

***Leucaena leucocephala* as an alternative protein supplement to fishmeal for small holder indigenous lactating cows in Bangladesh**

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Keywords: Fishmeal; legume; milk; mimosine

Abstract

In Bangladesh, locally produced fishmeal is being used as a protein source for lactating cows but sometimes it is scarce and expensive. There is a need for an alternative protein source such as a *Leucaena* species which can be grown by the roadside, embankment or in a small area close to home. An experiment was carried out to assess the effect on the performance of partially replacing fishmeal with fresh foliage from *Leucaena leucocephala* in the diet of lactating cows. Three diets containing (kg/day) urea-treated rice straw (11.0) with either fishmeal (0.25), fishmeal (0.15) and *Leucaena* (0.5), and fishmeal (0.075) and *Leucaena* (1.0) were designed to provide the same metabolizable energy (41 MJME/day) and a similar amount of protein (460 g/day). They were designated diets A, B, and C, respectively. Nine local cows, in their first lactation and weighing on average 128 kg, were grouped into trios according to calving date where animals in each trio were allocated at random to one of the dietary treatments. The experiment began in the 23rd week of lactation and continued for 15 weeks. Mean results for cows on diets A, B, and C, respectively were daily milk yield (kg) 0.99, 1.05, and 1.12; butter fat content (g/kg) 66, 67, and 68; protein content (g/kg) 42, 41, and 41 and daily weight gain (kg) 0.11, 0.18, and 0.14. None of the differences between treatments was significant ($p > 0.05$). There was no evidence of any adverse effect of mimosine in the cows' given diets B or C. The results indicate that fishmeal may be partially replaced by foliage from the legume shrubs *Leucaena leucocephala* without affecting the performance of local cows.

Introduction

Leucaena leucocephala is a small tree that originated in Mexico and escaped as a weed in tropical and warm temperate regions of other countries. It is a tree legume fodder which is a good source of protein and has been gaining importance for livestock production in S. E. Asia and other tropical countries. Fodder tree legumes have several attributes that make their potential use in the tropics very high. The legumes have deep root systems and can withstand drought and often serve as the main multiple-purpose plants and are often grown for fuel wood, timber, poles and even a source of food, in addition to fodder. Tree legumes, once established, are easier to maintain in association with tropical grass compared to conventional creeping legumes as they can be grown as an upper story on land used for growing crops at lower levels. In the Philippines, Ipil-ipil or *Leucaena* is the most popular legume and has been given a great deal of attention since the early seventies, with people in the livestock sector looking at it almost as a 'cure-all' for the growing animal industry. Smallholder dairy farmers raising Sahiwal-Holstein Friesian fed their animals with 5 to 19 kg of fresh Ipil-ipil leaves in combination with fresh grass fodder and obtain 4 to 7 kg milk per cow per day. Ipil-ipil is planted in hedges around the home-lots and farm-lots, and in evenly spaced rows (1 to 2m) under coconuts (Moog 1989). Small quantities of *Leucaena* can give useful increases in milk production at low cost since it is possible to produce 10-22 tons of edible DM/ha (Hutton and Beattie 1976). It is also one of the few tropical legumes that are persistent under both cutting and grazing regimes. Any detrimental effect due to the amino acid, mimosine, is unlikely to influence animal health or performance when *Leucaena* constitutes such a small proportion of the diet. Restricted grazing of the legume for 30-60 minutes daily before the cows are allowed onto pasture could be one practical method of supplementation. The important point arising from the study is that the need for concentrate supplementation could be reduced or even eliminated (Flores-Ramos 1977). *Leucaena leucocephala* is a small tree commonly cultivated in the garden as an ornamental, avenue and forage crop

in India. The various parts of this plant like roots, leaves, stem bark, wood and seeds are highly useful to human beings and animals. The stem has high timber value. The leaves are used as animal feed because of their high nutritional value. The plant has the property of fixing atmospheric nitrogen in the root nodules. The seed oil could be used as a potential bio-inhibitor for the corrosion of mild steel and copper. The product obtained from the plant is natural and eco-friendly. So, it is very apt to call it a miracle tree (Meena Devi et. al. 2013). In cattle the rumen micro-organisms hydrolyze mimosine into 3, 4-DHP so efficiently and rapidly that even when the animals are fed on a diet rich in *Leucaena*, their blood, meat and milk are quite free of mimosine. Generally, when diets contain less than 30% *Leucaena* meal, cattle can thrive on them for long periods without signs of ill health, but when *Leucaena* comprises more than 50% of the animal's feed intake, and feeding is continued for more than 6 months, the result may be general ill-health, loss of hair, production of goitres, reduced fertility and poor growth of the goitrous cows. The effects are mostly reversible and can be seen early enough that the legume can be withdrawn from the cattle feed to allow them to recover (Ruskin 1977).

In Bangladesh, locally produced fishmeal is available as a protein concentrate for lactating cows but sometimes it is scarce and expensive. There is a need to find an alternative source of protein such as a *Leucaena* species, which can be grown by the roadside, embankment or in a small area close to home. An experiment has been carried out to assess the effect on the performance of partly replacing fishmeal with freshfoliage from *Leucaena leucocephala*.

Methods and Materials

The research work was conducted at Bangladesh Agricultural University (BAU) Farm, Department of Dairy Science, BAU, Mymensingh, Bangladesh. Three diets containing (kg/day) urea-treated rice straw (11.0) with either fishmeal (0.25), fishmeal (0.15) and *Leucaena* (0.5), or fishmeal (0.075) and *Leucaena* (1.0) were designed to provide the similar level of metabolizable energy (43 MJME/day) and a similar amount of protein (490g/day). They were designated diets A, B and C, respectively. The composition and nutritive value of the ingredients and of the three diets are given in Tables 1 and 2.

Table 1. Approximate composition and nutritive value

	DM (g/kg)	ME (MJ/kg)	RDP (g/kg/ DM)	UDP (g/kg/ DM)	CP (g/kg/ DM)
Treated straw	524	7.0	58	7	65
Fishmeal	846	11.1	226	340	566
<i>Leucaena</i>	323	10.0	213	44	257

¹ DM= Dry Matter, ME=Metabolizable Energy , RDP=Rumen Degradable Protein, UDP=Undegradable Dietary Protein , CP=Crude Protein

Table 2. Composition of nutritive value of the diets

Ingredients	Fresh wt. (kg/d)	DM (kg/d)	ME (MJ/d)	RDP (G/d)	UDP (g/d)	CP (g/d)
Diet A						
Treated straw	11	5.76	40.3	334	40	374
Fishmeal	0.25	0.21	2.3	48	71	119
<i>Leucaena</i>	0	0	0	0	0	0
Total	11.25	5.96	42.6	382	111	493
Diet B						
Treated straw	11	5.76	40.3	334	40	374

Fishmeal	0.15	0.13	1.4	29	44	73
<i>Leucaena</i>	0.50	0.16	1.6	35	7	42
Total	11.65	6.05	43.3	398	91	489
Diet C						
Treated straw	11	5.76	40.3	334	40	374
Fishmeal	0.075	0.06	0.7	14	20	34
<i>Leucaena</i>	1	0.32	3.2	68	14	82
Total	12.075	6.14	44.2	416	74	490

Nine local cows, in their lactation and weighing on average 128 kg, were grouped into trios according to calving date and animals in each trio were allocated at random to one of the dietary treatments. The experiment began on the 23rd week of lactation and continued for 15 weeks. The experimental design was Completely Randomized Design. The data was analyzed by SPSS. Milk sample was collected fortnightly for analysis.

Results and Discussion

Table 3. Effect of *Leucaena leucocephala* on body weight and milk composition of cows.

	DIET			SD	Level of significance
	A	B	C		
Body weight gain (kg/day)	0.11	0.18	0.14	0.037	NS
Milk yield (kg/day)	0.97	1.05	1.12	0.111	NS
Butter fat (g/kg)	66	67	68	3.4	NS
Milk protein (g/kg)	42	41	41	0.42	NS

Mean results for cows on diets A, B, and C, respectively were: daily milk yield (kg) 0.99, 1.05, and 1.12; butterfat content (g/kg) 66, 67, and 68; protein content (g/kg) 42, 41, and 41; daily weight gain (kg) 0.11, 0.18, and 0.14. None of the differences between treatments were significant ($p > 0.05$). There was no evidence of any adverse effects of mimosine in the cows' given diets B or C. *Ipil-ipil (Leucaena leucocephala)* could be used as alternative sources of protein for ruminants, which may result in better weight gain, milk yield and reproductive performances during the postpartum period in indigenous cows without toxic effect (Alam et al. 2009).

Conclusions/or Implications

The results indicate that fishmeal may be partially replaced by foliage from the legume shrubs *Leucaena leucocephala* without adversely affecting the performances of the local cows in late lactation. There is a need to carry out a similar trial in early lactation before recommendations are made to farmers.

Acknowledgements

The author acknowledges International Foundation for Science (IFS), Stockholm, Sweden for technical and financial support.

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