NUTRITIVE VALUE ANALYSIS OF SOME FODDER TREE SPECIES

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ABSTRACT

Nutritive value (chemical constituents) was determined for three fodder tree species including *Acacia nilotica, Bauhinia variegata,* and *Ceratonia siliqua*. The leaf samples of the selected species were collected with replication of ten (10) from the Range Research Garden of Pakistan Forest Institute (PFI), Peshawar, and brought into the Forest Chemistry Laboratory of PFI in polypropylene woven bags for chemical analysis. Quality parameters including moisture content, ash, protein, fat/oil, fiber, and carbohydrate content were determined. The results of the study revealed that *Bauhinia variegata* has a maximum percentage (12.56%) of protein content, followed by *Acacia nilotica* (10.28%) and *Ceratonia siliqua* (6.54%). The maximum carbohydrate percentage was found in *Acacia nilotica* (39.41%) followed by *Bauhinia variegata* (33.8%), while the minimum concentration (27.48%) was found in *Ceratonia siliqua*. Relatively high concentrations of fat were found in *Acacia nilotica*, followed by *Ceratonia siliqua* while minimum percentage was found in *Bauhinia variegata*. This study provides technical guidance for the suitability of tree species to be used as fodder. The information about the various contents like moisture content, Ash content, protein content, fat/oil content, fiber content, and carbohydrate can be helpful for the farming community to use tree leaves as fodder.

Keywords: Nutritive Value, *Acacia nilotica, Bauhinia variegata, Ceratonia siliqua*.

INTRODUCTION

A major constraint to animal production, as perceived by farmers in most areas, is a shortage of fodder, both in quantity and quality during the dry seasons. Because of the potentially high nutritive value of tree foliage, deep-rooted woody plants can help overcome these problems. Many of the important wood genera like Albizia, Acacia, Cajanus, Colliandra, Chamaecytisus, Flemingia, Gliricidia, Prosopis, Leucaena, and Sesbania have been screened during attempts to identify suitable fodder trees for a range of conditions (Derero and Kitaw, 2018). The major cause of poor productivity of small ruminant livestock in Pakistan is inadequate nutrition. Over 80% of the feed for livestock in Khyber Pakhtunkhwa is derived from crop residues and grazing on low-quality ranges (Habib *et al*. 2003). Digestibility and daily dry matter intake are low on feeding animals with low-quality forages, which adversely affects their productive efficiency. Supplementation of poor-quality forages with energy and protein supplements enhances its utilization, but these supplements are increasingly becoming scarce and expensive. Recent research in developing countries is centered on the utilization of local feed resources. Leguminous tree foliages are

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a rich source of protein and minerals (Norton, 2000), and many local species of trees provide an important feed bank for ruminant livestock in Pakistan.

Leaves and pods of *Acacia nilotica* (kikar) are used as fodder and contain 8% digestible protein (12% crude protein), 7.2% MJ/Kg energy, and are rich in minerals (Larbi *et al*., 2005). In part of its range small stock mainly consumes it, but elsewhere it is also very popular with cattle. Pods are used as a supplement to poultry rations in India. Dried pods are particularly sought out by animals on rangelands.

Bauhinia variegata is deciduous and the most popular leguminous fodder tree. The plant grows up to 10m tall, plant occurs in the south to middle belt region from 300m -1800m altitude. The naturally grown plant is protected along the buds and the terrace rises in the crop field. Leaves make good fodder and are more greedily eaten by sheep, goats, and cattle. The average annual fodder yield per tree is 15-20 kg of dry matter. Leaves of *Bauhinia variegata* contain 28% dry matter (DM), 30% crude protein, 19.03% ash, 3.39% calcium, phosphorus, etc (Ghol, 1981).

Ceratonia siliqua (Carob) is of medium size tree, occasionally up to 50 feet, with evergreen compound leaves. The tree is a legume, and the fruits are pods, up to a foot long and about an inch wide, containing 3-6 seeds. Both seeds and pods are edible. Carobs are grown mainly for livestock feed, but the finally ground pods and seeds make sweet, nutritious human food (Leng, 1992). Carob pulp is high (48-56%) in total sugar content. In addition, it contains about 18% cellulose and hemicellulose. The mineral composition mg/100gm of pulp is comprised of K (1100), Ca (307), Mg (42), Na (13), Cu (0.23), Fe (104), Mn (0.4), Zn (0.59) (Prasad *et al*., 1997).

The nutritive value of fodder tree is determined by their ability to provide a range of nutrients required by the animals for growth and reproduction. It is related to intake, chemical composition, digestibility, and the presence and absence of anti-nutritive factors (Bonsi *et al.,* 1994). The present study has been designed to evaluate the nutritive value of the selected fodder tree species to recommend more nutritious and healthy food for livestock.

Objectives of the study

- To assess the levels of essential nutrients such as proteins, carbohydrates, fats and fibers in the selected species

- To recommend more nutritious and healthy food for livestock.

MATERIALS AND METHODS

A study was carried out to assess the nutritive value of fodder tree species including *Acacia nilotica, Bauhinia variegata,* and *Ceratonia siliqua*. The leaf samples of the selected species were collected with replication of ten from Range Research Garden of Pakistan Forest Institute (PFI), Peshawar, and brought into the forest chemistry laboratory of PFI in polypropylene woven bags for chemical analysis. Quality parameters including moisture content, ash, protein, fat/oil, fiber, and carbohydrate content were determined by the procedure (Anonymous, 1990).

Moisture Content

The moisture content of leave samples was determined by the oven drying method. About 20g of well-mixed sample was accurately weighed (W_1) in a clean weighed petri dish and oven dried at 105°C for 4 to 6 hours. After gaining constant weight, the samples were placed in a desiccator for 30 minutes to cool and weighed again (W_2). The Percent moisture was determined by the following formula:

$$\text{Percent moisture} = \frac{W1 - W2}{W1} \; X \; 100$$

Ash content

For the determination of ash about 20g of oven-dried sample was placed into a muffle furnace at 550°C overnight until the white ash appeared. The percent ash was calculated as follows:

$$\text{Percent Ash} = \frac{weight\ of\ ash}{Oven\ dry\ weight\ of\ the\ sample} \; X \; 100$$

Crude Protein Content

Crude protein was determined by estimating the nitrogen content of the leaves sample. Nitrogen content was examined by the proposed procedure of Bremner (1982). Crude protein was calculated by multiplying the amount of nitrogen with an appropriate factor of 6.25.

Crude Fat Content

Crude fat content was determined by Soxhlet's apparatus. A 1gm of moisture-free sample was taken in a fat-free thimble. The thimble was plugged with absorbent cotton wool and placed in an extraction tube. A clean and dried 250ml round bottom flask was weighed and filled up one-third of this flask with anhydrous petroleum ether. The flask was then connected to the extraction tube and the fat was extracted repeatedly with petroleum ether between boiling points

of 40-60°C. The flask was then dried at 105°C for 1hr, then cooled and weighed again. The percent oil content of the sample was calculated as follows:

$$\text{Percent Oil} = \frac{(wt.\ of\ flask + Oil) - wt.of\ empty\ flask}{Oven\ dry\ weight\ of\ sample}\ X\ 100$$

Crude fiber Content

Moisture-free and ether-extracted sample leaves were first digested with dilute H_2SO_4 and then with dilute NaOH solution. The undigested residue collected after digestion was ignited and the loss in weight after the ignition was considered crude fiber.

$$\text{Crude fiber (\%)} = \frac{Loss\ in\ weight\ on\ ignition}{Oven\ dry\ weight\ of\ sample}\ X\ 100$$

Carbohydrate Content

The carbohydrate content is the percent of the amount remaining after removing moisture content, ash content, protein content, fat content, and fiber content from the sample. It is calculated by adding all values of moisture content, ash content, protein content, fat content, and fiber content and subtracting from hundred.

Carbohydrate content (%) = (Moisture + Ash + Protein + Fat + Fiber content) – 100

RESULTS AND DISCUSSION

Nutritive value estimation of *Acacia nilotica*

Moisture content, ash content, protein content, fat/oil content, fiber content, and carbohydrate content of leave samples were determined to evaluate the leaves for their suitability as fodder for different types of animals. Average moisture content, dry matter, and total ash content in the leaves were 17.32, 82.68 and 15.32 % respectively. The protein content in the leaves was 10.28%. The protein content was sufficient and meet the standard requirement of digestible nutrients. Fat and fiber content were respectively 11.54% and 6.10%, which is considered to be sufficient for grazing animals. Carbohydrate content was as high as 39.41%. Therefore, fulfills the nutritive requirement of Oxen, fattening cattle, milk cows, and horses.

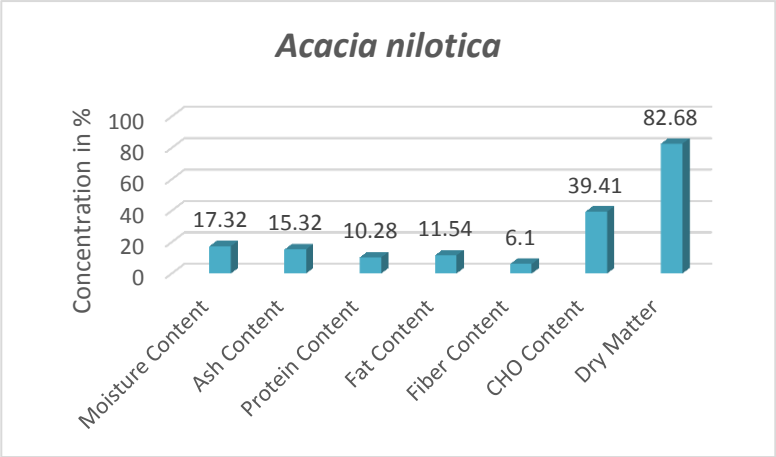

Fig.1. The mean percent nutrition in leaves of *Acacia nilotica*.

Nutritive estimation of *Ceratonia siliqua*

Moisture content, ash content, protein content, fat/oil content, fiber content, and carbohydrate content of leave samples were determined to evaluate the leaves for their suitability as fodder for different types of animals. The average moisture content of the leaves was found 22.35%, while dry matter and ash or crude mineral content was 77.65 and 19.84% respectively. Protein content and fat or oil content in the leaves were 6.54% and 10.38 % respectively. The fiber content in the leaves was 13.38%. Carbohydrate content was as high as 27.48% and fulfills the nutritive requirement of Oxen, fattening cattle, milk cows, and horses.

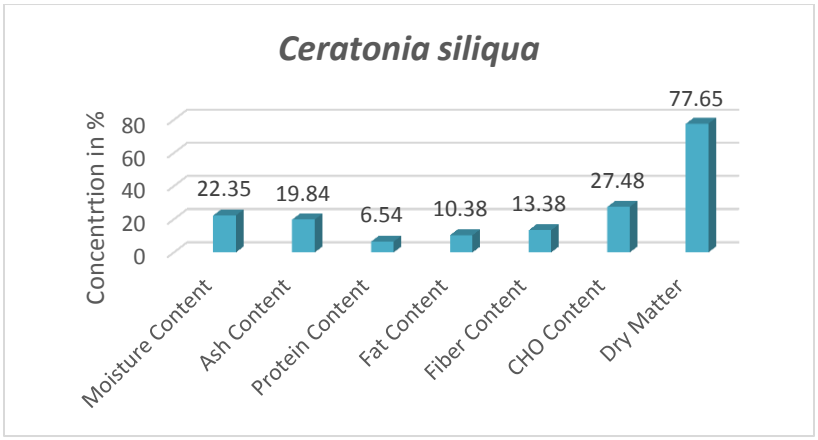

Fig.2. The mean percent nutrition in leaves of *Ceratonia siliqua*.

Nutritive estimation of *Bauhinia variegata*

Moisture content, ash content, protein content, fat/oil content, fiber content, and carbohydrate content of leave samples were determined to evaluate the leaves for their suítabilíty as fodder for different types of animals. Moisture content, ash content, and dry matter of the ten replicates were determined at 16.45, 83.55 and 14.34 % respectively. The protein content (12.55%) in the leaves was found satisfactory which meets the standard requirement of digestible nutrient. Fat and fiber content was 8.65% and 14.1%, which is sufficient for grazing animals. Carbohydrate content was as high as 33.88 % and fulfills the nutritive requirement of Oxen, fattening cattle, milk cows, and horses.

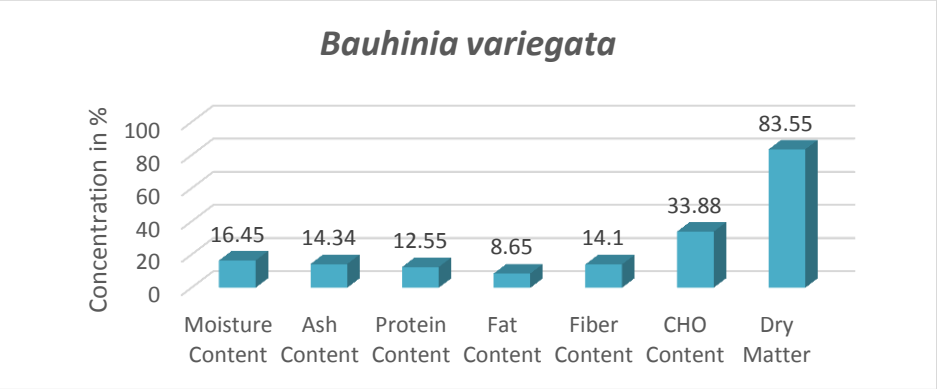

Fig.3. The mean percent nutrition in leaves of *Bauhinia variegata.*

CONCLUSION

- Based on the results of the study, it is concluded that *Ceratonia siliqua* has a high percentage of moisture content and ash content, *Bauhinia variegata* has the highest content of protein and fiber and *Acacia nilotica* has the highest percentage of fat/oil content and carbohydrates than other species in this study.

- Fodder tree leaves have the potential for alleviating some of the feed shortage and nutritional deficiencies experienced in the dry season. Therefore, there is a need to evaluate them for use as fodder in dry seasons.

- Educate the farmers regarding the good quality fodder trees for effective utilization and promote the use of fodder tree species among the farming community to establish fodder gardens on fellow lands.

RECOMMENDATION

The integration of *Bauhinia variegata* into livestock feeding or as a component of balanced feed formulations due to its high protein and fiber content is recommended.

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