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Evaluation of Wheat Middlings as a Supplement for Beef Cows Grazing Native Winter Range

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Summary

A winter grazing trial was conducted at the SDSU Cottonwood Research Station near Cottonwood, SD, to compare wheat middlings to soybean meal and corn-soybean meal supplements. During December and January 122 pregnant Simmental-Angus crossbred cows grazing two pastures with differing amounts of available forage were fed four supplemental treatments that provided the following amounts of crude protein (lb) and metabolizable energy (Mcal) per cow daily: 1) soybean meal .75 and 2.40, 2) corn-soybean meal 1.50 and 9.40, 3) low wheat middlings .75 and 4.76, and 4) high wheat middlings 1.50 and 9.40. Cows grazing the high available forage pasture gained 56 lb more than those grazing the low available forage pasture. Cows grazing the high available forage pasture were able to select a diet higher in crude protein and lower in acid detergent fiber. The supplement x pasture interaction indicates that level of forage availability is a factor in determining a cow's response to the supplemental treatment. When forage availability was low, wheat middlings was a less effective source of supplemental protein than soybean meal and a less effective source of supplemental energy compared to a corn-soybean meal supplement balanced to provide equal protein and energy. For cows grazing the high available forage pasture, soybean meal and the low wheat middlings supplements produced similar cow weight gains and the high wheat middlings supplement was a less effective source of supplemental energy than the corn-soybean meal supplement. Cows grazing the high forage pasture receiving 1.89 lb soybean meal had similar weight gains and lower supplement cost than cows grazing the low forage pasture receiving 6.59 lb of the corn-soybean meal supplement.

Key Words: Beef Cows, Winter Range, Available Forage, Wheat Middlings

Introduction

Previous studies at the SDSU Cottonwood Research Station demonstrated the importance of adequate cow body condition at calving and prior to the breeding season for high reproductive performance. Supplementation of cows grazing mature low protein forage can be used to maintain adequate body condition by minimizing cow weight loss in the winter.

Protein is typically the first limiting nutrient for cows grazing native winter range pastures. The use of all natural high protein supplements has been shown to increase cow weight change during the winter grazing period by improving forage intake and digestibility.

The use of grain which is high in starch can be detrimental to cow performance due to a reduction in intake and digestibility of the base forage. Previous research at the Cottonwood Station indicates that grain supplements are more likely to be beneficial when there is abundant forage to graze or when additional protein is provided with the grain supplement. Lower starch by-product feeds such as wheat middlings, soybean hulls, brewers grains, and

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sugar beet pulp have the potential to increase energy consumption without the detrimental effects of the starch in grains.

This study was conducted to compare wheat middlings to soybean meal and corn-soybean meal supplements on the performance of beef cows grazing native winter range with two levels of forage availability.

Materials and Methods

A winter grazing trial was conducted with 122 pregnant Simmental-Angus crossbred cows grazing native winter range pastures at the SDSU Cottonwood Research Station. Cows were allotted by age and weight to four supplemental treatments (Table 1) and grazed on pastures with either high or low available forage. A soybean meal supplement was used as a base to provide .75 lb crude protein per cow daily. A low wheat middlings supplement was balanced to provide the same amount of protein daily. A high wheat middlings supplement was balanced to provide twice the amount of energy as the low wheat middlings supplement. A corn-soybean meal supplement was balanced to provide the same amount of protein and energy as the high wheat middlings supplement. Supplements were pelleted (3/16 in. diameter) and balanced to exceed NRC (1984) requirements for phosphorus and potassium (Table 2).

Two pastures used in the study were predominately western wheatgrass. The low available forage pasture (270 acres) was grazed for 5,575 animal unit days prior to the start of the trial to create differences in available forage. The high available forage pasture (351 acres) had not been grazed since the previous year.

From December 4 to January 30, cows were gathered every morning, sorted into treatment groups, and bunk fed their respective supplements. At the beginning and end of the trial, cows were weighed in the morning on two consecutive days after overnight removal from feed and water. At the end of the supplemental feeding period, cows were grazed on a common pasture without supplementation for four days to equalize fill. Initial and final cow weights were the average of the two consecutive weights. Condition scores (1 to 9, 1 = extremely emaciated) were assigned by two trained technicians at the beginning and end of the trial. On the second weigh day at the beginning and end of the trial, subcutaneous fat was measured at the twelfth rib with an Aloka 500V ultrasound system using a 5 MHz, 5.8 cm probe. Cows were bred to either Angus or Simmental bulls and had mean calving dates of February 21 and April 9 for first calf heifers and mature cows, respectively.

In early January, forage samples were collected using four esophageally fistulated steers fitted with screened collection bags. Steers grazed with the cows for 30 minutes following morning supplementation on two consecutive days per pasture. Samples were frozen, lyophilized, and ground for later analysis.

Data for the grazing trial were analyzed as a 2 x 4 factorial arrangement with two pastures and four treatments as main effects using the

Table 1. Supplemental treatments[a]

	Supplement			
Item	Soybean meal	Corn-soybean meal	Low wheat middlings	High wheat middlings
Soybean meal	90.00	32.25	--	--
Corn	--	64.63	--	--
Wheat middlings	--	--	97.27	97.27
Molasses	2.17	2.28	2.73	2.73
Dicalcium phosphate	7.83	.84	--	--

[a]Percentage on a dry matter basis.

Table 2. Composition of daily supplemental intake per cow[ab]

Item	Supplement: Soybean meal	Corn-soybean meal	Low wheat middlings	High wheat middlings
Dry matter, lb	1.89	6.59	4.15	8.36
Metabolizable energy, Mcal/lb	2.40	9.40	4.76	9.40
Crude protein, lb	.75	1.50	.75	1.50
Phosphorus, lb	.041	.041	.040	.081
Potassium, lb	.039	.070	.052	.103
Calcium, lb	.039	.020	.005	.011
Price/lb supplement, $	.135	.104	.080	.080
Price/cow/day, $	.29	.78	.38	.77
Price/cow/period, $	16.82	45.24	22.04	44.66

[a]ME values are calculated from NRC feed tables. Other values are based on chemical analysis.
[b]Costs are as fed based on delivered feed without bulk discounts.

GLM procedures of SAS and treatment means were separated by the PDIFF option. Dependent variables include initial, final, and change in cow weight, condition score, and rib fat. Independent variables include supplement, pasture, cow age, and supplement x pasture. Initial measurements were included as covariates for weight change, condition score change, and change in rib fat.

Results and Discussion

Esophageal samples indicate that cattle on the high available forage pasture were able to select a diet higher in crude protein ($P<.05$) and lower in acid detergent fiber ($P=.06$). Neutral detergent fiber, acid detergent lignin, and ash content were similar (Table 3) between pastures.

Table 3. Composition of forage samples[ab]

Item	Forage available: Low		High	
Organic matter basis, %				
Crude protein	3.34[c]	(.26)	4.40[d]	(.18)
Neutral detergent fiber	85.87	(.90)	84.20	(.64)
Acid detergent fiber	56.80[e]	(.75)	54.75[f]	(.53)
Acid detergent lignin	5.52	(.28)	5.97	(.20)
Dry matter basis, %				
Ash	13.26	(.36)	12.82	(.25)

[a]Least squares means followed by standard errors.
[b]Uncorrected for salivary contamination.
[c,d]Means with uncommon superscripts differ ($P<.05$).
[e,f]Means with uncommon superscripts differ ($P=.06$).

Cows grazing the high available forage pasture gained 56 lb more (P<.001) and lost less body condition (P<.001) than cows grazing the low available forage pasture. There was a treatment x pasture interaction (P<.05) for both weight and condition score change, indicating that supplement response was dependent on the amount of available forage (Table 4).

When forage availability was low, cows that were fed .75 lb crude protein from soybean meal lost less weight (P<.05) and condition score (P<.05) than the low wheat middlings cows. Cows that received 1.5 lb crude protein from the corn-soybean meal supplement had greater weight (P<.05) and condition score changes than high wheat middlings fed cows. Cows fed high wheat middlings lost less weight (P<.05), condition score (P<.05), and rib fat than low wheat middlings. When forage availability is limited wheat middlings appears to be a less effective protein source compared to soybean meal. When forage availability is low or when cows are thin and maximum weight gain is important, a corn-soybean meal supplement will provide the highest weight gains, but it has the highest feed costs.

When forage availability was high, cows that received .75 lb crude protein from soybean meal had similar weight gains and condition score changes compared to cows fed low wheat middlings. Cows that received 1.5 lb crude protein from corn-soybean meal gained 32 lb more (P<.05) and had a greater condition score change than high wheat middlings supplemented cows with a similar cost per day. Cows fed high wheat middlings had a 22-lb weight change advantage (P<.05) over cows fed low wheat middlings.

Previous studies have shown that a grain supplement may be detrimental to cow performance. Grain supplements are more likely to improve cow weight change when there is abundant forage or when the amount of protein in the supplement is high. In this study, the lower starch wheat middlings supplement did not improve weight change compared to the corn-soybean meal supplement that was balanced to provide the same level of protein and energy as the wheat middlings. Regardless of forage availability, the lower starch wheat middlings supplement did not improve performance over the higher starch corn-soybean meal supplement.

The wheat middlings supplements had the lowest price per pound of supplement (Table 2). The soybean meal supplement cost the least per day and for the entire feeding period. Cows fed low wheat middlings had intermediate feed costs. The corn-soybean meal and high wheat middlings supplements resulted in the highest daily and 58-day feeding period feed costs.

A digestibility trial is in progress to determine the effects of the same supplements on the intake and digestibility of mature native grass hay. The grazing trial will be repeated.

The results from this study indicate that forage availability is a factor in determining the response to a supplement. When forage availability is low, wheat middlings is a less effective source of supplemental protein compared to soybean meal. With limited forage availability wheat middlings does not appear to be as beneficial as a corn-soybean meal supplement when added energy is needed. If abundant forage is available, wheat middlings will provide similar gain responses as a protein supplement compared to soybean meal. With a high amount of grazeable forage, wheat middlings and corn-soybean meal supplements had positive and beneficial weight gains when used as a source of additional energy, but they also have the highest feed costs. When maximum weight gains are needed, usually when cows are thin in the fall, a corn-soybean meal supplement will provide the greatest weight gains. However, it also has the highest feed costs associated with it. Soybean meal supplements appear to be the most beneficial supplement for minimizing weight and body condition losses at the least cost.

Table 4. Effect of available forage and supplement on cow performance

Level of forage	Low				High			
Supplement	Soybean meal	Corn-soybean meal	Low wheat middlings	High wheat middlings	Soybean meal	Corn-soybean meal	Low wheat middlings	High wheat middlings
No. cows	14	16	15	15	16	15	16	15
Initial wt, lb	1140	1141	1154	1114	1129	1118	1122	1124
Init. condition score, 1-9	5.5	5.4	5.4	5.4	5.5	5.4	5.3	5.4
Initial rib fat, in.	.17	.14	.15	.11	.15	.15	.13	.12
Wt change, lb	2[d]	34[bc]	-73[f]	-23[e]	35[bc]	72[a]	18[cd]	40[b]
Condition score change	-.1[ab]	.0[ab]	-.6[c]	-.2[b]	-.0[ab]	.2[a]	-.1[b]	-.0[ab]
Rib fat change, in.	-.04[a]	-.02[ab]	-.05[a]	-.02[ab]	-.03[ab]	-.00[b]	-.03[ab]	-.00[b]

[a,b,c,d,e,f]Means with uncommon superscripts differ ($P<.05$).