Pak. Jour. Agri. Sci.
24 (1) 1, 1987

NUTRITIONAL QUALITY OF GRASSES IN RELATION TO DIFFERENT CUTTINGS DURING THE VEGETATIVE GROWTH STAGE

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Concentrations of nutrients such as protein fat, ash, Na, K, P, Fe, Zn and Cu in 3 pasture grasses, grown at a single location at six (weekly) cuttings during the vegetative growth stages, were determined. The study revealed significant differences in these nutrients among grasses and their different growth stages ($P<0.01$). *Panicum maximum* (local) had the highest protein (26.1%) followed by exotic species (22.21%) and *L. fusca* (18.27%) while they did not differ markedly with respect to lipid and ash contents. *Leptochloa fusca* had generally higher Na and lower K contents than other grasses while *Panicum maximum* (local) contained approximatly ten times less Na and two times more P than other grasses. *Leptochloa fusca* and *P. maximum* (exotic) had similar quantities of Fe. *Panicum maximum* (local) was found to be low in Fe and rich in Zn and Cu as compared to other 2 species. The contents of protein, lipids, ash and individual mineral elements in grasses exhibited though significant but an irregular trend during initial cuttings; however they generally decreased during later stages, especially after the 5th and 6th cuttings. *Panicum maximum* (exotic) was considered better than *L. fusca* as a fodder and colonizer of saline and waterlogged soils on the basis of its higher proteins and lipids as well as considerable accumulation of Na.

INTRODUCTION

Grasses are important for the live-stock and the grasslands cover a major area of the earth surface. Many research workers have reported nutritive value of forages from various places (Malik and Sheikh, 1957; Obara *et al.*, 1974; Bhatia *et al.*, 1974). Some studies have revealed a general decrease in protein,

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nitrogen fractions and fat contents of forage plants with advanced age (Trevino and Hernandez, 1977; Shah, 1976). In these studies, the composition of forages with regard to major and trace elements has been given little consideration, which are considered essential for the health and growth of plants, animals and human beings (Sattar and Khalid, 1979). In a recent study (Sattar *et al.*, 1981) reported the concentration of these nutrients in several grasses during 3 major growth stages (vegetative, pre-bloom and post-bloom).

There is general agreement that plant species differ remarkably in the uptake and translocation of mineral elements and the genetic and environmental variations have profound effects on the composition of plants. In view of the potential and nutritional values of pasture grasses for the livestock, present study was conducted to determine the effect of short growth intervals during the vegetative stage of some grasses.

MATERIALS AND METHODS

A field trial with three forage grasses was conducted on irrigated plots (15 x 5 meters for each grass) located at the Nuclear Institute for Agriculture and Biology, Faisalabad. during the summer months (May - August 1980). Nursery for these grasses was raised from seeds obtained from Australia except the *Leptochloa fusca*, which was of local origin. The soil of the plots was sandy clay loam and had the characteristics: saturation % age 35.5, CEC 7.9 me/100g of soil, pH 8.0, ECe 3.7 dSm^{-1}, SAR 11.0, organic matter 0.77 % Ca CO_3 4.8 % and DTPA-extractable Zn 0.54 ug/g, Cu 1.13 ug/g, Fe 5.0 ug/g and Mn 7.3 ug/g. Plant cuttings were taken after 1, 2, 3, 4, 5 and 6 weeks of growth during the vegetative stage (40 days after transplanting) of each grass. Plant samples from each growth stage were collected, dried, ground in stainless steel grinder and stored in plastic containers for further analysis.

Chemical analysis of the samples was carried out by standard procedures (AOAC, 1980). Ash percentage was determined at 550°C; protein by microKjeldahl distillation and fat by Soxhlet extraction with petroleum ether (b.p. 40.60°C); After wet digestion of the samples with $HNO_3/HCLO_4$ (Chapman and Pratt, 1961) Fe, Zn, and Cu were determined by atomic absorption spestrophotometry; Na, K and Ca by flame emission, and P by spectrophotometry.

RESULTS AND DISCUSSION

The reeults of this investigation are an extension to the ones reported earlier by Sattar *et al.*, (1981), where the influence of major growth stages (vegetative prebloom and postbloom) on nutritional changes of different grasses was studied. In the present study, the effect of short growth intervals during the vegetative stage of selected grasses is presented. Concentrations of protein, lipids, ash and mineral elements in the three grasses under study have been given in Tables 1, 2 and 3. Data revealed that *Panicum maximum* (local) exhibited the highest protein contents at all respective growth stages followed by *Panicum maximum* (exotic) and *Dipladme fusca*. In all the grasses, protein concentration decreased after 2 weeks of growth. Similar was the case with lipids. The grasses contained highest amount of lipids at the initial growth stage and then gradually decreased after six weeks. However, grasses did not differ markedly with respect to lipid contents. The grasses contained almost similar concentrations of ash during the initial stage which, invariably increased up to 4th week of growth and then decreased, However, they differed significantly with respect to mineral concentrations ($P<0.05$). Among grasses, *Panicum maximum* (local) had the least amount of Na at any comparable growth stage and it tended to increase up to 4th week and then declined, *Panicum maximum* (exotic) and *L. fusca* contained approximately 10 times more Na than that of *P. maximum* (local) at any comparable growth stage. In view of the accumulation of higher Na concentrations and protein contents in the *P. maximum* (exotic), this grass can beconsidered better than *L. fusca* (kallar grass) for animals for growing on saline and water-logged soils of Pakistan. Both species of Panicum axhibited similar concentration of K and the growth stage had little effect on this metal. However, *L. fusca* contained the highest values of K in the first stage, which continuously decreased during successive cuttings. *Panicum maximum* (local) had higher P concentration at Ist and 2nd week of growth stage than the other two grasses but after 3rd week, all of the grasses were almost similar with respect to P. Phosphorus contents decreased with advanced growth in all the grasses. Iron concentrations did not follow any consistent trend in relation to the growth stage of any grass. *Panicum maximum* (local) contained the least Fe at any comparable growth stage whereas the other two species revealed a similar pattern. *Panicum maximum* (local) showed higher Zn and Cu concentrations than other grasses. Zinc and Cu contents tended to decrease with advanced growth stage.

Table 1. *Mineral elements and other nutrients in relation to growth stage of Panicum maximum (local)*[1].

Constituents		Growth stage (weeks)					
		1	2	3	4	5	6
Protein	%	25.42a	26.1a	27.44	20.68	17.88	12.51
Lipids	%	2.68ab	2.04b	3.85a	1.00c	0.77cd	0.59d
Ash	%	9.79	11.31a	12.00	13.14	10.58ab	11.01ab
Na	mg/g	0.95	1.02	2.28	2.68	2.50	1.99
K	mg/g	22.83	34.68	29.88	29.05a	30.29	29.05a
P	mg/g	4.27	3.94	2.99	2.64	1.73	1.35
Fe	mg/100g	20.08	28.14	23.87	38.84	26.29	34.78
Cu	ug/g	17.85	15.65	13.05	11.59	7.55	7.13
Zn	ug/g	38.20	34.14	29.79	22.91	19.55a	19.21a

1. Dry matter basis.
abcd: For each constituent, values sharing common letter are not significantly different ($P<0.05$).

Table 2. *Mineral elements and other nutrients in relation to growth stage of Panicum maximum (exotic)*[1].

Constituents		Growth stage (weeks)					
		1	2	3	4	5	6
Protein	%	21.59a	22.21a	16-75	14.33	12.25	9.24
Lipids	%	2.98	2.36a	1.99ab	2.07ab	1.66b	0.79
Ash	%	9.70b	11.30a	11.62a	11.85a	9.16b	9.50b
Na	mg/g	8.63	9.93	11.36	13.59	13.89	12.79
K	mg/g	25.73a	26.15a	25.73a	24.07	23.24	22.41
P	mg/g	2.23	2.09	1.73a	1.59	1.75a	1.47
Fe	mg/100g	56.3c	57.59b	69.03a	68.20a	56.21c	56.99bc
Cu	µg/g	10.77a	10.65ab	10.43b	9.33	5.76c	5.84c
Zn	µg/g	26.73	20.00a	27.20a	20.57b	20.72b	22.65b

1. Dry matter basis.
abc: For each constituent, values sharing common letter are not significantly different ($P<0.05$).

Table 3. *Mineral elements and other nutrients in relation to growth stage of Leptochloa fusca*[1].

Constituents		Growth stage (weeks)					
		1	2	3	4	5	6
Protein	%	18.27a	17.71a	12.44	11.72	12.11	10.15
Lipids	%	2.38	1.73a	1.68a	1.08b	1.17b	1.09b
Ash	%	10.48bc	9.87c	10.96b	11.88a	12.01a	8.24
Na	mg/g	11.72	14.31	11.23	12.84	15.75	7.30
K	mg/g	28.64	17.43	16.60a	16.19a	16.60a	14.70
P	mg/g	2.34	1.89	1.53	1.39a	1.39a	1.39a
Fe	mg/100g	47.89	38.18	66.62	89.49	76.09	53.10
Cu	µg/g	11.24	9.29a	9.11a	7.34b	7.80	7.26b
Zn	µg/g	20.46ab	17.49c	18.17c	18.77bc	21.88a	19.11b

1. Dry matter basis

abc : For each constituent, values sharing common letter are not significantly different ($P<0.05$).

Statistical analysis of the data by the analysis of variance also revealed that nutrient concentrations differed significantly among grasses as well as among each grass in this study ($P<0.01$).

Results are in agreement with the general distribution pattern of ash and protein contents observed in some grasses (Shah, 1976). Robson and Gartrell (1979) reported that concentrations of most nutrients in plants declined markedly with plant age, seed production and weathering of pasture. The extent of decline varies with the particular nutrient, plant species and the amount of nutrient supply. Initial cuttings have generally been recognized to be of higher nutritional value than the last cuttings. It has indeed been found that the ME (metabolizable energy) value and quality as well as protein yield of intitial cuttings of grass, were better than the last cuttings. (Donaldson and Edwards, 1977; Balasundaram *et al.*, 1977). Trevino and Hernandez (1977) reported that even nitrogen fractions in lucerne decreased as the forage age advanced. Chemical composition of some local fodders and grasses for protein, fat and ash has been reported on samples of undefined origin by some workers (Sattar *et al.*, 1980; Malik and Sheikh, 1967; Malik *et al.*, 1967). Since the difference in quality

of a grass in relation to location and growing year are reportedly significant more often than that among cultivars (Robinson, 1978), present study was conducted to compare the formation of protein and fat as well as uptake of different elements from a single location. It is suggested that grasses with high protein (7-22%), medium protein (11-21%), and low protein (7-10%) can be compared with and could be replaced with vegetable protein, low quality concentrate and leguminous fodders respectively.

Nutritive value of some tropical grasses and forage crops have also been given by Holm (1976) and Simon (1976) with special reference to their protein contents of forage plants can be favourably affected by selection of protein rich species, cutting at an early date, increasing the cutting frequency as well as appropriate fertilizer application.

Compasition of these data with mineral requirements reported by the NRC (1971) for animals, indicate that these fodders have adequate levels of the mineral elements and protein needed by the animals. Interestingly, *P. maximum* (exotic species) having relatively more protein and lipids as well as adequate capacity to accumulate Na, can be better than *L. fusca* (kallar grass) which hither to has been considered a good colonizer of saline and water logged soils. Therefore an evaluation of local and exotic species of plant materials in quantitative terms for dietary essential nutrients, could be of value to agriculture planners for getting maximum production of milk and meat.

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