



Summer-Annual Grasses for Supplemental or Emergency Forage

Shortages of forage crops in Pennsylvania most often occur during the summer, when dry conditions have reduced the productivity of pastures, hay crops, or silage corn fields. Summer-annual grasses, which maintain relatively high levels of production during hot and dry conditions, can greatly reduce the risk of inadequate forage production during the summer. They also can be used as an emergency forage source when production of corn and hay crops is likely to be less than adequate.

PLANT DESCRIPTIONS

Summer-annual grasses differ in growth and production potential but have several similar characteristics. They grow best at relatively high temperatures (80° F) and can produce under conditions of limited moisture.

Sorghum is an upright-growing grass that has been bred for both grain and forage production. The grain sorghum types are relatively short growing (less than 6 feet) and provide moderate yields when harvested as a forage. Forage sorghum, on the other hand, grows tall (6 to 15 feet) and has the potential for high yields. Of the two types, forage sorghum is preferred for forage production. Like corn, sorghum hybrids are classified by maturity. Late-maturing sorghums yield more than earlier-maturing types, but they may not reach maturity before a killing frost. Forage sorghums are usually harvested only once and are used for silage or green-chop production.

Sudangrass usually grows between 3 and 8 feet high and has stems about 1/4 inch in diameter. Solid stands of sudangrass grow shorter than when seeded in rows. Sudangrass develops only fibrous roots and does not have rhizomes. However, many stems may develop from a single seed if space is available. Sudangrass will regrow following each harvest until cool temperatures or lack of moisture inhibit growth.

Sorghum-sudan hybrids or Sudax resemble sudangrass but are taller, have larger stems and leaves, and give higher yields. Hybrids tend to be coarser than sudangrass and vary in seed color and size, yield, and growth characteristics, depending on their parents. Like sudangrass, sorghum-sudangrass hybrids will regrow after each harvest unless environmental conditions are restrictive.

Millet has smaller stems and is more leafy than the sorghum, sudangrass, or sorghum-sudangrass hybrids. Pearl millet will regrow after harvest but not as rapidly as either the sudangrass or sorghum-sudangrass hybrids. German or

Foxtail millet, however, does not regrow after harvest. Millet yields are usually lower than yields of sorghum-sudangrass hybrids.

ESTABLISHMENT

Summer annuals should be planted from two weeks after planting corn until the end of June. Soil temperatures should be at least 60° F. Seedings may be made as late as July 15 in emergency situations, but yields will be reduced because of limited moisture in the summer and cool temperatures during the fall. When using any of the summer-annual crops in a planned rotational grazing situation, two seedings should be made about three weeks apart. This will stagger the maturities and make grazing management easier.

Forage and grain sorghum planted for forage should be planted in rows to facilitate harvest and minimize lodging. Avoid planting sorghums too deeply, as emergence problems may occur if planting is deeper than 1 inch in most Pennsylvania soils. Also, avoid seeding rates above 10-12 lb per acre since such rates can increase the risk of lodging, particularly with the tall forage sorghum types. Corn planters work well for planting sorghum provided the appropriate plates or feed cups are used to achieve the desired seeding rates (Table 1). Sorghum can be planted using any tillage system as long as adequate weed control can be achieved.

Table 1. Suggested seeding rates for summer-annual forage grasses in Pennsylvania.

Seeding method	Soil moisture expectations	
	Dry	Moist
lb/A		
Rows	8	12
Grain drill	10	15
Broadcast	20	30

Fewer herbicides are labeled for grain and forage sorghum than for corn, so select fields where weeds can be controlled with labeled herbicides. When using Lasso or Dual, be sure to use seed that has been treated with the appropriate safener. When planting after a failed corn crop, be sure that the herbicides used on the corn are labeled for sorghum.

The other summer-annual species can be broadcast seeded and cultipacked or seeded with a grain drill into a



well-prepared seedbed. A firm, well-prepared seedbed is best, although acceptable stands may be established without tillage using no-till drills. Solid seedings result in finer and shorter plants, which are desirable for silage and grazing. Wider row spacings (20-36 inches) allow for cultivation and result in better regrowth and more uniform production throughout the season. Narrow rows make for intense competition, and herbicides are rarely necessary when seeding is done in this fashion. Only a few herbicides are labeled for these summer-annual crops, so weed control should be considered carefully in selecting a row spacing. Row spacing itself, however, has relatively little effect on total forage production. Seeding rates vary, depending on seeding method and anticipated moisture conditions (Table 1).

Plant sudangrass, sorghum-sudangrass hybrids, and millets 1 inch deep in medium to heavy soils and 1 1/2 inches deep in sandy soils. If the soil is dry and rain is not anticipated before seedling emergence, cultipack the seedbed to maximize seed-to-soil contact and moisture conservation.

FERTILIZATION

For forage production, fertilize grain and forage sorghums using soil test recommendations. In lieu of a soil test, fertilize similarly to corn silage. Starter fertilizers can be used and should be most beneficial on the earliest plantings.

Fertilization of the other summer-annual grasses should be similar to that of other annual grass crops. Apply sufficient nitrogen (N) (40 to 80 lb per acre) at planting to ensure establishment and stimulate plant development. Use the low rate of N when manure has been applied and when planting after a failed corn crop that already received N. Another 50 lb of N after the first harvest is also recommended for optimum production. Crude protein content of these grasses is directly related to rate of N fertilization. In a Pennsylvania study, crude protein content of summer-annual grasses was 7.7 percent when 50 lb of N was applied and 11.4 percent when 200 lb was applied. However, caution must be exercised to avoid nitrate poisoning when high rates of nitrogen fertilizer or manure are applied, especially if dry conditions persist.

The amount of phosphorus (P) and potassium (K) will depend on the soil test level and yield goal. At optimum soil test levels and a yield of about 4 tons dry matter per acre, 60 lb of P₂O₅ and 120 lb of K₂O are removed.

USE

Both the grain and forage sorghums are most frequently used for silage or green chop in a single cut system, although they can be grazed if desired. Silage should be cut when the grain is in the medium to hard dough stage. Generally, whole plant moisture should be near the desired level for ensiling at this time. In some cases, where maturity is delayed, a frost may be necessary to reduce whole plant moistures to an acceptable level. Under most conditions, corn silage will produce higher silage yields

and quality (Table 2). The sorghums will produce similar or higher yields than corn silage on droughty soils or in fields with significant deer damage. Deer will not graze the sorghums to the extent they will corn. Digestibility of silage made from sorghums will usually be about 90-95 percent of well-preserved corn silage.

Table 2. Silage yield and nutrient content of summer-annual grasses.

Species	Dry matter yield	Crude protein		Total digestible nutrients
		%		
	T/A			
Hybrid corn	5.46	8.2		64.9
Forage sorghum	4.50	8.3		61.1
Sudangrass	4.15	12.2		58.5
Millet	3.75	10.1		56.4

Adapted from Penn State Univ. Progress Report 224.

The other summer-annual grasses can be used for grazing, green chop, silage, or hay. When used for grazing, these grasses must be grazed at the proper stage of growth to reduce herd health problems and to optimize production. The best time to graze is when plants are between 18 and 30 inches tall (6 to 8 weeks after planting). Grazing when plants are less than 18 inches tall will delay regrowth and increase the chances of prussic acid poisoning in sorghum, sudangrass, and sorghum-sudangrass hybrids.

A sufficient number of animals should be placed in the pasture to graze the grass down in less than 10 days. Six or more animals per acre may be necessary to accomplish this rapid grazing. After grazing, clip the residue at about 8 inches high to eliminate old stems and ensure high quality for the next grazing period. Do not graze or clip these grasses too closely (less than 8 inches) because that will weaken the plants and may kill them. It will normally take three to four weeks for sufficient regrowth for grazing again.

Grazing can continue on these grasses until frost, or even after frost if the plants are allowed to turn brown (one week after a killing frost) before they are grazed. Do not graze frost-damaged or stunted sorghum, sudangrass, or sorghum-sudangrass hybrids until they have been killed (turn brown) by the frost. If the plants begin to grow again after being frost damaged, they should not be grazed until the regrowth is 18 inches tall or the entire plant is killed by frost and turns brown.

Summer-annual grasses are ideal for green chop. For feeding as green chop, use the same harvest precautions as are used for grazing to avoid prussic acid poisoning. Cut the plants down to about 8 inches. Green-chop harvesting should not begin until the plants are at least 18 inches tall, but it should begin early enough to complete harvesting before the plants begin to head. Harvesting after the plants have headed will reduce dry matter intake and milk production in cows, and regrowth potential of the plants.

Sudangrass, sorghum-sudangrass hybrids, and millet should be harvested for silage when they are between 36

and 48 inches tall or in the boot to early-head stage, whichever comes first. At this maturity, they contain excessive moisture for proper ensiling and should be wilted (mowed and allowed to partially dry in the field) before ensiling.

Greatest hay yields are obtained if the annual grasses are harvested when the seed is in the soft-dough stage. However, proper drying is difficult at this stage. Therefore, harvest for hay is recommended during the vegetative stage before the heads emerge or the plant reaches a height of 4 feet. A hay conditioner should be used to mow and crush the stems for rapid, uniform drying. *It is extremely difficult to field cure these grasses adequately for safe storage as hay.*

POTENTIAL ANIMAL HEALTH HAZARDS

Prussic acid poisoning is a major concern in feeding sorghum, sudangrass, or sorghum-sudangrass hybrids. These species contain varying amounts of cyanogenic glucosides. In the rumen, these compounds are converted into prussic acid, which is readily absorbed into the bloodstream where it interferes with respiration. If prussic acid is present in the rumen and absorbed rapidly enough, the animal will soon die from respiratory paralysis.

Forage species and varieties may be selected that contain low levels of cyanogenic glucosides. Piper sudangrass has low levels and millet is free of these compounds. The management practices described below also can reduce the risk of prussic acid poisoning from sorghum, sudangrass, and sorghum-sudangrass hybrids:

1. Graze or green chop only when grass is greater than 18 inches tall.
2. Don't graze plants during or immediately after a drought when growth has been reduced.
3. Don't graze on nights when a frost is likely. High levels of the toxic compounds are produced within hours after a frost occurs.
4. Don't graze after a killing frost until the plant is dry (the cyanogenic glucosides usually dissipate within several days).
5. Don't graze after a nonkilling frost until regrowth is greater than 18 inches.
6. Delay feeding silage for 6 to 8 weeks after ensiling.

Nitrate poisoning can be a problem under conditions of high N fertilization, heavy manure applications, drought, or overcast weather, when the plants can accumulate high levels of nitrates. When an animal eats plants containing high levels of nitrates, the nitrates are converted into nitrites faster than the animal can properly utilize them. Excessive nitrites are absorbed into the bloodstream and alter the blood so that it cannot carry oxygen. This causes rapid breathing, fast and weak heartbeat, muscle tremors, staggering, and ultimately death if corrective steps are not taken.

The same precautions for prussic acid poisoning will help prevent nitrate poisoning. Millet can cause nitrate poisoning but not prussic acid poisoning. High nitrate levels

will persist in forages cut for hay but will be reduced by one-half or so if the crop is ensiled. If you suspect high nitrates in the forage, have it tested by a forage testing laboratory.

Poisoning of horses fed sorghum, sudangrass, or sorghum-sudangrass hybrids also has been reported. The exact cause of poisoning is not known. Affected horses exhibit a staggering gait and urine dribbling; pregnant mares may abort. There is currently no treatment for this poisoning and affected horses rarely recover. *Do not feed horses any of these summer annual species.*

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