1997

Cow-Calf Production from Alfalfa-grass or Smooth Bromegrass Pastures Rotationally Grazed at Different Stocking Rates

Jodi M. Western
Iowa State University

James R. Russell
Iowa State University

Rod Berryman
Iowa State University

Extension Number: ASL R1349

Cow-Calf Production from Alfalfa-grass or Smooth Bromegrass Pastures Rotationally Grazed at Different Stocking Rates

Abstract
Pastures containing alfalfa-smooth bromegrass or smooth bromegrass were stocked with .6, .8, or 1.0 cow-calf units per acre to compare cow and calf production in rotational grazing systems managed for optimum forage quality. To remove excess forage early in the grazing season, yearling heifers grazed with the cows in each pasture at a stocking rate of .6 heifers per acre for the first 28 days of grazing. Live forage density and days of grazing per paddock were estimated by sward height. Cows, calves, and heifers were weighed and cows condition scored every 28 days. All cows grazed for 140 days except those grazing the smooth bromegrass pasture stocked at 1.0 cow-calf units per acre; these were removed after 119 days in 1994 and 129 days in 1995 because of lack of forage. Alfalfa-grass pastures tended to have a more consistent supply of forage over the grazing season than the bromegrass pastures. Cows grazing the alfalfa-cool season grass pastures had greater seasonal weight gains and body condition score increases and lower heifer weight gains than the smooth bromegrass pastures. Daily and total calf weight gains and total animal production also tended to be greater in alfalfa-cool season grass pastures. Increasing stocking rates resulted in significantly lower condition increases and heifer weight gains, while increasing the amounts of calf and total growing animal produced.

Keywords
ASL R1349

Disciplines
Animal Sciences

Cow-Calf Production from Alfalfa-grass or Smooth Bromegrass Pastures Rotationally Grazed at Different Stocking Rates

A.S. Leaflet R1349

Jodi M. Western, graduate research assistant,
James R. Russell, professor of animal science,
Rod Berryman, superintendent of ISU Beef Nutrition Research Center

Summary

Pastures containing alfalfa-smooth bromegrass or smooth bromegrass were stocked with .6, .8, or 1.0 cow-calf units per acre to compare cow and calf production in rotational grazing systems managed for optimum forage quality. To remove excess forage early in the grazing season, yearling heifers grazed with the cows in each pasture at a stocking rate of .6 heifers per acre for the first 28 days of grazing. Live forage density and days of grazing per paddock were estimated by sward height. Cows, calves, and heifers were weighed and cows condition scored every 28 days. All cows grazed for 140 days except those grazing the smooth bromegrass pasture stocked at 1.0 cow-calf units per acre; these were removed after 119 days in 1994 and 129 days in 1995 because of lack of forage. Alfalfa-grass pastures tended to have a more consistent supply of forage over the grazing season than the bromegrass pastures. Cows grazing the alfalfa-cool season grass pastures had greater seasonal weight gains and body condition score increases and lower heifer weight gains than the smooth bromegrass pastures. Daily and total calf weight gains and total animal production also tended to be greater in alfalfa-cool season grass pastures. Increasing stocking rates resulted in significantly lower condition increases and heifer weight gains, while increasing the amounts of calf and total growing animal produced.

Introduction

With the termination of the Conservation Reserve Program (CRP) contracts in the next five years, many farmers must choose the future use of this land. In order for highly erodible lands to remain in erosion-preventing forages, forage production and utilization must be as profitable on this land as grain production. Because legume species fix nitrogen into soil and have high nutritive value, incorporating them into pastures may improve economic returns from grazing by decreasing the need for nitrogen fertilizer and increasing animal performance. Grazing by rotational stocking offers producers many benefits. These include improved plant persistence. Legumes are more sensitive to time and frequency of defoliation so the rest periods incorporated in rotational stocking help maintain legumes in a forage stand. Improved forage quality and yield resulting from more timely use are other advantages. Rotational stocking can also increase animal production per acre by allowing higher stocking rates.

Even in a rotational grazing system, grazing at excessively high stocking rates may adversely affect individual animal weight gains, body condition, and reproductive performance. Furthermore, because of the rapid growth of cool-season forage species in mid-spring, stocking rates that are excessive in mid-to late-summer are inadequate to optimize forage use during the spring. Consequently, some method of removing excess forage, such as hay harvest or lead-grazing with growing animals, is necessary to optimize forage utilization.

To effectively manage a rotational system, stocking rate and the grazing and rest times per paddock must interact to result in optimum production per acre without damaging the stand longevity of a given forage mixture. The objective of this project was to compare cow and calf production from grass and grass-legume pastures grazed at three stocking rates in a rotational system managed for optimum forage quality.

Materials and Methods

Pasture management

In April 1992, a 30-acre field was seeded with 'WL hybrid 321' alfalfa and 'Barton' smooth bromegrass at rates of 10 and 8 pounds per acre with a nurse crop of oats. Two cuttings of hay were harvested from this field in 1992. Because of poor establishment, smooth bromegrass was frost-seeded into the alfalfa on March 1, 1993. However, establishment was again poor. On August 5, 1993, smooth bromegrass and orchardgrass were drilled into the alfalfa at seeding rates of eight and six pounds per acre. This seeding was successful. In the spring of 1994, the alfalfa-cool season-grass pasture was divided into six 5-acre pastures, each of which was divided into eight paddocks. A 20-acre smooth bromegrass pasture was divided into four 5-acre pastures that were also divided into eight paddocks. Smooth bromegrass pastures were fertilized each spring with 100 pounds of nitrogen.

Table 1. Botanical composition of pastures at initiation of grazing.

Pasture	Year	% Grass	% Legume	% Weed	% Dead
Alfalfa-grass	1994	42	40	17	2
	1995	75	8	6	11
Smooth Bromegrass	1994	86	3	9	2
	1995	85	1	4	7

Cow/calf management

On May 12, 1994**,** and May 12, 1995, 40 Angus X Simmental X Charolais cows with calves were allotted to pastures on the basis of cow weight and condition score to graze in a rotational system. Replicate pastures containing the alfalfa-cool-season grass mixture were stocked at .6, .8, and 1.0 cow-calf units (ccu) per acre. Two of the four pastures containing smooth bromegrass were stocked at .8 ccu per acre. The two remaining smooth bromegrass pastures were stocked at .6 or 1.0 ccu per acre. To remove excess forage growth early in the grazing season, yearling heifers were stocked in each pasture at a rate of .6 heifers per acre for the first 28 days of grazing in 1994 and the first 37 days of grazing in 1995. To remove the rapidly growing forage the first 28 days of the trial, animals grazing the smooth bromegrass were moved between paddocks daily. For the rest of the grazing season, cows in smooth bromegrass pastures were moved when 50% of the forage was removed as determined by a falling plane meter (8.8 lbs/yd^2). Because bloat may be a problem in cows that are rapidly rotated in alfalfa pastures, animals were moved when 33% of the forage was removed for the first 28 days of grazing and when 50% of the forage was removed thereafter. In excessively wet conditions, persistence of legume species such as alfalfa will be adversely affected even in a rotational grazing system. Therefore, one paddock in each of the alfalfa-cool-season grass pastures was designated as a sacrifice paddock for grazing when more than one inch of rain had fallen within a 24-hour period. Cows were returned to the grazing rotation after 24 hours with no precipitation. Sacrifice paddocks were grazed for 13 days in 1994 and 5 days in 1995 as a result of precipitation. Because grazing at a high stocking rate may reduce the length of the grazing season, it was decided to conclude grazing of individual pastures if sward height dropped below 5 cm (approximately 500 pounds of live dry matter per acre). Grazing the smooth bromegrass pasture at 1.0 ccu per acre ended on September 9 (119 days of grazing) in 1994 and on September 18 (129 days of grazing) in 1995. Grazing of all other pastures continued for 140 days. After calves were weaned (September 29 in 1994 and 1995), cows were returned to pastures for an additional 35 days in 1994 and 27 days in 1995 after which they were transferred to winter grazing systems.

Water was available in each paddock of each pasture as well as from a central tank. Cattle had access to a trace mineral mixture.

Forage density, measured with a falling plane meter (8.8 lb/yd^2), was measured daily in six locations in each grazed paddock. Forage quantity and botanical composition were determined by hand-clipping a .25 square meter area in 12 locations in each pasture every 28 days. The total amount of forage produced was determined by hand-clipping two .25 square meter locations inside and outside an exclosure every 28 days. All hand-clipped samples were sorted into live grass, legume, and weed, and dead forage.

Cows and calves were weighed and cows condition scored (1=very thin, 5=moderate, 9=obese) at 28-day intervals. In 1994, cows were bred by artificial insemination 72 hours after a second injection of Lutalyse. Four days later, five bulls were placed in the pastures and rotated at 12-hour intervals among pastures for 30 days. In 1995, cows were implanted with Syncromate, removed from pastures for five days after the implant was removed to observe estrus, and artificially inseminated. Cows were then returned to pastures and five bulls were rotated at 12-hour intervals among pastures for 45 days.

Results and Discussion

Alfalfa-grass pastures contained 75% grass and 8% legume at the initiation of grazing in 1995, as compared to 40% grass and 40% legume in 1994 (Table 1).

Paddocks in the alfalfa-cool-season grass pastures were generally grazed longer than paddocks in the N-fertilized smooth bromegrass pastures. Therefore the smooth bromegrass pastures went through more rotations than the alfalfa-cool-season grass pastures did.

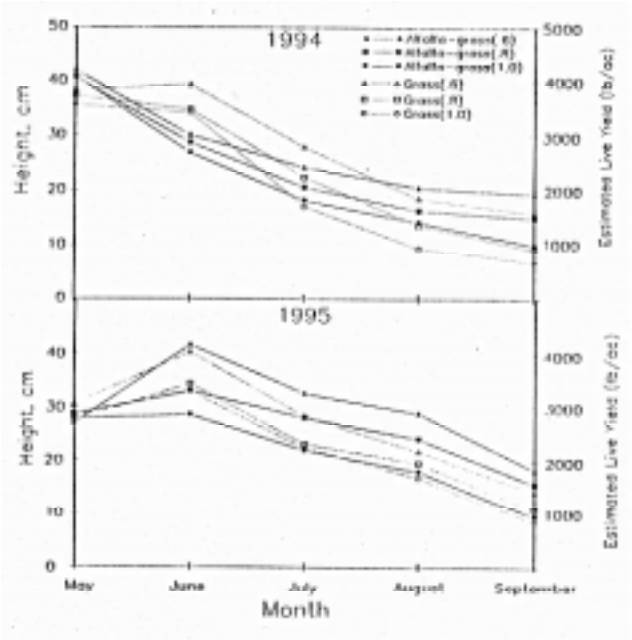
Sward heights were greater in bromegrass pastures than in alfalfa-grass pastures early in the grazing season. By July, however, alfalfa-grass pastures had higher sward heights and estimated live yield than the bromegrass pastures stocked at equal stocking rates. Pastures stocked at .6 ccu/ac had more available live forage than pastures stocked at .8 and 1.0 ccu/ac within each species throughout the grazing season (Figure 1). This result implies that while N-fertilized bromegrass may outyield alfalfa-cool season grass pastures in the early summer, the presence of alfalfa in the pasture extends forage yields later in the summer.

Table 2. Forage heights, yields, and digestibilities for alfalfa-smooth bromegrass and smooth bromegrass pastures stocked at different rates in 1994.

	Forage Species (f) and Stocking Rate (s)								
	Alfalfa-Bromegrass			Smooth Bromegrass			Significance[a]		
	.6	.8	1.0	.6	.8	1.0	f	s	f*s
Height,cm	18.0	15.4	13.4	20.5	15.8	13.4		*	
Total yield, lb/ac	3067	2707	2463	3265	3268	2688	*	*	
Live yield, lb/ac	2025	1658	1527	1920	1864	1264		*	
Forage allowance, lb/cow									
Live	2842	1934	1415	2939	2136	1212		*	
Total	4532	3232	2343	5152	3876	2396		*	
IVDDM yield, lb/ac									
Live	1193	999	918	1075	1078	691		*	
Total	1543	1387	1239	1496	1531	1065		*	
IVDDM forage allowance, lb/cow									
Live	1837	1151	840	1613	1214	504		*	
Total	2413	1597	1157	2301	1773	1030		*	
% IVDDM									
Live	59.7	61.1	59.3	56.0	57.5	57.3	*		
Total	51.6	51.2	49.2	46.6	45.7	44.2	*		

[a]Significance:*, p<.05

Figure 1. Sward heights of alfalfa-smooth bromegrass and smooth bromegrass pastures rotationally grazed at different stocking rates in 1994 and 1995.



In 1994, bromegrass pastures had greater total forage yields than alfalfa-grass pastures (Table 2). Yields of live and digestible dry matter, however, did not differ between pastures containing N-fertilized smooth bromegrass or an alfalfa-grass mixture. Similarly, the allowance of total, live and digestible dry matter per cow did not differ between N-fertilized bromegrass and alfalfa- grass pastures. The in vitro digestibilities (IVDDM) of the total and live forage in alfalfa-grass pastures were 11 and 5 % greater than smooth bromegrass.

Increasing the stocking rate decreased both the yields and allowances of total, live and digestible dry matter. Stocking rate did not affect the concentration of digestible dry matter in either the total or live forage.

Heifer daily gains and production per acre were affected by species and stocking rate the first year, but were not different between pastures with different forage species or stocking rates in 1995 (Table 3). Heifers grazed pastures early in the grazing season when smooth bromegrass is at its most productive stage. This high yield may help explain the improved performance of the heifers on bromegrass pastures in 1994. The increased proportion of grass in the alfalfa-grass pastures could explain similarities in heifer production between pastures containing either forage species.

Table 3. Calf and heifer production from alfalfa-smooth bromegrass pastures or smooth bromegrass pastures grazed at different stocking rates.

		Forage species(f) & stocking rate(s)								
		Alfalfa-bromegrass			Smooth bromegrass			Significance[a]		
	Year	.6	.8	1.0	.6	.8	1.0	f	s	f x s
Calf weight										
lb/day	1994	2.51	2.65	2.62	2.37	2.54	2.34			
	1995	2.53	2.53	2.28	2.37	2.48	2.36			
	avg	2.52	2.59	2.45	2.37	2.51	2.35			
lb/acre	1994	211	297	366	199	284	274	*		*
	1995	212	283	318	199	278	305		*	
	avg	212	290	342	199	281	290			*
Heifer weight										
lb/day	1994	1.87	0.92	1.03	2.61	1.84	2.1	*	*	*
	1995	1.69	1.73	1.66	2.14	1.71	1.72			
	avg	1.8	1.3	1.3	2.4	1.8	1.9			
lb/acre	1994	31	16	17	44	34	30	*	*	*
	1995	37	38	37	48	38	38			
	avg	34	27	27	46	36	34			
Growing animal production[b],										
lb/ac	1994	242	312	383	243	317	304			*
	1995	250	322	355	247	316	343		*	
	avg	246	317	369	245	317	324			*
Total animal production[c]										
lb/ac	1994	483	475	538	355	445	410	*		
	1995	343	417	413	343	422	395	*		*
	avg	413	446	475	349	434	403			

[a] Significance: *, p<.05.
[b] Calf and yearling heifer.
[c] Cow, calf, and yearling heifer.

Average daily gains and production per acre by heifers were lower at higher stocking rates of cows in 1994. Cow stocking rate, however,did not affect either the daily gains or total production of heifers in 1995.

In 1994, cows grazing pastures containing the alfalfa-grass mixture produced 15% more pounds of calf per acre than those grazing bromegrass. This effect was greatest at the highest stocking rate where 33% more calf was produced per acre on the alfalfa-grass pastures than the smooth bromegrass pastures. In contrast, calf production did not differ between forage species in 1995.

Increasing the stocking rate from .6 to 1.0 cow-calf units per acre increased calf production by 52% in 1995. Because calf production per acre was directly related to stocking rate in 1995, production of total growing animals (calves and heifers) was also directly related to stocking rate. Because grazing of the smooth bromegrass pasture at the highest stocking rate was terminated after 119 days in 1994 and 129 days in 1995, mean growing animal production for the two years was increased by 52 pounds per acre from the alfalfa-grass pastures but only 7 pounds per acre for the N-fertilized smooth bromegrass compasred to the .8 ccu/ac stocking rate.

Increases in cow weight and condition score were greater for alfalfa-grass pastures than smooth bromegrass pastures in 1994. Forage species did not affect body weight gains in 1995. Stocking rate did not significantly affect cow weight gains in either year. However, cows grazing smooth bromegrass at the highest stocking rate had a smaller increase in body condition score than the other stocking rates in 1994. In 1995, condition score changes were inversely related to stocking rate. This implies that forage allowance at the highest stocking rate may have been inadequate to optimize condition score. However, rebreeding rates were 78, 88, and 93% for .6, .8, and,1.0ccu/ac stocking rates.Dry matter intake of cows in 1994 was similar across all treatments (Table 4).

Implications

Although calf production did not differ between alfalfa-grass and N-fertilized smooth bromegrass pastures, cow weight and body condition tended to increase on alfalfa-grass pastures. This is probably due to greater growth of the legume species later in the season. Production may be optimized by using a combination of cool-season grasses early in the grazing season and a legume-grass pasture in mid- to late-season. Increasing the stocking rate of rotationally grazed pastures can increase calf production per acre but can also result in less available forage per cow, decreasing the weight gains of cows and length of the grazing season. Legume persistence may also be adversely affected.

Acknowledgments

This project is supported in part by a grant from the Leopold Center for Sustainable Agriculture, Iowa State University. The authors gratefully acknowledge the assistance of Karen Haberer, Matt Hersom, Andy Hitz, Akif Karsli, Laura Kepler, Angie Lichtsinn, Joel Morrical, and the animal caretakers at the Beef Nutrition Farm.

Table 4. Cow weight gains and condition scores while grazing alfalfa-smooth bromegrass and smooth bromegrass pastures at different stocking rates.

		Forage species(f) & stocking rate(s)								
		Alfalfa-bromegrass			Smooth bromegrass			Significance[a]		
	Year	.6	.8	1.0	.6	.8	1.0	f	s	f x s
Weight, lb										
Initial	1994	1243	1191	1237	1193	1230	1208			
	1995	1140	1360	1388	1373	1272	1325			
	avg	1192	1276	1313	1283	1251	1267			
Seasonal	1994	241	163	155	112	128	106	*		
change	1995	93.5	95	57.5	96	106	52			
	avg	167	129	106.25	103.85	117.1	79.05			
Condition score										
Initial	1994	4.3	4.3	4.3	4.3	4.5	4.3			
	1995	5.1	4.9	5	4.3	4.6	5			
	avg	4.7	4.6	4.65	4.3	4.55	4.65			
Seasonal	1994	1.3	0.8	0.8	0.7	0.9	0.4	*		*
change	1995	0.15	0.34	-0.2	1	0.5	-0.2		*	
	avg	0.725	0.57	0.3	0.85	0.7	0.1			
Dry Matter Intake										
% of body wt		3.28	2.88	3.25	3.65	3.33	2.05			

[a]Significance: *, $p<.05$.