

Development of an intra-ruminal nylon bag technique for feed evaluation which does not require the use of fistulated animals

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Introduction For many years the nylon bag method for measuring ruminal degradation of forages and concentrates (Ørskov *et al.*, 1980) has been a widely used and reliable tool for evaluating ruminant feeds. In its current form the technique necessitates the use of surgically-prepared animals, but in many countries there is mounting pressure to discontinue their use. The purpose of this work was to develop a nylon bag method using intact sheep, by oral dosing at differing times, bags containing test feeds. The bags would be removed from the rumen following slaughter of the animals.

Materials and methods Three sequential experiments were carried out using individually-housed intact cast ewes fed dried grass pellets and grass hay, to evaluate orally-dosed nylon bags containing about 1g dried forage (ground to pass through a 2mm sieve). The bags were smaller than those of the conventional method, but the ratio of bag area to forage sample weight was maintained. They were constructed from the conventional fabric (Dacron, 40µm mesh size) with heat-welded seams. Two designs were tested, either flat or tetrahedral shapes. The tops of the bags were closed by machine stitching and were wrapped in tissue paper to facilitate oral dosing. Sheep received two flat and two tetrahedral bags on each of seven occasions (96h, 72h, 48h, 24h, 16h, 8h and 4h) prior to slaughter by sodium pentobarbitone injection; the forestomachs were opened to allow removal of the bags. Recovered bags were washed in cold water and dried at 60°C before removing the stitching and weighing. In Trial 1, bags containing grass hay and two stainless steel 5g weights, were dosed to two sheep. In Trial 2, three pairs of sheep each received bags containing grass hay and having different designs of anti-regurgitation device, which were constructed from nylon cable ties and stitched to the tops of the bags. They were folded for dosing, being retained by the tissue paper wrapping, and designed to open out in the rumen. The designs of anti-regurgitation devices tested were: (i) 'z'-shaped; (ii) double 'z'-shaped; (iii) umbrella-shaped. In Trial 3, the degradation of three different forages (freeze-dried red clover, freeze-dried perennial ryegrass and barley straw) were examined using six sheep, with each sheep receiving two of the forages in separate pairs of bags, which were all fitted with 'z'-shaped devices.

Results In Trial 1, few intact bags were recovered from the rumen, with most of the bags having been regurgitated. In Trial 2, the recovery of intact bags from the rumen was high for all anti-regurgitation designs, being 100%, 96% and 100%, respectively, for types (i), (ii) and (iii). Missing bags were apparently lost at the time of dosing and not due to regurgitation. Reproducible dry matter losses (% units) at each time point were obtained from all sheep and no differences were found between bag shapes (mean within-sheep differences between replicates ± SE - flat bags: 2.04±0.718; tetrahedral bags: 1.77±0.460; between-sheep SEM over all time points - flat bags: 1.000; tetrahedral bags: 0.743. In Trial 3, only one bag was not recovered from five of the sheep, but six bags were lost from the sixth animal. Using the procedure of Ørskov and McDonald (1979) and assuming the different shaped bags to be replicates, degradation curves were obtained for the three forages tested in Trial 3 (five sheep), and for the grass hay used in Trial 2. The observed and fitted degradation characteristics (Figure 1 and Table 1, respectively) were in accordance with those to be expected from the conventional nylon bag method.

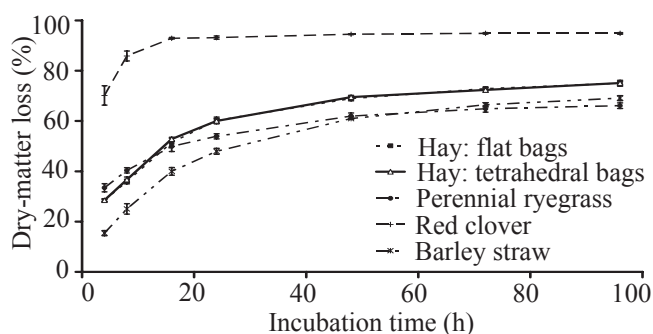


Figure 1 Observed ruminal degradation of four dried forages in nylon bags orally dosed to intact sheep (mean ± SE).

Conclusions These studies show that ruminal degradation of dried forages can be characterised using a modified nylon bag method with intact sheep. Further work is required to increase the reliability of the dosing method and to test its use with additional feeds.

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References

- Ørskov, E.R., Hovell, F.D. DeB. and Mould, F. 1980. *Tropical Animal Production* 5, 195-213.
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Table 1 Ruminal degradation constants for four dried forages using nylon bags orally dosed to intact sheep

Forage	Degradation constants (means ± S.E.) ¹				
	n ²	WL ³	a (%)	b (%)	c (/h)
Grass hay	12	27.4	15.1±0.65	58.4±0.88	0.057±0.0016
Perennial ryegrass	4	29.4	26.3±2.52	39.5±0.88	0.054±0.0042
Red clover	3	51.0	19.1±9.42	76.1±9.18	0.309±0.0323
Barley straw	3	12.6	4.7±1.27	64.2±1.77	0.048±0.0032

¹Obtained from the fitted equation: $p = a + b(1 - e^{-ct})$, where p is the percent degradation at time, t (h)

²Number of sheep observations (seven time points each).

³Washing loss (%): bags in water at 39°C; washed in cold water