Comments: on: Tree mixtures within Integrated Farming Systems by M. Rosales and M. Gill

From Chris Wood <Chris.Wood@nri.org>

Comments on Rosales and Gill's paper

Dr Rosales refers to work done in Nepal on tree fodders. In many Nepalese farming systems a major role of livestock is to provide manure to fertilize their fields as fertilizer is considered too expensive. Farmers have a two scale quality evaluation system, the chiso-obano (obhano) scale referred to by Dr Rosales and the posilo-kam posilo scale where posilo means palatable and production-enhancing. A recent study conducted by the Natural Resources Institute, Pakhribas Agricultural Centre and the University of Wales has indicated that posilo feeds are good sources of dietary protein while the chiso-obano scale appeared to be related to dung characteristics. Obano feeds, which were considered to be palatable and voraciously consumed but sometimes caused constipation, were of low in vitro digestibility. Hence there was the unexpected finding that farmers considered tree fodders of low digestibility, which would have been expected to be of little value, to in fact be of considerable use to them. It was unclear whether this was related to dung quality or was perhaps related to the avoidance of antinutritive factors in more digestible fodders. However, an important point is that feeds must be evaluated in the context of the farming system as a whole. In this case ranking in terms of in vitro digestibility would have been highly misleading.

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Comments on fodder trees and the use of PEG

We have read with interest the papers of Mauricio Rosales and Margaret Gill, Ali Nefzaoui and comments from Thomas Acamovic. The subject is original and we understand that little is known about the functioning of secondary chemical compounds of fodder tree species especially in ruminant feeding. We would like to add some results and reflections about the use of PEG for condensed-tannin-rich plants from our own experience.

As shown by several researchers, PEG has an affinity for tannins and reduces their negative effect. Even though the effects of PEG on intake and digestibility of diets based on tannin-rich plants are inconsistent, several researchers showed a positive effect on nitrogen use by ruminants. In our laboratory, we supplemented Acacia cyanophylla (11-13% CP and 4-7% condensed tannin) with PEG (about 25 g /day) for feeding sheep. Results showed a positive effect of PEG on digestibility and retention of nitrogen, a higher N-NH3 and VFA concentration in the rumen and an increased concentration of total protozoa (see abstract below).

Most recent studies concerning tannins were based on chemical PEG. This alternative offers several advantages such as the control of the dose of PEG in relation to the tannin concentrations in plants and the ease of treatment (watering, spraying, in concentrate and in nutritional blocks). However, we think that it is actually difficult to develop a feeding system based on fodder trees and shrubs using PEG particularly in developing countries because it is very expensive. Furthermore some questions might be raised:

1. Is the current knowledge sufficient to take up this option?
2. Are all the natural PEG analogues identified in each species of fodder tree (class of chemical, concentration in plant, specific effects...), especially in developing countries where laboratories are under-equipped?
3. Does the positive effect of natural PEG analogues meet the eventual positive effect of the mixture (nutritional complementarity or synergistic effects)?

Use of Multi-Nutritional Blocks for the Improvement of an *Acacia cyanophylla* Lindl. -based Diet for Sheep

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In this paper we report results of an experiment dealing with the improvement in the quality of an *Acacia cyanophylla*-based diet using multi-nutritional blocks where energy, nitrogen, minerals and PEG are added.

Six sheep where used to test diets (double 3*3 Latin square design). All diets included 400g of oat-vetch hay, dried *Acacia cyanophylla* leaves and twigs *ad libitum* (D1) and supplemented with two types of block: D2 (10% urea, 10% molasses, 5% NaCl, 5% MVS, 5% Ca2PO4, 10% cement, 20% olives cake and 35% wheat bran) or D3 (10% PEG 4000, 10% urea, 10% molasses, 5% NaCl, 5% MVS, 5% Ca_2PO_4, 10% cement, 15% olives cake and 30% of wheat bran) *ad libitum*. Each experimental period lasted 33 days (21 days for adaptation and two 5 day periods of measurements separated with 2 days rest). Intake of Acacia and blocks was measured by difference between that offered and refused, while digestibility was measured by the total faecal collection method.

The two kinds of blocks improved significantly ($p<0.01$) the DM intake of *Acacia*. Block dry matter intake was similar for the two kinds of blocks (D2 and D3). Dry matter intake of the whole diet increased significantly ($p<0.01$) on both diets. Blocks did not affect DM and OM digestibility of the diet. Nitrogen digestibility was very low for D1 but was significantly ($P<0.01$) improved on D2 and D3. Nitrogen retention was significantly different ($P<0.01$) for the three diets. For D1, Nr was negative, while clear improvements were noted with D2 and especially when PEG was added (D3). Supplementation with block improved the nutritive value of the diet; this positive effect was most marked on D3.

In conclusion, energy, nitrogen and mineral supplies given in blocks improved the nutritive value of an *Acacia cyanophylla* Lindl - based diet. A supplementary specific effect of PEG is observed for nitrogen retention and digestible crude protein.

Diets	D1	D2	D3	SE
DM intake(g)				
Acacia	569.68b	760.42a	773.42a	29.65
Block	0	271.88a	260.89a	11.81
Diet	929.5b	1392.1a	1394.08a	12.94
Diet digestibility (%)				
DM	48.49	47.15	49.49	0.96
OM	51.75	50.24	52.4	0.95
CP	30.45c	51.26b	64.18a	1.4
Nitrogen use (g)				
Nr	-0.39c	4.11b	7.73a	0.71
Nutritive value of dietsg/LW$^{0.75}$				
DOM	25.75b	34.24a	35.75a	1.05
DCP	1.75c	6.65b	7.95a	0.312

a, b, c; Data in the same line with different superscripts differ ($p<0.01$)

From: Tony Goodchild (PFLP) <t.goodchild@cgnet.com>
Reply to Chedly Kayouli's comments on the use of PEG

It was good to see that Chedly Kayouli's results on *Acacia cyanophylla*, particularly the response to multinutrient block supplementation. No-one can argue with his conclusion that "energy, nitrogen and mineral . . . in blocks improved the nutritive value of an *Acacia cyanophylla* . . . based diet" even without PEG, but it would be good to know which of the nutrients he supplied had the greatest effect.

Work was reported in Australia in the 1970s for merino sheep consuming a rather similar shrub, *Acacia aneura* (mulga). Feeding supplements containing sulphate, such as Na_2SO_4, $CaSO_4$, molasses and the ash of molasses, increased the sheep's voluntary DM intake by about 40% (Hoey *et al.* 1976; see also Gartner and Niven 1978). Phosphorus supplementation increased mulga intake by 20% (McMeniman 1976).

Mulga may be lower in DM digestibility than *A. cyanophylla*, but seems to be similar in tannin and apparent nitrogen digestibility.

Kayouli's 50% increase in DM intake should be seen in this light.

This E-mail conference seems to have neglected the role of minerals in improving the efficiency of animal production. Surely, if a specific micronutrient is limiting, the response to correcting the deficiency is usually enormous in comparison with the cost, and work to locate problem zones will have potential benefits for even the poorest producers.

I look forward to meeting you all again, either in TFConf3 (please!) or in person,

Tony Goodchild, ICARDA, P.O. Box 5466 Aleppo, Syria (t.goodchild@cgnet.com).

References:

Gartner,R.J.W. and Niven, D.R. (1978) Australian Journal of Experimental Agriculture and Animal Husbandry (AJEAAH) 18:768-772.

Hoey, W.A., Norton, B.W. and Entwistle, K.W. (1976) Proceedings of the Australian Society of Animal Production 2:377-380, McMeniman,N.P. (1976) AJEAAH 16: 818-822.

From Chedly Kayouli <101763.2164@compuserve.com>
Reply to Tony Goodchild's comments on the use of PEG

Thank you for reading with interest our results concerning supplementation of *Acacia cyanophylla*. We absolutely agree with you that the role of mineral effects in improving the efficiency of animal production seems to be neglected. In our trials we added minerals through the different nutrients, cement, bicalcic phosphate, NaCl, and mineral-vitamin supplement. Minerals were not studied for their specific effect, and the most important factor that we considered for its greatest effect was PEG 4000.

We believe, as reported by Jansman (1993, Nutrition Research Reviews, 6, 209-236) that information on interaction between tannins and minerals is hardly available. The research work you referred to provides little but precious information about this aspect. It seems that tree leaves

are generally very rich in calcium and poor in phosphorus, so a negative phosphorus balance is frequently shown by animals fed on tree leaves. Most studies we have seen on the interactions between minerals and tannins concerned especially phosphorus (tannins do not seem to affect phosphorus) and sulphur (because of the sulphur amino acids). The presence of high dietary tannin has been found to be responsible for a decrease in wool growth due to the reduced sulphur amino acids absorption.

In this respect, Pritchard *et al.* (1992, J., Agric, Res, 43; 1739-1746) showed that sheep fed Mulga (*Acacia aneura*) retained more N and S when supplemented with 24 g/day PEG. These results were further enhanced when a mixture of nitrogen, phosphorus and sulphur was added in conjunction with 24 g/day PEG.

A few years ago, we carried out some research (unpublished) where we studied the effect of minerals on *in vitro* fermentation of some by-products. We hope to do the same with acacia in combination with PEG effect.

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