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ALTERNATIVE PASTURE AND FORAGE SYSTEMS

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The livestock producer must use the most economical system for raising cattle or sheep if he is to stay in business. This publication discusses some of the pasture and forage alternatives for use between mid-April and November.

We ordinarily think about using pasture and range. However, grazing pasture and range may not always be the most economical method. At the Pasture Research Center in north-central South Dakota, a cow-calf herd was managed under three systems (Table 1). System 1 included 10 cow-calf pairs on 40-acre pastures for 194 days of grazing (they were fed hay the remainder of the year, or 171 days). Pastures included the rotation grazing of four seasonal tame-grass pastures. During the first 6 years, the cost was $71.35 per cow and return for labor and management was only $12.25 per cow.

System 2 included an average of 130 days of grazing on tame pasture and 235 days of hay with 10 cow-calf pairs on 32-acre pastures. Costs were $44.43 per cow and returns for labor and management were $39.96 per cow.

System 3 included 16 cow-calf pairs on 96-acre pastures for 172 days of grazing and 193 days of hay. The cost was $37.96 for each cow with a net return of $24.79 per cow.

The use of hay for a longer part of the season yielded the best returns per cow, the highest returns per hour of labor, and the best returns per acre. Over an 8-year period average calf gains per acre, while on pasture, were 65.5 lb/A from the seasonal pastures of System 1, 60 lb/A from the short-season tame pastures of System 2, and 39 lb/A from the native pasture in System 3, but total weights per acre to weaning were 75.8, 86.1 and 47.5 respectively for the three systems.

Other data indicate that more forage is produced if cut for hay than when grazed. In Turner County, a bromegrass-intermediate wheatgrass-alfalfa pasture produced 990 pounds of air-dry forage when clipped three times to simulate grazing and 1230 pounds when cut for hay. On fertilized pasture at the same location, yields were about ¾ ton per acre when clipped three times and almost 1 ton when cut for hay. If forage is cut for hay, it is possible to have a higher percentage of alfalfa in a grass-alfalfa mixture and it produces more forage than grass. Where an alfalfa-grass hay mixture produces 2 tons of hay, a grass-alfalfa pasture yields only slightly more than 1 ton.

These research results indicate that best returns for investment, labor and management might be obtained if hay were fed 12 months of the year, and prompted us to make the cost estimates found later in this publication. Since costs are governed by type of forage used, management and land values, all of these factors are discussed so that a producer can adjust our estimates to fit his situations. He can estimate the cost and number of acres required for forage production or pasture for more than 35 different systems that will cover a 6½-month period between mid-April and early November.

FORAGE SPECIES

Studies that illustrate the value of tame grasses in a pasture mixture were conducted at Huron and Norbeck and at Mandan, ND. 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 forage and 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 (P_2O_5) per acre. It produced 2.0 tons of forage and 296 pounds of animal gain per acre.

At the Pasture Research Center near Norbeck, native grass produced an average of 0.96 animal unit month (AUM) of grazing per acre, while a mixture of bromegrass-intermediate wheatgrass and Teton alfalfa produced 1.33 AUM's of grazing, and a series of four seasonal tame-grass pastures provided 1.74 AUM's of grazing per acre during 8 grazing seasons (Table 1).

At Mandan, native range produced an average of 42 pounds of animal gain per acre. Crested wheatgrass produced more than twice as much

Fact Sheets for Additional Information

FS 546, Cool-Season Grasses for Early Spring and Fall
FS 547, Cool-Season Grasses for May and June
FS 548, Warm-Season Grasses for July and August
FS 549, Grasses for Special Purposes
FS 302, Grazing Management Based on How Grasses Grow
FS 422, Interseeding and Modified Renovation
FS 425, Fertilizing Pastures and Hayland
FS 426, Chemical Weed Control in Pasture, Range and Hayland

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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. Haytype 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 grasses 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. At Norbeck a mixture of Teton alfalfa, bromegrass and intermediate wheatgrass is in excellent condition after 9 years of grazing under two different management systems.

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. Figure 1 illustrates that 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 mismanagement 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 yields more forage with higher percentage of protein than grass alone. Consequently, it produces more pounds of animal product per acre. A grass-legume pasture should contain 35 to 50% pasture-type alfalfa. An alfalfa-grass hay crop should contain 80% of a hay-type alfalfa. The value of alfalfa in a pasture mixture has been demonstrated in numerous studies. At Brookings, for instance, a smooth bromegrass-alfalfa pasture produced an average of 308 pounds of animal gain per acre over a 5-year period. Fertilized smooth bromegrass without alfalfa produced only 236 pounds of gain.

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, ND, while crested wheatgrass alone produced only 104 pounds.

Under irrigation at Newell, a smooth bromegrass-orchardgrass-

Table 1. Periods of grazing three different pastures systems at the Pasture Research Center near Norbeck in Faulk County and adjustments (parentheses) used in this publication.

Dates of Grazing	Pasture Mixture	No of Days	A/AU	AUM/A
System 1 (rotation grazing), series of pastures				
Mid-Apr to late May 4/22-6/2(4/22-5/26)	Crested wheatgrass	42(35)	0.87(0.72)	1.65
Late May to early July 6/3-7/14(5/27-7/10)	Brome-Int wht-Alf	42(45)	1.29(1.40)	1.12
Early July to mid-Aug 7/15-8/19(7/11-8/21)	Switchgrass	36(42)	0.67(0.78)	1.93
Mid-Aug to mid-Sept 8/20-9/19(8/22-9/21)	Brome-Int wht-Alf	31(30)	1.3	0.87
Mid-Sept to early Nov 9/20-11/2(9/22-11/2)	Russian wildrye	43(42)	0.97	1.49
Total		194	3.08(3.87)	1.74(1.67)
System 2 (continuous grazing-short season)				
Late May-mid-Sept 5/25-10/2(5/27-9/23)	Brome-Int wht-Alf	130(120)	3.78(3.5)	1.33
System 3 (continuous grazing-long season)				
Late May-early Nov 5/17-11/5(5/27-11/3)	Native	172(160)	6.02(5.6)	0.96

alfalfa pasture produced an average of 334 pounds of beef per acre over a 3-year period while the grass without alfalfa produced 275 pounds of gain.

The value of alfalfa depends on the price of beef. If beef were worth $30 per cwt, the alfalfa increased net income $28.85 per acre at Brookings, $11.40 at Mandan and $39.70 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, MN, were grazed on (1) an all-grass pasture composed of bromegrass 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, bromegrass and alfalfa made the only significant contributions to forage production in the grass-legume mixtures.

Pasture-type Alfalfa. Hay-type alfalfas such as Agate, Iroquois, 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 alfalfa.

The type of management of grass-legume mixture should be determined by the characteristics of the grass when pasture-type alfalfas are used. Though it is possible that pasture-type alfalfas may cause bloat, the writers have not heard of a single case in 15 years.

GRAZING SYSTEMS

Continuous grazing is the most common grazing system. 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.

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.

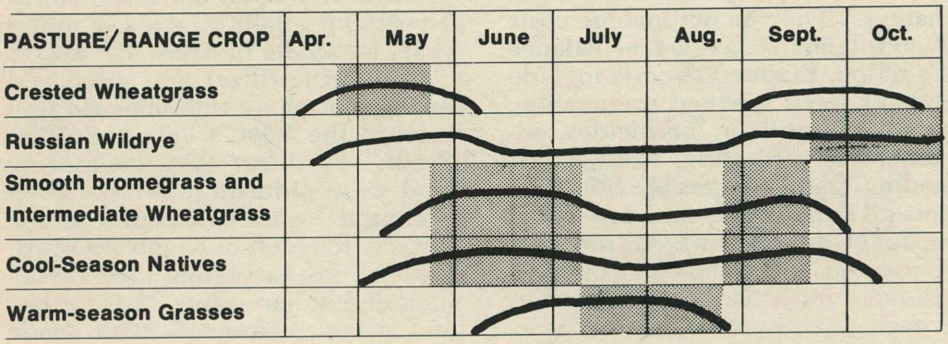
The benefits of the various grazing systems on the mixed prairie ranges are not fully known yet. Ranges can be improved more rapidly by use of deferment than by continuous grazing.

Season of Growth

Grasses produce more forage if grazed during the season of rapid growth. Figure 1 shows the season of most rapid growth for several groups of grasses.

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.

Figure 1. Growing season of several groups of grasses with five grazing periods (Table 1) superimposed.



FORAGES FOR FIVE 30- TO 45-DAY PERIODS

It is possible to graze green grass for 6½ months between late April and early November by grazing two or more species of grass. Table 1 shows the grazing dates, number of days of grazing, the acres required for each cow (A/AU) and the AUM/A from three grazing systems over an 8-year period at the Pasture Research Center near Norbeck in Faulk County.

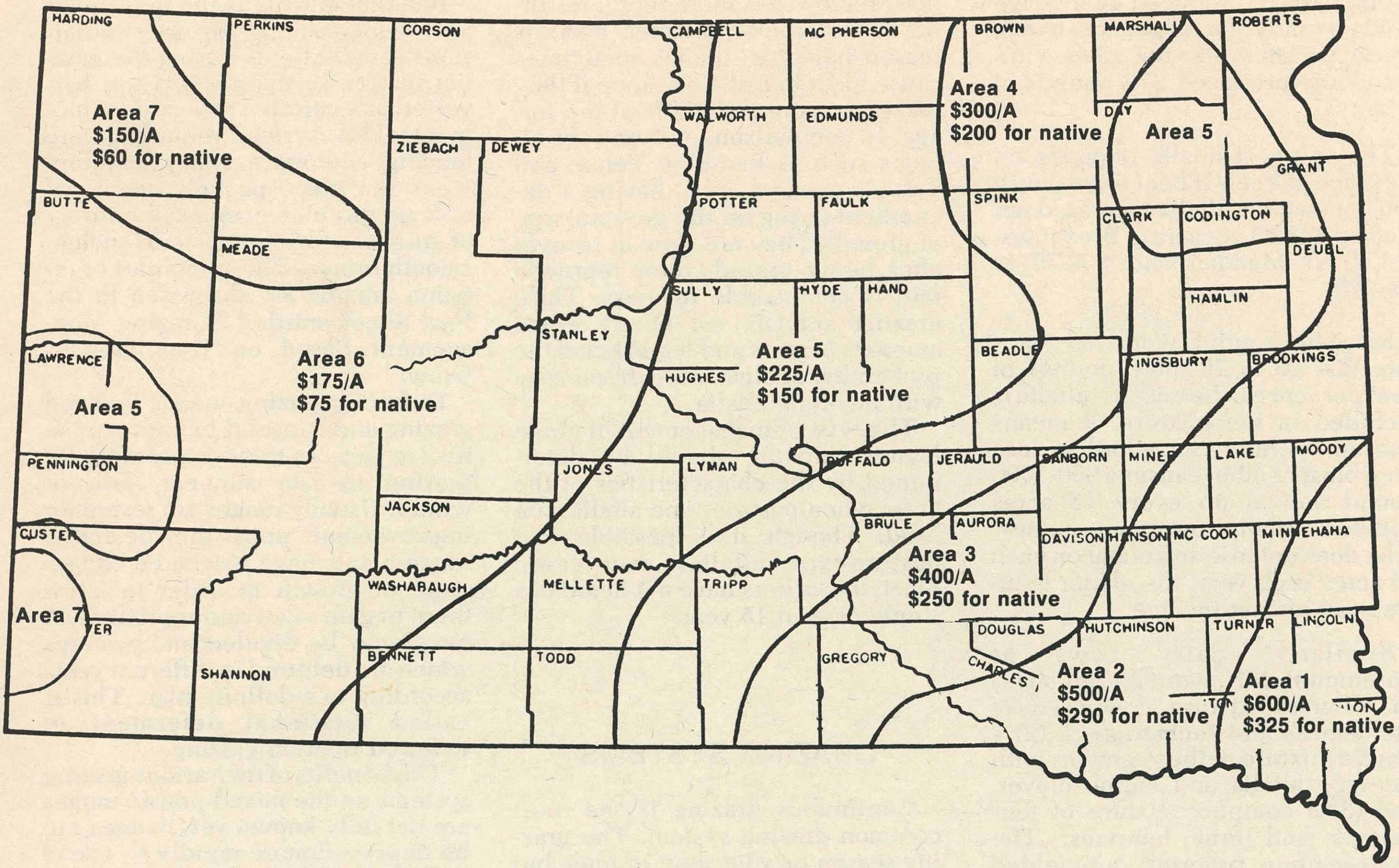


Fig. 2. Seven forage growing areas, delineated primarily on basis of average annual rainfall, in South Dakota, and the estimated average land value.

For this publication the grazing dates used at the Pasture Research Center have been adjusted as shown in parentheses. The first grazing dates for bromegrass-intermediate wheatgrass-alfalfa (BIA) in Systems 1 and 2 and for native in System 3 are changed to May 27. The last date for grazing BIA in both systems is around September 20, to minimize the possibility of causing winter injury to the alfalfa by too late grazing. This necessitated adjustments in the acres required for each animal unit (A/AU) in order to keep the animal unit months per acre (AUM/A) constant and led to a shortening of the grazing period and A/AU for crested wheatgrass and an increase for number of days and A/AU for switchgrass.

The carrying capacity is estimated for both fertilized and unfertilized pastures, and yields are estimated for fertilized hay, silage, and haylage in six areas of South Dakota (Figure 2). Average land values are estimated to be $600/A ($325 for native) in Area 1; $500/A ($290 for native) in Area 2; $400/A ($250 for native) in Area 3; $300/A ($200 for native) for native) in Area 4; $225/A ($150 for native) in Area 5; and $175/A ($75 for native) in Area 6.

In Tables 3 to 7 inclusive, the estimated acreage and forage costs are given for each of the areas (Figure 2) for each of five grazing periods (Table 1). Forage costs are divided into "costs of production" and "land charges." They **do not** include costs of supplements needed to balance the ration. Production costs include costs of seed, seedbed preparation, planting, fertilizer, herbicides, insecticides, harvesting, storing, and feeding. Land charges are 6% of estimated land value and are listed separately for those who do not want to use our estimates. All costs are pro-rated for actual number of days in each grazing period. For example, the total cost of BIA pasture for 120 days is pro-rated for 45 days in Table 4, 42 in Table 5, and 33 in Table 6.

Costs for planting include plowing, disking, harrowing, and planting for corn, sorghum, grasses, and alfalfa; and disking, harrowing, and drilling for oats.

Costs of stand establishment for perennial forages are pro-rated over 20 years for crested wheatgrass pasture, 15 years for grass-alfalfa pastures, 10 years for switchgrass, 3 years for alfalfa hay in Areas 1 and 2, 5 years for alfalfa in Area 3, and 8 years for alfalfa in Areas 4, 5 and 6.

Costs of fertilizer and weed and insect control are the same as those used in the EMC's "Marketing for Profit." Fertilizer rates on grazing land were reduced to allow for recycling at the rate of ⅓ pound per AU per day for each of N and P_2O_5. Allowance for harvesting losses were included in harvesting costs for hay and silage. Allowances were made for the storage and feeding losses shown in footnotes of several tables.

Estimates of forage yield and carrying capacity are based on forage yield trials at the Southeast Experimental Farm near Centerville and a pasture demonstration on the Bones Hereford Farm near Parker for Area 1; on forage yield and pasture research trials at Brookings for Area 2; on forage yield trials at Redfield for Area 4; on forage yield trials at Highmore, Selby, and Norbeck and pasture research at the Pasture Research Center near Norbeck for Area 5; and on small grain forage yield trials at Timber Lake and county agent and SCS estimates for Area 6.

Table 2 gives a comparison of nutritive requirements of cows and yearlings with nutrient content of tame grass pastures, native pastures, hay, silage and straw (stubble).

Early Spring (mid-April to late May)

Early spring is a critical period in a cow's life. She has her calf and starts to recuperate from the winter. She must supply milk for the new-born calf and get in condition for recycling and the breeding season.

Forages most commonly available are hay, silage, dry grass that has stood over winter and, in late-April, new growth of early cool-season grasses. The data in Table 2 indicate that hay and haylage should be supplemented with energy (corn or other concentrate), crested wheatgrass pasture with phosphorus, and silage and prairie hay with phosphorus and protein. Dry grass residue is very low in nutritive value. Green grass or a combination of alfalfa hay and silage come closest to meeting a cow's nutritional needs.

Estimated acres and forage costs of several forages for one animal unit for the 5-week period between late April and late May are compared in Table 3 for six areas delineated in Figure 2. Production costs and labor requirements for pasture are lower than for harvested forages, but pastures require more acres per cow. In years past, the addition of "land charges" to "production costs" pushed the total costs of crested wheatgrass pasture above those of harvested forages in Areas 1, 2 and 3. However, increased costs of production, harvesting, storing, and feeding of silage have surpassed the increases in land charges for the additional acreage required for pasture. In recent years the addition of nitrogen did not increase production of crested wheatgrass enough to pay for the cost of fertilizer. However, the cost of nitrogen is somewhat lower at present, and it is estimated that the carrying capacity can be increased enough so that land charges on unfertilized crested wheat pasture offset the cost of fertilizer.

At present it appears that the most economical forage for use in late April and May is crested wheat-alfalfa pasture. The alfalfa provides the nitrogen and increases productivity. It requires little supplementation, except for phosphorus, if cows are able to consume enough succulent forage to get 20 pounds of dry matter. In areas of higher rainfall the mixture can be grazed until late May and a cutting of alfalfa can be obtained in June to further reduce the cost of this forage for early spring.

Large round bales of alfalfa hay appear to be an economic forage, but alfalfa is low in energy and should be supplemented, especially in early spring. The practicality of alfalfa hay depends on the cost of high energy grain.

A corn silage-alfalfa hay mixture requires no supplementation of protein or energy and appears to be the most economical type of harvested forage in Areas 1 and 2. In fact when land charges are included in the cost, it competes favorably with straight crested wheat pasture. Good oats silage requires little supplementation and appears to be an economical forage for this period, especially in Areas 3, 4, 5 and 6.

General recommendations for late April and early May are to feed alfalfa-grass hay and corn silage until mid-May on higher value land in eastern South Dakota. On lower value land in central South Dakota, use oatlage. In western half of the state, use crested wheatgrass-alfalfa pastures whenever practical for grazing. Use ⅔ to 2 acres for each animal unit. Cut for hay crop in late June. 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.

If you use standing grass residue from last year's growth, be sure to supplement it properly to get the cow in condition for the breeding season. This will help ensure a good calf crop.

Table 2. Nutritional requirements of cattle and the nutritive value of good quality forage (on a dry matter basis) commonly used between April and November.

	PROTEIN %	PHOSPHORUS %	TDN %
Cow needs	9.2	0.23	60
Yearling needs	10.0	0.30	60
Crested wheatgrass (65-0-0)	15-20	0.20	65
Brome pasture (0-0-0)	18-20	0.19-.22	65
Brome pasture (80-20-0)	20-24	0.21-.25	65
Brome-alfalfa pasture	19.5	0.36	61
Green needlegrass	10	0.16	58
Sudangrass	14	0.31	58
Switchgrass	10	—	64
Warm native	11	0.16	58
Alfalfa-brome hay	16	0.26	55
Prairie hay	7.5	0.15	50
Corn silage	8.5	0.21	68
Oat haylage	9.7	0.33	55
Barley straw	4.1	0.09	41
Dry grass (standing residue)	3.5	0.08	48

Crested wheatgrass and Russian wildrye are early-emerging, cool-season grasses adapted to most of the state. Both are bunch-type grasses which do not give good erosion con-

Table 3. Acres and forage costs per animal unit (AU) for 5-week period (late April to late May) for several forages for six areas delineated in Fig. 2.

Pasture or Forage	A/AU[1]	Forage Costs/AU Prod.	Forage Costs/AU Land	A/AU[1]	Forage Cost/AU Prod.	Forage Cost/AU Land
	Area 1			Area 2		
Crested wheat pasture	.55	$1.95	$19.80	.60	$1.05	$18.00
Crested wheat + N	.45	4.55	16.20	.50	4.00	15.00
Crested wheat-alfalfa + P	.45	0.90	16.20	.50	3.15	15.00
Alfalfa hay (baled)[1]	.137	8.20	4.95	.169	8.45	5.05
Oatlage (33% DM)[2]	.142	19.10	5.10	.142	18.65	4.75
Corn silage (33% DM)[3]	.086	22.00	3.10	.121	23.00	3.65
Corn silage & alfalfa hay[4]	.099	18.70	3.55	.133	19.40	4.00
Sorghum silage (33% DM)[5]	.080	19.95	2.80	.100	21.30	3.60
	Area 3			Area 4		
Crested wheat pasture	.75	$1.30	$18.00	.90	$1.60	$16.20
Crested wheat + N	.60	5.20	14.40	.65	3.90	11.70
Crested wheat-alfalfa + P	.55	2.75	13.20	.60	2.20	10.80
Alfalfa hay (baled)[1]	.243	8.85	5.85	.292	8.50	5.25
Oatlage (33% DM)[2]	.145	18.65	3.50	.151	18.90	2.70
Corn silage (33% DM)[3]	.142	24.90	3.40	.151	24.30	2.70
Corn silage & alfalfa hay[4]	.167	20.95	4.00	.186	20.45	3.35
Sorghum silage (33% DM)[5]	.127	22.85	3.10	.134	23.10	2.40
	Area 5			Area 6		
Crested wheat pasture	1.00	$1.75	$13.50	1.70	$3.05	$17.90
Crested wheat + N	.70	4.00	9.45	1.25	6.60	13.10
Crested wheat-alfalfa + P	.70	3.00	9.45	1.25	5.65	13.10
Alfalfa hay (loose)[1]	.408	11.15	5.50	.49	11.95	4.40
Oatlage (33% DM)[2]	.183	19.70	2.45	.192	17.90	1.75
Corn silage (33% DM)[3]	.201	25.00	2.70	.302	28.60	2.70
Corn silage & alfalfa hay[4]	.242	21.35	3.25	.337	28.45	3.00
Sorghum silage (33% DM)[5]	.173	23.85	2.35	.302	24.25	2.70
Prairie hay (loose)[6]	.980	7.10	8.80	1.23	7.15	5.55

[1] Harvested yields of 3.2, 2.6, 1.8, 1.5, 1.2 & 1.0 T/A for Areas 1-6 respectively; rack fed @ 22 lb/day + 13.5% wastage in Areas 1-4; loose fed with 27% wastage in Areas 5 & 6.
[2] Harvested yields of 8.5, 8.5, 8.3, 8.0, 6.6 & 6.3 T/A for Areas 1-6 respectively; bunk fed @ 60 lb/day with 15% storage and feeding losses.
[3] Harvested yields of 14, 10, 8.5, 8.0, 6.0 and 4.0 T/A in Areas 1-6 respectively; bunk fed @ 60 lb/day with 15% storage and feeding losses.
[4] Silage bunk fed @ 52 lb/day + 15% wastage; hay @ 5 lb/day + 25% wastage.
[5] Harvested yields of 15, 12, 9.5, 9.0, 7.0 & 4.0 T/A in Areas 1-6 respectively; bunk fed @ 60 lb/day with 15% storage and feeding losses.
[6] Harvested yields of 0.5 + 0.4 T/A in Areas 5 & 6; loose fed @ 22 lb/day + 27% feeding loss.

trol on steep slopes. They are useful for livestock producers who start grazing before mid-May. 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, these grasses are not needed by the producer who likes to "calve" in drylot.

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 4 to 5 weeks than to utilize land for a relatively low-yielding crop of grass. Fewer acres are required to raise the forage fed in drylot than are needed for a crested wheatgrass pasture.

Kentucky bluegrass pastures that are 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.

Late Spring and Summer (Late May to Early July)

Tame grasses (smooth bromegrass and intermediate wheatgrass) and native cool-season grasses (western wheatgrass and needlegrasses) are most productive during this 6½-week period. Fertilized bromegrass pasture or a brome-alfalfa pasture will provide the nutrients (Table 2) except salt and water, required by a cow with a calf at her side. Yearlings will require phosphorus supplementation. Native grass or alfalfa-brome hay are low in phosphorus and energy.

Estimated acres and forage costs of several pastures for one animal unit for the 6½-week period between late May and early July are compared in Table 4 for six areas delineated in Figure 2. Native grazing land has lowest production costs and highest acreage requirements per animal unit. When "land charges" are added to "production costs" the total costs for native pasture are lower for West River, and they also are lower than for tame pastures grazed continuously for Areas 3, 4 and 5. The estimates do not indicate that carrying capacity of pastures is increased enough by the use of fertilizer so that lower land charges will offset the cost of fertilizer, but the use of alfalfa in a tame grass mixture consistently lowers the total cost per animal unit. When increased fencing and watering costs are not included, the costs of production and land charges are consistently lower on tame grass pastures that are grazed intensively for 75 days than for the same pastures grazed continuously for 120 days. It will be noted that the most economical forage listed for five areas is brome-intermediate wheat-alfalfa that is grazed intensively for 45 days in late May to early July and again from mid-August to mid-September.

Forage recommendations for 6 weeks between late May and early July are to use smooth bromegrass and/or intermediate wheatgrass mixed with alfalfa, where adapted, for pastures to be grazed between mid-May and mid-September. Pubescent wheatgrass may be added to the mixture.

Use 1 to 3 acres of pasture for each animal unit (more acres on low-producing soils and fewer on good-producing areas) if the pasture is to be grazed continuously for 4 months. 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.

Fewer acres are needed if you graze more intensively 6 weeks in May to July and 1 month in August and September. Use ⅝ to 1½ acres for each animal unit. Plan for a midsummer pasture during July and August.

If you have cool-season native range in good or excellent range condition on normal soils, allow 4 to 12 acres for each animal unit from mid-May to early November (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.

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). Grazing from late May to mid-September 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 2 AU/A from mid-May to mid-July and again in September but only ½ 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 carrying capacity by 1 AUM/A.

At the Pasture Research Center near Norbeck, pastures composed of smooth bromegrass, intermediate wheatgrass, and Teton alfalfa supported ⅓ AU/A for 130 days and pro-

Table 4. Acres and forage costs per animal unit (AU) for a 6½-week period (late May to early July) for several pastures in six areas delineated in Fig. 2.

Pasture or Range	A/AU	Forage Cost/AU Prod.	Forage Cost/AU Land	A/AU	Forage Cost/AU Prod.	Forage Cost/AU Land
	Area 1			Area 2		
Native pasture	3.25	$0.90	$17.80	4.2	$1.20	$20.50
Native pasture + N	2.8	6.30	15.30	3.2	3.25	15.60
Brome-Int wheat[1]	1.3	0.85	17.50	1.8	1.20	20.50
Brome-Int wheat + N[1]	1.0	6.10	13.50	1.3	6.60	14.60
Brome-Int wheat-alfalfa + P[1]	1.0	1.30	13.50	1.3	2.50	14.60
Brome-Int wheat[2]	0.8	0.85	17.30	1.0	1.05	18.00
Brome-Int wheat + N[2]	0.6	5.75	13.00	0.7	5.35	12.60
Brome-Int wheat-alfalfa + P[2]	0.6	1.15	13.00	0.7	1.75	12.60
	Area 3			Area 4		
Native pasture	4.5	$1.25	$19.00	5.0	$1.40	$16.90
Native pasture + N	3.8	8.90	16.00	4.0	7.30	13.50
Brome-Int wheat[1]	2.5	1.65	22.50	3.0	1.95	20.30
Brome-Int wheat + N[1]	2.0	8.95	18.00	2.5	10.25	16.90
Brome-Int wheat-alfalfa + P[1]	2.0	4.10	18.00	2.5	4.60	16.90
Brome-Int wheat[2]	1.2	1.25	17.30	1.4	1.45	15.10
Brome-Int wheat + N[2]	0.9	5.75	13.00	1.1	7.00	11.90
Brome-Int wheat-alfalfa + P[2]	0.9	2.05	13.00	1.1	3.05	11.90
	Area 5			Area 6		
Native range	5.6	$1.60	$14.20	11.2	$3.15	$14.20
Native range + N	4.7	7.75	11.90	—	—	—
Brome-Int wheat[1]	4.0	2.60	20.20	5.0	3.30	19.70
Brome-Int wheat + N[1]	3.5	13.10	17.75	4.4	11.80	17.30
Brome-Int wheat-alfalfa + P[1]	3.5	4.95	17.75	4.4	6.20	17.30
Brome-Int wheat[2]	1.75	1.85	14.20	3.4	3.55	21.40
Brome-Int wheat + N[2]	1.4	7.50	11.30	2.6	10.80	16.40
Brome-Int wheat-alfalfa + P[2]	1.4	3.30	11.30	2.6	5.50	16.40

[1] Grazed 120 days from late May to mid-September
[2] Grazed intensively 45 days late May to early July and 30 days mid-August to mid-September.

vided 1.33 AUM/A of grazing. Similar pastures grazed more intensively from mid-May to early July and again in September supported 5/6 AU/A and provided 2 AUM/A of grazing. The cattle were pastured on switchgrass in July and August. By grazing green grass as fast as it grew and using a combination of cool-season and warm-season grasses, the carrying capacity of the bromegrass-wheatgrass-alfalfa mixture was increased by 60%.

Under the first system, 32 acres were required for 10 cows for 130 days. Under the second system, 12 acres of brome-wheatgrass-alfalfa and 10 acres of switchgrass (a total of 22 acres) were required for 10 cows for about the same period (110 days).

At Fargo, ND, 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 Lincoln, NE, 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.

If brome grass and/or intermediate wheatgrass-alfalfa pastures are used for 4 months, the carrying capacity can be increased about 10% by 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 (early June), 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 (late 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 percent 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.

Mid-Summer (Early July to Mid-August)

July and August are the months when growing forage is frequently in short supply because most livestock producers rely on cool-season grasses. Forages are sudangrass, warm-season perennials, cool-season grasses that are semi-dormant, small grain stubble, or hay. The data in Table 2 indicate that sudangrass pasture, bromegrass-alfalfa pasture and switchgrass pasture would provide all the nutrients needed. Warm-season natives and hay should be supplemented by phosphorus and energy. Straw in a stubble field is far short in protein, phosphorus and energy (Table 2). Weeds and grain in a stubble field improve the nutritive value of grain stubble.

Estimated acre and forage costs of several forages for one animal unit for a 6-week period from early July to mid-August are compared in Table 5 for six areas delineated in Figure 2. Native grazing land has lowest production costs and highest acreage requirements per animal unit. When "land charges" are added to "production costs," native range is more economical than cool-season tame pastures grazed continuously in Areas 3, 4, 5, 6.

Warm-season grasses appear to be more costly than cool-season grasses, even though less acreage per animal unit is required. Their production costs are high because of the cost of nitrogen fertilizer and because sudan grass must be planted every year and switchgrass every 6 to 10 years.

Since cool-season grasses produce more forage if cut for hay than when cut several times to simulate grazing, it was thought that one part of a tame grass-alfalfa pasture could be fenced and cut for hay during late June. The cattle could be fed hay in the pasture for 6 weeks. This has been done for 2 years at the Pasture Research Center near Norbeck. Preliminary results indicate that wastage can be held to a minimum if cows are forced to clean up the hay before they are fed more. The calves gained well.

The practicality of this system depends on the amount of wastage. Estimates are given in Table 5 for 36% wastage and 13.5% wastage—a difference of 5 pounds per day per cow. With the lower amount of wastage, it is one of the lower priced forages in all areas, but with the higher amount it costs more than any of the cool-season pastures.

Forage recommendations for 6 weeks between early July and mid-August are to 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 ⅔ to 1 acre per animal unit (more acres on low-producing soils and fewer on good-producing areas).

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.

Dairy cows were grazed on Piper sudangrass, a sudan hybrid and a sorghum-sudan hybrid at Brookings. Each provided 109.5 cow days of grazing (10 cows on 6.76 acres for 74 days). Milk production was 5,320 pounds per acre from Piper sudan, 5,350 from the sudan hybrid and 5,135 from the sorghum-sudan hybrid. The cattle consumed 67% of forage from Piper sudan, 57% of the sudan hybrid and 46% of the sorghum-sudan hybrid, indicating that Piper was more palatable.

Dairy yearlings grazed on the same three types of pastures planted in 6- 12- and 36-inch rows. The 6- and 12-inch rows produced the most forage and had less weed competition, but there was less trampling in the 36- inch rows. The highest yields of dry matter for the three pastures were 4.5 tons per acre for the sudan hybrid (12-inch rows) 3.5 for the sorghum-sudan hybrid (6-inch rows) and 3.0 for Piper (6-inch rows). The amounts left in the field were 0.9, 1.4 and 1.0 tons per acre, respectively.

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 period, an average of 147 pounds of beef was produced from 1.28 tons of forage per acre.

Summer switchgrass and a sorghum-sudan hybrid were grazed

Table 5. Acres and forage costs per animal unit (AU) for 6 weeks (early July to mid-August) for several forages in six areas delineated in Fig. 2.

Pasture or Range	A/AU	Forage Cost/AU Prod.	Forage Cost/AU Land	A/AU	Forage Cost/AU Prod.	Forage Cost/AU Land
		Area 1			Area 2	
Native pasture	x	$0.85	$16.70	x	$1.10	$19.20
Native pasture + N	x	5.80	14.40	x	3.00	14.60
Brome-Int wheat[1]	x	0.80	16.40	x	1.10	18.90
Brome-Int wheat + N[1]	x	5.65	12.60	x	6.15	13.70
Brome-Int wheat-alfalfa + P[1]	x	1.20	12.60	x	2.30	13.70
Brome-Int wheat-alfalfa hay[2]	.315	11.50	11.35	.371	12.00	11.15
Brome-Int wheat-alfalfa hay[3]	.263	9.60	9.45	.309	10.00	9.25
Switchgrass + N	.5	13.00	18.00	.5	13.00	15.00
Sudangrass + N	.3	11.30	10.80	.4	14.20	12.00
		Area 3			Area 4	
Native pasture	x	$1.25	$17.70	x	$1.30	$15.80
Native pasture + N	x	8.40	15.00	x	6.80	12.60
Brome-Int wheat[1]	x	1.55	21.00	x	1.85	18.90
Brome-Int wheat + N[1]	x	8.35	16.80	x	9.55	15.70
Brome-Int wheat-alfalfa + P[1]	x	3.80	16.80	x	4.30	15.70
Brome-Int wheat-alfalfa hay[2]	.485	12.50	11.65	.573	12.95	10.30
Brome-Int wheat-alfalfa hay[3]	.409	10.40	9.70	.477	10.80	8.55
Switchgrass + N	.6	10.95	14.40	.7	11.40	12.60
Sudangrass + N	.5	16.60	12.00	.6	19.40	10.80
		Area 5			Area 6	
Native range	x	$1.45	$13.20	x	$2.95	$13.20
Native range + N	x	7.25	11.10	—	—	—
Brome-Int wheat[1]	x	2.50	18.90	x	3.05	18.40
Brome-Int wheat + N[1]	x	12.25	16.50	x	11.05	16.20
Brome-Int wheat-alfalfa + P[1]	x	4.60	16.50	x	5.75	16.20
Brome-Int wheat-alfalfa hay[2]	.63	9.90	8.50	1.05	14.75	9.45
Brome-Int wheat-alfalfa hay[3]	.525	8.25	7.10	—	12.30	7.90
Switchgrass + N	.8	11.35	10.80	—	—	—
Sudangrass + N	.7	20.60	9.50	—	—	—
Prairie hay (loose)[4]	1.18	8.55	10.60	1.476	8.55	6.65

[1] Grazed 120 days from late May to mid-September
[2] Brome-Intermediate wheat-alfalfa pasture fenced separately, harvested for hay and fed in pasture; yields of 2.0, 1.7, 1.3, 1.1, 1.0, & 0.6 T/A in Areas 1-6, respectively plus 36% feeding losses.
[3] Same hay with only 13.5% wastage.
[4] Harvested yields of 0.5 + 0.4 T/A in Areas 5 & 6; loose fed @ 22 lbs/day + 27% feeding loss.
x Same pastures used in Table 4.

Estimated acres and forage costs of several forages for one animal unit for a 6-week period between mid-September and early November are compared in Table 7 for six areas delineated in Figure 2. Sorghum-sudan is included here because it was widely used after September 1 during the days that it was planted on "set-aside" acres.

Estimated production costs of fertilized pasture or harvested forage and sorghum-sudan are higher than for unfertilized pasture. However, when estimated "land charges" are added to "production costs," the situation changes. The higher acreage requirements of pasture and the correspondingly higher "land charges" raise the total cost of pasture above sorghum-sudan in Areas 1 and 2, above alfalfa hay in two-thirds of the state and above prairie hay in western counties.

Crop aftermath, such as straw, is low in nutritive value (Table 2) and must be supplemented in order to balance the ration. However, most small grain stubble fields contain green growth and some grain until after frost and require less supplementation. Likewise, corn stalk fields generally contain enough grain to provide the energy needed by livestock until after November 1.

Forage recommendations for late September and October are to use crop aftermath, sorghum-sudan, Russian wildrye or native pasture. Be sure to supplement crop aftermath with protein, at least until the calf is weaned and for yearlings. Also provide for replacement of soil nutrients removed in the crop aftermath. Use ¾ to 1½ acres of perennial grass, 4 to 12 acres of native grass, or 1/5 to 1/3 acre of sorghum-sudan for each animal unit. Graze continuously. Do not use a perennial grass pasture that you intend to graze early next spring.

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 greens up quickly from fall rain and produces green forage for 2 weeks longer than any other grass.

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

PASTURE AND FORAGE SYSTEMS

Use the estimated costs and acres per animal unit (A/AU) in Tables 3 to 7 to estimate costs and acreage required for forage production for about 6½ months. If the estimated carrying capacities or forage yields in the tables are too high, the estimated costs per cow are low, and vice versa.

Estimate the cost and acreage requirements for 6½ months by totaling the estimated costs and A/AU of a selected forage from each of the five tables (3-7). See Tables 8 and 9 for an

Table 7. Acres and forage costs per animal unit (AU) for 6 weeks (mid-September to early November) for several forages in six areas delineated in Fig. 2.

Pasture or Forage	A/AU	Forage Costs/AU Prod.	Forage Costs/AU Land	A/AU	Forage Costs/AU Prod.	Forage Costs/AU Land
	Area 1			Area 2		
Native pasture	x	$0.90	$17.00	x	$1.10	$19.70
Native pasture + N	x	6.00	14.60	x	3.15	15.00
Russian wildrye	.75	1.35	27.00	.80	1.45	24.00
Russian wildrye + N	.70	7.80	25.20	.70	6.00	21.00
Sorghum-sudan	.25	9.70	9.00	.35	13.00	10.50
Alfalfa hay (baled)	.164	9.85	5.95	.203	10.15	6.05
Crop aftermath	—	supplement		—	supplement	
	Area 3			Area 4		
Native pasture	x	$1.20	$18.10	x	$1.30	$16.10
Native pasture + N	x	8.50	15.30	x	6.90	12.95
Russian wildrye	.9	1.60	21.60	.90	1.60	16.20
Russian wildrye + N	.8	7.20	19.20	.80	6.15	14.40
Sorghum-sudan	.45	17.65	10.80	.50	17.05	9.00
Alfalfa hay (baled)	.291	10.60	7.00	.350	10.20	6.30
Crop aftermath	—	supplement		—	supplement	
	Area 5			Area 6		
Native range	x	$1.50	$13.60	x	$3.00	$13.50
Native range + N	x	7.40	11.40	x	—	—
Russian wildrye	1.1	2.00	14.90	2.5	4.50	26.30
Russian wildrye +N	1.0	6.20	13.50	2.0	11.40	21.00
Sorghum-sudan	.7	19.95	8.00	.75	20.25	7.90
Alfalfa hay (loose)	.490	13.40	6.60	.588	14.35	5.30
Prairie hay (loose)	1.176	8.50	10.55	1.476	8.60	6.65
Crop aftermath	—	supplement		—	supplement	

x Same pastures used in Tables 4, 5 & 6.

example. A low-cost forage system for 6½ months was selected for each area of the state. The low-cost system was obtained by using forage with a low cost per animal unit from each of the Tables 3, 4, 5, 6, and 7 and inserting the acre requirements and forage costs per animal unit in Tables 8 and 9. They are compared with other forage systems that are commonly used in the areas represented. The cost and acreage of about 35 different systems for each land value can be estimated in a similar manner from the figures given in Tables 3-7. Costs and acreage for a 50-cow herd are 50 times greater than the acreage and cost totals obtained for each forage system.

Table 8. Comparison of total costs (including land charges) of three forage systems for eastern South Dakota.

			Area 1		Area 2		Area 3	
Table	Period	Forage[1]	A/AU	Cost/A	A/AU	Cost/A	A/AU	Cost/A
3	5 wk	Cr-alf	0.45	$ 17.10	0.50	$18.15	0.55	$15.95
4	6½ wk	BIA	0.60	14.15	0.70	14.35	0.90	15.05
5	6 wk	Sw[2]	0.50	31.00	0.50	28.00	0.60	25.35
6	1 mo	BIA	x	9.35	x	9.55	x	9.95
7	6 wk	RWR	0.70	33.00	0.70	27.00	0.80	26.40
Total	194 days	—	2.25	$103.70	2.40	$97.05	2.85	$92.70
				or				
3	5 wk	Sil & hay	0.086	22.25	—	—	—	—
3	5 wk	Oatlage	—	—	0.142	23.40	0.145	22.15
4-6	4 mo	BIA	1.00	39.45	1.30	45.65	2.00	58.90
7	6 wk	Stubble	—	—	—	—	—	—
Total	194 days	—	1.086	$ 61.70	1.442	$79.05	2.145	$81.15
				or				
3	5 wk	Sil & hay	0.086	22.25	—	—	—	—
3	5 wk	Oatlage	—	—	0.142	23.40	0.145	22.25
4	6½ wk	BIA	0.60	14.15	0.70	14.35	0.90	15.05
5	6 wk	Hay	0.263	19.05	0.309	19.25	0.409	20.10
6	1 mo	BIA	x	9.35	x	9.55	x	9.95
7	6 wk	Stubble	—	—	—	—	—	—
Total	194 days	—	0.949	$ 64.80	1.151	$66.55	1.454	$67.35

[1] Cr-alf for crested wheat-alfalfa pasture; BIA for smooth bromegrass- intermediate wheatgrass-alfalfa pasture; Sw for fertilized switchgrass; RWR for fertilized Russian wildrye; Sil & alf for corn silage and alfalfa hay.

[2] The use of sudangrass instead of switchgrass would lower total cost $8.90 in Area 1, $1.80 in Area 2 and $3.25 in Area 3.

x Same A/AU as in 6½ wk period.

Table 9. Comparison of total costs (including land charges)of three forage systems for central and western South Dakota.

			Area 4		Area 5		Area 6	
Table	Period	Forage[1]	A/AU	Cost/AU	A/AU	Cost/AU	A/AU	Cost/AU
3	5 wk	Cr-alf	0.60	$13.00	0.70	$12.45	1.25	$13.90
4	6½ wk	BIA	1.10	14.95	1.40	14.60	—	—
4-6	4 mo	BIA	—	—	—	—	4.40	62.70
5	6 wk	Sw	0.70	24.00	0.80	22.15	—	—
6	1 mo	BIA	x	9.95	x	9.80	—	—
7	6 wk	RWR	0.80	20.55	1.00	19.70	2.0	21.00
Total	194 days	—	3.20	$82.45	3.90	$78.00	7.65	$96.80
				or				
3	5 wk	Cr-alf	—	—	1.00	$12.45	1.25	$13.10
3	6½ wk	Oatlage	0.151	$27.00	—	—	—	—
4-6	4 mo	BIA	2.50	57.25	3.50	60.45	4.40	62.70
7	6 wk	Stubble	—	—	—	—	—	—
Total		—	2.65	$84.25	4.50	72.90	5.65	$75.80
				or				
3	5 wk	Cr-alf	0.6	$13.00	—	—	—	—
3	5 wk	Crested	—	—	1.00	$15.25	1.70	$19.70
4-7	160 da	Native	5.0	$65.00	5.6	$56.00	11.20	$61.60
Total	195 days	—	5.6	$78.00	6.60	$71.25	12.90	$81.30

[1] Cr-alf for crested wheat-alfalfa pasture; BIA for smooth bromegrass-intermediate wheatgrass-alfalfa pasture; Sw for fertilized switchgrass; RWR for fertilized Russian wildrye.

x Same A/AU as in 6½ wk period.