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Evaluation of wheat middlings-based supplements at different crude protein concentrations for cattle consuming winter range forage

Abstract

Influence of increasing crude protein concentration in a wheat middlings-based supplement was evaluated in an intake/digestion trial. Protein-supplemented steers demonstrated increased ($P < .01$) intake of dormant, bluestem-range forage when compared with unsupplemented steers. Although increasing concentration of supplemental crude protein from 15 to 20% substantially increased ($P < .01$) forage and total dry matter intake, only slight increases in forage and total dry matter intake occurred when the concentration exceeded 20%. Protein supplementation increased ($P < .01$) fiber and dry matter digestibilities. Additionally, fiber digestibility tended ($P = .087$) to increase with increasing crude protein concentration of the supplement. Results suggest that when feeding a wheat middlings-based supplement, the crude protein concentration should be 20% or higher to optimize use of poor-quality forage.

Keywords

Cattlemen's Day, 1990; Kansas Agricultural Experiment Station contribution; no. 90-361-S; Report of progress (Kansas State University, Agricultural Experiment Station and Cooperative Extension Service); 592; Beef; Protein; Supplementation; Wheat middlings; Intake; Digestibility; Winter range

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**EVALUATION OF WHEAT MIDLINGS-BASED
SUPPLEMENTS AT DIFFERENT CRUDE PROTEIN
CONCENTRATIONS FOR CATTLE
CONSUMING WINTER RANGE FORAGE¹**

**G. D. Sunvold, R. C. Cochran,
and E. S. Vanzant**

Summary

Influence of increasing crude protein concentration in a wheat middlings-based supplement was evaluated in an intake/digestion trial. Protein-supplemented steers demonstrated increased ($P < .01$) intake of dormant, bluestem-range forage when compared with unsupplemented steers. Although increasing concentration of supplemental crude protein from 15 to 20% substantially increased ($P < .01$) forage and total dry matter intake, only slight increases in forage and total dry matter intake occurred when the concentration exceeded 20%. Protein supplementation increased ($P < .01$) fiber and dry matter digestibilities. Additionally, fiber digestibility tended ($P = .087$) to increase with increasing crude protein concentration of the supplement. Results suggest that when feeding a wheat middlings-based supplement, the crude protein concentration should be 20% or higher to optimize use of poor-quality forage.

(Key Words: Protein, Supplementation, Wheat Middlings, Intake, Digestibility, Winter Range.)

Introduction

Kansas leads the nation in quantity of wheat produced (17.3% of the U.S. total from 1985 to 1988) and wheat flour milled (13.4% of the U.S. total from 1985 to 1988). Approximately 25% of the wheat milled is left as the by-product, wheat middlings or mill feed. Wheat middlings are often reasonably priced and included in commercial range cattle supplements. Past research has demonstrated that protein supplementation increases forage intake and digestibility and, thus, performance of cattle grazing dormant winter-range. Protein supplementation research using wheat middlings-based supplements has also demonstrated potential for improving the intake and digestibility of dormant range forage over those of unsupplemented cattle. However, it is unclear whether increasing the crude protein concentration of wheat middlings-based supplements would improve their efficacy. Therefore, an experiment was conducted to evaluate the forage intake and digestibility responses to wheat middlings-based supplements containing increasing concentrations of crude protein.

Experimental Procedures

Sixteen ruminally cannulated, Hereford \times Angus steers averaging 928 lb were randomly assigned within weight groups to one of four treatments: 1) control (no supplement); 2) 15.4%

¹The authors express sincere appreciation to Gary Ritter, Wayne Adolph, and the student employees at the Range/Cow-calf unit for their invaluable assistance in conducting this trial.

crude protein supplement; 3) 20.7% crude protein supplement; 4) 25.4% crude protein supplement. All protein supplements consisted of 60% wheat middlings and 40% soybean meal and grain sorghum. Soybean meal to grain sorghum ratios were adjusted to alter the crude protein concentration of the supplements. All supplements were fed at 3.7 lb/head/d and contained similar metabolizable energy levels (3.9 Mcal/head/d). Dormant, winter-harvested, bluestem-range forage (2.0% crude protein) was fed to each steer at 130% of its previous 5-d intake. Steers were housed in individual pens. The trial consisted of a 14-d adaptation period, a 7-d intake measurement period, and a 7-d total fecal collection period. Forage and grain offered, forage refusals, and fecal output were weighed and sampled daily, analyzed for dry matter, and stored for analyses.

Results and Discussion

Supplementation increased ($P < .01$) intake of range forage by 44% (Table 27.1). Supplemented steers displayed an 80% higher ($P < .01$) total intake than unsupplemented steers. Steers fed 20% crude protein consumed 45% more forage and 34% more total dry matter than steers fed 15% crude protein, whereas steers fed 25% crude protein consumed only 5% more forage and total dry matter than steers fed 20% crude protein supplements. Dry matter digestibility of the total diet was 42% greater ($P < .01$) in supplemented steers than unsupplemented steers. Similarly, fiber digestibility was 15% greater ($P < .01$) in supplemented than

Table 27.1. Influence of Supplemental Protein Sources on Intake, Diet Digestibility, and Fiber Digestibility of Dormant, Bluestem-range Forage

Item	None	Supplement			SE ^a
		15% Crude protein	20% Crude protein	25% Crude protein	
Forage DM ^b intake, % BW ^c	1.03	1.12	1.62	1.70	.096
Supplement DM intake, % BW	—	.37	.37	.38	—
Total DM intake, % BW ^c	1.03	1.49	1.99	2.08	.096
Total DM digestibility, % ^d	34.70	49.28	48.84	49.78	1.589
Neutral Detergent fiber digestibility, % ^e	46.18	51.19	53.15	55.49	2.241

^aSE = standard error.

^bDM = dry matter.

^cSupplemented greater than unsupplemented ($P < .01$); quadratic response ($P < .05$) within supplemented groups.

^dSupplemented greater than unsupplemented ($P < .01$).

^eSupplemented greater than unsupplemented ($P < .01$); linear response ($P = .087$) within supplemented groups.

unsupplemented steers. Fiber digestibility tended ($P=.087$) to increase with increasing crude protein concentration of the supplement. Increases in forage intake and digestibility with protein supplementation agree with previous research. The positive impact of protein supplementation on forage use and the observed enhancement of forage intake and digestibility when supplement crude protein concentration was increased also are in agreement with previous research. Therefore, when wheat middlings are used as the major feedstuff in a range supplement, the crude protein concentration frequently will need to be adjusted upward (20% or greater) to optimize range forage use.

