

Transfer of Sodium from soil to forage

A Case study in Livestock station
Khizarabad Sargodha Pakistan

**Humayun Bashir^a, Zafar Iqbal Khan^a, Kafeel Ahmad^a
Nasira Raza^a, Muhammad Sohail^a, Asma Zafar^a**

^aDepartment of Botany, University of Sargodha, Sargodha, Pakistan

International Journal of Applied Sciences
(ISSN: 2371-0381)

Corresponding Author: humayunuos@gmail.com

: zikhan11@gmail.com

Abstract

An experiment was conducted to determine the sodium status of soil and forage during four sampling periods (October, November, December and January) in livestock station at Khizarabad, Sargodha, Pakistan. Forage plants and soil samples were gathered in four sampling periods of winter seasons of 2014. Highest sodium level in soil (98.496 mg/kg) was found in October and forage sample show highest sodium (0.0802%) level in October. Similarly lowest sodium level in soil (64.584 mg/kg) and forage (0.300%) samples was also found in same sampling period of January. Results of the present study showed that sodium concentrations in soil and forage samples were higher than critical levels. Transfer of mineral from soil to forage showed serious effect on plants and also on ruminant which consumed these plants so Further studies are required to find out the exact requirement of minerals for the area under study for forage productions and to cope with diseases in small ruminants.

Key words: Translocation, Sodium, Forage, Soil.

INTRODUCTION

Pakistan is an area of agriculture land. Most area of Pakistan is highly suitable for crop production. Land of Pakistan has many types of soil and agro-climatic zones. Different types of soils and agro-climatic regions are present in Pakistan. In Pakistan, most of the regions show arid and semi-arid environment, which shows deficiency of macro and micronutrients on which the growth of animals depends. Different types of mineral nutrients, which are necessary for growth of animals, are present in very low concentration in Pakistan (Ashraf *et al.*, 2006). Adverse effects occur in animals due to the shortage of essential minerals all over the world (Khan *et al.*, 2010). Livestock are restricted only to some villages due to urbanization, because of this, quantity of milk and other products including livestock decreases (Ashraf *et al.*, 2006). Most animals and animal products show high amount of Na as compared to plant and plant products. Deficiency of Na causes serious problems like decreased growth, loss of appetite, loss of weight and reduced production of milk. Usually excessive availability of water helps the animal to tolerate against large quantity of dietary salt (McDowell, 1992). Mineral imbalance in forage and soil can seriously affect the growth and performance of ruminants. Potassium is one in all mineral nutrients which is most effected by forage maturity (Khan *et al.*, 2007a). Availability and amount of mineral nutrients in forage mainly depends upon many factors like irrigation water, fertilization and texture of soil. This study was planned to assess the effect of late and early winter seasons on the translocation of sodium from soil to forage, which are used by ruminants in livestock station at Khizarabad.

MATERIALS AND METHODS

Studies were conducted at local Cows farm Khizarabad Livestock station situated in Sargodha. Six samples were collected after the interval of one month of soil for four times and

converted into one pool sample. Soil samples were gathered from six different locations in study area and after collection, samples were air dried, grounded, properly mixed and then prepared for chemical analysis. Forage samples were also collected from same locations where soil samples were gathered and pooled into one sample. The ground soil and forage samples were treated with acid solution for digestion as described by Wolf (1982). Flame photometer (Jenway, PFP-7) was used for determination of sodium by using standard curves and spectrophotometer. A split-plot design (Steel and Torrie, 1980) was used for analysis of data. Differences among means were ranked using Duncan's new multiple ranges test (Duncan, 1955).

Results and Discussions

Sodium

Sodium play major role in animals for acid base balance and amino acid and glucose transport to maintaining body fluids. Pastures consist only 0.029% of Na. Sodium can be a limiting nutrient factor in diet when salt is not supplemented to sheep and cattle. Therefore sufficient amount of salt is necessary in livestock feed to fulfill the Na requirement (Rayburn, 1997).

1. Soil

From the analysis of variance the data for soil sodium, it is observed that sampling periods had a significant affect ($P < 0.05$) on its concentration (Table 1). Lowest level of sodium was found at 4th sampling period (January) and highest sodium level was found at the 1st sampling period (October) (Fig. 1). The values of sodium during all sampling periods ranged from 64.584 mg/kg to 98.496 mg/kg. In this study, the soil sodium levels were higher than the results as reported by Morillo *et al.*, (1989) for different regions of central Venezuela for wet and dry seasons of the year. This study values were also higher as compared to the results reported by Rhue & Kidder (1983). The accessibility of minerals in soils mostly relies on their efficient

concentration in soil section (Reid & Horvath, 1980). Natural forages low in Na has been reported in numerous tropical countries throughout the world (McDowell, 1985). Low level of Na concentration was reported in Pakistan in another study by Khan *et al.* (2004) and in Guatemala by Tejada *et al.* (1987).

2. Forage

Analysis of variance of data of forages for Sodium showed non-significant effect ($P>0.05$) of sampling periods on its concentrations (Table 1). The maximum value was reported at first sampling period (October), while in fourth sampling period (January) minimum value of sodium was reported (Fig. 2). The mean values ranged from 0.03% to 0.0802% among all sampling periods. Forage Na concentration was above the critical value 0.06% recommended by NRC (Anon., 1985; Tudsri and Kaewkunya, 2002). To meet the need of highly productive animals, forage should contain sodium concentration more than 0.15% (Anon, 1973). Forage Na concentration reported in present study was above the values as reported by Khan *et al.*, (2007b).

Conclusion

The results showed that the soil of the studied area has high concentration of Na. The plants grown on this soil show maximum growth so there is no need of being amended with sodium containing fertilizer. The forage showed high level of Na, which is sufficient for healthy growth of animals, so there is no need of any fertilizer to the forage plants.

Table1: Analysis of variance of data for Sodium concentrations in soil and forage plants at different sampling intervals

Source of Variation (s.o.v)	Degree of freedom (df)	Mean Squares	
		Soil	Forage
Sampling Period	3	987.008*	0.002 ^{ns}
Error	16	153.323	0.001

*** =significant at 0.001level

*=significant at 0.05 level

ns=non significant

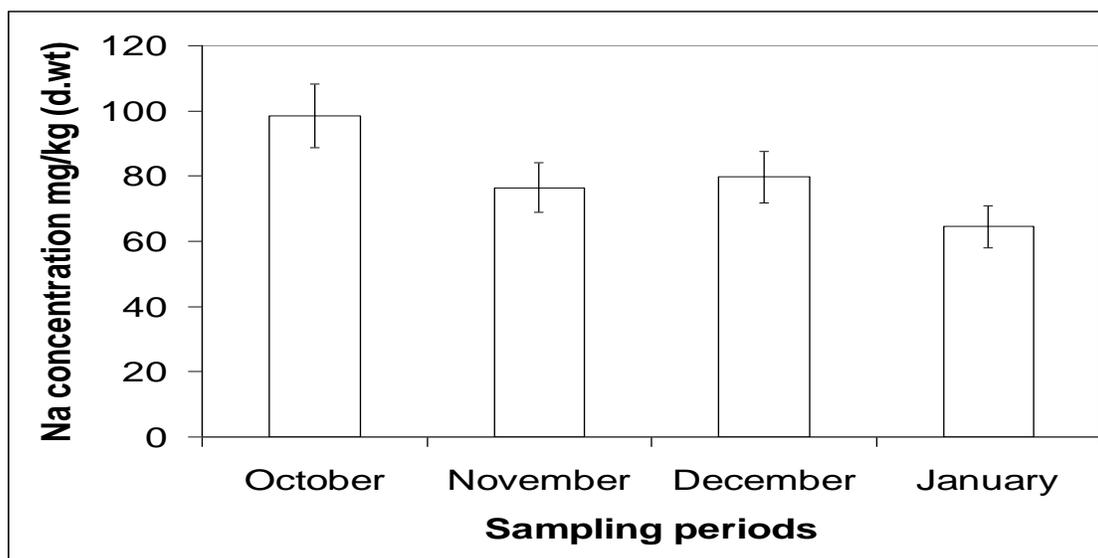


Figure 1: Fluctuation in levels of Sodium in soil at different sampling periods.

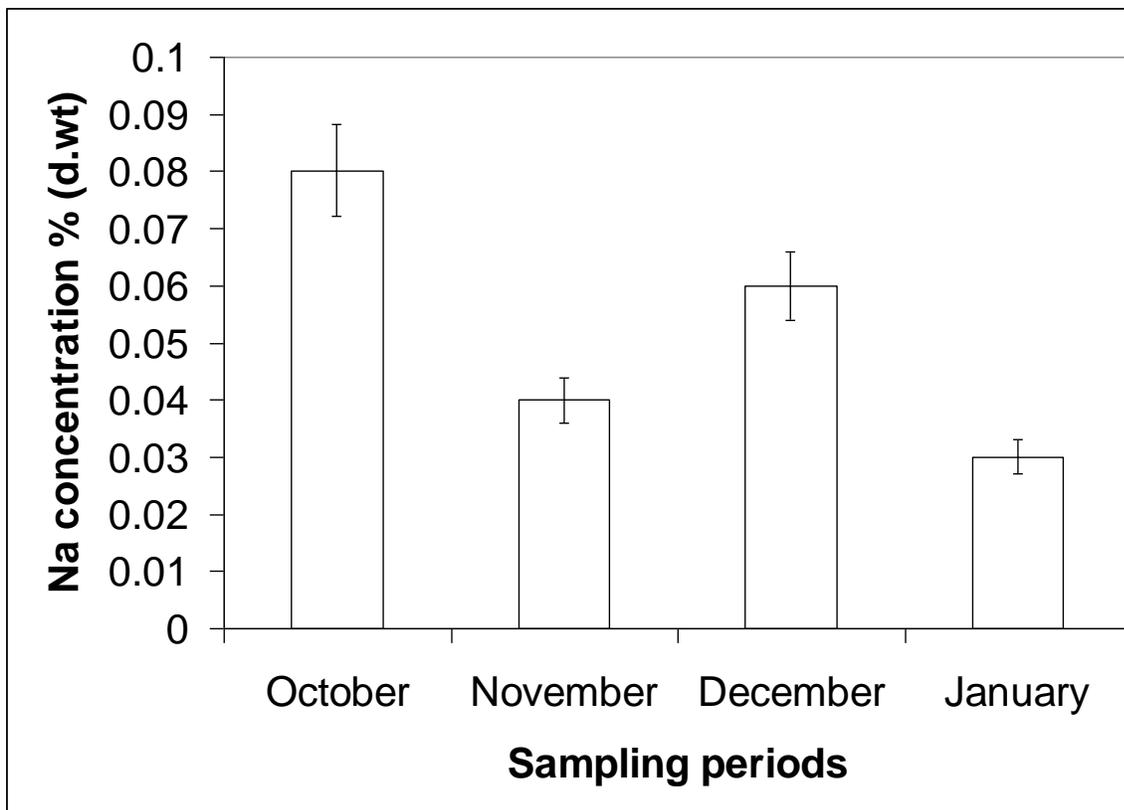


Figure 2: Fluctuation in levels of Sodium in forage at different sampling periods.

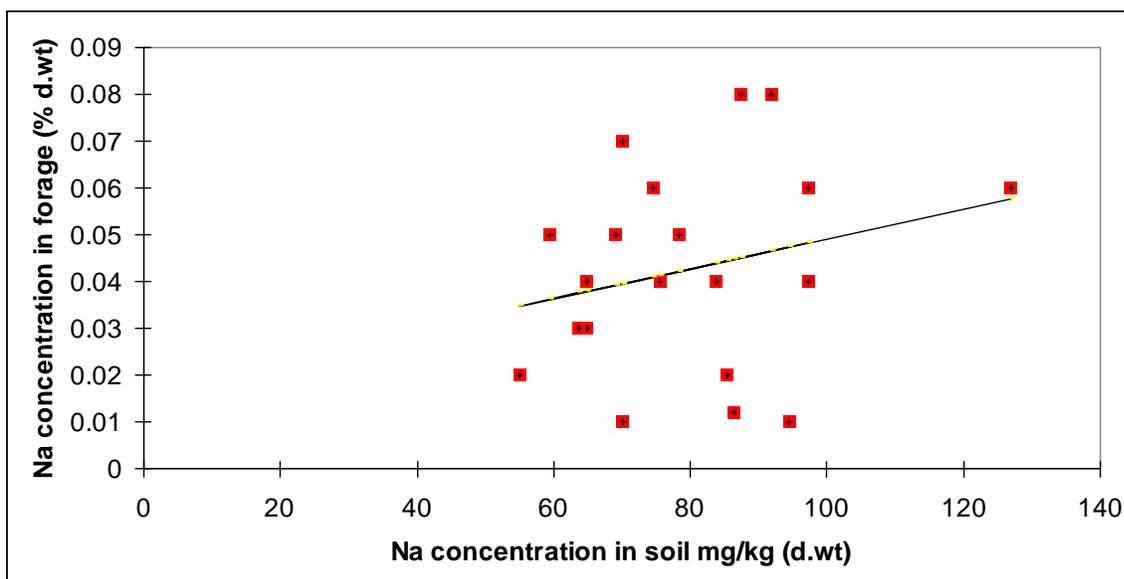


Figure 3: Relationship between soil and forage Na concentrations.

REFERENCES

- Anonymous. 1973. "Tracing and Treating Mineral Disorders in Dairy Cattle". Netherlands Committee on Mineral Nutrition, Center for Agriculture Publishing and Documentation-Wageningen, The Netherlands.
- Anonymous. 1985. "National Research Council, Nutrient Requirements of Domestic Animals, Nutrient Requirements of a Sheep". (5th Edition) Natl Academic Science. N.R.C., Washington, D.C.
- Ashraf, M.Y., A. Khan, M. Ashraf and S. Zafar, 2006. Studies on the transfer of mineral nutrients from feed, water, soil and plants to buffaloes under arid of environment. *Journal of Arid Environment*, 5: 632-643.
- Duncan, D.B., 1955. Multiple range and multiple F-tests. *Biometrics*, 11: 1-42.
- Khan, Z.I., A. Hussain, M. Ashraf, M.Y. Ashraf, L.R. McDowell and B. Huchzermeyer, 2007a. Copper nutrition of goats grazing varying and improves pasture with the seasonal variation in a semiarid region of Pakistan. *Small Ruminant Research*, 67: 138-148.
- Khan, Z.I., M. Ashraf and A. Hussain. 2007b. "Evaluation of manganese status of grazing sheep in a semi-arid region of Pakistan". *Trace Elements and Electrolytes*, 24: 55-60
- Khan, Z.I., M. Ashraf, K. Ahmed, Raza, Nasra, N. Ahmad and E.E. Valeem, 2010. Status of two macro elements calcium and magnesium of pasture and cattle grazing in a semiarid region of central Punjab, Pakistan. *Pakistan Journal of Botany*, 42(4): 2391-2395.
- Khan. Z.I., M. Ashraf, A. Hussain, H.W. Koyro and B. Huchzermeyer. 2005. "Seasonal variation in the status of selenium in goats grazing native and improved pastures in a semiarid region of Pakistan". *Deutsche Tierärztliche Wochenschrift*, 112: 460-465.
- McDowell, L.R. 1985. "Nutrition of Grazing Ruminants in Warm Climates". Academic Press New York, pp. 443.
- McDowell, L.R., 1992. Minerals in Animal and Human Nutrition. Academic Press, Inc. Harcourt Brace Jovanovich, Publishers, New York, USA.
- Morillo, D.E., L.R. McDowell, C.F. Chicco, J.T. Perdowo, J.H. Conrad, and F.G. Martin. 1989. "Nutritional Status Of Beef Cattle In Specific Regions Of Venezuela.I.Macrominerals and Forage Organic Constituents. *Nutrition Reproduction International.*, 39:1247-1262.
-

- Rayburn, E.B. 1997. "Forage Quality Minerals".
- Reid, R.L. and D.J. Horvath. 1980. "Soil Chemistry and Mineral Problems in Farm Livestock: A Review". *Journal of Animal Feed Science and Technology*, 5: 95-167.
- Rhue, R.D. and G. Kidder. 1983. "Analytical Procedures Used By the Ifas Extension Soil Laboratory and the Interpretation of Results". Soil Science Department, University of Florida, Gainesville.
- Steel, R.G.D and J.H. Torrie, 1980. Principles and Procedures of Statistics with Special Reference to Biological Science. McGraw Hill Book Co., Inc., New York..
- Tejada R., L.R. McDowell, F.G Martin, and L.H Conrad. 1987. "Evaluation of the Macro-Mineral and Crude Protein Status of Cattle in Specific Regions in Guatemala". *Nutrition Reproduction International*, 35:989-998.
- Tudsri, S. and C. Kaewkunya. 2002. "Effect of Leucaena Row Spacing and Cutting Intensity on Growth of Leucaena and Three Associated Grasses in Thailand". *Asian-Australian Journal of Animal Science*, 15: 986-991.
- Wolf, B., 1982. A comprehensive system of leaf analysis and its use for diagnosing crop nutrient status. *Common Soil Science and Plant Analysis*, 13: 1035-1059.