**Tropical Agricultural Research Vol. 21(4): 412 - 420 (2010)**

# Development of a Leguminous Leaf Meal Blocks as an Animal Feed

S.C. Somasiri, S. Premaratne[1], H.A.J. Gunathilake[2], H.A. Abeysoma[2] and J.H.M.N. Satsara[2]

Coconut Research Institute
Lunuwila, Sri Lanka

***ABSTRACT.*** *The present study was carried out with the objective of develoing a leguminous leaf meal (LM) block as an animal feed. Leguminous leaf meals were prepared from sun dried leaves and twigs of* *__Acacia__* *__mangium__* *(Acacia),* *__Gliricidia__* *__sepium__* *(Gliricidia),* *__Leucaena__* *__leucocephala__* *(Leucaena) and* *__Calliandra__* *__calothyrsus__* *(Calliandra). Nine recipes were prepared by adding coconut (*__*Cocos*__ __*nusifera*__*) poonac, rice (*__*Oryza*__ __*sativa*__*) bran, salt and a preservative (Sodium Meta Bi Sulphite) in different proportions. These LM preparations were pressed into briquettes and stored for three months under room temperature. Complete Randomized Design (CRD) was used in this experiment. Two blocks were weighed and samples were analyzed for free fatty acid content (FFA) and Total Plate Count (TPC) each month to decide the length of storage period. Cost of production was calculated for each recipe. Data were statistically analyzed by repeated measure analysis using SPSS version 13 and means were separated by Duncan's Multiple Range test. Gliricidia and Leucaena leaf meals formed a tightly packed briquette when hydraulic pressure was applied compared to those prepared using Acacia and Calliandra. Further, Gliricidia leaf meal had the lowest ($P< 0.05$) FFA content while Leucaena had the highest ($p<.05$). Hence, Gliricidia leaf meal was selected as the best leaf meal. Gliricidia recipe 3 (Gliricidia leaf meal 75% + Coconut poonac 25%) and recipe 7 (Gliricidia leaf meal 75% + Rice bran 12.5% + Coconut poonac 12.5%) had the highest ether extract (EE) and crude fibre (CF) percentages and the lowest cost of production, which was Rs 30.00. Therefore, these two Gliricidia leaf meal recipes were selected as the best two recipes.*

## INTRODUCTION

Coconut triangle is a high potential area for rearing livestock. Recent government policies have also been designed to encourage expansion of livestock farming activities especially dairying under coconut (*Cocos nusifera*). Space available between palms provides the opportunity to grow pastures and fodders for the use of livestock. Young plantations below 5 years of age and mature plantations over 25 years of age are recommended for intercropping as palm to palm spacing is 8x8 m. Carrying capacity under improved pastures under coconut is two crossbred cows per ha (Liyanage, 1999).

Coconut triangle is also popular for production of agro-industrial by products such as, rice (*Oryza sativa*) bran, and coconut poonac as well as crop residues. The well organized milk collecting network and social environment (demand for meat) encourage coconut growers and farm families to undertake farming activities related to animal husbandry. Cattle and buffaloes are tethered to palms twice or thrice a day depending on the feed availability and

---

[1] Department of Animal Science, Faculty of Agriculture, University of Peradeniya, Peradeniya

[2] Coconut Research Institute, Lunuwila

allowed to graze the ground cover vegetation in the coconut land. They are paddocked at the coconut land or put in a shed during the night. Extensive and Semi intensive methods of management are commonly practiced. Therefore, the production is low as nutrients are barely enough to meet the maintenance requirement of the animal especially, during the dry season.

Considering the potential space availability under coconut, forage production can be increased. Quality and quantity of herbage fluctuate with the seasonal rainfall distribution (Serasinhe, 2008). During the dry season such as January to March and July to October feed becomes scarce. Therefore, during dry period it is important to use crop residues such as rice straw and agro-industrial by products like coconut poonac and rice bran/polish abundantly to maintain the level of production. Farmers use common properties such as scrub jungles, land reservations, tank bunds, tank beds, fallow paddy lands and road sides for grazing livestock (Ibrahim, 1999) in the coconut triangle.

Pasture and fodder production during the rainy season is comparatively high in the coconut triangle. Therefore, excess feed can be harvested and preserved for the dry season to maintain a uniform production throughout the year. Forage can be preserved in the form of leaf meals, hay, silage and feed blocks. Leguminous leaf meals are an alternative feed/protein source for livestock during dry seasons. Leaf meals can be pressed into blocks/briquettes with/without incorporating other concentrate feed ingredients such as coconut poonac, rice polish/bran and molasses so that keeping quality can be increased and a market value can be obtained. Information on fodder leaf meal blocks as an animal feed is not available under local conditions. Therefore, this research was carried out with an objective of developing a leguminous leaf meal block as an animal feed economically.

## MATERIALS AND METHODS

Experiments on preparation of leguminous leaf meal block were carried out at the Coconut Research Institute (CRI), Lunuwila. In addition, keeping quality as well as the cost of production of leguminous leaf meal blocks were determined.

### Experiment 1: Preparation of various types of leguminous leaf meal blocks as an animal feed.

Leaves and twigs of *Acacia mangium* (Acacia), *Gliricidia sepium* (Gliricidia), *Leucaena leucocephala* (Leucaena) *and Calliandra calothyrsus* (Calliandra) were collected, sun dried up to 20-30% moisture and ground to make leaf meals. The technology used to produce coir briquettes, a popular export industry available at the coconut triangle of Sri Lanka was adopted to produce the leguminous leaf meal blocks. It was a simple technology and required a hydraulic press.

Nine recipes (R) were prepared from each fodder legume. As shown in Table 1, leaf meal blocks were prepared with Acacia, Gliricidia, Leucaena and Calliandra using different feed ingredients such as coconut poonac or/and rice bran available in the coconut triangle or/and salt and a preservative (Sodium Meta Bi Sulphite) in different proportions. Design used was CRD with six replicates. Six blocks were prepared from each recipe so that 216 blocks were prepared from all legumes (4 legumes x 9 recipes x 6 blocks = 216 blocks).

**Table 1. Percentage of feed ingredients used to prepare recipes**

| Recipe / Ingredient (%) | R1 | R2 | R3 | R4 | R5 | R6 | R7 | R8 | R9 |
|---|---|---|---|---|---|---|---|---|---|
| Leaf meal [a] | 100 | 75 | 75 | 75 | 75 | 70 | 75 | 95 | 95 |
| Rice bran | - | 25 | - | 10 | 10 | 10 | 12.5 | - | - |
| Coconut Poonac | - | - | 25 | 10 | 10 | 10 | 12.5 | - | - |
| Preservative [b] | - | - | - | 5 | - | 5 | - | 5 | - |
| Salt | - | - | - | - | 5 | 5 | - | - | 5 |

[a] Leaf meals were prepared from 4 varieties of fodder, namely Acacia, Gliricidia, Leucaena and Calliandra (4 varieties x 9 recipes x 6 blocks)
[b] Sodium Meta Bisulphite

Recipe 1 (R1) represents 100% leaf meal whereas R2 to R7 represent different combinations of leaf meal, coconut poonac, rice bran, salt and preservative. Recipe 8 and 9 represent 95% leaf meal with 5% preservative and 5% salt, respectively. The relevant ingredients were measured and mixed well. A hydraulic press machine named "high compress burger" (model 'M 05') was used to prepare each leaf meal briquette/block of 500 g. This machine was operated by a hydraulic system with manual lever control. Each block was wrapped with polythene (gauge 300) and sealed using a gum tape. Then the recipe number, date and weight were marked and stored at room temperature.

In order to find out the shelf life of these blocks, samples from two blocks of each variety of leaf meal recipe were analyzed for free fatty acid (FFA) content (Pearson, 1973) and Total Plate Count (TPC) using Sri Lanka Standard guidelines. Blocks were carefully observed for any change in appearance, odour and colour. Leaf meal samples and feed ingredients were analyzed for dry matter, crude protein, crude fibre, either extract and ash content according to standard analytical procedures. Crude protein was determined using Micro Keljdhal method and other nutrients were determined using AOAC procedures (AOAC, 1995).

**Experiment 2: Cost of production of leguminous leaf meal blocks**

Cost of production was calculated to see the economic viability of these different blocks. Cost of all the inputs such as cost for labour, ingredients, packaging and electricity were considered in the calculations. Cost of labour for the collection and preparation of Acacia, Gliricidia and Calliandra leaf meals was Rs 20.00 per kg while it was Rs 30.00 per kg for Leucaena leaf meal.

**Analysis of data**

Data were statistically analyzed by repeated measure analysis in SPSS version 13 and means were separated by Duncan's Multiple Range test.

## RESULTS

**Experiment 1: Preparation of various types of leguminous leaf meal blocks as an animal feed.**

Nutritional composition of leaf meal recipes are given in Table 2. Crude protein (CP) content in Leucaena, Calliandra, Acacia and Gliricidia were 22, 13, 14 and 22% respectively while it was 21% in Coconut poonac and 6% in Rice bran. This low CP in Calliandra may be attributed to the low light conditions available under coconut. In general CP content of

Calliandra is 22% (Wiersum and Rika, 1992). According to Table 2, dry matter (DM) percentage and CP content (16-22%) were higher in the recipes prepared from Leucaena and Gliricidia compared to Calliandra and Acacia leaf meal recipes. Except in Acacia recipes ash content was more than 7% in all the other recipes indicating that these recipes were a good source of minerals. Fibre content of Acacia was very high (39%) compared to all the other legumes and this is in agreement with other workers (Ibrahim *et al*., 1987). Highest CP percentage was recorded in Recipe 1 (leaf meal only) compared to other recipes for Leucaena and Gliricidia. This may be related to the high CP in leaf meals compared to poonac and rice bran.

**Table 2. Nutrient composition (%) of leaf meal recipes**

| Variety / Recipe | *Leucaena leucocephala* | | | | | *Calliandra calothyrsus* | | | | | *Acacia mangium* | | | | | *Gliricidia sepium* | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Nutrient (%)** | | | | | | | | | | | | | | | | | | | |
| | **DM** | **CP** | **CF** | **EE** | **Ash** | **DM** | **CP** | **CF** | **EE** | **Ash** | **DM** | **CP** | **CF** | **EE** | **Ash** | **DM** | **CP** | **CF** | **EE** | **Ash** |
| R 1 | 98 | 22 | 26 | 7 | 7 | 93 | 13 | 25 | 10 | 8 | 94 | 14 | 39 | 10 | 6 | 93 | 22 | 26 | 9 | 8 |
| R 2 | 96 | 16 | 26 | 8 | 9 | 92 | 11 | 25 | 10 | 9 | 93 | 10 | 35 | 10 | 8 | 92 | 16 | 26 | 9 | 9 |
| R 3 | 96 | 21 | 22 | 8 | 7 | 92 | 15 | 21 | 10 | 7 | 93 | 16 | 32 | 10 | 6 | 92 | 21 | 22 | 9 | 7 |
| R 4 | 92 | 19 | 23 | 7 | 8 | 88 | 13 | 22 | 9 | 8 | 89 | 13 | 33 | 9 | 7 | 88 | 19 | 23 | 8 | 8 |
| R 5 | 92 | 19 | 23 | 7 | 8 | 88 | 13 | 22 | 9 | 8 | 89 | 13 | 33 | 9 | 7 | 88 | 19 | 23 | 8 | 8 |
| R 6 | 87 | 18 | 22 | 7 | 7 | 83 | 12 | 21 | 10 | 7 | 84 | 12 | 31 | 10 | 6 | 83 | 18 | 22 | 9 | 7 |
| R 7 | 96 | 20 | 24 | 8 | 8 | 92 | 13 | 23 | 10 | 8 | 93 | 14 | 34 | 10 | 7 | 92 | 20 | 24 | 9 | 8 |
| R 8 | 93 | 21 | 25 | 7 | 7 | 88 | 13 | 24 | 9 | 7 | 89 | 13 | 37 | 9 | 6 | 88 | 21 | 25 | 9 | 7 |
| R 9 | 93 | 21 | 25 | 7 | 7 | 88 | 13 | 24 | 9 | 7 | 89 | 13 | 37 | 9 | 6 | 88 | 21 | 25 | 9 | 7 |

DM-Dry Matter, CP-Crude Protein, CF-Crude Fiber, EE-Ether Extract.
Note: Average of 2 blocks

Table 3 presents the FFA content of blocks after 3 months of storage. According to Table 3, FFA content was less than 5% in recipes R2 and R1 (Leuceana), R2 and R7 (Calliandra), R3 (Acasia) and, R3 & R7 (Gliricidia). Three Leucaena recipes namely, R5, R3 and R4 as well as Acacia recipe R4 had a FFA content of more than 30%. Recipes with higher initial EE (R3 and R7) had a lower FFA content after 3 months (Table 3). This may be related to the fatty acid composition of leaf meals and level of rancidity in different leaf meals.

**Table 3. Mean Free Fatty Acid content of recipes for each legume after 3 months of storage#**

| Variety / Recipe | Leucaena | Calliandra | Acacia | Gliricidia |
|---|---|---|---|---|
| | **Mean FFA values (%)** | | | |
| R 1 | $3.1^{h}$ | $5.2^{d}$ | $10.7^{c}$ | $7.5^{b}$ |
| R 2 | $2.7^{h}$ | $3.4^{e}$ | $7.5^{d}$ | $8.2^{b}$ |
| R 3 | $34.9^{b}$ | $5.4^{d}$ | $4.5^{e}$ | $4.5^{c}$ |
| R 4 | $78.3^{a}$ | $17.4^{a}$ | $37.1^{a}$ | $18.5^{a}$ |
| R 5 | $30.2^{c}$ | $5.5^{d}$ | $11.6^{c}$ | $11.0^{b}$ |
| R 6 | $24.0^{d}$ | $18.9^{a}$ | $28.4^{b}$ | $19.9^{a}$ |
| R 7 | $18.8^{e}$ | $4.7^{d}$ | $7.7^{d}$ | $4.9^{c}$ |
| R 8 | $10.6^{g}$ | $14.1^{b}$ | $12.0^{c}$ | $12.2^{b}$ |
| R 9 | $13.4^{f}$ | $8.6^{c}$ | $8.4^{d}$ | $9.5^{b}$ |

*Means having different superscripts within the same column differ significantly ($p<0.05$).
[#] Average of 2 blocks

FFA is a measurement of rancidity and the level of rancidity may vary according to the heat, light and the presence of moisture or traces of metals such as copper and iron (Pearson, 1973). FFA content was calculated as oleic acid in this study. The Maximum limits of edibility vary according to the type of oil but a critical limit of 1% could be taken as a general guide for human food (Pearson, 1973). Five percent of FFA was considered as the critical FFA level of animal feeds in this study. Table 4 presents the mean free fatty acid (FFA) content of the four types of leaf meals.

**Table 4. Mean free fatty acid content of leaf meals[#]**

| Leaf Meal | FFA, % |
|---|---|
| Leucaena | 27.71 [a] |
| Calliandra | 18.22 [b] |
| Acacia | 14.79 [c] |
| Gliricidia | 10.83 [d] |
| Standard Error | 0.116 |

*Means having different superscripts within the same column differ significantly ($p<0.05$).
#Average of 54 blocks

According to Table 4, Gliricidia leaf meal had the lowest ($P<0.05$) FFA content compared to the other three types of leaf meals whereas Leucaena leaf meal had the highest ($p<0.05$) value. The value of FFA in Leucaena leaf meal was approximately 3 times higher than that of Gliricidia leaf meal. Keeping quality was reduced when the FFA content of feed is high. However, with proper packaging and controlling the storage temperature, decomposing rate of oil could be decreased.

Total plate counts of blocks after 3 months of storage are presented in Table 5. No significant differences in TPC were found between Leucaena and Calliandra recipes. None of these blocks were exposed to light and temperature which are favorable conditions required for microbial growth. However, R7 recipe (75% Acacia + 12.5% rice bran + 12.5% coconut poonac) reported a significantly high TPC value ($p<0.05$) compared to other Acacia recipes. Similar pattern of TPC was observed with R3 (75% Gliricidia + 25% coconut poonac) compared to other Gliricidia recipes. TPC of Coconut poonac and rice bran were $1.6x10^5$ and $0.4x10^4$, respectively in this study. Recipes 4, 8 and 9 of all leaf meals included the preservative Sodium Meta Bi Sulphite though there was no difference ($p<0.05$) in the level of TPC between recipes for any of the leaf meals except in Acacia leaf meal recipes 4 and 7.

**Table 5. Total plate count of recipes for each legume after 3 months of storage [#]**

| LM / Recipe | Leucaena | Calliandra | Acacia | Gliricidia |
|---|---|---|---|---|
| | Mean TPC (no) | | | |
| R 1 | $6.0x10^4$ [b] | $5.6 x10^4$ [a] | $4.8 x10^4$ [b] | $1.8 x10^5$ [b] |
| R 2 | $2.4x10^5$ [a] | $7.1 x10^4$ [a] | $1.0 x10^5$ [a] | $1.4 x10^5$ [b] |
| R 3 | $6.5x10^4$ [b] | $1.3 x10^4$ [a] | $9.8 x10^4$ [a] | $8.5 x10^5$ [a] |
| R 4 | $8.6x10^4$ [a] | $1.2 x10^4$ [a] | $1.5 x10^4$ [b] | $3.4 x10^5$ [b] |
| R 5 | $1.3x10^4$ [b] | $3.4 x10^4$ [a] | $2.4 x10^4$ [b] | $2.0 x10^5$ [b] |
| R 6 | $1.5x10^4$ [b] | $3.0 x10^4$ [a] | $2.2 x10^4$ [b] | $3.8 x10^4$ [b] |
| R 7 | $1.0x10^5$ [a] | $5.6 x10^4$ [a] | $5.5 x10^5$ [a] | $2.7 x10^5$ [b] |
| R 8 | $1.3x10^4$ [b] | $5.7 x10^4$ [a] | $3.0 x10^4$ [b] | $8.3 x10^4$ [b] |
| R 9 | $0.9x10^4$ [b] | $1.2 x10^4$ [a] | $1.0 x10^4$ [c] | $3.9 x10^5$ [b] |

*Means having different superscripts within the same column differ significantly ($p<0.05$).
[#] Average of 2 blocks

According to Table 6, lowest ($p<0.05$) mean TPC was recorded in Acacia species, followed by Leucaena and Calliandra recipes. The highest ($p<0.05$) was recorded in Gliricidia recipes. This may be due to the higher microbial contamination with Gliricidia leaf meal than that with the other three varieties in the field. Further more, Ahn (1989) and Ahn *et al.*(1990) reported that drying removes all extractable tannins from Gliricidia. Therefore, it may have reduced the anti nutritive factors present in Gliricidia leaves and must have increased the microbial growth in Gliricidia. However, when blocks were carefully observed for any changes in odour, colour and dampness during the storage of 3 months, none were detected in any of the leaf meal blocks especially in the blocks prepared from Gliricidia leaf meal recipes.

.

**Table 6. Mean and Log 10 values of Total Plate Count of the leaf meal recipes**

| LM | Mean | Log10 |
|---|---|---|
| Leucaena | 321,978.06 [b] | 5.508 |
| Calliandra | 487,626.19 [b] | 5.688 |
| Acacia | 237,710.43 [b] | 5.376 |
| Gliricidia | 847,516.93 [a] | 5.928 |
| Standard Error | 70474.86 | 4.848 |

*Means having different superscripts within the same column differ significantly ($p<0.05$).

**Mean weight of leaf meal blocks**

Mean weight of Leucaena, Calliandra, Acacia and Gliricidia leaf meal blocks were 495, 498, 496 and 496 g, respectively. Mean weight of blocks for different varieties of legumes were not significantly different ($p<0.05$) from each other.

Table 7 and 8 present the estimated cost of production of Acacia/ Gliricidia/ Calliandra and, Leucaena leaf meal blocks, respectively.

**Table 7. Estimated Cost of production of Acacia/ Gliricidia/ Calliandra leaf meal blocks (Rs)**

| Recipe | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|
| Cost of Ingredients per block + labour | 20.00 | 21.25 | 20.00 | 28.50 | 22.50 | 30.50 | 20.63 | 28.00 | 22.00 |
| Cost for Tape and Polythene per block | 9.43 | 9.43 | 9.43 | 9.43 | 9.43 | 9.43 | 9.43 | 9.43 | 9.43 |
| Total Cost | 29.43 | 30.68 | 29.43 | 37.93 | 31.93 | 39.93 | 30.06 | 37.43 | 31.43 |

**Table 8. Estimated Cost of production for Leucaena leaf meal recipes (Rs)**

| Recipe | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|
| Cost of Ingredients per block + labour | 30.00 | 28.75 | 27.50 | 36.00 | 30.00 | 37.50 | 27.50 | 37.50 | 31.50 |
| Cost for Tape and Polythene per block | 9.43 | 9.43 | 9.43 | 9.43 | 9.43 | 9.43 | 9.43 | 9.43 | 9.43 |
| Total Cost | 39.43 | 38.18 | 36.93 | 45.43 | 39.43 | 46.93 | 36.93 | 46.93 | 40.93 |

Cost of production of recipes was calculated using cost for labour, ingredients and packaging. In order to prepare one kg of dried leaf meal 5 kg of fresh leaves and twigs were required from Acacia, Gliricidia and Calliandra (ratio 1:5). Therefore, cost of labour for the collection and preparation of these leaf meals were Rs 20.00 per kg (Table 7). However, to prepare one kg of dried leaf meal, 10 kg of Leucaena fresh leaves and twigs were required (ratio 1:10) and the cost of labour was Rs 30.00 per kg (Table 8). Least cost of production was recorded for Acacia/ Gliricidia/ Calliandra leaf meal recipes 1, 3 and 7, respectively (Table 7).

**Selection of the best recipe**

Selection of recipes was done using several factors such as availability of leaves, briquette making ability of leaf meals, ratio of fresh leaves and twigs to dried leaf, nutritional composition, cost of production and FFA content. Acacia and Calliandra were the least suitable leaves to make briquettes as they did not form tightly packed briquettes when hydraulic pressure was applied. Dried Gliricidia and Leucaena leaves and twigs could be pressed even without grinding into particles. Therefore, Gliricidia and Leucaena leaf meal were comparatively more suitable for making leaf meal briquettes. Furthermore, according to Table 2, dry matter (DM) percentage and CP content (16-22%) were also higher in the recipes prepared from Leucaena and Gliricidia compared to Calliandra and Acacia leaf meal recipes. In those recipes ash content was also more than 7%.

However, in order to prepare one kg of leaf meal, ratio of fresh leaves and twigs to dried leaf was 5:1 for Gliricidia and 10:1 for Leucaena. Price of Leucaena briquettes was therefore, higher due to the high requirement of fresh leaves to produce a kilogram of dried leaves. Hence, Gliricidia was selected as the best legume to prepare briquettes in the coconut triangle of Sri Lanka. Furthermore, when FFA content of briquettes were considered, Gliricidia had the least mean FFA content ($p<0.05$) (Table 5) compared to other recipes. Therefore, Gliricidia leaf meal recipe briquettes especially Gliricidia leaf meal recipes 3 (75% Gliricidia + 25% coconut poonac) and 7 (75% Gliricidia + 12.5% coconut poonac + 12.5% rice bran) could be selected since those can be stored for more than 3 months. According to Table 7, total cost of production of a kg of Gliricidia leaf meal briquette from recipe 3 or 7 was Rs 30.00. Hence, considering the above views and factors, Gliricidia leaf meal recipes 3 and 7 were selected as the best two recipes for the feeding trial.

## DISCUSSION

Forage production is seasonal in the coconut triangle of Sri Lanka but the requirement of forage/feed by animals is somewhat uniform throughout the year. The protein present in leguminous fodder trees consists of both soluble and insoluble components. Legumes are also an important source of minerals such as sulfur, copper and iron (Dixon *et al.*, 1987). Cultivation of Leguminous fodder trees (Nitrogen fixing trees) in coconut lands helps to enhance the fertilizer status in soil, reduce soil erosion and rehabilitate soil in marginal coconut lands. Gliricidia is considered as the fourth plantation crop which can be easily propagated and established in the field. It can be grown in different soil and weather conditions and frequently used as an intercrop in coconut lands. It withstands periodical pruning and branches and leaves are used as a fodder and a source of mulch (Premaratne, 1993 and 1995). The wood is used to generate electricity. Gliricidia produces more biomass than other leguminous species such as *Calliandra calothyrsus* and *Leucaena leucocephala* (Liyanage *et al*., 1993).

Therefore, preservation of forage can be done in the area when the Gliricidia forage is in excess. Preparation of blocks during the excess period could increase the feed availability to animals during the dry season as well as be a source of income. When, the leaf meal recipes are prepared, the farmer himself could make these feed blocks at farmer household level as the hydraulic press machine could be easily operated by single phase electricity. The model of the machine used in the present study was not too large therefore, it can be kept at normal room environment and does not generate much noise when in operation. These blocks could be fed to cattle and small ruminants like sheep and goats as a strategic supplement of protein especially during the dry season. The blocks can be produced using under utilized-feed ingredients available in the coconut triangle. Feed blocks such as leaf meal blocks and urea molasses blocks as protein supplements would improve the nutritive value of the low quality diets and there by increase the performance of the animal (Technical Advisory Notes, IFAD, 1999).

The advantage of the leaf meal block is that it could be stored for an extended time period as it is tightly pressed and properly packed with polythene. If the gauge of the polythene is less, damage during storage could be high. Black colour polythene is better than the transparent polythene because the photo radiation of leaf meals could be avoided. Gum tape was used to seal the blocks in this experiment. But keeping quality could be improved if a mechanical sealer is used. A feeding trial using milking cows was conducted to decide the effect of these blocks on milk yield and weight gain of cows. The data is to be analyzed in due course.

## CONCLUSION

Gliricidia leaf meal recipes 3 (75% Gliricidia + 25% coconut poonac) and 7 (75% Gliricidia + 12.5% coconut poonac + 12.5% rice bran) were the best two recipes with respect to pressing ability, free fatty acid content, cost per leaf meal block and requirement of unit of fresh leaves for the preparation of a unit of dried leaf meal.

## ACKNOWLEDGEMENTS

Authors wish to express their sincere thanks to Director, Post Graduate Institute of Agriculture, Director, Deputy Director (Research) and Deputy Director (Administration and Finance), Coconut Research Institute (CRI), for their assistance during the study. Special thanks are extended to Superintendent and estate staff of Rathmalagara estate, CRI for the support given during the feed meal preparation period. Authors are grateful to Head and staff of Soils & Plant Nutrition Division, Coconut Processing & Research Division of CRI and Head & Staff of Department of Animal Science, Faculty of Agriculture, University of Peradeniya for providing facilities to analyze the samples. They also express their thanks to Biometrician, CRI for the support given during statistical analysis. The authors sincerely appreciate the support given by Head and staff of Agronomy Division, CRI. Appreciation is expressed to the National Science Foundation for funding the Research Project.

## REFERENCES

Ahn, J.H. (1990). Quality assessment of tropical browse legumes: Tannin content and nitrogen degradability. PhD thesis, The University of Queensland

Ahn, J.H., Robertson, B.M., Elliott, R., Gutteridge, R.C. and Ford, C.W (1989). Quality assessment of tropical browse legumes: Tannin content and protein degradation. Ani. Feed Sci. and Technol. 147-156 pp.

AOAC (1995). Official Methods of Analysis, 16$^{th}$ Ed, Association of Analytical Chemists, Washington, USA.

Dixon, R.M. and Egan, A. R. (1987). Strategies for utilizing fibrous crop residues as animal feed; Paper presented at the 7$^{th}$ AAFARR Workshop, Chiang Mai, Thailand.

Ibrahim M.N.M., Ketelaar, R.S., Tamminga, S., Zemmelink, G. and Meer, van der J., (1987). Nutritive value of commonly available ruminant feeds in Sri Lanka. Institute for Livestock Feeding and Nutrition Research, Lelystad, The Netherlands, Report no 181. 34

Ibrahim M.N.M and T.N. Jayatileka (1999) Livestock Production under Coconut Plantations in Sri Lanka – Cattle and Buffalo Production systems. Asian-Aust. J. Ani. Sci. 1999. **13**(1):.

Liyanage, M.de.S. (1999); A guide to scientific cultivation and management of coconut, Coconut Research Institute of Sri Lanka, Bandirippuwa Estate, Lunuwila (Sri Lanka). ISBN 955- 96945-0-2

Liyanage, M.de.S, Bastian, M and Wijeratne, A.M.U. (1993). Performance of four multipurpose tree species under coconut plantations in Sri Lanka. Multipurpose tree species in Sri Lanka - Research and Development, Proceedings, fourth regional workshop on multipurpose trees, Kandy, Sri Lanka.

Pearson, D. (1973). Laboratory Techniques in Food Analysis. Butterworth & Co Ltd. London, UK. Pp. 124-125.

Premaratne, S. (1993). Role of tree fodders in livestock feeding. Proc. Forth Regional Workshop on Multipurpose Tree species in Sri Lanka. Sri Lanka. 77-79

Premaratne, S. (1995). Importance of fodder as a feed supplement to goats. Seventh National Workshop on Multipurpose Trees, National Research Net Work on Multipurpose Trees. Sri Lanka. 183-187

Serasinhe, T. (2008). Feeding Dairy Animals for a higher milk production. Economic Review. Aug/Sep/2008. Research Department, People’s Bank, Head Office, Colombo, Sri Lanka.

Technical Advisory Notes (1999): IFAD, Agricultural Technologies for Rural Poverty Alleviation. Feed blocks. International Fund for Agricultural Development (IFAD) Via Paola di Dono, 44, 00142, Rome, Italy.

Wiersum, K.F. and Rika, I.K. (1992.) *Calliandra calothyrsus* Meissn. In: Westphal, E and Jansen, P.C.M. (Eds), Plant Resources of Southeast Asia: 4 Forages. Wageningen, Netherlands, pp 68-70