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Use of the gas production technique to investigate responses of supplementing low quality forages: 2. *In vivo* interactions and comparison with *in vitro* parameters

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Introduction. Supplementation of poor quality roughage diets with forages high in nitrogen can result in increased voluntary feed intake and digestibility although the mechanisms of this response are not well understood nor quantitatively predictable. At present the only way of measuring these responses is by conducting expensive and lengthy animal feeding trials. Recent interest had focused on the potential use of *in vitro* techniques to predict *in vivo* responses to supplementation. Here, the evaluation of the gas production technique for identifying interactions between high and low quality forages, is investigated. In an accompanying paper interactions between forages observed *in vitro* were described (Wood *et al.*, 1997).

Materials and Methods Sheep were fed wheat straw (WS) supplemented with either high temperature dried grass (HTDG) or high temperature dried Lucerne (HTDL). They were offered straw ad libitum, either alone or with 4 levels of supplementation (0.1, 0.2, 0.3 and 0.4 dry matter (DM) basis) . Voluntary feed intake, apparent digestibility of DM and organic matter were measured for 7 days following a 14 day adaptation period. Both supplements were tested in two concominant 5x5 latin squares. Following this the 10 diet combinations were fermented in both N-rich and N-free medium using the *in vitro* gas production technique. Gas production was conducted as described by Wood *et al.* (1997). Parameters from the France model were correlated with *in vivo* data.

Results Table 1 shows the *in vivo* responses to supplementation. Increasing levels of supplementation had little or no effect on straw DMI. There was an increasing linear response in total DMI to increasing levels of supplementation for both HTDG and HTDL; the response was curvilinear with digestibility. With the HTDL there was no increase in digestibility with increasing levels of supplementation after 0.1 inclusion of supplement.

Table 1 The effect of supplementing wheat straw with high temperature dried forages on straw DMI intake and digestibility

	Level of Supp	0	0.1	0.2	0.3	0.4	SED
HTDG	Straw DMI(gd^{-1})	798	792	799	808	790	
	Total DMI(gd^{-1})	798	907	1054	1256	1457	51.6***
	DM Digestibility	0.44	0.49	0.51	0.53	0.53	0.017***
HTDL	Straw DMI(gd^{-1})	701	742	721	699	701	
	Total DMI(gd^{-1})	701	846	948	1086	1235	48.5***
	DM Digestibility	0.46	0.49	0.49	0.49	0.49	0.009**

The correlations between the above *in vivo* data and *in vitro* are shown in Table 2. For the HTDG and HTDL there was a strong correlation between DMI and the France parameters apart from the relationship between DMI and the gas pool (A) for HTDG. There was a strong correlation between DM digestibility and the rate constant (c) and the lag time (T+) although the correlation with DM digestibility and the gas pool (A) was poor for both supplements. For HTDG cumulative gas at 48 hours (CG48) correlated well with DMI and DM digestibility.

***Table 2* Correlations between *in vivo* and *in vitro* parameters**

	HTDG					HTDL				
	A	b	c	T+	CG48	A	b	c	T+	CG48.
DMI	-0.165	0.959	0.809	-0.943	0.975	-0.954	0.949	0.895	-0.938	0.658
DM Digestibility	0.151	0.773	0.931	-0.980	0.957	0.454	0.500	0.860	-0.821	0.865

Conclusion These result show that there are some strong correlations between *in vitro* data and *in vivo* data, such as between DMI and the rate constant (b). The poor correlation between DM digestibility and gas pool (A) is also noteworthy. A more mechanistic approach is now being adopted to further analyse these data.

References

Wood C.D., Murray A.H., Moss A.R. and Givens D.I. (1997) Use of the gas production technique to investigate the response of supplementing low quality forages: 1. *In vitro* interactions.