

TECHNICAL NOTES

Ruminal Digestion Consistency of Zebu Cattle

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Abstract

Two nylon bag digestion trials were run to estimate the solubility of 4 kinds of forage in the rumens of 3 fistulated Zebu cattle which were grazing natural rangelands at the National Range Research Station - Kiboko, Kenya. Animal to animal differences (1.1%) in rumen digestion during a test period were small in comparison to differences between the same animal on different dates (5.3%), and were smaller than differences associated with different nylon bag fabrics (3.4%).

Factors influencing estimates of forage digestion in the rumen by the cloth bag technique have been extensively studied. Types of cloth, porosity, mesh density, sizes of bags, amounts of substrate, fineness of grind of substrate, chemical treatment of substrate, diet of digester, and variability due to animal, breed, dates of trials, contamination, washing technique and other factors have been examined (Van Dyne 1962, 1968; Quinton 1972; Figroid et al. 1972; Uden et al. 1974; Schneider and Flatt 1975; Crawford et al. 1978; Martin 1981; Van Soest 1982; Johnson et al. 1982; Weakley et al. 1983).

Perusal of the literature suggests that the cloth bag technique has been plagued with high variation within duplicates and between replicates which vary from about 4 to 20%. Our objective was to learn where the greatest source of variation occurs for the procedure used at the National Range Research Station using Zebu cattle. We chose to test whether or not mean differences in rumen digestive power between individual cattle on one date were similar on a subsequent date.

Methods

Two steers and 1 heifer weighing about 300 kg were fitted with rumen fistulas. The breed of one steer and the heifer was East African Sahiwal and the other steer was a Kenya Boran. Throughout their life and during the 2 tests the cattle grazed on bushed grassland at the National Range Research Station near Kiboko, Kenya. Two tests were conducted 1 week apart in mid-March 1983 toward the end of the short dry season.

Two kinds of nylon cloth were used. Openings between the threads could not be seen using 400X magnification. We chose cloth without discernible pores because our goal was to prevent

solid particles from entering or leaving the nylon bags. The mesh of the nylon was 48/cm for one kind of material and was 50/cm for the other.

The aboveground parts of 4 kinds of forage were used. The plants were *Pennisetum clandestinum*, *Cynodon dactylon*, *Panicum maximum* and *Chrysanthemum cinerariaefolium*. The plant materials were dried in a forced air oven at 65°C for 3 days and then ground in a Wiley mill using a 1.0-mm screen.

Forty bags, 10 of each forage, were placed in each animal's rumen for 48 hr following the procedures of Van Dyne (1962) and Quinton (1972). There were 5 bags of the 48-mesh cloth and 5 of the 50-mesh cloth among the 10 subsamples of each forage type per rumen test.

Prior to placement in the rumen each bag plus its contents was oven dried at 65°C until no further weight loss before weighing to the nearest 0.01 g. After removal from the rumens, the samples were washed and rinsed with tap water in a bucket until no color in the wash water was seen. The bags plus their residues after rumen digestion were oven dried at 65°C until no further weight loss before weighing to the nearest 0.01 g.

Results

The 50-mesh nylon bags lost significantly ($p < 0.05$) higher percentage of dry weight during rumen digestion than did the 48 mesh bags for 17 of the 24 comparisons (Table 1). There was no significant difference between the means of the 50- and 48-mesh bag types during the 1st test in the rumens of the Sahiwal steer and heifer for *P. clandestinum* and *C. dactylon*, and no significant difference for mean percentage dry weight lost between 50 and 48 mesh bags during the 2nd test. Difference in all the other comparable means showed 50-mesh bags lost significantly ($p < 0.05$) more dry weight than 48-mesh bags when placed for digestion in the same rumen.

There was no significant difference between the rumen-digestion indexes of the 3 fistulated cattle within the 1st and within the 2nd test. However, the comparable types of nylon bags lost significantly ($p < 0.05$) more dry weight during the 2nd 48-hr, rumen-digestion test than during the 1st with one exception. There was no significant difference in percent dry weight lost of *C. cinerariaefolium* in the Boran steer's rumen between the 1st and 2nd tests.

Discussion

The average difference ($\bar{x} \pm SE$) between the test periods for 50-mesh and 48-mesh bags was $5.6\% \pm 0.7\%$ and within tests was

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Table 1. The percentage ($\bar{x} \pm SE$) dry weight dissolved in the rumens of 3 Zebu cattle during two 48-hr trials using 5 nylon bags with 48 and 50 threads per cm.

Forage and bag type	Sahiwal				Boran	
	Steer		Heifer		Steer	
	1st	2nd	1st	2nd	1st	2nd
<i>Pennisetum clandestinum</i>						
48 mesh	50 ± 0.8	55 ± 0.3	47 ± 1.3	54 ± 0.6	49 ± 0.7	55 ± 0.7
50 mesh	51 ± 0.8	61 ± 0.6	51 ± 0.7	59 ± 0.7	52 ± 0.4	
<i>Cynodon dactylon</i>						
48 mesh	55 ± 1.0	59 ± 0.3	52 ± 0.9	58 ± 0.7	52 ± 0.5	58 ± 0.5
50 mesh	53 ± 0.7	62 ± 0.3	52 ± 0.8	62 ± 0.4	54 ± 0.5	61 ± 0.6
<i>Panicum maximum</i>						
48 mesh	52 ± 0.7	57 ± 0.6	53 ± 1.0	57 ± 0.4	53 ± 0.6	58 ± 0.4
50 mesh	59 ± 0.8	66 ± 0.4	58 ± 0.2	65 ± 0.4	58 ± 0.5	64 ± 0.2
<i>Chrysanthemum sp.</i>						
48 mesh	71 ± 1.1	74 ± 0.4	70 ± 0.9	73 ± 0.4	73 ± 1.4	74 ± 0.6
50 mesh	72 ± 0.5	77 ± 0.5	72 ± 0.4	77 ± 0.4	73 ± 0.3	77 ± 0.5

3.3 ± 0.8%. These means were not significantly different. Presumably, different cloths used in nylon bags may result in different rumen digestion indexes. We believe the 48-mesh nylon material had a tighter weave than the 50-mesh nylon.

Mean paired differences ($\bar{x} \pm SE$) in digestion coefficients between the 1st and 2nd tests for the individual animals was -5.3 ± 0.6% ($p < 0.05$) and the mean paired differences between the 3 animals for the same forage during the same tests was 1.1 ± 0.8% (NS). Therefore, we must conclude that even though there may be statistically significant differences ($p < 0.05$) in the rumen digestive indexes of cattle during the same test period, these differences are very small in relation to those observed between tests only a week apart and, furthermore, the average difference caused from different nylon fabrics is greater than comparable animal to animal differences. Also, the number of threads per centimeter (mesh) may be of minor importance.

The difference observed between tests 1 week apart suggests that paired samples be run together. However, this study also indicated that the paired samples may not have to be in the same rumen to distinguish significant differences of 3% or more. Due to the greater variation between dates of tests than between animals we assume that the nylon bag technique should be used to compare relative rumen digestion and not to estimate true digestion of a particular feedstuff.

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