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Nutritional Evaluation of some promising top foliages of Aizawl district of Mizoram

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Abstract :
Leaves of ten tree species Ficus elastica (Thelrit hnah), Schima wallichii (Khiang hnah), Duabanga grandiflora (Zuang hnah), Artocarpus heterophyllus (Lamkhuang hnah),Rhus semialata (Khawmhma), Albizia chinensis(Vang), Wendlandia tinctoria (Batling), Ficus hirta (Sazutheipui),Ficus prostrata (Theitit) and Derris robusta (Thingkha hnah) were evaluated for their chemical composition, fibre fractions and in vitro dry matter digestibility(IVDMD) by Rumen Simulation Technique (RUSITEC).The crude protein, ether extract, total ash, Neutral Detergent fibre, Acid detergent fibre, and hemicelluloses content in different species of tree leaves ranged from 9.03 to 29.65%,1.54 to 6.44%, 5.05 to 18.28%,30.01 to 59.53%, 22.46 to 51.77%, 4.11 to 23.4% respectively. The IVDMD% of different species of tree leaves by rumen simulation technique varied from 38.25% to58.99 % .The Ca(%), P(%), Zn(ppm), Fe(ppm) &Cu(ppm) content in the top foliages varied from 0.77-2.96, 0.13- 0.61, 13.88 – 43.07, 72.73 – 323.17 and 7.51 – 56.44 respectively. The macro mineral (Ca & P) and micro mineral status of the tree leaves are within the normal range. Based on the present study, Ficus hirta ,Ficus prostrata , Albizia chinensis and Derris robusta seem to have good nutritional potential for ruminants.

Key words: Tree leaves; chemical composition; drymatter digestibility; RUSITEC,;macro & micro mineral

Introduction: The North Eastern Region (NER) of India comprising of 8 states namely Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Tripura and Sikkim falls under the high rainfall zone and the climate ranges from subtropical to alpine. Mizoram, one of the states of North-Eastern hilly region of India is situated between the 20.58 and 23.35 degrees north latitude and 92.15 and 93.29 degrees east longitude. Agriculture has been one of the main occupation in Mizoram in which animal husbandry occupies a potential source of rural economy. Animal husbandry is an inseparable part of economy in Mizoram, as this state is dominated by mono cropping and crop failure often pushes the farmer's economy at the verge of collapse. Feed is a vital component as feed amounts to major input of cost of livestock production. Feeding of livestock costs more than 60 -65% of total recurring inputs. Fodder scarcity remains one of the major constraints in animal production which is all the more acute in a hilly state like Mizoram with very less area under the fodder cultivation and progressive decline of pasture lands further aggravates the situation. Due to lack of adequate transport facilities, import of feed ingredients from other states is very costly. So, the livestock particularly ruminants are largely dependent on the local vegetation. In this regard,the role of top foliages in the diet of ruminant animals is considered particularly important in the North East India. Tree foliages represent an important source of cellulosic biomass for feeding ruminants throughout the world. The tree leaves not only provide a cheap source of nitrogen, energy and micronutrients, but have also many other advantages like their wide spread availability and easy accessibility to farmers. The tree leaves can be harvested

and either directly fed as green fodder or sun dried and used in compounded protein supplements and in complete feed block. Keeping in view the importance of tree foliages in ruminant feeding, the present study was undertaken to exploit the nutritional potential of tree leaves available in Aizawl district of Mizoram for ruminants feeding.

Materials and methods: The samples of commonly available tree leaves viz, *Ficus elastica* (Thelrit hnah), *Schima wallichii* (Khiang hnah), *Duabanga grandiflora* (Zuang hnah), *Artocarpus heterophyllus* (Lamkhuang hnah),*Rhus semialata* (Khawmhma), *Albizia chinensis*(Vang), *Wendlandia tinctoria* (Batling), *Ficus hirta* (sazutheipui),*Ficus prostrata* (Theitit),*Derris robusta* (Thingkha hnah), were collected from Aizawl district of Mizoram state. The leaves were individually sun dried and ground to pass l mm screen and stored in screw capped plastic bottles for further analysis.These samples were analyzed for chemical composition (AOAC, 1995), fibre fractions (Goering and Van Soest, 1970) and calcium content *(*Talapatra et al., 1940). Phosphorus was determined by spectrophotometric method as described by AOAC,1995. Dry matter digestibility of different species of tree leaves was estimated by Rumen Simulation Technique (RUSITEC) (Czerkawski and Breckenridge, 1977 and Jayasuria *et al.*, 1987). The instrument used for determining in vitro dry matter digestibility(IVDMD) was Rusi-E-Tek (Eaga Tools and Instruments, Chennai). Rumen liquor was collected from goat. 500 ml strained rumen liquor, 200 ml artificial saliva (McDougall, 1948) and 100 ml distilled water were placed in each reaction vessel. Approximately 80 gm of solid rumen contents in a nylon bag and a quantity of grinded feed in another bag were weighed and placed into the perforated feed container. After 24 hrs all the nylon bags were removed and processed for determining IVDMD %. All samples were processed by following standard procedure and mico mineral content of top foliages was estimated by Atomic Absorption Spectrophotometer (Model No. SENSAA, GBC, Australia) The data observed were subjected to standard statistical analysis by statistical method of Snedecor and Cochran (1994) for discussion and interpretation of results.

Results and discussions:

Chemical composition:

There was a wide variation in the crude protein content of the top foliages (Table1).Most of the tree leaves have a medium to high range of crude protein (CP) with the highest in *Albizia chinensis* (29.65%) and lowest in *Schima wallichii* (9.03%).The CP content(on DM basis) in *Ficus hirta* ,*Ficus prostrate* and *Derris robusta*, was found to be 19.91%,25.60% and 21.81%, respectively. Crude protein content in the seven sample out of the ten sample was found to be more than 14% indicating the potential of these tree leaves as protein supplement. The findings are similar with the observation of Kanhal & Subba, 2001 who reported that crude protein content of the fodder tree species was higher than 11.0%. Subba, 1999 reported that tree leaves containing more than 14%CP sufficient for medium level of production performances from the ruminants. Sheikh et al. (2011) observed that different species of the foliages of Kargil district of Ladakh was varied from 8.29 – 25.35%.The Ether extract content of different top foliages ranged from 1.54 to 6.44%. The ether extract content was below 5.0% in all tree leaves except *Rhus semialata (5.06%) and Ficus elastica* (6.45%). Similar observation on EE content of the top foliages was reported by Azim et al., 2011.

Fibre fractions :

Fibre fraction(NDF,ADF & Hemi-cellulose) composition of the top foiliages are presented in the Table1. The NDF content was highest in *Artocarpus heterophyllus* (59.53%) and lowest in *Ficus hirta* (30.01%) The ADF content in leaves of different tree leaves varied from 22.46% (*Ficus prostrate*) to 51.77 %(*Artocarpus heterophyllus*). The results are in

agreement with the findings of Prakash *et al*., (2007).Hemicellulose content varied from 4.11% in Ficus elastic to 23.46% in *Ficus prostrate*. Hemicellulose content in most of the top foliages was low. The NDF%, ADF% &hemicelluloses % of the top foliages are comparable with the earlier findings of Prakash et al.(2007) and Bakshi et al.(2006).However, the lower values of fibre fractions were reported by Singh et al., 2009. The differences in chemical composition, fibre fractions could be due to variation in agro climatic condition, soil fertility, season harvesting methodology and sample processing methods.

In vitro dry matter digestibility (IVDMD)

The in vitro dry matter digestibility (IVDMD) by RUSITEC varied from 36.55% in *Albizia chinensis* to 58.99% in *Derris robusta.* The IVDMD% of *Wendlandia tinctoria, Ficus hirta*, *Ficus prostrate* was 56.23%, 55.29% and 55.06% respectively. Similar finding on IVDMD was reported by Datt et al. (2008). The lower IVDMD% in some top foliages under the study could be due to high fibre content.

Macro & micro mineral status

Concentration of macro (Ca & P) and micro (Cu, Fe & Zn) minerals is presented in Table 2 The calcium content of the tree leaves was varied from I 0.77% to 2.96%. Most of the top foliages had higher calcium content, more than 1.0% with as high as 2.96% in *Derris robusta*. High calcium level in tree leaves is very useful fpr the lactating cattle to prevent them from milk fever. Phosphorus content in the top foliages ranged from 0.13 to 0.61%. The phosphorus content in the entire sample was below 1%. Phosphorus content was comparatively lower in all the top foliages. P is one of the most important minerals for many metabolic processes in animals (Conrads et al., 1988) and its deficiency may lead to poor reproductive performances (Paterson et al., 2006).Fe content of the top foliages ranged from 72.73 ppm(*Duabanga grandiflora) to 323.17 ppm (Derris robusta).* It was observed that most of the top foliages in Aizawl districts of Mizoram are high in Fe content which could mostly be attributed to acidic soils (McDowell, 1997). However, high Fe content would not have any detrimental effects because ruminants can tolerate much higher level of Fe (>1000 ppm) if it is from the natural feed resources (NRC, 1978). Cu content of the top foliages varied from 7.51 ppm to 56.44 ppm. Most of the top foliages had higher Cu concentration than normal requirement range. Zn content in the top foliage ranged from 13.88 ppm to 43.07 ppm. The highest concentration of Zn was found in *Ficus hirta*. Most of the top foliages had Zn levels within the normal requirement range.

Conclusion: Based on the chemical composition, fibre fractions and in vitro dry matter digestibility , *Ficus hirta ,Ficus prostrata* , *Albizia chinensis* and *Derris robusta* seem to have good nutritional potential for ruminants.

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Table1.Chemical composition, fibre fraction and in vitro dry matter digestibility (IVDMD) of top foliages.

Scientific name	Common name	CP%	EE%	TA%	NDF%	ADF%	HC%	IVDMD%
Ficus elastica	Thelrit hnah	11.68	6.44	7.76	50.05	45.94	4.11	39.96
Schima wallichii	Khiang hnah	9.03	2.87	16.15	47.40	39.18	8.22	38.25
Duabanga grandiflora	Zuang hnah	11.15	2.53	18.28	36.27	27.08	9.19	48.42
Artocarpus heterophyllus	Lamkhuang hnah	16.04	2.72	16.66	59.53	51.77	7.76	50.23
Rhus semialata	Khawmhma	17.59	5.06	16.97	49.83	38.23	11.60	43.79
Albizia chinensis	Vang	29.65	2.85	16.89	53.69	44.54	9.15	46.55
Wendlandia tinctoria	Batling	14.49	1.78	5.05	37.13	24.91	12.22	56.23
Ficus hirta	Sazutheipui	19.91	1.83	9.70	30.01	25.60	4.41	55.29
Ficus prostrata	Theitit	25.60	1.54	6.53	45.92	22.46	23.46	55.06
Derris robusta	Thingkha hnah	21.81	4.44	8.99	44.65	30.86	13.79	58.99
Average		17.69	3.21	13.29	45.44	35.05	10.39	49.27
SE		2.09	0.51	1.61	2.79	3.24	1.75	2.26

CP=Crude protein, EE= Ether extract, TA=Total ash, NDF= Neutraldetergent fibre, ADF= Acid detergent fibre, HC=Hemicellulose, IVDMD= In vitro dry matter digestibility

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Sl.No	Top foliages	Micro mineral			Macro mineral	
	Scientific name	**Zn(ppm)**	**Fe(ppm)**	**Cu(ppm)**	**Ca(%)**	**P(%)**
1	*Ficus elastica*	21.66	130.10	41.43	1.28	0.29
2	*Schima wallichii*	13.88	284.13	56.44	1.39	0.28
3	*Duabanga grandiflora*	14.24	72.73	16.83	2.04	0.23
4	*Artocarpus heterophyllus*	20.29	130.39	19.91	1.59	0.22
5	*Rhus semialata*	25.78	150.32	9.23	1.94	0.30
6	*Albizia chinensis*	33.57	137.37	47.98	0.77	0.48
7	*Wendlandia tinctoria*	31.04	148.41	9.75	2.37	0.13
8	*Ficus hirta*	43.07	139.50	11.01	2.59	0.25
9	*Ficus prostrata*	24.41	87.38	7.51	2.02	0.39
10	*Derris robusta*	35.76	323.17	29.70	2.96	0.61
	Average	26.33	160.35	24.97	1.89	0.31
	SE	3.00	25.35	5.66	0.20	.04
	*Normal requirement**	20-40 ppm	30-50 ppm	7-11 ppm	0.19 – 0.82 %	0.12-0.48 %

Table 2.Macro & Micro mineral content of tree leaves

.SE Standard Error
*Recommended mineral elements (for all classes of ruminants) suggested by National Research Council and summarized by McDowell (1997)