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Impacts of wheat milling by-products in supplements on the intake and digestion of steers consuming low-quality forage

Abstract

Sixteen ruminally fistulated steers were used to evaluate the effects of feeding supplements containing combinations of two wheat-milling by-products on forage intake, digestibility, and ruminal characteristics. The by-products accounted for 47 to 49% of each supplement and were as follows: 1) 100% wheat bran; 2) 67% wheat bran, 33% second clears; and 3) 33% wheat bran, 67% second clears. All supplements contained about 30% CP. Compared with unsupplemented controls, forage intake and digestibility were significantly higher for supplemented steers. However, no differences occurred among by-product treatments. In conclusion, if the protein content is adequate, the choice of bran (high digestible fiber) vs. second clears (high starch) has little impact on forage use.

Keywords

Cattlemen's Day, 1999; Kansas Agricultural Experiment Station contribution; no. 99-339-S; Report of progress (Kansas State University. Agricultural Experiment Station and Cooperative Extension Service); 831; Beef; Steers; Forage; Intake; Digestion; Wheat by-products

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IMPACTS OF WHEAT MILLING BY-PRODUCTS IN SUPPLEMENTS ON THE INTAKE AND DIGESTION OF STEERS CONSUMING LOW-QUALITY FORAGE

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Summary

Sixteen ruminally fistulated steers were used to evaluate the effects of feeding supplements containing combinations of two wheat-milling by-products on forage intake, digestibility, and ruminal characteristics. The by-products accounted for 47 to 49% of each supplement and were as follows: 1) 100% wheat bran; 2) 67% wheat bran, 33% second clears; and 3) 33% wheat bran, 67% second clears. All supplements contained about 30% CP. Compared with unsupplemented controls, forage intake and digestibility were significantly higher for supplemented steers. However, no differences occurred among by-product treatments. In conclusion, if the protein content is adequate, the choice of bran (high digestible fiber) vs. second clears (high starch) has little impact on forage use.

(Keyword: Steers, Forage, Intake, Digestion, Wheat By-Products.)

Introduction

When beef cows graze low-quality forage, supplemental protein is imperative to stimulate intake. Recent research at Kansas State University also implies that the type of protein is important. Degradable intake protein (DIP) is that portion of the crude protein that is degraded by ruminal microorganisms. It is required for efficient utilization of low-quality forage and, consequently, for desirable cow performance. Even so, when DIP needs are met, additional energy may be required to achieve desired levels of performance. Our objective was to evaluate the effect of two wheat-milling by-products used as supplemental energy sources on forage intake, digestion, and selected ruminal fermentation characteristics of steers.

Experimental Procedures

Sixteen ruminally fistulated beef steers (avg. BW 1064 lb)were blocked by weight and assigned to one of four treatments. Each steer was offered tallgrass prairie hay (3.1% CP, 76.4% NDF) at 130% of average voluntary intake for the preceding 5-day period. The treatments included a negative control (no supplement) and three different supplements fed at a rate (.378% BW per day, dry basis) similar to that provided to cows in a companion trial. The wheat-milling by-products accounted for 47 to 49% of each supplement and were as follows: 1) 100% wheat bran, 2) 67% wheat bran, 33% second clears; and 3) 33% wheat bran, 67% second clears. Wheat bran is high in digestible fiber, and second clears is a low-grade flour that is high in starch (> 75%). Soybean meal (approximately 40% of the supplements) provided sufficient DIP to maximize forage intake and digestion (based on previous K-State research). Supplements were formulated to contain about 30% CP. Based on National Research Council values, about 70% of each supplement's CP was in the form of DIP. The forage contained about 50% of its CP as DIP. A 7-day intake and fecal collection period was followed by a 14-day adaption period. Fecal grab samples were analyzed for acid detergent insoluble ash, which served as an internal marker to

[1]Consolidated Nutrition, Omaha, NE.

determine total fecal output. Feed offered, feed refused, and total fecal output were used to calculate intake and digestibility coefficients. Immediately following the collection period, ruminal pH and ammonia concentrations were measured at feeding and 3, 6, 9, and 12 hours after feeding.

Results and Discussion

Forage organic matter (OM) intakes and total OM intakes were lower (P<.01) for the negative control compared with supplemented steers but were not different (P≥.23) among the supplemented steers (Table 1). Digestion of OM was lower (P=.03) for control than for supplemented steers, with no difference (P≥.46) among supplemented groups. Digestion of NDF was not affected (P≥.47) by treatment. Total digestible OM intake was also lower (P<.01) for control than supplemented steers, with no difference (P≥.21) among supplements. Ruminal pH was slightly higher (P<.01) for the control than supplemented steers, and the 67% wheat bran/33% second clears treatment resulted in slightly higher ruminal pH than the other supplements. Ammonia concentrations were lower (P<.01) for the control vs. the supplemented steers, but no differences (P≥.44) were evident among supplemented treatments.

Improved forage intake and digestion for the supplemented steers probably were due to the provision of ruminally available protein (i.e., DIP). Ruminal nitrogen concentrations are extremely deficient when cattle consume low-quality forage. The DIP provided in the supplement alleviated some or all of this deficiency (as seen in the ruminal ammonia concentrations) and increased microbial growth and forage breakdown. The lack of differences between the two wheat-milling by-products suggests that formulating supplements based on starch versus digestible fiber will have little impact on forage use if ruminally available protein is adequate.

Table 1. Influence of Wheat-Milling By-Product in Supplements on Intake and Digestion by Steers

	Treatment[a]					Contrasts[b]		
Item	NC	BRAN	BRSC	SCBR	SEM[c]	NC	L	Q
Forage OM[d] intake								
g/kg $BW^{.75}$	40.0	62.4	70.3	68.2	3.65	<.01	.29	.29
% BW	.86	1.32	1.50	1.46	0.08	<.01	.26	.27
Total OM intake								
g/kg $BW^{.75}$	40.0	77.8	85.9	84.1	3.65	<.01	.26	.29
% BW	.86	1.66	1.83	1.80	0.08	<.01	.23	.30
Digestible intake								
g/kg $BW^{.75}$	20.0	42.8	46.0	46.3	1.90	<.01	.23	.53
% BW	.43	0.91	0.98	0.99	0.04	<.01	.21	.54
OM Digestion, %	50.1	55.1	53.7	55.1	1.53	.03	1.00	.46
NDF Digestion, %	50.1	49.7	47.8	48.8	1.61	.49	.71	.47
Ruminal pH	6.74	6.56	6.62	6.54	0.02	<.01	.45	.44
Ammonia N, m*M*	.42	1.16	1.07	1.09	0.06	<.01	.57	.03

[a]NC=negative control. The by-product portion of the supplements were: BRAN=100% Bran; BRSC=67% Bran, 33% Second clears; SCBR=33% Bran, 67% Second clears.
[b]Contrasts: NC=Negative control vs. supplement, L=Linear within supplement; Q=Quadratic within supplement.
[c]SEM=standard error of the mean (n=16).
[d]OM=organic matter.