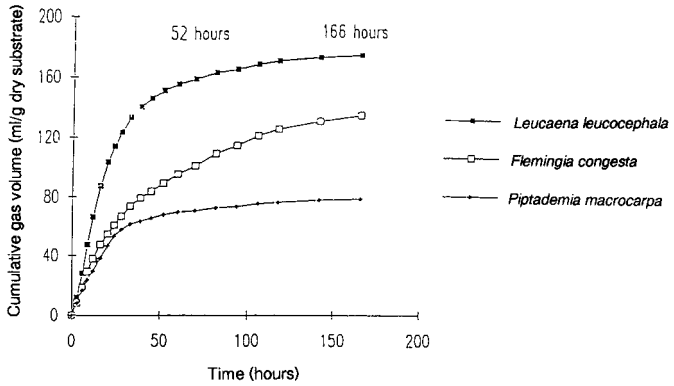
Tree Leaves for Livestock Feed, Green Manure and Mulch

Palatability of Bolivian tree fodder leaves to cattle as assessed by farmers is compared with digestibility using the *in vitro g*as production technique. Supplementing the low-nutritive value dry-season forage with indigenous fodder trees shows considerable promise.

Background

In many tropical countries the shortage of fodder, particularly in the dry season, is a major constraint to animal production. In the tropical regions of Bolivia, cattle frequently suffer significant weight losses during the dry season as fodder is not only limited in supply but is also of poor nutritive value. Indigenous trees are used as fodder in some regions – the leaves of leguminous species in particular are rich in protein. However, much of the protein may be indigestible and may contain high levels of tannins which reduce the availability of nutrients to the animals feeding on the leaves. The selection of suitable tree species for animal feeding requires assessment of their nutritive value, but the presence of these anti-nutritional factors can make the results of the conventional method of analysis – proximate analysis – misleading.



Gas production curves for these Bolivian tree leaves show that Leucaena *leaves – ranked highly palatable by the farmers – have a significantly higher degradability than* Flemingia *leaves – ranked as moderately palatable.*

Research highlights

The project demonstrated the value of the *in vitro* gas production technique in providing information on the rate and extent of fermentation of substrates by rumen microbes. It was used to assess the value of Bolivian tree leaves as livestock feed, green manure and mulch.

Cumulative gas production was assessed in dried samples of leaves of *Leucaena leucocephala* (low tannin) and *Flemingia congesta* (medium tannin) after 52 and 166 hours. Leaves from trees growing in three environmentally distinct sites showed that *Leucaena* leaves, ranked highly palatable by the farmers, had a significantly higher degradability than *Flemingia* leaves which were ranked as moderately palatable. Trees of both species produced leaves with significantly lower digestibility when grown in infertile soils.

Dried leaf samples from 19 Bolivian trees were ranked – from highly palatable to completely unpalatable to cattle – by local farmers. They were then ranked in order of digestibility using the *in vitro* gas production method. Difference in cumulative gas production at 52 and 166 hours was

Leaves of tree legumes can be used for feeding cattle in the dry season when pasture is scarce (near Santa Cruz, Bolivia).

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very similar for each of the species tested. However, there was no apparent relationship between palatability ranking by the local farmers and digestibility determined by *in vitro* gas production.

Losses in the protein precipitation activity of extractable tannins were observed in the dried samples of all species, when fresh and dried samples from 12 tree species were assayed for tannins by the radial diffusion technique. The losses, which ranged from 30.9–55.2%, were attributed to the drying process.

Uptake

The poor relationship between palatability and *in vitro* digestibility indicated that the farmers' knowledge of which trees the animals eat is not by itself a good indicator of nutritional value. Both palatability and digestibility must be investigated further to assess the nutritive value of fodder trees before the contribution of indigenous fodder trees to the diet can be increased. The variable tannin loss during sample preparation reinforces the need to test assessment methods on fresh material and to compare the results with those obtained from dry material.

Linkages

There is considerable potential to increase the contribution of indigenous fodder trees to the diet of livestock through the introduction of species which produce a higher biomass. Information on intake, digestibility and composition is essential for the selection of suitable fodder species.

Data from future work on *in vitro* measurements could be calibrated against animal performance to develop an index of nutritive values, particularly for diets which contain anti-nutritional factors.

Both the radial diffusion assay and the *in vitro* gas production technique have minimal requirements for sophisticated equipment which makes them particularly suitable for use in developing countries. Other Livestock Production Programme projects have used these techniques to investigate the digestive interactions between high quality and low quality forages (R6340) and to estimate the nutritive value of forages (R5180).

Experimental trials on the degradation of leaves on the ground from the species *L. leucocephala*, *Erythrina poeppigiana, F. congesta* and *Inga marginata* are continuing in Bolivia. Further studies looking at gas production assays on fresh leaves for comparison with the results obtained for dried samples would provide valuable information.

Relevance to sustainable livelihoods

The ability of the gas production technique to rank tree fodders to predict relative animal performance and the degradation of green manures and mulches will increase the contribution of indigenous fodder trees to supplement the low nutritive value of dry-season forage. Dry-season weight losses will thus be reduced, leading to increased animal productivity and improvements in the incomes of resource-poor smallholder farmers.

Selected project publications

- 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**(3): 28–34.

- Wood, C.D., Grillet, C., Rosales, M. and Green, S. (1995) Relationships between *in vitro* gas production characteristics and composition of tree leaf fodders from Bolivia, West Africa and Columbia. *Animal Science*, **60**: 541 (abstract).

- Wood, C.D. and Plumb, V.E. (1995) Evaluation of assays for phenolic compounds on the basis of *in vitro* gas production by rumen micro-organisms. *Animal Feed Science and Technology*, **56**: 195–206.

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