# NUTRITIVEVALUES OF FORAGESAVAILABLEAROUND THE EASTERNUNIVERSITY PREMISES

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**ABSTRACT**

A study was conducted to find out the nutrient content of available forages around the premises of Eastern University Sri Lanka. The forages used for this analysis were fodder grasses, pasture grasses, pasture legumes, leguminous tree fodder, non-leguminous tree fodder and crop residues. The collected forage samples were subjected to proximate analysis to find out the nutrient content namely Crude Protein, Crude Fibre, Ether Extract, Ash and Nitrogen Free Extract (NFE) and the Van Soest analysis of fibre components such as Neutral Detergent Fibre (NDF), Acid Detergent Fibre (ADF) and Acid Detergent Lignin (ADL).

The available fodder grasses (*Penesetum purpureum*, CO3 and *Panicum maximum),* pasture grass *(Bracharia brizantha),* pasture legumes (*Centrosema pubescens and Stylosanthes guianensis),* and fodder legumes *(Leucaena leucocephala*, *Gliricidia sepium* and *Erithrina indica)* were used for this study. Non-leguminous tree fodders (*Mangifera indica*, *Psidium guajava*, *Artocarpus tetraphyllus* and *Ficus benghalensis) and* certain crop residues derived from *Oryza sativa*, *Manihot esculetum*, *Glycine max*, *Zea mays*, *Vigna unguiculata* and *Ricinus communis* were also used for this analysis.

The analysis revealed that the non-leguminous tree fodder has the highest mean dry matter content (46.8%) and ADL content (16.8%) than other forages. The highest mean value of ash content (26.7%), Ether extract (4.9%) and Crude protein content (18.9%) were found in the leguminous tree fodder compared to others. The mean value of NDF was high (73.4 %) in pasture grasses whereas the ADF was found high (42.9%) in fodder grasses. The samples were deficient in ash, crude protein, NDF and ADF. Crude Fat content was very low in almost all the forages.

**Keywords:** Forages, Proximate analysis and Van Soest forage analysis



## INTRODUCTION

Ruminants and to a lesser extent non-ruminants are able to use forage (grasses, legumes and tree fodder) as a source of both energy and protein. Forage will also provide some minerals and vitamins, although the amounts and types of the vitamins and minerals provided vary widely between different species of forage. Ruminant animals are able to meet all of their feed requirementsfrom forage provided there is enough available of a sufficiently varied type. The problem is that forage resources are usually insufficient to meet all of the animals' needs and there will almost certainly be some times of the year when forage supply cannot meet requirements.

It is important to work for the development of these livestock species as they alone contribute 3.3% of the total agricultural gross domestic products (AGDP) (Central bank, 2007). But the animal industry is suffering from many problems which are responsible to hinder the productivity and production level in Sri Lankan farming system. The feed cost accounts 60% to 75% of the total cost. It is imperative to supply adequate forage in diet, in terms of nutrient content. The use of nutrient rich forages and agriculture productsmay helpto overcome thislimitation (Alexander, 1972) such as supplies of fodder grass, legumes, tree leaves and crop residues.

Production of high quality nutritional forages (fodder grass, legumes, tree leaves and crop residues) has a considerable impact on livestock production. Proper analysis of nutrient is essential to determine the feed quality of livestock. The major nutrients are Crude protein, Crude fibre, Neutral detergent fraction, Acid detergent fraction, crude fat, minerals and energy.

Therefore, study of nutrient content of forage such as fodder grass, legumes, tree leaves and crop residues are very help for livestock rearing. The main objective

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of this study was to evaluate nutrient content of forages in order to evaluate feed quality in the study area.

## MATERIALS AND METHODS

### Sample collection

The forage samples such as pasture grass, fodder grass, pasture legume, tree legumes, non leguminous tree and crop residues were collected around the University premises. The aerial parts of plants were clipped at different height of forage including leaves, buds and twigs. About 100 g fresh forage samples were collected from each of sample species for chemical analysis. Collection of fresh forage samples were wiped to remove any visible surface contaminants like pest eggs, bird dropping, dust, soil deposit and dry weight of forage was measured.

### Sample analysis

The collected forage samples were dried and ground using laboratory grinder. The ground samples were labeled and packed using polyethylene bags for analysis. The forage samples were analyzed using standard procedure (AOAC, 2000). Moisture content, crude protein, crude fibre, crude fat and ash were analyzed. The fibre component like ADF, NDF, and ADL were determined by Van Soest (1982) method.

### Data analysis

The data were statistically analyzed using Ms-excel spread sheet and SPSS (statistical package for social science version 11.0), software package. Statistical means were compared with standard values.

## RESULTS AND DISCUSSION

### Forage Distribution

Species of identified forage sample are given in the Table 1. The forage is categorized on the basis of feeding practices of animals. Fodder is used as cut and fed whereas pasture is used for grazing (Willoughby, 1970). The crop residues could be used as fodders or pastures.

### Nutrient Content of Forages

Proximate compositions of the forages and individual forage species (crude protein, crude fat/Ether extract, crude fibre, ash and nitrogen free extract) are given in Table 2 and Table 3.

**Table 1: Forage species in the study area**

| Forage type | Forage species (scientific name) | Common name |
|---|---|---|
| **Fodder grass** | *Pennisetum purpureum* | Napier grass |
| | *CO-3* | Hybrid Napier |
| | *Panicum maximum* | Guinea grass |
| **Pasture grass** | *Brachiaria brizantha* | Signal grass |
| **Pasture legumes** | *Centrosema pubescens* | Centro |
| | *Stylosanthes guianensis* | Stylo |
| **Leguminous tree** | *Laucaena leucocephala* | Ipil-Ipil |
| | *Gliricidia sepium* | Gliricidia |
| | *Erithrina indica* | Mulmurunga |
| **Non leguminous tree** | *Mangifera indica* | Mango |
| | *Azadirachta indica* | Neem |
| | *Psidum guajava L* | Guava |
| | *Artocarpus tetraphyllus* | Jack |
| | *Ficus benghalensis* | Banyan tree |
| **Crop residues** | *Oriza sativa* | Paddy |
| | *Manihot esculent* | Cassava |
| | *Glycin max* | Soybean |
| | *Zea mays* | Maize |
| | *Vigna ungiculata* | Cowpea |
| | *Ricinus communis* | Castor bean |

**Table 2: Proximate composition of the identified forages (% Average mean values)**

| Forage samples | DM | CP | CF | EE | Ash | NFE |
|---|---|---|---|---|---|---|
| Fodder grasses | 19.6 | 8.6 | 27.0 | 2.3 | 10.3 | 51.8 |
| Pasture grass | 25.1 | 7.5 | 33.1 | 1.0 | 16.6 | 41.9 |
| Pasture legumes | 22.4 | 15.6 | 16.6 | 2.6 | 6.4 | 58.8 |
| Non-leguminous tree fodder | 46.8 | 10.8 | 23.5 | 3.0 | 9.1 | 53.6 |
| Leguminous tree fodder | 26.9 | 18.9 | 21.6 | 4.9 | 26.8 | 27.9 |
| Crop residues | 32.2 | 10.4 | 23.2 | 3.2 | 7.2 | 56.0 |

**Table 3: Proximate composition of the individual forage species**

| Forage Samples | DM | CP | CF | EE | Ash | NFE% |
|---|---|---|---|---|---|---|
| Fodder grasses | | | | | | |
| *Pennisetum purpureum* | 17.79 | 4.47 | 30.09 | 2.0 | 6.19 | 57.25 |
| *CO-3* | 15.90 | 12.59 | 21.10 | 3.20 | 13.40 | 49.71 |
| *Panicum maximum* | 25.0 | 8.80 | 29.90 | 1.60 | 11.20 | 48.50 |
| **Mean value** | 19.60 | 8.62 | 27.03 | 2.27 | 10.27 | 51.82 |
| Pasture grass | | | | | | |
| *Brachiaria brizantha* | 25.10 | 7.46 | 33.10 | 1.0 | 16.60 | 41.87 |
| Pasture legumes | | | | | | |
| *Stylosanthes guianensis* | 21.45 | 11.05 | 26.80 | 2.10 | 5.10 | 54.95 |
| *Centrosema pubescens* | 23.25 | 20.15 | 6.43 | 3.0 | 7.74 | 62.68 |
| **Mean value** | 22.35 | 15.60 | 16.60 | 2.55 | 6.42 | 58.81 |
| Nonleguminous tree fodder | | | | | | |
| *Ficus benghalensis* | 30.90 | 8.70 | 32.30 | 3.40 | 8.60 | 47.0 |
| *Artocarpus tetraphyllus* | 31.40 | 13.80 | 20.10 | 3.70 | 10.60 | 51.80 |
| *Psidum guajava.L* | 94.0 | 14.0 | 22.80 | 3.0 | 7.70 | 52.50 |
| *Azadirachta indica* | 32.49 | 7.10 | 14.0 | 2.0 | 10.29 | 66.61 |
| *Mangifera indica* | 45.20 | 10.30 | 28.50 | 2.70 | 8.40 | 50.10 |
| **Mean value** | 46.80 | 10.78 | 23.54 | 2.96 | 9.12 | 53.60 |
| Leguminous tree fodder | | | | | | |
| *Laucaena leucocephala* | 22.0 | 10.30 | 14.90 | 4.50 | 60.0 | 10.30 |
| *Gliricidia sepium* | 34.50 | 20.69 | 23.08 | 4.95 | 7.69 | 43.59 |
| *Erithrina indica* | 24.08 | 25.70 | 26.70 | 5.30 | 12.6 | 29.70 |
| **Mean value** | 26.86 | 18.90 | 21.56 | 4.90 | 26.76 | 27.86 |
| Crop residues | | | | | | |
| *Oriza sativa* | 80.25 | 2.46 | 10.60 | 2.80 | 5.92 | 78.22 |
| *Zea mays* | 13.0 | 7.70 | 46.20 | 0.80 | 8.50 | 36.80 |
| *Glycin max* | 21.60 | 11.30 | 35.40 | 3.50 | 8.40 | 41.40 |
| *Manihot esculentum* | 27.30 | 15.20 | 15.20 | 7.60 | 7.60 | 54.40 |
| *Vigna unguiculata* | 18.20 | 12.80 | 21.40 | 2.20 | 7.10 | 56.50 |
| *Ricinus communis* | 33.0 | 12.80 | 10.30 | 2.10 | 5.80 | 69.0 |
| **Mean value** | 32.20 | 10.37 | 23.18 | 3.16 | 7.22 | 56.0 |

**Dry Matter of forage**

The dry matter (DM) of a feed contains all the nutrients of importance in livestock nutrition. Once the feed dry matter content is known, the amount of feed (as fed) to be offered to the animals can be calculated.

The mean values of forage DM% content range from 19.6 to 46.8% among the collected forage samples. The mean value of dry matter content was highest (46.8%) in non leguminous tree fodder and lowest (19.6%) in fodder grass (Table 2). The variation of dry matter content in forage is due to several factors such as species of the forage, altitude, soil condition, stage of maturity etc. This is supported by Abou – Ashour et al., ( 1984), and Willoughby (1970). Among the non leguminous tree fodders, Psidum guajava L has recorded the highest and Ficus benghalensis has recorded the lowest values.

**Ash content**

It is measured by the mass difference after dehydration, and solids or ash is recorded as the material remaining after the removal of all material at high temperature combustion in a furnace (at 500 ºC). Ash is the source of minerals, which is required for the ruminant. For example, calcium is needed during early stage of lactation. This may give some impression that less organic matter is available for digestion in the rumen when they are fed as the basal forage to the ruminants. But total ash may also be available for body function if it is high in digestibility. Generally, the total ash content of the fodder tree was high (Vargas and Elvira, 1987). From the study, ash content ranges from 6.42 to 26.76 %. The mean value of ash content was highest (26.76%) in leguminous tree fodders and lowest (6.42%) in pasture legumes. (Table 2).

**Protein content of forage**

Crude protein (CP) is a measure of the nitrogen in the forage. The CP is used by rumen bacteria in digesting forage and concentrates in the diet. The total protein content of a feed sample is estimated as total nitrogen (Kjeldahl method) after digestion, salt neutralization and titration of the ammonia released against standard acid. Crude protein in the forage is less soluble and more resistant to microbial degradation in the rumen (Pandy, 2005).

The mean value of forage CP% content ranges from 7.5 to 18.9%. The mean value of CP content was highest (18.9%) in leguminous tree fodder and lowest (7.46%) in pasture grass (Table 3). Crude Protein content of tree forages is higher than fodder grasses and leguminous forage (Table 3). Mean value of CP content of non leguminous tree fodder was almost similar with that of crop residues (Gowan, 1972 and Hafley etal.,1985).

**Fibre component of forage samples**

The amount of fiber which can be degraded by rumen bacteria is inversely related to the amount of lignin in forage. Digestibility of fiber decreases with increasing lignin content. Therefore, reducing the amount of lignin in forage maximizes its digestibility. Fibre composition of forages is given in Table 4.

**Neutral Detergent Fiber content**

Neutral Detergent Fiber (NDF) is a measure of total cell wall. Neutral detergent fiber (NDF) is related to voluntary intake of the feed for ruminant animal. Higher NDF content in the feedstuff is related to lower digestibility (Pandy, 1991). More than 30% NDF is considered to be lower in feed quality (Pande, 1997). The mean value of forage NDF content ranges from 29.7% to 73.4%. The mean value of NDF content was highest (73.4%) in pasture grass. and lowest (29.7%) in leguminous tree fodder. (Table 4).

**Acid Detergent Fiber content**

Acid detergent fiber (ADF) is highly related to digestibility of feedstuff in the animal. Higher ADF content in the feedstuff is related to lower digestibility. Feed consisting more than 45% ADF is considered as low quality feed. The mean value of forage ADF content ranges from 21 to 42.9%. The mean value of ADF content was highest (42.9%) in Fodder grass and lowest (21%) in leguminous tree fodder (Table 4). According to Table 4, the mean value of ADF content of pasture grass was almost similar with that of crop residues and the mean value of ADF content of fodder grass was almost similar with that of pasture legumes. The finding is supported by Alexander (1972).

**Acid Detergent Lignin content**

Lignin is the primary factor causing a decline in digestibility of plant cells with maturity. It reduces the digestibility of the cell wall carbohydrate (hemicelluloses and cellulose). From the study the mean value of forage ADL content range from 4.2 to 16.8%. The mean value of ADL content was highest

**Table 4: Fibre composition of different forages (%)**

| Forage Samples | NDF | ADF | ADL |
|---|---|---|---|
| Fodder grasses | | | |
| *Pennisetum purpureum* | 53.86 | 34.31 | 6.39 |
| *CO-3* | 78.44 | 47.19 | 15.71 |
| *Panicum maximum* | 68.1 | 47.2 | 1.8 |
| **Mean value** | 66.8 | 42.9 | 7.96 |
| Pasture grass | | | |
| *Brachiaria brizantha* | 73.41 | 41.25 | 4.28 |
| **Mean value** | 73.41 | 41.25 | 4.28 |
| Pasture legumes | | | |
| *Stylosanthes guianensis* | 47.1 | 39.72 | 6.6 |
| *Centrosema pubescens* | 53.3 | 45.2 | 17.62 |
| **Mean value** | 50.2 | 42.46 | 12.11 |
| Nonleguminous tree fodder | | | |
| *Ficus benghalensis* | 54.8 | 40.2 | 15.4 |
| *Artocarpus tetraphyllus* | 43.9 | 31.8 | 12.3 |
| *Psidum guajava L* | 55 | 32.6 | 14.2 |
| *Azadirachta indica* | 33.93 | 30.36 | 29.92 |
| *Mangifera indica* | 39.3 | 38.2 | 12.3 |
| **Mean value** | 45.38 | 34.63 | 16.82 |
| Leguminous tree fodder | | | |
| *Laucaena leucocephala* | 16.87 | 12.75 | 5.01 |
| *Gliricidia sepium* | 34.99 | 21.02 | 2.43 |
| *Erithrina indica* | 37.12 | 29.48 | 5.1 |
| **Mean value** | 29.66 | 21 | 4.18 |
| Crop residues | | | |
| *Oriza sativa* | 42.31 | 30.92 | 2.56 |
| *Zea mays* | 77.8 | 65.78 | 6.39 |
| *Glycinmax* | 57.69 | 50.54 | 15.24 |
| *Manihot esculent* | 39.6 | 25.9 | 8.9 |
| *Vigna ungiculata* | 64.54 | 55.19 | 2.04 |
| *Ricinus communis* | 67 | 23 | 17.2 |
| **Mean value** | 58.16 | 41.89 | 8.72 |

(16.8%) in non leguminous tree fodder and lowest (4.%) in leguminous tree fodder (Table 4). According to Table 4, mean value of the ADL content of pasture grass was almost similar with that of leguminous tree fodder.

## CONCLUSION

The analysis revealed that the non-leguminous tree fodder has the highest mean dry matter content (46.8%) and ADL content (16.8%) than other forages. The highest mean value of ash content (26.7%), Ether extract (4.9%) and Crude protein content (18.9%) were found in the leguminous tree fodder compared to others. The mean value of NDF was high (73.4 %) in pasture grasses whereas the ADF was found high (42.9%) in fodder grasses. The samples were deficient in ash, crude protein, NDF and ADF. Crude Fat content was very low in almost all the forages.

## RERFERENCES


Abou-Ashour, Abou-Akada, A.R., Youssef, A.M., Abou-Raya, A.K. Hathout, M.K., El-Ashry, M.A., Abdul Aziz, A.S., Makky, A.M. and Kassem, M.H. (1984) Policy for Development of feed resource until the year 2000.

Alexander, G.I (1972) Non protein nitrogen supplement for grazing animals in Australia. pp 11-14

Annual report, (2002). *Livestock breeding project (LBP), Ministry of Agriculture & livestock, Sri Lanka*

AOAC (2000), Official method of analysis, Association of official analytical chemist, Washington, USA Annual report, (2007). *Central Bank of Sri Lanka*

Pande, R.S. (1997). Fodder & Pasture Development

Pandy, S.B. and C. R. Upreti. (1991). Nutritional status of different feed resources. Sm

Panday, S.B. and C. R. Upreti. (2005). Nutritional status of different feed resources.

Van Soest, P.J. Metens, D.R. and Deinum, B. (1978) Preharvest factors influencing quality Of conserved forages

Willoughby, W.M. (1970). Grass land management: R.M. Moore (Editor), Australlian, Grasslands, Canberra pp.392-400.