

DEGRADABILITY OF SOME HIGH PROTEIN FORAGES IN THE RUMEN

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The following high protein forages were analysed for their suitability for feeding as supplements with sugar cane and molasses based diets: cassava, *Leucaena*, sweet potato, velvet bean and sword bean. Proximate analysis of crude protein and fibre and of DM content was carried out and the actual rate of degradation of the different forages and plant parts in the rumen was estimated by suspending nylon bags in the rumens of four bulls for varying periods of time. A comparison of the estimated crude fibre content of the forages with the measured rate of DM disappearances in the rumen, indicated that the greatest variation in the relationship between these parameters occurred when crude fibre levels were highest. It appears that the rate of DM disappearance was slower for the more stringy fibres (eg sword bean stem) than would be expected from the crude fibre content. It was suggested that the *in vivo* estimation may therefore have certain advantages in assessing forage characteristics.

Key Words: Cattle, nylon bags, protein forage, dry matter disappearance

Cattle production in Mauritius is based mainly on the feeding of molasses/urea with either whole sugar cane or sugar cane tops. Animal performance on these diets without supplementation with concentrate, has generally been low and also quite variable.

It appears that the the first two limiting factors when this diet is given are firstly: the low level of true protein in the diet. This has been demonstrated recently (Fernandez et al 1979) with an increase in growth rate of about 500 g/d when cattle given a basal diet of sugar cane and urea, received a supplement of 750 g of cottonseed meal (45% crude protein) per day. The second limiting factor appears to be the very slow rate at which sugar cane fibre is degraded in the rumen. Orskov and Hovell (1978) compared the rate of degradation of a Scottish hay with that of sugar cane fibre and observed a markedly slower degradation of the sugar cane,

As a first step to selecting forages suitable for feeding with molasses or sugar cane it appears that the properties of protein content, and degradability in the rumen should be considered. In the studies reported here a number of common local crops and forages have been analysed for N content and for their degradability measured *in vivo* using nylon bags suspended in the rumen of cattle.

Materials and Methods

Animals and Diets: Four bulls (Friesian x Creole) of approximately 170 kg and two years of age were housed under cover in single stalls. All animals had been prepared with permanent cannulae in the rumen at least six months prior to the commencement of the experiment. This animals received the same diet for the duration of the experiment, This consisted of 3kg of freshly harvested and chopped sugar cane tops, given with 0.5 kg cottonseed cake each morning. Both water and molasses (+ 2.5X urea) were freely available at all times.

. Forages and their preparation: Leucaena forage (*Leucaena leucocephala*), sweet potato (*Ipomeas batata*) and cassava forage (*Manihot esculenta*) were all harvested about six months after planting. The cassava forage was approximately 0.75 m high and only the top third of the stem had leaves attached. The sword bean (*Canavalia gladiata*) and the velvet bean forage (*Mucuna utilis*) were taken from old stands although only runners with flowers were harvested. The sword bean was manually separated into leaf and stalk.

All forages were put through a forage chopper, oven dried, and then ground through a 1.96 mm screen.

Procedure: Each bag contained about 5g forage, The four bags to be introduced into each animal were tied along a single nylon string at intervals of about 15 cm, before being soaked in water for 1 minute and then placed in the rumen. The bags were removed after 3, 6, 12 and 24 hours in the rumen and on each occasion one bag was removed from the line by cutting the nylon. The half-life of DM within the rumen was calculated from the slope of the regression of the semi-log of undegraded substrate against time. The percentage of DM rapidly degraded was estimated from the zero time intercept of this relationship. The SE of $T_{1/2}$ was calculated directly from the SE of the regression coefficient in the relationship described below .

Analytical: Total N of the forages was determined by standard Kjeldahl procedure. The crude fibre content was estimated by the method described by the Association of official Analytical chemists (AOAC 1965).

Results

The dry matter content of the forages and the levels of crude protein and crude fibre are given in Table 1. There was a tendency for the crude protein to be lower in forages with relatively higher levels of DM and crude fibre.

Table 1:
Proximate analysis of the forages

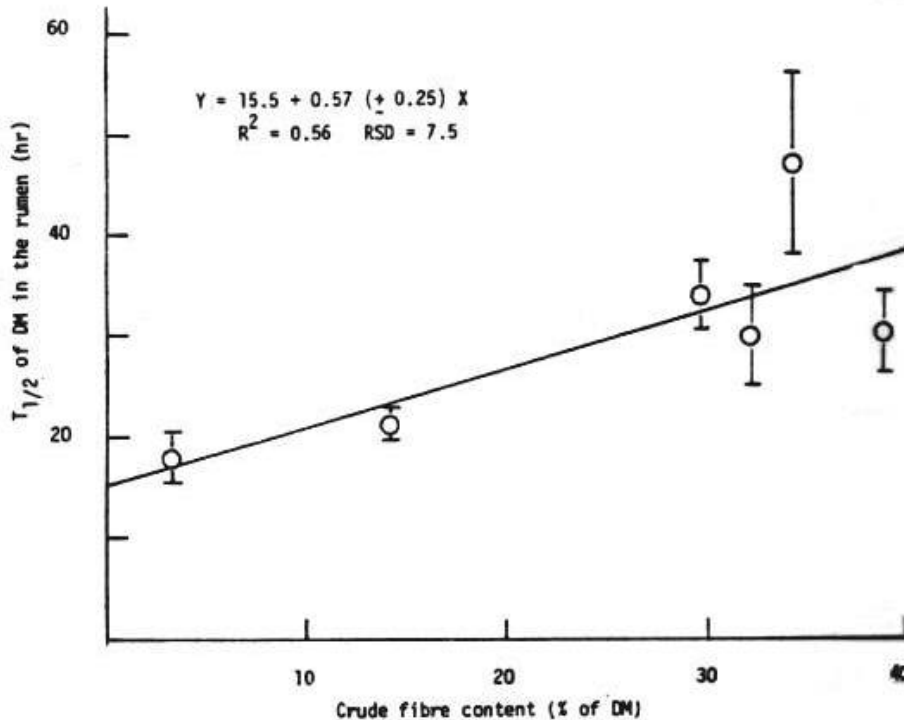
Forage	DM%	Concentration in DM%.	
		Crude protein	Crude fibre
Cassava	24.1	7.3	38.7
Leucaena	29.1	17.6	32.0
Sweet Potato	10.6	13.4	14.2
Velvet bean	26.6	16.7	29.7
Sword bean leaf	20.9	24.1	3.2
Sword bean stem	22.1	10.5	34.1

The rates of degradation of the forages in the rumen and the percentage of DM which was rapidly degraded are shown in Table 2 as $T_{1/2}$. The relationship between the rate of DM degradation measured in the rumen and the crude fibre content of the forages, estimated analytically, is shown in Figure 1. There appeared to be an increase in the $T_{1/2}$ for degradation in the rumen when the crude fibre content of the forage increased.

Table 2:
The amount of forage rapidly degraded in the rumen and the rate of degradation ($T_{1/2}$) of the more slowly fermented fraction.

Forage	% DM rapidly degraded	$T_{1/2}$ (hr)	SE $T_{1/2}$
Cassava	28	30	4
Leucaena	28	30	5
Sweet Potato	30	21	1.5
Velvet bean	37	34	3.5
Sword bean leaf	44	18	2.5
Sword bean stem	31	47	9.0

Figure 1:
Relationship between the crude fibre content of forages and the rate of degradation in the rumen.



Discussion

It is clear from a consideration of the rumen bag technique that the absolute value of the results depends on the way in which the forage is prepared, the fineness of the material from which the bag is made, the number of bags used and the time at which these are withdrawn from the rumen. In this experiment all of the forages were prepared in an identical way thus bringing the physical characteristics of the fibre in each forage to a similar form. The possible reason for approximately equal amounts of DM being "rapidly fermented" in this experiment was that the drying and grinding process resulted in approximately the same amount of fine dusty particles in each forage. These fine particles would be rapidly fermented or else washed out of the nylon bag unfermented.

However the relationship between the crude fibre content and the $T_{1/2}$ of DM in the rumen does indicate the sort of advantages that would be expected using this in vivo technique. The greatest deviation from this relationship occurs at high crude fibre content where the rate of DM degradation is far slower for the stringy fibres of the sword bean stem ($T_{1/2} = 47\text{h}$) than for the more pulpy cassava forage ($T_{1/2} = 30\text{h}$). This emphasises the importance of defining physical as well as chemical characteristics of a forage.

References

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