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Nutritional evaluation of fodder resources from trees of Bundelkhand region

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Tree plays an important role in providing top feeds for ruminants particularly during lean period when pasture forage is in short supply. In Bundelkhand region due to very less rainfall, availability of green fodder is scanty and whatever is available is limited to a very short duration. Therefore, livestock farmers largely depend on the top feed. In the present study locally available tree leaves and their pods/ fruits, which are generally used for feeding of livestock, were analysed for chemical composition and *in sacco* nutrient digestibility.

Samples of leaf fodder from six trees and pods/fruits from five species were collected during the month of November-December, from the Central Research Farm, IGFRI, Jhansi. These were dried at 60°C, ground to pass through 2 mm sieve and were analyzed for crude protein, total ash (AOAC 1990) and cell wall constituents (Goering and Van Soest 1970). The samples were also evaluated for *in sacco* rumen degradation of DM, OM, CP, NDF and ADF following decron bag technique (Orskov *et al.* 1980). Three adult crossbreed bulls (Jersey × Tharparkar) fitted with permanent rumen cannula maintained on a standard concentrate mixture (barley 40, wheat bran 22, mustard-cake 35, mineral mixture 2 and common salt 1 parts) and *ad lib.* wheat straw used for *in sacco* studies. Each sample (5 g) was taken in triplicate dacron bags (15 cm × 9 cm, pore size 40–50μ) and incubated in the rumen for 48 h. The bags were then removed and washed in running water and then dried in hot air oven at 55°C. The bags were weighed to calculate DM loss during incubation. The residual DM was analyzed for CP, NDF, ADF and total ash for computation of digestibility coefficients. The data were subjected to statistical analysis (Snedecor and Cochran 1968).

The average CP content of tree leaves varied from 6.76–14.25% (Table 1). Among the fruits/pods *Acacia catechu* pods contained highest level of CP (15.84%). It is reported that CP content of shrubs and tree species ranged from 7.4 – 22.3% (Nahed *et at.* 1997, Bhadauria *et al.* 2002, Pailan *et al.* 2004). Thus CP content of most of the tree species and fruits/pods are considered to be adequate to maintain the minimum level of ammonia (70 mg N/l) required by the

Table 1. Chemical composition of tree leaves and fruits/pods (% DM)

Species	CP	NDF	ADF	Lignin	Hemi-cellulose	Cellulose	Ash
Tree leaves							
Azadirachta indica	14.25	35.25	21.35	11.79	14.93	8.30	8.54
Anogeissus pendula	12.71	48.36	32.54	18.18	15.84	13.58	7.97
Acacia catechu	12.82	51.55	21.70	11.15	29.91	19.15	9.14
Acacia leucophloea	11.75	45.57	29.96	13.92	15.63	14.88	11.75
Bauhinia racemosa	9.88	58.85	45.02	24.96	13.85	19.43	6.80
Dalbargia sissoo	6.76	44.09	20.72	6.83	23.36	12.63	9.49
Fruits							
Ziziphus oenoplia	9.11	68.71	46.18	31.41	22.55	23.33	4.11
Maytenus emarginata	10.97	56.15	47.14	5.24	9.03	8.45	4.95
Grewia flavescens	9.31	66.20	55.72	24.35	10.48	30.51	4.84
Pods							
Acacia catechu	15.84	57.01	42.56	18.90	14.43	24.30	5.07
Bauhinia racemosa	5.85	66.72	60.44	33.21	6.30	26.42	3.84

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Table 2. *In sacco* nutrient degradability of tree leaves and fruits/pods (% DM)

Species	DM	OM	CP	NDF	ADF
Tree leaves					
Azadirachta indica	77.99	77.50	83.37	71.96	59.17
Anogeissus pendula	64.88	64.71	61.56	56.10	49.17
Acacia catechu	59.61	56.12	51.03	47.14	34.54
Acacia leucophloea	48.18	46.43	50.92	40.52	34.01
Bauhinia racemosa	55.38	54.96	58.32	39.36	36.38
Dalbargia sissoo	71.48	72.75	46.96	59.27	42.67
Fruits					
Ziziphus oenoplia	46.61	46.39	85.07	30.22	28.87
Maytenus emarginata	55.20	55.73	61.94	40.73	38.55
Grewia flavescens	39.99	35.99	84.88	15.43	13.88
Pods					
Acacia catechu	45.59	44.25	74.90	24.60	21.14
Bauhinia racemosa	62.24	60.81	82.70	50.45	47.84

microbial population in the rumen for optimum rumen fermentation (Satter and Slyter 1974). NDF content of tree leaves varied from 35.25% in *Azadirachta indica* to 58.85% in *Bauhinia racemosa*. ADF and lignin content in tree leaves ranged between 20.72 to 45.02% and 6.83 to 24.96%, respectively. In fruits/pods NDF and ADF content varied from 56.15 to 68.71% and 42.56 to 60.44%, respectively. The lignin content widely ranged from 5.24% in *Maytenus emarginata* fruits to 33.21% in *Bauhinia racemosa* pods. The result of NDF and ADF contents of shrubs under study matched with earlier reports on other tropical tree and shrub (Lohan *et al.* 1980, Bhadauria *et al.* 2002, Pailan *et al.* 2004). The average hemicellulose content in tree leaves (18.92%) was higher in fruits/pods (12.56%) however, average cellulose content in fruits/pods was maximum (22.60%) followed by tree leaves (14.66%) and the values are well within the range reported by Mandal (1997). The total ash content ranged from 6.80 to 11.75% in tree leaves and 3.84 to 5.07% in fruits/pods.

In sacco nutrient degradability of tree leaves and fruits/pods is presented in Table 2. Among the tree species DM degradability was highest in *Azadirachta indica* (77.99%) and lowest in *Acacia leucophloea* (48.18%). The differences in DM degradability of tree leaves reflect differences in the chemical composition i.e. as per level of CP, NDF, ADF and lignin. *In sacco DM* degradability in fruits/pods ranged from 39.99% in *Grewia flavescens* to 62.24% in *Bauhinia racemosa*. A wide variation in DM digestibility of different fodder tree species has been reported by Sharma *et al.* (2000), Kumar and Sharma (2003). *In sacco* OM digestibility in different tree leaves and fruits/pods varied from 46.43 to 77.50% and 35.99 to 60.81%, respectively (Table 2). These results are in agreement with the findings of Khatta *et al.* (1999) and Kumar and Sharma (2003) who reported wide variation in OM digestibility among different tree leaves. The average *in sacco* CP degradability varied from 46.96 to 83.37% in different tree leaves and 61.94 to 85.07% in different fruits/pods (Table 2). These findings are in agreement to those reported by Wilson (1977), Gurung *et al.* (1993), Singh *et al.* (1995) and Kumar and Sharma (2003). Average *in sacco* NDF and ADF degradability in different fodder tree leaves varied from 39.36 to 71.96% and 34.01 to 59.17%, respectively. The corresponding values for fruits/pods ranged from 15.43 to 50.45% and 13.88 to 47.84%, respectively. Singh *et al.* (1995), Kumar and Sharma (2003) also reported a wide variation in NDF and ADF digestibility among various fodder tree leaves.

In sacco DM degradability of different tree leaves showed negative correlation with NDF, ADF, cellulose, hemicellulose and lignin content (Table 3). The negative correlation of cellulose and hemicellulose with *in sacco* DM degradability indicates the importance of soluble cell content as principle energy source in fodder tree leaves (Sharma *et al.* 2000). The average CP content of different tree leaves has positive correlation to digestibility of DM, OM, CP, NDF and ADF (Table 3). These results were in agreement with the reports of Sohane and Singh (2000) in tropical tree-fodder, Tolera *et al.* (1997) in Scottish brouse species and Pailan *et al.* (2004) in tropical shrubs. On the basis of chemical composition and *in sacco* nutrient digestibility it may be inferred that nutritional value of *Azadiracta indica, Anogeissus pendula, Acacia catechu* leaves and pods of *Acacia catechu* were found to be higher as compared to other species under study.

Table 3. Correlation coefficient (r) of relationship between nutrients content and *in sacco* degradability in tree leaves

Parameter	Correlation with				
	DMD	OMD	CPD	NDFD	ADFD
CP	+0.37	+0.31	+0.75	+0.44	+0.57
NDF	–0.80	–0.79	–0.74	–0.88	–0.83
ADF	–0.68	–0.64	–0.37	–0.72	–0.51
Hemicellulose	–0.75	–0.16	–0.52	–0.16	–0.42
Cellulose	–0.68	–0.76	–0.66	–0.87	–0.85
Lignin	–0.65[1]	–0.63	–0.31	–0.66	–0.45

SUMMARY

Mature leaves and twigs from 6 fodder trees and fruits/

pods from 5 trees species were evaluated for their chemical composition and *in sacco* degradability. In tree leaves a positive correlation was observed among CP content and *in sacco* nutrient degradability while NDF, ADF, hemicellulose, cellulose and lignin content showed negative correlation with nutrient digestibility. The tree leaves viz. *Azadirachta indica, Anogeissus pendula, Acacia catechu* and pods of *Acacia catechu* were higher in nutritive values as compared to other species under study.

REFERENCES

AOAC 1990. *Official Method of Analysis* (15th ed.). Association of Official Analytical Chemists, Washington DC.

Bhadauria K K S, Pailan G H, Das M M, Kundu S S, Singh J P and Lodhi G N. 2002. Evaluation of shrubs and tree leaves for carbohydrate and nitrogen fractions. *Indian Journal of Animal Sciences* **72**: 87–90.

Goering H K and Van Soest P J. 1970. *Forage Fibre Analyses (Apparatus, Reagents, Procedures and Some applications)*. Agriculture Handbook No. 379, Agricultural Research Services, USDA, Washington, DC.

Gurung H B, Acamovic T, Stewart C. 1993. Effect of tannin on the rumen degradability of the fodder tree leaves. *Veterinary Review* (Katmandu) **8**: 14–16.

Khatta V K, Tewatia B S and Gupta P C. 1999. Evaluation of tree leaves of humid subtropical region of Himachal Pradesh. *Indian Journal of Animal Nutrition* **16**: 220–23.

Kumar Anoop and Sharma S D. 2003. Nutritive evaluation of some fodder tree leaves for ruminants in tarai region of Uttaranchal. *Indian Journal of Animal Nutrition* **20**: 161–67.

Lohan O P, Lall D, Pal R N and Negi S S. 1980. Cell wall constituents and *in vitro* dry matter digestibility of some fodder trees in Himachal Pradesh. *Forage Research* **6**: 21–27.

Mandal L. 1997. Nutritive values of tree leaves of some tropical species for goats. *Small Ruminant Research* **24**: 95–105.

Nahed J, Villafaerte L, Grande D, Perez-Gil F and Alennian T Carmona. 1997. Fodder shrub and tree species in the highlands of south Mexico. *Animal Feed Science and Technology* **68**: 213–23.

Ørskov E R, Hovel F D and Mould F. 1980. The use of nylon bag technique for evaluation of feedstuffs. *Tropical Animal Production* **5**: 195–213.

Pailan G H, Das M M, Singh J P, Nag S K and Shankar Vinod. 2004. Nutritional evaluation of leaf fodder from tropical shrubs. *Indian Journal of Animal Sciences* **74**: 771–74.

Satter L D and Slyter L L. 1974. Effect of ammonia concentration on rumen microbial protein production *in vitro*. *British Journal of Nutrition* **32**: 199–208.

Sharma R K, Singh B and Bhat T K. 2000. Nitrogen solubility, protein fractions, tannins and *in sacco* dry matter digestibility of tree fodder of Shiwalik range. *Indian Journal of Animal Nutrition* **17**: 1–7.

Singh K K, Samanta A K and Srinivas B. 1995. Nutritional evaluation of tree leaves and range legumes. *Indian Journal of Animal Nutrition* **12**: 234–36.

Snedecor G W and Cochran W G. 1968. *Statistical Methods*, IBH Publishing Co., Calcutta.

Sohane R K and Singh M. 2000. *In sacco* digestibility of nutrients in rice straw of different cultivars. *Indian Journal of Animal Nutrition* **17**: 184–88.

Tolera A, Khazaal K, Ørskov E R. 1997. Nutritive evaluation of some brows species. *Animal Feed Science and Technology* **67**: 181–95.

Wilson A D. 1977. The digestibility and voluntary intake of the leaves of trees and shrubs by sheep and goats. *Australian Journal of Agricultural Research* **28**: 501–08.