Research Article

Effect of Season on Mineral Composition of Two Trees of Quetta District Used as Fodder

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Accepted on: 21-06-2015; **Finalized on:** 31-08-2015.

ABSTRACT

Macro and micro elemental composition (P, Ca, K, Na, Fe, Al, Mn) of foliage of two dominated trees *Fraxinusxanthoxyloides* (G. Don) and *Pistaciakhinjuk* stocks of Quetta district were analyzed seasonally to determine their nutritional value as fodder. These trees contribute significantly to the community due to their medicinal forage value. Elemental concentration was determined by using atomic absorption, flame photometer and X-ray florescence spectrophotometer. *F. xanthoxyloides* was found to be better than *P. khinjak* as it has significantly high mineral content. Almost in all the cases reached to its maximum summer, start decreasing in autumn and minimum concentration was recorded during winter season. These concentrations of minerals were high during summer season. Mineral concentration gradually increased from spring to autumn season and decreased in winters.

Keywords: Mineral composition, trees, Quetta district, fodder.

INTRODUCTION

Woody plants are a common component of most rangelands in and around Quetta district, these plants play a key role in primary production and nutrient cycling, stabilizing soils and provide habitat for wild life. Generally trees are called browse or top feed, have long been considered important for nutrition of grazing animals in Pakistan, especially in Balochistan, particularly in those areas with dominant dry season. Fodder tree leaves are used as supplement in the quantity and quality of pastures compounds[1-3]. They provide a supplement of green feed when grasses and other herbaceous material are dry and are consider providing the source of protein and energy during drought when all other feed is absent. However fodder trees are less affected by seasonal dry conditions because of their more extensive root systems and longer life-spans.[4] In many regions tree life forms is best adapted to the prevailing biotic and abiotic conditions. These rangelands lie within the arid and semi-arid climatic zones. Due to severe drought these rangelands are degrading very rapidly causing loss of desirable species.

Due to drought from last decade in Balochistan an effort was made to found tree leaves as nutritional supplement. Previously no work on the quality of these plants was done.

Therefore on mineral composition of foliage of two dominated tree *Fraxinusxanthoxyloides* and *Pistaciakhinjuk* of Quetta district were evaluated.

Most of the woody species found here are deciduous, considering the above-mentioned aspects the study was conducted to determine mineral composition and seasonal variation at different habitats of Quetta district.

MATERIALS AND METHODS

Experimental Analysis

All three habitats are found in three different directions of district Quetta. Vegetation analysis was done by using complete random block design with three replicates. One specimen was deposited in the herbarium of Botany department, University of Balochistan, Quetta, Pakistan, for identification.

First habitat HazarGangiChiltan National Park is located near Quetta at a distance of 20Km on Quetta Mastung road towards N W at 30° 07'N longitude, 66° 58 'E, 1700 m altitude. The region has Mediterranean climate, cold winter and dry summer with dry semi-arid type of vegetation, the mean maximum temperature in summer is 36°C and mean minimum temperature in winter is –10°C, while rain fall varies between 250-300mm per year;

Second habitat Zarghoon it is located to the southern part of Quetta valley lies approximately between latitude 30° 39′ N and longitude 67° 15′ E. The locality has tremendous variation from hill top to valley bottoms and gentle slopes with grasses scattered trees, dominated by *Fraxinusxanthoxyloides* and *Pistaciakhinjuk.* Rain and snow fall is dominated in winter; the mean maximum temperature in summer is 25°C and means minimum temperature in winter is –15°C.

The 3rd habitat Karkhasa, which is near to the slopes of Chiltan mountain range of Quetta, has rocks and precipitation occurs only in winter. Karkhasa region lies at latitude 30° 09 and longitude 66° 55, the climate of the valley is arid with mild summer and severe winter. It is characterized by low precipitation, high rate of evaporation and wide range of temperature. The average

mean monthly maximum temperature rises to 35°C for the month of July in summer and the mean minimum in winter goes down to –5°C for the month of January.

The elemental Phosphorus (P), Calcium(Ca), Sodium(Na), Potassium (K), Iron (Fe), Aluminum(Al), Manganese (Mn) were determined by atomic absorption / flame spectrophotometer AA-6105 (Shimdzu), X-ray fluorescence spectrophotometer, according to "A manual of experiment for plant biology methods (1995)".[5] Analysis of samples was carried out in duplicate.

Results were calculated as % on dry weight basis. Standard deviation of elemental concentration was subject to analysis of variance (ANOVA). Level of significance was checked at 0.05 levels.

RESULTS

Table 1: Concentration of foliage elements of F.*xanthoxyloides.*

Seasons	Phosphorus %		Calcium %		Sodium %		Potassium %		Iron %		Phenolics %	
HazarGangi												
Spring	1.55	±1.2	0.86	±1.1	0.45	±0.3	0.61	±0.4	0.02	±0.001	0.2	±0.01
Summer	1.7	±1.03	1.08	±1.2	0.98	±0.4	0.59	±0.2	0.03	±0.002	0.3	±0.02
Autumn	1.63	±1.2	0.55	±1.3	1.25	±0.3	0.55	±0.3	0.03	±0.001	0.4	±0.01
Winter	1.36	±1.3	0.68	±0.6	1.25	±0.3	0.69	±0.2	0.02	±0.001	0.7	±0.03
Mean	1.56		0.79		0.98		0.61		0.02		0.4	
Zarghoon												
Spring	1.55	±1.3	1.01	±1.1	0.8	±0.3	0.57	±0.3	0.60	±0.001	0.7	±0.03
Summer	1.65	±1.3	0.81	±0.3	0.29	±0.3	0.32	±0.2	0.54	±0.002	0.5	±0.02
Autumn	1.01	±0.4	0.69	±0.4	0.41	±0.3	0.37	±0.3	0.52	±0.003	0.3	±0.01
Winter	1.07	±1.2	1.37	±0.4	0.29	±0.3	0.37	±0.2	0.41	±0.001	0.2	±0.01
Mean	1.32		0.99		0.44		0.40		0.51		0.4	
Karkhasa												
Spring	1.28	±0.3	1.12	±0.3	1.26	±0.3	0.59	±0.2	0.06	±0.001	0.3	±0.01
Summer	1.60	±1.3	0.73	±0.5	1.32	±1.0	0.55	±0.2	0.04	±0.002	0.4	±0.01
Autumn	1.16	±1.2	0.71	±0.4	1.29	±1.1	0.59	±0.3	0.05	±0.003	0.6	±0.03
Winter	1.16	±0.4	0.48	±0.2	1.30	±1.2	0.39	±0.2	0.04	±0.001	0.4	±0.02
	1.41		0.77		1.29		0.53		0.04		0.4	

Each value is mean ± standard deviation of twelve determinations; Mn (0.001% – 0.004%) Al (0.001% – 0.002%) ANOVA ($P < 0.05$), ($P > 0.05$)

Table 2: Concentration of foliage elements of *P. khinjuk*

Seasons	Phosphorus %		Calcium %		Sodium %		Potassium %		Iron %		Phenolics %	
HazarGangi												
Spring	0.52	±0.02	0.61	±0.03	0.32	±0.02	0.62	±0.02	0.02	±0.002	0.3	±0.01
Summer	0.65	±0.03	0.71	±0.04	0.31	±0.03	0.71	±0.02	0.01	±0.002	0.5	±0.01
Autumn	0.67	±0.02	0.52	±0.02	0.18	±0.02	0.61	±0.02	0.02	±0.002	0.6	±0.02
Winter	0.46	±0.02	0.49	±0.02	0.19	±0.03	0.71	±0.01	0.03	±0.002	0.9	±0.03
Mean	0.58		0.58		0.25		0.66		0.02		0.58	
Zarghoon												
Spring	1.62	±0.02	0.61	±0.03	0.28	±0.03	0.61	±0.10	0.05	±0.002	0.4	±0.02
Summer	1.32	±0.02	0.73	±0.04	0.27	±0.03	0.49	±0.02	0.63	±0.003	0.5	±0.01
Autumn	1.41	±0.02	0.65	±0.03	0.26	±0.02	0.32	±0.02	0.64	±0.002	0.8	±0.03
Winter	1.19	±0.02	0.39	±0.02	0.26	±0.02	0.42	±0.02	0.051	±0.002	0.3	±0.01
Mean	1.39		0.6		0.27		0.46		0.199		0.5	
Karkhasa												
Spring	0.18	±0.02	0.61	±0.03	1.20	±0.03	0.62	±0.11	0.07	±0.002	0.3	±0.01
Summer	0.17	±0.02	0.82	±0.05	1.27	±0.12	0.62	±0.12	0.59	±0.003	0.4	±0.02
Autumn	0.19	±0.02	0.67	±0.06	1.26	±0.2	0.44	±0.02	0.06	±0.002	0.7	±0.03
Winter	0.12	±0.02	0.49	±0.02	1.28	±0.2	0.43	±0.02	0.05	±0.002	0.7	±0.02
Mean	0.17		0.65		1.25		0.53		0.19		0.5	

Each value is mean ± standard deviation of twelve determinations; Mn (0.001% – 0.005%), Al (0.001% – 0.003) ANOVA ($P < 0.05$), ($P > 0.05$)

DISCUSSION

Forage trees of three localities of Quetta were analyzed seasonally for two years for their macro, micro elemental composition**.** Elemental ratios have been successfully used to establish the nature of nutrient limitation in range lands ecology. The assessments of the potential of forages to meet the mineral requirement of animals has been assayed and are well reported in literature.[6-7] Biological scientist has investigated the biology and utilization of wild land shrubs.[8-9]

Phosphorus

Phosphorus concentration of two trees are presented in table (1-2). The results of trees showed highest level of phosphorus that ranged from (1.65 to1.16%) DM in *F. Xanthoxyloides*, while low concentration 1.62-0.12% DM was found in *P.khinjuk.* Maximum concentration was observed in *F.xanthoxyloides* from Zarghoon during summer season, while the lowest amount 0.12% DM was estimated in *P. khinjuk* from Karkhasa in winter, and in autumn season. Phosphorus accumulation in two tree species was high in Zarghoon medium in HazarGangi and low at Karkhasa.

However mature trees leaves are found to be a good source of phosphorus for animal health during spring and summer season and these plants are able to provide complete nutritional requirement to animals as the trees examined had high level of phosphorus than the required amount which is below 0.15%.[10]

Calcium

Calcium concentration in leaves of two trees from three habitats was evaluated seasonally. Calcium in trees ranged between 1.37 to 0.48% DM. Higher level of calcium was recorded from F. *xanthoxyloides* leaves 1.37% DM, while in *P. Khinjuk* less amount of calcium was found. Its highest concentration was found from trees of Zarghoon, while low concentration was in the leaves of HazarGangi. High calcium was found during spring and summer season. It gradually declined in autumn and winter season. Therefore calcium content recorded was adequate to meet animal nutrition requirements, similar calcium values are reported by.[11] The calcium recorded was more or equal to that required for animal nutrition, a dietary essential level of calcium is 0.43%.[12] Forage concentration required by grazing animal is influenced by the animal type, age, and weight of the animal and level of production.[13] According to the recommendation of[14], Ca requirement for growing and finishing animals expected to grow is 0.35% DM. Therefore both these tree species are good source of calcium for the grazing animals. Apart from Ca; these requirements are hardly ever met by the grasses in the area studied so the tree Ca concentration was analyzed.

Sodium

Foliage of two trees was evaluated seasonally for the sodium concentration. The range of sodium in trees was 1.32%-0.8% DM. *F. xanthoxyloides* had higher amount of sodium as compared to *P. Khinjuk*. In both the tree species high amount was found from Karkhasa valley during winter season, medium amount (0.32%) DM was observed in *P. khinjuk* during spring season from HazarGangi, less amount of sodium in both trees was observed from Zarghoon.

The amount of Na in both trees was high during winter from Karkhasa while Zarghoon region showed less amount of Na in both trees. My results of trees are comparable to the[14,15] who found highest value (1.68%) in *Tamarix*from Egypt which can be categorized as high sodium accumulator.

Potassium

Potassium concentration of two trees were evaluated seasonally from three habitats of Quetta are given in (Table1-2). Amount ranged in trees between 0.71-0.32% DM. Highest (0.71%) DM amount was observed in *P. khinjuk* from HazarGangi during autumn season. Lowest amount (0.32%) was found in *F. xanthoxyloides* from Zarghoon during summer season.

High K was analyzed in *P. Khinjuk* from HazarGangi during autumn season while less in *F. Xanthoxyloides* from Zarghoon during summer. Critical level for potassium is 0.60% as recommended by[14] so, *P. Khinjuk* fulfills the recommended critical level from all three habitats while *F. Xanthoxyloides* only from HazarGangi fulfills the recommended level by.[14]

Iron

Iron is found in plants as micro element, Concentration of Iron of two trees of Quetta valley are evaluated and presented seasonally (Table1-2). In tree species its range was 0.07-0.01% DM high Iron (0.07%) DM was found in *P. khinjuk* from spring season, while lowest amount (0.01%) DM was found in summer season from HazarGangi. *F. xanthoxyloides* had medium amounts (0.05-0.02%) DM was observed in summer season. Less seasonal differences were observed between localities.

Other elements

Manganese (Mn) in *F. xanthoxyloides* was (0.004%), while in *P. khinjuk* (0.005%) DM was observed. Manganese plays vital role for normal functioning of several enzymes particularly for those that regulate the oxidation and reduction phenomena. This element also is necessary in nitrate reduction, and protein synthesis.

Anti-nutritional Studies

Phenolics of two trees were analyzed from three habitats of Quetta and are presented in (Tables 1 – 2). The amount of phenolics in tree ranged from (0.2%-0.9%) DM. High contents of Phenolics were recorded from *P. khinjuk* (0.9-0.3%) as compared to *F. xanthoxyloides* (0.2%-0.7%). These amounts were lower than that reported by.[16] It was observed that animals do not prefer to eat *P. khinjuk,* may be due to high Phenolics. Phenolics have both

primary and secondary deterrence causes a predator to reject a plant because of its bitter taste or offensive odor. Secondary deterrence involves inducing uneasiness in the animals, which lead the rejection of plants.[17]

However variations in contents of plant secondary metabolites are effected by many factors. There may be genetic components to such variations[18] but the genotype can be modified by a variety of biotic and abiotic features. It was suggested that seasonal changes in biochemistry caused by shifting patterns of resource allocation that reflect different physiological demands associated with growth, defense and reproduction.[16]

CONCLUSION

The seasonal analysis of macro and micro elemental composition two dominated trees *Fraxinusxanthoxyloides* (G. Don) and *Pistaciakhinjuk* stocks of Quetta district, for their nutritional value, revealed important findings. On the basis of the above observations it is further concluded that *F. xanthoxyloides*can be used as a source of fodder for small ruminants during harsh environmental condition, because it contains nutritionally important elements.

Acknowledgement: The authors are thankful to the Department of Botany University of Baluchistan, Institute of Biochemistry, University of Baluchistan, Quetta, Pakistan and Department of Botany, Sardar Bahadur Khan University, Quetta for providing us the assistance and material.

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Source of Support: Nil, **Conflict of Interest:** None.