurs in early June, two to three weeks earlier than the normal late June/early July start date. The warm-season grasses are grazed for 10-14 days when switchgrass and big bluestem are still leafy (10-20" tall). Following a second early-summer grazing of cool-season pastures in the rotation, warm-season grass regrowth is again grazed through late July and much of August. Using this earlier grazing of warm-season grasses approach, beef steers grazing high quality warm-season grass forage average 2.25 to 3.0 lbs. ADG. The early leaf removal slows seed stem development, resulting in higher quality forage during the summer grazing period.

## Fertilizing at Seeding Time

Soil deficiencies in lime, phosphorus, and potassium should be corrected before or at seeding time. Lime and fertilizer suggestions based on soil tests are the same as for cool-season grasses. The pH level should be at least 6.0. If phosphorus and potassium levels are low, apply at least 60 pounds of each per acre. Experience in Iowa

**Table 3. Length of grazing periods, animal performance, carrying capacity, and liveweight gain data for a smooth brome-grass-switchgrass grazing system. Western Iowa Research Center, Castana, Iowa, 1978-80.**

Grazing sequence	Days	Avg. daily gain, lb.	Steer days per acre	Liveweight gain per acre during grazing period, lb.
Smooth brome-grass	39	1.66	154	251
Switchgrass	43	1.43	129	168
Smooth brome-grass	34	1.26	51	69
Switchgrass	22	2.13	54	108
<b>Percent of grazing time from pasture components</b>				
Smooth brome-grass			52%	
Switchgrass			48%	
<b>Per-animal performance (weighted avg. daily gain, lb.)</b>				
Smooth brome-grass		1.48		
Switchgrass		1.66		

indicates that nitrogen should not be applied at seeding time. Even small amounts stimulate weeds and retard warm-season grass establishment. If weed control has been good in the seeding year, an application of 30 pounds per A of nitrogen in midsummer could stimulate more rapid switchgrass establishment.

## Seeding

Warm-season grasses can be seeded from late-April to June 15. Earlier seeding provides more time for these grasses to become well established before winter.

Warm-season grasses are most frequently seeded into tilled seedbeds. Seed often is broadcast and firmed in with a corrugated roller. Results will be better if a grain drill, grassland drill, or double-corrugated roller seeder is used. Drilling the seeds about 1/2-inch deep with packing over the row is best. The light, chaffy seeds of Indian-grass and big bluestem are difficult to seed without a special grassland drill.

Switchgrass seed is clean, free flowing, and can be seeded with a grain drill or other standard forage seeding equipment. Indiangrass and big bluestem seeds are light, chaffy, and difficult to seed without a special grassland drill. Seed conditioning equipment has been developed to "de-beard" or remove the long, hairy appendages from big bluestem and Indiangrass, making the seed free flowing and more easily seeded through standard forage seeders. Debearded seed provides improved seed purity and seeding efficiency with available equipment.

Warm-season grasses are sometimes drilled into mulched seedbeds. Mulch can be provided by shredding residue from a previous crop of corn, grain sorghum, or forage sorghum. A mulch also can be provided by drilling into a dead stand of fall-sown oats or sorghum residue. Mulch helps control erosion and conserve soil moisture. Successful stands have been established in mulches both from dormant seedings after the first of November and from spring seedings.

Another option for seeding switchgrass, big bluestem, and Indiangrass is to disk several times to kill successive crops of weeds in spring, and to seed about June 1. Seedbeds should be well tilled and firmed with a corrugated roller prior to and after seeding. Satisfactory switchgrass stands also have been established in southern Iowa by interseeding into herbicide-killed cool-season grass pastures. Burn-down herbicides are necessary to achieve adequate suppression of the old sod. A good interseeding management program must be followed.

Recent research at Iowa State University has shown that forage legumes such as alfalfa, red clover, birdsfoot trefoil and sweetclover can be successfully interseeded and frost seeded into established switchgrass sod. Thus far the research has been conducted on mechanically clipped stands with performance under grazing conditions yet to be tested.

## Seeding Rate

Warm-season grass seed lots vary widely in purity and germination. Germination percentages typically are less than 80%. Therefore, it is important to consider the percentage of pure live seed (PLS) when determining seeding rates for warm-season grasses. The PLS is calculated by multiplying the percent of purity by the percent of germination on the seed tag. Most suppliers of warm-season grass seed market and price on a PLS basis.

It is suggested that the seeding rate used provide about 40-50 live seeds per square foot of area seeded when precision seed placement and good seed-to-soil contact are assured. Consider using 25% more seed if broadcasting.

Use the information in Table 4 to determine seeding rate.

**Table 4. Seeding rates for warm-season grasses.**

Species	Seeds per lb.	Seeds per sq. ft. 1 lb./A PLS	Lbs. PLS per acre
Switchgrass	389,000	9	5-6
Indiangrass	175,000	4	10-12
Big bluestem	165,000	4	10-12

## Management During Establishment

Warm-season grasses often establish slowly and compete poorly with weeds. When established under heavy weed infestations, plants grow very slowly and may require 2 to 3 years before the stand is ready to graze. Switchgrass may become well established during the seeding year if weed competition is light. Big bluestem and Indiangrass may not establish as rapidly as switchgrass.

Weed competition during the seeding year can be reduced by mowing. Mowing at a height of 3 to 4 inches can be done early in the season. At this time, the grass plants are small and will not be clipped off. During June and July, clip to at least 6 inches high. If much of the grass plant is clipped off, vigor will be markedly reduced. Avoid all clipping after August 1.

If broadleaved weeds are a serious problem, consider spraying with 2,4-D at about 1/2 pound per acre. Spray after seedling grass plants have reached the 3- to 4-leaf stage.

It usually is best not to graze warm-season grasses during the year of seeding. Grazing young, immature plants is especially harmful. However, if a vigorous stand is obtained and the plants are in head, some grazing is possible. This usually will be in late-September or in October. A seed harvest can be made without serious injury to the plants if seed heads mature in the seeding year.

## Management of Established Stands

Warm-season grasses should not be grazed until they reach 16-20 inches or more in height. This usually will be by mid-June in southern Iowa counties and mid- to late-June in central and northern counties. Growth is usually rapid during July and early August.

The intensive grazing of warm-season grasses in Iowa is relatively new and understanding of proper grazing management is incomplete. Research in Nebraska and Kansas shows that overgrazing warm-season grasses can result in stand loss.

Observations of cattle grazing switchgrass reveal that they prefer to eat the less fibrous plant parts, leaves, young stem tips, basal tillers, and volunteer seedlings. When managing established switchgrass, close observation of the animals, the plant parts being consumed, and the quantity of desirable plant tissue remaining may be more important than stubble height. If the supply of desirable plant tissues is depleted midway through the summer, rotation of the livestock to another pasture or supplemental feeding of hay should be considered to reduce the risk of overgrazing. Summer regrowth is in the form of basal tillers and side shoots emerging along lower stems. This regrowth is leafy, palatable, and high in nutritional quality.

Warm-season grasses cease growing after frost and can be grazed safely without expected harm to livestock or the stand. It is desirable to provide warm-season grasses with a "fall rest period" for maintenance of

winter-hardiness and plant vigor as is done with perennial forage legumes.

Missouri research shows that switchgrass harvested for hay can be cut at a 3- to 4-inch height with only a slight reduction in stand vigor. Leaving a 5- to 6-inch stubble is recommended.

Cool-season grasses and broadleaf weeds can be managed with prescribed burning. Broadleaf weeds can be controlled by spraying with the amine or low-volatile ester form of 2,4-D. Spray when weeds are small. Use rates suggested for pasture weeds.

## Fertilizing Established Stands

Warm-season grasses respond to fertility as do cool-season grasses. A soil test is the best guide for maintenance rates of phosphorus and potassium. A general suggestion is 30 pounds each of P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O per acre annually. The rate and timing of phosphorus and potassium applications are the same as for cool-season grasses. However, the rate and time of nitrogen application is different.

Nitrogen should not be applied until the warm-season grasses have started spring growth, which is about mid-May. Earlier applications will stimulate weeds and encourage encroachment of cool-season grasses.

Lower nitrogen rates sometimes are suggested for warm-season grasses than for cool-season grasses. This is partly to avoid carryover, which can be as harmful as early spring applications.

For a single application, apply 80 to 100 pounds of nitrogen per acre in early to mid-May. For higher rates, split the application with half in May and half in early July. Higher rates should only be used on thick, well-managed stands.

## Summary

Warm-season grasses are a suitable alternative for summer pasture in Iowa. They can provide productive grazing during mid-summer when cool-season forage is in short supply. The current acreage in Iowa is small, but interest is growing in light of improved varieties and management techniques.

Success with warm-season grasses depends on recognizing that management requirements are different from those normally followed for cool-season grasses. Differences in establishment procedure, fertilization, and grazing management are especially important.

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