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Summary and Implications

A winter grazing experiment was conducted to evaluate the performance of bred 2-year old second-calf heifers grazing stockpiled forage at two stocking rates and two levels of supplementation during winter. Two 30-acre blocks containing 'Fawn' endophyte-free tall fescue-red clover were each divided into four pastures of 6.25 or 8.75 acres. Hay was harvested from the pastures in June and August of 2003 and N applied at 40 lb/acre to initiate stockpiling in August. On October 22, 2003, twenty-four Angus-Simmental two-year old heifers, pregnant with their second calf, were allotted by weight and body condition score (BCS) to strip-graze for 147 d at 0.48 or 0.34 cow/acre and eight similar second-calf heifers were allotted to two drylots and fed tall fescue-red clover hay. Corn gluten feed was fed to maintain a mean BCS of 5 or 4.33 (9-point scale) for the high and low supplementation levels, respectively, or when weather prevented grazing. Mean initial forage yield was 3188 lb/acre and decreased 12.2 lb/acre/d in grazed areas of the pasture over 147 d. Mean seasonal concentrations of CP and IVDMD were greater ($P < 0.05$) in hay than stockpiled forage, while the concentration of ADF was greater ($P < 0.05$) in stockpiled forage. At the conclusion of winter feeding, animals grazing at the low stocking rate had greater ($P < 0.1$) BW than those grazing at the high stocking rate, and the BCS of grazing animals was 0.42 lower ($P < 0.05$) than animals maintained in the drylot. Animals in the drylot were fed 5944 lb/hd of hay. Mean amounts of corn gluten feed fed was 189.6, 19.1, 278.5, 16.9, and 5.2 lb DM/hd for the high stocking rate-high supplementation, high stocking rate-low supplementation, low stocking rate-high supplementation, low stocking rate-low supplementation, and drylot treatments, respectively, but did not significantly differ ($P > 0.1$).

Introduction

Allowing cattle to harvest their own feed decreases the amount of harvested feeds required to maintain cows and thus reduces feed costs. While it has been shown that mature cows winter grazing stockpiled tall fescue require less hay to maintain optimal condition for calving and rebreeding, the effects of winter grazing of heifers have received limited study. Because heifers have lower feed intakes, but higher nutritional requirements than mature cows, winter grazing of stockpiled forage may be less effective. Over 2 years, in previous research at Iowa State University, heifers grazing stockpiled forage at a low or high stocking rate only needed 18 or 94 lb of corn gluten feed /heifer to meet target weights in year 1 and 0 lb of corn gluten feed in year 2 to meet target weights. However, snowfall during the two years of this experiment was 4.3 and 3.5 inches lower than average in the first and second year, respectively. The objectives of this winter grazing experiment were to determine the effects of stocking rate and supplementation level on bred second-calf heifers.

Materials and Methods

At Iowa State University's Beef Nutrition Farm, two 30-acre pastures of 'Fawn' endophyte free tall fescue and red clover, established in 2000, were frost seeded in March of each year with red clover at a rate of 4 lb/acre. Hay was harvested from the pastures in late May and August, 2003. After hay was removed in August, N was applied at a rate of 40 lb/acre to initiate stockpiling which began August 15. Each pasture was divided into two-6.25 and 8.75-acre pastures, and further subdivided into 8 paddocks for strip-grazing. Twenty-four Angus-Simmental second-calf heifers (average body weight, 1193 lb; average body condition score, 4.92) were allotted to the pastures to graze at a high stocking rate (0.48 cow/acre) or a low stocking rate (0.34 cow/acre) and eight second-calf heifers were allotted to a drylot and fed tall fescue-red clover hay.

Corn gluten feed was fed to maintain a mean BCS of 5 and 4.33 (9-point scale) for high and low supplementation or when weather prevented grazing. Heifers were supplemented to meet their target BCS in 28 d based on the Cornell Net Carbohydrate and Protein System (V. 5.0, Cornell University). Supplementation was adjusted based on weekly BCS. Heifers were also weighed bi-weekly.

Winter grazing was initiated October 22, 2003. Initial mean forage mass was 3188 lb DM/acre. Number of grazing days per paddock was calculated by estimating the forage available using 50 and 70% forage removal for the low and high stocking rates and dry matter intakes of 2.5% of BW.

In November and March, forage DMI of two heifers per pasture was estimated from fecal output determined from the passage kinetics of pulse-dosed chromium-

mordanted fiber (2% Cr) and in vitro dry matter digestibility (IVDMD) on forage selected by ruminally fistulated steers grazing with the heifers.

Pasture samples were collected at the initiation of grazing and every 28 days, with the exception of February when snow cover prevented sampling. Pasture samples were hand- clipped at two 0.25-m^2 locations in each grazed or ungrazed paddock and composited by pasture. At termination of grazing, ungrazed pasture samples were clipped within a 0.5-m^2 grazing exclosure in each paddock to measure weathering loss. Large round hay bales were weighed and core-sampled prior to feeding. All pasture and hay samples were analyzed for DM, IVDMD, crude protein (CP), acid detergent fiber (ADF), neutral detergent fiber (NDF), and acid detergent insoluble nitrogen (ADIN).

Pasture samples collected before a frost were sorted into live grass, legume, broadleaf weed, and dead forage, dried, and weighed to determine botanical composition of the pastures.

Winter grazing terminated following 147 days of grazing prior to calving in early April. At calving, calf birth weights and calving ease scores (1=no assistance, 2=assistance without mechanical help, 3=assistance with mechanical help, and 4=mechanical help resulting in calf loss) were recorded.

Results and Discussion

Average composition of tall fescue-red clover pastures was 75% grass, 5% legume, 3% weed, and 17% dead material. Initial forage mass was 3188 lb/acre and decreased 12.2 lb/acre/day over 147 days of grazing, while loss of forage DM from weathering was 5.5 lb/acre/day. Based on available forage, cattle were allowed to graze a new paddock every 19 days. Forage utilization was designed to remove 70 and 50% of forage for high and low stocking rates, but actual removal rates were 71 and 63%. Greater forage utilization by heifers in the low stocking rate pastures maybe attributed to greater weathering losses causing leaching of soluble nutrients. Ambient temperatures were near normal during the stockpiling and grazing periods while precipitation was lower than normal during the stockpiling period. Average snow depth during the grazing period was 3.4 to 13.4 inches, with 62 days of snow cover greater than one inch. A maximum snow depth of 21 inches during the trial prevented grazing and all cattle grazing stockpiled forage received corn gluten feed supplementation.

Forage composition of ungrazed stockpiled forage and hay is listed in Table 1. Concentration of IVDMD decreased and concentrations of NDF, ADF, and ADIN increased throughout the grazing period. Tall fescue-red clover hay contained higher concentrations of CP, IVDMD, ADF, and lower ADIN than stockpiled forage in each month of winter feeding. Lower quality of ungrazed stockpiled forage may be caused by greater forage maturity at initiation of winter grazing.

Heifers in the drylot consumed more forage ($P < 0.01$) than heifers grazing stockpiled forage in November (Table 2) however, stocking rate did not affect forage intake in November. There was no treatment difference ($P=0.37$) in DMI of heifers grazing forage or consuming hay in March.

There was no difference in body weight ($P=0.3$) or BCS ($P=0.58$) at initiation of winter grazing. Lower body weights of heifers grazing stockpiled forage than heifers fed hay in December and February correspond to periods of greater snow cover during winter grazing (Figure 1). At the conclusion of winter grazing, heifers grazing at the low stocking rate and heifers maintained at a high supplementation level had higher body weights ($P <0.1$) than heifers grazing at a high stocking rate or heifers maintained at a low stocking rate. A significant interaction ($P <0.1$) occurred between stocking rate and supplementation level (Figure 1). Heifers consuming hay in the drylot had significantly higher BCS ($P <0.1$) than heifers grazing stockpiled forage at the conclusion of winter grazing (Figure 2). As the amounts of hay fed to heifers in the drylot were designed to maintain an average body condition score of 5, condition scores of hay fed heifers near the end of winter grazing were above 5 even though hay feeding was limited.

Snow cover prevented grazing and all heifers grazing stockpiled forage were fed corn gluten feed for 6 days. Although heifers grazing stockpiled forage fed at the high level of supplementation tended to consume more corn gluten feed than heifers supplemented at the low level of supplementation or fed hay, there was no treatment difference ($P=0.28$) in amounts of corn gluten feed fed (Table 3). There was no difference ($P=0.63$) in calf birth weights among treatments (Table 3) although heifers in the drylot had significantly higher body condition scores at the termination of winter feeding.

An economic analysis was performed to analyze the cost of feeds fed during winter grazing (Table 3) with corn gluten feed costing $75/ton and a hay costing $50/ton. Feed costs were higher for the drylot heifers as 5,944 lb DM hay was fed per animal in the drylot during winter grazing. Further economic analysis needs to include pasture rental costs to access the costs of the stockpiling system.

Conclusion

Grazing stockpiled tall fescue-red clover required feeding of corn gluten feed when weather prevented grazing. However, stockpiled grazing reduced the amounts of stored feed fed compared to heifers in the drylot. Winter grazing stockpiled forage decreased the cost of stored feeds, but pasture costs need to be incorporated to evaluate an economic comparison between treatments.

Acknowledgments

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Table 1. Composition of non-grazed stockpiled tall fescue-red clover forage and hay.

	Forage and Month[a]											Significance		
	Stockpiled forage					Hay								
	1	2	3	4	6	1	2	3	4	5	6	Forage	Month	F x M
% DM														
CP	10.0	10.0	9.2	8.9	10.0	12.1	12.2	12.2	11.8	11.8	12.0	< 0.01	< 0.01	0.58
IVDMD	54.2	45.1	48.8	51.6	46.5	63.3	62.2	51.3	55.7	57.7	56.9	< 0.01	< 0.01	0.42
NDF	50.7	51.2	58.9	56.7	62.7	49.6	50.7	51.2	51.4	50.5	52.0	0.14	< 0.01	< 0.01
ADF	30.6	31.7	36.3	34.9	38.4	32.1	31.4	33.2	32.1	31.2	31.6	< 0.01	< 0.01	< 0.01
% N														
ADIN	8.5	8.7	10.0	12.3	11.8	7.1	4.5	6.6	5.4	4.4	3.5	0.55	< 0.01	< 0.01

[a]Month corresponds to 28 day intervals beginning on October 22, 2003.

Table 2. Dry matter intakes of forage of heifers grazing stockpiled forage and hay.

	Forage					Contrasts		
Treatment[a]	HSR, HS	HSR, LS	LSR, HS	LSR, LS	Hay	LSR vs HSR	LS vs HS	Stockpiled forage vs hay
Forage intake, % BW								
November	3.0	2.2	2.4	2.7	4.0	NS	P < 0.1	P < 0.01
March	2.9	2.9	3.1	2.4	2.1	NS	NS	NS

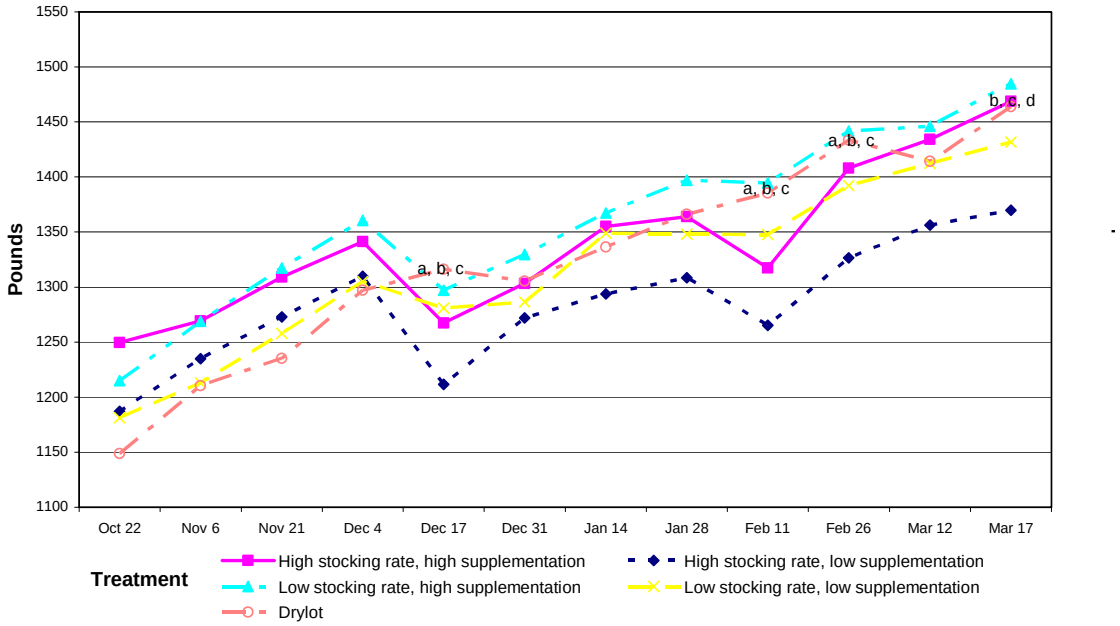
[a]HSR- high stocking rate, LSR-low stocking rate, HS-high supplementation level, LS- low supplementation level

Table 3. Amounts of stored feed fed, length of feeding, cost of feeds fed, and calf birth weights of pregnant heifers grazing stockpiled tall fescue-red clover pastures or hay.

	Treatment[a]				
	HSR, HS	HSR, LS	LSR, HS	LSR, LS	DL
CGF (lb DM/hd)	189.6	19.1	278.5	16.9	5.2
Days fed	49	13	74	9	15
$/hd/season[b]	7.11	0.72	10.44	0.63	0.20
Hay (lb DM/hd)					5944
Days fed					147
$/hd/season					148.6[c]
Calf birth weight, lb	97	102	98	100	97

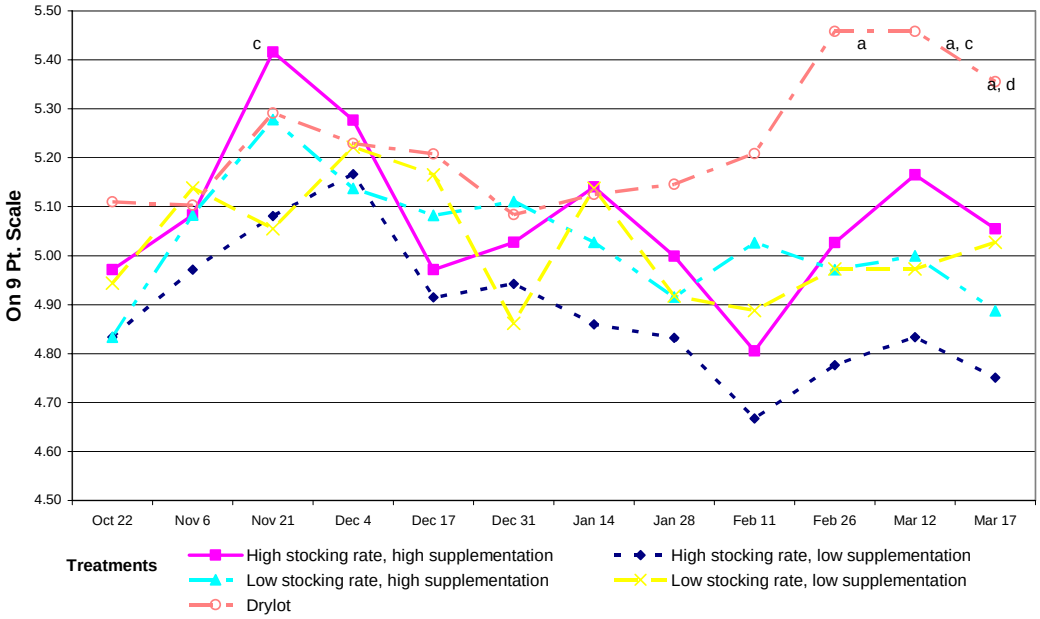
[a]HSR- high stocking rate, LSR-low stocking rate, HS-high supplementation level, LS- low supplementation level
[b]Price of corn gluten feed based on $75/ton
[c]Price of hay based on $50/ton

Figure 1. Body weights of pregnant two-year old heifers grazing stockpiled forage or fed hay with high or low levels of corn gluten feed supplementation.



a=difference in hay vs grazing at P < 0.1
b=difference in stocking rate at P < 0.1
c=difference in supplementaion level at P < 0.1
d=stocking rate x supplementation level at P < 0.1

Figure 2. Body condition score of pregnant two-year old heifers grazing stockpiled forage or fed hay with high or low levels of corn gluten feed supplementation.



a=difference in hay vs grazing at P < 0.1
b=difference in stocking rate at P < 0.1
c=difference in supplementaion level at P < 0.1
d=stocking rate x supplementation level at P < 0.1