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Figure 1. Pasture layout, with central watering place, for pasture rotation on pastures composed of tame and native grasses. Grazing rotation is indicated for the jointed-stemmed species.
A PASTURE SYSTEM FOR YOU

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In South Dakota’s 43 East River counties there are over 2 million animal units of cattle and sheep—one animal unit for each 5 acres of range and pasture. Only about 20% of the total grassland produces enough forage per acre for one animal unit (cow and calf) for one month (1 AUM), while over half requires more than 10 acres per animal unit per season. In the 23 West River counties there are about 1.1 million animal units—one animal unit for each 18 acres of grassland. However, 25 to 35 acres of range in good to fair range condition are required for one animal unit for a year. Even though a portion of the requirements of the livestock are provided from croplands, these figures indicate a very heavy grazing load. Production from many of our pastures and ranges is now declining, yet the trend in livestock numbers is upward. The situation demands the most careful and efficient management of both grazing lands and livestock to meet the needs of our economy and improve our grazing resource.

Most efficient production will require careful land use planning. On land suitable for cultivation, tame grasses will produce more forage than native range and will often increase net income.

This publication describes the management of a series of tame pastures (with or without native range) for maximum forage production. The type of management will be especially applicable to operations with a high proportion of arable land, especially those in the central and eastern counties and in the Black Hills.

PRODUCTIVITY OF TAME GRASSES

Studies that illustrate the value of tame grasses in a pasture mixture were conducted at Huron, South Dakota and Mandan, North Dakota. At Huron, native grass (largely western wheatgrass and blue grama) produced a 3-year average yield of 0.67 ton of hay or 95 pounds of animal gain per acre. Native grass that had been fertilized each year with 100 pounds of ammonium nitrate (33.5 lb. of N.) produced slightly more—1.0 ton of hay or 100 pounds of gain per acre. However, the yield was doubled in a bromegrass-alfalfa pasture that was fertilized annually with 45 to 115 pounds of phosphate (P₂O₅) per acre. It produced 2.0 tons of hay or 296 pounds of animal gain per acre.

At Mandan, native range produced an average of 42 pounds of animal gain per acre. Crested wheatgrass produced more than twice as much under spring use—a 28-year-old pasture produced an average of 89 pounds and a 6-year-old pasture produced 104 pounds.

In the past the additional cost of maintenance and re-establishment of tame grasses often nullified the advantages of increased production. Tame grasses generally became sod-bound, and production was seriously reduced in 4 or 5 years unless nitrogen fertilizer was applied. Most people did not use fertilizer. Hay-type alfalfas were often planted in a mixture to furnish nitrogen for the grasses and to improve quantity and quality of forage produced. As a general rule the stand of alfalfa was depleted in 4 or 5 years and the grass then became sod-bound. Cost of re-establishment reduced the net profit from the pasture.

With the newer, pasture-type alfalfa varieties this problem is diminished. The pasture-type alfalfa is much more persistent under grazing than the older hay-type varieties. When a pasture-type alfalfa is planted with tame grasses and is fertilized properly, it is anticipated that tame pastures will continue to be productive for 12 to 15 years. At Brookings, pastures composed of Teton alfalfa and either bromegrass or intermediate wheatgrass were more productive after 7 years than at the end of the first pasture season.

Grass Mixtures

It is sometimes desirable to use two grass species and a legume in a pasture mixture. Early growing, cool-season grasses should not be mixed with later, cool-season grasses; cool-season grasses should not be mixed with warm-season grasses. Some cool-season grasses, such as crested wheatgrass, Russian wildrye, and Kentucky bluegrass, start growth early in the spring. Smooth bromegrass, intermediate wheatgrass and cool-season natives (western wheatgrass, needlegrasses, etc.) start somewhat later, but before warm-season grasses (switchgrass, yellow Indiangrass, bluestems, gramas and others) which do not start growth until late in the spring. All are not ready for grazing or mowing at the same time. Later-emerging grasses mixed and grazed with the earlier grasses suffer a loss of root reserves and do not give maximum forage production.

Grasses with jointed stems produce more forage when managed with a rotational grazing system. Grasses without jointed stems do better under a system of continuous moderate grazing and can be grazed earlier. Mixing the two types results in mismanage-
ment of either one or the other. For more detailed information see Fact Sheet “Grazing Management Based on How Grasses Grow.”

Likewise there are few if any known instances where a mixture of native and domesticated plants are maintained under grazing use with satisfactory production of both kinds. The management which favored one group has worked to the detriment of the other.

**Grass-Legume Mixtures**

A grass-legume mixture has more protein than grass alone. Consequently, it not only produces more forage, but it produces more pounds of animal product. The value of alfalfa in a pasture mixture has been demonstrated in numerous studies. At Brookings, for instance, smooth brome-grass-alfalfa pasture produced an average of 308 pounds of animal gain per acre over a 5-year period. Fertilized smooth brome-grass without alfalfa produced only 236 pounds of gain. Fertilizer cost $7.17 per acre for the grass and $3.30 for the alfalfa-grass mixture. Likewise, a combination of crested wheatgrass and alfalfa produced an average of 142 pounds of gain per acre over a 12-year period at Mandan, N.D., while crested wheat-grass alone produced only 104 pounds.

Under irrigation at Newell, a smooth brome-grass-orchardgrass-alfalfa pasture produced an average of 334 pounds of beef per acre over a 3-year period while the grasses produced 275 pounds of gain. Fertilizer costs were $9.78 per acre for the grass-alfalfa mixture and $17.89 for the grasses alone—the alfalfa provided about $8 worth of nitrogen.

The value of alfalfa depends on the price of beef. If beef is worth $30 per cwt, the alfalfa increased net income $26.47 per acre at Brookings, $11.40 at Mandan and $25.81 at Newell.

Since the South Dakota trials indicate that 60 to 70 more pounds of beef per acre can be raised if alfalfa is included in the mixture it means that an operator can afford to lose from bloat or other causes a 900-1000 pound animal on every 15 acres without actually losing any money. If he does not lose an animal on each 15 acres each year, the alfalfa is increasing his net income.

Similarly, dairy cows at Rosemount, Minnesota, were grazed on (1) an all-grass pasture composed of brome-grass and orchardgrass, (2) a simple mixture of these grasses with hay-type alfalfa and ladino clover, and (3) a complex mixture of four grasses and four legumes. The grass-legume pastures out-yielded the fertilized, all-grass pasture. After the first year when the clover winterkilled, brome-grasses and alfalfa made the only significant contributions to forage production in the grass-legume mixtures.

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 mixture should be determined by the characteristics of the grass when pasture-type alfalfas are used.

**Grazing Systems**

The most common grazing system is **continuous grazing**. The grazing season may be short or long, but once the livestock are placed on the pasture, they are not removed until the end of the grazing season. Continuous grazing at a moderate rate for a specific season appears to be the best way to utilize grasses with unjointed stems such as Kentucky bluegrass and most native ranges. However, future research may modify this view.

Seasonal **pasture rotation** is the movement of livestock from one pasture to another in order to graze the grass species in each at the desired stage of growth.

**Rotation grazing** is the movement of livestock among pasture subdivisions several times during the grazing season, so that the grass is harvested at a certain stage of development. This system requires more fencing and more water development, but it is especially beneficial to tame pastures composed entirely of grasses with jointed stems such as smooth brome. The principles of rotation grazing are discussed in the Fact Sheet entitled “Grazing Management Based on How Grasses Grow.”

**Deferred grazing** means delayed grazing and is useful to improve native ranges, or to save pastures for grazing in late summer, fall, or winter. Usually ranges are rested for improvement until the desirable range plants have reached a certain stage of growth in order to allow them to gain vigor and reproduce. A range may be divided into pastures which are deferred in different years according to a definite plan. This is called rotational deferment or deferred rotation grazing.

The benefits of the various grazing systems on the mixed prairie ranges are not fully known yet. Ranges can be improved more rapidly by use of deferment than by continuous grazing.
SEASONAL PASTURES

GRAZE GREEN GRASS FOR GREATER GAINS

Cool-season grasses produce the most forage during the cool days of spring, early summer, and autumn; warm-season grasses produce more forage in July and August when the weather is warm.

With a relatively light stocking rate on cool-season pasture, livestock do not utilize forage as fast as it is produced during cool weather (May, June, and September), but may use it faster than it is produced during warm weather (July and August). This type of management allows the use of one pasture for an entire season, but is not always the most efficient type of management. Another type of management includes a heavier stocking rate that utilizes forage from cool-season grasses as fast as it is produced during cool weather and includes the use of another pasture during warm weather.

Smooth bromegrass-alfalfa pastures and intermediate wheatgrass-alfalfa pastures at Brookings were capable of supporting 1 animal unit per acre for 4.5 months and provided 4.5 AUM/A of grazing. Some forage produced in May and June was not utilized until later. With management that utilized the forage as fast as it was produced, these pastures were capable of supporting a 2 AU/A from mid-May to mid-July and again in September but only 1/2 AU/A during late July and August. They provided about 5.5 AUM/A of grazing. By grazing grass as it grew it was possible to increase the stocking rate by 1 AUM/A.

At Fargo, North Dakota, a bromegrass-alfalfa pasture supported two to three cows per acre during May and June, but less than one cow per acre during the remainder of the season. This illustrates that the retarded growth of cool-season grasses during July and August makes it necessary to reduce herd size at that time or use a mid-summer (supplemental) pasture.

At the Pasture Research center near Norbeck pastures composed of smooth bromegrass, intermediate wheatgrass and pasture-type alfalfa were capable of supporting 3/4 AU/A for 4-5 months and provided 3 AUM/A of grazing. Similar pastures were capable of supporting 2 AU/A from mid-May to July and again in September. The cattle were pastured on warm-season perennial grasses in July and August at the same stocking rate. This type of management provided 4.5 AUM/A. By grazing green grass as fast as it grew and using a combination of cool-season and warm-season grasses, the stocking rate was increased by 50 per cent.

At Lincoln, Nebraska 189 days grazing on cool-season grasses produced 193 pounds of gain per steer while 104 days (56 days in the spring and 48 in the fall) on cool-season grasses and 85 on warm-season produced 267 pounds. A greater gain of 74 pounds was obtained by grazing green grass as fast as it was produced.

FOUR MONTHS OF GRAZING

Each farm or ranch should use its land in accordance with its capability. In western South Dakota, the use of introduced grasses may be feasible only on limited acreages; in eastern counties, however, it is often advisable to use tame grasses in all pastures. Use two pastures for 4 months of grazing. Practice rotation-grazing in a late-spring and summer pasture (main pasture) from mid-May to mid-July and late-August to mid-September. Use a mid-summer pasture (supplemental pasture) during late-July and August.

Late Spring and Summer Pasture

Smooth bromegrass and intermediate wheatgrass can be used for 4 to 5 months of the year if managed properly. 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 these wheatgrasses have jointed stems. They should be mixed with a legume and grazed when they reach the boot stage of growth.

The best management system for these grasses is rotation grazing. 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.

At Brookings, smooth bromegrass and intermediate wheatgrass were each mixed with Teton alfalfa. Each pasture was divided into two equal parts. Cattle were turned into one pasture during the third week in May when the grass was in the boot stage. 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 half of the pasture had been grazed four times, and the other half (the first mowed) had been grazed three times. Cattle were removed from both pastures in September. The smooth bromegrass-alfalfa pasture produced an average of 194 pounds of animal gain and 0.85 ton (1.7 T/A from mowed half) of hay per acre over a 5-year period. The intermediate wheatgrass-alfalfa pasture averaged 209 pounds of animal gain and 0.83 ton of hay.

Native ranges composed principally of cool-season grasses such as western wheatgrass, green needlegrass, or needle-and-thread are excellent pastures for late-spring and early-summer use. Although they do
not produce as much forage in eastern counties as adapted, tame-grass species, native grasses are permanent, do not require reseeding if managed properly, and have lower maintenance costs.

The most use possible on native pastures (ranges) while maintaining production has received much research in the United States and Canada during the past 20 years. There can be little doubt that grazing more than 40-60 per cent of each year's growth is self defeating. Try to visualize how the pasture will look on November 1 and adjust your stocking rate accordingly.

Use smooth bromegrass and/or intermediate wheatgrass mixed with alfalfa, wherever practical, for pastures to be grazed from mid-May to August. Pubescent wheatgrass may be added to the mixture. From ½ to 2 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. Plan 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 cool-season native range in good or excellent range condition on normal soils, allow 2 to 6 acres for each animal unit from mid-May to mid-July (more acres in drier areas and lower range condition and fewer in wetter areas and higher range condition.)

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

Mid-Summer (Supplemental) Pasture

Sudangrass, hybrid sudans, and sorghum-sudan 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. New growth contains a higher percentage of prussic acid than older growth. Under continuous grazing, new growth is utilized as it appears, while rotational grazing allows the new growth to age before it is grazed and reduces the hazard of poisoning.

Piper is a variety of sudangrass with low prussic acid content. It is not hazardous to grazing livestock. Consult companies that produce commercial sorghum-sudangrass or hybrid sudans 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.

Soybean-sudangrass pastures have been profitable for both dairy and beef production at Brookings. Dairy cattle were grazed from June 25 to September 16. The pasture was divided into five parts and ten cows per acre were rotated daily. The pasture produced 5,030 pounds of dry matter per acre which produced 5,073 pounds of milk for a net profit of $77.00 per acre. The same crop used as hay produced 4,624 pounds of dry matter, 3,672 pounds of milk and a net profit of $17.85. In similar pastures, over a 4-year (1954-1957) period, an average of 147 pounds of animal gain was produced from 1.28 tons of forage per acre. More details in the use of sudangrass are given in Fact Sheet “Sudangrass for Supplemental Forage.”

Frequently warm-season grasses such as little bluestem and sideoats grama are dominant on steep slopes and on weakly developed soils. Big bluestem, switchgrass, and Indiangrass are warm season grasses that are dominant on deep soils with favorable moisture in high range conditions in eastern South Dakota. These grasses make excellent mid-summer pastures. Blue grama and buffalograss are also warm season grasses, but they are short growing, low yielding species that often become dominant on ordinary overgrazed uplands in central and western South Dakota.

Plan for enough supplemental pasture for about half of the herd during late-July and August. Use sudangrass, a sorghum-sudan hybrid, a true sudangrass hybrid, or a mixture of soybeans and sudangrass, and rotate grazing. Divide the pasture in two or more parts. Rotate between the parts, or rotate between the mid-summer pasture and the early spring and summer pasture, or rotate between the mid-summer pasture and crop aftermath.

If you prefer perennial grasses, seed switchgrass, Indiangrass or big bluestem alone or in mixture in central and eastern counties for pasture in July and August. Allow 1 to 2 acres per animal unit per month (more acres on low-producing soils and fewer on good-producing areas).

FIVE TO SEVEN MONTHS OF GRAZING

For pasture before May 15, use an early spring pasture; for pasture after September 15, use a fall pasture. This is a total of four pastures for 6 months of grazing.

Early Spring Pasture

This pasture is needed by livestock producers who start grazing before mid-May. Young stock can be moved out of the barnyard when the yards are muddy and other spring work occupies the producer's time. On the other hand, it is not needed by the producer who likes to “calve” in drylot.

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 which do not give good erosion control to steep slopes.
Crested wheatgrass is not overly productive in eastern counties. Where a late-spring and summer pasture of tame grasses can be grazed by mid-May, it may be more profitable to keep the livestock in drylot for an additional 2 or 3 weeks than to utilize land for a relatively low-yielding crop of grass. Fewer acres may be required to raise forage fed in drylot than would be needed for a crested wheatgrass pasture.

The economic status of crested wheatgrass may be improved in at least two ways. It is possible to harvest a crop of seed after the livestock have been shifted from crested wheatgrass to other pastures. Or an alfalfa hay crop may be harvested from a crested wheatgrass-alfalfa pasture after the livestock have been moved to other pastures. Either procedure makes it possible to get increased production from the early spring pasture without restricting its usefulness.

Kentucky bluegrass pastures, too rocky or rolling to seed to new species are best used during May and early June. Bluegrass does not have jointed stems and can be grazed continuously for about a month. Many bluegrass pastures can be improved by weed control, fertilization, and interseeding portions of the pasture with early-emerging, cool-season grasses and legumes.

Ranches on which special early-season tame pastures are not feasible can still have early, green forage by deferring for spring use a native range that supports mostly cool-season grasses such as western wheatgrass, green needlegrass, or needle-and-thread. In most years such ranges, when high in vigor, will provide green forage in adequate amounts by about mid-April. If grazing is continued past mid-May, spring deferment should be provided about one year in four.

Use crested wheatgrass-alfalfa pastures whenever practical for grazing during late April and early May. Use ½ to ¾ acre for each animal unit. Russian wildrye, winter rye, and cool-season native range, deferred for spring use, are ready at this time. Kentucky bluegrass is of most value in May. Use reed canarygrass and/or creeping foxtail for low, wet areas. Graze continuously.

Fall Pasture

The same kinds of pastures used in early spring can be used for pasture during September and October. However, they should be rested for fall use. Crested wheatgrass greens-up in September and provides late-fall grazing if ample fall rain is received. Russian wildrye is less dependent on fall rain and produces green forage for 2 weeks longer, but very little is known about its performance in South Dakota. Therefore, it is suggested that the two be planted together for fall pasture. If the Russian wildrye performs well, it probably will “crowd-out” the crested wheatgrass. If it doesn’t do well, the crested wheatgrass will still be available.

In order to produce maximum forage yields pastures need a rest period during the growing season to replenish root reserves. Therefore, pastures grazed late in the fall are not very useful for grazing early the next spring.

Use Russian wildrye, and/or crested wheatgrass for pasture during September and October. Use 1 to 2 acres for each animal unit. Graze continuously. Do not use a pasture that you intend to graze early next spring.

Winter Pasture

Grazing can be extended into the winter by the use of native range until prohibited by snow cover. Greater production per acre can usually be obtained by feeding harvested roughages through the winter. However, except on small acreages with good land, where machinery and labor are not fully used, wintering costs are usually lower when livestock are grazed on winter range.

Native range in good to excellent range condition is unexcelled for winter grazing, especially when the dominants are cool-season grasses, such as western wheatgrass and green needlegrass. Most native ranges in lower range condition classes have limited value for winter use because of the abundance of short growing plants which are easily covered by snow. Likewise, weedy forbs and invading grasses which are often more abundant on depleted ranges have little or no value for winter grazing.

Winter range requires protein and phosphorus supplementation for adequate growth of young stock or for adequate nutrition of reproducing females. At the Cottonwood Range Field Station, steer calves have responded much more to increases in the protein content of range supplements than to increases in energy. Steers gained an average of ½ to ¾ pound per day when fed ½ pound of total protein in 1½ to 2½ pounds of total supplement (1½ pounds 40% or 2½ pounds 27% protein supplement). Similar gains can be expected when calves are fed 3 to 4 pounds of alfalfa hay as a supplement to winter range. Such gains put calves in good shape to go on pasture the following summer. Cows have been wintered well on range grazing with 1½ pounds of 40% protein supplement. Ewes at Antelope Range have produced well when winter-grazed and supplemented with either ½ pound 40% or ½ pound 20% protein supplement winterlong. However, ½ pound of 40% supplement appeared to be superior.

Supplemental phosphorous is needed on winter range. It may be supplied in a mineral supplement, protein supplement or in the drinking water.
Where practical, graze native range—in good to excellent range condition saved for winter use—as long as absence of snow permits. Feed protein and phosphorous supplements.

**SPECIAL PURPOSE GRASSES**

Reed canarygrass and creeping meadowfoxtail can be used in low wet areas, but the former will also do well on uplands. If reed canarygrass is not grazed early, it may be necessary to mow it in order to produce more succulent, more palatable growth. Neither grass should be grazed when turf is spongy from excessive moisture.

Reed canarygrass is a non-jointed cool-season grass that produces more forage than most cool-season grasses during July and August. It should be grazed continuously and may be grazed most anytime during the growing season.

Tall wheatgrass and alkali sacaton tolerate saline and alkaline soils and should be used in these areas. Like reed canarygrass they must be kept in a succulent state in order to be palatable.

Russian wildrye is a cool-season, non-jointed grass that does not have serious retardation of growth during the warmer months of the year. It makes good pasture throughout the season. Continuous moderate grazing is required to get the maximum production. It is not a good hay crop because its growth comes from elongation of leaves rather than a lengthening of stem as with jointed grasses.

A spare pasture of Russian wildrye may be useful to many large operators, especially for those who plan to graze green grass for 7 months. He probably will not be able to have the right amount of pasturage in three or four seasonal pastures every year. Differences in weather conditions are apt to cause a shortage of pasturage in one pasture one year and another the next. A spare pasture of Russian wildrye could be used to help overcome the shortage during one month one year and another the next. Remember that Russian wildrye does not produce maximum forage if cut for hay. If you have enough pasture so that you can cut hay from one of them, be sure to graze the Russian wildrye and mow one of the other pastures.

**PASTURE ALTERNATIVES**

Several different grass species and other types of pasture that can be utilized at various times to give a complete pasture program are listed below.

- **Mid-April to mid-May**
  - Crested wheatgrass
  - Russian wildrye
  - Kentucky bluegrass
  - Winter wheat or rye

- **Mid-May to mid-July**
  - Smooth bromegrass
  - Intermediate wheatgrass
  - Western wheatgrass
  - Green needlegrass
  - Reed canarygrass
  - Russian wildrye

- **Mid-July to September**
  - Switchgrass
  - Indiangrass
  - Bluestem
  - Grama grass
  - Sudangrass
  - Crop aftermath
  - Russian wildrye

- **September to November**
  - Russian wildrye
  - Crested wheatgrass
  - Kentucky bluegrass
  - Sorghum-sudangrass hybrids
  - Crop aftermath
  - Winter rye or wheat
  - Mature natives
  - Rape

- **November to snow cover**
  - Mature native grasses

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