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# Seasonal nutrient profile of some preferred fodder tree species of Kashmir Valley

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**Abstract**
Quantitative analysis of some preferred fodder tree species viz., *Populus deltoides*, *Populus nigra*, *Robinia pseudoacacia*, *Salix alba* and *Salix fragilis* was performed to find out the seasonal effect on nutrient composition of their foliage in District Budgam of Kashmir Valley. Leaves were collected during three seasons i.e. spring, summer and autumn from four prevalent agroforestry systems of District Budgam of Kashmir valley viz. Boundary plantation, Homegarden, Horti-agricultural and Horti-silvi-pasture system during the year 2013-14. The results of the investigation revealed that nutrient composition significantly varied among different tree species. The crude protein content decreased, while crude fibre, ether extract and ash content increased with successive seasons among all evaluated species.

**Keywords:** Nutrient profile, seasonal variation, agroforestry systems, Kashmir valley

## Introduction
Nutrition is the most important consideration in ruminant production system. Ruminant depends solely on plants for their nutritional requirements in general and energy in particular (Fasae *et al*., 2010) [10]. Trees and shrubs are important feed components of ruminant diet (Babayemi and Bamikole, 2006) [5] and play an important role in the nutrition of livestock in areas where few or no alternatives are available (Singh and Todaria, 2012) [20]. Azim *et al*. (2011) [4] has also pointed out trees and shrubs increasingly being recognized as important components of animal feeding, especially as suppliers of protein. Knowledge of mineral nutrient concentrations of the foliage, at different time during a growth season can be used as one indicator to determine the appropriate lopping period of a particular tree species. Many of the preferred and higher quality species in terms of its nutritional values are under pressure, leading to changes in species compositions and forest succession patterns (Chettri *et al*., 2002) [8]. There is little information about the compositional changes in nutritive value of leaves of preferred trees in Kashmir valley with respect to season. It is therefore necessary to have acquaintance of the quality of species that are used for feeding ruminants as a basis for promoting planting and management of such species.

## Material and Methods
**Study area:** The study was conducted in District Budgam located between 34°1′12″N latitude and 74°46′48″E longitude at an altitude of 1610 m above mean sea level (amsl), roughly 15 km south east of Srinagar city anciently known to be *Deedmarbag*. The topography of the district is mixed with both mountainous and plain areas. The climate is of the temperate type with the upper-reaches receiving heavy snowfall during winter. The average annual precipitation of the district is 585 mm.

**Sample collection and analysis:** A total of three tehsils namely: Budgam, Beerwah and Chadoora were selected to carry out the study in District Budgam. Multistage stratified random sampling was used to select the blocks; villages within tehsils and then farmers within villages (Table-1).

**Table 1:** Details/ Methodology for the selection of sample areas

| Selected Tehsils | Beerwah | Budgam | Chadoora |
|---|---|---|---|
| Selected Blocks (06) | 2 | 2 | 2 |
| Selected Villages (06 per Block) | 6 x 2 = 12 | 6 x 2 = 12 | 6 x 2 = 12 |
| Selected Farmers (7 per Village) | 6 x 2 x 7 = 84 | 6 x 2 x 7 = 84 | 6 x 2 x 7 = 84 |
| Grand Total | 252 | | |

After reconnaissance, four prevalent agroforestry systems were identified viz., Boundary plantation, Homegarden, Horti-agricultural system and Horti-silvi-pasture system. Five tree species were identified as most important fodder tree components of these prevalent agroforestry systems of District Budgam namely: *Populus deltoides*, *Populus nigra*, *Robinia pseudoacacia*, *Salix alba* and *Salix fragilis*, The forage (leaf) samples of *Populus deltoides*, *Populus nigra*, *Robinia pseudoacacia*, *Salix alba* and *Salix fragilis* were collected from four identified prevalent agroforestry systems of District Budgam during 2013-14 on seasonal basis viz., spring, summer and autumn season using stratified random sampling. Leaves were washed in distilled water to remove dust after collection and dried in hot air oven at 60 °C for 24 hrs, ground and stored in polythene bags at room temperature before subsequent nutrient analysis as per standard procedures described by the Association of Official Analytical Chemists methods (AOAC) (1999) [1] for the following parameters:

a) **Crude protein (%):** The contents of crude proteins in samples were estimated by using macro-Kjeldahl method, in which digestion of samples was done with considerable amount of acid. After adding alkali, distilled the digested material. The released ammonia was collected in 4% boric acid. Boric acid along with ammonia was titrated against N/10 $H_2SO_4$. Then percentage nitrogen was multiplied by 6.25 percentages to obtain crude protein content of the sample.
b) **Crude fibre (%):** Ovendried sample after ether extraction was put into 250 ml of spoutless flask/beaker and 1.25% $H_2SO_4$ is added to it and then heated for about 30 min, filtered then washed until traces of acid could not be detected using pH paper. The acid extracted was again transferred into 250 ml flask/beaker and 1.25% NaOH is added subsequently. Sample was then heated again for 30 minutes, filtered and washed. The material was transferred into crucible and oven dried at 120 °C for 12 h. After it, crucibles were placed in muffle oven for 2 hrs at 550 °C-650 °C and recorded the crucible weight.
c) **Ether extract (%):** A dried sample (2-3 g) was extracted with petroleum ether (4°C - 60°C) in soxhlet apparatus to remove the ether soluble component present in it. The extracted material was then dried to a constant weight in an oven at 70 °C.
d) **Total ash (%):** 2 g of leaf sample was placed in crucible, weighed and put in muffle furnace at 650 °C for 3 hrs and weighed again.

**Statistical Analysis:** All data were subjected to analysis of variance (ANOVA) using R- software. Means were separated using the comparisons based upon the least significant difference (LSD) (Level of significance $P<0.05$).

**Results and Discussion**

The data for different quality parameters is presented in the Table-2 and 3. The critical scrutiny of the data indicated that the seasons have significant effect on the crude protein content of different preferred tree species i.e. crude protein decrease with successive seasons. The mean values for crude protein content concentration were significantly maximum in spring (13.33%) with highest value recorded for *Robinia pseudoacacia* (18.73%) and lowest for *Populus deltoides* (11.52%), followed by summer (10.87%) with same trend of maximum concentration evaluated for *Robinia pseudoacacia* (18.58%) and minimum for *Populus deltoides* (8.80%). During autumn season, minimum nutritive value of 10.05% in terms of crude protein was evaluated which was found to be at par with summer season with highest value scored by *Robinia pseudoacacia* (17.01%) and minimum (7.73%) by *Populus deltoides* being at par with *Populus nigra*, *Salix alba* and *Salix fragilis*. The possible reasons may be ascribed to the dilution effect, i.e. the rate of inflow of nutrient into the leaves may be lower than the amount of dry matter produced at a particular growth stage, thus decreased level of crude protein with season and/ or maturity of the leaves (Khosla *et al*. 1992 [16]; Singh and Todaria, 2012) [20]. Furthermore, there is close relationship between physiological activities of plants and water content. Physiological events slowdown in drying plants and DM increases as the amount of water inside the cells decreases. Plants need more nitrogenous food for vegetative growth and therefore they efficiently store protein in early stages of growth, which is later on consumed during flowering and fruiting followed by dormant phase whereby their nutritional status reduces (Hussain and Durrani 2009) [13]. These findings are in conformity with Ahmed *et al*. (2013) [2] for various forage plants for ruminants investigated in a semi-arid region of Punjab, Pakistan; Bamigboye *et al*. (2013) [6] for assessment of seasonal nutrient composition of predominant forages in Nigeria; Parlak *et al*. (2011) [19] for forage quality of deciduous woody and herbaceous species at different seasons in Mediterranean shrublands of Western Turkey; Azim *et al*. (1989) [3] for nutritional evaluation of maize fodder at two different vegetative stages. Kacar *et al*. (2006) [14] have stated that protein synthesis is stimulated as the plants starts to grow in the spring. Number of young cells increase and the physiological events are induced. These events are the results of enzyme activities derived from proteins. Young cells also have high ratio of protoplasm. Most of the proteins in a cell are located in the protoplasm.

The perusal of the data in Table-2 revealed that crude fibre increases with advancing seasons. Significant variation was found among different preferred tree species. The mean values for crude fibre content were found to be minimum during spring (15.00%) with highest value recorded as 15.92% for *Populus nigra* and lowest in *Robinia pseudoacacia* (12.91%), followed by summer (17.09%) with same trend of maximum concentration in *Populus nigra* (19.65%) and minimum in *Robinia pseudoacacia* (13.16%). Highest nutritive profile in terms of crude fibre was evaluated during autumn season as 17.77% with maximum achieved by *Populus nigra* (19.93%) and minimum (14.11%) by *Robinia pseudoacacia.* Fibrous compounds are found in the cell wall and its components are more abundant in the older cells than the younger ones (Lyons *et al*., 1999) [17]. Cell wall development is related to plant development and as the plant matures wall compounds, crude fibre increases and protoplasm compounds like crude protein decreases (Haddi *et al*. (2003) [11]; Parissi *et al*. (2005) [18]; Hashmi and Waqar (2014) [12]; Kaplan *et al*. (2014) [15]. Numeric values in Table-3 elaborates that seasons showed highly significant variation in terms of ether extract among tree species investigated. It was observed that ether extract increased with advancing seasons. The mean values for ether extract concentration were minimum during spring (3.34%) with highest value recorded in *Robinia pseudoacacia* (4.86%) and lowest in *Populus deltoids* (2.28%), followed by summer (3.96%) with same trend of maximum concentration in *Robinia pseudoacacia* (5.10%) and minimum in *Populus deltoides* (3.03%). Highest ether extract value was evaluated during autumn (4.31%) with highest value scored by *Robinia pseudoacaia* (5.12%) and lowest by *Populus deltoides* (3.38%) which was found to be

at par with *Populus nigra*, *Salix alba* and *Salix fragilis*. Increased ether extract with increasing maturity in the species under study can be attributed to increased uptake of mineral elements from the soil at this time and later deposition of an important part of these elements into the cell walls. Our findings are in conformity with Blair and Epps, (1969) [7], Haddi *et al*. (2003) [11] and Hashmi and Waqar (2014) [12].

Data pertaining to total ash in Table-3 revealed highly significant variation during three different seasons (spring, summer and autumn) and among different tree species. It was observed that total ash increases with successive season within each species examined. The mean values for total ash were recorded to be minimum during spring (12.12%) with highest value recorded (13.23%) in *Populus nigra* and lowest in *Robinia pseudoacacia* (8.91%), followed by summer (12.42%) with same trend of maximum percentage in *Populus nigra* (13.36%) and minimum in *Robinia pseudoacacia* (9.51%). Nutritive value in terms of total ash was evaluated to be maximum (12.87%) during autumn season with highest value exhibited by *Populus nigra* (13.82%) and lowest (9.98%) by *Robinia pseudoacacia.* Parlak *et al*. (2011) [19] observed lowest Ca and P in the two shrubs viz., gall oak (*Quercus infectoria* Oliv.) and Christ's thorn (*Paliurusspina-cristi* Mill.) of western Turkey during April which then shows high level during November as calcium involves in the structure of harder tissues (cell walls) and is important constituent of ash. This was because protoplasm compounds of the cell were high at the beginning of plant growth, therefore, Ca and ash was low in the young shoots of the shrubs taken during fast growth in April and May. Cook and Harris (1950) [9] attributed increase in ash with maturity to dust accumulations.

## Conclusion

The preceding results on seasonal variation in fodder values of preferred tree species in District Budgam explained that crude protein was high during spring, shows decreasing trend in summer and autumn season. Crude fibre, ether extract and ash content increased with advancing season among all the evaluated tree species. Among species investigated, *Robinia pseudoacacia* and *Populus nigra* proved to be an excellent source of protein, fat, fibre and ash for efficient maintenance of ruminants.

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**Table 2:** Effect of Season on Crude protein and Crude fibre contents of preferred fodder tree species of District Budgam.

| Season' / Plant species | Crude protein (%) | | | | Crude fibre (%) | | | |
|---|---|---|---|---|---|---|---|---|
| | Spring | Summer | Autumn | Mean | Spring | Summer | Autumn | Mean |
| *Populus deltoides Bartr.* | 11.52 | 8.80 | 7.73 | 9.35 | 15.89 | 19.63 | 19.92 | 18.48 |
| *Populus nigra Bartr.* | 11.73 | 8.93 | 7.92 | 9.53 | 15.92 | 19.65 | 19.93 | 18.50 |
| *Robinia pseudoacacia L.* | 18.73 | 18.58 | 17.01 | 18.10 | 12.91 | 13.16 | 14.11 | 13.40 |
| *Salix alba L.* | 12.42 | 9.07 | 8.87 | 10.12 | 15.14 | 16.53 | 17.26 | 16.31 |
| *Salix fragilis L.* | 12.27 | 8.97 | 8.71 | 10.00 | 14.80 | 16.15 | 17.24 | 16.06 |
| Mean | 13.33 | 10.87 | 10.05 | - | 15.00 | 17.02 | 17.77 | - |
| CD ($p \leq 0.05$) | | | | | | | | |
| Plant species: | 1.75 | 0.71 | | | | | | |
| Season: | 1.35 | 0.55 | | | | | | |
| Plant sp. x Season: | N.S | 1.23 | | | | | | |

**Table 3:** Effect of Season on Ether extract and Total ash contents of preferred tree species of District Budgam.

| Seasons / Plant species | Ether Extract (%) | | | | Total Ash (%) | | | |
|---|---|---|---|---|---|---|---|---|
| | Spring | Summer | Autumn | Mean | Spring | Summer | Autumn | Mean |
| *Populus deltoides Bartr.* | 2.28 | 3.03 | 3.88 | 3.06 | 13.22 | 13.36 | 13.80 | 13.46 |
| *Populus nigra Bartr.* | 2.30 | 3.09 | 3.90 | 3.09 | 13.23 | 13.40 | 13.82 | 13.48 |
| *Robinia pseudoacacia L.* | 4.86 | 5.10 | 5.12 | 5.03 | 8.91 | 9.51 | 9.98 | 9.46 |
| *Salix alba L.* | 3.64 | 4.14 | 4.34 | 4.04 | 12.63 | 12.94 | 13.39 | 12.98 |
| *Salix fragilis L.* | 3.62 | 4.12 | 4.31 | 4.02 | 12.61 | 12.90 | 13.37 | 12.96 |
| **Mean** | 3.34 | 3.96 | 4.31 | - | 12.12 | 12.42 | 12.87 | - |
| CD ($p \leq 0.05$) | | | | | | | | |
| Plant species: | 0.50 | 0.60 | | | | | | |
| Season: | 0.39 | 0.47 | | | | | | |
| Plant sp. x Season: | 0.87 | 1.05 | | | | | | |

## References

1. A.O.A.C. Official methods of analysis. 26th ed. AOAC International Association of Official Analytical Chemists. Washington D.C., 1999, 401-420.
2. Ahmed K, Shaheen M, Mirzaei F, Khan ZI, Gondal S, Fardous A *et al*. Proximate analysis: Relative feed values of various forage plants for ruminants investigated in a semi-arid region of Punjab, Pakistan. Agricultural Sciences. 2013; 4(6):302-308.
3. Azim A, Naseer Z, Ali A. Nutritional evaluation of maize fodder at two different vegetative stages. African Journal of Agricultural Sciences. 1989; 2(1):27-34.
4. Azim A, Ghazanfar S, Latif A, Nadeem MA. Nutritional evaluation of some top fodder tree leaves and shrubs of District Chakwal, Pakistan in relation to ruminants requirements. Pakistan Journal of Nutrition. 2011; 10(1):54-59.

5. Babayemi OJ, Bamikole MA. Supplementary value of *Tephrosia bracteolate*, *Leucaena leucocephala* and *Giliricidia sepium* hay for West Africa Dwarf goats kept on range. Journal Central European Agriculture. 2006; 7(2):323-328.
6. Bamigboye F, Babayemi O, Adekoya A. Feed resources and seasonal nutrient composition of predominant forages for small ruminant production in two local government area of Osun state, Nigeria. Journal of Biology, Agriculture and Healthcare. 2013; 3(17):1-11.
7. Blair RM, Epps EA. Seasonal distribution of nutrient in plants of seven browse species in Louisiana, Southern forest experiment station Forest Service U.S. Department of Agriculture. 1969, 13-14.
8. Chettri N, Sharma E, Deb DC, Sundriyal RC. Effect of firewood extraction on tree structure, regeneration, and woody biomass productivity in a trekking corridor of the Sikkim Himalaya. Mountain Research and Development. 2002; 22(2):150-158.
9. Cook CW, Harris LE. The nutritive value of range forage as affected by vegetation, site, and stage of maturity. Utah Agricultural Experiment Station Bulletin. 1950, 344.
10. Fasae OA, Sowande OS, Popoola AA. Evaluation of selected leaves of trees and foliage of shrubs as fodder in ruminant production. Journal of Agricultural Science and Environment. 2010; 10(2):36-44.
11. Haddi ML, Filacorda S, Meniai K, Rollin F, Susmel P. In vitro fermentation kinetics of some halophyte shrubs sampled at three stages of maturity. Animal Feed Science and Technology. 2003; 104:215-225.
12. Hashmi MM, Waqar K. Nutritional Evaluation of *Grewia optiva* and *Grewia populifolia*in different seasons and sites of Chakwal District in Pakistan. European Academic Research. 2014; 2(4):1-11.
13. Hussain F, Durrani MJ. Nutritional evaluation of some forage plants from Harboi rangeland, Kalat, Pakistan. Pakistan Journal of Botany. 2009; 41(3):1137-1154.
14. Kacar B, Katkat AV, Ozturk S. BitkiFizyolojisi.2nd Ed. Nobel Press Inc.m, Ankara., (in Turkish). 2006, 563.
15. Kaplan M, Kamalak A, Kasra AA, Gven I. Effect of maturity stages on potential nutritive value, methane production and condensed tannin content of *Sanguis orbaminor* hay. Kafkas Universitesi Veteriner Fakultesi Dergisi. 2014; 20(3):445-449.
16. Khosla PK, Toky OP, Bisht RP, Himidullah S. Leaf dynamics and protein content of six important fodder trees of the western Himalaya. Agroforestry Systems. 1992; 19:109-118.
17. Lyons RK, Machen RV, Forbes TDA. Why Range Forage Quality Changes, Texas Agric. Ext. Serv. 1999; B-6036, 7.
18. Parissi ZM, Papachristou TG, Nastis AS. Effect of drying method on estimated nutritive value of browse species using an in vitro gas production technique. Animal Feed Science and Technology. 2005; 123-124(1):119-128.
19. Parlak AO, Gokkus A, Hakyemez BH, Baytekin H. Forage quality of deciduous woody and herbaceous species throughout a year in Mediterranean shrublands of western Turkey. The Journal of Animal & Plant Sciences. 2011; 21(3):513-518.
20. Singh B, Todaria NP. Nutrients composition changes in leaves of *Quercus semecarpifolia* at different seasons and altitudes. Annals of Forest Research. 2012; 55(2):189-196.