Response of Gestating Beef Cows to Limit-Fed Diets Containing Rolled Barley

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Summary

In the Northern Great Plains, barley grain may be a more economical source of energy than hay. An experiment was conducted at South Dakota State University Cottonwood Research Station to determine the efficacy of limit-fed, barley-based diets as an alternative to alfalfa hay for beef cows in late gestation. Ninety-six gestating, crossbred cows (age 3 to 11 years; average calving date of May 7) were stratified by age and weight and randomly assigned to one of 12 pens (8 cows/pen). Pens were randomly allotted to one of three winter feeding treatments (4 pens/treatment) from January 15 to April 10, 2003. Treatments were: 1) course-ground alfalfa hay (Hay; fed at approximately 1.6% of BW); 2) dry rolled barley replacing alfalfa hay at 29% of the diet dry matter (Low Barley; fed at approximately 1.4% of BW); and 3) dry rolled barley replacing alfalfa hay at 67% of the diet dry matter (High Barley; fed at approximately 1.2% of BW). All diets were formulated using the 1996 NRC computer model to provide for maintenance of body condition score. A supplement (0.5 lb/d) supplied adequate protein, minerals, vitamins, and 200 mg/hd/d of Rumensin. Rations changed monthly to account for changing cow requirements during late gestation. All diets were consumed within a two-hour period each day. Treatment means were separated using orthogonal contrasts (Hay vs. High and Low Barley; High Barley vs. Low Barley). Cows fed barley gained more weight than cows fed Hay ($P < 0.01$; weight change of 79, 126, and 132 lb for Hay, Low Barley, and High Barley, respectively). Cows fed barley also gained more body condition than cows fed Hay ($P < 0.01$; body condition score change of -0.10, 0.24, and 0.38 for Hay, Low Barley, and High Barley, respectively). There were no differences ($P > 0.10$) in weight or body condition score change between Low and High Barley treatments. There were no differences between treatments in subsequent pregnancy rates ($P > 0.50$). Rolled barley can be used to replace alfalfa hay in diets for gestating beef cows.

Introduction

Feed costs in many operations account for the largest proportion of operating costs. Limit feeding concentrate diets can lower feed costs while maintaining performance during gestation (Loerch, 1996). South Dakota can have harsh, severe winter conditions, which increase the maintenance requirements of beef cattle. It is not clear that limit feeding will work under such conditions.

The availability of barley is abundant in South Dakota with fifty-four percent (USDA) of United States' barley production coming from North Dakota, South Dakota, Minnesota, and Montana from 1996-2000. Barley is a cheaper source of energy than hay in many situations. Most studies with barley have been with growing and finishing cattle, and most limit feeding studies with cows have used corn as a concentrate source (Loerch, 1996; Tjardes et al., 1998). We hypothesize that barley can be used to maintain cow body weight and body condition score during the winter months for cows in late gestation. Therefore, the objectives of this study were to evaluate body weight, body condition score, and reproduction of cows limit-fed various levels of barley during late gestation.

Materials and Methods

This study was conducted from January 15 to April 10, 2003 at South Dakota State University's Cottonwood Range and Livestock Research Station, near Philip, SD. Ninety-six gestating, crossbred cows (age 3 – 11 yr; average calving date of May 7) were blocked by summer management, stratified by age, weight, body condition score, and randomly allotted to

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one of 12 pens (8 cows/pen). Pens were randomly allotted to one of three winter feeding treatments (4 pens/treatment): 1) alfalfa hay (**Hay**); 2) rolled barley replacing alfalfa hay at 29% of the diet dry matter (**Low Barley**); 3) rolled barley replacing alfalfa hay at 67% of the diet dry matter (**High Barley**).

Cows were housed in confinement pens and fed rations once daily in concrete bunks with at least 2 ft of bunk space per animal. All diets were formulated using the 1996 NRC computer model to result in maintenance of body condition score (Table 1). Rations changed monthly to account for changing cow requirements during late gestation. Alfalfa hay was course ground and analyzed as 19.7% CP and 32.5% ADF (DM basis). Barley was dry rolled and analyzed as 11.0% CP and 6.4% ADF (DM basis). A supplement (Table 2) was fed to all treatments at a rate of 0.5 lb/d throughout the trial and supplied 200 mg of Rumensin to each cow daily. All diets were formulated to be adequate in degradable intake protein, undegradable intake protein, vitamins, and minerals.

Cows were limit-fed alfalfa hay at 2% of body weight for 5 d prior to initial weights. On d 1 of the trial (January 15), cows fed Low Barley and High Barley treatments were fed an adaptation diet of approximately 85% hay and 15% barley. On d 2, Low and High Barley cows were then placed on the Low Barley diet (Table 1). After four days on the Low Barley diet, High Barley cows were fed a third adaptation diet consisting of 55% hay and 45% barley for an additional 6 d prior to being moved to their treatment diet (Table 1). All cows were limit-fed the Hay diet for three days prior to the final weight measurements. The High Barley cows were fed the Low Barley diet for two days prior to being placed on the final hay ration (adaptation to the hay). Cows were weighed on two consecutive days and a body condition score was assigned by two trained technicians at the beginning and end of the experiment. Pregnancy was determined by rectal ultrasonography in October of 2003.

Performance data were analyzed by ANOVA and means compared with orthogonal contrasts: Hay vs. Barley (Low and High Barley); and Low Barley vs. High Barley. Due to management decisions unrelated to treatments, only 73 cows were available for pregnancy determination (26, 25, and 22 cows for he Hay, Low Barley, and High Barley, respectively). Pregnancy data were analyzed in Proc GENMOD of SAS (SAS Inst. Inc., Cary, NC) as a randomized complete block, with pen as the observation, animal as the trial within observation, and summer treatment as the block. Cows in this study were on one of two subsequent summer treatments (low versus high sulfate water).

Results and Discussion

Daily feed was consumed within a 2-h period each day for all treatments. No digestive or health problems were observed. All cows gained weight over the course of the experiment (Table 3). Cows consuming Low Barley and High Barley had more weight gain ($P < 0.01$) than those fed Hay. In addition, the cows fed hay lost body condition during the experiment, whereas cows fed barley gained body condition ($P < 0.01$, Table 3). There were no differences ($P > 0.10$) between the Low Barley and High Barley groups for the variables measured. There were no differences in pregnancy rates between treatments ($P = 0.86$, Table 3).

Loerch (1996) compared ad libitum hay and corn-based diets. The composition of hay was mainly orchardgrass with a small portion of alfalfa (approximately 75% NDF and 10.2% CP). Loerch found in yr 1 that there were no differences in cow weights but a higher BCS change for crossbred gestating cows limit-fed corn compared to cows consuming ad libitum hay. Tjardes et al. (1998) compared ad libitum hay, limit-fed whole corn with hay, and limit-fed cracked corn with hay for cows in early lactation. Cows and calves experienced temperatures ranging from -9 to 73°F with an average low of 28°F and average high of 44°F. Tjardes et al. (1998) found no differences in cow weight change or body condition score when comparing ad libitum hay to either of the limit-fed corn treatments. During the current study, cows experienced temperatures ranging from -1 to 52°F with an average high of 41°F and average low of 14°F (weather data taken from a national weather station located on the research station). The low temperatures during this study were not as severe as some winter weather conditions in South Dakota. The Barley diets in our study resulted in better performance, but it is important to note that all diets were limit-fed.

In conclusion, barley, like corn, will work as an alternative to hay as a wintering program for late gestating cows.

Implications

Barley can be used to replace alfalfa hay in limit-fed diets and increase weight and BCS for late gestating beef cows. Therefore, the use of barley in limit feeding of gestating cows is an option during periods of low and/or expensive forage supply. Further research is needed for a comparison of limit-fed barley diets with full-fed grass hay diets.

Literature Cited

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Tables

Table 1. Daily feed offered to gestating cows across three treatments during three periods in late gestation (DM basis)

Ingredient	Hay	Low Barley	High Barley
		January 15 – February 13	
Hay, lb/d	20.0	12.5	4.9
Barley, lb/d	0.0	5.3	10.6
Supplement, lb/d	0.5	0.5	0.5
		February 14 – March 14	
Hay, lb/d	21.8	13.7	5.3
Barley, lb/d	0.0	5.7	11.7
Supplement, lb/d	0.5	0.5	0.5
		March 15 – April 6[a]	
Hay, lb/d	23.5	13.9	5.7
Barley, lb/d	0.0	6.2	12.6
Supplement, lb/d	0.5	0.5	0.5

[a]All cows were fed the Hay diet on April 7, 8, 9, and 10. Final weights were taken April 10 and 11.

Table 2. Nutrient content of supplement feed to gestating cows across three treatments in late gestation

Item	Amount (DM Basis)
Crude Protein, %	27.28
Crude Fat, %	3.15
NE_M, Mcal/lb	0.25
NE_G, Mcal/lb	0.16
Calcium, %	4.30
Phosphorus, %	3.64
Potassium, %	1.10
Sulfur, %	0.87
Zinc, ppm	1,209
Iron, ppm	1,431
Manganese, ppm	1,714
Copper, ppm	631
Sodium, %	4.31
Magnesium, %	1.08
Rumensin, ppm	1,000

Table 3. Weight and body condition score (BCS) of cows program fed alfalfa hay (Hay), rolled barley replacing alfalfa hay at 29% of the diet (Low Barley), or rolled barley replacing alfalfa hay at 67% of the diet (High Barley) during the last trimester of gestation

Item	Hay	Low Barley	High Barley
Initial wt, lb	1418	1429	1396
Final wt, lb	1497	1555	1528
Avg. wt change, lb[a]	79	126	132
Initial BCS	5.89	5.93	5.76
Final BCS	5.79	6.17	6.14
Avg. BCS change[a]	-0.10	0.24	0.38
Pregnancy rate, %	92.3	92.0	95.5

[a] Hay vs. Barley: ($P < 0.01$)