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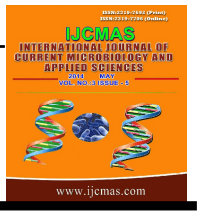

Original Research Article

Nutritional Evaluation of Some Top Fodder Tree Leaves and Shrubs of District Dir (Lower), Pakistan as a quality livestock feed

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A B S T R A C T

Keywords

Nutritional evaluation, fodder tree leaves, browse plants, crude protein, dry matter

The aim of present research was to record out the nutritional evaluation of different fodder tree leaves, shrubs and brows plants of district Dir, Khyber Pakhtunkhwa, Pakistan. The climate of this range is characterized by a relatively medium to high annual rainfall (1000-1200 mm). Temperature during winter is -06 to 38^{0}C and during summer is 15 to 40^{0}C. Top 13 tree leaves, shrubs and brows plants, i.e *Eleusine coracana, Cyperus rotundus, Sorghum halepense, Tike mimosa, Populus Euphratica, Morus nigra, Sorghum bicolor, Oryza sativa, Prunus persica, Cynodon dactylon ,Cotton seed cake , Ficus carica and Wheat straw* were identified and analyzed for proximate analysis, i.e; DM (Dry Matter), CP (Crude Protein) and Ash. The DM, CP and Ash contents of the foliages varied from 88.45-96.26, 6.90-26.68 and 4.64-21.90% of DM respectively.

Introduction

Fodder trees and shrubs represent an enormous potential source of protein for ruminants in the tropics. Until relatively recently, these feed resources have been generally ignored in feeding systems for ruminants, mainly because of inadequate knowledge on various aspects of their potential use, as well as initiatives associated with the development of more innovative systems of feeding (Devendra, 1990b).

The use of fodder trees and shrubs have been secondary to these efforts, despite their potential value in prevailing small farm systems (Devendra, 1983). The current status of animal protein deficiency in developing world is caused by lack of forage. Fodder trees and shrubs have always played a role in feeding livestock. Trees and shrubs are increasingly recognized as important components of

animal feeding, especially as suppliers of protein. In difficult environmental conditions, where the available grazing is not sufficient to meet the maintenance requirements of animals for part of the year, the contribution from trees and shrubs is significant. Tree fodders contain high levels of crude protein and minerals and many show high levels of digestibility. They are readily accepted by livestock and presumably because of their deep-root systems, they continue to produce well into the dry season. However, antinutritive factors can be a problem in some species (Paterson et al., 1998). Natural pasture and crop residues are major sources in the highlands. These feed resources are characterized by low digestibility, protein content and mineral composition (Seyoum and Zinash, 1998). Fodder tree and shrub species are mostly required as supplement to low quality feeds. Fodder tree and shrub species are considered important contributors to grazing animal nutrition in the highlands of northern areas of Pakistan.

During the dry and crop-fallow season, farmers traditionally feed indigenous fodder species to meet nutritional requirements of the grazing animals. So far, very little work has been done on the identification, prioritization and characterization of indigenous fodder and soil improving trees and shrubs in high altitude areas of Khyber Pakhtunkhwa.

Similarly, farmers' local knowledge on indigenous fodder trees and shrub species are not strongly supported by scientific investigations. Grazing livestock in warm climates have to depend largely upon forage to fulfill their mineral requirements. Forages rarely satisfy all of the needed mineral requirements of grazing livestock (McDowell, 1977). It has been reported that mineral concentrations in both soils and plants affect the mineral status of grazing livestock (Towers and Clark, 1983). At the same time litter is known about the energy, proximate and cell wall composition of fodder tree leaves. (Lefroy et al. 1992) documented the importance of trees, shrubs and herbs for their nutrition capacity for browsing and grazing animals, especially in areas of poor quality pastures for longer period of time. Compared to grasses, fodder trees, shrubs and herbs have relatively higher concentrations of CP, minerals, neutral detergent fiber, while their average concentration in acid detergent fiber, as well as their average dry matter, were both lower. These nutrients contents were subject to less variation than with grasses and this particularly enhances their values as dry season feeds for livestock (Wilson, 1969; Ibrahim, 1981). During the first growth of the grass species, energy content varied mainly with age, whereas during re-growth and in legumes the affect is smaller (Daccord et al., 2002). Significant variations existed between species for mineral concentrations which range from inadequate to toxic levels for the production of livestock.

In the past, research efforts on alternative feed resources for ruminants have concentrated more on a limited number of the available plant foliages with little information on the nutrient status of the various other foliages in relation to their being utilized as feed for ruminants. The present study was therefore undertaken to explore nutrient contents of 13 fodder tree leaves and shrubs available in the district Dir, Khyber Pakhtunkhwa Pakistan consumed by ruminants. The experimental foliage species were selected because they are abundantly available and highly preferred by ruminants in its natural

habitat and because farmers strongly believe that these foliage species are highly nutritious.

Materials and Methods

Dir district is some of the wettest place in Pakistan: annual rainfall at Dir averages 58 inches, of which 400 mm falls during the summer monsoon from July to September and twice that amount during the winter rainy season from December to April. At the temperature varies from -6^{0}C to 38^{0}C. The district is 1,582 square. Almost all of it lies in the valley of the Punjkora which raises high in the Hindo Kush Latitude 35^o 45' and joins the Swat River near Chikdara, where the district is usually entered, at Latitude 34^o 40'. Apart from the tehsils of Adenzai round Chakdara and Munda in the south-west, Lower Dir is rugged and mountainous.

Sample collection

Most dominant fodder tree leaves, shrubs and brows plants in the region, which are being used for feeding ruminants locally, were *Eleusine coracana Cyperus rotundus, Sorghum halepense, Tike mimosa, Populus Euphratica, Morus nigra, Sorghum bicolor, Oryza sativa, Prunus persica, Cynodon dactylon, Cotton seed cake, Ficus carica and Wheat straw.* The green leaves were rinsed in distilled water to remove dust and stored in a refrigerator to be freeze dried as soon as possible after collection. All the foliages were cut into small pieces so as to facilitate easy handling and uniform sampling for analysis. Samples were dried in the hot air oven at 65^{0}C for 24 hrs and ground to pass through 1-mm sieve, grinded and stored in polythene bags at room temperature. All samples were collected within 25 days to minimize effects of sampling time on nutrient composition. These samples were analyzed chemically. The procedures followed are described below: Foliages samples were air dried until the weight of dry matter became constant. The moisture content was determined by drying the sample at 75^{0}C to a constant weight. The difference between the fresh and dry weight were used for calculation of moisture content of the sample. The dry matter percentage was calculated by following formula:

$$\text{Dry matter (DM)\%} = \frac{Dry\ weight\ of\ the\ sample}{Fresh\ weight\ of\ the\ sample} \times 100$$

The air dried foliages samples were oven dried at 100 ^{0}C for 24 hrs for chemical analysis

Chemical analysis

Dry Matter (DM), Crude Protein (CP) and ash of the samples were determined according to AOAC (1990). The dry matter was determined by drying the samples at 80^{0}C till constant weight. Crude protein was estimated by micro kjeldhal method. Oven dried sample was digested with H_2SO4 in the presence of catalyst mixture containing K_2SO_4 and $CuSO_4$. A known aliquate of the diluted sample was distilled in the presence of 10 ml of 2% boric acid solution and titrated against standard 0.1N H_2SO_4. The percent of nitrogen was calculated for the estimation of CP. For ash, sample was ignited in muffle furnace at 550^{0}C to burn all the organic matter and leftover was weighed as ash.

Statistical analysis

Detail statistical analysis was not carried out but the average figure with their standard deviation has been given with the help of Minitab version 15. This was just an idea

about the nutritive value of the leaves from Dir district fodder tree leaves. A minimum of five observations were polled for each of the species to calculate the average values.

Results and Discussion

Dry Matter (DM) is the actual amount of feed material leaving water and volatile acids and bases if present. The DM contents of various foliages used for feeding livestock in the study area varied from 88.45 to 96.26 % and the mean was 92.76308 ±1.814109%. Most of the samples contained DM more than 93%, while only few of them contained more than 88% DM (Table 1). The highest DM value was observed for *Eleusine coracana* followed by *Cyperus rotundus, sorghum halepense, Tike mimosa, Populus euphratica, Morus nigra, Sorhum bicolar, Oryza sativa, Prunus persica, Cynodon dactylon, Cottonseed cake, Ficus carica and waheat straw* respectively. High DM content could be due to the time of sampling between November and January, after 6 months of little new growth.

Moreover farmers start harvesting of the foliages somewhere in October when other sources of green forage are declining and it continues till the end of March /April. Actual harvesting time and its duration, however, depends on the availability of fodder in the tree and numbers of ruminants a farmer owns. Nevertheless, it indicated that they constitute an important, reasonable and reliable source of DM, beside other nutrients, for feeding ruminants in the Dir district. The CP contents of fodder varied from 6.90-26.68% and the mean was 16.65077±6.010186. The highest CP value was observed for *Sorghum Bicolor* followed by *Tike mimosa, Cottonseed meal, Prunus persica, Morus nigra, Cynodon dactylon, Sorghum halepense, Populus euphratica, Ficus carica, Wheat straw, Oryza sativa, Eleusine coracana* and *Cyperus rotundus*. Statistical analysis of the data showed that % ash of various fodder trees and shrubs was significantly different (table 1). Mean values shows that ash contents of various foliages used for feeding livestock in the study area varied from 4.64 to 21.90% and the mean was 12.83385±5.17348. Most of the samples contained ash more than 13%, while only few of them contained lesser than 10% ash.

The highest ash value was observed for Mulberry while lowest was observed with wheat straw. The highest ash value was observed for *Tike mimosa* followed by *sorghum bicolor, Oryza sativa, Sorghum halepense, Prunus persica, Cynodon dactylon, Morus nigra, Ficus carica, Populus euphratica, Cyperus rotundus, Eleusine coracana, Cottonseed meal* and *Wheat straw.*

This has been demonstrated in other tree legume browse in various studies (Abdulrazak *et al*., 1997; BenSalem *et al*., 1997; Ondiek *et al*., 1999; Abdulrazak *et al*., 2000; Ondiek *et al*., 2000; Abdulrazak *et al*., 2001; Adjorlolo *et al*., 2001; Nantoume *et al*., 2001). The findings of this study were in line with those of Bakshi and Wadhwa (2004) they also reported a high CP in the *M. azedarach, M. alba and S. bicolor.* Srivastava *et al*. (2006) reported high CP contents of *M. alba,* 15.31-30.91% on DM basis. Similar findings were reported by Ba *et al*. (2005) who reported high CP contents, 18 to 25% on DM. Therefore Mulberry leaves, Sorghum and chinaberry leaves have a high potential as a protein-rich forage supplement for animal production (Benavides, 2000). Same results were recorded in our study which makes mulberry, sorghum and chinaberry a more

Table.1 Proximate composition (% in DM) of fodder tree leaves and shrubs of District Dir Khyber Pukhtunkhwa Pakistan

Local Name	English Name	Botanical Name	DM	CP	Ash
Bajra	Millet	*Eleusine coracana*	96.26	7.84	7.83
Dela	Nut sedge	*Cyperus rotundus*	94.81	6.90	9.90
Dadam	Johnson grass	*Sorghum halepense*	93.31	16.78	14.80
Tora shanday	Chinaberry	*Tike mimosa*	93.28	25.03	19.54
Sopedar	Poplar	*Populus euphratica*	93.27	15.46	11.85
Tooth	Mulberry	*Morus migra*	93.22	18.71	21.90
Makai	Sorghum	*Sorghum bicolor*	93.13	26.68	17.12
Shola	Rice	*Oryza sativa*	92.38	11.86	15.85
Shaftalu	Peach	*Prunus persica*	92.31	19.55	13.14
Kabal	Bermuda grass	*Cynodon dactylon*	92.31	18.66	13.14
Khal	Cotton seed cake	*Gossypium arboreum*	91.69	22.02	5.08
Inzar	Fig	*Ficus carica*	91.5	13.59	12.05
Bosa	Wheat straw	*Triticum aestivum*	88.45	13.38	4.64
Mean			92.76308	16.65077	12.83385
SD			1.814109	6.010186	5.17348

DM = Dry Matter, CP = Crude Protein, SD = Standard Deviation

nutritious feed source for high-protein demanding animals such as nursing cows and convalescents. Distel *et al*. (2005) reported that CP contents in different forage species declined with time. Proteins of mulberry leaves are of high quality and used with wheat flour to make parathas in the sub-continent. CP contents of all the species of this study were approximately higher than 10%, sufficient for medium level of production from ruminants (Subba, 1999). Subba (1999) has reported that a higher proportion of the CP in the fodder tree leaves is actually in the form available to ruminants. The fodder tree leaves like etc. are higher preferred by the farmers for their palatability and performance of the animal.

Dry matter and crude protein contents of different fodders showed wide variations. These variations could be a result of agronomic factors such as application of various levels of nitrogen fertilizers, time of harvest, ensiling, field drying and storage. Similar findings have been reported in Italian rye grass for its dry matter yield, which varied from 18.8-75.5% mainly due to different harvesting time (Bittante and Andrightto, 1982). Like DM and CP, other nutrients could also vary in different feeds due to agro climatic conditions, cultural practices and post-harvest processing and storage conditions. The total ash content is also almost higher than 10% or less in few of the fodder species. But few species like *Morus nigra*, *Tike mimosa*, and *Sorghum bicolo*r have exceptionally higher amount of total ash. Higher percentage of acid insoluble ash indicates the poor quality of feed Ranjhan (1981).

The current investigations on nutritional evaluation of foliages revealed that their leaves are carbohydrate-rich. Their low moisture content is an index of their great permanence due to less microbial

susceptibility and long shelf-life of their meal. These plants resulted as a good source of nutrients (proteins, fats, carbohydrates, fiber and minerals) and can be used as substrates deficit in either of these nutrients for livestock grazing in this specific district.

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