

Digestibility of *Ficus roxburghii*, *Castanopsis indica* and *Ficus cunia* on Growing Buffalo from Western Hills of Nepal

Netra P. Osti¹, Purna B. Chapagain², Megh R. Tiwari² and Chet R. Upreti¹

¹ Animal Nutrition Division, NARC, Khumaltar, Lalitpur, Nepal <nposti@narc.gov.np>

² Regional Agriculture Research Station, NARC, Lumle, Kaski, Nepal

ABSTRACT

Nine buffalo calves were subjected to three fodder tree species namely; Nimaro (*Ficus roxburghii*), Dhalne Katus (*Castanopsis indica*) and Rai Khanyu (*Ficus cunia*) for digestibility trial during November 27 and December 3, 2005 in Regional Agricultural Research Station, Lumle, Kaski, Nepal. Animals were kept 7 days for adaptation for these fodders. Weighed amount of fodder tree leaves including twigs and small branches were fed two times a day and observation on fodder offered, refused and faeces voided were recorded daily. Chemical composition of fresh matter and faeces voided were carried out for dry matter (DM), crude protein (CP), neutral detergent fiber (NDF), acid detergent fiber (ADF), lignin, calcium (Ca) and phosphorus (P). The mean DM content and their dry matter digestibility (DMD) of these three fodder tree species were found 27.86, 46.02, 34.72, 73.21, 65.93 and 71.28 percent, respectively. Strong negative correlations ($r=-0.75$ to -0.78 ; $p<0.05$) were observed between Ca and CP with fiber fraction (NDF and ADF). A weak correlation was also observed between P and other constituents with respect to digestibility. From the results, if there could be provision of low fiber content in dry season, the three main nutrients (Ca, P and CP) may easily be absorbed by the animals.

Key words: Buffalo, digestibility, fodder tree, nutrients

INTRODUCTION

About 39.6 percent of the total land of Nepal is covered by forest and shrub. Fodder and leaf litter from forest, fodder tree from crop lands, grasses legumes available from bunds and fallow lands, crop by products from agricultural crops are the major sources of feed for ruminant animals. Fodder trees from terrace risers and marginal lands are lopped for supplementing green fodder from December to June, which is the feed scarcity period in hills and mountain of Nepal (Sherchand and Pariyar 2002). Even though the protein contents of fodder tree leaves are moderate, the animals loose their body weight and milk production drops drastically during winter months when animals are mainly provided with fodder tree leaves and rice straw. This problems may be due to seasonal rainfall, upland areas where decrease in soil moisture, deciduous plant species particularly mid hills across the country and composition and availability of nutrients present in the plant species during moisture stress condition.

Nutrient composition of fodder tree leaves, tree fodder, grasses and legumes were evaluated (Subba 1998), but studies on nutrient availability from these feeding resources to the animals are very limited. Review of literature shows very few fodder tree species have been studied for nutrient availability to the animals (Subba 1998). In this study, efforts have been made to find out the digestible co-efficient of nutrients of fodder tree foliage such as Nimaro (*Ficus roxburghii*), Rai Khanyu (*Ficus cunia*) and Dhalne Katus (*Castanopsis indica*) and side by side to point out the positive and negative relation among the constituents under fresh and digestible basis.

MATERIALS AND METHODS

Nine growing buffalo calves about one and half year age (male and female) were allotted to three treatments ie Nimaro (*Ficus roxburghii*), Dhalne Katus (*Castanopsis indica*) and Rai Khanyu (*Ficus cunia*) and replicated three times. Animals were kept under metabolic shed, weighed amount of fodder tree leaves including twigs and small branches were provided two times a day and experiment was lasted up to 7 days. Observations as fodder offered, refused and faeces voided were recorded daily.

Fodder and fecal samples were collected in morning and evening for 7 days experimental period. The average maximum and minimum temperature recoded in samples collection site was 20.61°C and 12.22°C, respectively and the total rainfall of the site was 5833.60 mm and average was 5303.1 mm per year (Annual Report 2001). Collected tree foliage and fecal samples were dried at constant heat in hot air oven at 72°C for over night (24 hours). Dried fodder and fecal samples were ground to passes through 1 mm sieves in hammer mill and stored for chemical analysis.

After dry matter determination, nitrogen content was determined by the Micro-Kjeldal method (AOAC 1990). The crude protein (CP) was calculated as $N \times 6.25$. Neutral detergent fiber (NDF), acid detergent fiber (ADF) and acid detergent lignin (ADL) were determined by the method developed by Van Soest et al (1991). Calcium (Ca) and phosphorus (P) were measured by titration and spectrophometry method, respectively.

One-way analysis of variance (ANOVA) was carried out to compare the chemical composition and digestibility values with species of fodder tree as the main factor by using General Linear Model (GLM) procedure (Statistix for Windows 1996). Simple correlation analysis was used to establish the relationship between the chemical constituents as fresh and digestible basis.

RESULTS AND DISCUSSION

The mean chemical constituents are presented in Table 1, there is positive and negative relationship observed among the chemical constituents (Table 2). Protein, calcium and phosphorus content in feed are very important for milk production from milking animals, fiber content in fodder tree leaves have strong negative correlation (Table 2) with these nutrients. When commencing dry season plant tend to increase fiber content in the leaves, which lead to decrease these two minerals content during the winter or dry season.

Table 1. Chemical constituents of three different fodder tree leaves from western hills of Nepal

Name of fodder	Chemical constituents						
	DM	CP	NDF	ADF	Lignin	Ca	P
<i>Ficus roxburghii</i>	27.86	14.27	54.00	52.46	32.53	2.82	0.49
<i>Castanopsis indica</i>	46.02	11.38	65.13	64.52	21.82	0.76	0.23
<i>Ficus cunia</i>	34.72	13.61	43.63	41.08	20.55	2.47	0.37
Mean	36.20	13.08	54.25	52.69	24.97	2.01	0.36

DM, Dry matter. CP, Crude protein. NDF, Neutral detergent fiber. ADF, Acid detergent fiber. Ca, Calcium. P, Phosphorus.

Table 2. Correlations (Pearson) coefficients of different chemical constituents of three fodder tree leaves from western hills of Nepal

	DM	CP	NDF	ADF	Lignin	Cal
CP	0.276 0.473					
NDF	-0.181 0.640	-0.750 0.020				
ADF	-0.173 0.656	-0.752 0.019	1.000 0.000			
Lignin	0.197 0.612	0.602 0.086	0.076 0.846	0.073 0.852		
Cal	0.273 0.477	0.998 0.000	-0.786 0.012	-0.788 0.012	0.738 0.023	
P	0.238 0.538	0.775 0.014	-0.163 0.675	-0.166 0.669	0.564 0.114	0.453 0.221

Digestibility of chemical constituents present in Nimaro, Dhalne Katus and Rai Khanyu were similar (Table 3). Positive correlation was observed in digestibility of all constituents except phosphorus to other constituents. Phosphorus has weak correlation to other constituents in terms of digestibility (Table 4). This low phosphorus content in fodder tree leaves may have negative effect on absorption of nutrient present in the fodder tree leaves specially lactating animals.

Table 3. Digestibility coefficients of chemical constituents from Nimaro, Dhalne Katus and Rai Khanyu found in western hills of Nepal

Name of fodder	Digestibility coefficient						
	DMD	CP	NDF	ADF	Lignin	Ca	P
<i>Ficus roxburghii</i>	73.21	80.22	74.58	74.55	74.94	85.34	74.14
<i>Castanopsis indica</i>	65.93	74.58	62.67	61.54	76.08	80.89	82.04
<i>Ficus cunia</i>	71.28	74.29	77.99	77.45	79.63	85.32	71.24
Mean	70.14	76.36	71.75	71.18	76.88	83.85	75.81
CV, %	8.21	5.81	17.61	19.02	8.28	3.69	12.74
SEM	1.92	1.48	4.21	4.51	2.12	1.03	3.21

Table 4. Correlations (Pearson) coefficients of digestibility of different chemical constituents of three fodder tree species leaves from western hills of Nepal

	DMD	CP	NDF	ADF	Lignin	Cal
CP	0.837 0.005					
NDF	0.928 0.000	0.680 0.044				
ADF	0.929 0.000	0.677 0.045	0.997 0.000			
Lignin	0.728 0.026	0.502 0.168	0.863 0.003	0.856 0.003		
Cal	0.910 0.001	0.683 0.042	0.855 0.003	0.833 0.005	0.598 0.089	
P	0.066 0.866	0.054 0.889	-0.056 0.887	0.000 0.999	0.154 0.693	-0.247 0.522

Fodder tree leaves contain high level of calcium (2.20%) and low level of phosphorus (0.25%) among 30 fodder tree species found in the hills and mountain of Nepal Osti et al (2006). Similarly, Subba 1998 analyzed over 75 tree fodder species and found 0.10 to 0.90 percent total phosphorus content and he also analyzed for calcium content ranges from 26.5 mmol/kg Bakaino (*Melia azedarach*) to 689 mmol/kg Teli bans (*Teli bans*), and most of tree fodder species found 100 + mmol/kg calcium content. This low level of phosphorus and negative correlation between calcium and phosphorus with fiber fraction may be the one factor for low milk production during dry season in the hills and mountain of Nepal. This finding is closely supported with the finding of Davies et al (1938) who reported that the presence of soils low in plant available phosphorus results in herbage with subnormal phosphorus content and occurrence of a dry period in each year when the plants are dry and mature and the seed is set accentuated or prolong this effect. Calcium and phosphorus are the major minerals required for proper milk formation in the body of milking animals, this low phosphorus contain in fodder tree leaves also have another possibility of binding to other nutrients like protein with phytate to form protein phosphorus complex which lead to low absorption of these nutrients in the animal body. The protein content of plant falls with phosphorus and also energy because all soluble carbohydrates ultimately non available with increase in dry matter content in dry season (Lapkin et al 1961). There is also quantitative ratio (2:1) between calcium and phosphorus required for proper functioning of milk secretion and 1.5 part of calcium there should be 1 part of phosphorus in the diet. If the ratio is narrower than 1:1 and wider than 2.5:1 there will be incidence of milk fever and other deficiency diseases appeared (Wattiaux 1994). From this finding the ratio between calcium and phosphorus is very weak. This low phosphorus contain in fodder tree leaves open the another rooms for further research in this area with respect to milk production in the hills and mountainous region.

Strong negative correlation was observed among fiber fraction (NDF and ADF) of fodder tree leaves with Ca, P and CP. A weak correlation was also observed between P and digestibility of other constituents. If there could be provision of low fiber content in dry season these three nutrients (Ca, P and CP) may absorbed easily by the animals.

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