Optimising the Use of Poor Quality Forage by Ruminants

Poor quality forage, which is often fed to ruminant livestock in tropical developing countries when other feed is scarce, can be improved by adding small amounts of higher quality feed. *In vivo* methods of measuring the effects of supplementation on digestibility and intake are both costly and time-consuming. Laboratory-based techniques were developed to assess the interactions of one feed upon another.

Background

Ruminant animals have an extremely important role to play in animal production systems in developing countries and offer both economic and social benefits. For poor families, ruminant livestock provide a key link between crop production and human food supply by converting low quality crop residues into food. The animals consume poor quality roughages such as straws, stovers and senescent native pasture as a major part of their diet, particularly during the dry season when higher quality forages are in short supply. Most roughages are high in fibre and low in protein, providing insufficient nutrients to meet daily needs. However, intake and digestibility of these poor quality roughages can be improved by supplementing with small amounts of higher quality material.

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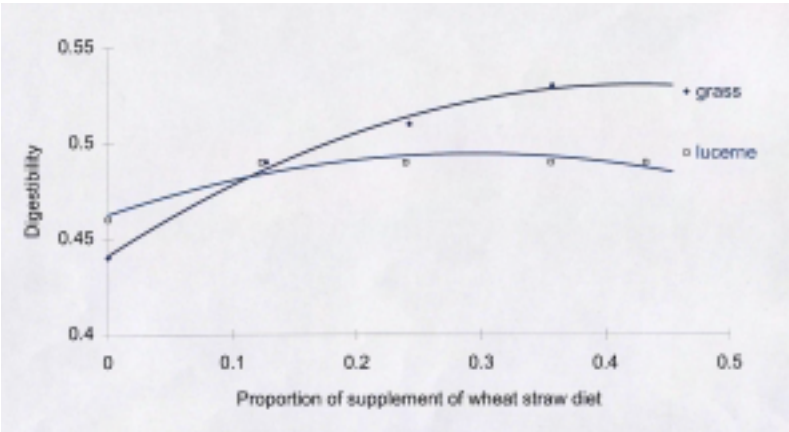
Farmer in Zimbabwe brings poor quality crop residues (mainly maize stover) for feeding to cattle in the dry season. Many smallholder farmers in tropical countries use crop residues as dry season feeds.

There are no established laboratory-based *in vitro* methods for investigating interactions between individual feeds. Previous studies have, however, shown that an *in vitro* gas production method could be used to investigate interactions between roughages and nitrogen sources.

Research highlights

The project studied the effects of supplementing low quality forages with higher quality forages on *in vivo* digestibility and voluntary intake. It also examined the ability of the *in vitro* gas technique to predict these responses in the laboratory.

Sheep were fed a low quality wheat straw diet *ad libitum,* supplemented with either grass or lucerne dried at high temperatures. *In vivo* digestibility studies showed that there are interactions between the feeds. The curved lines in the graph indicate that the digestibility of the feed mixtures is often higher than the sum of the digestibilities when the feeds are fed



In vivo *methods of assessing the effects of supplementing feeds involve expensive and time-consuming feeding trials. The curved lines indicate there are interactions between the feeds – and digestibility of low quality wheat straw increases on supplementing with lucerne or grass.*

separately. Digestibility is the proportion of the amount ingested (intake) that has been digested.

Strong correlations were seen between the data from *in vivo* and *in vitro* measurements when voluntary intake, apparent dry matter digestibility and organic matter digestibility were measured in sheep. Samples of feeds from the feeding trial were evaluated as individual feeds and in mixtures by *in vitro* gas production. The *in vitro* data indicated that the straw plus supplement mixtures reached a balance between fermentable nitrogen and energy when a proportion of about 0.5 per cent of supplement was used.

Uptake

The *in vitro* gas production technique permits the study of ruminant responses to supplementing poor quality forages with small amounts of high quality material. This means it can be used as a practical alternative to expensive and lengthy *in vivo* experimentation which is not feasible in developing countries. Current *in vitro* techniques are able to assess only individual feeds – they cannot predict animal response accurately. However, this *in vitro* gas production technique provides a tool to guide decision-making on efficient ways of using low quality feed resources in developing countries. The gas production technique is also useful for investigating interactions between low quality roughages and supplements under realistic conditions. It may provide predictions of dry matter digestibility and other parameters. Further work is required to calibrate interactions of low quality forages and high quality supplements against *in vivo* responses.

Linkages

Research on the *in vitro* gas production method for the development of improved methods for estimating the nutritive value of tropical forages and for the assessment of the value of tree leaves for fodder, green manure and mulch has been carried out in other DFID-commissioned Livestock Production Programme projects (R5180: Estimating the nutritive value of tropical forages, R5458: Tree leaves for livestock feed, green manure and mulch and R6421: Anti-nutritional factors in tropical legumes).

Relevance to sustainable livelihoods

In resource-poor smallholder farms in developing countries, crop residues are often used as dry season feeds in diets which are deficient in nitrogen. The *in vitro* gas production method can be used to generate information on feeds and feed mixtures to help farmers select diets to maximise the use of locally available natural feed resources. Improved feeding strategies result in increased livestock production and, hence, improved incomes for smallholder farmers.

Selected project publications

- Wood, C.D., Murray, A.H., Moss, A.R. and Givens, D.I. (1998) Use of the gas production technique to investigate responses of supplementing low quality forages: 1. *In vitro* interactions. pp. 92–94. In: In vitro *Techniques for Measuring Nutrient Supply to Ruminants. Proceedings of International Symposium of the British Society of Animal Science, University of Reading, 8–10 July 1997.* BSAS Occasional Publication no. 22. Deaville, E.R., Owen, E., Adesogan, A.T., Rymer, C., Huntingdon, J.A. and Lawrence, T.L.J. (Eds.). British Society of Animal Science, Edinburgh, UK.

- Murray, A.H., Moss, A.R., Wood, C.D., Givens, D.I. and Gill, M. (1998) Use of the gas production technique to investigate responses of supplementing low quality forages: 2. *In vitro* interactions and comparisons with *in vivo* parameters. pp. 266–268. In: In vitro *Techniques for Measuring Nutrient Supply to Ruminants. Proceedings of International Symposium of the British Society of Animal Science, University of Reading, 8–10 July 1997.* BSAS Occasional Publication no. 22. Deaville, E.R., Owen, E., Adesogan, A.T., Rymer, C., Huntingdon, J.A. and Lawrence, T.L.J. (Eds.). British Society of Animal Science, Edinburgh, UK.

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