Evaluation of a Year-Round Grazing System: Winter Progress Report

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Summary

The winter component of a year-round grazing system involving grazing of corn crop residues followed by grazing stockpiled grass-legume forages was compared at the McNay Research Farm with that of the winter component of a minimal land system that maintained cows in drylot. In the summers of 1995 and 1996, two and one cuttings of hay per year were harvested from two 15-acre fields containing "Johnston" low endophtye tall fescue and red clover. Two cuttings of hay in 1995 and one cutting in 1996 were harvested from two 15-acre fields of smooth bromegrass and red clover. Hay yields were 4,236 and 4,600 pounds of dry matter per acre for the tall fescue-red clover in 1995 and 1996, and 2,239 and 2,300 pounds of dry matter per acre for the smooth bromegrass-red clover in 1995 and 1996. Following grain harvest, four 7.5-acre fields containing corn crop residues were stocked with cows at midgestation at an allowance of 1.5 acres per cow. Forage yields at the initiation of corn crop grazing in 1995 and 1996 were 3,757 and 3,551 pounds of dry matter per acre for corn crop residues. Stockpiled forage yields were 1,748 and 2,912 pounds of dry matter for tall fescue-red clover and 1,880 and 2,187 pounds for smooth bromegrass-red clover. Corn crop residues and stockpiled forages were grazed in a strip stocking system.

For comparison, 20 cows in 1995 and 16 cows in 1996 were placed in two drylots simultaneously with initiation of corn crop grazing, where they remained throughout the winter and spring grazing periods. Cows maintained in drylots or grazing corn crop residue and stockpiled forages were supplemented with hay as large round bales to maintain a body condition score of five. In both years, no seasonal differences in body weight and body condition score were observed between grazing cows or cows maintained in drylots, but grazing cows required 85% and 98% less harvested hay in years 1 and 2 than cows in drylot during the winter and spring. Because less hay was needed to maintain grazing cows, excesses of 12,354 and 5,244 pounds of hay dry matter per cow in 1995 and 1996 remained in the year-round grazing system.

During corn crop grazing, organic matter yield decreased at 23.5 and 28.8 pounds of organic matter per day from grazed areas of corn crop residues in 1995 and 1996. Organic matter losses due to weathering were 6.8, 10.3, and 12.7 pounds per day in corn crop residue, tall fescue-red clover and smooth bromegrass-red clover in 1995 and 12.1, 10.7, and 12.1 in 1996. Organic matter losses from grazed and ungrazed areas of tall fescue-red clover and smooth bromegrass-red clover during stockpiled grazing were 6.9, 6.9, and 2.1, 2.9 in 1995 and 13.4, 4.3, and +6.9, 4.4 pounds per day in 1996.

Introduction

The profitability of cow-calf production systems is directly related to the amount of stored feed required. Approximately one-third of the cost associated with beef cow-calf production is derived from this need for stored feed. Therefore, strategies that promote efficient use of a year-round grazable forage supply should increase the number of days animals are able to graze; decreasing the need for stored feeds should increase profitability.

A system that would reduce the amount of stored feeds necessary to maintain beef cows during the winter and make efficient use of grazable forage involves grazing corn crop residues during the fall and early winter. Grazing stockpiled forages in late winter and early spring takes advantage of the forage's ability to retain nutrients. In this system, forage is harvested as hay or grazed until late summer. Forage that regrows during the late summer and early fall is grazed in the early winter following fall grazing of corn crop residues. Stored hay is supplemented as necessary.

The efficacy of a system using corn crop residue and stockpiled grazing would seem to depend on several factors. Proper management may overcome problems

imposed by weather. Previous studies have shown that snow cover does not limit grazing of corn crop residues or stockpiled forages. Frequent observation of cow body condition will indicate when hay supplementation may be required to maintain cow performance. The adverse effects of grazing under muddy conditions in the fall and early spring may be limited by strip-stocking. Strip-stocking through timely cow movement will limit forage removal and limit animal movement on the land area. This method may also control intake and selection of forage during grazing. Delaying grazing of stockpiled forages may result in losses in organic matter of up to 11.4 pounds per acre during the time of corn crop residue grazing. However, the ability to graze further into the winter and spring offsets this loss. The ability to produce stockpiled forage is another factor. The amount of time allowed for forage stockpiling could influence the amount of forage produced. Inadequate stockpiling periods produce yields that may be insufficient for winter needs. Stockpiling periods that are too long may produce forage of low quality that will not meet the needs of the gestating beef cow, especially in the early spring. Fall fertilization of stockpiling pastures can greatly increase the amount of forage produced. Application of 40 pounds per acre of nitrogen may increase yields up to one-and one-half times those of unfertilized stockpiled fields.

The objectives of the winter portion of the project are to compare three different winter systems for gestating beef cows in terms of cow performance, hay utilization, and nutritive values of corn crop residues and stockpiled forages.

Material and Methods

In the summer of 1995 (Yr.1), two cuttings of hay were harvested and in the summer of 1996 (Yr.2), one cutting of hay was harvested from two tall fescue-red clover (TF-RC) and two smooth bromegrass-red clover (SB-RC) stockpiled pastures. In August of Yr.2, stockpiled pastures were fertilized with 40 pounds per acre of nitrogen. In the fall, each pasture was divided into four paddocks using temporary electric fence. Four 7.5-acre fields of corn crop residues (CCR) also were divided into four paddocks by installation of temporary electric fence after grain harvest. All fields divided into strips were grazed by strip stocking.

On October 26 in Yr.1 and October 31 in Yr.2, 20 cows were allotted from summer grazing experiments to four corn crop residue fields to strip graze for 55 days. Simultaneously with initiation of corn crop grazing, 20 cows in Yr.1 and 16 cows in Yr.2 were allotted to replicate drylots where they remained throughout the winter and spring grazing periods. After grazing corn crop residues, each group of cows was allotted to one of four stockpiled forage pastures containing tall fescue-red clover or smooth bromegrass-red clover. Cows strip-grazed the stockpiled forages from late December to early May; a new paddock was opened every four weeks to provide for adequate forage. Cows maintained in the drylot and grazing con crop residues and stockpiled forages were supplemented with large round bales of hay as necessary to maintain a body condition score of five on a nine-point scale, or when forage availability was limited by weather conditions or forage density. In Yr.1, cows in the drylot received hay from the first cutting of tall fescue-red clover followed by hay from the first cutting of smooth bromegrass-red clover. In Yr.2, drylot cows first received hay from the summer grazing experiment followed by alternate feedings of tall fescue-red clover and smooth bromegrass-red clover. Cows grazing tall fescue-red clover stockpiled pastures received tall fescue-red clover hay, cows grazing smooth bromegrass-red clover stockpiled pastures received smooth bromegrass-red clover hay. All cows were weighed at the initiation and end of each grazing period (corn crop residue, stockpiled pre-calving, and stockpiled post-calving). Body condition scores (1 = very thin, 5 = moderate, 9 = very obese) were recorded biweekly.

In both years, spring calves (mean body wt 541 lbs. Yr.1, 572 lbs. Yr.2) were used to compare maintenance on hay with a period of corn gluten (CGF) supplementation followed by summer grazing to complete feedlot finishing of calves as winter management systems in the year-round grazing system. On October 19, Yr.1, 29 yearlings were allotted to a drylot and fed hay as needed throughout the winter and spring. CGF was supplemented at 2.48 lbs./head/day for 32 days at the initiation of the drylot period. In Yr.2, 24 yearlings were allotted to a drylot and fed hay as needed throughout the winter and spring. CGF was supplemented at 2.45 lbs./head/day for 42 days. Simultaneously, 12 yearlings were placed directly into a feedlot to begin a finishing program. Yearling body weights were taken monthly for all animals.

Results and Discussion

Dry matter yields of forage at the initiation of corn crop residue grazing in Yr.1 and Yr.2 were 3,757and 3,551 pounds per acre from CCR. Stockpiled TF-RC yielded 1,747 and 2,912 pounds per acre; SB-RC yielded 1,880and 2,187 pounds per acre (Table 1). Forage yields as hay harvested during the summers of Yr.1 and Yr.2 from TF-RC were 2,536 and 2,239 pounds per acre, SB-RC produced 2,660 and 2,300 pounds per acre.

Total forage yields for Yr.1 were 3,757 pounds per acre from corn crop residues, 4,283 pounds from TF-RC, and 4,540 pounds from SB-RC. In Yr.2, total forage yield from CCR was 3,551 pounds per acre,

5,151 pounds from TF-RC, and 4,487 pounds from SB-RC. Similar to dry matter yields, total organic matter yields and digestible organic matter yields were greater in CCR fields than in either of the stockpiled forages in both Yr.1 and Yr.2 (Table 1). Corn crop fields lost dry matter, organic matter, and digestible organic matter during the grazing period. Rates of loss were not different between years for dry, organic, or digestible organic matter yields. Stockpiled forages lost dry matter, organic matter, and digestible organic matter in both years. Rates of loss were not different between years for dry, organic, or digestible organic matter yields. The rate at which these components were lost during grazing did not differ between stockpiled forage species in Yr.1; however in Yr.2, differences in rates of

Table 1. Initial and daily changes in the yields of dry matter and digestible organic matter from grazed and ungrazed portions of fields containing corn crop residues (CCR), stockpiled tall fescue-red clover (TF-RC), or stockpiled smooth bromegrass-red clover (SB-RC).

		Initial lb./acre			Grazed lb./acre			Ungrazed lb./acre		
		CCR	TF--RC	SB--RC	CCR	TF--RC	SB--RC	CCR	TF--RC	SB—RC
DM Yield	Yr.1	3757	1747	1880	-23.5	-9.2	-9.9	-2.8	-5.9	-7.5
	Yr.2	3551	2912	2187	-28.8	-13.7	-8.6	-19.1	-1.5	-8.6
	Avg.	3654	2330	2034	-26.2	-11.5	-9.3	-11.0	-3.7	-8.1
OM Yield	Yr.1	3128	1580	1710	-21.0	-8.3	-9.0	-3.8	-5.3	-6.7
	Yr.2	3176	2647	1992	-27.8	-12.4	-7.8	-16.5	-1.2	-7.9
	Avg.	3152	2114	1851	-24.4	-10.4	-8.4	-10.2	-3.3	-7.3
IVOMD	Yr.1	1755	1105	1069	-14.6	-6.3	-5.9	-3.5	-4.8	-4.7
	Yr.2	1893	1586	1088	-19.8	-8.3	-4.7	-5.6	-2.5	-4.8
	Avg.	1824	1344	1079	-17.2	-7.3	-5.3	-4.6	-3.7	-4.8

Table 2. Initial concentrations and daily changes in concentrations of chemical components from grazed and ungrazed portions of fields containing corn crop residue (CCR), stockpiled tall fescue-red clover (TF-RC), or stockpiled smooth bromegrass-red clover (SB-RC).

		Initial			Grazed			Ungrazed		
		CCR	TF-RC	SB-RC	CCR	TF-RC	SB-RC	CCR	TF-RC	SB-RC
Ash %	Yr.1	16	9.6	9.0	.06	-.01	-.01	.04	-.001	-.01
of DM	Yr.2	10.7	9.1	8.9	.11	0	0	-.001	-.01	.001
	Avg.	13.4	9.4	9.0	.09	-.01	-.01	.02	-.006	-.006
% of OM										
IVOMD	Yr.1	56.1	69.9	62.5	-.15	-.23	-.20	-.05	-.23	-.19
	Yr.2	59.6	59.9	54.6	-.19	-.09	-.12	-.06	-.07	-.07
	Avg.	57.9	64.9	58.6	-.17	-.16	-.16	-.55	-.15	-.13
NDF	Yr.1	72.3	52.1	55.9	.11	.08	.06	-.02	.09	.05
	Yr.2	71.8	57.6	62.6	.11	.05	.02	.03	.05	.03
	Avg.	72.1	54.9	59.3	.11	.07	.04	.01	.07	.04
ADF	Yr.1	45.1	31.9	37.1	.13	.05	.01	.004	.05	.01
	Yr.2	42.5	33.7	34.0	.08	.04	.02	.03	.03	.03
	Avg.	43.8	32.8	35.6	.11	.05	.02	.02	.04	.02
CP	Yr.1	6.3	14.5	13.9	-.02	-.02	-.01	0.0	-.01	-.01
	Yr.2	5.5	14.1	13.1	-.02	-.005	0.0	.02	-.006	-.01
	Avg.	5.9	14.3	13.5	-.02	-.01	-.004	.01	-.007	-.01

lost were observed for dry matter and organic matter yields between stockpiled forage species. At the initiation of corn crop grazing period, CCR had a higher concentration of ash, neutral detergent fiber (NDF), and acid detergent fiber (ADF) in both Yr.1 and Yr.2, whereas stockpiled forages had higher concentrations of IVOMD and CP (Table 2). Tall fescue—red clover had higher concentrations of in vitro organic matter digestibility (IVOMD) and crude protein (CP), whereas SB-RC had higher concentrations of NDF and ADF in both years. The concentration of IVOMD decreased with time in both Yr.1 and Yr.2 of CCR and stockpiled forages. In Yr.1, stockpiled forages had greater rates of loss than did stockpiled forages, whereas in Yr.2, CCR lost IVOMD at a greater rate than did stockpiled forages. Rates of loss were greater on grazed areas than ungrazed areas, where there was no difference between forage types. The rate at which concentrations of CP were lost was not affected by forage species or grazing in Yr.1. In Yr.2 the rate at which concentrations of CP changed was not affected by forage species or grazing.

The rate at which the concentrations of NDF and ADF increased was greater in grazed corn crop residues than stockpiled forages in both Yr.1 and Yr.2. Tall fescue-red clover had a higher rate of concentration increase in NDF and ADF than smooth bromegrass-red clover for both grazed and ungrazed areas in Yr.1 and Yr.2. The lack of difference in the rate of change in concentrations of ash, IVOMD, NDF, ADF, and CP in stockpiled forages implies that much of the change in concentration was the result of weathering loss rather than loss from selective grazing during both Yr.1 and Yr.2. In CCR differences in the rate of change in concentrations of IVOMD, NDF, and ADF may suggest that some measure of selective grazing occurred during the grazing period in both years.

Table 3. Mean cow-weight and body condition score changes for three winter forage systems containing corn crop residues (CCR) and tall fescue-red clover (TF-RC), or smooth bromegrass-red clover (SB-RC), or drylot.

	Forage System					
	Drylot		CCR-TF-RC		CCR-SB-RC	
	Year 1	Year 2	Year 1	Year 2	Year 1	Year 2
Body Weight, lb.						
Initial	1119	1157	1142	1143	1153	1151
Seasonal change						
Period 1[c]	54[a]	47[a]	37[a]	-47[b]	-14[b]	-75[b]
Period 2	42[a]	102	-59[b]	103	-63[b]	125
Period 3	-75[a]	-159	18[b]	-121	51[b]	-115
Total	21	-10	-4	-65	-27	-65
Body Condition Score[d]						
Initial	4.45	5.1	4.95	5.2	4.9	5.3
Seasonal change						
Period 1	.55[a]	-.2	-.05[a]	-.4	-.15[b]	-.8
Period 2	-.1	0	.1	-.7	-.2	-.5
Period 3	-.6[a]	-.2	0[b]	1.1	0[b]	1.1
Total	-.15	-.4	.05	0	-.34	.2

[a,b] Differences between means by year with different superscripts are significant $p < .05$.

[c] Yr.1 Period 1 = 10/26/95 – 12/20/95, Period 2 = 12/21/95 – 3/7/96, Period 3 = 3/8/96 – 5/1/96.
Yr.2 Period 1 = 11/1/96 – 12/26/96, Period 2 = 12/27/96 – 3/10/97, Period 3 = 3/11/97 – 5/7/97.

[d] 9 point scale.

Mean cow-weight of cows maintained on hay in drylots was greater than cows grazing corn crop residues in Period 1 in both Yr.1 and Yr.2 (Table 3). During Period 2 of Yr.1, drylot cows continued to have greater mean cow body weights than did cows grazing stockpiled forages; however in Yr.2, this was not the case, as cows on all forage treatments gained equal amounts of weight during period 2 (Table 3). In both years cows maintained in drylots had greater body weights losses than did cows grazing stockpiled forages during Period 3. In Yr.1, this resulted in no difference in seasonal body weight changes of cows maintained on either system. In Yr.2, cows grazing stockpiled forages had greater seasonal body weight changes than did cows on drylot. The body weight losses of cows maintained in the drylot during Period 3 of Yr.1 may have been

caused by the quality of stored hay relative to the cows' metabolic needs. The body weight gains of cows grazing stockpiled forage during Period 3 in Yr.1 may have been due to an increase in forage quality during late spring. In Yr.2, the same trends can be observed relative to hay and forage quality. Cow body weight losses occurred in Period 3 for cows maintained in the drylot, whereas in Yr.2, cows grazing stockpiled forage lost weight during Period 3, unlike during Yr.1.

In Yr.1, similar to body weight, the body condition scores of cows maintained in the drylots increased, whereas those of cows grazing corn crop residues decreased during Period 1. In Yr.2, both drylot and grazing cows decreased body condition scores during Period 1. However, during Period 3 of both years, body condition scores of cows maintained in the drylot decreased more than those of cows grazing either of the stockpiled forage mixtures. Therefore, seasonal body condition score changes did not differ between wintering systems in either year.

Mean yearling body weight gains were greater during the period of CGF supplementation than the period following supplementation in both Yr.1 and Yr.2. Mean body weight gains were 33 and 32 lbs. in Yr.1 and Yr.2 for the 40 days during supplementation. Thereafter in both years, hay was fed at a level that would result in lower body weight gains throughout the remaining drylot period. Mean body weight gains were .39 and .23 lbs./day for the remaining 145 days in Yr.1 and Yr.2. Mean total seasonal body weight gains were 94 and 72 lbs., resulting in a gain of .48 and .49 lbs./day.

Cows sequentially grazing corn crop residues and stockpiled grass-legume forages required 5,300 and 7,424 lbs. hay dry matter less per cow than cows maintained in the drylot in Yr.1 and Yr.2 (Table 4). In Yr.1 during Periods 1 and 2, the amounts of hay required by cows sequentially grazing corn crop residue and either stockpiled TF-RC or SB-RC forages did not differ. However, during Period 3, cows grazing stockpiled TF-RC forage required 2.1 times less hay than cows grazing stockpiled SB-RC forage. In Yr.2, there were no differences in the amount of hay required by cows grazing either stockpiled forage. Because of the hay produced from fields used in the stockpiled grazing system, the TF-RC and SB-RC produced 11,905 and 12,803 in Yr.1 and 4,925 and 5,562 in Yr.2 lbs. hay DM per cow more than was required to maintain those cows grazing the stockpiled forages (Table 4). In contrast, the 6,201 and 5,003 lbs. hay DM per cow required by cows maintained in the drylot in Yr.1 and Yr.2 would have to come either from some other field within the farm or be purchased. Yearlings maintained in drylot required 2,778 and 2,662 lbs. hay DM during the winter and spring grazing periods of both years. Cow-calf pair hay balance was decreased in both years with the feeding of yearlings through the winter and spring.

Implications

The utilization of corn crop residues followed by grazing of stockpiled forages can greatly reduce the amount of stored hay needed to supplement gestating beef cows. As a result, considerable excess hay is produced which may be sold or used for other animals on the farm. One option may be to retain the spring calf crop through the winter and utilize the excess hay produced. In the spring, the yearlings may then be put into a feedlot or grazed on summer pastures. Corn crop residues offer a low-cost grazing resource that can be utilized throughout the fall and early winter. Body weight and body condition scores can be maintained or show only small losses over the course of a 55-day grazing season. Corn crop residue grazing followed by grazing of stockpiled legume-containing forages can have positive effects on body weight gain and body condition scores. Increases in body weight and body condition scores approaching calving have been shown to be beneficial in cow maintenance and subsequent rebreeding rates. Having cows at a desirable body weight and body condition scores through the grazing of corn crop residues and stockpiled forages will reduce the amount of stored forage required by gestating cows in the fall and winter.

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Table 4. Hay use and hay balance of different winter forage systems containing corn crop residues (CCR) and tall fescue-red clover (TF-RC), or smooth bromegrass-red clover (SB-RC), or drylot.

	Forage System							
	Drylot		CCR-TF-RC		CCR-SB-RC		Yearlings	
	Year 1	Year 2	Year 1	Year 2	Year 1	Year 2	Year 1	Year 2
Hay Feeding lb. DM/cow								
Summer	0	591[c]	0	0[d]	0	0[d]	0	0
Period 1	2,024[a]	2,518[c]	241[b]	0[d]	245[b]	0[d]	731	690
Period 2	2,478[a]	2,169[c]	392[b]	0[d]	392[b]	0[d]	1,197	831
Period 3	1,700[a]	2,259[c]	172[b]	112[d]	360[b]	114[d]	850	1,141
Total	6,201[a]	7,537[c]	805[b]	112[d]	997[b]	114[d]	2,778	2,662
Hay Balance[e]								
lb. DM/cow	-6,202[a]	-4,656[c]	11,905[b]	4,925[d]	12,803[b]	5,062[d]	-2,778	-2,662
lb. DM/cow-calf	-8,980[a]	-4,656[c]	9,127[b]	2,263[d]	10,025[b]	2,400[d]		

[a,b,c,d] Differences between means by year with different superscripts are significant $p < .05$.

[e] lb. Hay DM produced – lb. Hay DM fed / number of cows.