

## Forage Tree Legumes as Protein Supplements for Ruminants

The leaves of tree legumes such as *Gliricidia sepium* or *Leucaena leucocephala* show considerable promise as forage supplements for feeding to ruminants, especially in the dry season. Forage tree legumes provide a cheap and readily available source of high quality protein and can improve animal productivity and hence the sustainable livelihoods of resource-poor smallholder farmers in developing countries.

### Background

Leguminous trees are a potential source of relatively high quality fodder readily available to many smallholders. However, farmers are often unaware of appropriate feeding strategies for combining tree fodders with poorer quality feeds to improve animal production. Researchers in the field are hampered by a lack of techniques to assess the nutritive value of fodders to support research programmes aimed at developing appropriate feeding strategies.

Legume forages containing protein which cannot be degraded in the rumen are able to supply ruminant livestock with amino acids at the small intestine. Increasing the dietary level of such forages increases total nutrient intake and improves overall animal productivity. Factors such as yield, tolerance of soil type and cutting

influence the choice of legume by the smallholder.

### Research highlights

Novel nutritive value assessment methods, contributing to the development of feeding strategies involving the supplementation of poor quality feeds for ruminants in tropical Africa, were identified.

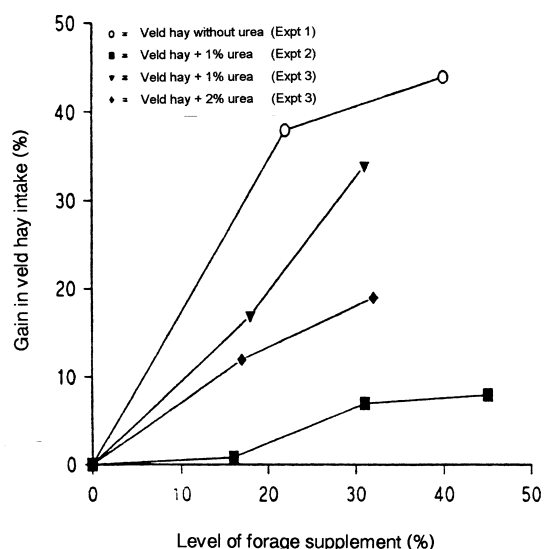
Feeding moderate levels (20–30%) of *Gliricidia sepium* or *Leucaena leucocephala* forage supplements significantly improved dry matter intake and performance of cross-bred steers fed low quality diets of maize stover in Kenya and Zimbabwe. Liveweight gains were approximately 700 g/day on supplemented diets compared to 80 g/day when no supplement was offered. The response was not affected by legume species. Palatability problems associated with *Gliricidia* forage were overcome by wilting and a short period of adaptation.

Napier hay (*Pennisetum perpureum*) supplements given to sheep in Zimbabwe receiving poor quality natural pasture (veld) hay increased total feed intake and *in vivo* digestibility of the total diet without reducing the intake of the veld hay. Inclusion of urea in the diet did not alter the pattern of intake. In trials in Ethiopia, the subtropical forage legume, *Sesbania sesban*, was found to contain an anti-protozoan

agent, identified as a saponin, which was capable of suppressing the activity of ciliate protozoa in the rumen. Foliage from six legume species showed similar suppressive capability.

### Uptake

This project has shown that *G. sepium* can be used as an alternative legume forage supplement in areas of Africa where *L. leucocephala* is heavily attacked by the insect pest, *Heteropsylla cubana*. Feeding leaves of leguminous trees, containing anti-protozoal agents to suppress the activity of rumen ciliate protozoa in ruminants, could remove one of the major limitations to protein nutrition in ruminants. The benefits to livestock nutrition of using these legumes in animal feeding – as a rumen manipulating agent – are far in excess of their nutrient content. Also, the benefit of removing protozoa under Ethiopian livestock production conditions, demonstrated by the project, led to the construction of the 'Wallace Isolation Unit' to house sheep which have had their protozoa removed.



Inclusion of urea in the diet did not increase the stimulating effect of Napier forage supplementation on veld hay intake.

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Project completed in 1995



The new Wallace isolation unit in Ethiopia to house sheep fed *Sesbania sesban* to suppress rumen protozoa.

## Linkages

More research under practical on-farm feeding conditions would help to substantiate results and evaluate other tree legumes as potential ruminant feeds. Since animal performance increased proportionately, further experiments are required to quantify the response to higher levels of legume supplements and responses to energy rich supplements for Napier/legume diets.

Follow-up long-term studies on the anti-protozoal agent found in the subtropical legume, *S. sesban*, showed that it was unsuitable in manipulating the rumen because of an adaptive effect in the microbial population.

Recent studies from ILRI, Ethiopia, in collaboration with the Rowett Research Institute, on the use of tropical plants to improve ruminant nutrition, have been published. ILRI is likely to be involved in a collaborative

study with the Rowett Research Institute and Agriculture Canada on the potential of another forage legume, *Enterolobium cyclocarpum*, as a rumen-manipulating agent, identified as containing anti-protozoal agents and without the adaptive problem of *S. sesban*.

## Relevance to sustainable livelihoods

Tree legumes can improve animal productivity and hence the sustainable livelihoods of resource-poor smallholder farmers in developing countries by providing a cheap and readily available source of high quality protein forage for livestock, especially in the dry season. Protein utilisation can be improved by the ability of identified forage legumes to enhance rumen function.

## Selected project publications

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- Manyuchi, B., De B. Hovell, F.D., Ndlovu, L.R., Topps, J.H. and Tigere, A. (1996) Feeding Napier hay as a supplement to sheep given poor quality natural pasture hay: effects of Napier hay supplement and inclusion of urea in the basal diet on intake and digestibility. *Animal Feed Science and Technology*, **63**: 123–135.
- Abdulrazak, S.A., Muinga, R.W., Thorpe, W. and Ørskov, E.R. (1997) Supplementation with *Gliricidia sepium* and *Leucaena leucocephala* on voluntary food intake, digestibility, rumen fermentation and live weight of crossbred steers offered *Zea mays* stover. *Livestock Production Science*, **49**: 53–62.
- Teferedegne, B., McIntosh, F., Osuji, P.O., Odenyo, A., Wallace, R.J. and Newbold, C.J. (1999) Influence of foliage from different accessions of the subtropical tree, *Sesbania sesban*, on ruminal protozoa in Ethiopian and Scottish sheep. *Animal Feed Science and Technology*, **78**: 11–20.
- Teferedegne, B. (1999) New Perspectives on the use of Tropical Plants to Improve Ruminant Nutrition. PhD Thesis. Rowett Research Institute, Aberdeen UK and ILRI, Addis Abbaba, Ethiopia. Also to be published in *Proceedings of the Nutrition Society*.

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