7-1-1985

Management Choices: Native, Interseeded Native, or Tame Pastures

F. R. Vigil

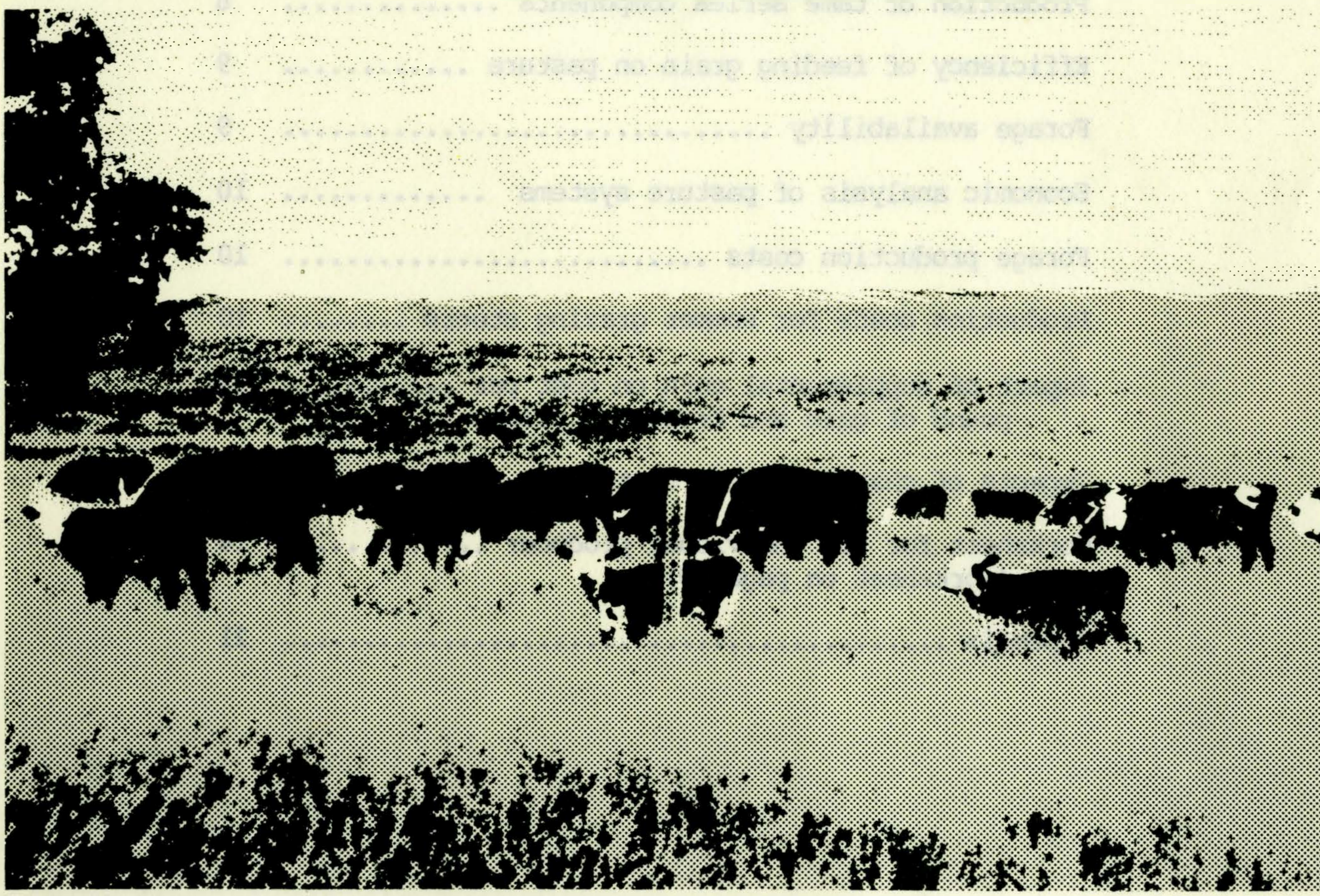
R. Shane

S. Fransen

D. Huber

B 685
July 1985

Management choices: Native, interseeded native, or tame pastures



Agricultural Experiment Station • South Dakota State University • Brookings, South Dakota 57007

CONTENTS

Published in accordance with an Act passed in 1881 by the 14th Legislative Assembly, Dakota Territory, establishing the Dakota Agriculture College and with the Act of re-organization passed in 1887 by the 17th Legislative Assembly, which established the Agricultural Experiment Station at South Dakota State University.
File: 1.4-8.1—AX 060

Management choices: Native, interseeded native, or tame pastures

SUMMARY

"Why didn't they gain like I expected?" That is not the question a cattleman wants to face at the end of a summer of grazing.

To answer that question, the producer must ask two more: Did he use native, interseeded, or tame pasture? Did he do any supplemental feeding to add energy?

This report of a 3-year grazing study in north-central South Dakota demonstrates the importance of those questions. In brief, the report discusses how we achieved economical and sustained beef cattle production on native and tame pastures with and without energy supplementation at the Pasture Research Center in Faulk County.

We used native range, interseeded range (native range interseeded with 2 lb/A 'Travois' pasture-type alfalfa), and a tame pasture series in the study. The tame pasture series consisted of crested wheatgrass, brome-alfalfa, sudangrass, and Russian wildrye, grazed in sequence.

Corn was fed daily to cattle on all pasture systems at 0, 0.5, and 1.0% of body weight. Crested wheatgrass and Russian wildrye pastures were fertilized yearly with 65 lb/A of nitrogen. The sudangrass received 60 lb/A.

Average daily gain (ADG) on the three pasture systems was not significantly different; steers on all three systems gained an average 1.5 lb/day. Significant differences did occur between years, grain levels, and year and grain level.

ADGs for the 0.5 and 1.0% grain supplement levels were 22% higher than the 0% level for the 3-year period. Conversion of grain to animal product was poor when grain was fed throughout the grazing season, but grain supplementation was very effective in the later part of the grazing season when forage quality was poor. ADGs on the native and interseeded ranges were extremely poor during this time except at the highest level of grain supplementation.

Animal gains per acre were about 60% higher on both the interseeded range and tame pasture series than on native range. Interseeded range with no corn supplementation equaled the productivity of the native range supplemented at the 1.0% level. Interseeded range equaled the productivity of the tame pasture series at all levels of corn supplementation.

The carrying capacity of both tame and interseeded pastures was 51% greater than that of the native range. Feeding grain on pasture increased carrying capacity while it maintained or increased ADG. Supplementing grain at the 0.5 and 1.0% levels increased carrying capacity by 10 and 23%, respectively.

Interseeded range was the most economical system for producing beef cattle, followed by the native range and tame pasture series, respectively. Even though the production of the tame pasture series equaled that of the interseeded range, it was the least economical system because of the high cost of maintaining the tame pasture. Native range, which was the least productive of the three systems, was intermediate in cost per pound of gain and in breakeven price because of its low input requirements.

Introduction

Grasslands occupy most of South Dakota's land area, but their management often is left to nature or chance. Grasslands, however, are vital to the state's economy because they produce a large portion of its beef and wildlife. Any small improvement in human management of their vast resources has far reaching impacts on the state's economy.

The objective of the 3-year grazing study reported in this bulletin was to develop effective, economical, and sustained beef cattle production on native and tame pastures with and without energy supplementation. The three pasture systems studied were native range, interseeded native range, and a tame pasture series.

The tame pasture series consisted of crested wheatgrass (Agropyron desertorum Fisch. ex Link, Shult.), brome-alfalfa (Bromus inermis Leyss. and Medicago sativa L.), sudangrass (Sorghum bicolor Linn. Moench), and Russian wildrye (Elymus junceus Fisch.).

Cattle grazed the tame pastures in the following sequence: crested wheatgrass, beginning in May when it was 6-8 inches tall, for approximately one month; brome-alfalfa, when the brome was at early to full heading; sudangrass, in late July when it was 24-26 inches tall; brome-alfalfa regrowth after it had a 4-5 week rest; mature Russian wildrye for fall grazing (Fig 1).

Because the tame pastures included the early-season crested wheatgrass, we could extend the grazing season 22 days past native and interseeded grazing.

Crested wheatgrass and Russian wildrye pastures were fertilized yearly with 65 lb/A nitrogen; sudangrass was fertilized at 60 lb/A nitrogen. No other pastures were fertilized.

Major plants in the prairie that made up the native pasture were Kentucky bluegrass (Poa pratensis L.), western wheatgrass (Agropyron smithii Rydb.), green needlegrass (Stipa viridula Trie.), and needleandthread (Stipa comata Trinit Rupr.), with a mixture of forbs and other grasses (Table 1).

The only difference between the native range and the interseeded native range was that the latter had alfalfa interseeded into its sod. At 30.2% relative density, alfalfa was the most abundant species in the interseeded range, followed by Kentucky bluegrass and western wheatgrass.

Plant density comparisons between native and interseeded ranges showed that the sod-forming grasses such as

Fig 1. Pasture components of three grazing management systems tested at Norbeck, SD, from 1977-1979.

Pasture System	Grazing Season						
	May	June	July	August	Sept.	Oct.	Nov.
Tame Series	Crested Wheatgrass	Brome-Alf.	Sudangrass		Brome-Alf.	Russian Wildrye	
Native Range		Native Range					
Interseeded Native		Interseeded Native Range					

Table 1. Percent relative density and percent relative frequency of major plant species in native and interseeded ranges, 1978.

Plant Species	Native Mean	Native S.E.[1]	Interseeded Mean	Interseeded S.E.
	-----------Percent Relative Density	-----------		
Alfalfa	--	--	30.2	3.0
Western wheatgrass	17.1	1.0	11.5	1.1
Green needlegrass	9.0	1.4	4.0	.6
Needle-and-thread	20.0	2.4	8.2	.9
Kentucky bluegrass	20.8	2.0	17.5	1.8
Other tame grasses	--	--	6.2	2.1
Other species[2]	33.0	2.7	22.4	2.7
	-----------Percent Relative Frequency	-----------		
Alfalfa	--	--	18.9	1.6
Western wheatgrass	15.2	8.5	12.3	.6
Green needlegrass	9.4	1.0	5.6	.7
Needle-and-thread	13.7	1.0	9.9	1.0
Kentucky bluegrass	15.3	.9	15.7	.9
Other tame grasses	--	--	4.4	1.5
Other species[2]	46.7	2.2	34.0	2.4

[1] Standard error of the mean

[2] Includes such species as bluegrama, prairie Junegrass, sedges, forbs, and others. Each contributes $\leq$ 1% of the total.

Kentucky bluegrass and western wheatgrass were more important in the interseeded range. The South Dakota interseeding technique with its relatively wide furrows appears to enhance sod-forming grasses and slightly suppress bunchgrass species.

The percent relative frequency (evenness of distribution of a species within the plant community) showed a stable mixed sod and bunchgrass community in both the native and interseeded ranges. Distribution of grasses did not appear to be influenced by the alfalfa.

The native and interseeded ranges were grazed continuously from early June to early November. Grazing started after most cool-season grasses had headed and the alfalfa was 10-12 inches high.

Productive, actively growing forages provide excellent cattle feed. However, late in the growing season, depletions in energy and protein begin to limit animal performance. To explore the use of mature, poorer quality forage while still maintaining good animal gains, we fed cracked corn daily as an energy supplement at 0, 0.5, and 1.0% of body weight.

We used yearling steers, three pasture replications, and a put-and-take system. (Put-and-take is simply putting more animals on the pasture when the grass looks good and taking some animals off when the pasture begins to show overgrazing.) No matter how many animals were moved about, six "tester" steers stayed on each pasture for the duration.

For computing animal performance, only the tester animals were used. For estimating carrying capacity in terms of animal days per acre, all animals were considered.[1]

The research was conducted in north-central South Dakota at the Pasture Research Center near Norbeck in Faulk County. The average annual precipitation at the station was 17.6 inches. Climatic data for Faulkton are presented in Appendix tables 1-3. The soil and climatic conditions at the Center make the study results applicable to the Northern Great Plains.

As to be expected anywhere in the region, each grazing season of the study had its own unique weather pattern. The study area suffered a severe drought in 1975 and 1976; soil moisture carryover was low or nonexistent in 1977. Although the spring of 1977 was early and warm and there was enough moisture for fair plant growth to begin, the lack of subsoil water restricted dry matter production for the year.

Some subsoil water was added in the fall of 1977. The spring of 1978 was cool with adequate moisture into late spring. However, rainfall was light in June and July, limiting full production during that period.

The spring of 1979 was cool and dry. Moisture arrived late in July and was then generally adequate for the remainder of the season.

Average daily gains

Animal performance on the different pastures and grain levels was determined using average daily gain periods. Animals were weighed at the beginning and end of each period.

[1]G.O. Mott. 1973. Evaluating forage production. In M.E. Heath et al, (ed) Forages, the science of grassland agriculture, Iowa State University Press, 126-135.

Average daily gains (ADGs) on the three pasture systems were not significantly different over the entire pasture period. Steers on all systems gained an average 1.5 lb/day (Table 2). ADGs were significantly different for year, year x grain level, year x pasture system x grain level, pasture period x pasture system, pasture period x grain level, and pasture period x pasture system x grain level interactions.

ADGs on interseeded range were highest during the earliest grazing period (P1) and lowest during the last grazing period (P5) (Table 3). Animal performance was very poor on the native and interseeded ranges in period 5, due to poor forage quality. In the tame pastures, Russian wildrye was grazed in period 5. This was the only pasture where animals continued to gain weight in that period.

Grain supplementation always increased animal performance, although to a greater degree on interseeded range than on the other systems (Tables 4 and 5). In the tame pasture series in both 1977 and 1978, ADGs at the 0.5 and 1.0% grain levels were similar, indicating that the lower grain level provided as much benefit as the higher.

ADGs were high early in the season at all grain levels. They decreased as the season progressed (Table 6). Grain supplementation was important on all pasture systems in periods 4 and 5. Feeding grain produced modest ADG increases in the first four periods. The effect of grain supplementation was greater as the grazing season progressed, greatest in period 5 at the 1.0% level. ADG was lower on interseeded range in period 5. Steers on the native and interseeded range consistently lost weight in period 5 at the 0 and 0.5% grain level; only at the 1.0% level were they able to maintain their body weight. The best animal gains during period 5 were on the tame pasture supplemented with 1.0% grain. ADGs on the tame pastures in period 5 without grain energy were higher than on the interseeded range supplemented at the 1.0% body weight level.

Table 2. Pasture production of yearling steers grazing on three forage management systems during the 1977, 1978, and 1979 grazing season, Norbeck, SD. Average across three grain levels.

Pasture Management System	Pounds Gain/Acre	ADG*	T Gain	AUM/acre	Grazing season length, days
Native	53	1.47	227	.85	156
Interseeded	85	1.54	240	1.28	156
Tame	83	1.49	262	1.32	178
$LSD_{.05}$	21	N.S.	33	.20	

*ADG = Average Daily Gain; T Gain = Total gain for grazing season per animal; AUM = Animal Unit Month, considered to be the amount of feed eaten by one mature cow with calf or cow alone in a month; $LSD_{.05}$ = Least Significant Differences at the 5% level of probability: a 21-lb difference in gain/acre between average treatments would be significantly different.

Table 3. Average daily gain of yearling steers by pasture period for three pasture systems and for three grain levels during the 3-year study.

Pasture System	Pasture Period P1	P2	P3	P4	P5
	ADG (Pounds)				
Native	1.98	1.98	1.85	1.30	.09
Interseeded	2.20	2.20	1.85	1.34	-.02
Tame	2.09	2.09	1.72	1.43	.81
Percent Grain					
0.0	1.94	1.96	1.50	1.19	.07
0.5	2.11	2.07	2.03	1.41	.15
1.0	2.23	2.25	1.90	1.45	.64

Consequently, feeding grain on pasture does not appear practical until the later grazing periods. High quality forage alone can provide the nutritional requirements of growing animals.

Carrying capacity and animal gains per acre

Carrying capacity, measured in animal unit months (AUM) per acre, is an important way to express pasture productivity. The carrying capacities of the tame pasture and interseeded range were 51+% greater than that of the native range (Tables 6 and 7). Gains per acre on the interseeded native range and tame pastures were about 60% higher than for native range. Steer gains per acre increased with increasing levels of grain supplementation.

Grain supplementation on pasture at the 0.5 and 1.0% levels increased AUM/A by 10 and 23%, respectively. Feeding grain on pasture increased carrying

Table 4. Average daily gain of yearling steers on three pasture systems for three grain levels during different pasture periods during the 3-year study.

Percent Grain Levels and Pasture Periods	Pasture System: Native	Interseeded	Tame
		ADG (Pounds)	
0.0 Grain			
1	1.72	2.14	1.98
2	1.59	2.16	2.12
3	1.63	1.63	1.21
4	1.21	1.34	1.19
5	-0.02	-0.26	.46
0.5 Grain			
1	2.05	2.16	2.12
2	2.14	2.16	1.90
3	1.96	1.96	2.16
4	1.30	1.43	1.52
5	-0.31	-0.04	.84
1.0 Grain			
1	2.16	2.31	2.16
2	2.25	2.27	2.27
3	1.98	1.94	1.79
4	1.39	1.43	1.57
5	0.55	0.22	1.12

Table 5. Average daily gain of yearling steers by pasture system and grain level for the 1977-1979 grazing seasons.

Percent Grain Level	Pasture System: Native	Interseeded	Tame
		ADG (Pounds)	
		1977	
0.0	1.06	1.06	1.01
0.5	1.28	1.30	1.39
1.0	1.43	1.37	1.45
		1978	
0.0	1.23	1.45	1.21
0.5	1.32	1.54	1.37
1.0	1.23	1.54	1.43
		1979	
0.0	1.45	1.70	1.63
0.5	1.94	1.96	1.85
1.0	2.25	1.98	2.07

Table 6. Carrying capacity by grazing system for three grain levels during the 1977-1979 grazing seasons.

Percent Grain Level	Pasture System Native	Interseeded	Tame	Mean
	AUM/acre			
0.0	.74	1.12	1.24	1.03
0.5	.88	1.23	1.28	1.13
1.0	.92	1.43	1.45	1.27
Mean	.85	1.26	1.32	

Table 7. Carrying capacity by grazing season for three pasture systems and three grain levels for the 1977-1979 seasons.

Pasture System	Grazing Season 1977	1978	1979
	AUM/acre		
Native	.85	.91	.78
Interseeded	1.20	1.33	1.30
Tame	1.40	1.49	1.08
Percent Grain			
0.0	1.08	1.04	.97
0.5	1.14	1.27	1.02
1.0	1.22	1.42	1.16
Mean	1.15	1.24	1.05

capacity while maintaining or increasing animal daily gains.

At 0.0% grain the interseeded range increased gain per acre 69% over a straight native range (Table 8). The productivity of interseeded range and tame pastures at 0.0% grain equaled the productivity of the native range at 1.0% grain supplementation. Interseeded range production equaled that of the tame pastures at all levels of corn supplementation.

Pasture systems x grain level interactions showed that the carrying capacity of interseeded range equaled that of the tame pasture series and that the interseeded range without grain had a higher carrying capacity than native range supplemented at 1.0% of body weight.

It is clear that the addition of alfalfa into a native range can increase its productivity. The question that future research must address is, can this increase be sustained over long periods of time?

Acres required per animal unit

Without any grain, the number of acres required to carry an animal unit through the season was 7.0 A for native

Table 8. Average annual animal gain in pounds per acre, by grazing systems for three grain levels for the 1977-1979 grazing seasons.

Percent Grain Level	Native Range	Interseeded	Tame
		Pounds of gain	
0.0	40	68	66
0.5	56	88	82
1.0	63	100	100

range, 4.7 for interseeded, and 4.8 for tame. At all three grain levels, the interseeded range and tame pastures required about 2 less acres to carry an animal unit than the native range.

Production of tame series components

Production on the tame pastures is shown in Table 9 and Appendix tables 4-6. ADGs were high at all corn levels early and declined as the season progressed.

Grain supplementation started to be important in period 3 (sudangrass), especially in 1977 and 1979. Grain supplementation at 0.5% increased ADGs on sudangrass by 232 and 69%, respectively, during these seasons.

ADG on brome-alfalfa regrowth in period 4 was also greatly improved by

Table 9. Production of the tame pasture components at three grain levels during the 1977-1979 grazing seasons.

Pasture Component and Pasture Period	Percent Grain Supplement 0	0.5	1.0	Mean
	Average Daily Gain, Pounds			
Crested wheatgrass, P1	1.98	2.12	2.17	2.09
Brome-alfalfa, P2	2.12	1.90	2.22	2.08
Sudangrass, P3	1.22	2.17	1.79	1.73
Brome-alfalfa, P4	1.20	1.52	1.57	1.43
Russian wildrye, P5	.46	.84	1.12	.81
	Animal Unit Days/Acre			
Crested wheatgrass, P1	37	35	43	38
Brome-alfalfa, P2	24	27	28	26
Sudangrass, P3	46	46	50	48
Brome-alfalfa, P4	14	15	16	15
Russian wildrye, P5	35	35	45	38
	Gain/Acre, Pounds			
Crested wheatgrass, P1	103	107	132	114
Brome-alfalfa, P2	71	70	88	76
Sudangrass, P3	78	148	128	118
Brome-alfalfa, P4	14	18	24	19
Russian wildrye, P5	19	38	67	41

grain supplementation. The brome-alfalfa regrowth had poor forage quality and was composed primarily of bromegrass since the alfalfa had been selectively grazed down in period 2. In period 5, grain supplementation also greatly increased ADG. The Russian wildrye was completely mature, yet 800-lb animals also continued to gain weight without added corn.

Compared to the 0% grain level, the 0.5% level did not greatly increase the carrying capacity, but 1.0% corn increased carrying capacity by 17%. Production increases at the 0.5% level came from increases in ADG; at the 1.0% level they came from increases in both ADG and carrying capacity. Gains per acre over the 3-year period were increased 34 and 54% by the 0.5 and 1.0% corn levels, respectively.

Efficiency of feeding grain on pasture

Feeding grain throughout the grazing season is not efficient (Table 10). Providing supplemental energy on pasture should be done during selected grazing periods when forage quality is poor, such as during periods 4 and 5. Supplementing with grain allows a greater stocking rate without reducing animal gains.

Forage availability

Interseeded ranges had 93 and 50% more forage available in the early spring than did the native range for

Table 10. Efficiency of feeding corn for improving total animal gains under three pasture systems and three grain levels, 1977-1979.

	Percent Grain Level		
	0	0.5	1.0
	Native (156-day grazing season)		
ADG (lb)	1.25	1.40	1.28
Gain/animal (lb)	195	218	200
Corn fed/day/animal (lb)	0	3.71	7.37
Corn fed/season/animal (lb)	0	579	1150
Corn/100-lb gain (lb)	-	265	575
Gain over 0% corn/lb corn fed (lb)	-	.04	.008
	Interseeded (156-day grazing season)		
ADG (lb)	1.52	1.60	1.53
Gain/animal (lb)	237	250	239
Corn fed/day/animal (lb)	0	3.73	7.45
Corn fed/season/animal (lb)	0	582	1162
Corn/100-lb gain (lb)	-	233	486
Gain over 0% corn/lb corn fed (lb)	-	.03	.004
	Tame Pasture (178-day grazing season)		
ADG (lb)	1.64	1.63	1.66
Gain/animal (lb)	292	290	295
Corn fed/day/animal (lb)	0	3.79	7.74
Corn fed/season/animal (lb)	0	675	1378
Corn/100-lb gain (lb)	-	233	525
Gain over 0% corn/lb corn fed (lb)	-	0	.006

1978 and 1979, respectively. Alfalfa production was essentially the same in both years, but native grass production was suppressed in 1979.

At mid season, the alfalfa component in the interseeded range was still high, indicating that a large amount of alfalfa was available and that the animals were not selectively grazing out the alfalfa. In the tame brome-alfalfa pasture, the alfalfa decreased dramatically from the early season, indicating that the alfalfa was being grazed selectively. The alfalfa plants were still present, but they were not making any contribution to the available forage.

At the end of the grazing season, Russian wildrye in the tame pasture had less forage remaining than did either the native or interseeded ranges. Russian wildrye was grazed only in the late fall and at a very heavy stocking rate, removing 90-95% of the top growth.

The interseeded range had about 35% more available forage remaining than did the native range at the end of the 1978 grazing season, despite higher stocking rates. The interseeded range had only 62% as much available forage as did the native range in 1979, due to lower forage production with about the same stocking rate as 1978.

Economic analysis of pasture systems

Relatively high productivity does not necessarily result in the highest profit potential for the farmer or rancher. Costs are associated with greater productivity, and these costs may exceed the returns.

We now analyze changes in costs and returns as pasture types are varied. We use breakeven prices and cost per pound of gain for each pasture type with varying levels of corn supplementation. In all instances, 1985 costs apply.

Forage production costs

Interseeded pasture was established at a net cost of $2.10/A after government cost sharing (Table 11). The $2.10 represents the cash outflow during the establishment year. When spread over the 20-year expected life of the interseeding, the annual cost of establishment is 10 cents/A.

Annual establishment costs for the other pastures were derived in the same way, except for sudangrass which had only a 1-year life. Sudangrass was established annually at $60.30/A.

Annual maintenance costs for the native and interseeded pastures included fertilization and miscellaneous costs such as spot spraying. Costs associated with repairing fence and water facilities are included in the steer enterprise budgets discussed in the next section.

The highest total annual costs were incurred in the tame pastures since sudangrass had to be established annually and non-legume pastures were fertilized.

Production costs for summer grazing steers

The forage costs of Table 11 were combined with other costs of summer grazing steers to derive enterprise production budgets for each pasture system and each supplemental corn feeding level. An example calculation for the three pasture systems with 0% corn is presented in Table 12.

Some assumptions made in deriving these budgets were (1) 600-lb steers were purchased at $65/hundredweight; (2) interest on operating capital was 15% for the length of the grazing season; (3) death loss was 2% of operating costs; and (4) land was valued at $250/A and required a 10% rate of return. It was also assumed that corn cost $2.50/bu.

Table 11. Forage production costs per acre by pasture type.

Cost	Pasture Type				
	Interseeded	Crested Wheatgrass	Russian Wildrye	Brome-Alfalfa	Sudangrass
Establishment[1/]		(dollars/acre)			
Seed	3.60	8.25	10.50	24.15	9.00
Custom Seeding	4.80	4.80	4.80	4.80	4.80
Fertilizer (60#N)	--	--	--	--	14.40
Machine Costs	--	--	--	--	12.10
Fixed Costs	--	--	--	--	20.00
Less Gov't Cost Sharing[2/]	(6.30)	(9.75)	(10.00)	(10.00)	--
TOTAL	2.10	3.30	5.30	18.95	60.30
Expected Life	20	20	20	15	1
Annual Establishment Cost	.10	.15	.25	1.25	60.30
Annual Maintenance Costs					
Miscellaneous	.50	.50	.50	.50	--
Fertilizer (65#N)	--	15.60	15.60	--	--
Application	--	1.50	1.50	--	--
TOTAL ANNUAL COSTS[3/]	.60	17.75	17.85	1.75	60.30

[1/] Establishment costs in addition to normal companion crop costs. Russian wildrye was sown into stubble and the sudangrass was established annually with no companion crops.

[2/] Government cost sharing at 75% of seed and 75% of planting costs, up to $10 per acre.

[3/] Exclusive of interest on capital.

Given these assumptions, the variable or operating costs were nearly the same for native and interseeded pasture, $426.35 and $429.45, respectively. The tame pasture operating costs were $521.75. This cost is greater because of the annual costs of establishing sudangrass and fertilizing crested wheatgrass and Russian wildrye.

Fixed costs per acre changed with carrying capacity. As fewer acres per steer were required, taxes and required return on land investment dropped. Since interseeded range required the least acres per animal, its fixed costs were lowest. Native range, at 7 acres per animal, cost the most per animal unit.

Total production costs per animal unit were lowest for interseeded range at $556, followed by native range at $613.85 and tame pasture at $650.95. Compared to native range, the reduced cost of land associated with tame pasture was more than offset by the increased annual costs of the sudangrass, crested wheatgrass, and Russian wildrye pastures.

The gain per animal over the grazing seasons was greatest on tame pasture. The added gain, however, did not offset added costs, as breakeven costs were highest for tame pasture.

Table 12. Production costs for summer grazing steers on three types of pasture with no corn supplementation.

	Pasture Type		
	Native	Interseeded	Tame
Variable Costs	- - - - - - -(Dollars/head)- - - -		
Steer 600# @ $65	390.00	390.00	390.00
Vet-medicine	3.00	3.00	3.00
Salt & mineral	4.00	4.00	4.00
Repair	.50	.50	.50
Miscellaneous	1.20	1.20	1.20
Corn	--	--	--
Pasture (Table 11)[1]	--	2.85	85.05
Interest (15% for length of grazing season)	25.55	25.75	35.40
Death loss	2.10	2.15	2.60
TOTAL VARIABLE COSTS	426.35	429.45	521.75
Fixed Costs			
Equipment	1.50	1.50	1.50
Taxes & insurance	11.00	7.55	7.70
Land ($250 @ 10%)	175.00	117.50	120.00
TOTAL FIXED COSTS	187.50	126.55	129.20
TOTAL COSTS	613.85	556.00	650.95
Final Weight	796	818	825
Breakeven price (lb)	.77	.68	.79
Gain	196	218	225
Cost per pound of gain	1.14	.76	1.16
Acres per animal	7	4.7	4.8
Grazing days	156	156	178

1/ Annual pasture costs per acre from Table 11 were multiplied by acres of pasture per head and summed to derive these figures.

The breakeven price on interseeded range was lowest. The cost per pound of gain was also lowest.

None of the pasture alternatives produced enough beef to lower the cost per pound of gain below the initial price per pound of steer. Breakeven prices, therefore, were all higher than the initial steer price. These conditions suggest that in order for a producer to profit from any of the pasture alternatives, a rising livestock market must exist.

Impact of supplemental corn on cost per pound of gain and breakeven prices

The production data showed that supplementing summer grazing with corn led to increased gain per acre and fewer acres per animal than when no corn was fed. Costs per pound of gain with supplemental corn feeding are presented in Table 13. The costs which correspond to Table 12 are in the rows with $65 steer prices. The impact of feeding corn can be seen by reading across the rows.

At the 0.5% level, the cost per pound of gain decreased for all three systems. The lowest cost per pound of gain was on interseeded range. With corn supplementation, tame pasture was still the most expensive way to put on a pound of gain.

Supplementing corn at the 1% level increased costs per pound of gain over the 0.5% level for native and interseeded pastures. At this higher level, the cost per pound of gain for the native range remained below the cost for no corn, but for interseeded range the 1.0% level was more costly per pound of gain than with no corn at all. Costs continued to decline for the tame pasture at the 1.0% level.

Breakeven prices (Table 14) show the same pattern. The best pasture type, with or without corn, was interseeded range. The native range was consistently a little better than the tame series range.

Tables 13 and 14 also show the impact of purchase price of the steers on cost per pound of gain and breakeven price. For every 5-cent per pound increase in steer price, cost per pound of gain went up about 1 cent and the breakeven price went up 4 cents. The impact stems from the interest paid on the purchase amount.

The cost of the steer had no impact on the relative ranking of pasture types. Interseeded range is always most economical and tame pasture always least economical.

Impacts of changing input costs

Other than the steers themselves, the inputs which contribute most to production costs are corn, interest, and land. Tables 15-20 show how costs and breakeven prices change as input prices change.

Changing corn prices had a very small effect on either cost per pound of gain or breakeven price. It does not change the relative ranking of pasture alternatives (Table 15).

Cost per pound of gain increased around 2 cents for every 50-cent increase in corn price for all pasture types at the 0.5% level. At 1.0%, cost per pound of gain increased 4 to 5 cents for every 50-cent rise in corn price. Breakeven prices changed approximately half as much as cost per pound of gain in all corn price changes (Table 16).

Interest rate on operating capital had a greater impact. Varying interest rates from 12-21% did not change the relative ranking of pasture types. Interseeded range still incurred the lowest costs per pound of gain at all corn supplementation levels; native range consistently edged out the tame pasture alternative.

Costs per pound of gain increased approximately 2 cents for every three-percentage-point change in interest rate for all pasture alternatives over all corn supplementation levels (Table 17). The impact of large interest rate increases led to breakeven price increases of from 7 to 9 cents per pound of gain, depending on the pasture type.

Breakeven prices are lowest for interseeded pasture with 0.5% supplementation (Table 18). Interest rate changes of three percentage points result in approximately 1-cent changes in breakeven price.

Since the return on land was the largest cost after the steer, changes in its value have the greatest probability of changing the relative economic ranking of the three pasture systems.

Interseeded range is still the best economic alternative under all land values ($150 to $450/A), corn levels, and pasture types. Native range continues to hold an economic edge over tame pasture at $150-250/A, but when land values exceed $250/A tame pastures are a better economic alternative (Table 19).

(Pasture land with the carrying capacity of the land in this study is unlikely to be sold at over $250/A since cost per pound of beef animal gain exceeds $1 even at that price.)

The interseeded pasture with $150 land is the only alternative in the entire study which results in costs per pound of gain which are lower than the purchase price per pound of the stocker steer. Correspondingly, this is the only alternative with breakeven prices below the purchase price of the steer (Table 20).

Worksheet for the individual producer

Table 21 is a worksheet for producers interested in comparing production costs for summer grazing steers or other livestock. The worksheet derives the breakeven price required at the end of the grazing

Table 13. Cost per pound of gain for summer grazing steers on three pasture types with three corn feeding levels and varying purchase prices of steers.

Pasture Type	Steer Price $/cwt	Cost Per Pound of Gain, Corn Level (% of body wt): 0.0	0.5	1.0
	60	1.13	.93	.96
Native	65	1.14	.94	.97
	70	1.15	.95	.98
	75	1.16	.96	.98
	60	.75	.70	.80
Interseeded	65	.76	.71	.80
	70	.77	.72	.81
	75	.78	.73	.82
	60	1.15	1.05	1.00
Tame	65	1.16	1.05	1.01
	70	1.17	1.06	1.01
	75	1.18	1.07	1.02

season. It also can be used to calculate the cost per pound of gain during the summer production period.

The line items in this table do not include costs other than those for the summer grazing period. Thus, the table covers costs for steers purchased in the spring and held to the end of the grazing season. If the animals are not sold in the fall, costs of feeding and caring for them beyond this time would have to be added before determining breakeven prices.

The best figures to be used in this table would come from your own records or estimates. The estimates in tables 11 and 12 may be used if they apply to your location and operating conditions.

After the initial enterprise budget is completed, alternatives can be calculated using a partial budgeting technique. To do that, simply add increased costs and subtract decreased costs from the total on line 17. For example, if vet medicine on line 2 increases from $3 to $5 per head, add $2 plus the change in interest on line 8 and the change in death loss on line 9 to the line 17 total. This same procedure can be used for any change in variable costs. If a fixed cost is changed (lines 11-15), the change can simply be added or subtracted from the total on line 17.

Table 14. Breakeven prices for summer grazing steers on three pasture types with three corn feeding levels and varying purchase price of steers.

Pasture Type	Steer Price $/cwt	Breakeven Price ($/cwt) Corn Level (% Body wt.) 0.0	0.5	1.0
	60	.73	.69	.70
Native	65	.77	.73	.74
	70	.81	.77	.78
	75	.85	.81	.82
	60	.64	.63	.66
Interseeded	65	.68	.67	.70
	70	.72	.70	.73
	75	.76	.74	.77
	60	.75	.74	.73
Tame	65	.79	.78	.77
	70	.83	.81	.80
	75	.87	.85	.84

Table 15. Costs per pound of gain for summer grazing steers on three pasture types with three corn feeding levels and varying corn prices.

Pasture Type	Corn Price $/bu	Cost Per Pound of Gain, Corn Level (% of Body wt) 0.0	0.5	1.0
	2.00	1.14	.92	.92
Native	2.50	1.14	.94	.97
	3.00	1.14	.96	1.01
	2.00	.76	.69	.76
Interseeded	2.50	.76	.71	.80
	3.00	.76	.73	.85
	2.00	1.16	1.03	.96
Tame	2.50	1.16	1.05	1.01
	3.00	1.16	1.08	1.05

Table 16. Breakeven prices for summer grazing steers on three pasture types with three corn feeding levels and varying corn prices.

Pasture Type	Corn Price $/bu	Breakeven Price ($/cwt), Corn Level (% of Body wt) 0.0	0.5	1.0
	2.00	.77	.72	.73
Native	2.50	.77	.73	.74
	3.00	.77	.74	.76
	2.00	.68	.66	.68
Interseeded	2.50	.68	.67	.70
	3.00	.68	.67	.71
	2.00	.79	.77	.75
Tame	2.50	.79	.78	.77
	3.00	.79	.78	.78

Table 17. Cost per pound of gain for summer grazing steers on three pasture types with three corn feeding levels and varying interest rates.

Pasture Type	Interest Rate (%)	Cost Per Pound of Gain ($) Corn Level (% of Body wt) 0.0	0.5	1.0
Native	12	1.12	.92	.94
	15	1.14	.94	.97
	18	1.17	.96	.99
	21	1.19	.98	1.01
Interseeded	12	.74	.69	.78
	15	.76	.71	.80
	18	.79	.73	.83
	21	.81	.75	.85
Tame	12	1.13	1.03	.98
	15	1.16	1.05	1.01
	18	1.19	1.08	1.03
	21	1.22	1.11	1.06

Table 18. Breakeven prices for summer grazing steers on three pasture types with three corn feeding levels and varying interest rates.

Pasture Type	Interest Rate (%)	Breakeven Price ($/cwt) Corn Level (% of Body wt) 0.0	0.5	1.0
Native	12	.76	.72	.74
	15	.77	.73	.74
	18	.78	.74	.75
	21	.78	.74	.76
Interseeded	12	.67	.66	.69
	15	.68	.67	.70
	18	.69	.67	.70
	21	.69	.68	.71
Tame	12	.78	.77	.76
	15	.79	.78	.77
	18	.80	.78	.78
	21	.81	.79	.78

Table 19. Cost per pound of gain for summer grazing steers on three pasture types with three corn feeding levels and varying land values.

Pasture Type	Land Value $/acre	Cost Per Pound of Gain ($) Corn Level (% of body wt)		
		0.0	0.5	5.0
Native	150	.79	.69	.74
	250	1.14	.94	.97
	350	1.50	1.19	1.19
	450	1.86	1.44	1.42
Interseeded	150	.55	.54	.64
	250	.76	.71	.80
	350	.98	.87	.96
	450	1.19	1.04	1.13
Tame	150	.95	.88	.87
	250	1.16	1.05	1.01
	350	1.37	1.23	1.15
	450	1.59	1.40	1.29

Table 20. Breakeven prices for summer grazing steers on three pasture types with three corn feeding levels and varying land values.

Pasture Type	Land Value $/acre	Breakeven Price ($/cwt) Corn Level (% of Body wt.)		
		0.0	0.5	1.0
Native	150	.68	.66	.68
	250	.77	.73	.74
	350	.86	.80	.81
	450	.95	.87	.88
Interseeded	150	.62	.62	.65
	250	.68	.67	.70
	350	.74	.72	.74
	450	.80	.76	.79
Tame	150	.73	.72	.72
	250	.79	.78	.77
	350	.85	.83	.81
	450	.90	.88	.86

Table 21. Production costs for summer grazing steers worksheet for individual producer.

Pasture Type________________________

Variable Costs	($ per head)	
1.	Steer _____pounds x $_____per pound	$________
2.	Vet medicine $_____per head	________
3.	Corn $_____per bushel x _____bushel	________
4.	Salt & mineral $_____per head	________
5.	Miscellaneous $_____per head	________
6.	Repair $_____per head	________
7.	Pasture $_____per acre x _____acres per head	________
8.	Interest _____% x (Sum lines 1-7) x days on pasture / 365	________
9.	Death loss _____% x (Sum lines 1-8)	________
10.	Total Variable Costs (Sum lines 1-9)	$________
Fixed Costs		
11.	Equipment (interest & depreciation) $_____per head	$________
12.	Taxes $_____per acre x acres per head	________
13.	Insurance: Liability, buildings, etc. $_____per acre x acres per head	________
14.	Insurance: Animals $_____per $1,000 of value x steer cost / 1000	________
15.	Land $_____per acre x _____% x acres per head	________
16.	Total Fixed Costs (Sum lines 11-15)	$________
17.	TOTAL COSTS (Sum lines 10 and 16)	$________
18.	Final weight _____pounds per head	________
19.	Breakeven Price Total cost (line 17) / Final Weight (line 18)	________
20.	Gain Final Weight (line 18) - purchase weight (line 1)	________
21.	Cost per Pound of Gain Total Cost (line 17)-Steer (line 1) / Gain (line 20)	________

APPENDIX TABLE 1

Precipitation and mean temperature for 1977 at Faulkton, South Dakota.

Month	Temperature (F) Average Maximum	Average Minimum	Monthly Average	Departure From Normal	Precipitation (in.) Total	Departure From Normal
January	15	-8	-4	-9	.20	-.06
February	39	16	27	9	1.44	.93
March	45	24	35	6	4.75	3.99
April	69	38	54	8	1.60	-.46
May	79	51	65	8	2.10	-.78
June	83	55	69	3	3.60	-.62
July	90	59	75	3	1.77	-.63
August	84	53	68	-3	1.41	.75
September	76	50	62	2	3.44	1.91
October	62	36	49	-4	1.25	.03
November	38	19	29	-4	2.39	1.81
December	22	6	14	-5	.49	.18
						+7.0 in.

APPENDIX TABLE 2

Precipitation and mean temperature for 1978 at Faulkton, South Dakota.

	Temperature (F)				Precipitation (in.)	
Month	Average Maximum	Average Minimum	Monthly Average	Departure From Normal	Total	Departure From Normal
January	11	-10	3	-12	.19	-.22
February	16	0	8	-10	.31	-.20
March	38	19	28	0	.24	-.52
April	54	35	45	-.9	2.85	.79
May	72	46	58	2	3.57	.69
June	81	53	67	1.2	2.35	-1.88
July	84	59	72	-.2	2.37	-.03
August	88	58	73	1.4	4.05	1.89
September	83	52	68	7	.45	-1.08
October	67	34	50	1	.05	-1.17
November	38	16	27	-5	.73	.15
December	23	5	14	-5	.17	-.14

-1.72 in.

APPENDIX TABLE 3

Precipitation and mean temperature for 1979 at Faulkton, South Dakota.

	Temperature (F)				Precipitation (in.)	
Month	Average Maximum	Average Minimum	Monthly Average	Departure From Normal	Total	Departure From Normal
January	10	-11	0	-13	.56	.15
February	15	-7	4	-14	.42	-.09
March	39	19	29	.2	1.48	.72
April	55	31	43	-2	1.99	-.07
May	68	39	54	-3	1.16	-1.72
June	81	53	67	1	2.59	-1.64
July	84	59	72	-.7	3.20	.80
August	82	56	69	-2	6.57	4.41
September	82	49	66	5	0.00	-1.53
October	64	33	48	-1	1.91	.69
November	40	20	30	-2	.11	-.47
December	43	13	28	9	.02	-.29
						+1.21 in.

APPENDIX TABLE 4

Production of the different pasture components of a tame pasture series under three grain levels during the 1977 grazing season.

Pasture Component and Pasture Period	Percent Grain Supplement 0.0	0.5	1.0	Mean
	Average Daily Gain, Pounds			
Crested wheatgrass, P1	1.98	2.01	2.16	2.05
Brome-alfalfa, P2	2.16	1.71	2.13	2.00
Sudangrass, P3	.74	2.46	1.82	1.67
Brome-alfalfa, P4	.91	1.18	1.17	1.09
Russian wildrye, P5	.04	.53	.65	.41
	Animal Unit Days/Acre			
Crested wheatgrass, P1	29	27	33	30
Brome-alfalfa, P2	32	32	35	33
Sudangrass, P3	59	58	61	59
Brome-alfalfa, P4	10	10	10	10
Russian wildrye, P5	46	42	46	45
	Gains/Acre			
Crested wheatgrass, P1	85	79	103	89
Brome-alfalfa, P2	98	78	106	94
Sudangrass, P3	60	202	158	140
Brome-alfalfa, P4	13	16	16	15
Russian wildrye, P5	3	32	44	26

APPENDIX TABLE 5

Production of the different pasture components of a tame pasture series under three grain levels during the 1978 grazing season.

Pasture Component and Pasture Period	Percent Grain Supplement 0.0	0.5	1.0	Mean
	Average Daily Gain, Pounds			
Crested wheatgrass, P1	2.00	2.33	1.89	2.07
Brome-alfalfa, P2	2.13	1.94	2.20	2.09
Sudangrass, P3	1.59	1.77	1.49	1.62
Brome-alfalfa, P4	.88	.99	1.32	1.06
Russian wildrye, P5	.47	.68	.65	.60
	Animal Unit Days/Acre			
Crested wheatgrass, P1	42	43	49	45
Brome-alfalfa, P2	19	23	23	22
Sudangrass, P3	41	44	51	45
Brome-alfalfa, P4	22	24	27	24
Russian wildrye, P5	37	39	51	42
	Gain/Acre			
Crested wheatgrass, P1	117	143	131	130
Grome-alfalfa, P2	57	65	78	67
Sudangrass, P3	94	112	109	105
Brome-alfalfa, P4	28	35	52	38
Russian wildrye, P5	25	38	46	36

APPENDIX TABLE 6

Production of the different pasture components of a tame pasture under three grain levels during the 1979 grazing season.

Pasture Component and Pasture Period	Percent Grain Supplement 0.0	0.5	1.0	Mean
	Average Daily Gain, Pounds			
Crested wheatgrass, P1	1.96	2.03	2.45	2.15
Brome-alfalfa, P2	2.06	2.06	2.32	2.15
Sudangrass, P3	1.34	2.27	2.08	1.90
Brome-alfalfa, P4	1.82	2.37	2.22	2.14
Russian wildrye, P5	.89	1.32	2.07	1.43
	Animal Unit Days/Acre			
Crested wheatgrass, P1	39	35	45	40
Brome-alfalfa, P2	20	23	25	23
Sudangrass, P3	40	37	37	38
Brome-alfalfa, P4	9	10	11	10
Russian wildrye, P5	21	23	36	27
	Gain/Acre			
Crested wheatgrass, P1	107	98	163	123
Brome-alfalfa, P2	59	67	81	69
Sudangrass, P3	81	130	119	110
Brome-alfalfa, P4	2	3	3	3
Russian wildrye, P5	28	43	110	60