A COMPARISON OF THE RUMEN DEGRADABILITY OF SOME FEEDS BY THE ARTIFICIAL-FIBRE BAG TECHNIQUE

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The extent to which the DM, nitrogen and starch contents of various concentrate by-products, forages and cassava root are degraded in the rumen was studied using artificial fibre bags. The rate of H degradation of fish meal was along, confirming its high value as a protein supplement. Copra cake and leucaena forage were next best in providing by-pass protein, while rice bran and cassava tuber were of similar quality in providing by-pass starch. The problems encountered with pea mash and rice bran are also discussed.

Key words: Nylon bags, protein, starch disappearance, by-products, forages

The use of substantial levels of sugar cane by-products in ruminant diets is of significant importance in the economics of meat and milk production in Mauritius and other sugar producing countries. Such feeds must, however, be supplemented with materials providing a certain amount of starch and pre-formed protein for performance-to be profitable (Leng & Preston 1976). It is also important that these supplements be degraded preferentially post-ruminally so that they can contribute directly to the amino acid and glucose pools.

The extent to which various protein and starch feeds are degraded within the rumen was therefore studied, using the procedure described by Mehrez and 0rskov (1977).

Materials and Methods

Animals and feeding: Two mature castrated sheep fitted with permanent rumen cannulae were used; they were fed a daily ration consisting of bagasse 400 g, molasses 500 g and urea 20 g, together with mineral supplements.

Treatments: The treatments were four concentrate byproducts (Rice bran, Copra cake meal, Fish meal and Pea mash), two forages (Cassava leaves and Leucaena foliage) and dried cassava root.

Procedure: Artificial fibre bags measuring 9 x 27 cm and having about 1600 holes/cm^2 were used. The four by-product meals were sieved (0.5 mm holes) and only the particles not passing through the sieve were used (>0.5 mm). The two forages and the cassava root, after drying, were milled through a 1 mm screen and then sieved. Only the material not passing through the sieve was used (< 1 mm >0.5 mm). Four bags containing the sample (5 g) were moistened for about one minute and then introduced into the rumen of each sheep. The bags were removed at intervals of 3, 6, 12 and 24 hr and washed in running water until the washing was clear. About two minutes washing were usually required after which the bags were dried at 70°C. The zero hr bags were moistened for one minute and left for five minutes in water at 39°C.

They were then washed for about two minutes in running water and dried at 70°C All bags were weighed after drying in a ventilated oven at 70°C for 48 hr and cooling over silica gel in a desiccator. For each feed,incubation was carried out on two consecutive days and in each of two sheep.

Analyses: N was determined by the conventional kjeldahl method (semimicro). Starch was hydrolysed to glucose by the amylo-glucosidase method described by Haslemore and Roughan (1976), using unpurified Agidex (Glaxo Laboratories Ltd, Greenford, Middlesex, England). Glucose was then determined by the arseno-molybdate method (Snell and Snell 1953).

Calculations: : DM, N and starch disappearance rates in the rumen were calculated using the regression of the semi-log plot of undegraded substrate against time. The half-life (t1/2) value (the time taken to reduce the amount of undegraded material by one half) was found from the slope of the regression. Loss at zero time was estimated from the intercept of the plot at time zero! This largely represents material easily washed out of the bag either because of very fine particle size or high solubility.

Results and Discussion

The levels of N and starch in the feeds are given in Table 1. Copra cake, fish meal, cassava leaves and leucaena forage contained negligible amounts of starch. Cassava tubers contained negligible N.

Table I:
N and starch contents of feeds (% in DM)

	Rice bran	Copra cake	Fish meal	Pea mash	Cassava leaves	Leucaena foliage	Cassava tubers
N	1.3	4.8	7.0	3.0	3.0	4.3	-
Starch	9.5	-	-	15.6	1.0	-	96.9

Degradation rates of DM, N and starch in the rumen ($t_{1/2}$) and the loss at zero time for the seven feeds are presented in Table

Table 2:
Mean values for $t_{1/2}$ (hr) and zero time loss for DM, N and starch (X±SEx)

	DM		N		Starch	
	$t_{1/2}$	% loss at zero time	$t_{1/2}$	% loss at zero time	$t_{1/2}$	% loss at zero time
Rice bran	30±4	13.6	67±16	54.5	19±4.6	30.0
Copra cake	17±2	26.7	19.5±0.1	28.2	-	-
Fish meal	55±g	24.6	51±11	36.9	-	-
Pea mash[1]	36±2	43.0	69±11	71.8	72±12	80.0
Cassava leaves	14±1	21.0	8±0.8	9.2	-	-
Leucaena foliage[2]	21.4±1.5	25.0	14.7±1.2	19.5	-	-
Cassava tubers	17.1±2.6	39.0	-	-	18±7	43.0

[1] Debris, husks, pea. from split pea production
[2] Leaves and twigs

Nitrogen: Although rice bran and pea mash had the longest half lives indicating a slow rate of degradation, the results for zero time loss indicated high solubility or a high percentage of fine particles. Thus, overall rate of disappearance from the rumen may be quite high.

Fishmeal had a relatively high $t_{1/2}$ value in comparison with copra cake. This supports observations as to the better performance obtained from fishmeal in Mauritius. However, the relatively low $t_{1/2}$ values for leucaena and cassava forage are surprising in view of the good animal performance data obtained from these supplements in molasses based diets (Hulman et al 1978; Fernandez & Preston 1978; Ffoulkes & Preston 1978).

Starch: Starch in rice bran and cassava tubers appears to have the same degradation rate, although it should be noted that the former contained only 9% starch cassava tubers would therefore be better. It has been reported by Silvestre et al (1977), that dried cassava root significantly improved the performance of animals on a sugarcane diet. While the excellent value of rice polishings (13% crude protein and 30% starch) as a supplement has been recognised (Preston 1977), that of the locally available rice bran has not been studied.

The results for pea mash indicate a high initial loss followed by a slow rate of degradation and the overall effect is therefore difficult to define.

Conclusions

Data obtained in this study confirm the very high value of fish meal as a protein supplement, and indicate copra cake and leucaena as next best. Starch in rice bran and cassava tubers appears to be of similar "bypass' quality. The nature of certain feeds, eg pea mash and rice bran, seems to impose certain limitations to the technique used.

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