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MINERAL COMPOSITION OF THE GREEN MASS AND HAY FROM DIVČIBARE REGION

MINERALNI SASTAV ZELENE MASE I SIJENA PODRUČJA DIVČIBARA

Milena P. Krstić, Radmila Marković, D. Šefer, G. Cilev, Z. Sinovec

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SUMMARY

The quality and some minerals contents were followed in the green mass and hay from different localities on Divčibare. Samples were taken from three different altitudes, up to 250 m, from 250 m to 550 m and over 550 m above sea level. Twelve samples of early bloom plants were taken (four samples of green mass from the same altitude), and after mowing, samples of hay were also taken from the same meadow. The samples were prepared from ashes by use of atomic absorption spectrophotometry (AAS) macro- and microelements content was determined, while the phosphorus content was determined by application of standard methods.

Average calcium content in the plants valued 5.85 g/kg, phosphorus 2.41 g/kg, magnesium 2.47 g/kg, sodium 0.93 g/kg and potassium 10.35 g/kg in dry substance. In the samples of hay, macro elements content was 6.65, 1.56, 1.54, 0.78 and 10.76 g/kg respectively. Average iron content in the samples of plants from Divčibare region amounted to 171.87 mg/kg, copper 5.12 mg/kg, zinc 21.67 mg/kg, manganese 63.97 mg/kg and selenium 17.17 μg/kg in dry substance. The average amount of iron 92.47 mg/kg, 4.75 mg/kg copper, 19.65 mg/kg zinc, 113.29 mg/kg manganese and 26.00 μg/kg selenium were found in the hay from the same localities.

Key words: green mass, hay, minerals

INTRODUCTION

The natural foods of herbivorous domestic animals are pasture grasses, during most of the year and hay in winter period. This type of nutrition has easy access and demands low investments.

Mineral content of forage varies and depends on the plant species, stage of growth, soil type, cultivation conditions and fertilizer treatment. Plant species, grasses, legumes and herbs determine the mineral profile of green mass as well as the chemical composition. Young plants consist mainly of soluble carbohydrates and proteins but with maturity the concentration of structural carbohydrates (cellulose

Milena P. Krstić, Department of Chemistry, Faculty of Veterinary Medicine, University of Belgrade, Radmila Marković, D. Šefer, Z. Sinovec, Department of Nutrition, Faculty of Veterinary Medicine, University of Belgrade, Bulevar oslobođenja 18, 11000 Belgrade, Serbia; G. Cilev, Institute for Animal Husbandry, Skopje, Macedonia.

and hemicelluloses) and lignin increases. The type of soil is also a limiting factor and may influence the composition of the pasture. If soil is deficient in some minerals plants will be too.

The selection of pasture species and application of fertilizers may influence the nutritive value of botanical composition. The aim of the haymaking process is to reduce the moisture content and contribute to a longer use (storage) of plant food. Mineral content of hay is also influenced by processing and conservation of green forage and the way of storage.

Earlier researches had shown different deficit and sufficit of some minerals in dependence of regions analyzed. The consequence of inadequate mineral composition are disorders in metabolic processes and the state of animal health, as well as the influence on low production level.

Generally, in the scope of balanced meal, increase of production and prevention of deficiencies, quality of pasture herbage and hay are necessary to follow.

MATERIAL AND METHODS

Six localities from Divčibare region were chosen, at three different altitudes: up to 250m, from 250m to 550m and over 550m above sea level. For the estimation of mineral contents, twelve samples of early bloom plants were taken (four samples of green mass from the same altitude) and after mowing, samples of hay were taken from the same place.

The samples were prepared by standard procedure; from ashes by use of atomic absorption spectrophotometry (AAS) the micro and macro elements content was determined, except the phosphorus content which was determined by use of standard methods.

RESULTS AND DISCUSSION

In the investigations of green mass and hay from three different altitudes of Divčibare, established macro elements contents are presented in Table 1. and Table 2.

The numerical differences were visible in all macro elements content, except sodium which was uniform in the sample of hay. Statistically very significant difference was found in the potassium content in samples of green mass.

In the samples of hay, from altitudes up to 250m and over 550m above sea level, biggest variations in the calcium, phosphorus, potassium and magnesium contents were determined. The results correspond to literature values (Česmedžijev, 1980, Rajčević et al., 1995, Stekar et al., 1998).

Statistically very significant differences were found in iron, copper and manganese contents in green mass and in copper, zinc and manganese contents in the samples of hay from different localities. These results correspond to the findings of other authors (Cilev et al., 2001), except for iron whose concentration was increased.

The selenium content under 50μg/kg is characterized as lower than normal level in feed (Kubota et al., 1967). Average selenium contents in samples of green mass and hay were lower than animal requirements and Divčibare region may be defined as deficient in this trace mineral.

The differences between concentrations of minerals in analyzed samples are the result of differences in floristical composition and soil type, too.

CONCLUSIONS

Investigation into the mineral content in green mass and hay from Divčibare grasslands showed adequate amounts of macro elements, but high levels of iron, copper and zinc, an adequate manganese content and a low amount of selenium.

In the hay samples differences in calcium concentration, as well as phosphorus, potassium and magnesium, were observed but without statistical significance.

Statistically highly significant differences were found in microelements contents (iron, copper and manganese) in green mass and in copper, zinc and manganese contents in the hay samples from different localities.

Pasture and hay from the investigated region can meet most requirements of ruminants in minerals. Supplementation of selenium is necessary to provide balanced nutritient ration and good management practice.

Table 1. Some macro elements contents in the green mass from Divčibare region, [g/kg DM]
Tablica 1. Sadržaj nekih makro elemenata u zelenoj masi iz područja Divčibare, [g/kg SM]

Localities (above sea level)	Measures of variation				
	X	S_x	S_d	C_v	i_v
Ca					
< 250 m	4.20^{x}	0.17	0.08	4.00	3.96-4.32
250-550 m	7.52^{y}	0.78	0.39	10.41	6.57-8.34
> 550 m	5.84	1.50	0.75	25.63	4.22-7.47
mean	5.85	1.67	0.48	28.58	3.96-8.34
P					
< 250 m	3.38^{a}	1.03	0.52	30.54	2.50-4.50
250-550 m	2.11	0.76	0.38	36.18	1.12-2.80
> 550 m	1.74^{b}	0.43	0.22	24.69	1.34-2.22
mean	2.41	1.02	0.29	42.22	1.12-4.50
Mg					
< 250 m	2.55	1.89	0.94	74.10	0.78-4.42
250-550 m	1.55^{x}	0.20	0.10	12.91	1.31-1.76
> 550 m	3.30^{y}	0.76	0.38	22.94	2.66-4.27
mean	2.47	1.30	0.38	52.86	0.78-4.42
Na					
< 250 m	1.09	0.40	0.80	73.38	0.35-1.87
250-550 m	0.58	0.03	0.06	9.85	0.53-0.66
> 550 m	1.13	0.46	0.91	80.38	0.34-1.97
mean	0.93	0.20	0.68	73.24	0.34-1.97
K					
< 250 m	10.59^{b}	0.43	0.87	8.19	9.85-11.84
250-550 m	12.24^{a}	0.28	0.56	4.60	11.49-12.86
> 550 m	8.21^{b}	1.12	2.24	27.23	6.22-10.22
mean	10.35	0.62	2.15	20.82	6.22-12.86

$p^{a,b}<0.05$, $p^{x,y}<0.01$

Table 2. Some macro elements contents in the hay samples from Divčibare region, [g/kg DM]
Tablica 2. Sadržaj nekih makro elemenata u uzorcima sijena iz područja Divčibare, [g/kg SM]

Localities (above sea level)	Measures of variation				
	X	S_x	S_d	C_v	i_v
Ca					
< 250 m	9.21^{x}	1.66	0.83	18.05	7.35-11.33
250-550 m	5.55^{y}	0.90	0.45	16.16	4.86-6.77
> 550 m	5.21^{y}	1.23	0.61	23.58	3.51-6.31
mean	6.65	2.23	0.64	33.46	3.51-11.33
P					
< 250 m	1.71^{y}	0.20	0.10	11.94	1.50-1.89
250-550 m	1.82^{y}	0.26	0.13	14.22	1.45-2.03
> 550 m	1.13^{x}	0.11	0.05	9.33	1.04-1.27
mean	1.56	0.36	0.11	23.40	1.04-2.03
Mg					
< 250 m	1.64^{x}	0.19	0.09	11.40	1.41-1.86
250-550 m	1.24^{y}	0.07	0.03	5.59	1.16-1.30
> 550 m	1.75^{y}	0.12	0.06	7.10	1.56-1.82
mean	1.54	0.26	0.07	16.65	1.16-1.86
Na					
< 250 m	0.74	0.08	0.15	20.88	0.57-0.89
250-550 m	0.66	0.06	0.12	17.67	0.52-0.80
> 550 m	0.95	0.16	0.32	33.66	0.61-1.29
mean	0.78	0.07	0.23	29.68	0.52-1.29
K					
< 250 m	$13.68^{a,y}$	0.28	0.55	4.06	13.09-14.23
250-550 m	$15.32^{b,y}$	0.55	1.11	7.22	14.28-16.30
> 550 m	3.27^{x}	0.42	0.84	25.53	2.30-4.34
mean	10.76	1.62	5.63	52.30	2.30-16.30

$p^{a,b}<0.05$, $p^{x,y}<0.01$

Table 3. Some microelements contents in the green mass from Divčibare region, [mg/kg DM]
Tablica 3. Sadržaj nekih mikroelemenata u zelenoj masi iz područja Divčibare, [mg/kg SM]

Localities (above sea level)	Measure of variation				
	X	S_x	S_d	C_v	i_v
Fe					
< 250 m	195.37^{y}	42.48	21.24	21.74	158.31-232.61
250-550 m	199.90^{y}	7.10	3.55	3.55	189.74-205.28
> 550 m	120.33^{x}	38.75	19.37	32.20	81.44-171.19
mean	171.87	48.66	14.05	28.31	81.44-232.61
Cu					
< 250 m	6.43	3.86	1.93	59.98	2.92-9.77
250-550 m	5.55^{a}	0.82	0.41	14.83	4.58-6.25
> 550 m	3.39^{b}	0.61	0.30	17.91	2.92-4.27
mean	5.12	2.47	0.71	48.30	2.92-9.77
Zn					
< 250 m	17.90	14.83	7.42	82.87	4.01-38.91
250-550 m	20.43	4.59	2.29	22.45	15.52-24.67
> 550 m	26.67	11.67	5.84	43.78	16.09-38.37
mean	21.67	10.85	3.13	50.08	4.01-38.91
Mn					
< 250 m	29.51^{a}	3.22	1.61	10.93	26.11-32.51
250-550 m	84.08^{b}	37.88	18.94	45.05	51.23-117.77
> 550 m	78.33	54.73	27.36	69.87	30.02-132.74
mean	63.97	43.19	12.47	67.51	26.11-132.74
Se (μg/kg DM)					
< 250 m	0.020^{x}	0.002	0.001	10.04	0.018-0.022
250-550 m	0.014^{y}	0.001	0.001	9.37	0.013-0.016
> 550 m	0.018^{x}	0.001	0.001	7.46	0.016-0.019
mean	0.017	0.003	0.001	16.81	0.013-0.022

$p^{a,b}<0.05$, $p^{x,y}<0.01$

Table 4. Some microelements contents in the hay samples from Divčibare region, [mg/kg DM]
Tablica 4. Sadržaj nekih mikroelemenata u uzorcima sijena iz područja Divčibare, [mg/kg SM]

Localities (above sea level)	Measures of variation				
	X	S_x	S_d	C_v	i_v
Fe					
< 250 m	90.49	16.02	8.01	17.71	76.99-111.60
250-550 m	89.51	21.47	10.73	23.98	69.64-119.82
> 550 m	102.36	5.51	3.90	5.38	98.46-106.26
mean	92.47	16.43	5.20	17.77	69.64-119.82
Cu					
< 250 m	5.43^{x}	0.61	0.31	11.26	4.89-6.11
250-550 m	4.71	0.99	0.49	20.99	3.79-6.11
> 550 m	4.09^{y}	0.27	0.13	6.51	3.87-4.46
mean	4.75	0.85	0.24	17.88	3.79-6.11
Zn					
< 250 m	15.77^{a}	1.55	0.77	9.80	14.08-17.39
250-550 m	16.59	1.11	0.55	6.68	15.31-17.73
> 550 m	26.60^{b}	8.68	4.34	32.65	16.86-36.17
mean	19.65	6.93	2.00	35.25	14.08-36.17
Mn					
< 250 m	37.26^{y}	8.38	4.19	22.48	28.67-46.03
250-550 m	218.50^{x}	28.17	14.08	12.89	118.15-243.06
> 550 m	84.11^{y}	55.34	27.67	65.80	32.87-133.15
mean	113.29	86.65	25.01	76.48	28.67-243.06
Se (μg/kg DM)					
< 250 m	$0.032^{a,x}$	0.006	0.003	17.43	0.026-0.038
250-550 m	0.020^{y}	0.001	0.001	5.45	0.019-0.021
> 550 m	$0.026^{b,x}$	0.001	0.001	4.00	0.025-0.027
mean	0.026	0.006	0.002	22.72	0.019-0.038

$p^{a,b}<0.05$, $p^{x,y}<0.01$

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SAŽETAK

Vrsta i sadržaj nekih minerala praćen je u zelenoj masi i sijenu s različitih lokacija na Divčibarama. Uzorci su uzimani s različitih nadmorskih visina: do 250 m, od 250 do 550 m i iznad 550 m. Uzeti su uzorci dvanaest rano procvalih biljaka (po četiri uzorka zelene mase s jedne nadmorske visine), a nakon košnje uzorci sijena su uzeti s iste livade. Uzorci su pripremljeni iz pepela korištenjem metode atomske spektrofotometrijske absorpcije (ASA), dok je sadržaj fosfora utvrđen primjenom standardnih metoda.

Prosječan sadržaj kalcija u zelenoj masi iznosio je 5.85 g/kg, fosfora 2.41 g/kg, magnezija 2.47 g/kg, natrija 0.93 g/kg i kalija 10.35 g/kg suhe tvari. Odnosni iznosi makro elemenata u uzorcima sijena iznosili su: 6.65, 1.56, 1.54, 0.78 i 10.76 g/kg. Prosječan sadržaj željeza u uzorcima zelene mase s područja Divčibara iznosio je: 171.87 mg/kg, bakra 5.12 mg/kg, cinka 21.67 mg/kg, mangana 63.97 mg/kg i selena 17.17 μg/kg suhe tvari. Prosječan sadržaj tih elemenata u uzorcima sijena s istog područja iznosio je za željezo 92.47 mg/kg, bakar 4.75 mg/kg, cink 19.65 mg/kg, mangan 113.29 mg/kg, te selen 26.00 μg/kg.

Ključne riječi: zelena masa, sijeno, minerali