PJN
ISSN 1680-5194

PAKISTAN JOURNAL OF NUTRITION

ANSInet
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan
Mob: +92 300 3008585, Fax: +92 41 8815544
E-mail: editorpjn@gmail.com

Pakistan Journal of Nutrition 13 (11): 622-625, 2014
ISSN 1680-5194

Evaluation of Micro-Minerals and Nutritional Status of Some Forage Grasses in Mastuj Valley, Hindukush Range, Pakistan

Syed Mukaram Shah and Farrukh Hussain
Department of Botany, University of Peshawar, Peshawar, Pakistan

Abstract: Four important grasses Bermuda grass *Cyanodon dactylon* L., Reed grass *Phragmites karka* (Retz.) Trin ex Steud, Thatch grass *Saccharum spontaneum* L. and *Calamogrostris pseudophragmites* Hall. f. Koeler were analyzed for their micro-minerals and nutritional status. Eight micro-minerals including Cd, Co, Cu, Cr, Fe, Mn, Sr, Zn and NDF, ADF, lignin, hemicellulose and cellulose contents were analyzed at three phenological stages. The concentration of majority of elements increased from pre-reproductive to post reproductive stages except Cd, Cu, Mn and Sr. Cd, Cu, Co, Cr, Sr and Zn were lowest while Fe and Mn were highest in the forage grasses. NDF, ADF and lignin contents were highest at post-reproductive stages in *Phragmites karka* (80.84%) and *Saccharum spontaneum* (80.34%). Hemicellulose contents were high (42.94%) at pre-reproductive stages in *Cynodon dactylon*. *Calamogrostris pseudophragmites* had highest (7.99%) cellulose at pre-reproductive stage. *Saccharum spontaneum* had the highest amount of organic matter (94.71%), moisture contents (10.89%) and crude fiber (26.26%) at pre-reproductive and reproductive stages. Ash contents were maximum (18.98%) in *Phragmites karka* at reproductive stage, while crude protein (20.01%), fat (12.83%) and NFE (46.30%) were highest in *Cynodon dactylon*. The plants must be analyzed to know the natural compounds, proximate composition and nutritional values. At high concentration these may prove high toxicity in consumer species.

Key words: Mastuj valley, grasses, micro-minerals, nutritional values

INTRODUCTION

Plants obtain their mineral and nutrient requirement from soil. Grazing animals get their mineral nutrients from plants. Calamogrostris pseudophragmites, Cynodon dactylon, *Phragmites karka* and *Saccharum spontaneum* are the important forage grasses in the pastures of Mastuj Valley. *Cynodon dactylon* and *Saccharum spontaneum* are highly palatable during reproductive and post-reproductive stages when the other feed resources become deficient. Mineral composition and nutritive value of forages have the subject of evaluation in rangeland productivity. Ahmad *et al*. (2008) showed varying mineral composition of Cu, Fe, Mn and Zn in the forage species. Ahmad *et al*. (2009) stated that forage concentration of Pb, Ni and Cr varied among different pastures and different plant parts of Soone Valley, Punjab. Ahmad *et al*. (2010) reported that Fe and Mn contents of soil, forages and blood plasma of buffaloes in Sarghoda, Punjab, were sufficient than the requirement. Khan *et al*. (2006) observed different levels of macro and micro minerals including Ca and Mg and lower levels of Cu and Zn in forages of Leiah district, Punjab. Fe was sufficient in forages. Khan *et al*. (2007) reported Se deficiency in four grasses of Rakh Kharie Wala, Punjab. Khan *et al*. (2009) observed that seasonal concentration of Ca, Mg, Na and K in forages and animals increased during summer than winter. Khan *et al*. (2009) reported that forages had sufficient K, Ca, Mg, Mn, Fe and Zn. While Na and Cu were deficient in forages. Khan *et al*. (2010) recorded moderate concentrations of Ca and Mg in forages and cows in Sarghoda, Punjab. Shamat *et al*. (2009) observed that Ca, Na, Co, Mn and Fe increased during dry season while K, P, Cu, Mo and Zn levels increased during wet season. Sultan *et al*. (2007) analyzed 12 marginal land grasses for their nutritive value in Chagharzai Valley, Bunair. Sultan *et al*. (2009) evaluated 11 herbs for their nutritive value. Sultan *et al*. (2010) analyzed leaves of five shrubs for their nutritive value. Mashwani *et al*. (2012) analyzed 21 forage grasses for macro-mineral composition in Gandgar Hills, Western Himalaya. The grasses had high concentration of macro-minerals and were suitable to fed livestock. There is no such reference on the forage plants of this high altitude pasture. The present study fills this gap.

MATERIALS AND METHODS

The plant samples were collected at three phenological stages during 2008-2009. They were shade dried and ground into powder, added concentrated nitric and perchloric acids and heated. After digestion, 0.5 g plant samples were prepared for mineral analysis by the wet digestion method using nitric acid and perchloric acid. After digestion the samples were diluted with distilled

Corresponding Author: Syed Mukaram Shah, Department of Botany, University of Peshawar, Peshawar, Pakistan

water and made the volume 100 mL. The analysis of samples was carried out for the detection of elements with the help of Atomic Absorption Spectrophotometer. Dry matter (DM), ash contents and crude fiber were determined following AOAC (1984). Nitrogen was determined by micro Kjeldahl (AOAC, 1984) method. Ether extract (EE) and nitrogen free extract (NFE) were determined after Galyean (1985). ADF and NDF were determined after Van Soest (1964) and Goering and Van Soest (1970). Acid detergent lignin (ADL) was determined following Georing and Van Soest (1970) and Waldern (1971). Hemicelluloses were determined after Van Soest and Robertson (1985). Total carbohydrates were calculated after Galyean (1985).

RESULTS AND DISCUSSION

The results of analyzed micro-minerals are shown in (Table 1). Cd contents remained unchanged in *Cynodon dactylon*, *Calamogrostris pseudophragmites* and *Saccharum spontaneum*. While it decreased in *Phragmites karka*. Co contents increased from pre-reproductive to post-reproductive stages in all grasses. Cu contents decreased in *Cynodon*, *Phragmites* and *Saccharum*, while remained inconsistent in *Calamogrostris*. Cr contents increased in *Phragmites* and *Saccharun*, while remained unchanged in *Calamogrostris* and *Cynodon*. Fe contents increased in *Calamogrostris* and *Phragmites* from pre-reproductive to post-reproductive stages. It was high at reproductive stages in *Cynodon* and *Saccharum*. Mn contents increased in *Cynodon*, *Phragmites* and *Saccharum*, while decreased in *Calamogrostris* from pre-reproductive to post-reproductive stages. Sr contents increased in *Saccharum* and decreased in *Cynodon* and *Phragmites*. It concentration was maximum 0.340 mg/L at reproductive stage in *Calamogrostris*. Zn concentration increased in *Saccharum* and decreased in *Cynodon* from pre-reproductive to post-reproductive stage. Maximum Zn concentration was observed at reproductive stages in *Phragmites*, while no trend was found in *Calamogrostris* (Table 1). NDF and ADF contents increased towards maturity in *Phragmites karka* and *Saccharum spontaneum*, while decreased in *Calamogrostris pseudophragmites*. In *Cynodon dactylon* maximum NDF and ADF concentrations were seen at pre-reproductive stages. Lignin contents increased in *Phragmites* and *Saccharum*, while no trend was found in *Calamogrostris* and *Cynodon*. Hemicellulose increased in *Saccharum* and decreased in *Phragmites*. While it remained inconsistent in *Calamogrostris* and *Cynodon*. Cellulose contents decreased in *Calamogrostris* and *Cynodon*, while remained maximum in *Phragmites* and *Saccharum* at reproductive stages (Table 2). Organic matter showed increase in *Cynodon dactylon* and *Phragmites karka* from pre-reproductive to post-reproductive stages, while remained inconsistent in *Calamogrostris pseudophragmites* and *Saccharum spontaneum*. Moisture concentration decreased in *Cynodon* and *Phragmites*. *Saccharum* exhibited maximum 10.89% moisture contents at reproductive stage, while no trend was found in *Calamogrostris*. Ash contents decreased in *Cynodon* and *Saccharum*. It was maximum 18.98% in *Phragmites* at reproductive stage and no trend was seen in *Calamogrostris*. Crude protein contents decreased in all the grasses. Fat contents decreased in *Phragmites* and *Saccharum*, while increased in *Cynodon*. Fats remained inconsistent in *Calamogrostris*. Crude fiber contents decreased in *Cynodon* from pre-reproductive to post reproductive stages and remained inconsistent in *Calamogrostris, Phragmites* and *Saccharum*. NFE contents increased with maturity in *Cynodon* and *Phragmites*. NFE contents were maximum 46.23% at reproductive stage in *Calamogrostris* and 38.45% at post-reproductive stage in *Saccharum spontaneum* (Table 3). Similar results were also shown by Sultan *et al*. (2007), Hussain and Durrani (2009) and Adnan *et al*. (2010).

Table 1: Determination of micro-minerals of forage grasses found in Mastuj Valley, District Chitral, Pakistan

		Mineral content (mg/L)							
Plant species	Phenological stages	Cd	Co	Cu	Cr	Fe	Mn	Sr	Zn
Calamogrostris	Pre-Reproductive stage	0.092	0.152	0.124	0.948	3.345	944.4	1.106	0.062
pseudophragmiyes	Reproductive stage	0.089	0.139	0.126	0.947	5.262	873.2	0.340	0.072
Hall. F. Koeler.	Post-Reproductive stage	0.090	0.179	0.123	0.994	7.467	809.7	0.164	0.068
	Average	0.090	0.157	0.124	0.963	5.358	875.8	0.537	0.067
Cynodon dactylon (L.)	Pre-reproductive stage	0.084	0.131	0.138	0.890	3.309	730.9	0.656	0.124
Pers.	Reproductive stage	0.081	0.129	0.128	0.894	7.931	663.6	0.600	0.100
	Post-reproductive stage	0.083	0.180	0.126	0.898	6.131	789.6	0.496	0.120
	Average	0.083	0.147	0.131	0.894	5.790	728.0	0.584	0.115
Phragmites karka	Pre-reproductive stage	0.095	0.184	0.121	1.071	1.952	4007	0.764	0.073
(Retz.) Trin ex Steud.	Reproductive stage	0.090	0.203	0.124	1.084	2.986	477.7	0.440	0.116
	Post-reproductive stage	0.082	0.211	0.118	1.108	5.544	1069	0.222	0.057
	Average	0.089	0.199	0.121	1.088	3.494	1851.2	0.475	0.082
Saccharum	Pre-reproductive stage	0.088	0.147	0.120	0.998	2.010	543.9	0.168	0.037
spontaneum L.	Reproductive stage	0.088	0.169	0.119	1.020	3.369	531.9	0.327	0.076
	Post-reproductive stage	0.089	0.161	0.114	1.037	2.987	554.5	0.513	0.108
	Average	0.088	0.159	0.118	1.018	2.789	543.4	0.336	0.074

Table 2: Cell wall constituents of some forage grasses of Mastuj Valley, District Chitral, Pakistan

Plant species	Phenological stages	NDF (%)	ADF (%)	Lignin (%)	Hemicellulose (%)	Cellulose (%)
Calamogrostris pseudophragmites Hall. f. Koeler.	Pre-reproductive stage	70.93	43.96	22.98	26.97	7.99
	Reproductive stage	75.81	46.88	32.42	28.93	4.99
	Post-reproductive stage	27.46	33.75	21.47	11.71	5.29
	Average	58.06	41.53	25.62	22.53	6.09
Cynodon dactylon (L.) Pers.	Pre-reproductive stage	76.88	33.95	26.96	42.94	4.99
	Reproductive stage	49.90	16.97	7.98	32.93	4.49
	Post-reproductive stage	70.43	29.47	22.98	40.96	3.50
	Average	65.73	26.79	19.30	38.94	4.32
Phragmites karka (Retz.) Trin ex Steud.	Pre-reproductive stage	68.33	43.89	22.94	24.44	4.49
	Reproductive stage	37.92	32.93	19.96	4.99	7.49
	Post-reproductive stage	80.84	59.88	49.90	20.96	3.99
	Average	62.36	45.56	30.93	16.79	5.32
Saccharum spontaneum L.	Pre-reproductive stage	27.93	22.89	17.91	5.04	3.48
	Reproductive stage	31.95	28.46	19.97	3.49	7.49
	Post-reproductive stage	80.34	48.40	42.91	31.94	4.49
	Average	46.74	33.25	26.93	13.49	5.15

Table 3: Proximate composition of some forage grasses of Mastuj Valley, District Chitral, Pakistan

Plant species	Phenological stages	Organic matter (%)	Moisture (%)	Ash (%)	Crude protein (%)	Fat (%)	Crude fiber (%)	NFE (%)
Calamogrostris pseudophragmites Hall. f. Koeler.	Pre-reproductive stage	94.22	5.78	17.70	9.96	4.25	27.57	34.75
	Reproductive stage	94.66	5.34	17.03	5.54	1.06	24.80	46.23
	Post-reproductive stage	94.38	5.62	17.79	3.70	2.12	28.08	42.69
	Average	94.42	5.58	17.50	6.4	2.47	26.81	41.22
Cynodon dactylon (L.) Pers.	Pre-reproductive stage	93.81	6.19	10.99	20.01	7.45	25.01	30.34
	Reproductive stage	93.43	6.57	12.29	10.83	12.83	21.38	36.10
	Post-reproductive stage	94.20	5.80	5.38	9.62	11.67	21.23	46.30
	Average	93.81	6.18	9.55	13.48	10.65	22.54	37.58
Phragmites karka (Retz.) Trin ex Steud.	Pre-reproductive stage	93.95	6.05	13.19	10.03	12.76	38.26	19.72
	Reproductive stage	94.66	5.34	18.98	9.20	10.56	21.66	34.26
	Post-reproductive stage	94.66	5.34	13.26	8.49	3.17	27.98	41.76
	Average	94.42	5.57	15.14	9.24	8.83	29.3	31.91
Saccharum spontaneum L.	Pre-reproductive stage	94.71	5.29	7.85	8.08	12.66	32.20	33.91
	Reproductive stage	89.11	10.89	6.38	7.45	10.08	39.26	25.94
	Post-reproductive stage	94.18	5.82	4.85	6.29	7.43	37.16	38.45
	Average	92.66	7.33	6.36	7.27	10.05	36.20	32.76

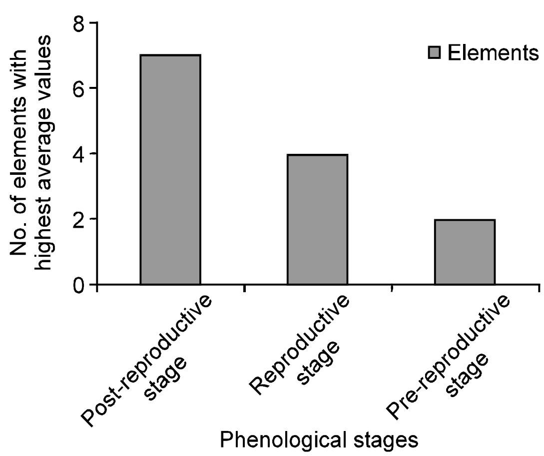

Fig. 1: Chemical evaluation of minerals

Information is lacking on mineral nutritive potential of native pastures in arid pastures in different regions of Pakistan. In order to optimize livestock productivity in ruminants feed on the pasture forages, especially, during winter or dry season, there is a need to supplement with micro mineral sources (Khan *et al.*, 2006). The importance of minerals to livestock is well known and their deficiency will be manifested by reduced milk yield, reduced water intake, increased straying in search of salty plants, chewing bones and eating soil. For sufficient livestock production in pasture deficient nutrients must be supplied at a minimum level to make up differences in animal daily requirement (Shamat *et al.*, 2009). It was concluded that the forage species were found to be palatable and had less concentration of micro elements require for the needs of grazing livestock in that specific range and required urgent need of supplementation.

ACKNOWLEDGEMENT

We are thankful to HEC for financial help and University of Peshawar for sponsorship

REFERENCES

Adnan, M., J. Hussain, M.T. Shah, Z.K. Shinwari, F. Ullah, A. Bahader, N. Khan, A.L. Khan and T. Watanabe, 2010. Proximate and nutrient composition of medicinal plants of humid and sub-humid regions in Northwest Pakistan. J. Med. Pl. Res., 4: 339-345.

Ahmad, K., Z.I. Khan, M.Y. Ashraf, M. Ashraf and E.E. Valeem, 2008. Forage evaluation for some trace elements: A case study in the Soone Valley, Pakistan. Pak. J. Bot., 40: 999-1004.

Ahmad, K., Z.I. Khan, M. Ashraf, E.E. Valeem, Z.A. Shah and L.R. Mcdowell, 2009. Determination of forage concentrations of lead, nickel and chromium in relation to the requirements of grazing ruminants in the Salt Range, Pakista. Pak. J. Bot., 41: 61-65.

Ahmad, K., A. Ejaz, Z.I. Khan, S. Gondal, A. Fardous, A. Hussain, M. Sher, E.E. Valeem and S. Ullah, 2010. Evaluation of dynamics of iron and manganese from pasture to buffaloes: A case study at rural livestock farm. Pak. J. Bot., 42: 3415-3421.

AOAC, 1984. Official Methods of Analysis (14th ed). Association of Official Analytical Chemists, Washington, DC.

Galyean, M., 1985. Techniques and procedures in animal nutrition research, New Mexico State University, Deptt. Animal and Range Conditions.

Goering, H.K. and Van Soest, 1970. Forage fiber analysis (Apparatus, reagents, procedures and some applications) ARS, U.S, gout printing office, Washington, D.C. 20402.

Hussain, F. and M.J. Durrani, 2009. Nutritional evaluation of some forage plants from Harboi rangeland, Kalat, Pakistan. Pak. J. Bot., 41: 1137-1154.

Khan, Z.I., M. Ashraf and E.E. Valeem, 2006. Forage mineral status evaluation: The influence of pastures. Pak. J. Bot., 38: 1043-1054.

Khan, Z.I., M. Ashraf, K. Ahmad, I. Mustafa and M. Danish, 2007. Evaluation of micro minerals composition of different grasses in relation to livestock requirements. Pak. J. Bot., 39: 719-728.

Khan, Z.I., M. Ashraf, K. Ahmad, E.E. Valeem and L.R. Mcdowell, 2009. Mineral status of forage and its relationship with that of plasma of farm animals in southern Punjab, Pakistan. Pak. J. Bot., 41: 67-72.

Khan, Z.I., M. Ashraf, K. Ahmad, N. Ahmad, M. Danish and E.E. Valeem, 2009. Evaluation of mineral composition of forages for grazing ruminants in Pakistan. Pak. J. Bot., 41: 2465-2476.

Khan, Z.I, M. Ashraf, K. Ahmad, N. Raza, 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. Pak. J. Bot., 42: 2391-2395.

Mashwani, Z.R., M.A. Khan, M. Ahmad, M. Zafar, N.I. Raja, M. Arshad and Samiullah, 2012. Macro-mineral quantification of the forage grass species in the Gandgar Hills, Western Himalaya, Pakistan. Pak. J. Bot., 44: 117-121.

Shamat, A.M., I.A. Babiker, A.M.S. Mukhtar and F.A. Ahmed, 2009. Seasonal and regional variations in mineral content of some important plant species selected by camels (*Camelus dromedaries*) in arid and semi-arid lands (ASAL) OF Sudan. J. Appl. Sci. Res., 5: 1676-1684.

Sultan, J.I., I.U. Rahim, H. Nawaz and M. Yaqoob, 2007. Nutritive value of marginal land grasses of northern grasslands of Pakistan. Pak. J. Bot., 39: 1071-1082.

Sultan, J.I., I.U. Rahim, M. Yaqoob, M.I. Mustafa, H. Nawaz and P. Akhtar, 2009. Nutritional evaluation of herbs as fodder source for ruminants. Pak. J. Bot., 41: 2765-2776.

Sultan, J.I., I.U. Rahim, A. Javid, M.Q. Bilal, P. Akhtar and S. Ali, 2010. Chemical composition, mineral profile, palatability and *in vitro* digestibility of shrubs. Pak. J. Bot., 42: 2453-2459.

Van Soest, P.J., 1964. A method for the determination of cell wall constituents in forages using detergent and relationship between this fraction and voluntary intake and digestibility. Proc. Am. Dairy Sci. Assoc. Tucson Arizona, June, 1964.

Van Soest, P.J. and J.B. Robertson, 1985. Analysis of forages and fibrous foods. A Laboratory Manual for Animal Science. 613 Cornel University, USA.

Waldern, D.E., 1971. A rapid micro-digestion procedure for neutral and acid detergent fiber. Can. J. Anim. Sci., 51: 67.