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Tree leaf meal from fodder trees in silvipasture and their potential to support growth in young ruminants.

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Abstract: The study was conducted with the aim of utilizing leaf meal prepared from *Leucaena leucocephala* and *Gliricidia sepium* trees from silvipasture model of agroforestry as alternate feeding strategy on partial replacement of feed ingredients in compound feeds of goat kids and buffalo calves. The edible leaf biomass from *Leucaena leucocephala* and *Gliricidia sepium* was 9.20 and 18.54 MT/ha/year respectively and their respective crude protein content was 14.81 and 17.66 per cent. Two feeding trials were conducted with *Leucaena leucocephala* and *Gliricidia sepium* leaf meal mix (1:1 ratio) incorporated in concentrate feed for goat kids and buffalo calves at 30 per cent inclusion. The average daily gain of goat kids and buffalo calves fed tree leaf meal incorporated concentrate feed was comparable to daily gain of kids / calves fed conventional concentrate feed in 90 days feeding trial. It was concluded that tree leaf meal (*Leuceana leucocephala* / *Gliricidia sepium* - 1:1) can be included up to 30% level in concentrate feed of goat kids and buffalo calves without any change in the growth rate but reducing feed cost.

INTRODUCTION

Silvipasture is an agroforestry practice that is specifically designed and managed for the production of trees, tree products, forage and livestock. Tree leaves available from silvipastures represent a potential source of protein for ruminants. Trees and shrubs are important components of ruminant diet (Babayemi and Bamikole, 2006) and they have been found to play an important role in the nutrition of grazing animals in areas where few or no alternatives are available (Van et al., 2005). The leaves of *Leucaena leucocephala* and *Gliricidia sepium* plants for instance have been widely reported (Fasae et al., 2006) as valuable forage supplements to ruminants consuming low-protein diets.

Supplementation of animals on grass basal diets with tree leaves increased feed intake and growth rate of West African dwarf sheep and small East African goats (Rubanza et al. 2007). When surplus tree leaves are available their conservation will ensure year round availability of good quality feed. Tree leaf meal production is the most practical way of conserving the surplus tree leaves. Tree leaves can be harvested, sun-dried and used in compounded feed as protein supplements. The replacement of conventional ingredients by dried tree leaves will make the concentrate feed cheaper than the commercial concentrates (Ondiek *et al.*, 2000). Ebong found that calliandra leaf meal is a potentially valuable substitute for soybean meal in compound feeds for feeding goats raised for meat production. Supplementation with *Mimosa scabrella* in the highlands of Rwanda enabled goats to gain 50 g day−1 compared with 31 g day−1 for grass alone. In the Tanga area of northeastern Tanzania, *L. leucocephala* leaf meal is widely marketed, primarily to urban dairy producers. Most is from wild populations but some is cultivated on farms. Leaf meal is also an ingredient of one of the country's major mineral supplements. The use of *Leucaena leucocephala* leaf as a supplement has been reported to increase milk production of grazing dairy cattle (Kakengi 2001).

It is with this background a study was conducted with the objective of converting the surplus tree leaves available from *Leucaena leucocephala* and *Gliricidia sepium* based silvipasture and using the leaf meal as a part of concentrate feed for goats and buffalo calves.

MATERIALS AND METHOD

The experiments were conducted at Institute of Animal Nutrition, Tamil Nadu Veterinary and Animal Sciences University, Kattupakkam in buffalo calves and goats for a period of 90 days each with the tree leaves harvested from silvipasture model of Agroforestry.

Silvipasture model of Agroforestry

One hectare of calcareous wasteland under rain fed conditions was planted with *Leucaena leucocephala and Gliricidia sepium* tree saplings in alternate rows with spacing of one metre between trees and two metre between rows. *Stylosanthes hamata* was cultivated as perennial legume under storey the trees. Pollarding of the trees was carried out at 1m from ground level once in four months

after one year of its establishment. The edible fresh fodder biomass yield from *Gliricidia sepium* (4 harvests / year) was calculated by pruning the tree fodder at periodical intervals**.**

The biomass yield of *Leucaena leucocephala and Gliricidia sepium* were documented in terms of Leaf + Stem weight (kg), Stem weight (kg), Edible leaf weight (kg), Leaf stem ratio and Edible biomass yield (MT/ha). Leaves were analysed for their proximate principles and acid insoluble ash as per AOAC (2000).

Proximate analysis

The proximate content of *Leucaena leucocephala, Gliricidia sepium,* Bajra napier hybrid grass and concentrate feeds were analyzed which constituted the ration in experimental animals. The samples were taken randomly and were analyzed (AOAC, 2000) for the dry matter (DM), crude protein (CP), crude fibre (CF), ether extract (EE) and total ash (TA).

Processing and preparation of leaf meal

For preparing leaf meal leaves of *Leucaena leucocephala and Gliricidia sepium* were sun-dried for three days so that the moisture content was reduced to 10-13% and then ground to pass through 1 mm sieve and stored in sacks. A tree leaf meal mix was prepared by mixing *Leucaena leucocephala and Gliricidia sepium* leaf meals in the ratio of 1:1. The tree leaf meal was used in the preparation of concentrate feed for goats and buffalo calves.

Experimental animals and feeding - Goat

Fourteen weaned female goats (Kanni) of approximately 5- 6 months with an average body weight of 5 kg were randomly divided into two groups of seven goats each. One group was fed with control concentrate feed and the other tree leaf meal based concentrate feed. All the goats were grazed for 8 hours every day and supplemented with their respective concentrate mixture at the rate of 200 gram / animal / day. All animals were kept in individual pens and received free choice of clean fresh water.

The ingredient composition, nutritive value and cost of control and tree leaf meal based concentrate feed for goats are presented in Table 1. The experimental period was for 90 days. Weight of animals was recorded at the start and at the end of the experimental period, to document the weight gain.

Experimental animals and feeding - Buffalo calves

Twelve buffalo female calves (8-9 months old) with average body weight of 90 Kg were randomly allotted into two treatment groups viz control group of six calves fed conventional concentrate mixture and treatment group of six calves fed tree leaf meal incorporated concentrate mixture. The ingredient composition, nutritive value and cost of control and tree leaf meal based concentrate feed for buffalo calves are presented in Table 2. The buffalo calves were housed individually and stall fed. *Ad libidum* hybrid napier grass was offered as roughage and respective concentrate mixture was supplemented at the rate of 750 gram per animal per day. The experimental period was for 90 days. All animals were kept in individual pens and received free choice of clean fresh water. Weight of animals was recorded at the start and at the end of the experimental period, to document the weight gain.

Table 1: The ingredient composition, nutritive value and cost of control and tree leaf meal based concentrate feed for goats

Ingredients / Nutritive Value / Cost	**Inclusion level (%)**	
	Control concentrate feed	**Tree leaf meal based concentrate feed**
Tree leaf mix	**0**	30
Yellow maize	24.5	28
Wheat bran	24.0	10
Deoiled rice bran	24.0	10
Soya bean meal	19.5	14
Sunflower oil cake	5	5
Mineral mixture	2	2
Salt	1	1
DCP%	**14.0245**	**14.337**
TDN%	**71.695**	**71.18**
Cost (Rs.)	**19.67**	**14.81**

Table 2 Ingredient composition, nutritive value and cost of control and tree leaf meal based concentrate feed for buffalo calves

Ingredients / Nutritive Value / Cost	**Inclusion level (%)**	
	Control concentrate feed	**Tree leaf meal based concentrate feed**
Tree leaf meal	0	**30**
Yellow maize	26	31
Wheat bran	22	19
Deoiled rice bran	26	0
Soyabean meal	23	17
MM - C	2	2
Salt	1	1
Total	100	100
DCP (%)	**14.32**	**14.54**
TDN (%)	**72.68**	**72.10**
Cost / Kg (Rs)	**19.88**	**15.18**

Table 3: The Leaf + Stem weight (kg), Stem weight (kg), Edible leaf weight (kg), Leaf stem ratio and Edible biomass yield (MT/ha) of *Leucaena leucocephala and Gliricidia sepium*

Tree species	**Pollarding**	**Leaf + Stem weight (kg)**	**Edible leaf weight (kg)**	**Leaf stem ratio**	**Edible biomass yield (MT/ha)**
Leuceana leucocephala	I	1.95±0.14	1.18±0.03	1.75±0.39	1.88
	II	3.62±1.13	2.18±0.59	1.85±0.32	3.48
	III	4.76±0.64	2.40±0.45	0.99±0.11	3.84
Gliricidia sepium	I	3.76±0.30	2.27±0.26	1.49±3.26	3.63
	II	10.8±1.52	6.02±0.90	1.28±0.10	9.63
	III	8.66±1.08	3.30±0.56	0.62±0.09	5.28

Statistical analysis

An independent student's t-test was performed to compare the mean body weight between different treatment groups.

RESULTS AND DISCUSSION

The biomass yield of *Leucaena leucocephala and Gliricidia sepium* in terms of Leaf + Stem weight (kg), Stem weight (kg), Edible leaf weight (kg), Leaf stem ratio and Edible biomass yield (MT/ha) is presented in table 3.

The leaf biomass and stem weight was found to be higher for *Gliricidia sepium* compared to *Leucaena leucocephala*. The total edible leaves biomass in *Leucaena leucocephala* and *Gliricidia sepium* was 9.20 MT/ha and 18.54 MT/ha respectively. In all the three pollardings the edible biomass was higher in *Gliricidia sepium* compared to *Leucaena leucocephala.* As reported in this study, bio mass yield for leaves harvested at 12 week cutting interval was higher for *G. sepium* and lower for *L. leucocephala*.

Gliricidia sepium leaves had 17.66, 19.91, 4.13, 9.45, 0.67 and 48.27 per cent crude protein, crude fibre, ether extract, total ash, acid insoluble ash and nitrogen free extractives respectively on DMB. *Leucaena leucocephala* leaves had 14.81, 21.45, 5.56, 8.22, 0.41 and 49.55 per cent crude protein, crude fibre, ether extract, total ash, and acid insoluble ash and nitrogen free extractives respectively on DMB. In the present study both *Gliricidia sepium* and *Leucaena leucocephala* leaves had lower crude protein, ether extract and higher crude fibre than that reported by Aye and Adegun (2013).

The average daily gain of goats fed control concentrate feed was 39.1 g per animal per day while it was 35.5 g per animal per day in goats fed tree leaf meal incorporated concentrate feed. The reduced daily weight gain in goats on treatment group could be due to the poor availability of pasture grasses in summer season. The difference in weight gain was not statistically significant. The cost of feeding concentrate in terms of per kg weight gain in goats was higher (Rs 38.41) in concentrate fed animals compared to tree leaf meal incorporated concentrate feed fed animals (Rs 31.81).

The average daily weight gain in control group calves was 155.38±28.06. The weight gain in tree leaf meal incorporated concentrate feed fed calves was 184.43±22.69 g. Supplementation of rain tree pod meal at 60 g/kg of total DM intake and feeding different concentrate ratios resulted in changing the rumen microorganisms, especially, when animals were supplemented with rain tree pod meal, which significantly reduced protozoa and methanogens population (Anantasook, 2013). Supplementation of leaf meal could have resulted in reduction in protozoa and methane producing bacterial count which may be the reason of increased weight gain in treatment group although there was no significant difference statistically. Indicating that tree leaf meal could be added in concentrate mixture of buffalo calves without any adverse effect. The reduction in feed cost in tree leaf meal fed animals was to the tune of Rs 4.70/Kg feed.

CONCLUSION

It was concluded that tree leaf meal (*Leucaena leucocephala* / *Gliricidia sepium* - 1:1) can be included up to 30% level in concentrate feed of goat kids and buffalo calves without any change in the growth rate but reducing feed cost.

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