Use of the gas production technique to investigate the supplementation of nitrogen deficient feeds

C. D. Wood, N. S. Prathalingam, A. M. Murray and R. W. Matthewman
Natural Resources Institute, University of Greenwich, Central Avenue, Chatham Maritime, Chatham, Kent ME4 4TB, United Kingdom

Introduction In many less developed countries senescent pasture and crop residues, such as cereal straws and stovers, are important dry season feeds for ruminants. These feeds are characteristically low in protein and high in fibre contents, leading to low intakes and digestibilities. A major focus for improving the diets is the provision of nitrogen (N) such as urea or protein supplements such as tree fodders. This paper outlines an approach which uses the gas production technique as a tool in investigating the interactions between nitrogen or protein supplements and N-deficient feeds.

Materials and methods The gas production methodology was based on that used for the ADAS ring test except that a N-free medium was used as well as the standard N-rich medium and the inoculum was diluted to different extents using N-free medium. Data was fitted to the France et al. (1993) model. The substrates used were glucose (0.5g) and barley straw (1g). Various browses from N W India were then evaluated singly and in selected combinations by fermentation in N-rich and N-free media using a 1 part rumen fluid + 3 parts N-free medium diluted inoculum.

Results In the N-rich medium, increasing dilution of the inoculum tended to decrease cumulative gas production after 96 h incubation, increase the lag time and decrease the rate constant (b). As indicated in Figure 1, rate constants tended to decrease linearly with dilution. In N-free medium similar, but more pronounced, trends were observed but rate constant (b) declined rapidly to four fold dilution of inoculum then was almost constant (see Figure 1). Therefore, a four-fold dilution of the standard inoculum appeared to maximise the difference in gas production obtained by fermentation in N-free and N-rich media while minimising the inhibitor effects of inoculum dilution.

Figure 1 Effect of inoculum dilution on rate constant (b) for glucose and barley straw fermented in N-rich and N-free media

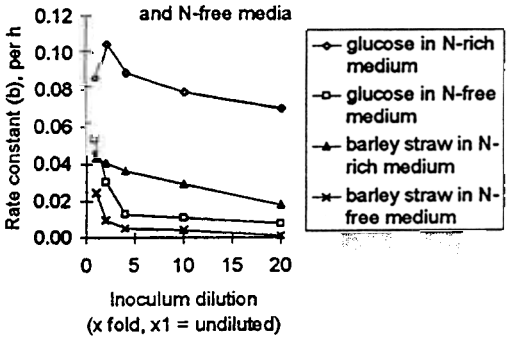

Table 1 presents data on the gas production from the supplementation of the N deficient tree leaves from *Ziziphus mauritania* supplemented with various *Acacia* fodders. *Acacia* pods were very effective protein supplements compared to leaves. A. *leucophloea* leaves were relatively poorly fermentable.

Table 1 Nitrogen deficiency of supplemented *Ziziphus mauritania* leaves
Nitrogen deficiency index = 100 x ($CG48_{N\text{-}rich}$ - $CG48_{N\text{-}free}$)/$CG48_{N\text{-}rich}$
CG48 = cumulative gas production/g dry matter after 48h incubation

Sample type	Supplement (%)	CG48 N-rich	CG48 N-free	Nitrogen Deficiency Index
Ziziphus mauritania leaves	0	137.6	85.5	38
Acacia nilotica pods	20	154.5	128.7	17
	40	156.3	153.0	2
Acacia leucophloea pods	20	157.4	121.6	23
	40	144.9	135.9	6
Acacia nilotica leaves	20	149.1	101.5	32
	40	150.2	114.1	24
Acacia leucophloea leaves	20	147.0	100.2	32
	40	129.0	95.6	26

Conclusions The gas production method appears to be a potentially useful tool for providing information on the N sufficiency of feed mixtures. Such information would be useful in investigating modified feeding strategies for ruminants and identifying strategic supplements for diets at different times of the year.

References France J, Dhanoa M S, Theodorou M K, Lister S J, Davies D R and Isac D (1993) A model to interpret gas accumulation profiles associated with in vitro degradation of ruminant feeds. Journal of Theoretical Biology 163: 99-111.