EFFECT OF MEAT MEAL SUPPLEMENTATION ON RUMINAL FERMENTATION OF STEERS GRAZING WHEAT PASTURE

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Story in Brief

The effect of meat meal supplementation on rumen fermentation of steers grazing immature and mature winter wheat pasture was studied. Eight rumen cannulated steers (979 + 110 lb) grazed wheat pasture and were fed 2.42 lb of either a 8% crude protein corn-based supplement or a 16% crude protein supplement that contained 17.7% meat meal (dry matter basis). Supplements were iso-caloric, and contained equal amounts of calcium, phosphorus and magnesium. Meat meal supplementation did not affect rumen pH, ammonia concentration, total volatile fatty acid concentrations or the molar proportions of acetic, propionic, isobutyric, butyric, isovaleric or valeric acids. These data indicated that the increased performance of wheat pasture stocker cattle supplemented with meat meal, as shown by Kansas and Oklahoma research, is not due to an altered ruminal fermentation.

(Key Words: Wheat Pasture, Rumen Fermentation, Protein Supplementation)

Introduction

Wheat forage will commonly contain 25 to 30% crude protein (CP) during the fall, winter and early spring grazing periods. However, a large portion of the crude protein of wheat forage is in the form of soluble nitrogen and non-protein nitrogen and is very rapidly degraded in the rumen to ammonia (Zorrilla-Rios et al., 1985). As a result of the rapid degradation of wheat forage crude protein and loss of ammonia-N that is not incorporated into microbial protein, performance of rapidly growing cattle may be decreased by flow of inadequate amounts of non-ammonia nitrogen (NAN) to the small intestine. This is supported by data of Lee (1984 and 1985) who reported that weight gains of stocker cattle fed 1.5 lb/day of a supplement that contained meat meal were increased .2 lb/day as compared to calves fed control, milo- or hominy feed-based supplements. Data reported here were obtained as a part of a study to determine the mechanism by which meat meal may increase performance of growing cattle on wheat pasture.

Materials and Methods

Eight rumen cannulated Hereford and Hereford x Angus steers (mean body wt 979 + 110 lb) grazed winter wheat pasture (var. TAM-105) from February through May, 1986. Steers were randomly allotted to two treatments and received 2.18 lb DM of a 8% crude protein (CP) corn-based supplement or a 16% CP supplement that contained 17.7% meat meal. Supplements were placed directly in the rumen once daily. Ingredient composition of the supplements is shown in Table 1. Supplements were

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Table 1. Ingredient composition of supplements (DM basis).

Ingredient	Control	Meat meal
Cottonseed hulls	9	9.05
Corn	79	67.05
Meat meal	---	17.7
Limestone	2	---
Dicalcium phosphate	3.5	---
Plain salt	1.2	1.2
Trace mineral salt	.3	.3
Magnesium oxide	.6	.3
Cane molasses	4.4	4.4
Rumensin 60 Premix[a]	+	+

[a]To supply 66 mg monensin/lb (as-fed) of supplement.

iso-caloric and contained equal amounts of calcium, phosphorus and magnesium. Rumen fluid samples were collected on March 14 when steers were grazing immature wheat forage and May 2 when steers were grazing mature wheat forage. Samples were taken through the rumen cannula 4 hr after feeding supplements for measurement of ruminal pH, ammonia (MgO distillation procedure), and volatile fatty acid concentrations by gas liquid chromotography.

Forage samples were taken at each rumen fluid sampling time. Hand plucked forage samples were collected, placed in cloth bags and frozen immediately over liquid nitrogen. Frozen forage was freeze dried, then ground in a Wiley Mill through a 2 mm screen. Nitrogen content of forage was determined by Kjeldahl analysis, NPN content was determined by difference between total nitrogen and protein nitrogen which was precipitated in a 10% H_2SO_4 and Na-tungstate solution. Soluble nitrogen was determined by Kjeldahl analysis of filtrate following a 1 hr incubation in a 2% buffer solution (Ohio Buffer, pH=6.5). In vitro dry matter digestibility (IVDMD) of forage samples was determined following a 48 hr incubation with buffered rumen fluid and subsequent 24 hr digestion in pepsin and HCl.

Results and Discussion

Chemical composition of the immature and mature wheat forage samples is shown in Table 2. Forage dry matter, organic matter, nitrogen, soluble N, NPN and IVDMD contents are similar to values reported for the 1984 and 1985 grazing seasons in early March and early May (Andersen et al., 1986). Forage crude protein concentrations (DM basis) are typically 25-28% in early March, and 11-14% in early May. Soluble N and NPN of wheat forage are generally 35-45% and 10-20% of total nitrogen.

Ruminal pH, ammonia and VFA concentrations are reported in Table 3. The sampling date by treatment interaction was not significant ($P>.30$), therefore data were pooled across sampling dates.

Meat meal supplementation did not affect any of the rumen fermentation parameters measured ($P>.30$). Possibly most important, is that meat meal supplementation did not affect ruminal pH or ammonia concentration. This may indicate that a relatively small portion of the meat meal protein was degraded in the rumen. This is supported by data of

Table 2. Composition of forage.

	March 14	May 2
Dry matter, %	24.76	28.32
	DM basis	
Organic matter, %	90.55	93.38
Crude protein, %	27.18	11.35
Nitrogen, %	4.35	1.82
Soluble nitrogen, %	1.71	.79
Non-protein nitrogen, %	.66	.36
Soluble N/nitrogen, %	39.22	43.72
NPN/nitrogen, %	15.14	19.82
IVDMD, %	76.40	64.43

Table 3. Effect of meat meal supplementation on rumen fermentation of steers grazing wheat pasture.

	Control	Meat meal	SE[a]	OSL
pH	6.27	6.23	.14	.31
Ammonia, mg/100 ml	17.1	19.0	2.5	.34
Total VFA, mMoles/liter	211.9	200.6	16.5	.31
Molar proportions, %				
Acetic	63.6	64.8	1.0	.49
Propionic	21.2	21.2	.8	.80
Isobutyric	1.1	1.1	.1	.90
Butyric	11.4	9.7	.6	.83
Isovaleric	1.6	2.0	2	.56
Valeric	1.1	1.2	.2	.31
Acetic/propionic	3.11	3.11	.17	.69

[a]Standard error of LS mean.

Vogel et al. (1987) who found that rumen degradability of meat meal was about 51%. In addition, Vogel et al. (1987) reported that after a 36-hr in situ incubation 54.2% of meat and bone meal nitrogen remained undegraded, whereas only 12.4% of soybean meal nitrogen remained undegraded, indicating a much lower extent of ruminal nitrogen degradation for meat and bone meal.

Meat meal supplementation did not effect total concentration of volatile fatty acids, or the molar proportions of acetic, propionic, isobutyric, butyric, isovaleric or valeric acids (P>.30). These data indicated that the increased performance of wheat pasture stocker cattle supplemented with meat meal, as shown by Kansas research and reported by Horn et al. (1987), is not due to an altered ruminal fermentation. Effects of meat meal supplementation of steers grazing wheat pasture on forage intake and post-ruminal flow of nutrients is reported in a companion paper of this report by Andersen et al. (1987).

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