

alfalfa diet was 7 percent less digestible than expected. Prairie hay, sorghum and corn silages were near expected values (+1 to +5 percent). Forage quality and type is more critical in diets containing high levels of roughage than feedlot finishing type diets. Positive and negative effects may be less when the grain in the ration has been more extensively processed. With steam-rolled barley, associative effects of alfalfa were not detected in a California study, but in Colorado, corn silage has consistently reduced digestibility of cracked corn diets. Selection of a forage should be based on the influence that forage has on digestion of the entire diet as well as forage digestibility, palatability, availability, protein content, physical characteristics and cost.

Literature Cited

Teeter, R. G. and F. N. Owens. 1981. Okla. Agr. Exp. Sta. Res. Rep. MP-107:156.
Rust, S. R. and F. N. Owens. 1982. Okla. Agr. Exp. Sta. Res. Rep. MP-112.

Influence of Infrequent Feeding on Ruminal Digestion

D. C. Weakley and F. N. Owens

Story in Brief

Four ruminally cannulated Hereford heifers were fed once daily either a high concentrate or high roughage diet. Dacron polyester bags containing either soybean meal (SBM) or cottonseed meal (CSM) were placed in the rumen of these animals for six consecutive four-hour exposure periods to study the influence of time after feeding on ruminal digestion. Disappearance of dry matter (DM) from CSM and SBM was greatest in those animals fed the high concentrate diet. Furthermore, disappearance of these materials from bags was not constant over the entire 24-hr period after feeding. Disappearance tended to be highest immediately after and before feeding. This demonstrates that rumen fermentation is not constant. Feeding protein 4 to 12 hr after feeding energy may increase protein bypass.

Introduction

Studies of rumen fermentation usually assume a steady rate of digestion. Constant conditions may not exist when animals are fed only once or twice daily. Infrequent feeding practices are often utilized in laboratory studies and in dairy parlors.

A procedure to study digestion rate in the rumen is to suspend a feed in dacron bags within the rumen and measure feed loss. The objective of this study was to measure the variation in digestion rate in the rumen of cattle fed once daily.

Materials and Methods

Four ruminally cannulated Hereford heifers (950 lb) were fed once daily either a high concentrate or a high roughage diet at a level equal to 1.4 percent of their body weight. The high roughage diet consisted of 81 percent chopped prairie hay and 19 percent soybean meal with a crude protein content of 12.5 percent. The high concentrate diet contained 62 percent corn, 14 percent cottonseed hulls, 10 percent soybean meal, 6 percent ground alfalfa hay, 6 percent molasses and 2 percent minerals and vitamins with a crude protein content of 12.8 percent. Two heifers were placed on each of the two rations in the first period and switched for the second feeding period.

Polyester bags received 2 g of either SBM or CSM. The two protein sources had been sieved to a particle size between .5 and 1.0 mm and extracted with .9 percent saline solution for 6 hr to remove soluble components.

Five days after the ration was first fed, two bags of each protein source were suspended in the rumen of each heifer during six consecutive 4-hr exposure periods after feeding (0 to 4, 4 to 8, 8 to 12, 12 to 16, 16 to 20 and 20 to 24 hr). Upon removal from the rumen, bags were rinsed and contents analyzed for dry matter disappearance, an index of digestion rate.

Rumen samples were collected at 0, 4, 8, 16 and 24 hr after feeding for analysis of rumen ammonia to determine whether ammonia was adequate for microorganisms in the rumen.

Results and Discussion

Rates of disappearance of SBM and CSM dry matter from dacron bags in the rumen of roughage or concentrate-fed heifers are presented in Figure 1. Protein disappearance was more variable. Since protein and DM disappearance from bags are closely related, only DM disappearance is presented.

For all exposure periods studied, disappearance of both SBM and CSM was faster in the concentrate than roughage-fed animals. Exposure periods in the rumen longer than 4 hr have shown faster protein digestion with roughage diets in other studies, but little effect of diet on disappearance from dacron bags was observed at shorter exposure times. Whether differences are due to different ruminal pH, ammonia level or bacterial species is uncertain. Greater disappearance observed at longer exposure periods in animals fed roughage is probably the result of increased degradation of the cellulose, exposing more dry matter to microbial attack and digestion.

Rate of ruminal degradation was greater for SBM than CSM. Protein bypass has been consistently greater for cottonseed meal than soybean meal in steer trials.

Influence of time after feeding on ruminal digestion rate of SBM and CSM in the rumen of high concentrate and roughage-fed animals is presented in Table 1. Rate of digestion was lowest from 4 to 12 hr after feeding. Ruminal ammonia concentrations followed a similar pattern in animals fed the high concentrate ration (Table 1). Results suggest that the once-daily feeding regimen established a pattern of digestion in the rumen that was not constant over the day. Consequently, feeding frequency and diet composition probably alter the utilization

and ruminal bypass of protein. Feeding protein supplements 4 to 12 hr after energy is fed, as might be possible in dairy parlors, may enhance escape of protein from ruminal digestion.

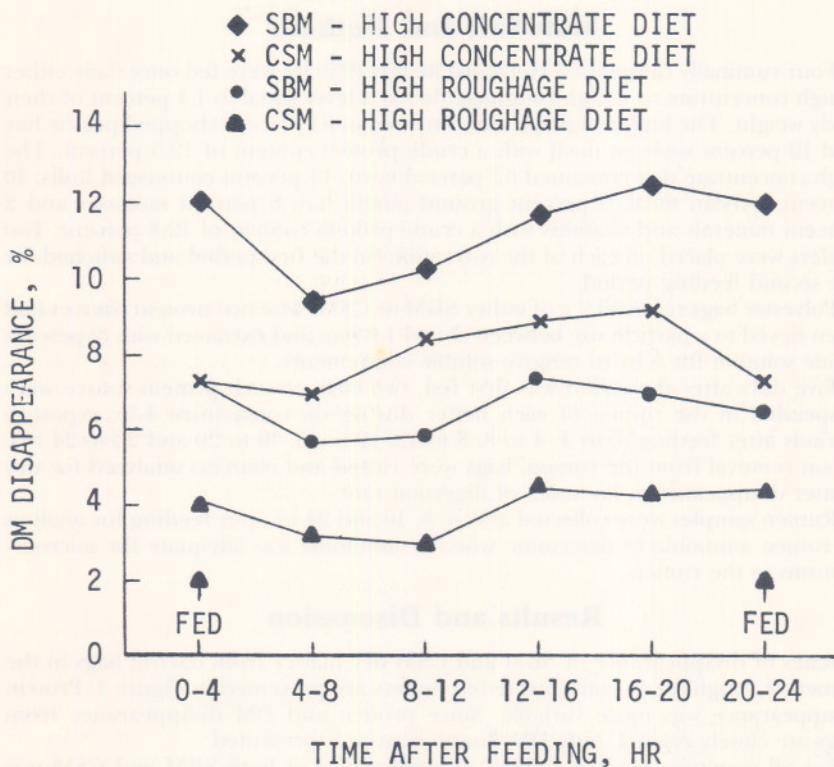


Figure 1. Dietary influence on DM disappearance of SBM and CSM from dacron bags

Table 1. Percent DM disappearance from dacron bags exposed for adjacent time periods in the rumen

Item	Exposure period, hr					
	0-4	4-8	8-12	12-16	16-20	20-24
Average DM disappearance, %	7.68 ^{ab}	6.35 ^c	6.92 ^{bc}	8.13 ^a	8.27 ^a	7.56 ^{ab}
Rumen NH ₃ -N, mg/dl						
High concentrate	13.3	7.9	7.3		14.1	12.4
High roughage	10.2	12.2	5.6		4.5	5.5

^{abc}Means in a row with different superscripts differ statistically ($P < .05$).