

The effect of cow-diet on the fermentation of forages

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Introduction *In vitro* fermentation of fresh forages minced to resemble chewed material have enabled net proteolysis and volatile fatty acid (VFA) production to be measured using rumen inocula from a cow fed lucerne hay (Burke *et al.*, 2000). However both cow and diet affect the rumen cellulolytic bacterial populations (Weimer *et al.*, 1999) and are able to influence *in vitro* digestion kinetics (Mertens *et al.*, 1998). The objective of this study was to measure cow-diet effects on *in vitro* digestion and fermentation of perennial ryegrass (P; *Lolium perenne*), sulla (S; *Hedysarum coronarium*), maize (M; *Zea mays*) silage and mixtures.

Materials and methods Four rumen fistulated cows were held in metabolism stalls and fed either ryegrass pasture (P), P:S (66:34 on a DM basis), P:M (66:34) or P:M:S (66:17:17) to provide inocula for fermentation of freshly minced P, S, M and P:M, P:S and P:M:S mixtures. About 2.5 g of freshly minced wet material (0.5 g DM) was incubated in 50 mL vented bottles with buffer, reducing agent and strained rumen liquor (Burke *et al.*, 2000) from each of the four cows. Duplicate samples of forages (and mixtures) were removed for sampling after 0, 2, 4, 6, 8, 12 and 24 h. *In vitro* pH was measured as well as net ammonia (NH₃) and VFA production (following correction for contribution from rumen contents) according to Burke *et al.* (2000). Effects of cow-diet were determined by analysis of variance.

Table 1 *In vitro* pH, net NH₃ (% forage N recovered as NH₃) and total VFA concentration (mmol/gDM) and the acetate:propionate (A:P) ratio of forages and mixtures incubated in inocula from cows fed four pasture-based diets

Cow-diet	pH	Net NH ₃		VFA	
		2	12	Total	A:P
Hours	12			12	12
P	6.40 ^a	8.6 ^b	-0.5 ^b	2.8 ^a	2.2
P:M	6.09 ^b	6.1 ^a	-1.3 ^b	3.3 ^b	2.2
P:S	6.29 ^c	8.4 ^b	0.3 ^a	2.7 ^a	2.1
P:M:S	6.14 ^b	9.0 ^b	0.2 ^a	2.8 ^a	2.2
SEM	0.03	0.5	0.5	0.2	0.2
Pr <	0.01	0.01	0.01	0.01	NS

^{a,b} LS means within columns with common superscripts do not differ significantly (Pr < 0.05)

Results and discussion Fermentation of forages and mixtures was faster when incubated *in vitro* with rumen inoculum from the cow fed P:M (Table 1) indicated by pH, net NH₃ concentrations and net VFA production. This rapid fermentation contrasts with a slow *in sacco* digestion in the same cow (Burke *et al.*, 2005), but *in vitro* incubations include soluble and rapidly fermented components which are washed out of *in sacco* bags. These results indicate that the rumen inoculum is influenced by the diet fed to cows and, together with results of Burke *et al.* (2005), suggest that the P:M cow-diet had higher amyolytic and proteolytic, but lower fibrolytic activity than other cow-diets. Inclusion of M in ryegrass-white clover-based diets which form the basis of New Zealand dairy systems may lower fibre digestion rates.

Conclusions The inclusion of maize silage with ryegrass-white clover-based pastures may increase rumen degradation rate of soluble components at the expense of fibre digestion. Further research is needed to separate cow and diet effects to better define the cause of the more rapid *in vitro* fermentation.

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