SEASONAL VARIATION IN CHEMICAL COMPOSITION OF TWIGS AND LEAVES OF KIKAR (*ACACIA NILOTICA*)

Muhammad Zafar Iqbal[1], Amjad Ali Ch.[2], Javaid Ahsan[3] and Shahzad Fazal[4]

Abstract

Twigs and leaves of *Acacia nilotica* are excellent fodder for livestock. The samples of *Acacia nilotica* were collected bimonthly from Rakh Dagar Kotli for two years. The proximate analysis indicated 32.86 – 40.72 percent dry matter (DM), 11.18 – 15.29 percent crude protein (CP), 22.36 – 30.78 percent crude fibre (CF), 2.88 – 3.62 percent ether extract (EE), 5.18 – 10.02 percent ash and 42.16 – 53.99 percent nitrogen – free extract (NFE). The data so collected suggest that leaves and twigs of *Acacia nilotica* can be fed to livestock due to their high contents of CP, EE, NFE and DM, CF during summer and winter respectively.

Introduction

The current status of animal protein deficiency in developing world is caused by lack of forage. Trees and shrubs play dual role serving both as shade and forage supply for livestock. During dry season, shrubs and trees provide green fodder i.e. twigs, leaves, flowers, fruit etc., often rich in protein, vitamins and minerals. However, during non-availability season, animals depend upon straw only from native grasses and this poor feed causes avitaminosis, mineral deficiencies and severe debilitation.

Pakistan is an agricultural country having a head of 137 million of livestock which contribute 10.8 % towards the GDP (Anonymous, 2006). Nutritional requirements of these animals are mainly met through fodder crops, grasses and shrubs. Akram (1990) reported that livestock were getting only 75% of required amount of total digestible nutrients and there was 60% shortage of digestible crude protein. Due to ever increasing human population the demands of meat, milk and milk products are also increasing, these demands could be overcome by improving the quality and quantity of feed and could enhance livestock production up to 50% from existing genetic pool of animals (Hasnain, 1983). Fodder trees and shrubs constitute a vital component in livestock productivity in the arid and semi-arid zones. They supply goats and camels with the bulk of their nutritive requirements and complement the diet of cattle and sheep with protein, vitamins and minerals in which bush straw is deficient during the dry season. Nutrition of game animals also greatly depends on them. Twigs and leaves of fodder trees contribute a major source of livestock feed. Leaf fodder of some trees is almost as nutritious as that of leguminous fodder crops (Singh, 1982).

Acacia nilotica is an evergreen moderate size tree and is indigenous to Sind, the Decan and tropical Africa. It is planted throughout the plains of Punjab. *Acacia nilotica* forests are mainly confined to the lower Sind where it grows on riverain alluvial sandy loam soils subject to inundation (Khan, 1965). It is salt tolerant but does not tolerate water logging for longer periods (Bangash, 1977). Singh (1982) reported that forage Dry

1 Director General, Punjab Forestry Research Institute, Faisalabad
2 Senior Research Officer, Punjab Forestry Research Institute, Faisalabad
3 Research Officer, Punjab Forestry Research Institute, Faisalabad
4 Research Assistant, Punjab Forestry Research Institute, Faisalabad

matter (DM) yield of 5.27 t/ha was obtained from its leaves. Sharma (1990) observed that maximum accumulation of nutrients was in leaves and twigs of *Acacia nilotica*. Andru (1992) observed that *Acacia nilotica* contains 45.3 % Dry matter (DM), 14.2 % Crude protein (CP), 3.3 % Ether extract (EE) and 66.2 % Nitrogen free extract (NFE). The Crude protein of leaves and pods of *Acacia nilotica* varies 12.1 to 13.1 %, Crude fibre (CF) 11.3 to 28.5 %, Ash 5.2 to 6.4 %, Ether extract (EE) 2.3 to 12.6 % and Nitrogen free extract (NFE) 51.2 to 67 % (FAO, 1992). Ray (1971) reported that leaves of *Acacia nilotica* contain 15 % Crude protein (CP), 20% Crude fibre (CF), 51.62% Nitrogen Free Extract (NFE), 5.06% Ether extract (EE) and 8.22% Ash.

Chemical composition of leaves varies in different months but the change in chemical composition at different localities is not regular as it is influenced by edaphic and climatic changes (Singh and Mudgal, 1967). Chemical composition is a fair indicator of feeding value of a plant species. Information of seasonal variation in chemical composition provides a guideline for utilizing tree fodder at specific stages to ensure optimum use. Little literature is available about seasonal variation in chemical composition of twigs and leaves of different species. The present study was, therefore, conducted with the objective to determine seasonal variation in proximate constituents of twigs and leaves of *Acacia nilotica*. Some *Acacia* species such as *Acacia albida*, *A. tortilis* and *A. erioloba* contain substances such as cynogenic glucosides, fluoroacetate or tannins which may considerably reduce their nutritive value or even by toxic to animal. However, toxicity depends upon the concentration of the deleterious compound in the fodder and the rate at which the forage is eaten. “An amount of the plant eaten quickly, say in one hour, could be fatal whereas the same amount of plant material eaten slowly over, for example, a five hour period, would be harmless” (Storrs, 1982).

Material and Methods

Acacia nilotica raised at Rakh Dagar Kotli were selected for this study. The samples of green leaves and twigs (less than 6 inches in length) were collected randomly on bi-month basis (in January, March, May, July, September and November) for two years. The samples were weighed immediately and preserved in air tight polythene bags, already marked for identification. The samples were dried in oven at 55°C to a constant weight. The difference between the fresh and dry weight indicated the moisture content of the samples. The dry matter percent was thus calculated by following formula:

$$\text{Dry matter percent} = \frac{\text{Dry weight of the sample}}{\text{Fresh weight of the sample}} \times 100$$

The dried samples were ground to 0.5 – 1.0 mm mesh and preserved for proximate analysis AOAC (1984) for following parameters:

1. Dry matter (DM) %
2. Crude protein (CP) %
3. Crude fibre (CF) %
4. Ether extract (EE) %
5. Ash %
6. Nitrogen – free extract (NFE) %

The proximate analysis for above parameters was done in triplicate and the mean value was calculated.

Results and Discussion

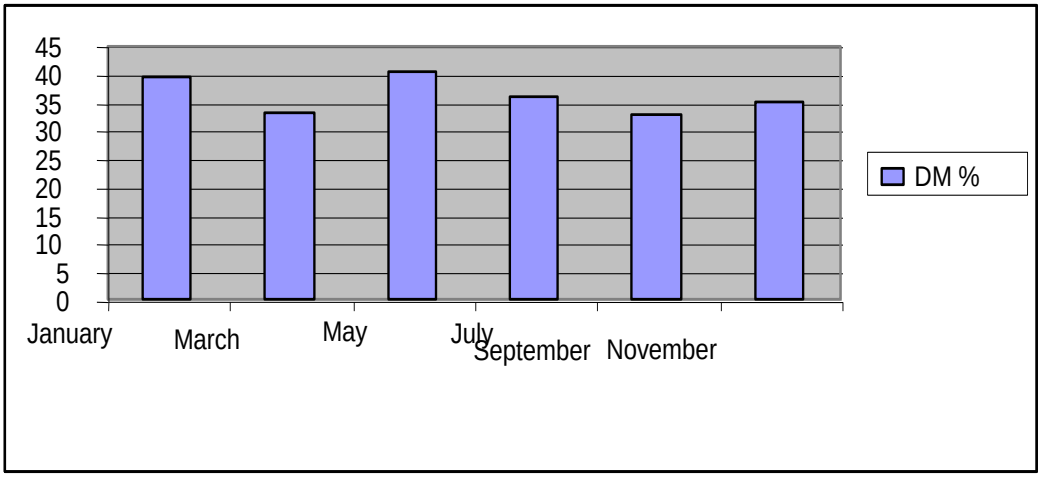
The results about variation in chemical composition of twigs and leaves of *Acacia nilotica* are shown in table – 1 and are summarized in the following paragraphs.

Table 1. Chemical composition of twigs and leaves of *Acacia nilotica*

	DM %	CP %	EE %	CF %	ASH %	NFE %
January	39.54	11.18	2.88	30.78	6.66	48.46
March	33.32	14.77	3.10	30.03	10.00	42.16
May	40.72	12.69	3.17	26.88	7.95	49.36
July	36.24	14.86	3.62	22.36	5.19	53.99
September	32.86	15.30	3.10	27.32	9.20	44.97
November	35.12	14.76	3.10	29.96	10.02	42.16

Dry matter

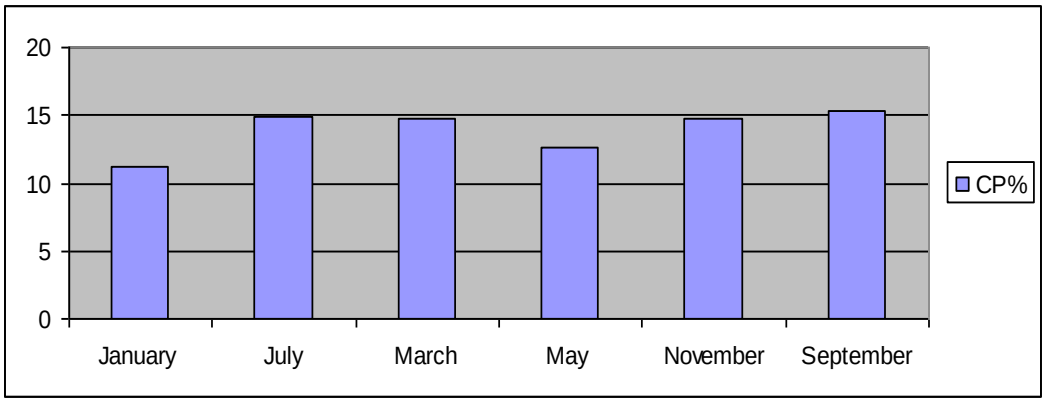
The mean values of DM% varied from 32.86 to 40.72. The minimum DM% was found in September. This might to be due to more fresh leaves and flowers in rainy season. The maximum DM % was found in May. It might be due to more evapotranspiration in the hot season. Generally the DM% was greater in winter season followed by spring and summer season.



Crude protein

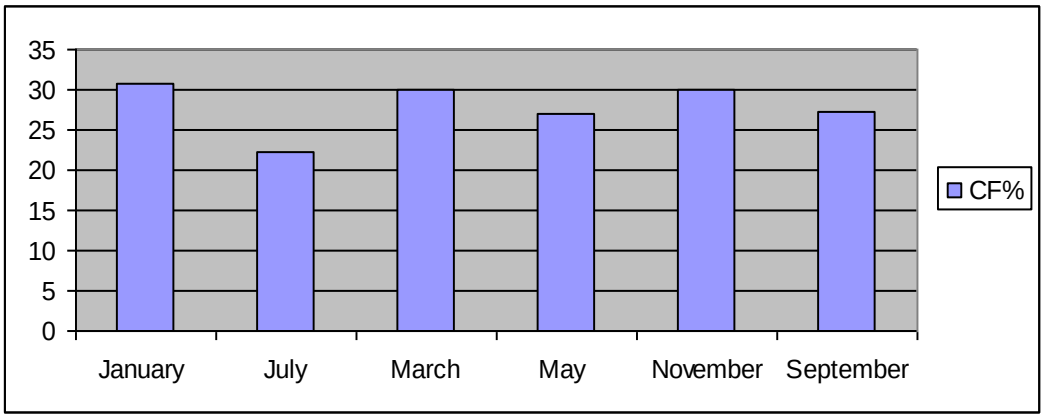
The mean values of CP% varied from 11.18 to 15.30. The minimum CP% was found in January. This might be due to less leaf growth in winter season. The maximum CP% was found in September which might be due to more leaf and flower growth in rainy

season. In general CP% increased from spring to monsoon almost linearly. This trend might be due to more suitable conditions for leaf and flower growth.



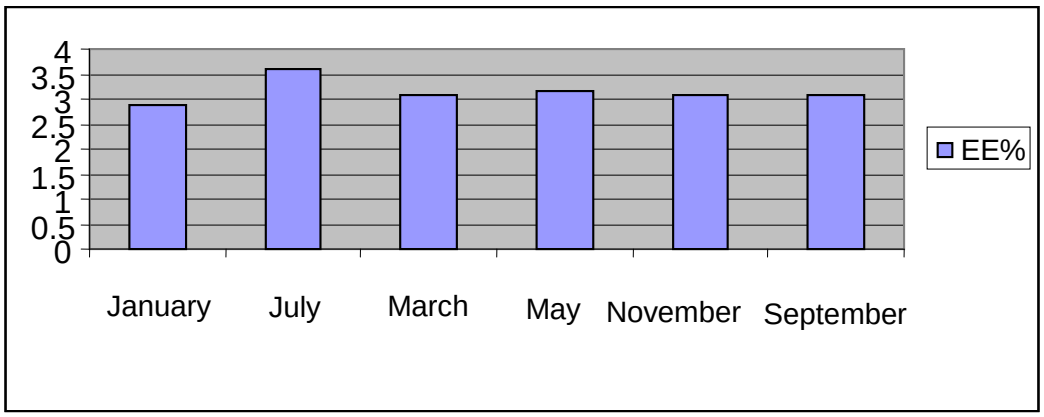
Crude fibre

The mean values of CF% varied from 22.36 to 30.78. the minimum CF % was found in July. This might be due to more fresh leaf growth in monsoon season. The maximum CF% was found in January which might be due to less growth of fresh leaves and more lignocellulose in the old leaves in winter season. In general CF% decreased from spring to monsoon almost linearly. This trend might be due to more suitable conditions for leaf and flower growth.



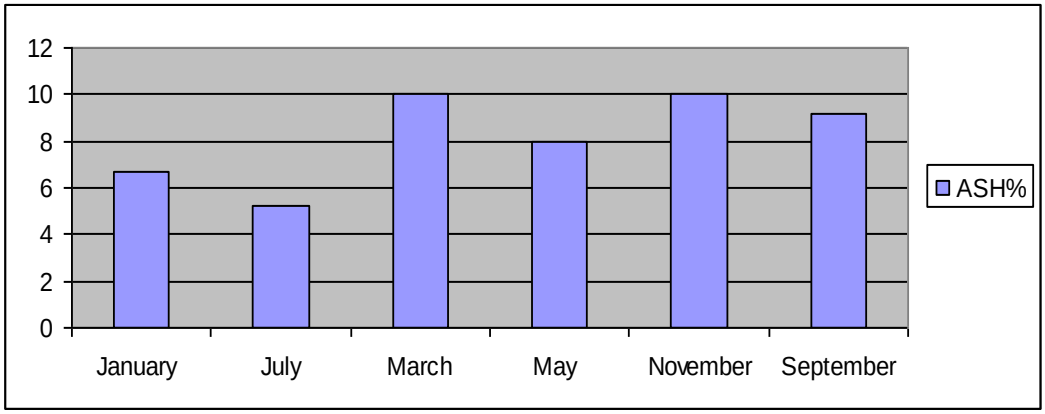
Ether extract

The mean values of EE % varied from 2.88 to 3.62. The minimum EE % was found in January. This might be due to less leaf growth in winter season. The maximum EE % was found in July which might be due to more fresh leaf and flower growth in rainy season. In general EE % was more in summer and autumn seasons than in winter and spring seasons. This might be due to more suitable conditions for leaf and flower growth.



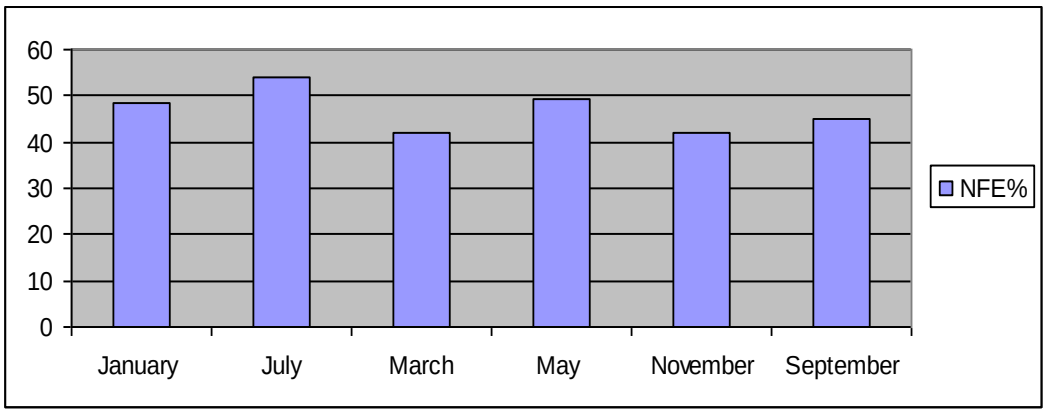
Ash

The mean values of Ash % varied from 5.18 to 10.02. The minimum Ash% was found in July. This might be due to low accumulation of salts in the fresh leaves. The maximum Ash % was found in November which might be due to more accumulation of salts in the old leaves. In general Ash% was more in winter followed by spring, summer and autumn seasons almost linearly.



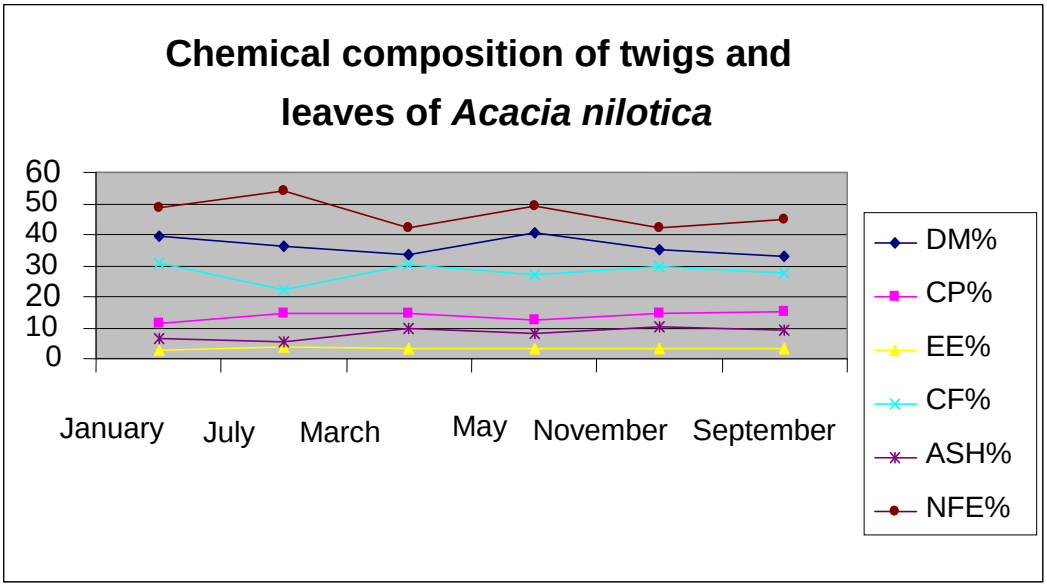
Nitrogen – free extract

The mean values of NFE% varied from 42.15 to 53.99. The minimum NFE% was observed in March and the maximum in July. It might be due to more suitable conditions in late summer for growth of fresh leaves and twigs.



Conclusions

The chemical analysis revealed that the DM and CF percent was maximum in winter and minimum in summer. Reverse was the case for CP and EE percent. Maximum values of Ash and NFE percent were found in autumn and summer respectively. The maximum CP, EE and NFE percent of *Acacia nilotica* in summer advocate for its use in summer season. However, maximum percentage of DM and CF in winter recommend that *Acacia nilotica* provides better nutrition if utilized in winter season.



References

Akram, M., 1990. Pakistan. Animal feed resources in Asia and Pacific. Asian Productivity Organization, Tokyo.

Andru, J., M. Labonne, H. Guerin and A. Bilha, 1992. *Acacia nilotica*: a traditional forage species among the Afar of Djibouti. FAO-Animal Production and health paper (102): 277-293.

Anonymous, 2006. Economic survey, Govt. of Pakistan. Finance Division, Economic Advisors Wing, Islamabad.

AOAC, 1984. Official methods of analysis (4th edition), Association of Agricultural Chemists, Washington, D.C.

Bangash, S. H., 1977. Salt tolerance of forest tree species as determined by germination of seeds at different salinity. Pak. J. For. 27(2): 93-97.

FAO, 1992. Animal Production and Health Paper. Food and Agriculture Organization of the United Nations, Rome. (102): 277-293.

Hasnain, H., 1983. Feed – The key to more food in Pakistan. Proc. FAO PARC Workshop on Least Cost Formulation, Islamabad. March, 1983.

Laurie, M. U., 1945. Fodder trees in India. Ind. For. Leaflet. 82. (Silva) F.R.I. Dehra Dun.

Roberts, T. J., 1977. The mammals of Pakistan. Ernest Benn Limited, London & Tonbridge.

Sen, K. C. and S. N. Ray, 1971. Nutritive values of Indian cattle feeds and the feeding of animals. Indian Counc. Agric. Res., New Delhi, 133p.

Sharma, K. N. Singh and J. L. Ogra, 1990. Performance of Barbari goats fed on *Acacia nilotica* (desi babul) and *Leucaena leucocephala* (subabul) foliage. Indian J. Anim. Sci. 60 (6): 746-747.

Singh, K. H. and V. D. Mudgal, 1957. Chemical composition and nutritive value of *Leucaena glauca* (white popinac). Ind. J. Dairy Sci. 20: 191-5.

Singh, R. V., 1982. Fodder trees of India. Oxford and IBH Publishing Co. New Dehli.

Storrs, A.E.G. 1982. More about trees. Forest Department Ndola, Zambia. 126pp.