International Journal of Science, Environment and Technology, Vol. 5, No 4, 2016, 2290 – 2295

ISSN 2278-3687 (O)
2277-663X (P)

BIOMASS YIELD AND CHEMICAL COMPOSITION OF *CALLIANDRA CALOTHYRSUS, DESMANTHUS VIRGATUS* AND *STYLOSANTHES HAMATA*

G. Jayaprakash*[1], K. Shyama[2], P. Gangadevi[3], K. Ally[4], K.S. Anil[3], Asha K. Raj[5], M. Sathiyabarathi[6] and M. Arokia Robert[1]

[1]Research Scholar, College of Veterinary and Animal Sciences, Mannuthy, Thrissur
[2]Assistant Professor, College of Veterinary and Animal Sciences, Mannuthy, Thrissur
[3]Professor and Head, College of Veterinary and Animal Sciences, Mannuthy, Thrissur
[4]Professor, College of Veterinary and Animal Sciences, Mannuthy, Thrissur
[5]Assistant Professor, College of Forestry, Vellanikara, Thrissur
[6]Research Scholar, SRS, NDRI, Bengaluru
E-mail: drgjayaprakash@gmail.com (**Corresponding Author*)

Abstract: The aim of present research has been carried out to find out the biomass yield and chemical composition three different fodder leaves/shrubs of district Thrissur, Kerala, India. Top three tree leaves and shrubs, i.e. *Calliandra calothyrsus, Desmanthus virgatus* and *Stylosanthes hamata* were identified and analyzed for biomass yield and chemical analysis, i.e; DM (Dry Matter), CP (Crude Protein), CF (Crude Fibre), Ash, EE (Ether Extract) and gross energy. Fodder samples were collected six times during the period August 2015 to January 2016. The objective of this study was aimed at measuring the nutrient composition of leaves, as well as overall biomass from tree species and shrubs found in the Thrissur district of Kerala.

Keywords: Nutritive evaluation, biomass yield, fodder leaves.

Introduction

The current status of the deficit of green and dry fodder were 63.50 and 23.56 per cent, respectively in India and the projected deficit of CP and TDN were 45.76 and 33.71 million tonnes analyzed at 2015 (IGFRI, 2013). Due to tremendous hike in concentrate feed cost alternative feeds may provide nutrients needed by cattle at a lower cost than traditional feeds. One such alternative feed for livestock is tree fodder/shrubs feeding because Tree fodders contain high levels of crude protein, ether extract, gross energy minerals and many show high levels of digestibility. Fodder legume tree leaves and shrubs always a role in the animal production system. However, antinutritive factors (tannins, mimosine) can be a problem in some species (Paterson et al., 1998).

Materials and Methods

Location and climate

The study area is located at an altitude of 2.8 m above the sea level at 10.52ºN 76.21ºE in central Kerala, which comes under the western Ghats plain agro-climatic zone of India.The environment is cool with subhumid climate. The rainfall mostly received during monsoon season in between mid of July to the mid of September with the range of 3100 mm. The winter rain begins in January and persists upto a beginning of March. The mean temperature ranges in summer 35ºC and winter temperature 20ºC.

Fig. 1. Location map of study area

Study area and sample collection

The study was performed during the period of August 2015 to January 2016 carried at College of Forestry, Vellanikara, Thrissur district, Kerala. Most dominant fodder leaves and shrubs in the region, which are being used for feeding ruminants locally, were *Calliandra calothyrsus, Desmanthus virgatus* and *Stylosanthes hamata.*

Fig 2. Calliandra, Desmanthus and Stylosanthes

Biomass yield

The biomass yieldsof calliandra, desmanthus and stylosanthes were estimated atCollege of Forestry, Vellanikara, Thrissur.

Chemical analysis

Chemical components such as crude protein, total ash, ether extract, crude fibre and nitrogen free extract were determined by standard methods (AOAC, 1990).

1. Determination of moisture

The dry matter was determined by drying the samples at 105ºC till constant weight.

2. Determination of crude protein

Crude protein was estimated by micro kjeldhal method. Oven dried sample was digested with H2SO4 in the presence of catalyst mixture containing K2SO4 and CuSO4. A known aliquot of the diluted sample was distilled in the presence of 10 ml of 2 per cent boric acid solution and titrated against standard 0.1 N H2SO4. The percent of nitrogen was calculated for the estimation of CP.

3. **Determination of ether extract**

The ether extract in a sample was determined by extracting with diethyl ether at 80ºC in soxhlet's apparatus.

4. Determination of crude fibre

Crude fibre, sample was reflexed first with 1.25 per cent H2SO4 and subsequently with 1.25 per cent NaOH for 30 min each to dissolve acid and alkali soluble component present in it. The residue containing CF was dried to a constant weight and the dried residue was ignited in muffle furnace, loss of weight on ignition was calculated to express it as CF.

5. Determination of total ash

For ash, sample was ignited in muffle furnace at 550ºC to burn all the organic matter and leftover was weighed as ash.

6. Determination of nitrogen free extract

The Nitrogen Nitrogen-free extract: determined on dry matter basis as % NFE = 100 - (%CP + %CF + %EE + % ash)

7. Determination of Gross energy

For gross energy calculation, dried ground material (0.5 g) was taken in crucible the crucible was put in the vessel. For firing, 80 mm length of pure cotton is huge over the firing wire (a 40 mm of 0.4 nichrome wire) with its tail touching the sample. 3000 kpa pressure was filled in the vessel. The vessel is ready for gross energy calculation. Gross energy of the samples

also calculated by the help of bomb calorimeter according to methods suggested by the manufacturer. A benzoic acid standard was used for calibration of bomb calorimeter.

Results and Discussion

All of the obtained results represent the mid values acquired during a 6 months research period. The results of quantitative chemical analysis of tested samples of three fodder tree leaves/ shrubs.

Biomass yield

In this study observed biomass yields of calliandra yielded 20 and 60 t/ha/yr were after first year and second year, respectively. Biomass yields of desmanthus and stylosanthes were 40 and 20 t/ha/yr, respectively on fresh basis. These results comparable with Radhakrishnan *et al.* (2007) assessed that biomass yields of *D. virgatus* legume fodder were 39.81 tonnes per acre, first cut began 60^{th} day and subsequent cuts after 45^{th} day intervals. Murugan *et al.* (2003) observed that dry biomass yield of *S. hamata* was 3.14 and 2.83 t/ha, respectively during the lush and lean season, respectively. *S. hamata* significantly enhances biomass yield, tillers and leaf width of *Panicum* (Alalade, 2014)

Proximate composition

The result are presented in Table 1. The crude protein concentration of the leaves and shrubs varied between 13.90 to 22.66 per cent on DM basis. The crude protein content of desmanthus was 22.66 per cent. These result compared well with those from other studies Gunasekaran *et al.* (2013) and Pasupathi *et al.* (2015) respectively for 18.94 and 20.28 per cent. Ether extract content of more in calliandra compared to other shrubs. Chellapandian *et al.* (2016) observed that leguminuous tree leaves contains 16.82 to 17.67 per cent CP on DMB and also Gunasekaran *et al.* (2014) noted that tree leaves contains CP ranged between 17.14 to 19.89 Per cent on DMB.

Gross energy values

Gross energy values for the leaves of the calliandra, desmanthus and stylosanthes were 4506, 4053 and 4737 GE/Kcal/Kg/DM, respectively are represented in Fig. 3. The differences between the energy values for the calliandra leaves are high compared to desmanthus and stylosanthes.

*Received July 5, 2016 * Published Aug 2, 2016 * www.ijset.net*

Table 1: Average concentration of nutrients in tree and shrub leaves, % DMB

Nutrient, %	Calliandra	Desmanthus	Stylosanthes
Dry matter	38.50	29.14	34.12
Organic matter	96.00	95.63	96.28
Crude protein	18.45	22.66	13.90
Crude fibre	19.57	22.50	25.28
Ether extract	3.12	2.29	2.53
Total ash	4.00	4.37	3.72
Nitrogen free extract	54.86	48.18	54.57
Acid insoluble ash	1.53	1.49	1.98
Calcium	1.54	2.15	2.11
Phosphorous	0.17	0.23	0.44
Gross energy (kcal/kg DM)	4506.00	4053.80	4137.30

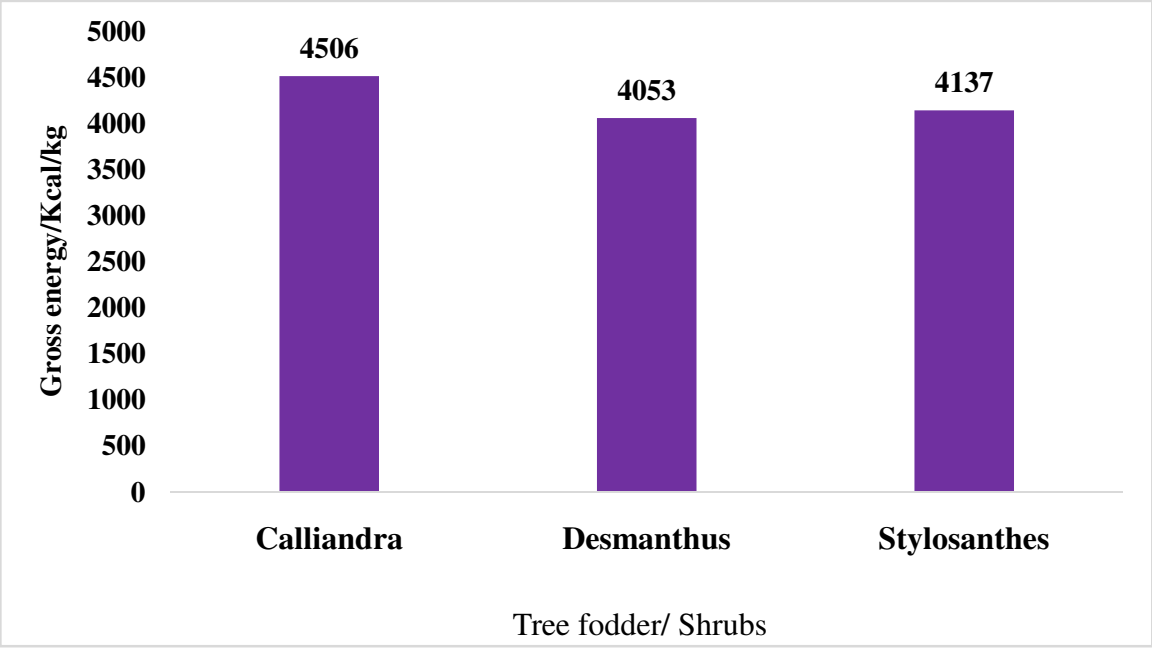

Figure 3. Gross energy values for dry powdered leaf samples for calliandra, desmanthus and stylosanthes

Conclusion

The preliminary studies concluded that calliandra, desmanthus, stylosanthes had relatively high protein, ether extract and energy content and thus have the potential to be a good alternate feed source for ruminant animals.

References

[1] Alalade, J.A., Akingbade, A.A., Akinlade, J.A, Akanbi, W.B., Gbadamosi, J., Okeniyi, G., Ajibade, A.O. and Akanji, K.A. 2014. Herbage yield and nutritive quality of Panicum maximum intercropped with different legume. *Int. J. of Sci., Environment and Technol.* **3**(1): 224-232.

[2] AOAC, 1990. Official methods of analysis. Association of official analytical chemist, Washington D.C.

[3] Chellapandian, M., Arulnathan, N. and Thirumeignanam, D. 2016. Chemical composition of tree leaves for small ruminants in southern Tamilnadu. *Int. J. of Sci., Environment and Technol.* **5**(3): 1303-1305.

[4] Das. M.M., Mahanta, S.K., Mojumdar, A.B. and Ram, S.N. 2014. Influence of partialreplacement of concentrate mixture with stylo meal on feed intake, nutrient utilization and growth performance in crossbred heifers. *Indian J. of Anim. Nutr.* **31**(3): 232-235.

[5] Gunasekaran, S., Viswanathan, K., Bandeswaran, C., Balasubramanyam, D. and Venkataramanan, R. 2013. Effect of supplementation of *Stylosanthes scabra* raised in the hortipasture model on goats. *Range Mgmt. & Agroforestry*. **34**(1): 98-100.

[6] Gunasekaran, S., Viswanathan, K. and Bandeswaran, C. 2014. Selectivity and palatability of tree fodders in sheep and goat fed by cafeteria method. *International Journal of Science, Environment and Technology*. **3**(5): 1767-1771.

[7] IGFRI. 2013. *Vision 2030*. Indian Grassland and Fodder Research. Available: http://www.igfri.res.in/pdf/Vision-2030.pdf. [12 May 2016].

[8] Murugan, M., Bandeswaran, C., Kumaravelu, N. and Radhakrishnan, L. 2003. Biomass yield and growth rate of lambs provided complementary grazing in amla– *Stylosanthes hamata* horticulture. *Indian J. Anim. Nutr.* **20**(4): 454-456.

[9] Pasupathi, K., Gopi, H., Babu, M. and Muthusamy, P. 2015. Growth performance of rabbits on tree leaves included complete extruder feed. *Wld. Vet. J.* **5**(2): 19-22.

[10] Paterson, R.T., G.M. Karanja, O.Z. Nyaata, I.W. Kariuki and R.L. Roothaert, 1998. A review of tree fodder production and utilization within smallholder agroforestry systems in Kenya. *Agroforestry Syst.* 41: 181-199.

[11] Radhakrishnan, L., Murugan, M. and Sivakumar, T. 2007. Biomass yield, chemical composition and nutritive value of *Desmanthus virgatus* (hedge lucerne) for sheep. *Anim. Nutr. and Feed Technol.* **7**: 119-123.