

INFLUENCE OF SAMPLE PREPARATION ON THE RUMINAL NYLON BAG DEGRADATION VALUES OF GRASS SILAGE

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Introduction

Recommended nylon bag procedures to estimate the ruminal degradation of feeds are mainly planned for concentrates. Forages, also wet samples, are usually proposed to oven-dried or freeze-dried and ground before the nylon bag incubation (Nocek, 1988). Forage sample preparation prior to rumen incubation is, however, likely to affect to the rumen degradation values obtained by the nylon bag method (Vik-Mo, 1989). In addition, attaching microbes may cause large errors in the fibrous feed N degradation values (Varvikko and Lindberg, 1985).

It was of our interest to estimate the effect of sample preparation prior to and washing technique of the bags after the rumen incubation on the degradability of dry matter (DM) and nitrogen of grass silage.

Materials and Methods

One ruminally cannulated non-lactating cow (live weight 520 kg) of Finnish Ayrshire breed was fed at maintenance level with formic acid preserved grass silage (crude protein 162 g/kg DM, acid detergent fibre 346 g/kg DM) as a sole feed, in two equal meals at 8:00 and 16:00 hours.

Experimental feed used in the nylon bag incubations was the grass silage used in feeding the animal. Prior to rumen incubation, the silage was chopped fresh (FC; < 10 mm length), oven dried (60 °C) and milled (ODM; 2 mm mesh), or freeze-dried (-50 °C) and milled (FDM; 2 mm mesh). The grass silage was weighed (2.5 g DM) into polyamide bags (6 x 12 cm, pore/free surface 41/33 µm/%).

The bags were introduced, in four consecutive replications, into the rumen before morning feeding and the subsequent rumen incubation times were 4, 8, 24 and 48 hours. The incubated bags were washed either under running cold tap water (1.5 hours) or in a rotating cylinder with

running cold tap water (20 minutes). Before weighing and emptying the bags were dried in a forced air oven (60 °C) for 24 hours. The feeds and their residues were analyzed for DM and N.

DM and N disappearance values of the silages were fitted into the equation $p=a+b(1-e^{-ct})$ to obtain constants a , b and c and $p=a+bc/c+k$ to estimate effective protein degradability (EPD) (Ørskov and McDonald, 1979). As the long term degradation values for DM and N were missing, an assumption was made, based on previous findings that respective degradation values were 85 and 90 for all the silage samples. The treatment effects (preparation, washing) and their interactions were statistically analysed according to the analysis of variance.

Results and discussion

Disappearance from the bags of feed DM and N, with respective statistical significance, as well as calculated estimates of a , b , c and effective protein degradation in the rumen (EPD) are given in table. The N content (g/kg DM) prior to rumen incubation of FC, ODM and FDM were 26.4, 26.5 and 29.3 respectively, the last value showing of more volatile N retained in freeze-dried than fresh or oven-dried silages.

Except for the 48 h value for DM and 24 h and 48 h values for N, the disappearance from the bags of DM and N, being significant ($P < 0.01$) between pretreatments but not washing methods, were clearly highest for FDM and lowest for FC. The averaged (mean of the two washing methods) DM disappearance after 4 h incubation was 25.2 % and 41.8 % (8.4 and 12.3 %-units) higher for FDM compared with ODM or FC. The differences (%) between pretreatments, however, gradually decreased with increasing incubation time, the respective averaged values after 48 h incubation being not more than 2.1 % or 4.2 %.

The order of N disappearance of the silages followed that of DM, but the disappearance of N

TABLE 1. EFFECT OF SAMPLE PREPARATION (PRETREATMENT, WASHING TECHNIQUE) ON THE DRY MATTER AND NITROGEN DISAPPEARANCE OF GRASS SILAGE FROM NYLON-BAGS INCUBATED IN THE RUMEN OF COW FOR 4, 8, 24 AND 48 HOURS AND ON ESTIMATES OF a, b, c AND EFFECTIVE PROTEIN DEGRADATION (EPD).

Pre-treatment Washing...	Fresh/ chopped		Oven dried/ milled		Freeze-dried/ milled		SEM	Statistical significance Pretreatment
	H	M	H	M	H	M		
Incubation hours	Dry matter							
4	29.0	29.8	31.5	35.1	39.2	44.1	1.93	***
8	39.0	41.4	48.8	52.0	53.1	56.2	3.39	***
24	65.8	69.4	71.4	73.1	74.7	74.8	1.43	***
48	75.7	75.3	77.3	76.8	78.1	79.3	1.26	NS
a	16.8	15.2	14.5	16.8	22.5	31.2		
b	67.4	67.7	67.5	64.5	59.7	51.8		
c	0.05	0.06	0.08	0.09	0.09	0.08		
a+b	84.2	82.8	82.0	81.3	82.3	83.0		
	Nitrogen							
4	42.3	49.2	47.4	51.6	59.5	67.2	4.17	**
8	57.0	58.4	67.9	69.1	72.9	77.5	3.59	***
24	76.7	80.6	80.3	78.6	82.3	82.0	3.22	NS
48	85.8	82.8	81.7	78.8	84.7	84.3	3.27	NS
a	29.1	35.7	8.5	18.2	40.3	51.9		
b	59.8	52.1	76.0	64.8	46.2	34.1		
c	0.07	0.07	0.18	0.18	0.14	0.16		
a+b	88.9	87.8	84.5	83.0	86.5	86.0		
EPD	73.2	74.1	75.2	75.1	79.5	81.4		

Chopped, 10 mm; milled, 2 mm; H, hand wash; M, machine wash;

NS, $P > 0.05$; **, $P < 0.01$; ***, $P < 0.001$; Effect of Washing or

Pretreatment x Washing interactions were not statistically significant; EPD, calculated with $k = 0.025$.

was much higher with short incubation times (4, 8 h) than loss of DM, indicating a rapid release of grass silage N in the rumen. Generally, machine washing resulted in a slightly greater ($P < 0.05$) loss of DM and N. The N disappearances from FC and FDM were quite close after 48 h incubation, and they were about 4.2 %-units higher than the N disappearance from ODM.

The pretreatment of grass silage clearly affected the calculated constants a, b and c, especially with for N degradation, soluble fraction (a) being markedly higher with FDM compared to ODM and FC. Maillard reaction during the oven-drying may have reduced the soluble N in ODM.

EPD varied according to preliminary treatment of the silage. Generally, the present EPD values were about 10 %-units lower than the respective values given by Vik Mo (1989) for freeze-dried or

oven-dried grass silages, but about at the same level with the respective values for oven-dried timothy grass given by Lindberg (1988). In accordance with results by Vik-Mo (1989), freeze-drying of the grass silage obviously resulted in a higher EPD than oven-drying. EPD was found to be lowest with chopped fresh samples. The present EPD values were, no doubt, lowered due to microbial N in the residues. Lindberg (1988) found the microbially corrected EPD values for timothy grass to be close to 90 %.

(Key Words: Sample Preparation, Grass Silage, Degradation)

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