Pastures for Maximum Production

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pastures for maximum production

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Published and distributed in furtherance of the Acts of Congress of May 8 and June 30, 1914, by the Cooperative Extension Service, South Dakota State University, Brookings, John T. Stone, Director, U. S. Department of Agriculture cooperating.

5M—1-65—File: 1.18—2023
South Dakota has almost 5½ million head of cattle and sheep and some 30 million acres of grassland, 80% of which is native grass. About 2 million acres more grazing land are needed to properly support the current livestock population. Much of the grazing land is overstocked and more than half of the native pasture is in poor or fair condition. This situation can be partially remedied by proper management of more productive grasses on some of these acres and by proper management of these more productive grasses on additional acres.

Use of several introduced grasses and proper management of good native range make for high production of pasture lands. Management based on growth characteristics of grasses is essential in the production of more, better-quality forage, resulting in more animal products per acre.

Grass is classified according to type of growth, season of growth, length of life, type of root system, relative economic value and morphology or the form and structural development of the plant. All of these factors must be considered when deciding what grasses to plant and how to use them most efficiently.

**Growth Characteristics**

To be emphasized here are the season of growth and structural development factors plus management practices required to utilize these factors for maximum forage production.

**Season of Growth**

Some cool-season grasses, such as crested wheatgrass, Russian wildrye, and bluegrass, start growth early in the spring. Others, such as smooth bromegrass and intermediate wheatgrass, start later in the spring. All are less productive in mid-summer but resume more active growth during late summer if moisture conditions are favorable. To give maximum production, grasses must produce a certain amount of growth before being grazed. Cool-season grasses that start late mixed with those that start early will be grazed as soon as they start to grow and will not give maximum forage production. Warm-season grasses—switchgrass, Indian grass and blue stem—start growth in late spring and produce maximum forage during July and August. If they are mixed with cool-season grasses, they will be grazed too early and will not give maximum production. They may not even survive.

**Morphological or Structural Development**

Smooth bromegrass and several wheat grasses have jointed stems with nodes and internodes as shown in figure 1. As spring growth begins, a "growing point" is located in each stem near the surface of the soil. Leaves develop from these growing points during the season. The growing point holds one of the keys to maximum forage production. If it is removed too early by grazing or mowing, the grass may go dormant. Later, when the boot begins to swell, the growing point must be removed by grazing or mowing to permit regrowth and maximum production.

In some seasons, with adequate moisture and fertility, considerable leaf growth might develop before the stems start to grow. Grazing may be done at this time, but if not done carefully, it will tend to lower root reserves and reduce production later in the season. Later when stems start to lengthen, nodes are formed and the growing point goes higher, always remaining above the uppermost node. Leaves are still being formed from the growing points and the grass should not be grazed at this time. Grazing or mowing removes the growing points and causes the grass to go dormant.
When the boot begins to swell, the seed head is developing rapidly from the growing point. Grazing or mowing off the growing point at this time will not result in dormancy. In fact the growing point should be removed. Then regrowth begins from basal buds in rhizomes (rootlike stems beneath the surface) or lower stems giving maximum forage. If smooth bromegrass is not grazed, but allowed to "head-out," regrowth will not occur and very little vegetation will be produced until seed has fully matured. The best management practice for this type of grass is to start grazing half the pasture and mow the other half for hay. In 10 to 14 days the mowed half will be ready to graze. With smooth bromegrass, seed heads should be clipped from the grazed half to prevent dormancy and produce a second crop for grazing.

The growth procedure is somewhat different in other grasses including orchardgrass, bluegrass, Russian wildrye and Junegrass where only 5% to 10% of the stems are jointed and produce seed heads. The growing points on the other stems remain near the soil surface during the entire season. Leaves develop from these lower growing points, but forage production comes from continued leaf growth at the junction of the blade and sheath—the collar (figure 2). Continued removal of leaves by grazing or mowing causes rapid regrowth of leaves and maximum forage production. Deferred grazing permits the sheath to grow too high thereby raising the collar to a vulnerable position. Removal of the collar results in dormancy because the source for regrowth is gone. Early but moderate grazing keeps the collar low—regrowth is rapid and maximum forage production is obtained.

**Type of Root System**

Grasses have two main types of root systems. Sod-forming grasses have fibrous roots, but in addition, they have rhizomes (the rootlike underground stems) that spread to form a dense sod. Bunch grasses have only fibrous roots and do not spread. A stand of bunch grass does not become thicker as time passes, except by reseeding itself. Sod-forming grasses are much more effective for preventing erosion. They are superior for use on slopes or other areas subject to erosion.

Alfalfa varieties also have different types of root systems. Hay type varieties have tap roots, as shown in figure 3, and do not spread. Pasture type varieties spread by means of underground parts—Teton spreads from the crown, but Rambler and Travois have proliferating roots as shown in figure 3. Pasture type alfalfas spread much the same as sod-forming grasses.
MANAGEMENT PRACTICES

Plant characteristics help determine best management practices.

Pasture Mixtures

Grass-legume mixtures. Two species of plants, growing together, usually produce more dry matter than a single species growing alone. This is especially true when the two species are not closely related. A grass-legume mixture almost always produces more forage than either crop alone. The legume draws its nutrients from deep in the soil and the grass feeds from the upper levels. In addition, the legume furnishes nitrogen needed by the grass.

A grass-legume mixture has more protein than grass alone. Consequently, it not only produces more forage, but also produces more pounds of animal product. For instance, smooth bromegrass-alfalfa pasture at Brookings produced an average of 308 pounds of beef per acre annually over a 5-year period. Smooth bromegrass without alfalfa produced only 236 pounds of beef per acre although it was fertilized early each spring and again in June or July with 100 pounds of ammonium nitrate.

Hay type alfalfas, such as Vernal, Ranger and Ladak, have been used in pasture mixtures. However, they have an erect type of growth. They grow as tall as the grasses and their regrowth is more rapid, resulting in differential grazing. For this reason hay type alfalfas sometimes cause bloat in cattle or sheep if they make up more than 50% of the forage. In comparison, pasture-type alfalfas, such as Rambler, Teton and Travois are less erect, having a decumbent (lying on the ground) type of growth. They are slow to recover after being grazed—their regrowth rate is comparable to grass. Thus, grazing animals eat nearly equal amounts of grass and legume and the probability of bloat is much less than with hay type alfalfas. The type of management of a grass-legume pasture should be determined by the characteristics of the grass when pasture type alfalfas are used.

Birdsfoot trefoil is an excellent legume for pasture mixtures where adapted. It does not cause bloat, but is more difficult to get established and is not as long-lived as alfalfa in South Dakota. Sweetclover is also used in pasture mixtures. However, some varieties contain high levels of coumarin, a bitter substance that reduces palatability of the forage. Denta and Goldtop are two sweetclover varieties recommended for South Dakota that have a low coumarin content. Red clover is a good legume for use in short-term pastures in southeastern South Dakota Counties, but generally lasts only 2 or 3 years.

Grass mixtures. It is sometimes desirable to use two grass species and a legume in a pasture mixture. Do not mix early growing cool-season grasses with later cool-season grasses or cool-season grasses with warm-season grasses. Grazing the earlier growing species damages the later ones.

Do not mix grasses with jointed stems with those that do not have jointed stems. The jointed stemmed

<table>
<thead>
<tr>
<th>Pasture/Range Crop</th>
<th>Apr</th>
<th>May</th>
<th>June</th>
<th>July</th>
<th>Aug</th>
<th>Sept</th>
<th>Oct</th>
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<tbody>
<tr>
<td>Kentucky bluegrass</td>
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<tr>
<td>Smooth brome and Alfalfa</td>
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<td>Crested wheatgrass</td>
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<td>Sweetclover (Second Year)</td>
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<tr>
<td>Winter rye</td>
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<tr>
<td>Piper sudangrass</td>
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<tr>
<td>Crop aftermath</td>
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<tr>
<td>Warm-season native range</td>
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<td>Cool-season native range</td>
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</table>

Figure 4 Pasture Calendar showing periods of high and low forage production for best pasture grasses for South Dakota
species cannot be grazed as early as the others and still produce maximum pasturage. As a result, it is impossible to manage both types properly if planted together.

**Pasture Rotation**

The best management procedure in South Dakota is to rotate livestock among different pastures. Use early emerging cool-season grasses for an early spring pasture, later emerging cool-season grasses for a late spring and summer pasture, warm-season grasses during late summer, and cool-season grasses for a fall pasture. With proper management livestock can be kept on good pasture at least 6 months each year and probably longer in many years. Figure 4 shows periods of high and low forage production for grasses discussed here.

Grass needs spring growth to build up root reserves before grazing and fall growth to maintain sufficient reserves to carry it through the winter. Table 1 is a general guide to follow in order to accomplish these needs.

**EARLY SPRING PASTURE.** Use a crested wheatgrass-alfalfa pasture wherever possible, for grazing during April and early May. About ¼ acre is needed for each animal unit. Russian wildrye is also a good grass for use at this time. But do not mix the two grasses. If you must use some bluegrass pasture, use it in May. Reed canarygrass is good for low wet areas, but do not graze it when turf is spongy from excess moisture.

Crested wheatgrass and Russian wildrye are early emerging cool-season grasses, adapted to the western two-thirds of the state. Both are bunch-type grasses and do not give good erosion control on steep slopes.

Reed canarygrass is excellent for use in low wet areas, but also does well on the upland. While less palatable than some other grasses, cattle will graze it and it is nutritious. To make it more palatable prevent excessive top growth by mowing or grazing.

Crested wheatgrass has jointed stems and should not be mixed with Russian wildrye, (which does not have jointed stems). Crested wheatgrass should be seeded with a legume, however, Russian wildrye is such a strong competitor that it generally "crowds out" other grasses or legumes in a few years.

Bluegrass pastures too rocky or rolling to seed new species are best used during May and June. Bluegrass does not have jointed stems and can be managed the same as orchardgrass or Russian wildrye. Many times, bluegrass pastures are improved by weed control, application of nitrogen fertilizer and interseeding portions of the pasture with early emerging cool-season grasses or legumes.

In emergencies, early spring pastures may be grazed again during the fall. However, late fall grazing reduces their value for the following spring. During good years a hay crop may be taken a month or 6 weeks after grazing has been discontinued.

**LATE SPRING AND SUMMER PASTURE.** Use smooth bromegrass and/or intermediate wheatgrass mixed with alfalfa, wherever possible, for pastures to be grazed from mid-May to August. Pubescent wheatgrass may be added to the mixture. From 1 to 3 acres of pasture are needed for each animal unit (more acres on low producing soils and fewer on good producing areas). Divide the pasture in half and rotate livestock every 2 to 3 weeks. Further division with rotation at shorter intervals may be desirable on high producing pastures. Plans for a mid-summer (supplemental) pasture for about half the herd, or the entire herd half the time, during July and August.

If you have good rangeland of mid or tall native grass, such as western wheatgrass and/or green needlegrass, graze it from mid-May to mid-July. Have 2 to 4 acres for each animal unit (more acres on low producing soils and fewer in good producing areas).

Use Reed canarygrass in low, wet areas, but do not graze while turf is soft. Use tall wheatgrass on alkaline or saline spots.

If managed properly, smooth bromegrass and intermediate wheatgrass can be used for 4 to 5 months of the year. Pubescent wheatgrass can be used in the same manner, but less is known about this species. At least one of these species is adapted to most areas of South Dakota.

Smooth bromegrass and the wheatgrasses have jointed stems. They can be mixed and managed in the same way. They should be mixed with a legume and grazed when they reach the boot stage of growth.
Figure 5. Bromegrass-alfalfa pasture properly managed.

The best management system for these grasses is to mow half of the pasture and graze the other half when the grass reaches the boot stage. This ensures maximum pasturage and also provides high quality hay for the winter as shown in experiments at Brookings (figure 5).

Smooth bromegrass and intermediate wheatgrass were each mixed with Teton alfalfa in the study. Each pasture was divided into two equal parts. Cattle were turned into one pasture when the grass was in the boot stage during the third week in May. The other pasture was mowed. About 2 weeks later (May 26-28) the grass in the mowed pasture had recovered and was 8 to 10 inches tall. The cattle were then moved to it. Seed heads on the grazed pasture were clipped (not necessary for intermediate wheatgrass) to prevent the grass from going dormant. About 3 weeks later (mid-June) the cattle were moved back to the pasture grazed earlier. This system continued until one pasture had been grazed five times and the other (the first mowed) had been grazed four times. Cattle were removed from both pastures in September.

Although these experimental pastures were used during July and August, their heaviest production was in May and June. This illustrated that the retarded growth of cool-season grasses during July and August makes it necessary to reduce herd size at that time or use other pasture.

Native pastures of western wheatgrass and/or needlegrasses are productive during late May, June and part of July. While not producing as much forage as adapted tame grasses, native species are longer-lived and will not require reseeding if managed properly. In some cases the yield of native species can be increased by commercial fertilizer or by interseeding a legume.

MID-SUMMER PASTURE. Use switchgrass, Indiangrass or big bluestem alone or in mixtures, wherever possible, for pasture in July and August. Figure 1 to 2 acres per animal unit per month (more acres on low producing soils and fewer on good producing areas) for half the herd on smooth bromegrass and/or intermediate wheatgrass earlier in the season. But arrange to have enough pasture for most of the herd if western wheatgrass and/or green needlegrass is used earlier.

In areas where warm-season natives are not adapted or available, use sudangrass, sudangrass-sorghum hybrids and/or aftermath from small grain or other crops. More details on the use of sudangrass are given in Fact Sheet, "Sudangrass for Supplemental Pasture."

Switchgrass, Indiangrass and big bluestem are native perennial grasses that produce good pasture in July and August. All are sod-forming and spread slowly by means of short rhizomes.

Aftermath from small grain and other crops can also be used as pasture during this period.

Sudangrass and sudangrass-sorghum hybrids are annual crops that have a high carrying capacity for 6 to 8 weeks. Some varieties have a high percentage of prussic acid which is poisonous to livestock. Piper and Greenleaf are varieties of sudangrass with low prussic acid content and are not hazardous to grazing livestock. Consult companies that produce commercial sudangrass-sorghum hybrids to find out if their hybrids are safe to graze. Hybrids frequently produce more forage and those low in prussic acid may be preferred to sudangrass.

FALL PASTURE. Use Russian wildrye for pasture during September and October. Use 1 to 2 acres for each animal unit. If a bluegrass pasture must be used, graze it at this time if it has not been used earlier. Also, western wheatgrass and/or needlegrasses can be used if they have not been grazed earlier. Do not use a pasture that you intend to graze early the next spring.

The same grasses grazed in early spring can be used for pasture during September and October. Bluegrass or cool-season native grasses (western wheatgrass and green needlegrass) provide good pasture during this time of year if they have not been grazed.
earlier. Bluegrass produces the least forage. Russian wildrye produces green forage for 2 weeks longer than the others. Ungrazed western wheatgrass provides good "winter pasture" after it has matured.

Pastures grazed late in the fall generally do not produce well early the next spring. A rest period is needed during the growing season to replenish root reserves before maximum forage will be produced.

Therefore, separate pastures are needed for early spring and fall grazing.

**Suggested Rotations.** Table 2 gives two suggested pasture rotation systems—each makes use of several grasses during optimum periods of growth. Rotation I is based primarily on use of tame grasses while Rotation II includes more native species. Other rotations including combinations of introduced and native species can readily be devised.

### Table 2. Two Suggested Rotation Systems

<table>
<thead>
<tr>
<th>Season*</th>
<th>Grasses</th>
<th>Acres per animal unit†</th>
<th>Grasses</th>
<th>Acres per animal unit†</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rotation I</strong></td>
<td></td>
<td></td>
<td><strong>Rotation II</strong></td>
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<tr>
<td>EARLY SPRING</td>
<td>Crested wheatgrass-alfalfa or Kentucky bluegrass</td>
<td>⅓</td>
<td>Crested wheatgrass or Kentucky bluegrass</td>
<td>1</td>
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<tr>
<td>April 15 to May 15</td>
<td></td>
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</tr>
<tr>
<td>EARLY SPRING AND SUMMER</td>
<td>Smooth bromegrass-alfalfa or Intermediate wheatgrass-alf.</td>
<td>1-3</td>
<td>Western wheatgrass or Green needlegrass</td>
<td>2-4</td>
</tr>
<tr>
<td>May 15 to July 15</td>
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<tr>
<td>MID-SUMMER</td>
<td>Switchgrass or Big bluestem or Indiangrass or Sudangrass or Crop aftermath</td>
<td>1½-3</td>
<td>Switchgrass or Big bluestem or Indiangrass or Sudangrass or Crop aftermath</td>
<td>1½-3</td>
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<tr>
<td>July 15 to Sept. 1</td>
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<tr>
<td>FALL</td>
<td>Russian wildrye or Kentucky bluegrass or Crop aftermath</td>
<td>1</td>
<td>Western wheatgrass or Green needlegrass or Kentucky bluegrass or Crop aftermath</td>
<td>2-4</td>
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<tr>
<td>September and October</td>
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<tr>
<td>WINTER</td>
<td>Mature western wheatgrass</td>
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<td>Mature western wheatgrass</td>
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<tr>
<td>November</td>
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*Dates are approximate as there will be overlapping of grazing dates.
†Estimated acreage for pastures in good condition on the majority of soils. The lower figure is for areas with 20 to 24 inches average rainfall and the higher figure for areas with 10 to 14 inches. Use more acres on low producing soils or pastures in fair to poor condition. Use fewer acres on high producing soils.