FEED SAMPLES FROM N W INDIA: REPORT ON INITIAL EVALUATION

Project A0316
Activity 1.5 Application of gas production method to the evaluation of feeds from India.

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Background

During a visit in March 1996 by Conroy and Matthewman (1996) to South Rajasthan (project A0506) some of the principal feeds for small ruminants were identified and selected samples taken by Dr. Matthewman for limited analyses and evaluation using the gas production method. This report has been prepared to report the findings and indicate possible implications for future work.

Sample collection

The samples were taken in Udaipur District in villages where Participatory Rural Appraisal (PRA) on goat keeping and feeding were being carried out. Two samples of each feed component were taken, either from a single location or from separate locations, but in the same village or district. Samples were air dried in the sun and kept in airtight plastic bags.

Analytical work

The crude protein (CP) and acid detergent fibre (ADF) of the samples, together with their laboratory codes, are given in Table 1 below.

All the samples contained over 8% CP, and so would be expected to contain sufficient protein to facilitate degradation by rumen microbes. *Acacia leucophloea* leaves and pods, *Leucaena leucocephala* leaves had CPs of about 20% indicating that they could be useful protein supplements. As is usual for leaves, fibre contents were modest (generally below 30%), although *Caruga pinnata* leaves with an ADF of about 30% could be of restricted digestibility.

However, the above conclusions are tentative as anti-nutritive factors and other components can have major impacts on the availability of tree fodder nutrients.

Gas production evaluation

Seven fodder samples, representing some of the most important fodders in South Rajasthan, were selected for a two stage evaluation using the gas production method. The samples selected are shown in bold in Table 1. Firstly the feeds were fermented individually in nitrogen-rich and nitrogen-free media to evaluate their relative degradabilities and nitrogen sufficiency. Selected combinations were then fermented in nitrogen-rich and nitrogen-free media to evaluate the ability of selected feeds to be used as protein (nitrogen) supplements.

The gas production curves for the seven samples fermented in nitrogen-rich medium are shown in Figure 1. *Acacia leucophloea* leaves were considerably less fermentable than the other samples. There were no indications as to why this was the case from the very limited analyses done, but tannins are likely to be a factor with Acacia fodders. Leucaena leucocephala has been found in previous work (Wood et al., 1993) to be one of the more readily fermentable tree fodders, so the other samples can be considered to be relatively highly fermentable for tree fodders (which are generally less fermentable than good quality pasture). *Acacia leucophloea* pods had a relatively high initial fermentation rate, possibly indicating a high content of readily fermentable soluble carbohydrates. Differences between fermentation properties in nitrogen-rich and nitrogen-free media were small for all the samples except *Ziziphus mauritania* leaves, where large differences were observed (Figure 2). This indicated that *Ziziphus mauritania* leaves were nitrogen deficient, again possibly due to tannins as the CP content of 12.66% was apparently more than sufficient. The other feeds were at least sufficient in nitrogen.

In the second part of the evaluation, the ability of *Acacia nilotica* pods and leaves, *Acacia leucophloea* pods and leaves, and *Leucaena leucocephala* to supplement *Ziziphus mauritania* leaves was assessed (the experimental plan was limited by insufficient quantity of two of the feed samples). Table 2 indicates the extent of nitrogen deficiency of the feed mixtures fermented, where the nitrogen deficiency index (at this stage experimental) was defined as:

$100 \times (CG96_{N\text{-rich}} - CG96_{N\text{-free}})/CG96_{N\text{-rich}}$

where $CG96_{N\text{-rich}}$ = cumulative gas production after 96 h fermentation (CG96) in the feeds fermented in nitrogen-rich.

$CG96_{N\text{-free}}$ = cumulative gas production after 96 h fermentation (CG96) in the feeds fermented in nitrogen-free media.

Unsupplemented *Ziziphus mauritania* leaves had a Nitrogen Defficiency of 39, which was reduced to 12 by supplementation with 20% *Acacia nilotica* pods (i.e. 0.2g *Acacia nilotica* pods fermented with 0.8g *Ziziphus mauritania* leaves), then to 5 with 40% supplementation.

The pods of both Acacias were extremely effective protein supplements, 20% supplementation greatly reducing nitrogen deficiency, 40% supplementation largely overcoming it (Figure 3 gives fermentation curves for *Ziziphus mauritania* leaves supplemented with *Acacia nilotica* pods). The leaves were considerably less effective, particularly *Acacia leucophloea* leaves. This was presumably a reflection of the low fermentability of this sample, the protein apparently being similarly only poorly available to rumen microbes.

Implications of findings

There would appear to be much to be gained by mixing feeds to aim for diets which are more balanced in terms of protein and energy. The Acacia pods in particular appear to be good quality feeds better used as supplements to roughages than as sole feeds or as feeds given with protein sufficient tree leaves. The possible negative effects of anti-nutritive factors (not fully evaluated here) may also be minimised by using these feeds in limited quantities as supplements.

Settled village livestock owners in Rajasthan make rational judgements about utilisation of feed resources for their livestock based on social, economic, labour availability and animal production criteria. Different feeding strategies are adopted for draught oxen, goats, sheep and milk cows/buffaloes. For example, crop residues such as maize and wheat straw are usually fed to draught oxen, whereas tree loppings are more often fed to goats and sheep than other livestock. The findings of the present work provide technical information about the nutritive value of local feeds and this may be used to complement farmer knowledge in order to modify feeding strategies for livestock and to provide strategic supplements for diets at different times of the year.

References

Conroy C. and Matthewman R. W. (1996) Agropastoralists' feeding systems for small ruminants in South Rajasthan, with particular reference to seasonal security. NRI Report R2334(S).

Wood C. D., Johnson J. and Powell C. (1993) Evaluation of Bolivian tree leaves as fodders by an in vitro fermentation technique. Agroforestry Forum **4:** 28 - 34.

Table 1 Analytical data and description of feed samples
Samples shown in bold were selected for evaluation by gas production

Sample code	Sample type	CP (% DM)	ADF (% DM)
1505	*Acacia nilotica* pods	14.06	14.47
1506	***Acacia nilotica* pods**	**16.27**	**18.21**
1507	*Acacia nilotica* pods	14.58	18.68
1508	*Acacia nilotica* leaves	15.70	12.59
1509	***Acacia nilotica* leaves**	**12.32**	**11.28**
1510	*Acacia leucophloea* leaves	20.12	19.70
1511	*Acacia leucophloea* leaves	21.76	27.04
1512	***Acacia leucophloea* leaves**	**19.48**	**22.77**
1513	*Acacia leucophloea* pods	18.40	21.77
1514	***Acacia leucophloea* pods**	**21.76**	**21.59**
1515	***Leucaena leucocephala* leaves, pods, flowers**	**20.94**	**18.03**
1516	***Leucaena leucocephala* leaves, pods, flowers**	**20.04**	**18.36**
1517	*Ziziphus mauritania* leaves	16.02	18.83
1518	***Ziziphus mauritania* leaves**	**12.66**	**24.90**
1519	*Ziziphus mauritania* leaves	15.95	26.79
1520	*Ziziphus xylopyrus* leaves	16.74	18.89
1521	*Ziziphus xylopyrus* leaves	12.89	21.77
1522	*Ziziphus xylopyrus* leaves	11.36	23.24
1523	*Caruga pinnata* leaves	9.66	32.63
1524	*Caruga pinnata* leaves	9.94	28.83

Table 2 Nitrogen deficiency of supplemented *Ziziphus mauritania* leaves

Nitrogen deficiency index = 100 x ($CG96_{N\text{-}rich}$ - $CG96_{N\text{-}free}$)/$CG96_{N\text{-}rich}$
CG96 = cumulative gas production/g dry matter after 96h incubation
N-rich = Nitrogen rich medium
N-free = Nitrogen free medium

Sample code	Sample type	Supplement (%)	CG96 N-rich medium	CG96 N-free medium	Nitrogen Deficiency Index
	Ziziphus mauritania leaves	0	178.7	108.7	39
	Acacia nilotica pods	20	187.1	164.1	12
		40	188.7	179.3	5
	Acacia nilotica leaves	20	184.4	134.9	27
		40	184.1	157.4	15
	Acacia leucophloea leaves	20	182.6	134.6	26
		40	168.0	126.4	25
	Acacia leucophloea pods	20	194.5	168.9	13
		40	193.3	183.9	5
	Leucaena leucocephala leaves, pods, flowers	40	185.1	155.9	16

FIGURE 1 Fermentation characteristics of Indian feed samples in Nitrogen-rich medium

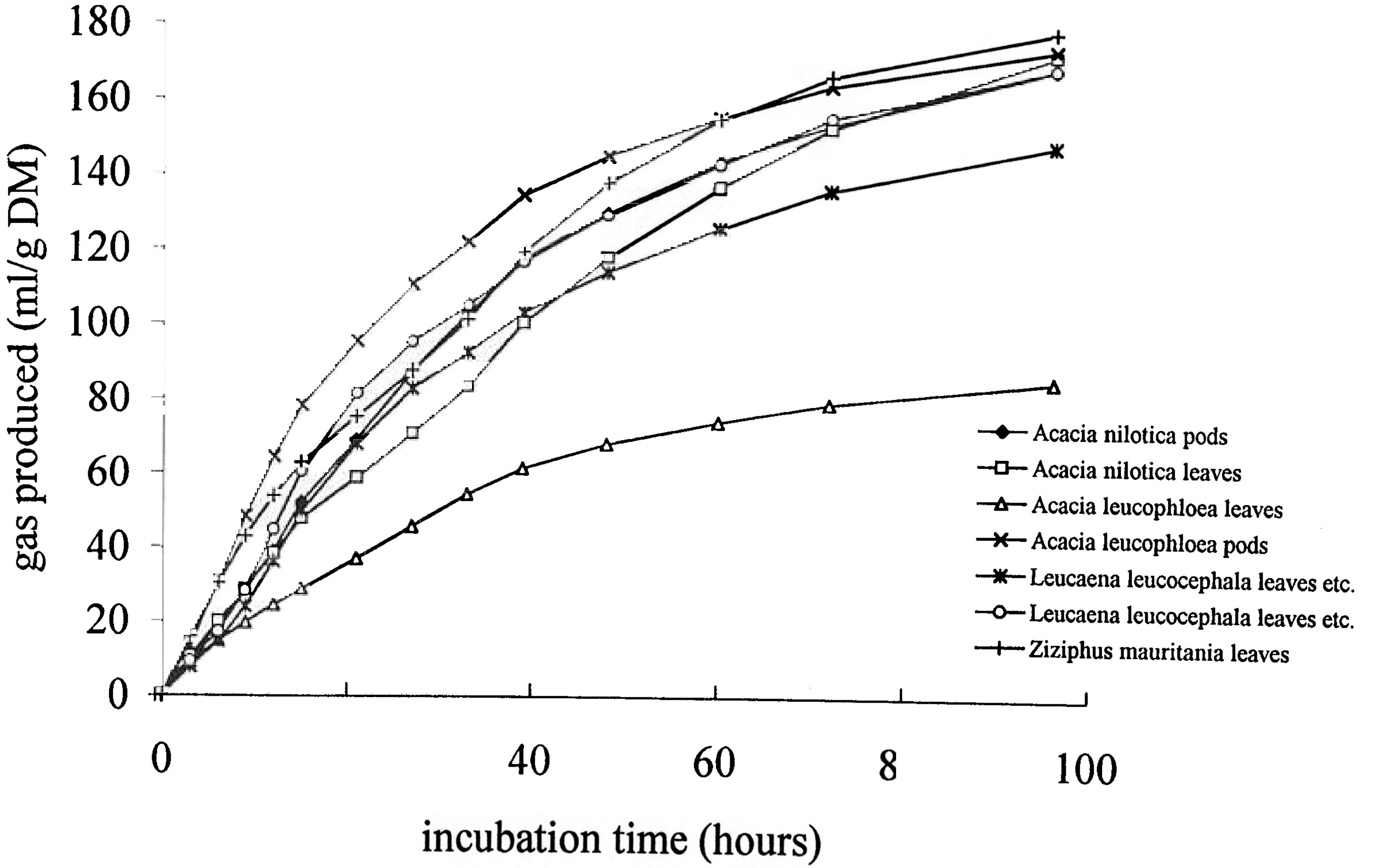

FIGURE 2 Z z phus mauritan a eaves fermented n N rich and N free med a

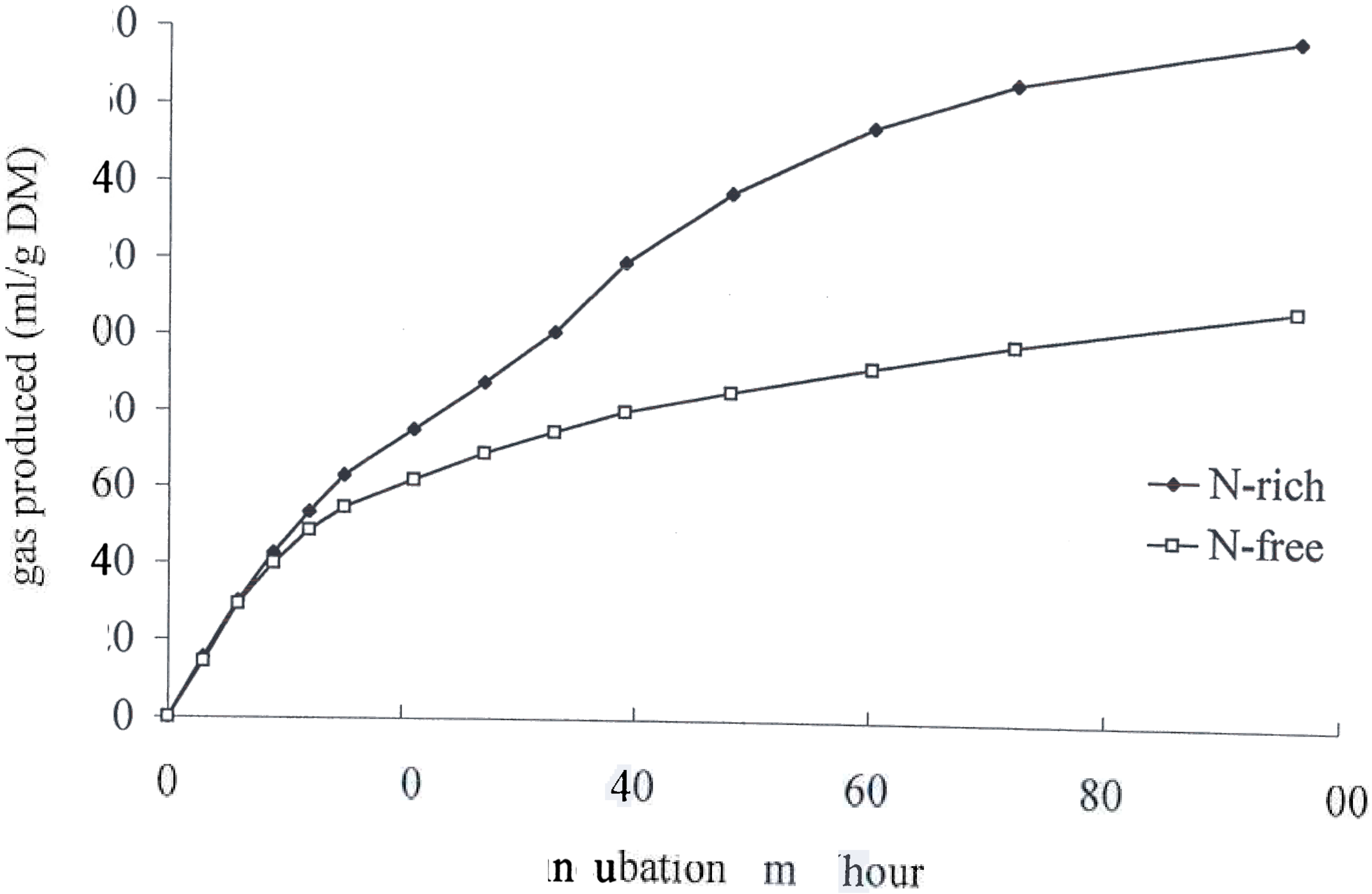

FIGURE 3 Acacia nilotica pods as supplements to Ziziphus mauritania leaves