EFFECT OF MEAT MEAL SUPPLEMENTATION ON INTAKE, SITE AND EXTENT OF DIGESTION OF WHEAT FORAGE BY STEERS

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Story in Brief

Effects of meat meal supplementation on forage intake and site and extent of digestion of wheat forage by steers was studied during the 1986 wheat forage grazing season. Eight multi-cannulated Hereford and Hereford x Angus steers grazed wheat pasture and were supplemented with 2.42 lb/d of a control, corn-based supplement or a supplement containing 17.7% meat meal (dry matter basis). Supplements were iso-caloric and contained equal amounts of calcium, phosphorus and magnesium. Meat meal supplementation increased forage organic matter intake, expressed as a percent of body weight, by about 10%. Supplementation with meat meal did not affect flow of total non-ammonia nitrogen to the small intestine. Bacterial nitrogen flow to the small intestine was not affected by treatment, however an increase in feed non-ammonia nitrogen reaching the small intestine was observed. Meat meal supplementation did not affect the percentage of organic matter and nitrogen digested in the rumen or the small intestine. These data indicated that the increased performance of wheat pasture stocker cattle supplemented with meat meal, as shown by Kansas and Oklahoma research, may be partially due to increased forage intake.

(Key Words: Wheat Pasture, Meat Meal Supplementation, Stocker Cattle.)

Introduction

Wheat forage commonly contains 25 to 30% crude protein during the fall 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. Ulyatt and MacRae (1974) reported that in sheep grazing ryegrass, only 37-57% of nitrogen intake reached the small intestine as non-ammonia nitrogen. Lee (1984 and 1985) reported that a supplement containing meat meal increased weight gains of stocker cattle grazing wheat pasture 0.2 lb/d as compared with cattle fed control, milo- or hominy feed-based supplements. The objective of this study was to examine site and extent of nutrient digestion of wheat forage by steers grazing wheat pasture and supplemented with meat meal.

Materials and Methods

Eight ruminal, duodenal and ileal cannulated Hereford and Hereford x Angus steers (mean body wt 980 $\pm$ 110 lb) grazed winter wheat

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pasture from February through May of 1986. Steers were randomly allotted to two treatments and fed a corn-based (control) or supplement containing meat meal. Ingredient composition of the supplements and chemical composition of the wheat forage are reported elsewhere in this research report (Andersen et al., 1987; Vogel et al., 1987).

Site and extent of forage digestion were measured during two experimental periods. The first represented immature wheat forage (March 9 to 14), while the second period represented mature wheat forage (April 27 to May 2). Steers were given ruminal doses of chromic oxide, Cobalt-EDTA and Yb-labeled wheat forage twice daily. Forage samples for in vitro dry matter digestibility (IVDMD), organic matter (OM) and nitrogen concentration determinations were obtained by hand picking wheat forage during each experimental period. Forage samples were frozen over liquid nitrogen and freeze dried for later analysis.

Fecal output and nutrient flows to the duodenum and ilium were calculated in reference to chromium. Extent of nutrient digestion in the rumen and small intestine were calculated by difference.

Daily intake of forage dry matter (DM) was calculated as follows:

$$\text{Forage DM Intake, kg} = \frac{\text{fecal Output, kg}}{1 - \text{IVDMD}}$$

Daily intake of OM and nitrogen were calculated from forage composition and forage DM intake.

Rate of passage of particulate and liquid fractions of digesta were determined as the slope of the logarithmic decline in fecal concentrations of ytterbium and cobalt after withdrawal of markers.

Results and Discussion

Effects of meat meal supplementation on rate of passage of particulate and liquid fractions are reported in Table 1. Meat meal supplementation did not affect rate of passage of Yb-labeled wheat forage, but increased liquid rate of passage ($P<.02$).

Effects of meat meal supplementation on forage intake, and site and extent of digestion of wheat forage are reported in Table 2. Intake of forage organic matter (OM), expressed as a percent of body weight, was increased about 10% ($P<.09$) by supplementation with meat meal.

Meat meal supplementation did not affect true ruminal digestion of OM or nitrogen (N). Also, flow of total non-ammonia nitrogen (NAN), or bacterial N to the small intestine was not affected by meat meal supplementation. However, feed NAN passing to the small intestine was greater ($P<.09$) in steers supplemented with meal meal. This increase

Table 1. Effect of meat meal supplementation on particulate and liquid rates of passage[a].

	Control	Meat meal	SE[b]	OSL
Particulate[c]	4.57	4.66	.57	.85
Liquid[d]	4.52	5.77	.53	.02

[a] %/hour.
[b] Standard error of LS mean.
[c] In reference to Yb-labeled wheat forage.
[d] In reference to Co-EDTA.

Table 2. Effect of meat meal supplementation on site and extent of wheat forage digestion by steers.

	Control	Meat meal	SE[a]	OSL
Organic matter intake				
kg	8.34	9.24	.68	.22
% of body weight	1.94	2.13	.14	.09
Nitrogen, kg	.324	.354	.028	.40
True ruminal digestion, %				
OM	75.9	73.9	.98	.27
N	77.2	69.6	4.73	.19
NAN[c] flow to SI[d], g/d				
Total NAN	188.5	220.4	21.0	.47
Bacterial N	134.3	149.9	18.9	.66
Feed N	54.2	70.4	7.0	.09
NAN flow to SI, % of N intake				
Total NAN	81.2	90.8	4.7	.37
Bacterial N	58.4	60.4	2.9	.81
Feed N	22.8	30.4	4.7	.19
Apparent digestion in SI				
OM, % of intake	16.5	20.7	1.6	.23
NAN, % of N intake	52.0	62.6	4.4	.32
NAN, % of flow to SI	63.8	66.4	2.2	.61

[a]Standard error of the LS mean.
[b]Observed significance level.
[c]Non-ammonia nitrogen.
[d]SI = small intestine.

is presumably attributable to meat meal protein that escaped degradation in the rumen. Flow of NAN to the small intestine, expressed as a percent of total N intake, was similar for both treatments. Averaged over both treatments and periods of forage maturity, about 85% of the N intake reached the small intestine as NAN. However, with immature forage only 45% of N intake reached the small intestine as NAN. This value for immature forage is similar to the 37 to 57% NAN flow/N intake reported by Ulyatt and MacRae (1974) for sheep grazing ryegrass. With mature wheat forage, on average 127% of N intake reached the small intestine as NAN. This seems unusually high, and must have been increased by N recycled to the rumen. Supplementation with meat meal did not affect apparent digestion of OM or NAN in the small intestine.

These data indicate that the increased performance of stocker cattle supplemented with meat and bonemeal on wheat pasture, may be partially due to increased forage intake. Meat meal supplementation did not significantly increase flow of total NAN to the small intestine.

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